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Energetics of Gaseous Ions

H.M. Rosenstock, K. Draxl,
B.W. Steiner, and J.T. Herron

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David R. Lide, Jr., Editor

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Foreword

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The regular issues of the *Journal of Physical and Chemical Reference Data* are published quarterly and contain compilations and critical data reviews of moderate length. Longer monographs, volumes of collected tables, and other material unsuited to a periodical format are published separately as *Supplements* to the *Journal.* This monograph, "Energetics of Gaseous Ions," by H. M. Rosenstock, K. Draxl, B. W. Steiner, and J. T. Herron, is presented as Supplement No. 1 to Volume 6 of the *Journal of Physical and Chemical Reference Data.*

David R. Lide, Jr., Editor
Journal of Physical and Chemical Reference Data

Energetics of gaseous ions

H. M. Rosenstock, K. Draxl, B. W. Steiner, and J. T. Herron

National Bureau of Standards, Washington, DC 20234

Critically evaluated data are compiled and presented on ionization potentials, appearance potentials, electron affinities, and heats of formation for gaseous positive and negative ions. The positive ion literature is covered for the period 1955–1971 inclusive, and earlier literature on molecular Rydberg series is covered as well. The negative ion literature is covered through the end of 1973. The techniques employed in determining these data are critically discussed.

Key words: Appearance potential; compilation; critically evaluated data; electron affinity; heat of formation; ionization potential; negative ions; photodetachment; photoelectron spectroscopy; photoionization; positive ions; Rydberg series.

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1. Introduction

The present volume constitutes a complete revision and updating of "Ionization Potentials, Appearance Potentials, and Heats of Formation of Gaseous Positive Ions", NSRDS–NBS 26, which appeared in 1969. That volume covered the positive ion literature from 1955 to mid-1966, in effect covering the papers that appeared since the publication of "Electron Impact Phenomena and the Properties of Gaseous Ions" by F. H. Field and J. L. Franklin. Since 1966, more than one thousand new publications have appeared and some major advances in instrumentation, techniques and interpretation have occurred which have brought about a marked improvement in the quality and reliability of the information. In consequence it has been possible to approach some of the material in a more critical spirit, although the interpretations and comments (sometimes on the work of others) in the literature form the major basis for the evaluation.

In addition to an updated tabulation of positive ion data, we have added a tabulation of selected data on negative ions. The basis of the latter table is discussed in section 5. The closing date for literature coverage is the end of 1971 for the positive ions and the end of 1973 for the negative ions.

In comparison with NSRDS–NBS 26, the following changes of scope and emphasis in the positive ion table are to be noted: All citations of quantum mechanical calculations have been eliminated. This area of research is undergoing rapid development and a thorough job of compilation or evaluation was simply beyond the capabilities of the present evaluators. However, much theoretical material of this type is presented or cited in the papers on photoelectron spectroscopy. Whereas the preceding compilation covered the literature from 1955 on, in the present revision the literature coverage for molecular ionization potentials obtained from Rydberg series has been extended back essentially to its beginnings, using the recent book of Duncan [1] as a reference source. Much of the early literature on Rydberg series gave quite reliable information and for some systems it is still the only reliable information. In connection with ionic fragmentation processes, it is well known that the appearance potentials of fragment ions cannot be used to deduce heats of formation unless the state of excitation of the fragments and their kinetic energies of separation at threshold are known. Knowledge in this area is quite scant. Where available, this information is given for the processes, and referenced. With the increase in precision and accuracy of some of the data the calculation of ion heats of formation must be more carefully thought out. Where possible, heats of formation have been computed at 0 K. Also, the use of estimated thermochemical information has been discontinued. In view of the abundance of ionization potentials of good-to-excellent accuracy, it no longer seems appropriate to calculate heats of formation of fragment ions unless the fragmentation threshold determination is likely to be of at least roughly comparable accuracy. This has essentially ruled out those data obtained by non-monoenergetic electron impact techniques which are of very doubtful and, worse, unpredictable reliability. An attempt has been made to select for full citation the best measurements for each process. Earlier, obsolete and inferior measurements are, however, given in reference to each process. These earlier references often give interesting and useful information of a qualitative or mechanistic nature. Thus, the present volume continues to serve as a guide to the experimental literature on positive ions.

Reference for Introduction

[1] Duncan, A. B. F., Rydberg Series in Atoms and Molecules (Academic Press, New York, 1971).

2. Acknowledgments

The authors gratefully acknowledge the support and encouragement given them by Dr. S. Rossmassler and Dr. D. R. Lide of the Office of Standard Reference Data of the National Bureau of Standards. Considerable assistance on the computer aspects of assembling and editing this volume was received from Dr. B. C. Duncan, Dr. D. Garvin, Mr. J. Hilsenrath, Mr. J. Koch, Mr. R. McClenon, Mrs. C. Messina, and Mr. R. Thompson. Dr. V. H. Dibeler and Dr. W. H. Evans made contributions to the literature search, and the late Dr. R. B. Parlin assisted in the abstracting. Many questions of data interpretation and presentation received helpful criticism from Dr. V. H. Dibeler, Dr. R. E. Huie, Mr. P. Krupenie, Dr. K. E. McCulloh and Dr. R. L. Stockbauer. Helpful criticism and a number of useful corrections were received from Dr. F. P. Lossing of the National Research Council, Ottawa, Canada. Considerable secretarial help was provided during the course of this work by Mrs. P. Davis, Mrs. K. Fadely, Miss R. McCoy, and Mrs. C. Schmidt. Last, and not least, all phases of the preparation of this book were crucially dependent on the careful, patient, and dedicated work of Miss Margaret Moore.

3. Energetics of Gaseous Positive Ions

Quantitative data leading to energetics of positive ions have been obtained by numerous techniques. Correspondingly, there are numerous methods of interpreting the data to yield ultimately the quantities known as ionization potentials, appearance potentials and heats of formation. In the following sections we summarize the various experimental techniques and the methods of data interpretation. Special attention is paid to highlighting the accuracies, problems, and limitations of the techniques and interpretations. An effort has been made to select references which discuss these matters in more detail.

This approach leads inevitably to a degree of optimism or pessimism on the part of the writers and the readers which depends strongly on the degree of accuracy desired or expected of the data. That, in turn, depends on the intended application of the data, and the purpose of the application. The body of data tabulated here varies in demonstrated or likely accuracy from 1 meV or better to data which may be in error by as much as 0.5 to 1 eV for singly charged species and 10 eV or more for some multiply charged species. It covers an enormous variety of chemical species. The types of uses and systems considered are also very large. We have focused the discussion to follow on the problems and barriers to attaining high accuracies, of the order of several hundredths of an electron volt (or several kilojoules per mole) or better. For the reader who has less stringent accuracy requirements we state that nearly all of the data are accurate to roughly 0.5 eV or better, with the probable exception of the electron impact experiments directed to determining ionization energies for producing highly charged species. We note that two classes of systems have been studied extensively by conventional electron impact: large organic molecules and high temperature species effusing from Knudsen cells. The measurement errors estimated by the original authors tend to be larger (more conservative, more pessimistic?) for the Knudsen cell experiments than for the organic experiments. Limited comparisons with demonstrably more reliable information indicate, in fact, no higher accuracy for one group than the other. In some instances, very nearly correct answers will be found in both areas. The difficulty is that the specific instances are hard to predict. The only generalization is that parent ionization potentials are more accurate and fragment ion appearance potentials less accurate.

3.1. Experimental Techniques

In this section we define and discuss the measurement techniques which provide the data presented in the Positive Ion Table (section 4). The nineteen distinct techniques can be grouped into several major categories, each of which represents a particular type of experimental approach and theory or rationale for interpretation of the data. In table 1 we give the categories, the techniques and the abbreviations used for them in the Positive Ion Table.

TABLE 1. Experimental techniques for positive ion energetics

Category	Technique	Abbreviation
Optical spectroscopy	–Spectroscopic	S
Threshold experiment	–Photoionization, with or without mass analysis	PI
	–Electron monochromator	EM
	–Retarding potential difference	RPD
	–Energy distribution difference	EDD
	–Square root plot	SRP
	–*n*th root extrapolation	NRE
	–First derivative electron impact	FD
	–Second derivative electron impact	SD
	–Sequential mass spectrometry	SEQ
	–Electron impact other than above	EI
Electron spectroscopy	–Photoelectron spectroscopy	PE
	–Auger electron spectroscopy	AUG
	–Resonant photoionization	RPI
	–Penning ionization	PEN
Other	–Surface or thermal ionization	SI
	–Born-Haber cycle calculations	BH
	–Charge transfer spectrum	CTS
	–A derived value	D

a. Optical Spectroscopy

In general, the most accurate data are obtained by spectroscopic techniques. The instrumentation and calibration have been refined to the point that in the visible and near uv, atomic absorption or emission lines can be measured with an accuracy of 0.001 to 0.0001 nm or better. A typical modern 21 or 35 ft. optical spectrograph will have a resolution of the order of several hundred thousand or more depending on the grating order used. On the other hand, most molecular spectroscopic studies cited have been carried out with instrumentation of somewhat lower resolution. Wavelengths are generally reported to 0.01 nm and occasionally to 0.001 nm. Details of typical instrumentation and techniques are given in references 1, 2, and 3.

b. Threshold Experiments

The second class of experimental techniques may be termed threshold techniques, in which the objective is to directly determine the minimum energy necessary to form an ion (parent or fragment) from a neutral species, or sometimes from an ion of lesser charge. These techniques include photoionization and the various electron impact techniques.

b.1. Photoionization

In photoionization, experiments are generally carried out with a Seya-Namioka 70° 15′ or near-normal incidence monochromator. Wavelength resolution of the monochromator used for ionization ranges from 0.04 to 0.2 to 0.3 nm in first order and the wavelength scale is known typically to 0.01 to 0.02 nm from calibration with known emission lines. This represents a best energy resolution of about 5 meV at 12 eV. The commonly used light sources are a hydrogen discharge and a helium discharge. The hydrogen discharge produces a many line spectrum in the 160 to 90 nm wavelength range. This limits the minimum distance between points at which data may be taken. The helium Hopfield continuum provides useful light intensity in the 110 to 58 nm wavelength region, and some workers have used the argon continuum for the 155 to 105 nm range. The experimental techniques are described in detail in references 4–8.

b.2. Electron Impact Techniques

This class of techniques is the one most widely used over the years in experiments directed to measurements of ionization and fragmentation energetics. Electron impact methods have been used for this purpose for nearly fifty years. There are two main problems with these techniques. There is a large energy spread in the electron beam, and the actual energy maximum of the beam can differ from the nominal energy expected from the applied electrode potentials. As a result, it is necessary to calibrate the nominal energy scale by carrying out experiments with a reference gas or gases and to minimize the difficulties presented by the electron energy spread. Many approaches have been developed to deal with these problems, with varying success. These techniques can be divided into three categories of progressively decreasing refinement and quality: a) monoenergetic, b) quasi-monoenergetic, and c) conventional or non-monoenergetic.

Monoenergetic

The major problem with electron impact techniques is the energy spread of the electrons in a conventional beam. This spread is several tenths of an electron volt or more, due to filament potential drop, filament temperature, field penetration and surface effects. A monoenergetic electron beam technique currently in use in one laboratory limits the electron energy spread by passage through a double hemispherical electron monochromator of known electron optical behavior [9–11]. Subsequent analysis of the beam indicates an energy spread of 70 meV at half maximum. The electron energy scale is calibrated by determining the ion yield curve of a rare gas, generally argon, in the ionization threshold region over a range of several volts. This calibration will be valid for determining threshold values for other species if their threshold behavior is similar enough. The rationale for this procedure is not really well established. However, where comparisons can be made, the several dozen results obtained by this technique agree with experimental photoionization thresholds to within about 30 meV. Some work has also been done using 127° cylindrical electrostatic analyzers to obtain electron beams of comparably narrow and defined energy spread [12–14]. Electron energy spreads of smaller than 50 meV at half maximum were obtained some years ago [13], but no results pertinent to the present compilation have been published.

Quasi-Monoenergetic

A radically different approach to overcoming the energy spread problem is that known as the RPD (Retarding Potential Difference) technique [15, 16]. In this method the electron gun is designed with a potential distribution such that the low energy portion of the electron energy distribution is not transmitted into the ion source. This cut-off potential is rapidly varied between two values differing by a small amount (of the order of 0.1 eV). The corresponding difference component of the ion signal is detected and amplified. This component corresponds in principle to the ion current produced by electrons having an energy distribution of that portion of the original distribution lying between the two cut-off voltages. In fact, the distribution is somewhat broader and not sharply defined [17]. In the years since its development this method has been widely adopted. However, not all the care and precautions of the originators have been followed.

A second quasi-monoenergetic method is the Energy Distribution Difference method (EDD) [18]. In this method the ion current measured at a nominal electron energy E is adjusted by subtracting from it a constant fraction, b, of the ion current measured at a nominal energy $E+\Delta E$. The originators of the method show that this difference current represents the ion current due to a considerably narrower electron energy distribution. The optimum values of the parameters b and ΔE depend on the form of the electron energy distribution.

Both of these methods have been successful in considerably reducing the lack of sharpness of experimental first ionization thresholds due to the large electron energy spread. However, a calibration with a gas of known ionization potential is required, and it is necessary to assume similar threshold behavior.

Non-Monoenergetic

Most of the remaining electron impact techniques are simply grouped under the category EI. They include the conventional techniques employing electron beams of broad energy and differing principally in the method of extrapolating to "threshold". The simplest and most unreliable method is the linear extrapolation method, which is frequently used in studies of high temperature species where the experiment is directed to the study of the thermodynamics of vaporization of the species rather than to the ionization energetics. This is unfortunate since, for these species, threshold data of even moderate accuracy would be very useful. Generally, a variety of more accurate extrapolation methods are used to correct for the broad electron energy distribution by careful comparison of the unknown and calibrant ion current in the threshold region. These include semi-log plot, extrapolated voltage difference, energy compensation and critical slope methods. These are described in references 19 and 20. Their accuracy ranges from less than 0.1 eV to more than 0.5 eV in an unpredictable manner.

Still another group of extrapolation techniques has been developed and applied to determination of threshold energies for multiple ionization. They are to be distinguished from the various other nonmonoenergetic extrapolation methods and are cited separately in the Positive Ion Table. The Square Root Plot (SRP) and Nth Root Extrapolation (NRE) techniques are extrapolation procedures often employed to obtain threshold values for N-fold charged species. Their rationale is the assumption that near threshold the cross section for direct multiple ionization varies with the Nth power of the electron energy in excess of the threshold value, e.g., a quadratic law for double ionization, a cubic law for triple ionization [21], etc. (see section 3.2.d.).

Another experimental technique which has been devised to determine threshold energies for multiple ionization is Sequential Mass Spectrometry (SEQ) [22]. In this technique, the ion source is operated with a potential configuration which brings about space charge trapping of the positive ions formed by electron impact. Some of the ions undergo a second ionizing collision with an electron before drifting out of the trapping region. Because of this step-wise ionization one can determine the ionization potentials of species which have been previously ionized. Trapping times vary from 10^{-4} s [20] to almost one second [23]. While this technique offers considerable advantages in obtaining information on highly charged species, there are considerable difficulties in interpretation because of the large energy spread of the electrons [24].

c. Electron Spectroscopy

The third class of techniques has as a common principle the energy analysis of electrons ejected from molecules which have been excited by uv photons (Photoelectron Spectroscopy, PE), X-ray Photons (Auger Electron Spectroscopy, AUG) or electronically metastable atoms and molecules (Penning Ionization, PEN) of known energy. For a given excitation energy, the energy distribution of the ejected electrons will reflect the distribution of accessible energy levels of the target neutral atom or molecule according to the relation:

$$E_{\text{ion}} = h\nu - E_{\text{electron}}.$$

Photoelectron spectroscopy in particular has undergone a rapid evolution since the first experiments fifteen years ago [25, 26]. It has been reviewed in a number of articles [27–35].

c.1. Photoelectron Spectroscopy

The most widely used photon source in photoelectron spectroscopy is the helium resonance line of wavelength 58.4331 nm corresponding to an energy of 21.218 eV. More recently, experiments have been carried out with a helium discharge operated so that there is appreciable intensity of the He II line at 30.3781 nm (40.813 eV) as well as the 58.4 nm line. Also, some work is being done with the neon resonance doublet, at wavelengths of 73.589 and 74.370 nm (16.848 and 16.671 eV) and the argon resonance doublet at 104.8218 and 106.6660 nm (11.829 and 11.623 eV). When the light source consists of a doublet, the photoelectron spectrum will consist of a superposition of two spectra shifted with respect to one another by the energy difference of the two emission lines, and with relative intensities depending on the relative line intensities and on the relative ionization cross sections at the two wavelengths. If the light source contains even traces of impurities, there is the possibility that impurity emission lines can contribute spurious structure in the photoelectron spectrum out of all proportion to the trace concentration [36–38].

The energy analysis of the ejected photoelectrons has been carried out with a great variety of analyzers including:

Cylindrical retarding grid
Spherical retarding grid
180° magnetic sector
127° electrostatic sector
Plane parallel electrostatic analyzer
Double focussing electrostatic prism
Double focussing hemispherical condenser

The relative merits of these devices have been discussed in a number of publications [31, 39–42]. The early devices had an energy resolution of one to several tenths of an electron volt. At present, the highest resolution attained is of the order of 10–15 meV [43, 44], with a 127° electrostatic analyzer. The factors limiting resolution have been discussed and estimated by Turner [45]. They include factors depending on the target, the light source, and the analyzer. The principal contribution of the target is the ejected electron velocity spread brought about by the thermal velocity distribution of the target and is typically of the order of 2 meV. For hydrogen and helium, however, it is much larger, roughly 20 meV. Compared to this, the Doppler broadening of the photon source emission line is negligible. However, self-reversal of the emission line may be significant; it is very dependent on experimental parameters of the discharge source [4, 46, 47]. Experience to date indicates that as yet no rotational structure can be clearly resolved but that spectrum line broadening attributable to rotational envelopes is sometimes observable [45]. Because of contact potentials the energy scale must be calibrated with a gas or gases of known ionization potential(s). Rare gases are frequently used. Details are given in reference 48.

c.2. Auger Electron Spectroscopy

The technique of Auger Electron Spectroscopy (AUG) is similar in principle to photoelectron spectroscopy. It, too, is based on energy analysis of ejected electrons. However, in this case the electron is ejected via an Auger cascade following prior inner shell ionization. The inner shell ionization is brought about by a high energy electron beam [49, 50] or a discrete X-ray source [50, 51]. The energy analysis is carried out by means of either a cylindrical mirror analyzer operated at an energy resolution of 0.12 to 0.16% [49, 51] or a double focussing electrostatic prism with 0.06 to 0.09% energy resolution [50, 52].

Since the Auger electrons have energies of several hundred volts or more, this percentage implies an energy resolution of several tenths of an electron volt. Calibration of the energy scale is carried out with known Auger electron energies of neon and argon [50, 53].

c.3. Resonant Photoionization

The resonant photoionization technique, also called threshold photoelectron spectroscopy, differs from photoelectron spectroscopy in that the photon energy is varied and only those photoelectrons are detected which lie in a narrow energy band corresponding to essentially zero energy of ejection [54]. Thus, in principle, a photon wavelength scan will directly indicate those ion states which are directly accessible, without interference by autoionization processes involving transitions to lower levels. In practice, due to finite energy resolution a signal is also obtained from autoionization processes which populate states close to the direct ionization threshold. The zero-energy electrons are selected by two different methods. In one, all photoelectrons are accelerated through a known potential drop and those whose energy corresponds to the drop itself are selected by a 127° electrostatic analyzer [54–56]. In the second method the electrons are accelerated through a uniform electrostatic field and non-zero energy photoelectrons intercepted by passage through channels of small angular aperture oriented parallel to the field (steradiancy analysis) [57, 58]. The accuracy of ionization threshold values is reported to be 10 to 20 meV [54, 55] and 2 to 5 meV [56–58], respectively.

c.4. Penning Ionization

The Penning ionization technique is also based on ejected electron energy analysis. In this technique, the ionizing agent is a beam of metastable neutral rare gas atoms with known excitation energy or energies. The excited species are produced by electron impact. The metastable atoms employed include mixtures of He(2^3S) (19.818 eV) and He(2^1S) (20.614 eV), Ne$(^3P_2)$ (16.619 eV) and Ne$(^3P_0)$ (16.715 eV), or Ar$(^3P_2)$ (11.548 eV) and Ar$(^3P_0)$ (11.723 eV). Because of the presence of two metastable states in a given atom beam the Penning electron spectrum consists of a shifted superposition of two spectra, each formed by one of the species. The relative intensity depends on the relative proportion of the two species and the relative cross sections for the process [62]. Electron energy analysis was carried out a first with a cylindrical retarding grid arrangement (Lozier tube) of 0.1 to 0.2 eV resolution [59–61].

More recently, a plane parallel retarding grid of 10 to 20 meV resolution [63] and a 127° electrostatic sector of better than 60 meV resolution [64] have been employed.

Energy calibration is carried out with a gas of known ionization potential or with photoelectrons produced by He 58.4 nm radiation [64, 65]. In the case of helium metastables, the He(2^1S) component of the beam can be quenched with radiation from a helium lamp [62]. In interpreting the results, careful consideration has to be given to possible kinetic energy transfer from the projectile to the target species [62].

d. Surface Ionization

The surface ionization method has been applied to the determination of first ionization potentials of some metal atoms, especially of the lanthanide and actinide elements. The principle of the method is based on the assumption that the atoms in a beam, after impinging on a hot metal surface, will come to thermodynamic equilibrium, producing a surface concentration of atoms and ions whose composition can be described by the Saha-Langmuir equation:

$$N_+/N_0 = g_+/g_0 \exp\ [e(\phi - I)]/kT,$$

where N_+/N_0 is the fraction of the atoms which are ionized, g_+ and g_0 are the statistical weights of the ions and atoms, e the electronic charge, ϕ the work function of the metal, I the ionization potential, k the Boltzmann constant, and T the absolute temperature. The temperature dependence of the positive ion current will give the ionization potential if the work function is known. Complications inherent in the method include the effect of surface coverage or impurities on the work function, definition of the work function for a polycrystalline surface exhibiting a variety of crystal planes with different work functions, and an occasional lack of reproducibility of experimental results which is simply not understood. Also, the fundamental assumption is open to question. These factors are discussed in detail in references 66–68. These difficulties are somewhat reduced by the determination of ionization potential differences by bombarding the metal surface with a composite beam of atoms of known ionization potential and atoms of unknown ionization potential [69], or comparing the temperature dependence of positive and negative ion emission of the same atomic species [70]. Where comparisons can be made with more reliable methods, the relative determinations give ionization potentials within several tenths of an electron volt of the correct value. Recently, the aniline molecule has been surface-ionized and the temperature variation of the parent ion current gave very nearly the correct ionization potential. It is noteworthy that not all the parent molecules pyrolyzed or fragmented [71].

e. Born-Haber Cycle Calculations

Another method occasionally used for determination of ionization potentials is based on the Born-Haber cycle. For an ionic crystal the lattice energy of the crystal can be defined as the energy liberated when the crystal is formed from ions at infinite separation. This quantity may be in turn related to the standard heat of formation of the crystal, and the difference between the lattice energy and the standard heat of formation is the energy required to convert the elements from their standard states to ions at infinite separation. If all but one quantity is known, such as an ionization potential or electron affinity, this unknown can be determined from the cycle. The lattice energy may be calculated or estimated by interpolation from related solids [72]. In the present context, this method has been used in determining the third ionization potentials of atoms of the lanthanide series [73–75]. The accuracy of the method is stated to be several tenths of an electron volt [75].

f. Charge Transfer Spectra

The charge transfer spectrum method is a semi-empirical method often used in estimating ionization potentials of large molecules such as polyphenyls, fused ring systems, amines, and certain biochemical compounds. It is based on a semi-empirical theory developed by Mulliken to explain the absorption bands of electron donor-electron acceptor complexes in solution [76]. These bands arise from a transition from the ground state of the molecular complex to an excited state in which an electron is largely transferred from the donor to the acceptor molecule. The bands are not characteristic of the isolated donor or acceptor molecules. Hastings et al. [77] derived from the Mulliken theory a simple algebraic relation between the frequency of the maximum of the charge transfer band and the ionization potential of the donor, and correlated it with experimental information. The subject has been extensively reviewed by Briegleb [78, 79]. A limited comparison of ionization potentials derived by this method and more accurate methods indicates that the estimates are frequently correct to within several tenths of an electron volt.

3.2. Interpretation of the Data

a. Atomic Spectra and Rydberg Series

The interpretation of atomic spectra to give ionization potentials is a highly developed field with an extensive theoretical foundation. Here we will only summarize some aspects of data handling and discuss two topics of general importance to the interpretation of the results of other techniques as well. These topics are Rydberg series and autoionization.

The analysis of atomic Rydberg series is discussed in detail in the review article of Edlén [80].

An atom with one excited electron in an orbital of high principal quantum number can, in first approximation, be considered as hydrogen-like. The excited (or optical) electron sees the central force field of the nucleus screened by the remaining core electrons. Accordingly, the energy levels of this system can be described by the Rydberg formula:

$$T_n = I - [2\pi^2 Z^2 e^4/ch^3 n^2] \cdot [mM/(m+M)] = I - RZ^2/n^2,$$

where I is the ionization potential, Z is the net charge of the nucleus and core electrons, n the principal quantum number, e the electronic charge, m the electron mass, M the mass of the nucleus plus core electrons, c the velocity of light, h Planck's constant and R the Rydberg constant (for mass M). This model has been refined by consideration of two other factors. First, while the electron is outside the core it will polarize the core, and second, the electron can penetrate the core to some extent and see more of the nuclear charge. Both of these factors increase the binding energy of the electron. The theoretical treatment of these factors [81] leads to the energy expression:

$$T_n = I - RZ^2/(n-\delta)^2 = I - RZ^2/n^{*2},$$

where δ is the quantum defect, and n^* is the effective quantum number. The quantum defect varies with principal quantum number, and is generally written as a power series in $t = 1/n^{*2}$

$$\delta = a + bt + ct^2 + dt^3 + \ . \ . \ .$$

It is seen from this expression that the quantum defect varies linearly with energy in the limit of high quantum numbers. Of the two factors affecting the quantum defect, the penetration effect is important for the penetrating *s* and *p* orbitals and the smaller polarization effect is important for the non-penetrating *d*, *f*, and *g* orbitals. Quantum defects are largest for *s* orbitals, smaller for *p* orbitals and smallest for *d*, *f*, and *g* orbitals. For examples see Edlén, [80] Kuhn [82] and the references cited in Moore's compilation [83].

The procedure which is generally employed to determine the ionization limit is to choose an estimate of the ionization limit, calculate the quantum defects from the term values of the series and adjust the ionization limit until one obtains a linear dependence of the quantum defect on energy at large quantum numbers [80]. Frequently, several sets of terms are obtained from experiments corresponding to *s*, *p*, *d* . . . series. Other things being equal, it is generally the practice to determine the ionization potential from the terms of highest orbital angular momentum, for which both penetration and polarization effects are smallest and, consequently, the linear dependence of quantum defect on term energy is expected for lower terms than, say, for an *s* series. The procedure and some detailed examples are given in a study of the spectrum of Ca II [84]. For example, in figure 1 is shown a plot of quantum defect vs term value for five members of the Rydberg series ($n = 5$ to 9) of singly ionized calcium, taken from a study of Edlén and Risberg [84]. Since it is a *g* series, the Rydberg electron has very high angular momentum, the orbits are essentially non-penetrating

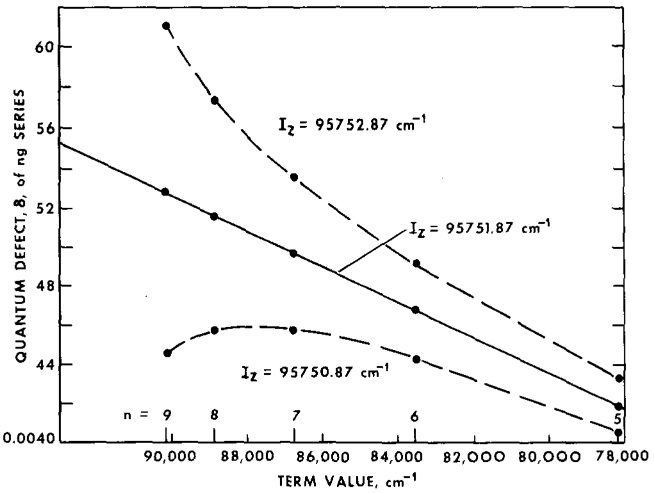

FIGURE 1. Dependence of the quantum defect, δ, on term values of the *ng* Rydberg series of Ca II, for three different assumed ionization limits. Adapted from data of Edlén and Risberg [84].

and the quantum defects are small, 0.004 to 0.006. The defects are plotted for the best value ionization limit of 95751.87 cm^{-1} and for ionization potentials assumed to be 1 cm^{-1} higher and lower, respectively.[1] It is seen that the plot is indeed linear for the correct value of the ionization potential and deviates significantly for values only slightly different from this. With this ionization potential the experimental term values can be computed with a maximum deviation of 0.005 cm^{-1} from the Rydberg formula with a linearly varying quantum defect. The authors [84] give an estimated error of several units in the last decimal place for this ionization limit. The basis for this error estimate and others in the literature is not clear. It seems to involve mainly the accuracy with which the energies of observed Rydberg series members agree with the values calculated from the formula. The most accurately known atomic series limits are those of the alkali metals and helium, all of which are stated to have errors of ±0.01 cm^{-1} or less [83]. Of these, the most accurate is the lithium limit, with an error of ±0.005 cm^{-1} [85].

There are several problems with the above approach to treatment of the data. First, assuming that the wavelength accuracy is constant in a given series of terms, the individual terms do not act equally as statistical estimators of the quantum defect. Second, if one has more experimentally determined series members than parameters in the quantum defect polynomial, the above procedure does not utilize all the information to the fullest. Third, there is no statistical basis for the error estimate. Seaton [86], has pointed out these problems and devised a least squares procedure for treating the data. He obtained for the ionization limit of helium 198310.76 ± 0.01 cm^{-1}, based on treatment of the term values of seven Rydberg series tabulated by Martin [87], compared to Martin's value of 198310.81 cm^{-1} based on the mean of three series limits, and Herzberg's [88] value of 198310.82 ± 0.15 cm^{-1}. Seaton obtains different limits for the three series considered by Martin, and concludes there is a systematic error in the term values for series members with $n > 10$. This has not yet been verified.

The discussion and examples above are for essentially unperturbed Rydberg series. The situation is far more complex for terms and series which are perturbed by configuration interaction, and this is not uncommon. If an isolated group of terms is perturbed, this will show up as an irregularity in graphs of the energy dependence of the quantum defect. Examples are given by Edlén [80]. If many terms are perturbed, much more sophisticated analyses must be carried out. Also, the spin-orbit splitting of terms complicates the analysis. This problem is encountered in the analysis of rare earth spectra [89]. In some instances the analyses are not yet far enough along to yield deperturbed term values from which limits can be derived, especially for atoms of high atomic number. Frequently, the analysis and comparison of isoelectronic terms is helpful [80]. References to individual species are to be found in the compilation of Moore [83].

b. Autoionization

States corresponding to the excitation of a more tightly bound electron or the excitation of two electrons may lie at energies above the lowest ionization energy of the atom. These can spontaneously eject an electron, undergoing autoionization. The selection rules for this type of process are well known [90], and represent essentially conservation of angular momentum and of parity. The lifetimes of autoionizing levels can vary a great deal, ranging from ~ 10^{-14} s all the way to ~ 10^{-6} s. Autoionization processes have the following experimental consequences [91, 92]:

a. Since autoionization lifetimes are frequently shorter than radiative lifetimes, in such cases these states are not observed in emission spectra.

b. Because of the selection rules, certain terms of an atomic multiplet may autoionize and others live long enough to radiate.

c. In an arc emission source, some autoionizing states will be populated at high arc currents by ion-electron recombination and hence observed.

d. In absorption, the lines will not be sharp when the autoionizing level has a lifetime considerably shorter than the radiative lifetime.

Theoretical study of the autoionization process leads to the following important conclusions [93, 94]. First, a great variety of asymmetrical line shapes can occur, including "windows" in which an autoionizing state will be observed as a local *decrease* in the absorption coefficient. It is to be remembered that since autoionizing states lie above an ionization limit, they are always observed against a continuous background of absorption

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[1] Although SI practice recommends joules and electron volts for energy units, it is useful to designate term values in cm^{-1} in spectroscopic discussions. The conversion factors are given elsewhere in the text.

due to direct ionization. Second, the higher members of Rydberg series with higher ionization potentials as their limit will always lie above the first ionization limit and often can autoionize. If one now considers the variation of the average absorption coefficient as one moves from below the limit to above the limit it is found theoretically that the variation is smooth and, in particular that there should be no "jump" or discontinuity at the limit. In an experiment measuring an absorption coefficient or a photoionization experiment one should not be able to detect a higher ionization "threshold". One can, of course, determine the wavelength of the autoionizing Rydberg series members insofar as they are resolved and carry out a conventional series analysis.

Various workers have in fact observed discontinuities at higher atomic ionization limits. These are experimental artifacts which arise as follows. In an autoionizing Rydberg series the level spacing converges with increasing energy, the individual autoionizing lines become less and less broadened and the absorption of a given line becomes concentrated in a progressively smaller wavelength range. As a result, unless the absorbing gas pressure is low enough the experimental absorption, which is of course averaged over the apparatus slit width, is no longer simply proportional to the average absorption coefficient. At and above the series limit, the absorption coefficient is no longer rapidly varying, and an abruptly increased absorption is observed. This type of artifact is observed in optical absorption experiments, which intrinsically require that a substantial fraction of the photons be absorbed. In contrast, in photoionization experiments generally a much smaller fractional absorption occurs, and no discontinuity is observed at the limit. An interesting example of this phenomenon is the argon absorption coefficient study of Hudson and Carter [95] as compared to the photoionization curves of Spohr, et al. [58] and of McCulloh [96] (see figure 2).

c. Molecular Spectra

The situation for molecules is still more complex due to added factors of vibrational and rotational structure. Approximately one hundred Rydberg series have been observed and analyzed [97]. In almost all instances, the series limits so obtained agree with photoionization threshold or later photoelectron spectroscopy measurements to within about 0.01 eV or better.

The most accurately known molecular ionization potential is that of hydrogen, which has been completely analyzed by Herzberg and Jungen [98] who obtained a value of 124417.2 ± 0.4 cm^{-1} (15.42541 ± 0.00005 eV) compared with the most accurate theoretical value of 124417.3 cm^{-1} calculated by Jeziorski and Kolos [99] and an upper bound of 124418 cm^{-1} based on observation and analysis of autoionizing rotational levels of Rydberg series in photoionization by Chupka and Berkowitz [100].

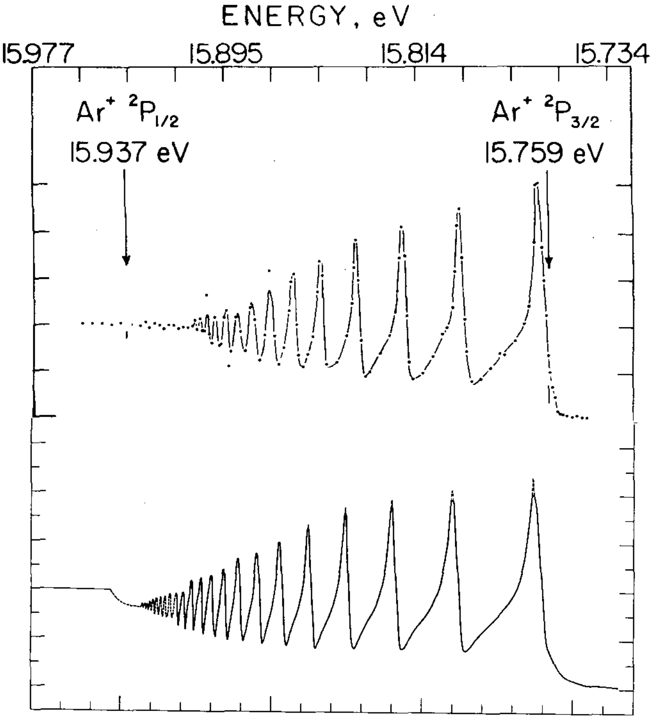

FIGURE 2. Comparison of photoionization yield (upper curve, from ref. [96]) and absorption cross section (lower curve, from ref. [95]) of argon in the ionization threshold region. Note the difference in appearance near the $^2P_{1/2}$ ionization limit.

The spectroscopic ionization potentials of other molecules are mostly based on analyses of Rydberg series. Interesting examples are described in a series of papers by Lindholm [101–103]. In these cases the rotational structure has not been resolved, leading to an uncertainty of roughly 5 meV due to difficulty in establishing the band origin. Since the geometry of the higher Rydberg states is often somewhat different from that of the ground state, the various rotational transitions to a particular vibrational level of a Rydberg state will produce a rotational envelope with a characteristic intensity distribution [104]. The appearance of this vibration-rotation band, e.g. shaded to the red or to the violet, depends on the sign and magnitude of the geometry change, as does the location of band origin corresponding to the (missing) transition between the rotationless ground state and Rydberg state. The one case where this effect has been considered is the series converging to the $b\,^4\Sigma_g^-$ state of O_2^+ [105]. The correction amounts to ~ 10 cm^{-1}.

The identification of molecular Rydberg series is often not completely straightforward. Criteria which are used include the requirement that the transitions be strong and gradually decrease in intensity with increasing energy, and, evidently, that the series fit the Rydberg formula. Frequently a deviation of 50 to 100 cm^{-1} between the calculated and measured term values is considered acceptable. However, even then there are occasional erroneous series assignments. Examples of this are found in spectroscopic studies of methylacetylene [106], ethylene oxide [107], furan [108], and nitric oxide [109].

Sometimes emission spectra are observed which are due to ions undergoing radiative transition from an electronically excited state to the ion ground state. When properly analyzed, these give information on the separation between the ion ground state and one or another electronically excited state. If Rydberg series are observed for transitions with the electronically excited ion as a limiting state, then an independent check can be obtained to verify the analysis. A particularly good example is that of molecular nitrogen [110]. Three sets of Rydberg series have been observed and analyzed. The Worley-Jenkins series converges to the ion ground state, $X^2\Sigma_g^+$, with a series limit of 125666.8 cm^{-1}; the Worley series converges to the first excited $A^2\Pi_u$ state with an average limit of 134685 cm^{-1}; and the Hopfield series converges to the $B^2\Sigma_u^+$ state at 151233 cm^{-1}. In emission, the Meinel bands have been observed and assigned to the $A^2\Pi_u-X^2\Sigma_g^+$ transition. Analysis of the two emission band systems leads to a term difference of 9016 cm^{-1} between the A and X states, and 25566.0 cm^{-1} between the B and X states. This may be compared to 9018 cm^{-1} and 25566 cm^{-1} obtained from the Rydberg series limits [110].

The determination of the various ionization potentials of molecular oxygen from spectroscopic data represents a rather different combination of information and reasoning. The first five electronic states of the O_2^+ ion are in order of increasing energy, $X^2\Pi_g$, $a^4\Pi_u$, $A^2\Pi_u$, $b^4\Sigma_g^-$ and $B^2\Sigma_g^-$. No Rydberg series have been observed to date which converge to any of the first three states. The $X^2\Pi_g$ limit is based on a photoionization threshold measurement for the production of a vibrationally excited O_2^+ ion, presumably in the $v=1$ vibrational state [111]. The result was corrected to the $v=0$ vibrational state using the vibrational frequency 1843.34 cm^{-1} of O_2^+ ($X^2\ \Pi_g$) determined from analysis of the second negative band emission system [104], leading to an ionization potential of 12.063 ± 0.001 eV. The vibrational numbering of the second negative band system has since been revised [112–114] leading to a corrected vibrational frequency of 1876.40 cm^{-1} and a resulting ionization potential of 12.059 ± 0.001 eV. One possible check on this value is the oxygen ionization threshold determined from the long-lived $O_2(a^1\Delta_g)$ metastable molecule. This has been determined as 11.090 ± 0.001 eV by photoionization [115] and 11.09 ± 0.005 eV by photoelectron spectroscopy [116]. Combining this with the O_2 $a^1\Delta_g$–$X^3\Sigma_g^-$ term difference of 7918.1 cm^{-1} (0.9817 eV) [104], leads to an $O_2(X^3\Sigma_g^-)$ first ionization potential of 12.072 ± 0.005 eV. The differences among the various results are unexplained, and possibly reflect different effects of rotations on the observations and on their interpretation. A further possible check on the ground state ionization potential could be based on the dissociation energy of the $O_2^+(X^2\Pi_g)$ state combined with the accurately known molecular oxygen dissociation energy and the atomic oxygen ionization potential. However, the O_2^+ dissociation limit is not accurately established and the results are inconclusive [113].

The $a\,^4\Pi_u$ series limit is based on the $b\,^4\Sigma_g^-$ series limit [105] and the term difference established from the first negative band $b\,^4\Sigma_g^-$–$a\,^4\Pi_u$ emission series [104]. The $A\,^2\Pi_u$ series limit is based on the $X\,^2\Pi_g$ corrected ionization threshold [112] and the term difference established from the second negative band $A\,^2\Pi_u$–$X\,^2\Pi_g$ emission series [113]. Further, the energies of other high lying states of O_2^+, the $b^4\Sigma_g^-$, $B^2\Sigma_g^-$, $c^4\Sigma_u^-$ and a possible $^2\Pi$ state have been determined from Rydberg series. The energies of the $b\,^4\Sigma_g^-$, $B\,^2\Sigma_g^-$, and $c\,^4\Sigma_u^-$ states have been confirmed by photoelectron spectroscopy; that of the $^2\Pi$ state has not (see the Positive Ion Table).

d. Ionization Threshold Laws

The determination of ionization thresholds is based upon assumptions concerning the energy dependence of the electron impact or photoionization cross section in the neighborhood of the threshold. Two cases are to be considered:

a. Determination of first ionization and multiple ionization thresholds.

b. Determination of higher ionization potentials.

For the first case, Wigner [117] and then Geltman [118] showed theoretically that, under certain restrictive assumptions, the cross section behavior in the threshold region is given by a power law of the form:

$$\sigma(E)=c(E-E_0)^{n-1},$$

where E is the ionizing electron or photon energy, E_0 the threshold energy, c a constant, and n the total number of outgoing electrons for the ionization process. This then leads to a linear threshold law for single ionization by electron impact, a quadratic threshold law for double ionization, and so on. For photoionization there would be a step function threshold for single ionization, a linear threshold for double ionization, etc. Morrison [119] showed how various derivatives of electron impact and photoionization curves could be used to obtain information on excited states of ions. His discussion was based implicitly on threshold laws of the above form.

In view of the widespread treatment and interpretation of ionization data tacitly based on use of these threshold laws, it is appropriate to inject a note of caution. The treatments of Wigner and Geltman do not give any information at all about how far above threshold the laws are expected to be valid. For practical purposes a range of validity of an electron volt or two would be desirable. However, there is no guarantee that the range of validity is this large; it may only be several millivolts, or even less, and it may vary from system to system. Thus, there is no theoretical reason to expect that there exist threshold laws of exactly the form, range of validity and universality desired by experimentalists.

The experimental evidence on photoionization of atoms is as follows. Among the rare gases, the photoionization cross sections of argon, krypton, and xenon are very nearly step functions above the $^2P_{1/2}$ threshold (the $^2P_{3/2}$ threshold region is overlaid with autoionizing terms of the Rydberg series converging to the $^2P_{1/2}$ limit) [120]. The photoionization cross section curve of neon exhibits a discontinuous onset but above that it has a pronounced positive slope [121]. Finally, the helium curve has a discontinuous onset followed by a negative slope, [121, 122] i.e. it resembles a saw-tooth. A large number of experimental results for other atoms, showing a wide variety of cross section behavior, are summarized and discussed by Marr [122]. A large number of these results have been more or less quantitatively confirmed by theoretical calculations. The simplest case, the photoionization cross section curve of the hydrogen atoms was accurately calculated many years ago and the energy dependence above the discontinuous threshold is proportional to $E^{-8/3}$ [123].

For electron impact ionization of atoms the situation is also complex. Following Wigner's general threshold law derivation, Bates and co-workers [124] carried out Born approximation calculations and also derived a linear threshold law for electron impact single ionization. However, Wannier [125] arrived by a classical phase space argument at a 1.127 power law. This argument has recently been put on a quantum mechanical basis by Rau [126]. It is now clear that there is no general linear threshold law for single ionization. The available experimental results indicate that near threshold the cross section energy dependence is not exactly linear, but close to the 1.127 power law [127–130]. In addition, for krypton and xenon which have large separations between the $^2P_{3/2}$ and $^2P_{1/2}$ ion states, there is evidence of more complicated behavior near threshold due to autoionization and, possibly, transient negative ion states. However, different experimenters obtain different results [131]. Studies on Na, K, and Mg on the other hand suggest a linear threshold law for single ionization [132, 133].

Experimental determinations of the threshold laws for multiple ionization have been carried out by a number of workers. However, none of these experiments employed truly monoenergetic electron beams. For helium, sodium, and potassium where there are no low lying excited doubly charged ion states, double ionization follows a quadratic threshold law [132, 133]. The experiments were carried out with both RPD and conventional electron beam sources. Studies of the other rare gases have also been carried out with these techniques [134–137]. The results are in conflict and the question of the form of the threshold law remains unresolved. These studies are complicated by the existence of excited multiply charged ion states near threshold, which may affect the experimental threshold behavior in a manner depending on the electron energy distribution. Studies on multiple ionization of other metal atoms show that the ionization efficiency curves have structure which can be correlated with autoionization and Auger effects [138, 139]. However, these features in the ionization efficiency curves have not been employed in a predictive fashion, and the prospect for doing so is remote.

e. Photoionization Thresholds of Diatomic Molecules

In contrast to atoms, the photoionization thresholds of molecules are not sharp because an ionizing transition in the threshold region is in fact a sum of many individual transitions of closely similar energy from one or another rotational state of the molecule to one or another rotational state of the ion. The molecule will generally be in the vibrational ground state. However, a number of vibrational states of the ion will be accessible. In addition, the ion electronic state is often a doublet, with a spin-orbit splitting that may be small, comparable to, or larger than the spacing of the vibrational levels of the ion. Thus, the problem of deducing the energy difference between the ground state of the molecule and the rotationless, vibrationless, electronic ground state of the ion (i.e. the adiabatic ionization potential) requires some analysis. Aspects of this problem have been discussed in detail by Guyon and Berkowitz [140].

Since the energy resolution of almost all photoionization experiments is not enough to resolve rotational structure, it is useful to discuss vibrational effects first.

The direct photoionizing transition of a molecule obeys the Franck-Condon principle [141–143]. According to this principle, the position of the nuclei and their momenta are unchanged by the transition. As a result the vibrational levels of the ion that are accessible in the transition depend upon the position and shape of the ion potential curve relative to the neutral potential curve (see figure 3). If the ion curve is very similar in shape and has an equilibrium internuclear distance identical to that of the molecular curve, essentially only the ion vibrational ground state will be accessible from the molecule ground state. If the ion internuclear distance is a little greater or smaller than that of the molecule (several thousandths of a nanometer) additional ion vibrational levels become accessible and a vibrational progression will be observed, with an intense $(0 \leftarrow 0)$ transition and progressively less intense transitions to the higher vibrational levels. For larger differences, roughly 0.005 nm and more, the vibrational ground state $(0 \leftarrow 0)$ transition is no longer the most intense and the maximum transition probability shifts to a higher vibrational level. For still larger distance changes, the $(0 \leftarrow 0)$ transition may be so weak as to be unobservable, and a significant portion of the accessible transition region may lie above the dissociation limit. To a good approximation the relative transition probabilities to the various ion vibrational levels may be represented by squares of normalized vibrational overlap integrals, also called Franck-Condon factors. A graph of the distribution of relative transition probabilities is known as a

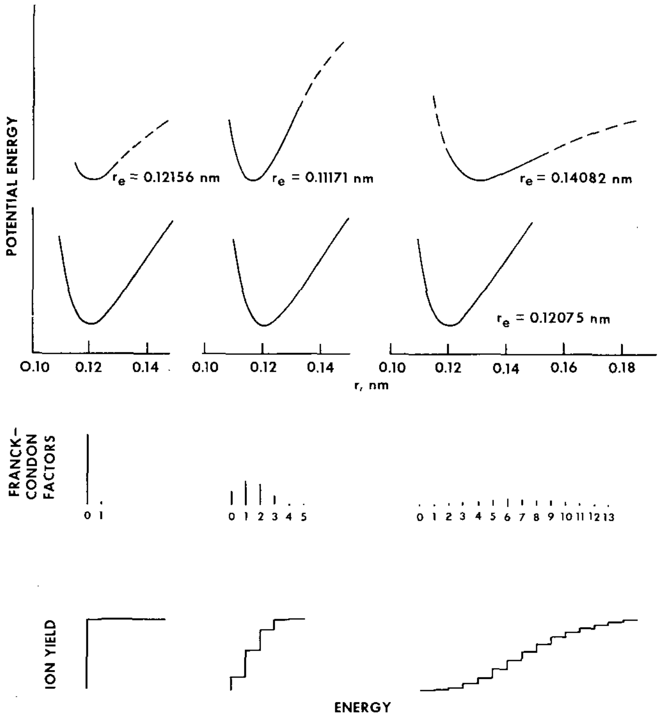

FIGURE 3. Franck-Condon factors and hypothetical direct photoionization yield curves expected for small, moderate and large bond length changes in a vertical ionization. Adapted from calculations by Krupenie [270].

Franck-Condon envelope. Thus, as the difference between the ion and neutral equilibrium internuclear distance changes from negligible to very large, the Franck-Condon envelope changes from a single vertical line to a monotone decreasing curve to a distorted bell shaped curve (see figure 3).

In direct photoionization, the various vibrational transitions manifest themselves as a staircase structure in the threshold region, with relative step heights corresponding to relative values of the Franck-Condon factors. This structure will occur if the photoionization threshold law is a step function. This appears to be the case for molecules studied thus far, in contrast to atoms. Experimentally, the sharp staircase structure would be smeared out into a series of sigmoidal onsets due to the triangular slit function of the monochromator. The point of inflection of the sigmoid occurs at the onset of the sharp step, and represents the point to be taken as the onset energy.

The effect of rotation on the direct ionization cross section curve shape is to produce some additional tailing of the onset and rounding of the step as a result of the spread of threshold energies of the individual rotational transitions. The exact shape of the threshold curve depends on the thermal population of rotational levels, the difference in moment of inertia of the molecule and ion, and the selection rules. The only case in which this effect has been analyzed carefully is in the photoionization of HF [140]. The analysis was only partially successful and the uncertainty in the estimated adiabatic ionization potential is somewhat less than 10 meV. For heavier molecules the uncertainty would be even less.

The next factor to be considered is vibrational hot bands. At room temperature most diatomic molecules have only small populations of vibrationally excited molecules. These will produce photoions below the adiabatic threshold through $(0 \leftarrow 1)$ transitions if, as is nearly always true, the ion and molecule bond lengths are not identical. In those cases the photoionization threshold region shows a small step followed by a large step, readily identified as the $(0 \leftarrow 0)$ transition, and a series of progressively smaller steps. This interpretation is readily confirmed since the energy difference between successive steps corresponds to the energy difference between the molecule ground and first vibrationally excited state. Further, changing the vibrational population by changing the sample temperature can be used to study and correct for hot band effects. In some cases, notably Br_2 and I_2, the vibrationally excited populations are so high and the vibrational progressions so long that this approach is essential to determining the adiabatic ionization potential [144].

Hot band problems are also widely encountered in the photoionization of high temperature species such as alkali and other metal halides [145]. The threshold curves have a more or less exponential tail, due principally to the Boltzmann distribution of vibrational populations [146]. The vibrationally excited species can have a lower ionization threshold for two reasons. First, $(0 \leftarrow 1)$, $(0 \leftarrow 2)$, $(0 \leftarrow 3)$, etc. transitions may occur as a result of differences between the ion and neutral bond distances. Second, only $(0 \leftarrow 0)$, $(1 \leftarrow 1)$, $(2 \leftarrow 2)$, etc. transitions may occur when there are only very small bond length changes. In this case, vibrational frequency differences between the ion and neutral will also produce progressively lower thresholds for the higher transitions. Consideration of these factors and plausible sets of Franck-Condon factors indicates that the threshold curve cannot be exactly exponential but will be nearly so. The adiabatic threshold is determined by plotting the data on a semilog scale and locating the point of departure from linearity. Numerous examples and detailed discussion are given in a review by Berkowitz [145].

The phenomenology of direct ionization sketched above has superimposed on it the effects of autoionization. In addition to the autoionization of high Rydberg states converging to the higher doublet limit of the ion ground state, and various terms converging to electronically excited ion states there is now a new possibility, namely, autoionization of Rydberg states belonging to series converging to vibrationally excited ions in their electronic ground state. The mechanisms of these processes have been discussed by Berry [147]. The effect of the autoionization is to change the expected staircase structure of direct ionization to a more complex one showing numerous peaks indicating autoionizing Rydberg levels converging to various vibrationally excited levels of the ion ground state. In NO for example, this additional structure is not very pronounced [148] whereas in the halogens [144] it is the dominant feature of the threshold region. Early photoionization work [146] on NO did not show this autoionization structure clearly, due probably to a poorer signal-to-noise ratio and fewer data points. A comparison is shown in figure 4.

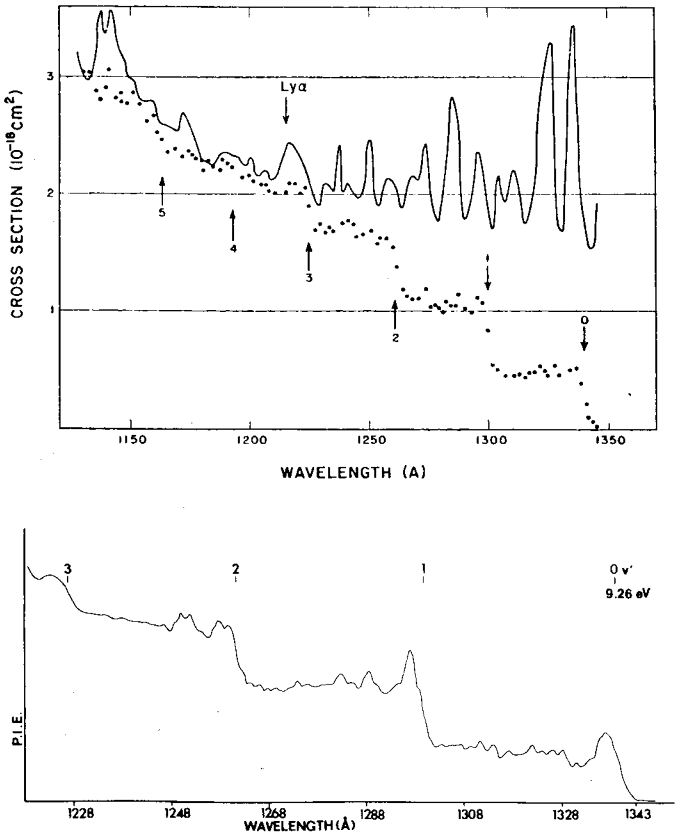

FIGURE 4. The ionization threshold region of NO. The upper curve is the total absorption cross section, and the experimental points the ionization cross section, determined in early experiments by Watanabe [146]. The lower curve is the photoionization yield curve recently determined by Killgoar et al. [148], showing pronounced autoionization peaks superposed on the staircase structure.

Lastly, Chupka and Berkowitz have drawn attention to the possibility that spurious lowering of ionization thresholds could result from collisional or electric field ionization of highly excited states produced by photon absorption slightly below the true ionization limit [149]. This can present a serious problem in very accurate threshold measurements, but no examples have yet been published.

f. Electron Impact Thresholds of Diatomic Molecules

Prior to the general recognition of the importance of autoionization it was expected that careful study of the electron impact ionization threshold region with monoenergetic or quasi-monoenergetic (RPD and EDD) techniques would give information on the Franck-Condon factors for vertical transition to the ion ground state. Assuming a linear threshold law for single ionization it was expected that a series of straight line segments would be observed in the threshold curve, with the onset of each new segment representing transition to a new vibrational level. The successive slope increases were interpreted as relative Franck-Condon factors. A significant number of the earlier studies employed a data treatment which was essentially a decision that successive groups of experimental points should fit a series of straight line segments, and indeed plausible results were obtained in some instances. In many other instances the decision that the data fitted a series of straight line segments rather than a smooth curve appeared quite subjective. Another approach taken was to deal with this problem electronically by taking derivatives of the ion current as a function of electron energy [150] and, later, overcoming the effect of electron energy spread and noise by means of deconvolution techniques [151, 152]. Application of these techniques to diatomic molecules revealed that the form of the ionization threshold curves was more complex, due to autoionization; the existence of straight line segments was not confirmed. The manner in which a combination of direct ionization and autoionization determines the form of an electron impact threshold curve has not yet been analyzed in detail.

In practice, with nearly monoenergetic electrons one generally obtains smooth threshold curves of more or less similar shape no matter what molecule is studied, and with a rare gas threshold curve for calibration of the energy scale and as an indicator of the electron energy spread, one can obtain results in essential agreement ($\leq$50 meV difference) with spectroscopic values [153, 154]. To date no procedure has been developed for correcting for hot bands or rotational effects.

There is no sound foundation for the still widely used conventional methods employing non-monoenergetic electron beams, a calibrating gas (generally a rare gas), and a variety of empirical extrapolation laws. These methods give results which are generally several tenths of an electron volt higher than the correct value, sometimes more and sometimes less. The problem is especially acute for species observed in high temperature Knudsen cell studies. Here hot band effects can be important, as discussed above, yet the electron impact results are still significantly higher than the true value. This is most likely a result of the conventional methods employed, especially the linear extrapolation and vanishing current techniques. Very careful studies have been carried out by both electron impact and photoionization on diatomic sulfur. These afford a basis for comparison. In spite of careful calibration procedures the electron impact result was more than 0.5 eV higher than the subsequent photoionization and spectroscopic results, which are in essential agreement [155, 156]. Additional comparisons and instances of closer agreement have been discussed by Hildenbrand [157]. Some other Knudsen cell studies undoubtedly give better answers. However, this will not become apparent until independent confirmation is obtained by more reliable techniques. At present, the only basis for assessing the likely inaccuracy of a particular measurement is the apparent care with which the measurement and calibration is carried out. The use of some diatomic and polyatomic gases of known ionization potential at high temperatures for calibration purposes might improve the degree of reliability of experimental results.

g. Photoelectron Ionization Thresholds

The basis for interpretation of photoelectron spectra has been extensively discussed in the books of Turner [32] and Eland [158]. In a photoelectron spectroscopy experiment, the ejected electron energy analyzer samples electrons arising from allowed electronic transitions to all vibronic levels of the ion which are Franck-Condon accessible and lie at or below the energy of the photon source line. With the assumption that the photoionization threshold law is a step function which is flat from the ionization threshold energy to the energy of the photon source line, the energy of the electrons ejected from any given electronic state will have a distribution determined by the Franck-Condon factors. With sufficient analyzer resolution one obtains for each accessible and allowed electronic transition a literal "bar graph" of experimental Franck-Condon factors. This enormously simplifies the determination of ionization potentials insofar as identification of the $(0 \leftarrow 0)$ transitions is concerned, not only for the first ionization potential but for higher ones as well. The spacing and Franck-Condon accessibility of higher electronic states is often of such a character that the accessible energy range of different states may overlap to some extent, i.e. there may be overlapping vibrational progressions. These aspects are well illustrated in figure 5 taken from the work of Edqvist et al. [44] on oxygen, carried out with an apparatus of 12 meV resolution (FWHM). An important application of this aspect of photoelectron spectra is to problems where hot bands may be important. Recently the photoelectron spectrum of the SO radical has been observed [159]. The SO was produced by means of a gas discharge in an SO_2 rare gas mixture. This method of producing transient unstable species raises questions as to whether the species so generated are vibrationally excited or not. The photoelectron Franck-Condon factors clearly indicate that this is not a problem and that a good adiabatic ionization potential can be obtained. A similar case is the hot band problem in some halogen molecules which was discussed above in connection with photoionization. The photoelectron spectra at room temperature are of course also complicated by this factor. Here, too, experiments at different temperatures are very useful in correcting for hot band effects [160].

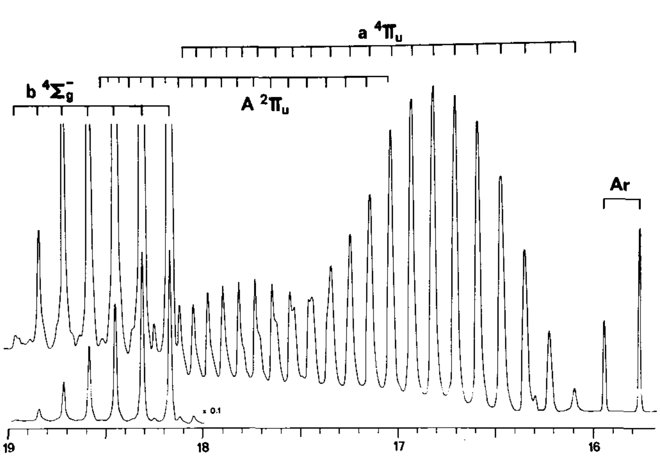

FIGURE 5. High resolution photoelectron spectrum of O_2, showing overlapping vibrational progressions from transitions to different electronic states of the ion. From work by Edqvist et al. [44].

The above discussion on deriving experimental Franck-Condon factors is somewhat oversimplified. There is no reason to suppose that the molecular photoionization threshold law is strictly a step function. Small deviations from this step function form will bring about some differences in the electronic part of the transition probability to various vibrational levels of an electronic state, so that the experimental relative intensities of the vibrational transitions no longer accurately represent the Franck-Condon factors. As evidence of this it is to be noted that the relative integrated intensities (integrated over all the vibrational structure) of transitions to various electronic states do depend on the photon source line energy [161]. Further, the angular distribution of photoelectrons depends both on the type of electronic transition and on the energy with which the photoelectron is ejected in producing a given ion state, i.e. the incident photon energy and the specific vibrational level [162–164]. Unless the apparatus is set up to collect photoelectrons at a fixed special angle, the resulting information on electron energy distribution may be distorted [165]. Part of the data interpretation problem, of course, is concerned with proper assignment of the electronic transitions observed. This is an extensive and highly specialized subject on which the reader is referred to the books of Turner [32] and Eland [158] and to the various papers cited in the Positive Ion Table.

In comparison with photoionization, the photoelectron spectroscopy experiments suffer far less interference from autoionization phenomena. In photoionization, the wavelength scan sweeps over all accessible neutral states which can autoionize (and many do). The photoelectron experiment yields information on many states with one photon wavelength. If an accessible autoionizing neutral state happens to lie at the ionizing photon energy, the process will of course occur and will add its complications to the measurement and interpretation [166].

The best present-day photoelectron experiments are capable of producing data with a reported accuracy

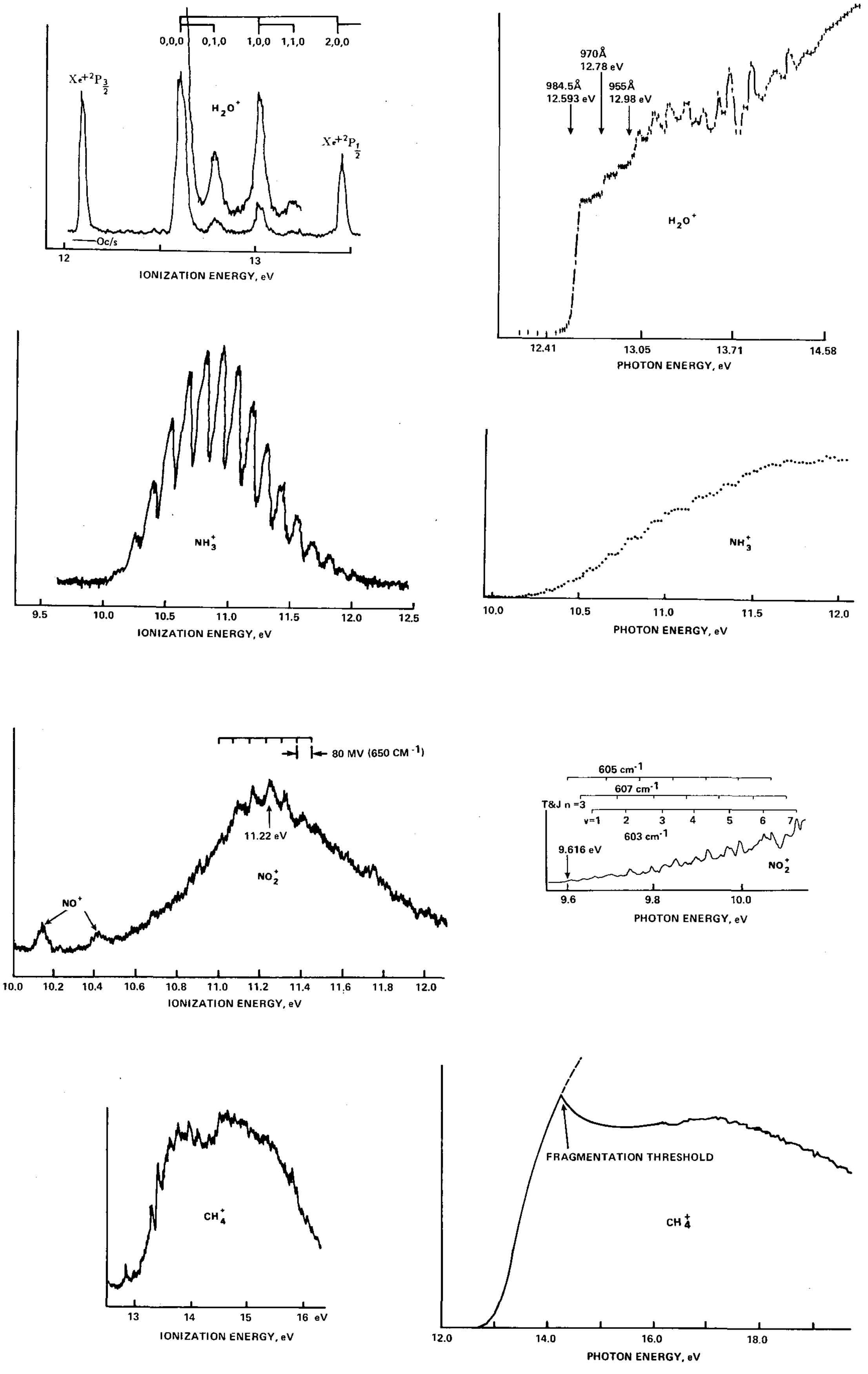

FIGURE 6. Photoelectron spectra and photoionization yield curves in the ionization threshold region for H_2O, refs. [271] and [272], NH_3, refs. [273] and [274], NO_2, refs. [275] and [174], and CH_4, refs. [180] and [168].

approaching 2 to 3 meV (~ 15 to 25 cm^{-1}). This accuracy is comparable to that of the best photoionization experiments (excepting the work on hydrogen [100], which is even better). Both in turn are beginning to approach the accuracy of many spectroscopic experiments. All have in common the problem of analyzing and correcting the experimental data for the contribution of various rotational transitions. With but three exceptions, H_2, N_2, and CO, spectroscopic data are measured on band heads, while photoionization data are measured on thresholds, and photoelectron data are measured on peak maxima of resolved vibrational levels. These three approaches are not simply related and remain to be analyzed in order to push accuracy and comparability beyond the 5 meV (40 cm^{-1}) limit.

h. Photoionization Thresholds of Polyatomic Molecules

The interpretation of photoionization thresholds of polyatomic molecules involves problems analogous to those for diatomic molecules. In addition to the form of the threshold law two aspects are especially significant, the Franck-Condon principle and hot band effects.

The experimental evidence for validity of the step function threshold law for direct ionization is not easy to assess because of the additional complexities introduced by Franck-Condon factors, hot bands, autoionization, and fragmentation. Where these complexities do not obscure things it appears that the step function threshold law is more or less closely followed. Exceptions include a number of ketones which have a variety of non-zero slopes above threshold [167], and methane, which appears to have an "overshoot" form [168]. It is not known how much of this overshoot is due to autoionization.

Whereas in the diatomic case one has only to consider the effect of a single internuclear distance change on the vibrational structure in direct photoionization, in the polyatomic case there can be changes in bond distances, bond angles and even in symmetry. The possibilities for vibrational structure are correspondingly more complex. In many instances the photoionization threshold curve still has a reasonably sharp onset which most probably corresponds to the adiabatic threshold. This is true for processes involving removal of a nonbonding electron, where little change in molecular geometry is expected. However, there are many cases in which significant geometry changes occur. These include ionization of tetrahedral and octahedral molecules, for which the equilibrium geometry of the ion ground state is considerably different from that of the neutral molecule due to the Jahn-Teller effect [169, 170]. In these instances, the photoionization threshold curve has a very gradual onset, and it is not immediately apparent whether the accessible (i.e. observed) Franck-Condon region includes the (0 ← 0) transition. A variety of ion yield curves are shown in figure 6. It is interesting to note that the values of the CH_4 ionization potential reported over the years have become progressively lower and lower, due presumably to the progressive increase in apparatus sensitivity (see figure 7). The adiabatic ionization potential is still not firmly established. In other cases, ionization of tetrahedral molecules produces only fragment ions, indicating that the parent ion equilibrium geometry is so different that the Franck-Condon transition does not even reach a stable region of the ion potential surface.

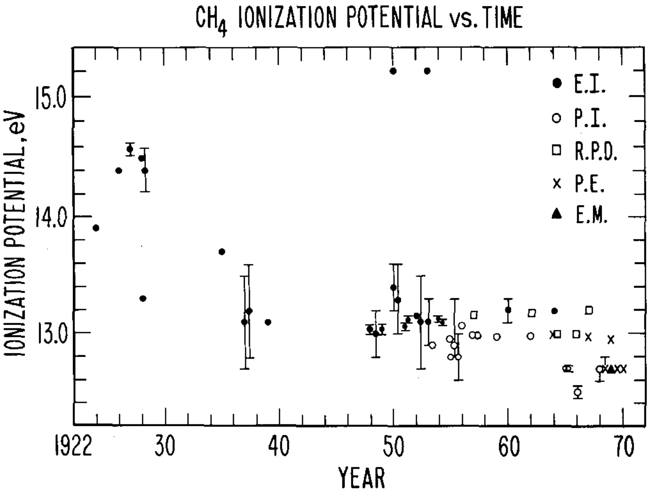

FIGURE 7. Variation over the years in the experimental values of the ionization potential of methane. Where no error bars are shown the limits of error are small.

In the case of NH_3, the removal of a "non-bonding" electron changes the molecular geometry from pyramidal to planar and the photoionization threshold exhibits only a weak (0 ← 0) transition [171]. Indeed, the identification of the (0 ← 0) transition is based on spectroscopic studies of the isotopic shift of vibrational Rydberg series terms [172]. A similar problem is found in the photoionization of the CF_3 radical [173], where the location of the (0 ← 0) transition is not yet firmly established. Also, it is not clear whether or not the experimentally generated radicals are vibrationally excited and show hot band effects.

Still another type of Franck-Condon problem arises in transitions between bent and linear (or vice versa) configurations, which produce long vibrational progressions. This is the case for NO_2, where the molecule is bent, with a bond angle of 134°, and the ion is linear. It is not yet established whether the photoionization threshold represents the (0 ← 0) transition. Only an upper limit has been obtained for the adiabatic ionization potential [174].

Large molecules often have low frequency normal modes which are appreciably populated at room temperature and whose effects on thresholds should be taken into account. However, the problem is very difficult. The photoionization curves of higher alkanes [175] and alkyl radicals [176] show a gradual onset which may be partially due to hot band effects. At present all that can be stated is that the adiabatic ionization potentials of these compounds are uncertain. Fortunately, there are many cases where the hot band effect appears as a low intensity tail preceding a large increase in the photoionization yield. An example of this is the acetylene molecule (see figure 8). There is little doubt that the large increase is due to the (0 ← 0) transition. Sometimes the (0 ← 0) transition is located by plotting the photoion yield on a semilog scale and looking for the departure from linearity as discussed earlier. As a result of differences in data interpretation there are sometimes differences of up to 5 meV in reported threshold values obtained by different workers. The various photoionization measurements on the first ionization potential of benzene are a good example (see the Positive Ion Table).

As in the diatomic case, the shape of the photoionization threshold curve may be affected by autoionization, which can somewhat complicate or even completely obscure the staircase structure expected from the Franck-Condon factors for direct ionization. Also, the observed structure is dependent on the photon energy resolution. Early work on photoionization of acetylene showed a staircase structure that could be readily related to Franck-Condon factors [177]. However, a recent study employing higher resolution (0.05 nm compared to 0.2 nm) demonstrated that the threshold ion yield curve shows a combination of direct ionization and a significant amount of superposed autoionization [178]. This is illustrated in figure 8. The experimental Franck-Condon factors for the estimated direct ionization were in good agreement with those determined by photoelectron spectroscopy and those theoretically calculated [171]. In another case, early work on photoionization of CO_2 near threshold suggested a significant deviation from the step function threshold law. Recent work at higher resolution demonstrated that in the threshold region there was considerable autoionization from an excited valence state of CO_2 [96] which strongly influenced the shape of the photoionization yield curve. Lastly, in the photoionization of methane there is considerable structure in the threshold curve. To what extent this is due to a complex series of vibrational progressions or to autoionization is unclear [179]. The photoelectron spectrum of methane also shows vibrational structure [180].

In summary, the determination of adiabatic ionization potentials from photoionization curves of polyatomic molecules is not always straightforward. In some cases, where there are large geometry differences between the ion and the molecule, the adiabatic value cannot be determined. These difficulties also manifest themselves in the uv spectra and in photoelectron spectra. However, in many other cases agreement among all three methods is better than 5 to 10 meV.

i. Electron Impact Thresholds of Polyatomic Molecules

It is evident from the above discussion that a wide variety of electron impact threshold behavior is to be expected for polyatomic molecules. This, when folded into a large electron energy spread (whose shape may

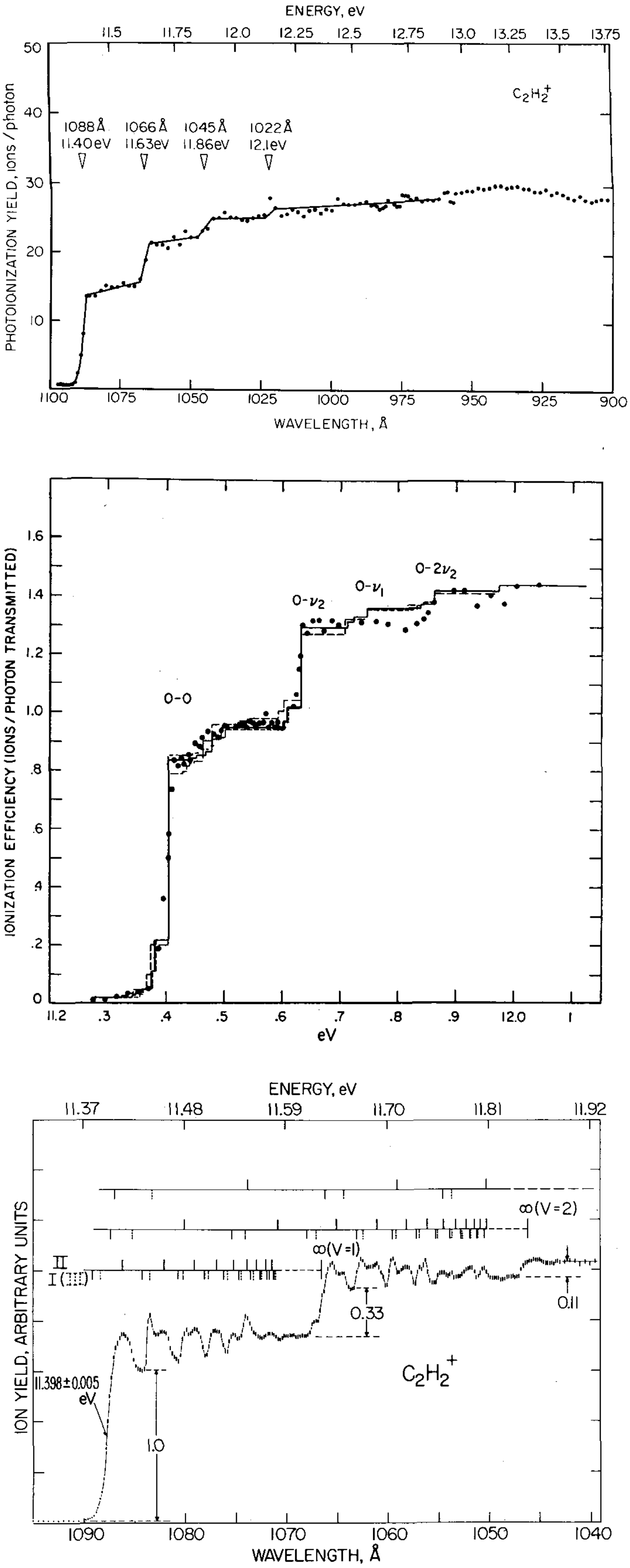

FIGURE 8. Photoionization yield curve in the threshold region of acetylene in three successive experiments of increasing refinement, refs. [276], [177], and [178].

vary with electron energy and the chemical nature of the gas sample) leads to a very ill-defined situation. The basis for the choice of calibrating gas and the meaning of the calibration process is not at all apparent. Reduction of the energy spread by means of an electron monochromator [154] appears to have overcome these difficulties in spite of the arbitrary nature of the calibration process. Essentially all of the ionization potentials determined by this technique are in satisfactory agreement (10 meV or better) with spectroscopic, photoelectron, and photoionization measurements with the exception of the results on methane [154] and benzyl radical [181, 182]. In methane the electron impact threshold curve does not have a sharp onset and the authors express the result as an upper limit ($I_z \leq 12.70$ eV) which is about 0.1 eV higher than the most recent photoionization ($\leq 12.615 \pm 0.010$ eV) [179] and photoelectron (< 12.616 eV) [170] upper limits. This is probably a matter of apparatus sensitivity. The ionization potential of the benzyl radical determined with an electron monochromator [181] ($\leq 7.27 \pm 0.03$ eV) is 0.4 eV lower than that obtained by photoionization [182] (7.63 eV). The reason for this is unknown. Other quasi-monoenergetic electron impact techniques (RPD and EDD) show a wide variety of agreement or disagreement which is, unfortunately, unpredictable.

j. Higher Ionization Thresholds

Numerous higher ionization thresholds have been determined by photoelectron spectroscopy and a small number by uv spectroscopy. The associated problems of Franck-Condon effects and assignment of the electronic transition have already been touched on. Some further aspects of photoionization and electron impact experiments should be discussed in this connection.

As mentioned above, molecular photoionization experiments reveal the presence of many autoionizing states which are members of Rydberg series converging to vibrationally and/or electronically excited ion states. In the discussion on atomic ionization potentials it was pointed out that in photoionization there would be no observable higher ionization threshold discontinuity. In the molecular case, however, the higher Rydberg states that autoionize also can undergo the competing process of predissociation into excited neutral species. This will lower the net ion yield per unit of absorption below a higher ionization threshold in comparison to the ion yield above the threshold where it is unity. Thus, in principle, higher ionization thresholds may be "directly" observable. However, the few observations of this type reported in the literature are not completely convincing [183]. Again, in principle, one could make the thresholds observable by raising the gas pressure to the point where true averaging of the absorption coefficient no longer occurs.

As for identification and interpretation of interesting features in the RPD and EDD electron impact curves above threshold no definitive information has yet been gained, the rationale is unclear and even the reality of the features is in dispute. One particular case that merits mention is the threshold curve for acetylene ion. Early photoionization work and Franck-Condon calculations indicated that the threshold photoion yield curve had a staircase structure due to a strong (0←0) transition and lesser excitation of the first and second carbon-carbon stretching overtones, with some minor additional transitions [177]. Later, the existence of these stretching transitions was confirmed by photoelectron spectroscopy [184]. An EDD study, however, concluded that the (0←0) transition was very weak and suggested that the Franck-Condon principle was violated [185]. Subsequently an electron monochromator study corroborated the results of the EDD study [186]. And more recently a different electron monochromator study disagreed with this work and essentially confirmed the Franck-Condon factors found in the photoionization and photoelectron spectroscopic work [187]. Finally, a recent photoionization study showed that autoionization was an important contributing process in the threshold region [178]. In view of the autoionization problem, the significance of the most recent electron monochromator results is not clear. One can only conclude that further careful work is required and that each molecule will present its own characteristic but interesting difficulties.

k. Multiple Ionization Thresholds

A number of molecules have doubly and triply charged ion states which are stable enough to permit ionization threshold measurements. Available experiments, employing conventional non-monoenergetic electron beams, indicate that double ionization follows a quadratic threshold law, whereas the results on triple ionization are inconclusive [188]. Also, high kinetic energy fragment ions, presumably arising from decomposition of doubly charged parent ions, have been shown to follow a quadratic electron impact threshold law [189]. It has also been shown that the appearance potential of these ions increases with increasing kinetic energy [190], as required from simple energy considerations.

l. Diatomic Fragmentation Thresholds

The idea that the fragmentation of diatomic ions could be described by the Franck-Condon principle was first advanced in 1928 by Condon and Smyth [191, 192]. The idea was that ionization produced vertical transitions from the molecule ground state to the various ion electronic states and that depending on the electron energy and the shape and location of each of the ion potential curves one would observe characteristic yields (large, small, none) of fragment ions with characteristic kinetic energy distributions. In the case of hydrogen, enough was known about the H_2^+ attractive and repulsive potential curves to lead to the prediction that little if any fragmentation would result from a vertical ionizing transition to the attractive $H_2^+(^2\Sigma_g^+)$ ground state, and that fragment ions would be produced exclusively by transitions to the repulsive $^2\Sigma_u^+$ state with a resultant kinetic energy of several electron volts. This was verified shortly thereafter by Bleakney [193]. The idea that fragmentation results from direct vertical transition to a repulsive curve or to an accessible part of an attractive curve which happens to lie above the dissociation limit is only a first approximation. Other factors must be considered. Fragmentation can occur via ion-pair production or via predissociation from an attractive ion state by curve crossing. Also, ion states may be populated by autoionization as well as by direct ionization.

In the autoionization case the Franck-Condon principle applies also, but in two steps. First, a particular region of an autoionizing electronic state becomes accessible by vertical transition from the molecule ground state. Second, for each populated autoionizing vibronic state a region of the ion curve becomes accessible since molecular autoionization is also governed by the Franck-Condon principle [166, 194]. The net result is, in effect, to broaden the accessible ion curve region beyond that expected from a direct ionization process. In order to derive ion thermochemical data from experimental fragmentation threshold data it is necessary to establish the nature of the dissociation process, the electronic states of the fragments, and the kinetic energy distribution of the fragments. Examples of the problems encountered are given below.

I.1. H_2

There has been very little recent work directed to measuring the dissociative ionization of hydrogen by electron impact and only one study by photoionization. This is probably due to the fact that the threshold energy for the dissociative ionization process is well known from the dissociation energy of the hydrogen molecule and the ionization potential of the hydrogen atom. In electron impact the threshold for formation of H^+ is in fact lower by about 0.8 eV due to the ion-pair process:

$$H_2 + e \rightarrow H^+ + H^- + e,$$

and there is a fairly sharp increase in proton current starting at the energy corresponding to dissociative ionization [195]. Recently the ion-pair process has been carefully studied in detail with photoionization [196]. Several thresholds were observed corresponding to predissociation of excited hydrogen molecules in different rotational states into ion pairs. With the assumption that the fragments had zero kinetic energy, and using accepted values for the dissociation energy of H_2 and the ionization potential of the hydrogen atom, a value was derived for the electron affinity of the hydrogen atom in essentially exact agreement with the best theoretical value (experiment, $\geq 0.754 \pm 0.002$ eV, theory, 0.75421 eV).

The kinetic energy distribution of protons from the dissociative ionization process has been carefully studied several times and is qualitatively in accord with expectations from the Franck-Condon principle [197, 198], however, no quantitative agreement has yet been obtained [199, 200]. Important aspects of this problem have been discussed recently by Crowe and McConkey [201]. In contrast, the experimentally measured kinetic energy distribution of proton pairs formed by double ionization of molecular hydrogen with 1 keV electrons is in very close agreement with accurate Franck-Condon calculations [202].

I.2. N_2, O_2, CO, and NO

It is well known that if one has an accurately determined ion fragmentation threshold, has established the electronic states of the fragments at threshold, has measured the kinetic energy distribution of the fragments and established a meaningful threshold energy correction procedure, and knows the energy required to form the ion in its product state from the corresponding atom in the ground state, one can determine a bond dissociation energy. This line of reasoning is widely applied in more or less detail in mass spectrometric experiments for determining bond energies. A somewhat similar line of reasoning applies to spectroscopic determinations of bond dissociation energies. Ideally, one should obtain the same answer on the same system. In practice, very often the requisite information is not all at hand in sufficient detail and accuracy to provide a definitive answer. There is no better illustration of this than the years-long controversies concerning the dissociation energy of the nitrogen molecule and of the carbon monoxide molecule (the latter case is equivalent to the heat of sublimation of graphite controversy). The history of these controversies can be followed in the three successive editions of Gaydon's book [203].

Briefly, a number of spectroscopic observations led to accurate values of energy thresholds at which these molecules predissociated. However, the lack of definite information on the electronic states of the product atoms led to a set of highly accurate but widely differing bond energy values for each molecule, only one of which could be correct. Other spectroscopic studies directed to determining the bond dissociation energy by extrapolation of the energies of the converging vibrational levels were at first inconclusive. During the same period a number of very careful electron impact mass spectrometric studies were directed at this problem area as well [12, 197, 198, 204–209]. Much effort was devoted to measurement of fragment ion kinetic energies, and examination of the complications arising from ion-pair formation processes. The efforts were handicapped for some time by lack of accurate knowledge of certain electron affinities. All in all it took years of effort to arrive at a set of answers that was consistent with all spectroscopic, mass spectroscopic, thermochemical, kinetic and high temperature information. The literature of this problem is replete with reasonable, plausible, but ultimately incorrect information.

This story must be kept in mind when reporting or evaluating experiments on mass spectrometric bond dissociation energies. A very widespread assumption, almost never stated explicitly, is that dissociation products are formed in their ground state. Too few experimenters report the use of available capability to establish whether or not ion-pair processes are significant. And in the case of electron impact experiments the capability of observing negative ions is subject to possible interference from dissociative electron capture processes. In our opinion, the large body of bond energy data based on conventional non-monoenergetic electron impact measurements is subject to errors of up to 50 kJ mol^{-1}. The small body of results now being obtained by means of monoenergetic electron beam techniques is an order of magnitude more reliable. And this can be demonstrated by the self-consistency of the results and the agreement of experimental thresholds with photoionization measurements, which do not suffer from energy spread or energy calibration problems at this level of accuracy.

With these facts in mind we turn to a photoionization controversy. All that has changed is that the need for energy scale calibration and the broad energy distribution of the ionizing beam have been eliminated.

l.3. F_2, HF, and ClF

The photoionization controversy has centered about the dissociation energy of fluorine. In this case one set of photoionization studies by Dibeler et al. on fragmentation processes of the above molecules arrived at a seemingly self-consistent set of threshold values all supporting a value of 1.34 ± 0.03 eV for the dissociation energy of fluorine, lower than the generally accepted value of 1.594 ± 0.026 eV [210, 211]. The same observations were consistent with the accepted heats of formation of HF and ClF but suggested that the spectroscopically determined dissociation energy of HF, 5.86 ± 0.01 eV, was about 0.1 eV too high. These observations and conflicting results stimulated further photoionization studies on F_2 and HF by Berkowitz et al. which ultimately led to the conclusion that the HF and F_2 dissociation energies proposed in the earlier photoionization studies were incorrect and that the fragmentation energetics were in fact consistent with the accepted F_2 and HF dissociation energies [212]. The differences in the conclusions arrived at by the two groups of workers were due to the following deficiencies in the earlier study. Although Dibeler et al. observed an ion-pair process in the F_2 fragmentation threshold region, the onset of the F^+ ion yield curve was not corrected for the contribution of this process to the F^+ yield from dissociative ionization. Indeed, the intensity of the ion-pair process observed in that study was significantly lower than in the later study by Berkowitz et al., presumably due to the different ion source configurations employed. In addition, Dibeler et al. chose a location in the curved region at the foot of the threshold curve for a threshold value, whereas Berkowitz et al. corrected the ion-pair-corrected threshold curve for the effect of photon bandwidth and the possible effect of rotational energy in lowering the fragmentation threshold [140]. The threshold values so deduced were 18.76 ± 0.03 eV [210] and 19.01 eV [212]. As for the dissociative ionization of HF, the two groups deduced thresholds for formation of $H^+ + F$ of 19.34 ± 0.03 eV [210] and 19.445 eV [212], respectively, differing principally because the latter value included the monochromator bandwidth and rotational population corrections. In addition, careful measurements were made of the kinetic energy of the protons from dissociative ionization of HF, and F^+ from the ion-pair process in F_2 [213]. There is no question that the results of Berkowitz et al. are to be preferred. The rotational correction model employed is one that tacitly assumes that the dissociation process is essentially a vertical transition from a population of rotational states of the molecule to the dissociation limit of the ion. However, the dissociation of HF^+ does not occur by this direct mechanism. Rather, it involves a predissociation of some sort, and the effect of rotations on this process is not clear.

Evidence for ion fragmentation has also been observed in HF by Brundle, using photoelectron spectroscopy [214]. In the first excited $^2\Sigma^+$ state of HF^+ the Franck-Condon envelope has vibrational structure only up to 19.400 ± 0.01 eV. Above this the envelope is smooth, indicating a very short lifetime. This threshold is consistent with the observations of Berkowitz et al. [212]. Lastly, an electron impact study on F_2 was recently carried out, leading to a value of 1.63 ± 0.1 eV for the F_2 bond dissociation energy [215], and confirming some of the kinetic energy measurements, thus supporting the accepted value. However, the experimental threshold data are not as precise. This controversy has been recently reviewed in detail by Berkowitz and Wahl [216].

m. Fragmentation Thresholds of Small Polyatomic Molecules

Over the past ten years numerous studies have been carried out on the fragmentation of triatomic and larger ions. These studies have established that the fragmentation processes are rather complex. In 1963, Dibeler and Rosenstock noted that the electron impact mass spectrum of H_2S showed evidence that at the fragmentation threshold some unimolecular ion decomposition processes took place which had lifetimes in the microsecond range (i.e. metastable transitions) [217]. They suggested that the decomposition process was a predissociation involving crossing of two potential surfaces. In 1964, Sharp and Rosenstock concluded on the basis of Franck-Condon calculations that fragmentation of the CO_2^+ ion could not possibly occur by direct vertical transition to the region above the dissociation limit of the ground state or first excited state of the ion [218]. In 1966, Fiquet-Fayard and Guyon showed, on the basis of adiabatic correlation rules, that the fragmentation of H_2O^+ and H_2S^+ occurred by predissociation of the accessible ion doublet states via the ion quartet states [219]. At the present time all available experimental evidence confirms the idea that the decomposition mechanism of small polyatomic ions is a predissociation, rather than a vertical transition to a region above the dissociation limit of the ion ground state. This of course raises questions as to whether the fragmentation products are formed in their ground states and whether the fragmentation occurs without kinetic energy at threshold. Two ions which have been studied in detail are CO_2^+ and N_2O^+.

The thermochemical threshold for the process $CO_2 \rightarrow O^+(^4S) + CO(X^1\Sigma^+, v=0)$ lies at 19.071 ± 0.002 eV, for $CO_2 \rightarrow O^+(^4S) + CO(X^1\Sigma^+, v=1)$ at 19.337 eV and for $CO_2 \rightarrow O(^3P_2) + CO^+(X^2\Sigma^+)$ at 19.466 eV, compared to the process $CO_2 \rightarrow CO_2^+ \; C^2\Sigma_g^+)$ which has a threshold of 19.389 eV [96]. It has been shown by photoelectron-photoion coincidence studies that the ground vibrational level of the C state of CO_2^+ is completely predissociated [220]. Most of the predissociations produce vibrationally excited CO and O^+ ions and some others ground state CO and O^+ with kinetic energy. Emission spectra have not been observed from the C state of CO_2^+, confirming the postulated predissociation mechanism [221]. A detailed photoionization study [96] showed that at the threshold of the C state the photoionization yield curve of the parent ion exhibited a sudden decrease, while the yield of the O^+ fragment ion increased at this threshold. The O^+ ion is observed at the expected thermochemical threshold and the fragmentation process is attributed to predissociation of Rydberg series members converging to the ground vibrational level of the ion C state, combined with or followed by autoionization of the O atom fragment. The ion yield curve for the CO^+ fragment shows an onset at its expected thermochemical threshold and the process is inferred to be predissociation of excited vibrational levels of the CO_2^+ C state.

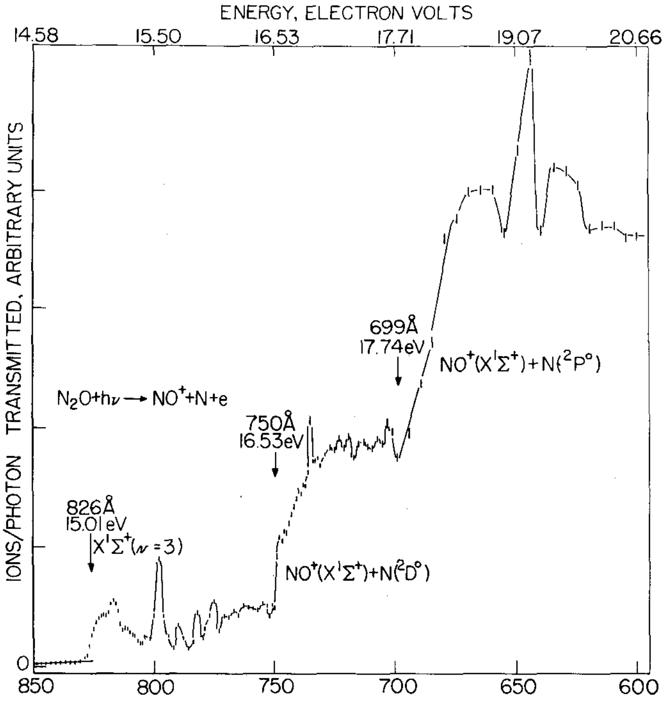

FIGURE 9. Photoion yield curve for the fragmentation process $N_2O + h\nu \rightarrow NO^+ + N + e$ showing discontinuities in the yield curve at energies corresponding to the formation of $N(^2D)$ and $N(^2P)$ neutral fragments, ref. [222].

The fragmentation of N_2O^+ has been the subject of considerable study, and illustrates once more the complexities encountered in interpreting fragmentation processes of small molecules. Dibeler et al. [222, 223] have measured the photoionization parent and fragment ion yield curves. Above the NO^+ threshold they observe additional sudden increases in ion yield suggesting the onset of fragmentation processes leading to excited nitrogen atoms (see figure 9). The experimental threshold values and the threshold values calculated from independent thermochemical and spectroscopic data are given in table 2.

TABLE 2. Comparison of experimental and thermochemical threshold values for fragmentation processes of N_2O^+

Fragmentation products	Experimental threshold, eV	Thermochemical threshold, eV
$NO^+(X^1\Sigma^+) + N(^4S)$	15.01	14.19
$NO^+(X^1\Sigma^+) + N(^2D)$	16.53	16.57
$NO^+(X^1\Sigma^+) + N(^2P)$	17.74	17.76
$N_2^+(X^2\Sigma_g^+) + O(^3P)$	17.27	17.25
$N_2(X^1\Sigma_g^+) + O^+(^4S)$	15.29	15.29
$NO(X^2\Pi) + N^+(^3P)$	20.06	19.46

The data suggest that the formation processes for only NO^+ and N^+ are accompanied by excess energy at threshold. Dibeler et al. suggested that the excess energy in the NO^+-forming process was vibrational excitation of the NO^+, the fragment ion being formed in the $v=3$ state for which the thermochemical threshold lies at 15.04 eV.

The fragmentation process $N_2O^+ \rightarrow NO^+ + N$ has been observed as a unimolecular delayed dissociation (metastable transition) in the mass spectrometer [224–226]. Coleman et al. [225] concluded that the dissociation process was a single decay process with a half-life of about 540 ns. Newton and Sciamanna [226], on the other hand, concluded that the delayed dissociation was a sum of two distinct decay processes with half-lives of ~90 ns and ≥300 ns, respectively. The difference in conclusions is unexplained, but certainly involves difficulties in the numerical analysis of the data [227]. This type of problem has been discussed in detail in a recent review [241]. Both groups of workers have estimated the kinetic energy release accompanying the delayed dissociation by analyzing the effect of kinetic energy release on the peak width and shape of the metastable transition in a manner first proposed by Beynon et al. [228]. They showed that the kinetic energy release was roughly 0.6–1.0 eV. Thus at least some and possibly all of the excess energy of the fragmentation process appears as translational energy, and not as vibrational energy, as had been suggested by Dibeler et al.

The symmetries and energies (above the N_2O molecule ground state) of the first four doublet states of N_2O^+ are $X\,^2\Pi$, 12.89 eV; $A\,^2\Sigma^+$, 16.39 eV; $B\,^2\Pi$, 17.65 eV; and $C\,^2\Sigma^+$, 20.11 eV. These states are accessible by photoionization. From the extent of the Franck-Condon envelopes observed in photoelectron spectra it is clear that the NO^+ and O^+ thresholds lie above the vertically accessible region of the ion ground state and more than one electron volt below the A state. In fact, the NO^+ threshold coincides with an autoionizing Rydberg term which is the $n=3$, $v=1$ member of a Rydberg series converging to the ion A state. The autoionization peak observed in the parent ion photoionization yield curve indicates that this state can autoionize to produce stable N_2O^+ ions in the electronic ground state as well. Lorquet and Cadet [229] have given the adiabatic correlations for various fragments and show that both the $NO^+(X\,^1\Sigma^+)+N(^4S)$ and the $N_2(X\,^1\Sigma_g^+)+O^+(^4S)$ fragment pairs correlate with a $^4\Sigma^-$ state of N_2O^+. Thus the fragmentations involve a predissociation-autoionization process via a quartet state, and do not involve the ion ground state. In addition it should be mentioned that studies with isotopically labeled N_2O indicate that a significant fraction of the processes leading to formation of NO^+ involve loss of the central nitrogen atom [224].

As mentioned above, Dibeler et al. observed a sudden increase in the NO^+ yield at 16.53 eV, nearly coinciding with the thermochemical threshold for the formation of $NO^+(X\,^1\Sigma^+)$ + $N(^2D)$ which lies at 16.572 eV. This energy also nearly coincides with that of the (100) vibrational level of the $N_2O^+A\,^2\Sigma^+$ state which is located at 16.56 eV [230]. Eland has studied the fragmentation of this state by photoion-photoelectron coincidence techniques [231]. He has demonstrated that the ground vibrational level of the N_2O^+ A state is completely stable (i.e. no fragmentation within a microsecond) whereas the (100) and (001) levels are partially predissociated. In addition, it is known that the (000) and (100) levels fluoresce, and the fluorescence lifetimes have been measured [232, 233].

From the branching ratio between fragmentation and fluorescence (i.e. observation of stable N_2O^+ ions) from the (100) vibrational level Eland deduced a half-life of 410±90 ns for the fragmentation process. Adiabatic correlations indicate that formation of NO^+ $(X\,^1\Sigma^+)+N(^2D)$ also involves a predissociation via another state [229]. The half-life of the predissociation is in reasonable agreement with the mass spectrometric half-life measurements of the metastable transition mentioned above. However, it is not clear whether the two measurements refer to the same fragmentation process. In summary, fragmentation to produce NO^+ $(X\,^1\Sigma^+)+N(^2D)$ occurs at least in part through direct vertical transition from the molecule to the (100) level of the ion A state, followed by a competition between predissociation and fluorescence to various vibrational levels of the ion ground state. The agreement of the threshold value for this process with the thermochemical threshold is somewhat coincidental. Further details on the fragmentation processes are found in the recent literature [234, 235].

The fragmentation of the methane and acetylene ions illustrates still another aspect of interpreting fragmentation thresholds. In a careful study of the photoionization yield curve of the methyl ion fragment from methane Chupka showed that there was no sharp onset at threshold [168]. He pointed out that one had to take into account the contribution of rotational energy to the energy available for decomposition. He showed that for a quasi-diatomic system separating into an ion and a polarizable neutral fragment, the rotational energy would reduce the dissociation energy because of conservation of angular momentum. As a result of the original thermal distribution of rotational energy of the molecules being ionized, a sharp fragmentation threshold for non-rotating molecules would be replaced by a gradual smooth onset curve reflecting the rotational energy distribution (and the slit function). Chupka applied this simplified model to the room temperature photoionization yield curve of methyl ions from methane and deduced a threshold value for the fragmentation of non-rotating (0 K) molecules. Guyon and Berkowitz [140] later gave a more detailed discussion of this effect, again for diatomic systems. They showed that above threshold, the effect of the rotational energy contribution was to shift the photoionization yield curve to lower energy by an amount equal to kT. The model assumes that the dissociation occurs by direct transition to the dissociation limit of the ion rather than by predissociation. This is indeed the case for loss of H from the methane ion.

More recently Dibeler, Walker, and McCulloh [236] have studied the photoionization fragmentation of acetylene ion at various temperatures (298 K and 130 K). They showed that this thermal shift and rotational tailing were real and temperature dependent, and also were able to observe and correct for the effect of vibrational hot bands. As a result they were able to deduce an accurate threshold value for non-rotating molecules. The problem with acetylene, however, is that the mechanism of fragmentation is not yet established. The lowest fragmentation threshold, involving loss of a hydrogen atom, lies in the Franck-Condon region of the first excited state of the ion. Fiquet-Fayard has analyzed the adiabatic correlations for this fragmentation process, assuming only linear configurations, and concluded that fragmentation occurs by predissociation via a quartet state [237]. It is not clear how the effects of rotation will manifest themselves in this case.

It is clear from the above examples that photoionization studies of small polyatomic molecules, together with the results of other types of experiments, are revealing a diversity of fragmentation mechanisms and threshold behavior. The recent studies of metastable transitions in small molecules are very useful here [238]. There are no ready generalizations which will greatly simplify the task of interpreting fragmentation thresholds to yield accurate thermochemical data. As for electron impact studies of fragmentation thresholds, they suffer even more from unpredictable accuracy than is the case for photoionization thresholds. This is due to the above mentioned diversity of fragmentation mechanisms. And because of the much more limited information displayed in electron impact curves, the interpretations and the thermochemistry deduced from them are much less reliable than those obtained from photoionization. One question of great interest is whether significantly different threshold behavior should be found in electron impact processes because of possible direct transition to the quartet states which are not accessible in photoionization. This may be the case in the formation of NO^+ from N_2O by electron impact [239], where the threshold value is significantly lower than the photoionization fragmentation threshold. The discrepancy remains unexplained.

n. Fragmentation Thresholds of Large Molecules

Quantitative description of the fragmentation of large molecules is based on quasi-equilibrium theory [240–242]. According to this theory the fragmentation processes of the molecule-ion can be considered separately from the act producing the ionization and internal excitation energy distribution. Further, the fragmentation processes can be described as a series of competing, consecutive unimolecular reactions. Finally, the rate constants for the unimolecular reactions can be quantitatively calculated by means of activated complex theory. It is tacitly assumed that between the ionization event and the decomposition there is sufficient time for the excitation energy to randomize in spite of the fact that the ion does not undergo collisions (hence the term quasi-equilibrium). For simplicity it is generally assumed that prior to decomposition the ions produced in excited electronic states undergo internal conversion forming vibrationally excited ions in their electronic ground state. Indeed, photoelectron spectra show that in the direct ionization process vertical transition to the ion ground state is generally accompanied by very little vibrational excitation, i.e. the Franck-Condon envelope is narrow. The excitation energy effective in producing fragmentation then comes predominantly from transitions to excited electronic states and to some degree from autoionization processes. The Rydberg states converging to higher ionization limits can also predissociate into excited neutral species, a process which competes with autoionization. Thus one can expect considerable variation in the extent to which autoionization may contribute to ion excitation in threshold experiments. Experimental studies indicate that there is significant predissociation as well as autoionization, and there are associated isotope effects [243].

In almost all discussions and calculations of fragmentation of large molecule ions it is assumed that this process or set of competing processes occurs from the ion ground state. One possible exception is the fragmentation of benzene ion, which appears to occur via two non-competing sets of reactions [244].

The quasi-equilibrium theory of ion fragmentation introduces three distinct factors which have to be considered in deducing thermochemical data from experimental fragmentation thresholds:

a. The relation between activation energy for decomposition and the heat of reaction for the process.

b. The relation between activation energy and the minimum energy required to produce observable fragmentation in the mass spectrometer ion source, i.e. the kinetic shift.

c. The effect of competing and consecutive reaction paths on the shape and interpretation of fragmentation threshold curves.

n.1. Activation Energy and Heat of Reaction

It was pointed out many years ago that some ionic decomposition processes might occur via pathways involving the surmounting of a barrier on the potential surface [245, 246]. Surmounting such a barrier would require an activation energy greater than the heat of reaction for the process, i.e. there would be a non-zero activation energy for the reverse process. Examination of the (inaccurate) electron impact literature suggested that for simple bond rupture processes the activation energy and the heat of reaction were equal, whereas more complex fragmentation processes such as loss of H_2 or CH_4 occurred with activation energies up to an electron volt higher than the heat of reaction. There are no general rules. For example, accurate photoionization studies of the threshold for

$$C_2H_4 + h\nu \rightarrow C_2H_2^+ + H_2 + e,$$

indicate that there is no potential barrier for this four-center reaction, to an accuracy of about 10 meV [247]. However, loss of H_2 in ethane and propane requires excess energies of 0.22 eV and 0.74 eV at threshold, respectively [8]. There are other examples in the literature. Thus, the determination of thermochemical information from fragmentation threshold energetics is always subject to the uncertainty of equating the activation energy to the heat of reaction. In some instances, the existence of a potential barrier for a fragmentation process may be deduced from the observation of fragment ion kinetic energies.

Two approaches have been used in recent years. Beynon, Cooks, and co-workers have related the peak shapes of so-called metastable transitions or delayed unimolecular dissociation processes observed in the mass spectrometer to the kinetic energy released in the dissociation process [228, 248, 249].

A somewhat related method based on electrostatic rather than magnetic analysis has been developed by Ottinger [250]. These metastable transitions represent unimolecular decompositions of ions which have an energy content such that the ions decompose after they have been accelerated out of the ion source and prior to deflection. Ions with slightly shorter lifetimes (slightly greater internal energy) will decompose in the ion source and hence will be detected as fragment ions. Thus the translational energy release observed for the metastable transition is, for all practical purposes, the translational energy release at the fragmentation threshold observed in the mass spectrometer. A very different method is based on the study of peak shapes observed in a time-of-flight mass spectrometer [251, 252]. Here the travel time distribution of a fragment ion is determined by its initial translational energy distribution, and this is studied as a function of electron energy and extrapolated to the fragmentation threshold. In some instances the translational energy is dependent on electron energy, in others it is not [253]. In principle the various methods should give the same results, but this is not always the case [254]. The reasons are not fully understood.

Work carried out along these lines indicates that fragmentation processes may be accompanied by kinetic energy release ranging from essentially zero to nearly one electron volt. The relation of this energy release to the height of the potential barrier is not straightforward. Instances are known where a large excess activation energy (determined from a threshold measurement and auxiliary thermochemical data) does not result in a fragmentation process with a correspondingly large translational energy release [255]. Thus, a correction for translational energy release may represent an underestimate of the excess activation energy. Further, studies have shown that the translational energy released in a fragmentation process is frequently a distribution rather than a single unique value [256]. The detailed procedures for correcting a threshold value for presence of a translational energy distribution remain to be worked out.

n.2. Kinetic Shift

In order to observe a fragmentation threshold in the mass spectrometer it is necessary that the fragmentation process occur prior to departure of the parent ion from the ion source. The residence time of an ion in the source is roughly several microseconds [257]. A necessary condition for fragmentation is that the ion contain enough excitation energy to equal or exceed the activation energy for the fragmentation process. However, if the activation energy is large and the number of degrees of freedom large the minimum rate of ion decomposition may be too slow to lead to observable fragmentation, i.e. fragmentation while the ion is still in the ion source. Additional excitation energy must be supplied to increase the decomposition rate. Thus, under some conditions the measured fragmentation threshold energy will overestimate the activation energy of the process. This difficulty was first pointed out by Friedman et al. [258] and discussed in detail by Chupka [259] and by Vestal [260]. Chupka pointed out that for these larger molecules, the kinetic shift effect is offset to some extent by the distribution of internal thermal energy of the molecule, all of which is assumed available for decomposition, in addition to the excitation energy imparted in the ionization process. As a result, the fragmentation threshold curves will vary with temperature [175, 261]. Vestal has given calculations which indicate the magnitude of the kinetic shift for a number of typical fragmentation processes.

For example the loss of H from propylene ion

$$C_3H_6^+ \rightarrow C_3H_5^+ + H,$$

for which an activation energy of 2.07 eV was assumed requires 0.19 eV additional energy to produce observable fragmentation in one microsecond. The estimates are, of course, dependent on the assumed value of the residence time and the assumed sensitivity of the mass spectrometer for detecting fragmentation "thresholds". Rosenstock et al. [244] have emphasized that for large molecule fragmentation processes the kinetics of decomposition lead to a gradual increase in fragment ion current so that there is no well defined threshold. They calculated the photoionization yield curve shapes for fragment ions of benzene in the threshold region and accounted quantitatively for kinetic shifts of various fragmentation processes in benzene.

Studies of the kinetic shift effect have also been carried out by electron impact techniques [262–264]. These are, however, subject to greater error resulting from the broad electron energy distribution. Although the kinetic shift phenomenon is widely recognized, it is seldom considered explicitly in experiments directed to determining thermochemical information from ion fragmentation processes.

n.3. Reaction Path and Reaction Competition

According to quasi-equilibrium theory, the fragmentation processes are a set of competing unimolecular reactions. Frequently the parent ion will decompose via a number of different competing reaction paths producing different first generation fragment ions. The energy dependence of the rate constant may be somewhat different for the various processes so that some fragment ions will be produced in experimentally detectable amounts only at energies somewhat in excess of the activation energy for the process. One indicator of this phenomenon is the observation that not all parent ion fragmentation reactions are observable as delayed dissociations (metastable transitions) [265]. At energies near the threshold for the energetically most favorable process the branching ratios for the other processes may be too small for detection or zero because they are below their threshold. One example of this is the fragmentation of n-butane, where the $C_2H_5^+$ ion is formed by a simple bond rupture process with a C_2H_5 radical as the accompanying neutral fragment. The process is not observed as a metastable transition because near the $C_2H_5^+$ threshold energy, the energetically more favored processes producing $C_3H_7^+$ and $C_3H_6^+$ ions have much higher rate constants [265]. Other examples are the pronounced effects of deuterium substitution on intensities of metastable transitions in propane [266]. These effects are due to rather small activation energy and frequency factor differences brought about by deuteration. The effect of reaction competition is then to shift the minimum observable decomposition rate for the less favored process to higher energies, increasing the kinetic shift.

Another factor must be considered in connection with thresholds for second generation fragment ions. First generation ions produced by fragmentation of parent ions containing a specific amount of energy will themselves contain a distribution of excitation energy. This is due to the large number of ways in which the excess energy of the parent can be partitioned between the daughter ion and the neutral fragment [267, 268]. As a result, there is no sharp threshold but instead a very gradual increase in second generation ion intensity with increasing energy. For all practical purposes this prevents the determination of meaningful threshold values for these processes.

3.3. Thermochemical Considerations

It should be apparent from the discussion above that the various types of ionization and fragmentation energy threshold measurements do not directly lead to room temperature heats of formation of the ions. The most nearly correct procedure is to attempt to make corrections for the effect of room temperature or, in the case of Knudsen cell experiments, elevated temperature, on the observations and arrive at an estimated 0 K energy requirement for the process [269]. Further, ions and their neutral counterparts have slightly different heat capacities and, in principle, this should be taken into account in computing room temperature heats of formation. In the tabulations to follow, we have given ionic heats of formation at absolute zero whenever possible. The tabulation of auxiliary thermochemistry, given in section 7, on which these values are partly based provides room temperature heats of formation as well, to facilitate estimates of room temperature ionic heats of formation should the need arise. In the ion tables room temperature values are given only when no 0 K neutral heats of formation are available.

The recent development of gas phase ionic equilibrium and steady state concentration measurements by high pressure mass spectrometry represents an important advance. These ion cyclotron resonance techniques are beginning to provide very precise relative heat and free energy values for gas phase ion species at and near room temperature. Detailed discussion of the relation of this class of measurements to those measurements described above will require considerable work in the future.

3.4. References for Section 3

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4. Tabulation of Positive Ion Data

4.1. Description of the Positive Ion Table

The Positive Ion Table gives the following information: empirical formula of the ion, electronic state where appropriate, the parent molecule studied, the nature of the neutral or other charged fragmentation product where known, the experimental threshold or other energy measured together with the likely error *given by the author*, the experimental technique used, and the reference or references. Also tabulated is the ionic heat of formation in kJ mol^{-1} computed in those instances where the measured threshold is, in our judgment, a reliable one. Our recommended value, if any, for the ionic heat of formation, in both kJ mol^{-1} and kcal mol^{-1}, is presented in the heading which begins each ion sub table.

The order of arrangement is based on the principle of latest atomic number in order of increasing charge and increasing elemental complexity. For a given ionic process the measurements are cited generally in order of decreasing reliability. When data are available for formation of an ion from different molecules, the processes are listed according to the principle of latest position for the molecule studied.

For the molecule studied one-line semi-structural formulas are given for all straight and branched chain compounds. For all ring compounds one-line condensed formulas are given along with a name. In naming these compounds we have attempted to follow the rules given in the Handbook of Chemistry and Physics [1].

In computing ionic heats of formation from fragmentation process threshold energies it is of course necessary to specify the identity of the other fragments. These are tabulated in the column headed "Other Products" for all fragmentation processes from which an ionic heat of formation is computed. In addition, for those other fragmentation processes not so used, the identity of the other fragments is given if in our opinion they are obvious, the evidence is convincing, or if they are unusual. Obvious other fragments include atoms such as H. However, when the fragment atom is a halogen, there is a possibility that this other fragment may be a negative ion. Examination of the literature reveals two kinds of information. First, those experiments where the charge of the halogen atom fragment was established experimentally, i.e. negative ion searched for and detected or not detected. Second, experiments in which the charge of the halogen is inferred from the threshold energies and auxiliary thermochemical information. We regard the latter as unconvincing, especially when the accuracy of the threshold measurement technique is low.

For polyatomic fragments, experience indicates that at threshold one generally finds the fragment in the most stable chemical form, e.g. CH_3 rather than CH_2 + H or $CH + H_2$. However, there are exceptions. Recent unpublished photoionization work indicates that the CHO fragment is not formed in fragmentation of selected organic oxygen compounds such as glyoxal, CHOCHO, but rather appears as CO + H. Further there is rather convincing evidence for the processes

$$cyclo\text{-}C_2H_4O \rightarrow C_2H_2O^+ + 2H \qquad \text{(ref. 2)}$$

$$ONF_3 \rightarrow NO^+ + 3F \qquad \text{(ref. 3)}$$

$$NF_3 \rightarrow NF^+ + 2F \qquad \text{(ref. 3)}$$

For more elaborate fragmentation processes, even thermochemical information cannot always resolve ambiguities, for example, a choice between the $CH_3 + H_2$ and $CH_4 + H$, or $CH_3 + H_2O$ and $CH_4 + OH$ pairs. Here, the study of metastable transitions is of great help. Unfortunately these studies are often found in papers other than the ones containing the energy information. We have tended to be conservative in tabulating fragments. In some instances we have indicated larger neutral fragments by empirical formula only, since the structure is not known but it has been established that the other product consists of only one fragment (e.g. C_3H_7, C_4H_9, etc.). In any event, the information as presented by the authors is available in the references cited.

The ionization potential or appearance potential is given in electron volts. For this purpose all spectroscopic values have been computed using the conversion factor 1 eV $\doteqdot$ 8065.73 cm^{-1}. Heats of formation are calculated using the conversion factors 1 eV molecule^{-1} = 96.4870 kJ mol^{-1} and 1 kcal mol^{-1} = 4.18400 kJ mol^{-1}.

The methods are described and evaluated in the preceding section. Wherever possible, heats of formation have been computed at absolute zero rather than at room temperature, for reasons discussed in the preceding section. Room temperature values are given only where insufficient auxiliary thermochemical data are available for the necessary computations. In these cases wherever possible we have used threshold values approximately corrected to 0 K rather than room temperature "thresholds". *In this compilation we assume the heat of formation of the electron is zero at all temperatures, in contrast to usage in other thermochemical compilations.* In the case of fragmentation processes, information on fragment kinetic energies has been included where available and sometimes used to correct the computed heats of formation. This is only approximate, for reasons discussed in the preceding section.

The heat of formation is calculated from those data which are in our judgment the most reliable. For this purpose we have used the sources explicitly cited in section 7 on auxiliary thermochemistry. We have arbitrarily taken information from the compilation of Stull, Sinke, and Westrum [4] for most of the heats of formation of larger organic compounds. We are aware of occasional differences between these values and those recommended by Cox and Pilcher [5] in their compilation, but have made no attempt to reconcile these differences or to arrive at better values. We have arbitrarily limited the computed and recommended heats of formation to a maximum accuracy of 0.1 kJ mol^{-1} or 0.1 kcal mol^{-1} even in those few instances where the ionization potentials are of greater accuracy, such as for H_2, N_2 and a number of atoms. The temperature associated with the heat of formation is the same as that given in the heading. In a few cases heats of formation are listed in parentheses in column six. These are given for illustrative purposes only and are not used in arriving at recommended values given in the heading. In all instances the recommended values are simple average values, suitably rounded, of the column values. No compelling reason exists for proceeding otherwise. In a very few instances no ionic heats of formation are given because no accurate neutral heats of formation are available, even though the ionization potential is reasonably reliable (±0.05 eV or better, generally from photoelectron spectroscopy). These instances are almost all to be found among the complex organic molecules.

Since the main thrust of this compilation is ion thermochemistry, the adiabatic ionization potential is the quantity of interest, in preference to the vertical ionization potential. In many instances the two quantities are one and the same, in other instances the vertical value is higher. Where available we have given the adiabatic value. A number of publications in photoelectron spectroscopy have emphasized determination of the vertical value and while the published spectra show clearly that the adiabatic value is lower, a number is given only for the former. In these instances the value tabulated here carries the designation (V) to indicate that it is a vertical value and that the adiabatic value is lower.

The development of photoelectron spectroscopy has led to many values of higher ionization potentials, corresponding to removal of more tightly bound electrons. We have tabulated these values for selected molecules, and only in those instances where an assignment is given for the excited states formed in the process. On the other hand there are numerous data on higher ionization potentials for many larger molecules. In those instances only the lowest ionization potential is tabulated here. Higher ionization potentials will be found in most of the photoelectron spectra and Penning ionization papers cited.

For some ionization processes, additional references are given in the form "See also". These refer to earlier work of lesser accuracy or, in the case of some electron impact work of low accuracy, to additional measurements of similar poor accuracy and similar nominal values. In a few instances some measurements of lower accuracy have been tabulated along with measurements of better quality to provide concrete examples of experimental disagreement.

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4.2. Index

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$C_3O_3ClRe^+$ I-669
$C_4O_4ClRe^+$ I-669
$C_5O_5ClRe^+$ I-669
$COMnRe^+$ I-669
$C_2O_2MnRe^+$ I-669
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$C_4O_4MnRe^+$ I-670
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$COBrRe^+$ I-670
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$C_3H_7Hg^+$ I-677
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$C_6H_{14}Hg^+$ I-678
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$TlCl^+$ I-680
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$PbBr^+$ I-683
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$PbTe^+$ I-683
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$C_2H_5Pb^+$ I-683
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$RbPbCl_3^+$ I-684
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Np

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Pu

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PuF^+ I-690
PuF_2^+ I-690

Am

Am^+ I-690

Cm

Cm^+ I-690

4.3. The Positive Ion Table

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
H^+ ΔH°_{f0} = 1528.0 kJ mol^{-1} (365.2 kcal mol^{-1})						
H^+	H		13.598	S	1528.0	2113, 3432
H^+	H		13.61	PE		3076
See also – EI: 87, 3294						
H^+	H_2	H^-	17.3	RPD		200
H^+	C_3H_6		19.5±1	EI		2542
H^+	C_3H_8		20.0±0.3	EI		1408
(Threshold value corrected for high fragment kinetic energy)						
H^+	HCN	CN^-	15.18±0.02	PI		2602
(Threshold value approximately corrected to 0 K)						
H^+	HCN	CN	19.00±0.01	PI		2602
(Threshold value approximately corrected to 0 K)						
H^+	H_2O	OH^-	16.0±0.3	EI		3144
H^+	H_2O	OH	19.6±0.25	EI		3144
See also – EI: 2484						
H^+	HF	F^-	16.061±0.005	PI		3274
(Position of peak maximum)						
The fragments are formed with no kinetic energy at threshold, see W. A. Chupka and J. Berkowitz, J. Chem. Phys. **54**, 5126 (1971).						
See also – PI: 2744 EI: 286						
H^+	HF	F	19.445±0.01	PI	(1528.2)	3217, 3274
(Threshold value approximately corrected to 0 K)						
H^+	HF	F	⩾19.44±0.02	PE		3086
See also – PI: 2744						
H^+	$(CH_3)_2SO$		23±0.5	EI		3294
H^+	HCl	Cl^-	14.5	RPD		199
D^+ ΔH°_{f0} = 1532.2 kJ mol^{-1} (366.2 kcal mol^{-1})						
D^+	D		13.602	S	1532.2	3432
D^+	D_2	D	25.3±0.2	SRP		1264
(High kinetic energy ion)						
D^+	DF	F^-	16.134±0.005	PI		3274
(Position of peak maximum)						
D^+	DF	F	19.513±0.005	PI		3274
(Threshold value approximately corrected to 0 K)						
T^+						
T^+	T		13.603	S		3432

4.3. The Positive Ion Table—Continued

H_2^+ ΔH°_{f0} = 1488.4 kJ mol^{-1} (355.7 kcal mol^{-1})

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
H_2^+	H_2		15.4256	S	1488.4	2762, 3077
H_2^+	H_2		15.4256±0.0001	S	1488.4	3018
H_2^+	H_2		15.4269±0.0016	S		2095
H_2^+	H_2		15.4225–15.4255	PI		2616, 2811
H_2^+	H_2		15.431±0.022	RPI		2831
H_2^+	H_2		15.439±0.015	PE		2810, 2875
H_2^+	H_2		15.43	PEN		2430
H_2^+	H_2		15.37±0.05	EM		3106
H_2^+	H_2		15.44±0.01	EM		2798

See also – S: 2655, 2891
PI: 230, 1118, 1143, 2774
PE: 248, 1050, 2830
PEN: 3171
EI: 119, 383, 1012, 1121, 1251, 2535, 3144

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
H_2^+	C_2H_6	$C_2H_4^+$?	31.1±1	EI		3175
(High kinetic energy ion)						
H_2^+	C_3H_6		16±1	EI		2542
H_2^+	C_3H_8		16.4±0.5	EI		1408
H_2^+	H_2O	O	20.7±0.4	EI		2484

HD^+

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
HD^+	HD		15.46	PI		1143

D_2^+ ΔH°_{f0} = 1492.2 kJ mol^{-1} (356.6 kcal mol^{-1})

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
D_2^+	D_2		15.46±0.01	PI		1118, 1143
D_2^+	D_2		15.468±0.022	RPI		2831
D_2^+	D_2		15.47	PE		2855
D_2^+	D_2		15.43±0.01	EM		2798
D_2^+	D_2		15.5	RPD		1121

The zero–point energy difference should give IP(D_2) – IP(H_2) ≈ 0.039 eV, see ref. 2831, leading to IP(D_2) = 15.465 eV when combined with Herzberg's (ref. 2762) and Takezawa's (ref. 3018) value for IP(H_2). Surprisingly, no difference was found in the electron monochromator study of ref. 2798. The recommended value for $\Delta H^\circ_{f0}(D_2^+)$ is based on IP(D_2) = 15.465 eV.

$He^+(^2S_{1/2})$ ΔH°_{f0} = 2372.3 kJ mol^{-1} (567.0 kcal mol^{-1})

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$He^+(^2S_{1/2})$	He		24.587	S	2372.3	2113
$He^+(^2S_{1/2})$	He		24.6±0.1	PI		163
$He^+(^2S_{1/2})$	He		24.59±0.03	RPD		1012

See also – EI: 1051, 1172, 2032

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
	He^{+2}	**ΔH°_{f0} = 7622.8 kJ mol^{-1} (1821.9 kcal mol^{-1})**				
He^{+2}	He		79.003	S	7622.8	2113
He^{+2}	He^+		54.416	S		2113, 3432
He^{+2}	He^+		54.5±0.2	SEQ		2473
He^{+2}	He^+		53±2	SEQ		2551
	Li^+	**ΔH°_{f0} = 679.4 kJ mol^{-1} (162.4 kcal mol^{-1})**				
Li^+	Li		5.392	S	679.4	2113
See also – EI:	1112, 2487, 2565, 3257					
Li^+	$(C_2H_5Li)_4$		14±2	EI		1
Li^+	LiF	F	11.5	EI		2179
Li^+	LiCl	Cl	10.6	EI		2179
Li^+	LiBr	Br	9.9	EI		2179
Li^+	Li_2MoO_4		11.2±0.5	EI		3257
Li^+	LiI	I	9.5±0.3	EI		2001
Li^+	Li_2I_2?		11.6±0.3	EI		2001
Li^+	Li_2WO_4		11.7±1.0	EI		3257
		Li_2^+				
Li_2^+	Li_2		5.15±0.1	PI		2633
Li_2^+	Li_2		4.94±0.1	EI		3416
	Be^+	**ΔH°_{f0} = 1219.5 kJ mol^{-1} (291.5 kcal mol^{-1})**				
Be^+	Be		9.322	S	1219.5	2113
Be^+	Be		9.4±0.2	EI		2715
See also – EI:	1106, 2141					
Be^+	BeF_2		28.3±1.0	EI		2142
Be^+	$BeCl_2$		20.4±0.4	EI		2715
See also – EI:	2195					

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
	B^+	**$\Delta H^\circ_{f0} = 1358.3$ kJ mol^{-1} (324.6 kcal mol^{-1})**				
B^+	B		8.298	S	1358.3	2113, 3066
See also – EI:	1116, 2409, 3206					
B^+	B_2H_6		18.39±0.02	EI		2559
See also – EI:	102, 209					
B^+	B_2D_6		18.6±0.1	EI		209
B^+	$(CH_3)_3B$		23.1±0.3	EI		364
B^+	$(C_2H_5)_3B$		30.1±0.5	EI		364
B^+	BH_3CO		19.31±0.2	EI		2705
B^+	B_4H_8CO		21.8±1	EI		3226
B^+	$(CH_3O)_2BH$		23.4±0.5	EI		364
B^+	$(CH_3O)_3B$		31.6±1.0	EI		364
B^+	BF_3		30.1±0.5	EI		364
B^+	BF_3		30.6±1	EI		440
B^+	BF_3		31.3±0.4	EI		2040
B^+	B_2S_3		17.0±0.2	EI		3428
B^+	BCl?		13.6±0.2	EI		440
(Probably formed by thermal decomposition of BCl_3)						
B^+	BCl_3		18.4±0.2	EI		440
B^+	BCl_3		19.5±0.2	EI		206
B^+	BCl_3		19.5±1.0	EI		364
B^+	BBr_3		19.6±0.2	EI		206
B^+	BI_3		16.6±0.5	EI		206
See also – EI:	3199					
	B^{+2}	**$\Delta H^\circ_{f0} = 3785.3$ kJ mol^{-1} (904.7 kcal mol^{-1})**				
B^{+2}	B		33.452	S	3785.3	2113
B^{+2}	B^+		25.154	S		2113, 3181
	B^{+3}	**$\Delta H^\circ_{f0} = 7445.1$ kJ mol^{-1} (1779.4 kcal mol^{-1})**				
B^{+3}	B		71.382	S	7445.1	2113
B^{+3}	B^{+2}		37.930	S		2113, 2889
		B_2^+				
B_2^+	B_2H_6	$3H_2$	21.1±0.2	EI		209
B_2^+	B_2H_6		26.3±0.5	EI		102
B_2^+	B_2D_6	$3D_2$	21.8±0.2	EI		209
		B_4^+				
B_4^+	B_4H_8CO		15.9±1	EI		3226

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
BH^+	**$\Delta H^\circ_{f0} \sim 1389$ kJ mol^{-1} (332 kcal mol^{-1})**					
BH^+	BH		9.77±0.05	S	1389	1109
BH^+	BH		9.8±0.5	EI		2735
BH^+	BH_3	H_2?	13.66±0.02	EI		2559
BH^+	BH_3	H_2?	13.7±1.0	EI		2735
BH^+	B_2H_6		16.39±0.3	EI		2559
See also – EI:	102, 209					
BH^+	BH_3CO		15.16±0.2	EI		2705
BH^+	$(CH_3O)_2BH$		28.3±2.0	EI		364
BD^+						
BD^+	B_2D_6		14.8±0.1	EI		209
BH_2^+						
BH_2^+	BH_2		9.8±0.2	EI		2030
BH_2^+	BH_3	H	12.3±0.5	EI		2735
BH_2^+	BH_3	H	12.95±0.05	EI		2559
BH_2^+	B_2H_6		13.4±0.1	EI		209
BH_2^+	B_2H_6		13.5±0.5	EI		102
BH_2^+	B_2H_6		15.5±0.05	EI		2559
BH_2^+	BH_3CO		14.36±0.2	EI		2705
BH_2^+	B_4H_8CO		15.3±0.5	EI		3226
BD_2^+						
BD_2^+	B_2D_6		13.6±0.1	EI		209
BH_3^+						
BH_3^+	BH_3		12.32±0.1	RPD		2559
BH_3^+	BH_3		12.24±0.1	EI		2705
BH_3^+	BH_3		11.4±0.2	EI		2030
BH_3^+	BH_3		11.5±0.5	EI		2735
BH_3^+	BH_3		14.0±2	EI		2869
BH_3^+	B_2H_6	BH_3?	12.1±0.2	EI		102
BH_3^+	B_2H_6	BH_3?	13.1±0.2	EI		209
BH_3^+	B_2H_6	BH_3?	14.88±0.05	EI		2559
BH_3^+	BH_3CO	CO	13.70±0.2	EI		2705
BD_3^+						
BD_3^+	B_2D_6	BD_3?	12.7±0.2	EI		209

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
B_2H^+						
B_2H^+	B_2H_6	$2H_2+H$	20.1±0.1	EI		209
B_2H^+	B_2H_6	$2H_2+H$	21.4±0.5	EI		102
B_2D^+						
B_2D^+	B_2D_6	$2D_2+D$	18.3±0.1	EI		209
$B_2H_2^+$						
$B_2H_2^+$	B_2H_6	$2H_2$	13.8±0.1	EI		209
$B_2H_2^+$	B_2H_6	$2H_2$	13.8±0.2	EI		102
$B_2H_2^+$	B_2H_6	$2H_2$	14.1±0.2	EI		1024
$B_2H_2^+$	B_4H_8CO		14.8±0.8	EI		3226
B_2HD^+						
B_2HD^+	B_2HD_5?		14.0±0.1	EI		209
$B_2D_2^+$						
$B_2D_2^+$	B_2D_6	$2D_2$	14.0±0.1	EI		209
$B_2H_3^+$						
$B_2H_3^+$	B_2H_6	H_2+H	14.2±0.1	EI		209
$B_2H_3^+$	B_2H_6	H_2+H	14.3±0.2	EI		1024
$B_2H_3^+$	B_2H_6	H_2+H	14.8±0.5	EI		102
$B_2HD_2^+$						
$B_2HD_2^+$	B_2HD_5?		14.2±0.1	EI		209
$B_2D_3^+$						
$B_2D_3^+$	B_2D_6	D_2+D	14.3±0.1	EI		209
$B_2D_3^+$	B_2D_6	D_2+D	14.5±0.2	EI		1024
$B_2H_4^+$						
$B_2H_4^+$	B_2H_6	H_2	12.3±0.1	EI		209
$B_2H_4^+$	B_2H_6	H_2	12.3±0.2	EI		1024
$B_2H_4^+$	B_2H_6	H_2	12.4±0.3	EI		102

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$B_2HD_3^+$				
$B_2HD_3^+$	B_2HD_5?		12.3±0.1	EI		209
		$B_2D_4^+$				
$B_2D_4^+$	B_2D_6	D_2	12.3±0.1	EI		209
$B_2D_4^+$	B_2D_6	D_2	12.3±0.2	EI		1024
		$B_2H_5^+$				
$B_2H_5^+$	B_2H_6	H	11.84±0.1	EI		2559
$B_2H_5^+$	B_2H_6	H	11.9±0.1	EI		209
$B_2H_5^+$	B_2H_6	H	12.0±0.1	EI		1024
$B_2H_5^+$	B_2H_6	H	12.0±0.3	EI		102
$B_2H_5^+$	B_4H_8CO		12.4±0.8	EI		3226
		$B_2HD_4^+$				
$B_2HD_4^+$	B_2HD_5?		12.0±0.1	EI		209
		$B_2D_5^+$				
$B_2D_5^+$	B_2D_6	D	12.0±0.1	EI		1024
$B_2D_5^+$	B_2D_6	D	12.1±0.1	EI		209
	$B_2H_6^+(^2B_{2g})$	**$\Delta H^\circ_{f0} \sim 1150$ kJ mol^{-1} (275 kcal mol^{-1})**				
$B_2H_6^+(^2B_{2g})$	B_2H_6		11.38±0.01	PE	1149	3147
$B_2H_6^+(^2B_{2g})$	B_2H_6		11.41±0.02	PE	1152	3105
$B_2H_6^+(^2B_{2g})$	B_2H_6		11.37±0.01	PE	1148	2960, 3050
$B_2H_6^+(^2A_g)$	B_2H_6		<12.7	PE		3147
$B_2H_6^+(^2A_g)$	B_2H_6		12.83±0.04	PE		3105
$B_2H_6^+(^2A_g)$	B_2H_6		<12.88	PE		2960
$B_2H_6^+(^2B_{3u})$	B_2H_6		<13.6	PE		3147
$B_2H_6^+(^2B_{3u})$	B_2H_6		13.81±0.06	PE		3105
$B_2H_6^+(^2B_{3u})$	B_2H_6		~13.5	PE		2960
$B_2H_6^+(^2B_{2u})$	B_2H_6		<14.5	PE		3147
$B_2H_6^+(^2B_{2u})$	B_2H_6		14.42±0.04	PE		3105
$B_2H_6^+(^2B_{2u})$	B_2H_6		~14.5	PE		2960
$B_2H_6^+(^2B_{1u})$	B_2H_6		16.06±0.01	PE		3147
$B_2H_6^+(^2B_{1u})$	B_2H_6		16.08±0.01	PE		3105
$B_2H_6^+(^2B_{1u})$	B_2H_6		16.05	PE		2960

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$B_2H_6^+(^2A_g)$	B_2H_6		20.2±0.1	PE		3147

The notation and assignments differ in all three studies. We have adopted the assignments of ref. 3147. There is also disagreement about the vibrational structure.

See also – EI: 102, 209

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$B_2D_6^+$				
$B_2D_6^+$	B_2D_6		12.0±0.1	EI		209
		B_3H^+				
B_3H^+	B_4H_{10}		16.5±0.8	EI		1119
		$B_3H_2^+$				
$B_3H_2^+$	B_4H_{10}		17.8±0.8	EI		1119
$B_3H_2^+$	B_4H_8CO		16.7±1	EI		3226
		$B_3H_3^+$				
$B_3H_3^+$	B_4H_{10}		14.2±0.3	EI		1119
$B_3H_3^+$	B_4H_8CO		14.8±0.5	EI		3226
		$B_3D_3^+$				
$B_3D_3^+$	B_4D_{10}		13.8±0.3	EI		1119
		$B_3H_4^+$				
$B_3H_4^+$	B_4H_8CO		14.3±0.2	EI		3226
		$B_3H_5^+$				
$B_3H_5^+$	B_4H_{10}		12.1±0.2	EI		1119
$B_3H_5^+$	B_4H_8CO		12.2±0.2	EI		3226
		$B_3D_5^+$				
$B_3D_5^+$	B_4D_{10}		12.8±0.3	EI		1119

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$B_3H_6^+$				
$B_3H_6^+$	B_4H_8CO		10.7±0.5	EI		3226
		$B_3H_7^+$				
$B_3H_7^+$	B_4H_8CO		11.5±0.5	EI		3226
		B_4H^+				
B_4H^+	B_5H_9		19.97±1.0	EI		205
B_4H^+	B_4H_8CO		13.0±0.8	EI		3226
		$B_4H_2^+$				
$B_4H_2^+$	B_5H_9		17.99±0.2	EI		205
$B_4H_2^+$	B_4H_8CO		13.1±0.8	EI		3226
		$B_4H_3^+$				
$B_4H_3^+$	B_4H_{10}	$3H_2+H$	14.0±0.4	EI		1119
$B_4H_3^+$	B_5H_9		15.96±0.5	EI		205
$B_4H_3^+$	B_4H_8CO		12.6±1	EI		3226
		$B_4D_3^+$				
$B_4D_3^+$	B_4D_{10}	$3D_2+D$	14.8±0.4	EI		1119
		$B_4H_4^+$				
$B_4H_4^+$	B_4H_{10}	$3H_2$	12.4±0.2	EI		1119
$B_4H_4^+$	B_5H_9		14.06±0.1	EI		205
$B_4H_4^+$	B_4H_8CO		12.6±0.3	EI		3226
		$B_4D_4^+$				
$B_4D_4^+$	B_4D_{10}	$3D_2$	12.5±0.2	EI		1119
$B_4D_4^+$	B_5D_9		13.7±0.2	EI		1024
$B_4D_4^+$	B_5D_{11}		12.4±0.5	EI		1024
		$B_4H_5^+$				
$B_4H_5^+$	B_4H_{10}	$2H_2+H$	12.5±0.3	EI		1119
$B_4H_5^+$	B_5H_9		15.07±0.3	EI		205
$B_4H_5^+$	B_4H_8CO		13.4±0.4	EI		3226

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$B_4D_5^+$				
$B_4D_5^+$	B_4D_{10}	$2D_2$+D	12.5±0.2	EI		1119
		$B_4H_6^+$				
$B_4H_6^+$	B_4H_{10}	$2H_2$	11.2±0.1	EI		1119
$B_4H_6^+$	B_5H_9	BH_3?	12.25±0.2	EI		205
$B_4H_6^+$	B_4H_8CO		11.2±0.2	EI		3226
		$B_4D_6^+$				
$B_4D_6^+$	B_4D_{10}	$2D_2$	11.1±0.1	EI		1119
$B_4D_6^+$	B_5D_9	BD_3?	12.4±0.2	EI		1024
$B_4D_6^+$	B_5D_{11}		11.4±0.5	EI		1024
		$B_4H_7^+$				
$B_4H_7^+$	B_4H_{10}	H_2+H	12.5±0.2	EI		1119
$B_4H_7^+$	B_4H_8CO		11.5±0.5	EI		3226
		$B_4D_7^+$				
$B_4D_7^+$	B_4D_{10}	D_2+D	12.2±0.1	EI		1119
		$B_4H_8^+$				
$B_4H_8^+$	B_4H_8		10.19±0.5	EI		3226
$B_4H_8^+$	B_4H_{10}	H_2	10.4±0.1	EI		1119
$B_4H_8^+$	B_4H_8CO	CO	10.6±0.5	EI		3226
		$B_4D_8^+$				
$B_4D_8^+$	B_4D_{10}	D_2	9.9±0.1	EI		1119
		$B_4H_9^+$				
$B_4H_9^+$	B_4H_{10}	H	12.2±0.2	EI		1119
$B_4H_9^+$	B_8H_{18}		11.2±0.1	EI		2736
		$B_4D_9^+$				
$B_4D_9^+$	B_4D_{10}	D	11.9±0.2	EI		1119

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$B_5H_4^+$				
$B_5H_4^+$	B_5H_9	$2H_2+H$	13.01±0.3	EI		205
$B_5H_4^+$	B_5H_{11}	$3H_2+H$	14.2±0.4	EI		1024
		$B_5H_5^+$				
$B_5H_5^+$	B_5H_9	$2H_2$	12.67±0.03	EI		205
$B_5H_5^+$	B_5H_9	$2H_2$	12.8±0.2	EI		1024
$B_5H_5^+$	B_5H_9	$2H_2$	12.5±0.5	EI		3226
$B_5H_5^+$	B_5H_{11}	$3H_2$	12.7±0.2	EI		1024
$B_5H_5^+$	B_6H_{10}		13.6±0.2	EI		1024
		$B_5D_5^+$				
$B_5D_5^+$	B_5D_9	$2D_2$	12.4±0.4	EI		1024
$B_5D_5^+$	B_5D_9	$2D_2$	12.92±0.03	EI		205
$B_5D_5^+$	B_5D_{11}	$3D_2$	12.3±0.2	EI		1024
		$B_5H_6^+$				
$B_5H_6^+$	B_5H_9	H_2+H	12.13±0.3	EI		205
$B_5H_6^+$	B_5H_{11}	$2H_2+H$	12.6±0.3	EI		1024
		$B_5D_6^+$				
$B_5D_6^+$	B_5D_9	D_2+D	12.4±0.2	EI		1024
$B_5D_6^+$	B_5D_{11}	$2D_2+D$	12.2±0.3	EI		1024
		$B_5H_7^+$				
$B_5H_7^+$	B_5H_9	H_2	11.43±0.1	EI		205
$B_5H_7^+$	B_5H_9	H_2	11.6±0.2	EI		1024
$B_5H_7^+$	B_5H_9	H_2	11.4±0.5	EI		3226
$B_5H_7^+$	B_5H_{11}	$2H_2$	11.5±0.2	EI		1024
$B_5H_7^+$	B_6H_{10}	BH_3?	12.0±0.2	EI		1024
		$B_5D_7^+$				
$B_5D_7^+$	B_5D_9	D_2	10.93±0.2	EI		205
$B_5D_7^+$	B_5D_9	D_2	11.2±0.2	EI		1024
$B_5D_7^+$	B_5D_{11}	$2D_2$	11.1±0.2	EI		1024

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$B_5H_8^+$				
$B_5H_8^+$	B_5H_{11}	H_2+H	12.0±0.3	EI		1024
$B_5H_8^+$	$B_{10}H_{16}$		11.6±0.2	EI		1102
$B_5H_8^+$	B_5H_8Br	Br	12.0±0.2	EI		1102
$B_5H_8^+$	B_5H_8I	I	11.1±0.1	EI		1102
		$B_5D_8^+$				
$B_5D_8^+$	B_5D_{11}	D_2+D	11.4±0.3	EI		1024
		$B_5H_9^+$				
$B_5H_9^+$	B_5H_9		10.54±0.01	RPD		3228
$B_5H_9^+$	B_5H_9		10.38±0.05	EI		205
$B_5H_9^+$	B_5H_9		10.5±0.1	EI		1024
$B_5H_9^+$	B_5H_9		10.5±0.5	EI		3226
$B_5H_9^+$	B_5H_9		10.8±0.5	EI		103
$B_5H_9^+$	B_5H_{11}	H_2	10.3±0.2	EI		1024
		$B_5D_9^+$				
$B_5D_9^+$	B_5D_9		9.77±0.1	EI		205
$B_5D_9^+$	B_5D_9		10.0±0.1	EI		1024
$B_5D_9^+$	B_5D_{11}	D_2	10.4±0.2	EI		1024
		$B_5H_{10}^+$				
$B_5H_{10}^+$	B_5H_{11}	H	11.8±0.4	EI		1024
		$B_5D_{10}^+$				
$B_5D_{10}^+$	B_5D_{11}	D	11.3±0.4	EI		1024
		$B_6H_4^+$				
$B_6H_4^+$	B_6H_{10}	$3H_2$	13.4±0.3	EI		1024
		$B_6H_5^+$				
$B_6H_5^+$	B_6H_{10}	$2H_2$+H	12.0±0.3	EI		1024
		$B_6H_6^+$				
$B_6H_6^+$	B_6H_{10}	$2H_2$	11.9±0.1	EI		1024

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$B_6H_7^+$				
$B_6H_7^+$	B_6H_{10}	H_2+H	11.5±0.3	EI		1024
		$B_6H_8^+$				
$B_6H_8^+$	B_6H_{10}	H_2	11.2±0.1	EI		1024
		$B_6H_9^+$				
$B_6H_9^+$	B_6H_{10}	H	11.1±0.4	EI		1024
		$B_6H_{10}^+$				
$B_6H_{10}^+$	B_6H_{10}		9.3±0.1	EI		1024
		$B_6D_{10}^+$				
$B_6D_{10}^+$	B_6D_{10}		9.7±0.2	EI		1024
		$B_6H_{12}^+$				
$B_6H_{12}^+$	B_6H_{12}		9.75±0.2	EI		3225
		$B_8H_{12}^+$				
$B_8H_{12}^+$	B_8H_{12}		9.52±0.1	EI		3225
		$B_{10}H_6^+$				
$B_{10}H_6^+$	$B_{10}H_{14}$	$4H_2$	13.14±0.3	EI		189
		$B_{10}H_7^+$				
$B_{10}H_7^+$	$B_{10}H_{14}$	$3H_2$+H	12.51±0.5	EI		189
		$B_{10}H_8^+$				
$B_{10}H_8^+$	$B_{10}H_{14}$	$3H_2$	12.67±0.3	EI		189
		$B_{10}H_{10}^+$				
$B_{10}H_{10}^+$	$B_{10}H_{14}$	$2H_2$	11.62±0.2	EI		189

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol⁻¹)	Ref.
$B_{10}H_{11}^+$						
$B_{10}H_{11}^+$	$B_{10}H_{14}$	H_2+H	10.81±0.5	EI		189
$B_{10}H_{12}^+$						
$B_{10}H_{12}^+$	$B_{10}H_{14}$	H_2	10.87±0.2	EI		189
$B_{10}H_{14}^+$						
$B_{10}H_{14}^+$	$B_{10}H_{14}$		10.26±0.5	EI		189
$B_{10}H_{14}^+$	$B_{10}H_{14}$		11.0±0.5	EI		103
$B_{10}H_{16}^+$						
$B_{10}H_{16}^+$	$B_{10}H_{16}$		10.1±0.2	EI		1102
C^+ $\Delta H_{f0}^\circ = 1797.6$ kJ mol⁻¹ (429.6 kcal mol⁻¹)						
C^+	C		11.260	S	1797.6	2113
C^+	C		11.3±0.2	EI		1155
C^+	C_2H_2		23.6	EI		3156
C^+	C_3H_6		24.5±0.5	EI		2542
C^+	CNC≡CCN		24±1.0	EI		154
C^+	CNC≡CC≡CCN		23.0±0.5	EI		154
C^+	CH_3CN		27.0±0.3	EI		131
C^+	CO	O^-	20.82±0.05	RPD	(1790)	2431
C^+	CO	O^-	20.89±0.09	RPD	(1796)	2180, 2191
See also – PI:	163					
EI:	200, 2014, 2016					
D:	6					
C^+	CO	O	22.45±0.10	RPD	(1806)	2431
C^+	CO	O	22.57±0.20	RPD	(1817)	2180, 2191
See also – PI:	163					
EI:	200, 2014, 2016					
C^+	CO_2	O_2	23.2±0.5	EI		2472
C^+	CO_2	2O	28.4±0.6	EI		2472
C^+	CO_2^+	2O	14.15±0.5	SEQ		2472
C^+	C_3O_2	2CO	18.7±0.3	EI		2687
C^+	CH_3NO_2		22.83±0.05	EI		90
C^+	CF_4		31.5±0.5	EI		24
C^+	CF_2O	2F+O?	36±1	EI		3236
C^+	CF_3OF	4F+O?	41±1	EI		3236
C^+	CS_2	S_2	20.0±0.1	EI		3402
C^+	CS_2	S_2	19.9±0.6	EI		2472
C^+	CS_2	2S	24.0±0.5	EI		2472

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
C^+	CS_2^+	2S	12.3±0.9	SEQ		2472
C^+	$(CH_3)_2SO$		22.9±0.5	EI		3294
C^+	CH_3Cl		26.25±0.1	EI		131
C^+	CH_2Cl_2		25.45±0.1	EI		131
C^+	$CHCl_3$		24.62±0.05	EI		131
C^+	CF_3Cl		31±1	EI		24
C^+	CBr_4		23.1±0.4	EI		1246
C^+	CH_2Br_2		24.52±0.05	EI		131
C^+	$CHBr_3$		23.55±0.05	EI		131
C^+	CF_3Br		33±1	EI		24
C^+	CF_3I		32.6±1	EI		24
	C^{+2}	**ΔH°_{f0} = 4150.3 kJ mol^{-1} (991.9 kcal mol^{-1})**				
C^{+2}	C		35.643	S	4150.3	2113
C^{+2}	C^+		24.383	S		2113
C^{+2}	CO	O	54.2±0.2	EI		2431
(8.2±0.9 eV average translational energy of decomposition at threshold)						
	C_2^+	**ΔH°_{f0} = 1992 kJ mol^{-1} (476 kcal mol^{-1})**				
C_2^+	C_2		12.0±0.6	EI	(~1987)	1155
C_2^+	C_2		~13	EI		2102
C_2^+	C_2H_2	H_2	18.2	EI	(~1983)	2102
C_2^+	C_2H_2	H_2	19.5	EI		3156
C_2^+	C_2H_2	2H?	23.6	FD		3131
C_2^+	C_2H_2	2H?	22.7	EI		2102
C_2^+	C_2H_2	2H?	23.3±0.5	EI		13
C_2^+	C_2H_2	2H?	23.8	EI		3156
C_2^+	C_2D_2	2D?	23.6	FD		3131
C_2^+	C_3H_6		28±1	EI		2542
C_2^+	C_2N_2	N_2	17.46±0.02	PI	1992	2621
C_2^+	C_2N_2	N_2	18.4±0.3	EI		154
C_2^+	$CNC\equiv CCN$		18.5±0.3	EI		154
C_2^+	$CNC\equiv CC\equiv CCN$		18.4±1.0	EI		154
C_2^+	$CH\equiv CCN$		18.6±0.2	EI		154
C_2^+	C_3O_2		24.5±0.7	EI		2687
C_2^+	$Ni(CO)_4$		39.9±2	EI		2579
		C_3^+				
C_3^+	C_3		12.1±0.3	EI	(~1979)	2996, 3208
C_3^+	C_3		12.6±0.6	EI		1155
See also – EI: 154						
C_3^+	C_3H?		17.1±0.5	EI		154
C_3^+	$CH_3C\equiv CH$		26.0±1	EI		13
C_3^+	C_3H_6		27±1	EI		2542
C_3^+	$CNC\equiv CCN$		24.6±0.5	EI		154
C_3^+	$CNC\equiv CC\equiv CCN$		23.0±2.0	EI		154

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
C_3^+	CH≡CCN		24.5±0.5	EI		154
C_3^+	C_3O_2		29.8±0.4	EI		2687
		C_4^+				
C_4^+	C_4		12.6	EI		1155
C_4^+	CNC≡CCN	N_2	17.2±0.2	EI		154
C_4^+	CNC≡CC≡CCN		17.8±0.4	EI		154
		C_5^+				
C_5^+	C_5		12.7±0.5	EI		154
C_5^+	C_5		12.5±1	EI		1155
C_5^+	CNC≡CC≡CCN		24.0±0.5	EI		154
		C_6^+				
C_6^+	C_6		12.5±0.3	EI		154
	CH^+	ΔH°_{f0} = 1619 kJ mol^{-1} (387 kcal mol^{-1})				
CH^+	CH		10.64±0.01	S	1619	3042
CH^+	CH_3	H_2	15.58±0.30	EI	(1649)	414
CH^+	C_2H_2	CH	21.9	RPD		3345
(0.28 eV average translational energy of decomposition at threshold)						
CH^+	C_2H_2	CH	21.5±0.2	EDD		3177
See also – EI:	2102, 2450, 3131, 3156					
CH^+	C_3H_6		22.5±0.5	EI		2542
CH^+	C_3H_8	$C_2H_5^+$+H_2	26.0±1	EI		1408
(Threshold value corrected for high fragment kinetic energy)						
CH^+	CH_3CN		22.4±0.2	EI		131
CH^+	CH≡CCN		21.9±0.3	EI		154
CH^+	CH_3OH		22.31±0.09	EI		131
CH^+	$(CH_2)_2O$ (1,2–Epoxyethane)		22.8±0.4	EI		50
CH^+	CH≡CF	CF	19.2±0.2	EDD		3177
CH^+	$(CH_3)_2SO$		19.4±0.5	EI		3294
CH^+	CH_3Cl		22.5±0.06	EI		131
CH^+	CH≡CCl	CCl	18.7±0.2	EDD		3177
CH^+	CH_2Cl_2		21.72±0.04	EI		131
CH^+	$CHCl_3$		23.9±0.3	EI		43
CH^+	CH_3Br		21.41	EI		131
CH^+	CH≡CBr	CBr	20.3±0.2	EDD		3177
CH^+	CH_2Br_2		21.55±0.05	EI		131
CH^+	$CHBr_3$		21.70±0.05	EI		131
CH^+	CH_3I		21.2±0.2	EI		131

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
CH_2^+	**$\Delta H^\circ_{f0} \sim 1398$ kJ mol^{-1} (334 kcal mol^{-1})**					
CH_2^+	CH_2		10.396±0.003	S		1078
Dibeler *et al.*, ref. 1128, combine this ionization potential with their appearance potential for CH_2^+ from CH_4 to yield $\Delta H^\circ_{f0}(CH_2) = 392.9$ kJ mol^{-1} (93.9 kcal mol^{-1}).						
CH_2^+	CH_2		10.50±0.2	EI		2535
See also – EI: 87, 327						
CH_2^+	CH_3	H	15.09±0.03	PI	1386	2618
(Threshold value approximately corrected to 0 K)						
See also – EI: 14						
CH_2^+	CH_4	H_2	15.19±0.02	PI	1399	2605
(Threshold value approximately corrected to 0 K)						
CH_2^+	CH_4	H_2	15.16±0.04	PI	1396	1128
See also – EI: 160						
CH_2^+	C_2H_2	C	21	EI		2136
CH_2^+	C_2H_4	CH_2	18.05	PI	1409	2617
(Threshold value approximately corrected to 0 K but may be subject to kinetic shift and reaction competition)						
CH_2^+	C_3H_6		17.0±0.5	EI		2542
CH_2^+	C_3H_6 (Cyclopropane)	C_2H_4	19.3	RPD		3345
(0.52 eV average translational energy of decomposition at threshold)						
CH_2^+	CH_3CN	HCN	14.94±0.02	PI	1400	2623
(Threshold may be subject to kinetic shift and reaction competition)						
CH_2^+	CH_3CN	HCN	15.7	RPD		3345
(0.12 eV average translational energy of decomposition at threshold)						
CH_2^+	CH_2N_2 (Diazomethane)	N_2	12.3±0.1	EI		314
CH_2^+	CH_2N_2 (Diazirine)	N_2	11.0±0.1	EI		314
CH_2^+	CH_3OH	H_2O	15.3	RPD		3345
(0.13 eV average translational energy of decomposition at threshold)						
CH_2^+	$CH_2{=}CO$	CO	13.8±0.2	EI		2800
CH_2^+	$(CH_2)_2O$ (1,2–Epoxyethane)		16.5±0.4	EI		50
CH_2^+	C_3H_6O (1,2–Epoxypropane)		18.8±0.5	EI		50
CH_2^+	$HCOOCH_3$		19.8	EI		3224
CH_2^+	CH_3COOCH_3		20.8	EI		3224
CH_2^+	$C_4H_8O_2$ (1,2–Epoxy–3–methoxypropane)		21.3±0.5	EI		153
CH_2^+	$CH_2{=}CF_2$	CF_2	17.8	EI		419
CH_2^+	CH_3CF_3		16.2±0.3	EI		1075
CH_2^+	CH_3BF_2		16.9±0.1	EI		1076
CH_2^+	$(CH_2)_2S$ (Ethylene sulfide)		20.4±0.5	EI		51

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
CH_2^+	$(CH_3)_2SO$		15.5±0.3	EI		3294
CH_2^+	CH_3Cl	HCl	14.6±0.2	RPD		160
CH_2^+	CH_2Cl_2	Cl_2	17.0	RPD		3345
(0.36 eV average translational energy of decomposition at threshold)						
CH_2^+	C_3H_5OCl (1–Chloro–2,3–epoxypropane)		21.6±0.5	EI		153
CH_2^+	CH_3Br	HBr	14.9±0.2	RPD		160
CH_2^+	C_3H_5OBr (1–Bromo–2,3–epoxypropane)		21.4±0.5	EI		153
CH_2^+	CH_3I	HI	14.6±0.2	RPD		160
CD_2^+						
CD_2^+	CD_4	D_2	15.25±0.04	PI		1128
CH_3^+ $\Delta H^\circ_{f0} = 1095$ kJ mol^{-1} (262 kcal mol^{-1})						
CH_3^+	CH_3		9.842±0.002	S	1095	349
CH_3^+	CH_3		9.825±0.01	PI		2618
CH_3^+	CH_3		9.82±0.04	PI		1068
CH_3^+	CH_3		9.84±0.03	EM		3104, 3379
CH_3^+	CH_3		9.87±0.05	RPD		2776
The discrepancy between the spectroscopic and photoionization values is unexplained, see ref. 2618.						
See also – EI: 87, 327, 414, 1129, 2158, 2464, 2535, 2904, 2961, 2986, 3202						
CH_3^+	CH_4	H^-	13.50±0.05	PI	(1093)	2605
CH_3^+	CH_4	H	14.320±0.004	PI	(1099)	2605
(Threshold value corrected to 0 K)						
CH_3^+	CH_4	H	14.25±0.02	PI		1128
CH_3^+	CH_4	H	14.23±0.05	PI		2013
CH_3^+	CH_4	H	14.30	EM		3104
CH_3^+	CH_4	H	14.24±0.05	RPD		2776
See also – EI: 224, 1072, 1451, 2154, 3017						
CH_3^+	C_2H_6	CH_3	13.46±0.05	RPD		2776
See also – EI: 160, 2421						
CH_3^+	C_2H_6 (High kinetic energy ion)		30.3±0.2	SRP		1264
CH_3^+	C_2H_5D		14.94?	EI		2421
CH_3^+	CH_3CD_3		15.15?	EI		2421
CH_3^+	$CH_3C{\equiv}CH$		15.4±0.5	EI		13
CH_3^+	C_3H_6	C_2H_3	14.9	RPD		3345
(0.10 eV average translational energy of decomposition at threshold)						
See also – EI: 2542						

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
CH_3^+	C_3H_8	C_2H_5	14.0±0.5	EI		2021
See also – EI: 1408						
CH_3^+	C_3H_8	$C_2H_5^+$	22.0±0.5	EI		1408
(Threshold value corrected for high fragment kinetic energy)						
See also – EI: 2021, 2447						
CH_3^+	C_3H_8	$C_2H_3^+ + H_2$	25.0±0.5	EI		1408
(Threshold value corrected for high fragment kinetic energy)						
See also – EI: 1264						
CH_3^+	$CH_3CH{=}C{=}CH_2$		14.4±0.2	EI		462
CH_3^+	$CH_3C{\equiv}CCH_3$		17.6±0.5	EI		13
CH_3^+	$n\text{-}C_4H_{10}$		29.7±0.2	SRP		1264
(High kinetic energy ion)						
CH_3^+	$iso\text{-}C_4H_{10}$		29.4±0.2	SRP		1264
(High kinetic energy ion)						
CH_3^+	$neo\text{-}C_5H_{12}$		13.14	EI		2101
CH_3^+	$neo\text{-}C_5H_{12}$		29.5±0.2	SRP		1264
(High kinetic energy ion)						
CH_3^+	$C_2H_5C{\equiv}CC{\equiv}CH$		18.50	EI		1197
CH_3^+	$CH_3C{\equiv}CC{\equiv}CCH_3$		25.70	EI		1197
CH_3^+	C_6H_6 (Benzene)		28.2±0.2	SRP		1264
(High kinetic energy ion)						
CH_3^+	$n\text{-}C_7H_{16}$		27.9±0.2	SRP		1264
(High kinetic energy ion)						
CH_3^+	$(CH_3)_3B$		15.1±0.3	EI		364
CH_3^+	CH_3NH_2	NH_2	14.7	RPD		3345
(0.25 eV average translational energy of decomposition at threshold)						
CH_3^+	CH_3NC	CN	14.76	EDD		3214
CH_3^+	$(CH_2)_2NH$ (Ethylenimine)		15.5±0.3	EI		51
CH_3^+	$(CH_2)_3NH$ (Trimethylenimine)		14.4±1.0	EI		52
CH_3^+	$(CH_3)_3N$		14.0±0.1	EI		303
CH_3^+	CH_3NHNH_2		14.1±0.3	EI		424, 3216
CH_3^+	$CH_3N{=}NCH_3$		11.5±0.1	EI		304
See also – EI: 2549						
CH_3^+	$(CH_3)_2NNH_2$		14.5±0.3	EI		424, 3216
CH_3^+	$CH_3NHNHCH_3$		13.9±0.3	EI		424, 3216
CH_3^+	$(CH_3)_2NNHCH_3$		14.0±0.5	EI		424, 3216
CH_3^+	$(CH_3)_2NN(CH_3)_2$		14±1	EI		424, 3216
CH_3^+	CH_3N_3		14.1±0.1	EI		340
CH_3^+	CH_3OH	OH	13.5	EI		46
See also – EI: 2018, 3176						

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
CH_3^+	CH_3CHO	CHO?	14.53	RPD		3347
(≤0.04 eV average translational energy of decomposition at threshold)						
See also - EI:	127, 298, 2883					
CH_3^+	$(CH_2)_2O$ (1,2-Epoxyethane)		14.3±0.2	EI		50
CH_3^+	C_2H_5OH		14.70±0.10	RPD		3347
(0.11±0.02 eV average translational energy of decomposition at threshold)						
CH_3^+	$(CH_3)_2O$		14.93±0.13	RPD		3347
(0.12±0.02 eV average translational energy of decomposition at threshold)						
See also - EI:	2018					
CH_3^+	$(CH_3)_2CO$		15.36	RPD		3347
(0.17±0.01 eV average translational energy of decomposition at threshold)						
CH_3^+	$(CH_3)_2CO$		14.93	RPD		2977
See also - EI:	298, 2174, 2883					
CH_3^+	C_3H_6O (1,2-Epoxypropane)		13.9±0.2	EI		50
CH_3^+	*iso*-C_3H_7OH		30.2±0.2	SRP		1264
(High kinetic energy ion)						
CH_3^+	$C_2H_5OCH_3$		15.02	RPD		3347
(0.11±0.01 eV average translational energy of decomposition at threshold)						
CH_3^+	$C_2H_5COCH_3$		15.49	RPD		2977
See also - EI:	298, 2883					
CH_3^+	*n*-$C_3H_7COCH_3$		15.13	RPD		2977
CH_3^+	CH_3COOH		14.0±0.15	RPD		3347
(0.09±0.01 eV average translational energy of decomposition at threshold)						
See also - EI:	171					
CH_3^+	$HCOOCH_3$		13.71	RPD		3347
(≤0.10 eV average translational energy of decomposition at threshold)						
See also - EI:	3224					
CH_3^+	$HCOOC_2H_5$		11.07±0.04	EI		305
CH_3^+	CH_3COOCH_3		13.07±0.10	EI		305
See also - EI:	3176, 3224					
CH_3^+	$HCOOCH_2CH_2CH_3$		11.94±0.02	EI		305
CH_3^+	$CH_3COOC_2H_5$		13.94±0.08	EI		305
CH_3^+	$C_4H_8O_2$ (1,2-Epoxy-3-methoxypropane)		16.0±0.3	EI		153
CH_3^+	$(CH_3O)_2BH$		13.4±0.5	EI		364
CH_3^+	$(CH_3O)_3B$		13.6±0.5	EI		364
See also - EI:	115					

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
CH_3^+	CH_3NCO	NCO	14.6	RPD		3345
(0.33 eV average translational energy of decomposition at threshold)						
CH_3^+	CH_3COCHN_2		13.2±0.06	EI		2174
CH_3^+	CH_3NO_2	NO_2	12.6	RPD		2018
CH_3^+	CH_3NO_2	NO_2	13.6	RPD		3345
(0.18 eV average translational energy of decomposition at threshold)						
CH_3^+	CH_3ONO_2		15.5	EI		2456
CH_3^+	$C_2H_5ONO_2$		13.75±0.50	EI		1013
See also – EI:	2456					
CH_3^+	*iso*–$C_3H_7ONO_2$		14.9	EI		2456
CH_3^+	CH_3F	F^-	12.56	PI		2637
CH_3^+	CH_3F	F	16.25	PI		2637
This ion is formed with kinetic energy, see V. H. Dibeler and R. M. Reese, J. Res. NBS **54**, 127 (1955).						
See also – EI:	1136, 2154					
CH_3^+	CH_3CHF_2		18.6	EI		1288
CH_3^+	CH_3CF_3		15.0±0.1	EI		1075
CH_3^+	CH_3BF_2		14.8±0.1	EI		1076
CH_3^+	CH_3COCF_3		14.60	EI		298
CH_3^+	CH_3SiH_3		15.1±0.3	EI		2182
CH_3^+	$(CH_3)_3SiH$		14.8±0.5	EI		83
CH_3^+	CH_3PH_2		14.8±0.2	EI		2045
CH_3^+	$(CH_3)_3P$		21.7±0.5	EI		1036
CH_3^+	$(CH_3O)_2CH_3PO$		16.8±0.1	EI		3211
CH_3^+	$(CH_3O)_3PO$		18.6±0.3	EI		3211
CH_3^+	$(CH_3)_2S$		13.0	EI		307
See also – EI:	84, 3202					
CH_3^+	CH_3SCD_3		13.1	EI		307
CH_3^+	C_3H_6S (Propylene sulfide)		18.1±0.4	EI		188
CH_3^+	$C_2H_5SCH_3$		17.6±0.5	EI		176
CH_3^+	$CH_3SCH_2CH=CH_2$		17.7±0.5	EI		186
CH_3^+	*n*–$C_3H_7SCH_3$		16.6±0.5	EI		176
CH_3^+	*iso*–$C_3H_7SCH_3$		19.4±0.5	EI		186
CH_3^+	CH_3SSCH_3		~12.9	EI		3202
See also – EI:	176, 3286					
CH_3^+	CH_3NCS		15.3±0.3	EI		315
CH_3^+	C_2H_5NCS		19.6±0.5	EI		315
CH_3^+	$(CH_3)_2SO$		16.3±0.1	EI		3294
CH_3^+	CH_3SCF_3		14.24	EI		3202
CH_3^+	CH_3SSCF_3		~14	EI		3202
CH_3^+	CH_3Cl	Cl^-	10.07	PI		1399, 2637
See also – EI:	2776					

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
CH_3^+	CH_3Cl	Cl	13.87	PI		2637

The thermochemical threshold for this process is 13.35 eV.

See also – EI: 364, 1136, 2154

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
CH_3^+	C_2H_5Cl		15.9±0.3	EI		356
CH_3^+ (High kinetic energy ion)	*iso*–C_3H_7Cl		29.7±0.2	SRP		1264
CH_3^+	CH_3COCH_2Cl		13.9±0.20	EI		2174
CH_3^+	C_3H_5OCl (1–Chloro–2,3–epoxypropane)		14.6±0.5	EI		153
CH_3^+	CH_3SiCl_3		15.0±0.2	EI		2182
CH_3^+	$(CH_3)_2Zn$		15.1±0.5	EI		2556
CH_3^+	$(CH_3)_4Ge$		20.1±0.5	EI		83
CH_3^+	CH_3Br	Br^-	9.60±0.05	RPD		2776
CH_3^+	CH_3Br	Br	12.77	PI		2637

The thermochemical threshold for this process is 12.78 eV compared to an estimated 0 K photoionization threshold of 12.80 eV.

See also – EI: 1136, 2154, 2973

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
CH_3^+	C_2H_5Br		16.9±0.3	EI		356
CH_3^+	C_3H_5OBr (1–Bromo–2,3–epoxypropane)		15.6±0.5	EI		153
CH_3^+	CH_3I	I	12.22	EM		3104

The thermochemical threshold for this process is 12.23 eV.

See also – EI: 1136, 2154

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
CH_3^+	C_2H_5I		16.3±0.3	EI		356
CH_3^+	$(CH_3)_2Hg$	CH_3+Hg?	12.55	PI		2983

See also – EI: 306

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
CH_3^+	CH_3HgCl		14.8±0.2	EI		306

CH_2D^+

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
CH_2D^+	C_2H_5D	CH_3	14.71±0.30	EI		2421
CH_2D^+	CH_3CD_3	CHD_2	14.94±0.14	EI		2421
CH_2D^+	CH_2DCl	Cl^-	10.10	PI		2637

CHD_2^+

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
CHD_2^+	CH_3CD_3	CH_2D	14.97±0.10	EI		2421
CHD_2^+	CHD_2Cl	Cl^-	10.09	PI		2637

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
			CD_3^+			
CD_3^+	CD_3		9.832±0.002	S		349
CD_3^+	CD_4	D	14.38±0.03	PI		1128
CD_3^+	CH_3CD_3	CH_3	15.10±0.10	EI		2421
CD_3^+	C_2D_6	CD_3	15.54±0.10	EI		2421
CD_3^+	CD_3COOH		15.56	EI		171
CD_3^+	CD_3Cl	Cl	13.8	PI		2637

$CH_4^+(^2B_2)$ $\Delta H_{f0}^\circ \leq 1150$ kJ mol^{-1} (275 kcal mol^{-1})
$CH_4^+(^2A_1)$ $\Delta H_{f0}^\circ = 2094$ kJ mol^{-1} (500 kcal mol^{-1})

$CH_4^+(^2B_2)$	CH_4		≤12.615±0.010	PI	≤1150	3415
$CH_4^+(^2B_2)$	CH_4		12.704±0.008	PI		1253
$CH_4^+(^2B_2)$	CH_4		12.71±0.02	PI		1128
$CH_4^+(^2B_2)$	CH_4		12.55±0.05	PI		2013
$CH_4^+(^2B_2)$	CH_4		12.75±0.05	RPI		2857, 2858, 3293
$CH_4^+(^2B_2)$	CH_4		12.70	PE		2803
$CH_4^+(^2B_2)$	CH_4		12.75	PE		3092
$CH_4^+(^2B_2)$	CH_4		12.78	PE		3116
$CH_4^+(^2B_2)$	CH_4		12.9	PEN		2430
$CH_4^+(^2B_2)$	CH_4		≤12.70	EM		2798
$CH_4^+(^2B_2)$	CH_4		13.00±0.02	RPD		224
$CH_4^+(^2B_2)$	CH_4		12.99±0.05	RPD		2776

The ion ground state has a large Jahn–Teller distortion, see for example R. N. Dixon, Mol. Phys. **20**, 113 (1971), F. A. Grimm and J. Godoy, Chem. Phys. Letters **6**, 336 (1970) and refs. 3092, 3116, 3119. Consequently the onset is not sharp and the adiabatic value may be lower. Several PE studies (refs. 2803, 3092, 3119) have resolved vibrational structure near onset with a separation of ~1200 cm^{-1} (0.15 eV). This is just the difference between the PI threshold value given by Brehm, ref. 2013, and those determined by Nicholson, ref. 1253, and Dibeler *et al.*, ref. 1128.

See also – S: 138
PI: 182, 230, 331, 416, 2605, 3115, 3132
PE: 1130, 2801, 2829, 2843, 3072, 3119, 3132
PEN: 2467
EI: 289, 1072, 1129, 2136, 2154, 2414, 2535, 2575, 3435

$CH_4^+(^2A_1)$	CH_4		22.39	PE	2094	3092
$CH_4^+(^2A_1)$	CH_4		22.4	PE		3119
$CH_4^+(^2A_1)$	CH_4		23.1 (V)	PE		3072
$CH_4^+(^2A_1)$	CH_4		24	RPD		2414
$CH_4^+(^2A_1)$	CH_4		23.5–24	D		2846

Earlier electron impact work (refs. 289, 1072) gave values around 19.4 eV. These are due to autoionization or collision processes, see refs. 2414, 2575, 2846.

CH_4^+	C_3H_6		14.7±0.5	EI		2542
CH_4^+	$(CH_2)_2O$ (1,2–Epoxyethane)	CO	12.3±0.2	EI		50

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
CD_4^+						
$CD_4^+(^2B_2)$	CD_4		12.882±0.008	PI		1253
$CD_4^+(^2B_2)$	CD_4		12.87±0.02	PI		1128
$CD_4^+(^2B_2)$	CD_4		12.83	PE		3092
$CD_4^+(^2B_2)$	CD_4		13.1	EI		2136
$CD_4^+(^2A_1)$	CD_4		22.48	PE		3092
CH_4^{+2}						
CH_4^{+2}	CH_4		≤40.7±0.8 (V)	AUG		3424
C_2H^+						
C_2H^+	C_2H_2	H	17.22	PI		1400
C_2H^+	C_2H_2	H	17.3	EI		2102, 2136
This process is probably accompanied by considerable kinetic energy of decomposition, see R. Botter, R. Hagemann, G. Khodadadi and H. M. Rosenstock in "Recent Developments in Mass Spectroscopy," Proc. Intern. Conf. Mass Spectry., Kyoto, 1079 (1970).						
See also – EI: 13, 1129, 1451, 2450, 3131, 3156						
C_2H^+	$CH_3C{\equiv}CH$	CH_3	17.2±0.5	EI		13
C_2H^+	C_3H_6		20.5±1	EI		2542
C_2H^+	C_3H_8	$CH_3^+ + 2H_2$	30.4±0.5	EI		1408
(Threshold value corrected for high fragment kinetic energy)						
C_2H^+	$CH{\equiv}CC{\equiv}CH$	C_2H	20.1±0.5	EI		13
C_2H^+	$CH{\equiv}CCN$	CN	19.0±0.2	EI		154
C_2H^+	$(CH_2)_2O$ (1,2–Epoxyethane)		24.0±0.3	EI		50
C_2H^+	$CH_3COC{\equiv}CH$	CH_3+CO?	17.95	EI		298
C_2H^+	$C_2H_5SSC_2H_5$		11.35	EI		307
C_2D^+						
C_2D^+	C_2D_2	D	17.34	PI		1400
See also – EI: 3131						
$C_2H_2^+(^2\Pi_u)$ ΔH°_{f0} = 1328 kJ mol^{-1} (317 kcal mol^{-1}) **$C_2H_2^+(^2\Sigma_g)$ ΔH°_{f0} = 1806 kJ mol^{-1} (432 kcal mol^{-1})** **$C_2H_2^+(^2\Sigma_u)$ ΔH°_{f0} = 2001 kJ mol^{-1} (478 kcal mol^{-1})**						
$C_2H_2^+(^2\Pi_u)$	C_2H_2		11.41	S	1328	3145
(Average of two Rydberg series limits)						
$C_2H_2^+(^2\Pi_u)$	C_2H_2		11.396±0.003	PI		1253
$C_2H_2^+(^2\Pi_u)$	C_2H_2		11.400±0.005	PI		2013
$C_2H_2^+(^2\Pi_u)$	C_2H_2		11.406±0.006	PI		54, 1019, 1118, 1400

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_2H_2^+(^2\Pi_u)$	C_2H_2		11.41±0.01	PI		162, 182, 416, 1022
$C_2H_2^+(^2\Pi_u)$	C_2H_2		11.395±0.015	PI		2726
$C_2H_2^+(^2\Pi_u)$	C_2H_2		11.40±0.01	PE		2805
$C_2H_2^+(^2\Pi_u)$	C_2H_2		11.39±0.02	EM		3075
$C_2H_2^+(^2\Pi_u)$	C_2H_2		11.39±0.05	RPD		2776
$C_2H_2^+(^2\Pi_u)$	C_2H_2		11.40±0.02	RPD		224
$C_2H_2^+(^2\Pi_u)$	C_2H_2		11.41±0.01	EDD		2695
$C_2H_2^+(^2\Sigma_g)$	C_2H_2		16.36±0.01	PE	1806	2805
$C_2H_2^+(^2\Sigma_u)$	C_2H_2		18.38±0.01	PE	2001	2805
$C_2H_2^+(^2\Sigma_u)$	C_2H_2		18.5 (V)	PE		3096
$C_2H_2^+(^2\Sigma_g)$	C_2H_2		23.5 (V)	PE		3096

See also – PI: 156, 2759
PE: 1108, 1130, 2759, 2804
PEN: 2430, 2466, 2467
EI: 13, 166, 305, 2450, 2535, 2752, 2759, 3131, 3156, 3177

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_2H_2^+$	C_2H_4	H_2	13.13±0.02	PI	(1328)	2617
(Threshold value approximately corrected to 0 K)						
$C_2H_2^+$	C_2H_4	H_2	13.12±0.03	PI		2607
$C_2H_2^+$	C_2H_4	H_2	12.96±0.02	PI		2013

The three photoionization studies differ in their interpretation of the threshold. That of ref. 2617 is most convincing. The agreement of the $C_2H_2^+$ heat of formation with that derived from IP(C_2H_2) implies that the metastable transition $C_2H_4^+ \rightarrow C_2H_2^+ + H_2$ should have no excess energy.

See also – EI: 166, 419

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_2H_2^+$	C_2H_6	$2H_2$	15.35±0.50	EI		2421
$C_2H_2^+$	C_2H_5D	H_2+HD	15.49±0.25	EI		2421
$C_2H_2^+$	C_3H_6	CH_4	14.1	RPD		3345
(0.13 eV average translational energy of decomposition at threshold)						
$C_2H_2^+$	C_3H_6	CH_4	13.6±0.5	EI		2542
$C_2H_2^+$	C_3H_6 (Cyclopropane)	CH_4	13.1	RPD		3345
(0.07 eV average translational energy of decomposition at threshold)						

See also – EI: 3191

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_2H_2^+$	C_3H_8	CH_4+H_2	14.1±0.15	EI		1408
$C_2H_2^+$	C_3H_8	$CH_3^++H_2+H$	28.5±1	EI		1408
(Threshold value corrected for high fragment kinetic energy)						
$C_2H_2^+$	CH_2=CHCH=CH_2		16.46±0.1	EI		2455
$C_2H_2^+$	C_4H_8 (Cyclobutane)		16.8	EI		2742
$C_2H_2^+$	C_6H_6 (Benzene)		19±0.4	RPD		2520
$C_2H_2^+$	C_6H_6 (Benzene)		18.6±0.3	EI		1238

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_2H_2^+$ (High kinetic energy ion)	C_6H_6 (Benzene)		32.6±0.2	SRP		1264
$C_2H_2^+$	$(CH_2)_2NH$ (Ethylenimine)		16.4±0.4	EI		51
$C_2H_2^+$	C_2H_3CN	HCN	13.13±0.10	EI		1406
$C_2H_2^+$	C_2H_5CN		14.70	EI		2966
$C_2H_2^+$	$(CH_2)_3NH$ (Trimethylenimine)		16.6±0.5	EI		52
$C_2H_2^+$	n-C_3H_7CN		15.50	EI		2966
$C_2H_2^+$	$(CH_2)_4NH$ (Pyrrolidine)		17.3±1.0	EI		52
$C_2H_2^+$	$C_4H_4N_2$ (1,2–Diazine)		14.94±0.10	EI		1406
$C_2H_2^+$	$C_4H_4N_2$ (1,3–Diazine)		15.79±0.05	EI		1406
$C_2H_2^+$	$C_4H_4N_2$ (1,4–Diazine)		15.23±0.10	EI		1406
$C_2H_2^+$	$(CH_2)_2O$ (1,2–Epoxyethane)	H_2O?	15.7±0.3	EI		50
$C_2H_2^+$	C_3H_6O (1,2–Epoxypropane)		13.9±0.2	EI		50
$C_2H_2^+$	$(CH_2)_3O$ (1,3–Epoxypropane)		15.2±0.2	EI		52
$C_2H_2^+$	C_4H_6O (3,4–Epoxy–1–butene)		13.8±0.3	EI		153
$C_2H_2^+$	$(CH_2)_4O$ (1,4–Epoxybutane)		17.3±0.3	EI		52
$C_2H_2^+$	$HCOOC_2H_5$		14.9	EI		3224
$C_2H_2^+$	$C_4H_8O_2$ (1,2–Epoxy–3–methoxypropane)		16.2±0.3	EI		153
$C_2H_2^+$	C_2H_3F	HF	13.73±0.1	EI		419
$C_2H_2^+$	$CH_2{=}CF_2$		19.78±0.1	EI		419
$C_2H_2^+$	$C_2H_3CF_3$		13.3±0.15	EI		1075
$C_2H_2^+$	$C_2H_3BF_2$		13.75±0.1	EI		1076
$C_2H_2^+$	$(C_2H_5)_2PP(C_2H_5)_2$		12.0±0.3	EI		2948
$C_2H_2^+$	$(CH_2)_2S$ (Ethylene sulfide)		17.9±0.5	EI		51
$C_2H_2^+$	C_2H_5SH		14.7±0.3	EI		3286
$C_2H_2^+$	C_3H_6S (Propylene sulfide)		17.7±0.4	EI		188
$C_2H_2^+$	$(CH_2)_3S$ (Trimethylene sulfide)		17.1±0.4	EI		52
$C_2H_2^+$	$C_2H_5SCH_3$		17.8±0.5	EI		176
$C_2H_2^+$	$(C_2H_5)_2S$		21.7±0.3	EI		3286
$C_2H_2^+$	$C_2H_5SSC_2H_5$		19.5±0.5	EI		186
$C_2H_2^+$	C_2H_5NCS		18.1±0.2	EI		315
$C_2H_2^+$	$(CH_3)_2SO$		12±0.3	EI		3294
$C_2H_2^+$	C_2H_3Cl	HCl	13.8±0.3	EI		2793
$C_2H_2^+$	C_3H_5OCl (1–Chloro–2,3–epoxypropane)		16.6±0.1	EI		153
$C_2H_2^+$	C_3H_5OBr (1–Bromo–2,3–epoxypropane)		16.7±0.6	EI		153

4.3. The Positive Ion Table—Continued

C_2HD^+

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
C_2HD^+	CH_3CD_3		15.50±0.10	EI		2421

$C_2D_2^+$

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_2D_2^+(^2\Pi_u)$	C_2D_2		11.416±0.006	PI		54, 1019, 1118, 1400
$C_2D_2^+(^2\Pi_u)$	C_2D_2		11.40±0.01	PE		2805
$C_2D_2^+(^2\Sigma_g)$	C_2D_2		16.53±0.01	PE		2805
$C_2D_2^+(^2\Sigma_u)$	C_2D_2		18.44±0.01	PE		2805

See also – PE: 2804

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_2D_2^+$	C_2D_6	$2D_2$	15.70±0.20	EI		2421

$C_2H_3^+$ $\Delta H^\circ_{f0} \sim 1125$ kJ mol^{-1} (269 kcal mol^{-1})

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_2H_3^+$	C_2H_3		8.95	EM		3350

This ionization potential combined with the ion heat of formation implies an ethylene C–H bond energy of ~417 kJ mol^{-1} (100 kcal mol^{-1}) compared to the kinetic value of ⩾452±8 kJ mol^{-1} (108±2 kcal mol^{-1}) determined by D. M. Golden and S. W. Benson, Chem. Rev. **69**, 125 (1969).

See also – EI: 70, 87, 1129, 2535

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_2H_3^+$	C_2H_4	H	13.25±0.05	PI	1123	2617
(Threshold value approximately corrected to 0 K)						
$C_2H_3^+$	C_2H_4	H	13.37±0.03	PI		2013

See also – PI: 2607
EI: 70, 166, 419

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_2H_3^+$	C_2H_6	H_2+H	15.22±0.10	EI		2421
$C_2H_3^+$	C_2H_5D		15.27±0.15	EI		2421
$C_2H_3^+$	C_3H_6	CH_3	13.7±0.5	EI		2542

See also – EI: 194

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_2H_3^+$	C_3H_6 (Cyclopropane)	CH_3	13.4	RPD		3345
(0.12 eV average translational energy of decomposition at threshold)						
$C_2H_3^+$	C_3H_6 (Cyclopropane)	CH_3	13.3±0.2	EI		3191
$C_2H_3^+$	C_3H_8		14.5±0.15	EI		1408
$C_2H_3^+$	C_3H_8	CH_3^++H_2	25.0±0.5	EI		1408
(Threshold value corrected for high fragment kinetic energy)						

See also – EI: 1264

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_2H_3^+$	$CH_2{=}CHCH{=}CH_2$		15.68±0.2	EI		2455
See also – EI: 462						
$C_2H_3^+$	$CH_3C{\equiv}CCH_3$		14.7±0.2	EI		13
$C_2H_3^+$	1–C_4H_8		13.6	EI		194
$C_2H_3^+$	C_4H_8 (Cyclobutane)		17.7	EI		2742
$C_2H_3^+$	*neo*–C_5H_{12}		17.95	EI		2101
$C_2H_3^+$	C_6H_6 (Benzene)		19±0.4	RPD		2520
$C_2H_3^+$	C_6H_6 (Benzene)		31.1±0.2	SRP		1264
(High kinetic energy ion)						
$C_2H_3^+$	$(CH_2)_2NH$ (Ethylenimine)		16.9±0.3	EI		51
$C_2H_3^+$	$C_2H_5NH_2$		16.14	EI		2470
$C_2H_3^+$	C_2H_5CN		15.40	EI		2966
$C_2H_3^+$	$(CH_2)_3NH$ (Trimethylenimine)		16.6±0.5	EI		52
$C_2H_3^+$	*n*–C_3H_7CN		15.10	EI		2966
$C_2H_3^+$	$(CH_2)_4NH$ (Pyrrolidine)		16.7±0.3	EI		52
$C_2H_3^+$	$(C_2H_5)_2NH$		15.35	EI		2428
$C_2H_3^+$	$(CH_2)_2O$ (1,2–Epoxyethane)	OH	14.3±0.2	EI		50
$C_2H_3^+$	C_2H_5OH		14.7	EI		46
See also – EI: 3176						
$C_2H_3^+$	$CH_2{=}CHCHO$	CHO?	13.64	RPD		3347
(0.09±0.02 eV average translational energy of decomposition at threshold)						
See also – EI: 130						
$C_2H_3^+$	$(CH_3)_2CO$		16.9	RPD		2883
$C_2H_3^+$	C_3H_6O (1,2–Epoxypropane)		14.3±0.1	EI		50
$C_2H_3^+$	$(CH_2)_3O$ (1,3–Epoxypropane)		14.9±0.3	EI		52
$C_2H_3^+$	*n*–C_3H_7OH		14.7	EI		46
$C_2H_3^+$	*iso*–C_3H_7OH		14.6	EI		46
$C_2H_3^+$	C_4H_6O (3,4–Epoxy–1–butene)	CH_3CO?	12.6±0.3	EI		153
$C_2H_3^+$	$(CH_2)_4O$ (1,4–Epoxybutane)		16.1±0.3	EI		52
$C_2H_3^+$	$HCOOC_2H_5$		15.0	EI		3224
$C_2H_3^+$	$CH_3COOC_2H_5$		15.32±0.20	EI		3176
$C_2H_3^+$	$C_4H_8O_2$ (1,2–Epoxy–3–methoxypropane)		16.3±0.2	EI		153
$C_2H_3^+$	C_2H_5NO		12.8±0.2	EDD		3180
$C_2H_3^+$	C_2H_3F	F	14.38±0.1	EI		419
$C_2H_3^+$	$C_2H_3CF_3$		14.20±0.05	EI		1075

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol⁻¹)	Ref.
$C_2H_3^+$	$C_2H_5CF_3$		15.3±0.1	EI		1075
$C_2H_3^+$	$C_2H_3BF_2$		14.25±0.05	EI		1076
$C_2H_3^+$	*iso*–$C_3H_7BF_2$		14.8±0.1	EI		1076
$C_2H_3^+$	$(CH_3)_3SiH$		15.3±0.5	EI		83
$C_2H_3^+$	$C_2H_5PH_2$		15.4±0.3	EI		2948
$C_2H_3^+$	$(C_2H_5)_2PH$		20.4±0.3	EI		2948
$C_2H_3^+$	$(C_2H_5)_3P$		22.1±0.3	EI		2948
$C_2H_3^+$	$(CH_3)_2PP(CH_3)_2$		20.7±0.3	EI		2948
$C_2H_3^+$	$(C_2H_5)_2PP(C_2H_5)_2$		13.2±0.3	EI		2948
$C_2H_3^+$	$(CH_2)_2S$ (Ethylene sulfide)	SH	14.0	RPD		3345
(0.10 eV average translational energy of decomposition at threshold)						
See also – EI:	51					
$C_2H_3^+$	C_2H_5SH		15.8±0.3	EI		3286
$C_2H_3^+$	$(CH_3)_2S$		14.7	EI		307
See also – EI:	84, 3202					
$C_2H_3^+$	CH_3SCD_3		16.7	EI		307
$C_2H_3^+$	C_3H_6S (Propylene sulfide)		17.2±0.3	EI		188
$C_2H_3^+$	$(CH_2)_3S$ (Trimethylene sulfide)		16.7±0.2	EI		52
$C_2H_3^+$	$C_2H_5SCH_3$		16.0±0.4	EI		176
$C_2H_3^+$	$CH_3SCH_2CH{=}CH_2$		16.5±0.4	EI		186
$C_2H_3^+$	$(CH_2)_4S$ (Tetramethylene sulfide)		18.0±0.4	EI		52
$C_2H_3^+$	*n*–$C_3H_7SCH_3$		15.8±0.4	EI		176
$C_2H_3^+$	*iso*–$C_3H_7SCH_3$		16.5±0.5	EI		186
$C_2H_3^+$	$(C_2H_5)_2S$		16.7±0.5	EI		84
See also – EI:	3286					
$C_2H_3^+$	CH_3SSCH_3		14.6±0.3	EI		3286
$C_2H_3^+$	$C_2H_5SSC_2H_5$		17.2±0.4	EI		186
$C_2H_3^+$	C_2H_5NCS		15.6±0.3	EI		315
$C_2H_3^+$	$(CH_3)_2SO$		15.9±0.1	EI		3294
$C_2H_3^+$	C_2H_3Cl	Cl	12.5	EM	~1129	3350
See also – EI:	2793					
$C_2H_3^+$	C_3H_5OCl (1–Chloro–2,3–epoxypropane)		14.0±0.4	EI		153
$C_2H_3^+$	$(C_2H_5)_2Se$		19.0±0.3	EI		3285
$C_2H_3^+$	C_2H_3Br	Br	11.9	EM	~1123	3350
$C_2H_3^+$	C_3H_5OBr (1–Bromo–2,3–epoxypropane)		14.4±0.2	EI		153

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_2H_2D^+$						
$C_2H_2D^+$	CHD=CHD	D	14.1	PI		2607
$C_2H_2D^+$	CH_3CD_3		15.45±0.1	EI		2421
$C_2H_2D^+$	CH_3SCD_3		15.05	EI		307
$C_2HD_2^+$						
$C_2HD_2^+$	CHD=CHD	H	14.1	PI		2607
$C_2HD_2^+$	CH_3SCD_3		13.5	EI		307
$C_2D_3^+$						
$C_2D_3^+$	C_2D_6	D_2+D	15.60±0.1	EI		2421
$C_2D_3^+$	CH_3SCD_3		12.1	EI		307
	$C_2H_4^+(^2B_{3u})$	**$\Delta H^\circ_{f0} = 1075$ kJ mol^{-1} (257 kcal mol^{-1})**				
	$C_2H_4^+(^2B_{3g})$	**$\Delta H^\circ_{f0} \sim 1258$ kJ mol^{-1} (301 kcal mol^{-1})**				
	$C_2H_4^+(^2A_g)$	**$\Delta H^\circ_{f0} \sim 1453$ kJ mol^{-1} (347 kcal mol^{-1})**				
	$C_2H_4^+(^2B_{2u})$	**$\Delta H^\circ_{f0} \sim 1579$ kJ mol^{-1} (377 kcal mol^{-1})**				
$C_2H_4^+(^2B_{3u})$	C_2H_4		10.51±0.03	S	1075	3353
$C_2H_4^+(^2B_{3u})$	C_2H_4		10.50±0.01	PI	1074	2607
$C_2H_4^+(^2B_{3u})$	C_2H_4		10.50±0.02	PI	1074	268
$C_2H_4^+(^2B_{3u})$	C_2H_4		10.507±0.004	PI	1075	1253
$C_2H_4^+(^2B_{3u})$	C_2H_4		10.511±0.005	PI	1075	2013
$C_2H_4^+(^2B_{3u})$	C_2H_4		10.515±0.01	PI	1075	158, 182, 416
$C_2H_4^+(^2B_{3u})$	C_2H_4		10.51	PE	1075	2803
$C_2H_4^+(^2B_{3u})$	C_2H_4		10.51±0.05	PE	1075	2796
$C_2H_4^+(^2B_{3u})$	C_2H_4		10.51±0.02	PE	1075	3028, 3061
$C_2H_4^+(^2B_{3u})$	C_2H_4		10.50±0.05	RPD		2776
$C_2H_4^+(^2B_{3g})$	C_2H_4		12.38	PE	1255	2803
$C_2H_4^+(^2B_{3g})$	C_2H_4		12.40±0.05	PE	1257	2796
$C_2H_4^+(^2B_{3g})$	C_2H_4		12.46±0.02	PE	1263	3028, 3061
$C_2H_4^+(^2A_g)$	C_2H_4		14.47	PE	1457	2803
$C_2H_4^+(^2A_g)$	C_2H_4		14.35?	PE	1445	2796
$C_2H_4^+(^2A_g)$	C_2H_4		14.46±0.02	PE	1456	3028, 3061
$C_2H_4^+(^2B_{2u})$	C_2H_4		15.68	PE	1574	2803
$C_2H_4^+(^2B_{2u})$	C_2H_4		15.76±0.05	PE	1581	2796
$C_2H_4^+(^2B_{2u})$	C_2H_4		15.78±0.02	PE	1583	3028, 3061
$C_2H_4^+(^2B_{1u})$	C_2H_4		18.87	PE		2803
$C_2H_4^+(^2B_{1u})$	C_2H_4		18.46±0.05	PE		2796
$C_2H_4^+(^2B_{1u})$	C_2H_4		18.87±0.02	PE		3028, 3061
$C_2H_4^+(^2B_{1u})$	C_2H_4		19.5±1 (V)	PE		3096

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_2H_4^+(^2A_g)$	C_2H_4		24.5±1 (V)	PE		3096

We use the assignments given in ref. 3028.

See also – S: 2059, 3145
PI: 156, 297, 2059, 2617
PE: 1130, 2843, 3132, 3382
PEN: 2430, 2466, 2873
EI: 166, 268, 419, 1129, 2187, 2535, 3435

$C_2H_4^+$	C_2H_6	H_2	12.08±0.03	PI		2606
(Threshold value approximately corrected to 0 K)						
$C_2H_4^+$	C_2H_6	H_2	12.24±0.10	EI		2421

The thermochemical threshold for this process is 11.85 eV. The corresponding metastable transition has a mean kinetic energy of 0.15–0.20 eV, see G. Khodadadi, R. Botter and H. M. Rosenstock, Intern. J. Mass Spectrom. Ion Phys. **3**, 397 (1969).

See also – PEN: 2873

$C_2H_4^+$	C_2H_5D	HD	12.52±0.10	EI		2421
$C_2H_4^+$	C_3H_6		12.4±0.5	EI		2542

See also – EI: 194

$C_2H_4^+$	C_3H_8	CH_4	11.72±0.02	PI		2606
(Threshold value approximately corrected to 0 K)						
$C_2H_4^+$	C_3H_8	CH_4	11.70	RPD		2521
$C_2H_4^+$	C_3H_8	CH_4	11.5±0.1	EI		2521
(Appearance potential of the corresponding metastable transition)						

The thermochemical threshold for this process is 11.35 eV. Very little of the excess energy appears as fragment kinetic energy, see J. Bracher, H. Ehrhardt, R. Fuchs, O. Osberghaus and R. Taubert, Advan. Mass Spectrom. **2**, 285 (1963) and G. Khodadadi, R. Botter and H. M. Rosenstock, Intern. J. Mass Spectrom. Ion Phys. **3**, 397 (1969).

See also – PEN: 2873
EI: 1408

$C_2H_4^+$	C_3H_8	CH_2^++H_2?	27.2±0.5	EI		1408
(Threshold value corrected for high fragment kinetic energy)						
$C_2H_4^+$	CH_2=CHCH=CH_2	C_2H_2	12.45±0.1	PI	(1085*)	2013

This ionic heat of formation may be compared to $\Delta H^\circ_{f298}(C_2H_4^+)$ = 1066 kJ mol^{-1} obtained from the spectroscopic ionization potential tabulated above.

See also – EI: 2455

$C_2H_4^+$	1–C_4H_8		11.7±0.2	SD		2941

See also – EI: 194

*ΔH°_{f298}

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_2H_4^+$	*cis*-2-C_4H_8		11.7±0.25	SD		2941
See also - EI: 194						
$C_2H_4^+$	*trans*-2-C_4H_8		11.8±0.25	SD		2941
$C_2H_4^+$	*iso*-C_4H_8		12.0±0.25	SD		2941
$C_2H_4^+$	$C_3H_5CH_3$ (Methylcyclopropane)		12.5±0.2	SD		2941
$C_2H_4^+$	C_4H_8 (Cyclobutane)		11.0±0.15	SD		2941
See also - EI: 2742						
$C_2H_4^+$	*n*-C_4H_{10}	C_2H_6	~11.65	PI		2606
(Threshold value approximately corrected to 0 K)						
The thermochemical threshold for this process is 11.48 eV.						
$C_2H_4^+$	$(CH_2)_2NH$ (Ethylenimine)	NH	13.3±0.2	EI		51
$C_2H_4^+$	C_2H_5CN	HCN	12.40±0.05	EI		2704
See also - EI: 2966						
$C_2H_4^+$	C_2H_5NC		12.83	EDD		3214
$C_2H_4^+$	$CH_3N{=}NCH_3$		12.9±0.3	EI		2549
$C_2H_4^+$	C_2H_5OH	H_2O	12.0	PI		2647
(Threshold value approximately corrected to 0 K)						
The thermochemical threshold for this process is 10.91 eV.						
$C_2H_4^+$	C_3H_6O (1,2–Epoxypropane)		11.6±0.2	EI		50
$C_2H_4^+$	$(CH_2)_3O$ (1,3–Epoxypropane)		12.4±0.3	EI		52
$C_2H_4^+$	*n*-C_3H_7OH		~11.9	PI		2647
$C_2H_4^+$	$(CH_2)_5O$ (1,5–Epoxypentane)		~13.8	EI		2694
$C_2H_4^+$	$HCOOC_2H_5$		11.2	EI		3224
$C_2H_4^+$	$C_4H_8O_2$ (1,3–Dioxane)		13.16	EI		2422
$C_2H_4^+$	$CH_3CH{=}NOH$		12.9±0.2	EDD		3180
$C_2H_4^+$	$C_2H_5CF_3$		13.0±0.2	EI		1075
$C_2H_4^+$	$C_2H_5BF_2$		12.08±0.01	EI		1076
$C_2H_4^+$	$(C_2H_5)_2PP(C_2H_5)_2$		10.0±0.3	EI		2948
$C_2H_4^+$	C_2H_5SH		13.0±0.3	EI		3286
$C_2H_4^+$	$(CH_2)_3S$ (Trimethylene sulfide)		13.6±0.2	EI		52
$C_2H_4^+$	$(C_2H_5)_2S$		14.5±0.3	EI		3286
$C_2H_4^+$	CH_3SCH_3		15.6±0.3	EI		3286

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_2H_4^+$	$C_2H_5SSC_2H_5$		13.2±0.3	EI		3286
$C_2H_4^+$	$(CH_3)_2SO$		13.7±0.3	EI		3294
$C_2H_4^+$	C_2H_5Cl	HCl	11.33	EI		3201
$C_2H_4^+$	C_3H_5OCl (1–Chloro–2,3–epoxypropane)		13.6±0.4	EI		153
$C_2H_4^+$	$C_2H_5SiCl_3$		12.48±0.05	EI		2182
$C_2H_4^+$	$(C_2H_5)_2Se$		15.1±0.3	EI		3285
			$C_2H_3D^+$			
$C_2H_3D^+$	C_2H_5D	H_2	12.36±0.05	EI		2421
$C_2H_3D^+$	CH_3CD_3	D_2	12.75±0.10	EI		2421
$C_2H_3D^+$	$CH_3CD_2CH_3$	CH_3D	11.99	RPD		2907
			$C_2H_2D_2^+$			
$C_2H_2D_2^+$	CHD=CHD		10.50±0.01	PI		2607
$C_2H_2D_2^+$	CH_3CD_3	HD	12.35±0.06	EI		2421
$C_2H_2D_2^+$	$CH_3CD_2CH_3$	CH_4	11.78	RPD		2907
			$C_2HD_3^+$			
$C_2HD_3^+$	CH_3CD_3	H_2	12.81±0.01	EI		2421
$C_2HD_3^+$	$CD_3CH_2CD_3$	CHD_3	12.13	RPD		2907
			$C_2D_4^+$			
$C_2D_4^+(^2B_{3u})$	C_2D_4		10.52±0.03	S		3353
$C_2D_4^+(^2B_{3u})$	C_2D_4		10.52±0.02	PE		3028, 3061
$C_2D_4^+(^2B_{3g})$	C_2D_4		12.48±0.02	PE		3028, 3061
$C_2D_4^+(^2A_g)$	C_2D_4		14.45±0.02	PE		3028, 3061
$C_2D_4^+(^2B_{2u})$	C_2D_4		15.83±0.02	PE		3028, 3061
$C_2D_4^+(^2B_{1u})$	C_2D_4		18.90±0.02	PE		3028, 3061
$C_2D_4^+$	C_2D_6	D_2	12.58±0.08	EI		2421
$C_2D_4^+$	C_3D_8	CD_4	11.87	RPD		2521
$C_2D_4^+$	C_3D_8	CD_4	11.65±0.1	EI		2521
(Appearance potential of the corresponding metastable transition)						
		$C_2H_5^+$	**$\Delta H^\circ_{f298} \sim 917$ kJ mol^{-1} (219 kcal mol^{-1})**			
$C_2H_5^+$	C_2H_5		≤8.4	PI	≤918	1068
$C_2H_5^+$	C_2H_5		8.38±0.05	EM	916	3104, 3379
$C_2H_5^+$	C_2H_5		8.34±0.05	RPD		2776
See also – EI:	59, 87, 1129, 2158, 2535, 2719, 2904, 2986					
$C_2H_5^+$	C_2H_6	H^-	12.00±0.05	PI		2606
(Threshold value approximately corrected to 0 K)						

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_2H_5^+$	C_2H_6	H	12.65±0.08	PI	(918)	2606
(Threshold value approximately corrected to 0 K)						
$C_2H_5^+$	C_2H_6	H	12.66±0.05	RPD		2776
See also – EI:	160, 195, 1451, 2421					
$C_2H_5^+$	C_3H_6		12.6±0.5	EI		2542
$C_2H_5^+$	C_3H_8	CH_3	11.90±0.08	PI	(902)	2606
(Threshold value approximately corrected to 0 K)						
$C_2H_5^+$	C_3H_8	CH_3	12.02±0.05	RPD		2776
See also – EI:	195, 1408, 1451, 2521					
$C_2H_5^+$	C_3H_8	CH_3^+	21±2	EI		1408
(Threshold value corrected for high fragment kinetic energy)						
$C_2H_5^+$	C_3H_8	CH^++H_2	26.9±0.5	EI		1408
(Threshold value corrected for high fragment kinetic energy)						
$C_2H_5^+$	$C_2H_5C{\equiv}CH$	C_2H	12.9±0.1	EI		13
$C_2H_5^+$	*cis*–2–C_4H_8	C_2H_3	12.25	EI		194, 195
$C_2H_5^+$	C_4H_8 (Cyclobutane)		13.8	EI		2742
$C_2H_5^+$	*n*–C_4H_{10}	C_2H_5	12.55	EI		195
See also – PI:	2606					
$C_2H_5^+$	*iso*–C_4H_{10}	C_2H_5	13.80	EI		195
$C_2H_5^+$	*n*–C_5H_{12}		28.1±0.2	SRP		1264
(High kinetic energy ion)						
$C_2H_5^+$	*neo*–C_5H_{12}		13.81	EI		2101
$C_2H_5^+$	*n*–C_7H_{16}		12.89	RPD		2977
$C_2H_5^+$	*n*–C_7H_{16}		24.3±0.2	SRP		1264
(High kinetic energy ion)						
$C_2H_5^+$	*n*–C_8H_{18}		13.44	RPD		2977
$C_2H_5^+$	*n*–C_9H_{20}		13.20	RPD		2977
$C_2H_5^+$	$C_2H_5NH_2$		13.5±0.2	EI		2470
$C_2H_5^+$	C_2H_5NC	CN	12.94	EDD		3214
$C_2H_5^+$	*n*–C_3H_7CN		12.97	EI		2966
$C_2H_5^+$	$(C_2H_5)_2NH$		14.85	EI		2428
$C_2H_5^+$	$C_2H_5N{=}NC_2H_5$		10.45±0.2	EI		304
$C_2H_5^+$	C_2H_5OH	OH	12.7	PI		2647
(Threshold value approximately corrected to 0 K)						
The thermochemical threshold for this process is about 12.3 eV.						
See also – EI:	2018, 3176					
$C_2H_5^+$	$(CH_2)_3O$ (1,3–Epoxypropane)		12.6±0.2	EI		52
$C_2H_5^+$	*n*–C_3H_7OH	CH_2OH	12.3	PI		2647
(Threshold value approximately corrected to 0 K)						

The thermochemical threshold for this process is about 11.8 eV, see ref. 2647.

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_2H_5^+$	$C_2H_5COCH_3$		12.88	RPD		2977
See also – EI:	298, 2883					
$C_2H_5^+$	$(CH_2)_4O$ (1,4–Epoxybutane)		15.8±0.2	EI		52
$C_2H_5^+$	$(C_2H_5)_2O$		11.98±0.1	RPD		2776
$C_2H_5^+$	$(C_2H_5)_2CO$		13.04	RPD		2977
$C_2H_5^+$	C_2H_5COOH		12.90	EI		3435
$C_2H_5^+$	$HCOOC_2H_5$		12.0	EI		3224
$C_2H_5^+$	$CH_3COOC_2H_5$		12.1	RPD		2018
See also – EI:	305, 3176					
$C_2H_5^+$	C_2H_5NO	NO	13.4±0.2	EDD		3180
$C_2H_5^+$	$C_2H_5NO_2$	NO_2	11.0	RPD		2018
$C_2H_5^+$	$C_2H_5ONO_2$		11.86±0.25	EI		1013
$C_2H_5^+$	$n\text{-}C_5H_{11}F$		14.67	EI		2029
$C_2H_5^+$	$C_2H_5CF_3$		12.82±0.02	EI		1075
$C_2H_5^+$	$C_2H_5BF_2$		13.1±0.2	EI		1076
$C_2H_5^+$	$C_2H_5SiH_3$		12.6±0.2	EI		2182
$C_2H_5^+$	$C_2H_5PH_2$		12.5±0.3	EI		2948
$C_2H_5^+$	$(C_2H_5)_2PH$		14.5±0.3	EI		2948
$C_2H_5^+$	$(C_2H_5)_3P$		18.5±0.3	EI		2948
$C_2H_5^+$	$(CH_3)_2PP(CH_3)_2$		14.3±0.3	EI		2948
$C_2H_5^+$	$(C_2H_5)_2PP(C_2H_5)_2$		11.5±0.3	EI		2948
$C_2H_5^+$	C_2H_5SH		12.1±0.3	EI		3286
$C_2H_5^+$	$C_2H_5SCH_3$		14.1±0.2	EI		176
$C_2H_5^+$	$n\text{-}C_3H_7SCH_3$		15.3±0.5	EI		176
$C_2H_5^+$	$(C_2H_5)_2S$		14.5±0.3	EI		84
See also – EI:	3286					
$C_2H_5^+$	$C_2H_5SCH{=}CHC{\equiv}CH$		13.9±0.3	EI		2949
$C_2H_5^+$	$C_2H_5SC{\equiv}CCH{=}CH_2$		13.8±0.3	EI		2949
$C_2H_5^+$	$C_6H_5SC_2H_5$ (Ethylthiobenzene)		13.7	EI		307
$C_2H_5^+$	$C_2H_5SSC_2H_5$		14.2±0.2	EI		186
See also – EI:	3286					
$C_2H_5^+$	C_2H_5NCS		12.9±0.2	EI		315
$C_2H_5^+$	C_2H_5Cl	Cl	11.83±0.06	EI		3201
See also – EI:	160, 356					
$C_2H_5^+$	$n\text{-}C_3H_7Cl$		12.48±0.1	EI		72
$C_2H_5^+$	$C_2H_5SiCl_3$		12.77±0.05	EI		2182
$C_2H_5^+$	$(C_2H_5)_2Se$		13.2±0.3	EI		3285
$C_2H_5^+$	C_2H_5Br	Br	11.15	EI		2973
See also – EI:	160, 356					

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_2H_5^+$	C_2H_5I	I	11.0±0.3	EI		356
See also – EI: 160						
$C_2H_5^+$	$(C_2H_5)_2Hg$		10.25±0.1	EI		306
		$C_2H_4D^+$				
$C_2H_4D^+$	C_2H_5D	H	12.86±0.1	EI		2421
		$C_2H_3D_2^+$				
$C_2H_3D_2^+$	$CH_3CD_2CH_3$	CH_3	12.26	RPD		2907
		$C_2H_2D_3^+$				
$C_2H_2D_3^+$	CH_3CD_3	H	12.52±0.08	EI		2421
$C_2H_2D_3^+$	$CD_3CH_2CD_3$	CD_3	12.28	RPD		2907
		$C_2D_5^+$				
$C_2D_5^+$	C_2D_6	D	13.52±0.03	EI		2421
$C_2D_5^+$	C_3D_8	CD_3	12.23	RPD		2521
$C_2D_5^+$	$C_2D_5NH_2$		13.4	EI		2470
	$C_2H_6^+$	**$\Delta H^\circ_{f0} \sim 1041$ kJ mol^{-1} (249 kcal mol^{-1})**				
$C_2H_6^+$	C_2H_6		11.521±0.007	PI	1042	1253
$C_2H_6^+$	C_2H_6		11.45±0.05	RPI	1036	3293
$C_2H_6^+$	C_2H_6		11.51	PE	1041	2843
$C_2H_6^+$	C_2H_6		11.56	PE	1046	2803
$C_2H_6^+$	C_2H_6		11.55	PEN		2466
$C_2H_6^+$	C_2H_6		11.66±0.05	RPD		2776
For vibrational structure see refs. 2606, 2803.						
See also – PI: 182, 416, 1120, 2606 PE: 1130, 2801, 2829, 3072, 3096 PEN: 2430, 2467, 2873 EI: 160, 2421, 2535, 3338						
$C_2H_6^+$	$(CH_2)_3O$ (1,3–Epoxypropane)	CO	10.8±0.3	EI		52
$C_2H_6^+$	$(C_2H_5)_2PP(C_2H_5)_2$		10.5±0.3	EI		2948

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_2H_5D^+$				
$C_2H_5D^+$	C_2H_5D		11.58±0.04	EI		2421
		$C_2H_3D_3^+$				
$C_2H_3D_3^+$	CH_3CD_3		11.78±0.03	EI		2421
		$C_2D_6^+$				
$C_2D_6^+$	C_2D_6		11.73±0.06	EI		2421
		$C_2H_6^{+2}$				
$C_2H_6^{+2}$	C_2H_6		≤34.8±0.8 (V)	AUG		3424
		C_3H^+				
C_3H^+	$CH_2=C=CH_2$	H_2+H	18.56±0.05	EI		2455
C_3H^+	$CH_3C\equiv CH$	H_2+H	15.4±0.3	EI		13
C_3H^+	$CH_3C\equiv CH$	H_2+H	17.5±0.5	EI		3191
C_3H^+	C_3H_6	$2H_2+H$	20.2±0.5	EI		3191
C_3H^+	C_3H_6	$2H_2+H$	20.5±0.5	EI		2542
C_3H^+	C_3H_6 (Cyclopropane)	$2H_2+H$	19.7±0.5	EI		3191
C_3H^+	$CH_2=CHC\equiv CH$		18.71	EI		2102
C_3H^+	$CH_2=CHCH=CH_2$		12.44	EI		2102
C_3H^+	$C_2H_5C\equiv CH$		12.59	EI		2102
C_3H^+	$CH\equiv CCN$	N	18.0±0.2	EI		154
C_3H^+	C_3H_6S (Propylene sulfide)		22.2±0.5	EI		188
C_3H^+	$CH_3SCH_2CH=CH_2$		16.6±0.5	EI		186
		C_3H^{+2}				
C_3H^{+2}	C_3H_6		47±1	EI		2542
		$C_3H_2^+$				
$C_3H_2^+$	$CH_2=C=CH_2$	H_2	14.34±0.08	EI		2455
$C_3H_2^+$	$CH_3C\equiv CH$	H_2	14.0±0.1	EI		13
$C_3H_2^+$	C_3H_6	$2H_2$	16.5±1	EI		2542
$C_3H_2^+$	*trans*-$CH_2=CHCH=CHCH_3$		20.86±0.1	EI		2455
$C_3H_2^+$	C_6H_8 (1,3–Cyclohexadiene)		23.51±0.50	EI		2751
$C_3H_2^+$	C_6H_8 (1,4–Cyclohexadiene)		19.21±0.15	EI		2751

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_3H_2^+$	C_8H_8 (*syn*–Tricyclo[4.2.0.0^{2,5}]octa–3,7–diene)		16.91±0.10	EI		2914
$C_3H_2^+$	C_8H_8 (*anti*–Tricyclo[4.2.0.0^{2,5}]octa–3,7–diene)		17.00±0.35	EI		2914
$C_3H_2^+$	C_4H_6O (3,4–Epoxy–1–butene)		15.8±0.5	EI		153
$C_3H_2^+$	C_3H_6S (Propylene sulfide)		19.2±0.4	EI		188
$C_3H_2^+$	$CH_3SCH_2CH=CH_2$		20.3±0.5	EI		186
		$C_3H_2^{+2}$				
$C_3H_2^{+2}$	$CH_2=C=CH_2$		32.52±0.2	EI		2455
$C_3H_2^{+2}$	C_3H_6		33.3±0.5	EI		2542
	$CH_2C\equiv CH^+$ *cyclo*–$C_3H_3^+$	**$\Delta H^\circ_{f298} \sim 1175$ kJ mol^{-1} (281 kcal mol^{-1})** **$\Delta H^\circ_{f298} \sim 1075$ kJ mol^{-1} (257 kcal mol^{-1})**				
$C_3H_3^+$	$CH_2C\equiv CH$		8.68	EM	1175	3380
$C_3H_3^+$	C_3H_3		8.20±0.5	EI		2535
$C_3H_3^+$	$CH_2=C=CH_2$	H	11.48±0.02	PI	1082	2644
$C_3H_3^+$	$CH_2=C=CH_2$	H	11.48±0.03	PI	1082	2724
$C_3H_3^+$	$CH_2=C=CH_2$	H	11.47	EM	1081	3380
See also – EI:	165, 2455					
$C_3H_3^+$	$CH_3C\equiv CH$	H	11.55±0.02	PI	1082	2644
$C_3H_3^+$	$CH_3C\equiv CH$	H	11.56±0.03	PI	1083	2724
$C_3H_3^+$	$CH_3C\equiv CH$	H	11.60	EM	1087	3380
See also – EI:	13, 17, 462					
$C_3H_3^+$	C_3H_4 (*cis*–Cyclopropene)	H	10.54	EM	1075	3380
See also – EI:	165					
$C_3H_3^+$	C_3H_6	H_2+H	14.21	EI		194
$C_3H_3^+$	C_3H_6	H_2+H	14.3±0.5	EI		2542
$C_3H_3^+$	C_3H_6 (Cyclopropane)	H_2+H	13.73±0.1	EI		3191
$C_3H_3^+$	$CH_3CH=C=CH_2$	CH_3	10.86±0.04	PI	1068	2644
See also – EI:	462					
$C_3H_3^+$	$CH_2=CHCH=CH_2$	CH_3	11.40±0.02	PI	1068	2644
$C_3H_3^+$	$CH_2=CHCH=CH_2$	CH_3	11.39±0.03	PI	1067	2724
$C_3H_3^+$	$CH_2=CHCH=CH_2$	CH_3	11.35±0.05	PI	1063	2013
See also – EI:	462, 2455					

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_3H_3^+$	$C_2H_5C\equiv CH$	CH_3	10.84	EM	1069	3380
See also – EI:	13, 462					
$C_3H_3^+$	$CH_3C\equiv CCH_3$	CH_3	11.04	EM	1069	3380
See also – EI:	13					
$C_3H_3^+$	1–C_4H_8		13.82	EI		195
$C_3H_3^+$	*cis*–2–C_4H_8		13.75	EI		195
$C_3H_3^+$	C_4H_8 (Cyclobutane)		14.8	EI		2742
$C_3H_3^+$	*trans*–$CH_2=CHCH=CHCH_3$		15.16±0.02	EI		2455
$C_3H_3^+$	*neo*–C_5H_{12}		17.08	EI		2101
$C_3H_3^+$	$CH\equiv CCH=CHCH=CH_2$		14.57	EI		1197
$C_3H_3^+$	$C_2H_5C\equiv CC\equiv CH$		12.20	EI		1197
$C_3H_3^+$	$CH_3C\equiv CCH_2C\equiv CH$		12.05	EI		1197
$C_3H_3^+$	$CH_3C\equiv CC\equiv CCH_3$		11.99	EI		1197
$C_3H_3^+$	$CH\equiv CCH_2CH_2C\equiv CH$		12.17	EI		1197
$C_3H_3^+$	C_6H_6 (Benzene)		14.7±0.1	RPD		2520
See also – EI:	1197, 1238, 2103					
$C_3H_3^+$	$CH_2=CHCH=CHCH=CH_2$	$C_2H_2+CH_3$?	14.65±0.10	EI		2751
(0.30 eV average translational energy of decomposition at threshold)						
$C_3H_3^+$	C_6H_8 (1,3–Cyclohexadiene)		14.87±0.10	EI		2751
$C_3H_3^+$	C_6H_8 (1,4–Cyclohexadiene)		15.20±0.10	EI		2751
$C_3H_3^+$	$CH_3CH=CHCH=CHCH_3$		14.92±0.03	EI		2455
$C_3H_3^+$	$C_5H_8=CH_2$ (Methylenecyclopentane)		13.44±0.20	EDD		2738
$C_3H_3^+$	$C_5H_7CH_3$ (1–Methylcyclopentene)		13.23±0.21	EDD		2738
$C_3H_3^+$	$C_5H_7CH_3$ (3–Methylcyclopentene)		13.24±0.32	EDD		2738
$C_3H_3^+$	C_6H_{10} (Cyclohexene)		13.45±0.18	EDD		2738
$C_3H_3^+$	$(C_3H_5)_2$ (Bicyclopropyl)		11.99±0.18	EDD		2738
$C_3H_3^+$	C_6H_{10} (Bicyclo[3.1.0]hexane)		12.98±0.19	EDD		2738
$C_3H_3^+$	$C_6H_{10}=CH_2$ (Methylenecyclohexane)		13.90±0.13	EDD		2558
$C_3H_3^+$	$C_6H_9CH_3$ (1–Methylcyclohexene)		14.06±0.13	EDD		2558
$C_3H_3^+$	$C_6H_9CH_3$ (3–Methylcyclohexene)		13.85±0.08	EDD		2558
$C_3H_3^+$	$C_6H_9CH_3$ (4–Methylcyclohexene)		14.02±0.15	EDD		2558
$C_3H_3^+$	C_7H_{12} (Bicyclo[2.2.1]heptane)		14.03±0.09	EDD		2558

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_3H_3^+$	C_7H_{12} (Bicyclo[4.1.0]heptane)		12.53±0.12	EDD		2558
$C_3H_3^+$	$C_6H_5CH{=}CH_2$ (Ethenylbenzene)		14.90±0.10	EI		2914
(0.07 eV average translational energy of decomposition at threshold)						
$C_3H_3^+$	C_8H_8 (Cyclooctatetraene)		13.40±0.10	EI		2914
$C_3H_3^+$	C_8H_8 (Cyclobutenobenzene)		14.16±0.15	EI		2914
(0.11 eV average translational energy of decomposition at threshold)						
$C_3H_3^+$	C_8H_8 (Bicyclo[2.2.2]octatriene)		13.64±0.25	EI		2914
$C_3H_3^+$	C_8H_8 (*syn*–Tricyclo[4.2.0.0^{2,5}]octa–3,7–diene)		11.87±0.15	EI		2914
$C_3H_3^+$	C_8H_8 (*anti*–Tricyclo[4.2.0.0^{2,5}]octa–3,7–diene)		11.95±0.10	EI		2914
$C_3H_3^+$	C_8H_8 (Cubane)		10.01±0.10	EI		2914
See also – EI: 2105						
$C_3H_3^+$	$(CH_3)_2C{=}CHCH{=}C(CH_3)_2$		26.52±0.1	EI		2455
$C_3H_3^+$	$(CH_2)_4NH$ (Pyrrolidine)		18.9±0.4	EI		52
$C_3H_3^+$	C_5H_5N (Pyridine)		14.00±0.10	EI		1406
$C_3H_3^+$	$(CH_2)_3O$ (1,3–Epoxypropane)		14.5±0.2	EI		52
$C_3H_3^+$	n–C_3H_7OH		15.6±0.3	EI		46
$C_3H_3^+$	C_4H_6O (3,4–Epoxy–1–butene)		13.5±0.3	EI		153
$C_3H_3^+$	$(CH_2)_4O$ (1,4–Epoxybutane)		18.7±0.6	EI		52
$C_3H_3^+$	$C_4H_8O_2$ (1,2–Epoxy–3–methoxypropane)		15.9±0.4	EI		153
$C_3H_3^+$	C_6H_5F (Fluorobenzene)		14.27±0.1	EI		2103
$C_3H_3^+$	C_3H_6S (Propylene sulfide)		15.9±0.2	EI		188
$C_3H_3^+$	$(CH_2)_3S$ (Trimethylene sulfide)		15.3±0.4	EI		52
$C_3H_3^+$	C_4H_4S (Thiophene)		12.8±0.2	EI		2166
$C_3H_3^+$	$CH_3SCH_2CH{=}CH_2$		16.5±0.4	EI		186
$C_3H_3^+$	$(CH_2)_4S$ (Tetramethylene sulfide)		17.2±0.2	EI		52
$C_3H_3^+$	n–$C_3H_7SCH_3$		18.4±0.5	EI		176
$C_3H_3^+$	*iso*–$C_3H_7SCH_3$		21.0±0.5	EI		186
$C_3H_3^+$	$CH_3SCH{=}CHC{\equiv}CH$		13.4±0.3	EI		2949
$C_3H_3^+$	$CH_3SC{\equiv}CCH{=}CH_2$		13.4±0.3	EI		2949
$C_3H_3^+$	C_6H_5SH (Mercaptobenzene)		20.0±0.3	EI		3286
$C_3H_3^+$	$C_2H_5SCH{=}CHC{\equiv}CH$		14.8±0.3	EI		2949
$C_3H_3^+$	$C_2H_5SC{\equiv}CCH{=}CH_2$		15.2±0.3	EI		2949

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_3H_3^+$	$CH_3C\equiv CCl$	Cl	11.0±0.2	EI		13
$C_3H_3^+$	$(C_5H_5)_2TiCl_2$ (Bis(cyclopentadienyl)titanium dichloride)		18.0±0.5	EI		2479
$C_3H_3^+$	$C_5H_5V(CO)_4$ (Cyclopentadienylvanadium tetracarbonyl)		13.5±0.3	EI		1381
$C_3H_3^+$	$C_5H_5Mn(CO)_3$ (Cyclopentadienylmanganese tricarbonyl)		20.3±0.4	EI		1381
$C_3H_3^+$	$CH_3C\equiv CBr$	Br	11.1±0.2	EI		13
$C_3H_3^+$	$(C_5H_5)_2ZrCl_2$ (Bis(cyclopentadienyl)zirconium dichloride)		19.5±0.4	EI		2479

The heat of formation of the propargyl ion is ~1175 kJ mol^{-1}. For all other $C_3H_3^+$ ions for which accurate appearance potentials have been measured the computed heats of formation are on the average about 1075 kJ mol^{-1}. This value is assigned to the cyclic $C_3H_3^+$ structure on the basis of its greater stability. For details see ref. 3380.

$C_3HD_2^+$

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_3HD_2^+$	$CD_3C\equiv CH$	D	12.22±0.05	EI		17

$C_3D_3^+$

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_3D_3^+$	$CD_3C\equiv CH$	H	12.16±0.06	EI		17

$C_3H_3^{+2}$

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_3H_3^{+2}$	$CH_2=C=CH_2$	H	34.57±0.1	EI		2455
$C_3H_3^{+2}$	C_3H_6		34.1±0.5	EI		2542

$CH_2=C=CH_2^+$ $\Delta H^\circ_{f298} \sim$ 1124 kJ mol^{-1} (269 kcal mol^{-1})
$CH_3C\equiv CH^+$ $\Delta H^\circ_{f298} =$ 1185 kJ mol^{-1} (283 kcal mol^{-1})
$C_3H_4^+$ (*cis*-Cyclopropene) $\Delta H^\circ_{f298} \sim$ 1209 kJ mol^{-1} (289 kcal mol^{-1})

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_3H_4^+$	$CH_2=C=CH_2$		9.53±0.03	PI	1112	2724
$C_3H_4^+$	$CH_2=C=CH_2$		9.62±0.04	PI	1120	2644
$C_3H_4^+$	$CH_2=C=CH_2$		9.69	PE	1127	3058
$C_3H_4^+$	$CH_2=C=CH_2$		9.83	PE	1141	2843
$C_3H_4^+$	$CH_2=C=CH_2$		9.62	EM	1120	3380

The ionization potential is uncertain due to Jahn–Teller distortion and hot band effects.

See also – S: 3124
EI: 462, 2455

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_3H_4^+$	$CH_3C\equiv CH$ (Average of three Rydberg series limits)		10.36	S	1185	162, 1022
$C_3H_4^+$	$CH_3C\equiv CH$		10.349±0.015	PI	1184	2726, 2965
$C_3H_4^+$	$CH_3C\equiv CH$		10.365±0.015	PI	1186	3098
$C_3H_4^+$	$CH_3C\equiv CH$		10.36±0.01	PI	1185	162, 182, 416, 1022

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_3H_4^+$	$CH_3C{\equiv}CH$		10.36±0.02	PI	1185	2724
$C_3H_4^+$	$CH_3C{\equiv}CH$		10.38±0.02	PI	1187	2644
$C_3H_4^+$	$CH_3C{\equiv}CH$		10.37±0.01	PE	1186	2805
$C_3H_4^+$	$CH_3C{\equiv}CH$		10.37	PE	1186	2851
$C_3H_4^+$	$CH_3C{\equiv}CH$		10.36	EM	1185	3380
See also – S:	3152					
EI:	13, 17					
$C_3H_4^+$	C_3H_4 (*cis*–Cyclopropene)		9.70	PE	1212	3330
$C_3H_4^+$	C_3H_4 (*cis*–Cyclopropene)		9.64	EM	1206	3380
See also – EI:	62, 87, 1129, 2535					
$C_3H_4^+$	C_3H_6	H_2	12.3±0.5	EI		2542
$C_3H_4^+$	C_3H_6	H_2	12.52	EI		194, 195
$C_3H_4^+$	C_3H_6 (Cyclopropane)	H_2	11.57±0.1	EI		3191
$C_3H_4^+$	*trans*–$CH_2{=}CHCH{=}CHCH_3$	C_2H_4	12.63±0.02	EI		2455
$C_3H_4^+$	C_6H_8 (1,3–Cyclohexadiene)		14.52±0.10	EI		2751
$C_3H_4^+$	C_6H_8 (1,4–Cyclohexadiene)		13.95±0.10	EI		2751
$C_3H_4^+$	C_4H_6O (3,4–Epoxy–1–butene)		11.3±0.3	EI		153
$C_3H_4^+$	$(CH_2)_4O$ (1,4–Epoxybutane)		15.2±0.3	EI		52
$C_3H_4^+$	C_3H_6S (Propylene sulfide)		14.4±0.3	EI		188
		$C_3HD_3^+$				
$C_3HD_3^+$	$CD_3C{\equiv}CH$		10.62±0.05	EI		17
		$C_3D_4^+$				
$C_3D_4^+$	$CD_3C{\equiv}CD$		10.375±0.015	PI		3098
		$C_3H_4^{+2}$				
$C_3H_4^{+2}$	$CH_2{=}C{=}CH_2$		30.24±0.2	EI		2455
$C_3H_4^{+2}$	C_3H_6		30.1±0.5	EI		2542

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$CH_2=CHCH_2^+$	**$\Delta H^\circ_{f298} \sim 946$ kJ mol^{-1} (226 kcal mol^{-1})**					
$C_3H_5^+$	$CH_2=CHCH_2$		8.07±0.03	EM	949	3350
$C_3H_5^+$	$CH_2=CHCH_2$		8.05±0.1	EI		123
This radical, identified in ref. 123 as cyclopropyl, is now considered to have isomerized to allyl, see ref. 3380.						
See also – EI:	87, 1129, 3368					
$C_3H_5^+$	C_3H_6	H	11.88	EM	949	3350, 3380
See also – PEN:	3348					
EI:	194, 195, 1451, 2542, 3368					
$C_3H_5^+$	C_3H_6 (Cyclopropane)	H	11.49	EM	944	3380
See also – PEN:	3348					
EI:	123, 3191					
$C_3H_5^+$	C_3H_8	H_2+H	14.76	EI		195
$C_3H_5^+$	1–C_4H_8	CH_3	11.28	EM	946	3350, 3380
See also – EI:	194, 195, 1451, 2941					
$C_3H_5^+$	*cis*–2–C_4H_8	CH_3	11.33	EM	944	3350, 3380
See also – EI:	194, 195, 2941					
$C_3H_5^+$	*iso*–C_4H_8	CH_3	11.45	EM	946	3380
See also – EI:	2941					
$C_3H_5^+$	$C_3H_5CH_3$ (Methylcyclopropane)	CH_3	11.02	EM		3380
See also – EI:	2941					
$C_3H_5^+$	C_4H_8 (Cyclobutane)	CH_3	11.00	EM	946	3380
See also – EI:	2742, 2941					
$C_3H_5^+$	*n*–C_4H_{10}		13.40	EI		195
$C_3H_5^+$	*iso*–C_4H_{10}		14.55	EI		195
$C_3H_5^+$	*trans*–$CH_2=CHCH=CHCH_3$		14.20±0.02	EI		2455
$C_3H_5^+$	*neo*–C_5H_{12}		13.13	EI		2101
$C_3H_5^+$	$CH_3CH=CHCH=CHCH_3$		13.06±0.02	EI		2455
$C_3H_5^+$	$CH_2=CHCH_2CH_2CH=CH_2$		≥10.9	EI		3368
$C_3H_5^+$	$C_5H_8=CH_2$ (Methylenecyclopentane)		12.03±0.13	EDD		2738
$C_3H_5^+$	$C_5H_7CH_3$ (1–Methylcyclopentene)		12.45±0.13	EDD		2738

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_3H_5^+$	$C_5H_7CH_3$ (3–Methylcyclopentene)		12.28±0.17	EDD		2738
$C_3H_5^+$	C_6H_{10} (Cyclohexene)		12.12±0.12	EDD		2738
$C_3H_5^+$	$(C_3H_5)_2$ (Bicyclopropyl)		10.64±0.14	EDD		2738
$C_3H_5^+$	C_6H_{10} (Bicyclo[3.1.0]hexane)		11.65±0.14	EDD		2738
$C_3H_5^+$	$C_6H_{10}=CH_2$ (Methylenecyclohexane)		13.25±0.11	EDD		2558
$C_3H_5^+$	$C_6H_9CH_3$ (1–Methylcyclohexene)		13.46±0.09	EDD		2558
$C_3H_5^+$	$C_6H_9CH_3$ (3–Methylcyclohexene)		13.29±0.11	EDD		2558
$C_3H_5^+$	$C_6H_9CH_3$ (4–Methylcyclohexene)		13.38±0.11	EDD		2558
$C_3H_5^+$	C_7H_{12} (Bicyclo[2.2.1]heptane)		13.22±0.12	EDD		2558
$C_3H_5^+$	C_7H_{12} (Bicyclo[4.1.0]heptane)		11.90±0.10	EDD		2558
$C_3H_5^+$	$n-C_7H_{16}$		12.7±0.1	PI		2013
$C_3H_5^+$	$(CH_3)_2C=CHCH=C(CH_3)_2$		14.27±0.03	EI		2455
$C_3H_5^+$	$C_2H_5CH=C=CHCH_2C(CH_3)_3$		15.0	EI		3008
$C_3H_5^+$	C_3H_5CN (Cyclopropanecarboxylic acid nitrile)	CN	12.70±0.15	EI		202
$C_3H_5^+$	$n-C_3H_7NC$		13.18	EDD		3214
$C_3H_5^+$	$n-C_4H_9CN$		13.73	EI		2966
$C_3H_5^+$	$tert-C_4H_9CN$		13.50	EDD		3214
$C_3H_5^+$	$n-C_4H_9NC$		13.35	EDD		3214
$C_3H_5^+$	$(CH_2)_3O$ (1,3–Epoxypropane)	OH	11.8±0.2	EI		52
$C_3H_5^+$	$n-C_3H_7OH$ (Threshold value approximately corrected to 0 K)		12.6	PI		2647
$C_3H_5^+$	C_4H_6O (3,4–Epoxy–1–butene)	CO+H?	11.1±0.2	EI		153
$C_3H_5^+$	$(CH_2)_4O$ (1,4–Epoxybutane)		13.72	EI		2694

See also – EI: 52

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_3H_5^+$	$(C_2H_5)_2O$		11.6	EI		2971
$C_3H_5^+$	$(CH_2)_5O$ (1,5–Epoxypentane)		~12.8	EI		2694
$C_3H_5^+$	$n-C_5H_{11}F$		14.12	EI		2029
$C_3H_5^+$	$(C_2H_5)_3P$		16.4±0.3	EI		2948
$C_3H_5^+$	C_3H_6S (Propylene sulfide)	SH?	11.5±0.2	EI		188
$C_3H_5^+$	$(CH_2)_3S$ (Trimethylene sulfide)	SH?	12.2±0.2	EI		52
$C_3H_5^+$	$CH_3SCH_2CH=CH_2$		12.7±0.3	EI		186
$C_3H_5^+$	$(CH_2)_4S$ (Tetramethylene sulfide)		15.5±0.2	EI		52
$C_3H_5^+$	$n-C_3H_7SCH_3$		14.8±0.2	EI		176
$C_3H_5^+$	$iso-C_3H_7SCH_3$		15.2±0.2	EI		186

4.3. The Positive Ion Table—Continued

$C_3H_5^{+2}$

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_3H_5^{+2}$	C_3H_6	H	31.1±0.5	EI		2542

$C_3H_6^+$ $\Delta H^\circ_{f298} = 960$ **kJ mol^{-1} (229 kcal mol^{-1})**

$C_3H_6^+$ (Cyclopropane) $\Delta H^\circ_{f298} \leq 999$ **kJ mol^{-1} (239 kcal mol^{-1})**

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_3H_6^+$	C_3H_6		9.74	S	960	133
$C_3H_6^+$	C_3H_6		9.727±0.010	PI	959	1253
$C_3H_6^+$	C_3H_6		9.73±0.01	PI	959	133, 182, 416
$C_3H_6^+$	C_3H_6		9.73±0.02	PI	959	1120
$C_3H_6^+$	C_3H_6		9.73	PI	959	168
$C_3H_6^+$	C_3H_6		9.74±0.01	PI	960	3098
$C_3H_6^+$	C_3H_6		9.69	PE		2843
$C_3H_6^+$	C_3H_6		9.76	PEN		2430, 2466
$C_3H_6^+$	C_3H_6		9.72	EM		3380

See also – S: 3353
PE: 3359
EI: 194, 195, 411, 1129, 2535, 3201

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_3H_6^+$	C_3H_6 (Cyclopropane)		10.06±0.03	PI		182
$C_3H_6^+$	C_3H_6 (Cyclopropane)		≤9.8	PE	≤999	2808
(Value estimated from fig. 7 of this reference)						
$C_3H_6^+$	C_3H_6 (Cyclopropane)		10.1	PEN		2430
$C_3H_6^+$	C_3H_6 (Cyclopropane)		≤9.93	EM		3380

See also – PI: 416
EI: 123, 3191

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_3H_6^+$	C_3H_8	H_2	11.75±0.05	PI		2606
(Threshold value approximately corrected to 0 K)						

The thermochemical threshold for this process is 11.02 eV. The excess is due probably to reaction competition and kinetic energy of fragmentation.

See also – EI: 195

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_3H_6^+$	n-C_4H_{10}	CH_4	11.16±0.03	PI		1120
(Threshold value approximately corrected to 0 K)						
$C_3H_6^+$	n-C_4H_{10}	CH_4	11.18	PI		2606
(Threshold value approximately corrected to 0 K)						

The thermochemical threshold for this process is 10.48 eV.

See also – EI: 195

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_3H_6^+$	iso-C_4H_{10}	CH_4	10.93±0.03	PI		1120
(Threshold value approximately corrected to 0 K)						

The thermochemical threshold for this process is 10.56 eV.

See also – EI: 195

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_3H_6^+$	trans-CH_2=CHCH=$CHCH_3$	C_2H_2	12.73±0.03	EI		2455
$C_3H_6^+$	$C_3H_4(CH_3)_2$ (1,1–Dimethylcyclopropane)	C_2H_4	11.23±0.04	EI		1146
$C_3H_6^+$	$C_3H_4(CH_3)_2$ (cis–1,2–Dimethylcyclopropane)	C_2H_4	11.26±0.02	EI		1146
$C_3H_6^+$	$C_3H_4(CH_3)_2$ (trans–1,2–Dimethylcyclopropane)	C_2H_4	11.29±0.05	EI		1146
$C_3H_6^+$	n–C_5H_{12}	C_2H_6	10.99±0.02	PI		1120
(Threshold value approximately corrected to 0 K)						
$C_3H_6^+$	iso–C_5H_{12}	C_2H_6	10.84±0.025	PI		1120
(Threshold value approximately corrected to 0 K)						
$C_3H_6^+$	n–C_6H_{14}	C_3H_8	11.00±0.035	PI		1120
(Threshold value approximately corrected to 0 K)						
$C_3H_6^+$	iso–C_6H_{14}	C_3H_8	10.91±0.05	PI		1120
(Threshold value approximately corrected to 0 K)						
$C_3H_6^+$	$(CH_3)_2CHCH(CH_3)_2$	C_3H_8	10.695±0.02	PI		1120
(Threshold value approximately corrected to 0 K)						
$C_3H_6^+$	n–C_7H_{16}	C_4H_{10}	10.97±0.08	PI		1120
(Threshold value approximately corrected to 0 K)						
$C_3H_6^+$	n–C_7H_{16}	C_4H_{10}	10.65±0.1	PI		2013
$C_3H_6^+$	iso–C_3H_7CN		12.25	EDD		3214
$C_3H_6^+$	n–C_3H_7NC		12.13	EDD		3214
$C_3H_6^+$	n–C_3H_7OH	H_2O	10.50	PI		11
(Threshold value approximately corrected for thermal energy and kinetic shift)						
$C_3H_6^+$	n–C_3H_7OH	H_2O	10.65±0.03	PI		2647
(Threshold value approximately corrected to 0 K)						
$C_3H_6^+$	iso–C_3H_7OH	H_2O	~12.0	PI		2647
$C_3H_6^+$	$(CH_2)_4O$ (1,4–Epoxybutane)		11.54	EI		2694

See also – EI: 52

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_3H_6^+$	$C_5H_{10}O_2$ (1,3–Dioxepane)		12.28	EI		2694
$C_3H_6^+$	n–$C_5H_{11}F$		11.47	EI		2029
$C_3H_6^+$	iso–$C_3H_7BF_2$		11.48±0.02	EI		1076
$C_3H_6^+$	iso–$C_3H_7SiH_3$		10.81±0.04	EI		2182
$C_3H_6^+$	$(C_2H_5)_2PP(C_2H_5)_2$		11.3±0.3	EI		2948
$C_3H_6^+$	n–$C_3H_7SCH_3$		12.5±0.4	EI		176
$C_3H_6^+$	iso–$C_3H_7SCH_3$		13.5±0.2	EI		186
$C_3H_6^+$	n–C_3H_7Cl	HCl	11.03	EI		3201
$C_3H_6^+$	iso–C_3H_7Cl	HCl	10.3?	EI		3201
$C_3H_6^+$	iso–$C_3H_7SiCl_3$		10.92±0.1	EI		2182

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
			$C_3D_6^+$			
$C_3D_6^+$	C_3D_6		9.755±0.01	PI		3098
	n-$C_3H_7^+$	$\Delta H^\circ_{f298} \sim 868$ kJ mol^{-1} (207 kcal mol^{-1})				
	iso-$C_3H_7^+$	$\Delta H^\circ_{f298} \sim 800$ kJ mol^{-1} (191 kcal mol^{-1})				
$C_3H_7^+$	n-C_3H_7		≤8.1	PI	≤868	1068
$C_3H_7^+$	n-C_3H_7		8.10±0.05	EM	868	3104, 3379
$C_3H_7^+$	n-C_3H_7		8.15±0.1	RPD		2158
$C_3H_7^+$	n-C_3H_7		8.13±0.05	RPD		2776
See also – EI:	141, 145, 2719					
$C_3H_7^+$	iso-C_3H_7		≤7.5	PI	≤797	1068
$C_3H_7^+$	iso-C_3H_7		7.55±0.05	EM	802	3104, 3379
$C_3H_7^+$	iso-C_3H_7		7.52±0.1	RPD		2158
$C_3H_7^+$	iso-C_3H_7		7.57±0.05	RPD		2776
See also – EI:	2719					
$C_3H_7^+$	C_3H_8	H^-	~11.0	PI		2606
(Threshold value approximately corrected to 0 K)						
$C_3H_7^+$	C_3H_8	H	11.59±0.01	PI	(796)	2606
(Threshold value approximately corrected to 0 K)						
$C_3H_7^+$	C_3H_8	H	11.585±0.03	PI	(796)	1120
(Threshold value approximately corrected to 0 K)						
$C_3H_7^+$	C_3H_8	H	11.52	RPD		2521
$C_3H_7^+$	C_3H_8	H	11.57±0.05	RPD		2776
See also – PEN:	2873					
EI:	195					
$C_3H_7^+$	n-C_4H_{10}	CH_3	11.19±0.02	PI	(811)	1120
(Threshold value approximately corrected to 0 K)						
$C_3H_7^+$	n-C_4H_{10}	CH_3	11.18	PI	(810)	2606
(Threshold value approximately corrected to 0 K)						
$C_3H_7^+$	n-C_4H_{10}	CH_3	11.10±0.05	RPD		2776
See also – EI:	195					
$C_3H_7^+$	iso-C_4H_{10}	CH_3	11.23±0.03	PI	(807)	1120
(Threshold value approximately corrected to 0 K)						
$C_3H_7^+$	iso-C_4H_{10}	CH_3	11.16±0.05	RPD		2776
See also – EI:	195					
$C_3H_7^+$	n-C_5H_{12}	C_2H_5	11.105±0.05	PI	(818)	1120
(Threshold value approximately corrected to 0 K)						
$C_3H_7^+$	iso-C_5H_{12}	C_2H_5	11.145±0.05	PI	(813)	1120
(Threshold value approximately corrected to 0 K)						
$C_3H_7^+$	n-C_6H_{14}	C_3H_7	11.33±0.055	PI		1120
(Threshold value approximately corrected to 0 K)						

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_3H_7^+$	n-C_6H_{14}	C_3H_7	11.42	RPD		2977
$C_3H_7^+$	*iso*-C_6H_{14}	C_3H_7	~11.35±0.10	PI		1120
(Threshold value approximately corrected to 0 K)						
$C_3H_7^+$	$(CH_3)_2CHCH(CH_3)_2$	C_3H_7	11.395±0.07	PI		1120
(Threshold value approximately corrected to 0 K)						
$C_3H_7^+$	n-C_7H_{16}		11.05±0.05	PI		2013
$C_3H_7^+$	n-C_7H_{16}		11.58	RPD		2977
$C_3H_7^+$	$(CH_3)_2C{=}CHCH{=}C(CH_3)_2$		12.23±0.06	EI		2455
$C_3H_7^+$	n-C_8H_{18}		11.89	RPD		2977
$C_3H_7^+$	n-C_9H_{20}		12.17	RPD		2977
$C_3H_7^+$	n-C_3H_7NC	CN	12.43	EDD		3214
$C_3H_7^+$	n-C_4H_9CN		12.50	EI		2966
$C_3H_7^+$	n-C_4H_9NC		12.80	EDD		3214
$C_3H_7^+$	$(CH_3)_2NNHCH_3$		10.7±0.3	EI		424, 3216
$C_3H_7^+$	$(CH_3)_2NN(CH_3)_2$		10.9±0.2	EI		424, 3216
$C_3H_7^+$	$(CH_3)_2CHN{=}NCH(CH_3)_2$		9.35±0.1	EI		304
$C_3H_7^+$	n-C_3H_7OH	OH	11.6±0.1	PI	(~823)	2647
See also – EI: 2018						
$C_3H_7^+$	*iso*-C_3H_7OH	OH	11.6	PI	(~808)	2647
(Threshold value approximately corrected to 0 K)						
$C_3H_7^+$	$(n$-$C_3H_7)_2O$		11.97±0.1	RPD		2776
$C_3H_7^+$	$(iso$-$C_3H_7)_2O$		11.33±0.1	RPD		2776
$C_3H_7^+$	$(n$-$C_3H_7)_2CO$		11.80	RPD		2977
$C_3H_7^+$	$HCOOCH_2CH_2CH_3$		11.63±0.05	EI		305
$C_3H_7^+$	$HCOO(CH_2)_3CH_3$		12.24±0.12	EI		305
$C_3H_7^+$	$CH_3COOCH_2CH_2CH_3$		11.41±0.04	EI		305
$C_3H_7^+$	$CH_3COOCH(CH_3)_2$		11.12±0.08	EI		305
$C_3H_7^+$	$C_5H_{10}O_2$ (1,3-Dioxepane)		12.36	EI		2694
$C_3H_7^+$	$CH_3COO(CH_2)_3CH_3$		11.56±0.10	EI		305
$C_3H_7^+$	n-$C_3H_7NO_2$		10.6	RPD		2018
$C_3H_7^+$	n-$C_3H_7ONO_2$		11.8	EI		2456
$C_3H_7^+$	n-$C_4H_9ONO_2$		11.5	EI		2456
$C_3H_7^+$	n-$C_5H_{11}F$		12.02	EI		2029
$C_3H_7^+$	*iso*-$C_3H_7BF_2$		12.05±0.05	EI		1076
$C_3H_7^+$	*iso*-$C_3H_7SiH_3$		11.33±0.03	EI		2182
$C_3H_7^+$	n-$C_3H_7SCH_3$		12.3±0.4	EI		176
$C_3H_7^+$	*iso*-$C_3H_7SCH_3$		12.7±0.2	EI		186
$C_3H_7^+$	$(n$-$C_3H_7)_2S$		12.0	EI		307
$C_3H_7^+$	n-C_3H_7Cl	Cl?	11.13±0.03	EI		3201
$C_3H_7^+$	*iso*-C_3H_7Cl	Cl?	10.99±0.05	EI		3201
See also – EI: 160, 2776						
$C_3H_7^+$	n-C_4H_9Cl		11.92±0.1	EI		72
$C_3H_7^+$	*iso*-C_4H_9Cl		11.26±0.1	EI		72
$C_3H_7^+$	*iso*-$C_3H_7SiCl_3$		11.36±0.1	EI		2182
$C_3H_7^+$	n-C_3H_7Br	Br?	11.3±0.2	RPD		160
$C_3H_7^+$	n-C_3H_7I	I?	10.4±0.2	RPD		160
$C_3H_7^+$	$(iso$-$C_3H_7)_2Hg$		9.65±0.1	EI		306

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_3H_6D^+$				
$C_3H_6D^+$	$CH_3CD_2CH_3$	D	11.58±0.05	RPD		2776
$C_3H_6D^+$	$CH_3CD_2CH_3$	D	11.63	RPD		2907
		$C_3H_5D_2^+$				
$C_3H_5D_2^+$	$CH_3CD_2CH_3$	H	11.63	RPD		2907
		$C_3H_2D_5^+$				
$C_3H_2D_5^+$	$CD_3CH_2CD_3$	D	11.57?	RPD		2907
		$C_3HD_6^+$				
$C_3HD_6^+$	$CD_3CH_2CD_3$	H	11.56	RPD		2907
		$C_3D_7^+$				
$C_3D_7^+$	C_3D_8	D	11.74	RPD		2521
$C_3D_7^+$	C_3D_8	D	11.6±0.1	EI		2521
(Appearance potential of the corresponding metastable transition)						
	$C_3H_8^+$	**$\Delta H^\circ_{f298} \leq 953$ kJ mol^{-1} (228 kcal mol^{-1})**				
$C_3H_8^+$	C_3H_8		10.95±0.05	PI	953	2606
(Value estimated from fig. 4 of this reference)						
$C_3H_8^+$	C_3H_8		10.97	PI	955	3115
$C_3H_8^+$	C_3H_8		10.94±0.05	RPI	952	3293
$C_3H_8^+$	C_3H_8		11.06	PE		2843
$C_3H_8^+$	C_3H_8		11.07	PE		1130
$C_3H_8^+$	C_3H_8		11.07	PE		2829
$C_3H_8^+$	C_3H_8		11.12	PEN		2430, 2466
$C_3H_8^+$	C_3H_8		11.09±0.05	RPD		2776
$C_3H_8^+$	C_3H_8		11.22	RPD		2521

The ionization potential may not be adiabatic.

See also – PI: 182, 416, 1253
PE: 3060
PEN: 2467
EI: 195, 2521

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_3H_6D_2^+$				
$C_3H_6D_2^+$	$CH_3CD_2CH_3$		11.29	RPD		2907

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol⁻¹)	Ref.
		$C_3H_2D_6^+$				
$C_3H_2D_6^+$	$CD_3CH_2CD_3$		11.27	RPD		2907
		$C_3D_8^+$				
$C_3D_8^+$	C_3D_8		11.40	RPD		2521
		C_4H^+				
C_4H^+	$CH{\equiv}CC{\equiv}CH$	H	12.1±0.3	EI		13
C_4H^+	$CH_2{=}CHC{\equiv}CH$	H_2+H	12.13	EI		2102
C_4H^+	$CH_2{=}CHCH{=}CH_2$	$2H_2$+H	15.75	EI		2102
C_4H^+	$C_2H_5C{\equiv}CH$	$2H_2$+H	13.20	EI		2102
	$CH{\equiv}CC{\equiv}CH^+(^2\Pi_g)$	**$\Delta H^\circ_{f298} = 1455$ kJ mol^{-1} (348 kcal mol^{-1})**				
	$CH{\equiv}CC{\equiv}CH^+(^2\Pi_u)$	**$\Delta H^\circ_{f298} = 1690$ kJ mol^{-1} (404 kcal mol^{-1})**				
	$CH{\equiv}CC{\equiv}CH^+(^2\Sigma_u)$	**$\Delta H^\circ_{f298} = 2075$ kJ mol^{-1} (496 kcal mol^{-1})**				
$C_4H_2^+(^2\Pi_g)$	$CH{\equiv}CC{\equiv}CH$		10.180±0.003	S	1455	2669
$C_4H_2^+(^2\Pi_g)$	$CH{\equiv}CC{\equiv}CH$		10.17±0.01	PE	1454	2804, 2805
$C_4H_2^+(^2\Pi_u)$	$CH{\equiv}CC{\equiv}CH$		12.62±0.04	S	1690	2669
$C_4H_2^+(^2\Pi_u)$	$CH{\equiv}CC{\equiv}CH$		12.62±0.01	PE	1690	2804, 2805
$C_4H_2^+(^2\Sigma_u)$	$CH{\equiv}CC{\equiv}CH$		16.61±0.01	PE	2075	2804, 2805
$C_4H_2^+(^2\Sigma_g)$	$CH{\equiv}CC{\equiv}CH$		19.8 (V)	PE		2804, 2805
See also – S:	3152					
EI:	13, 2535					
$C_4H_2^+$	$CH_2{=}CHC{\equiv}CH$	H_2	12.84	EI		2102
$C_4H_2^+$	$CH_2{=}CHCH{=}CH_2$		16.87±0.05	EI		2455
$C_4H_2^+$	$CH_3C{\equiv}CCH_3$		16.7±0.3	EI		13
$C_4H_2^+$	$CH{\equiv}CCH{=}CHCH{=}CH_2$		17.55	EI		1197
$C_4H_2^+$	$C_2H_5C{\equiv}CC{\equiv}CH$		14.15	EI		1197
$C_4H_2^+$	$CH_3C{\equiv}CCH_2C{\equiv}CH$		15.10	EI		1197
$C_4H_2^+$	$CH{\equiv}CCH_2CH_2C{\equiv}CH$		15.02	EI		1197
$C_4H_2^+$	C_6H_6 (Benzene)		17.5±0.3	RPD		2520
$C_4H_2^+$	$CH_2{=}CHCH{=}CHCH{=}CH_2$	$C_2H_2+2H_2$	16.46±0.15	RPD		2751
(0.31 eV average translational energy of decomposition at threshold)						
$C_4H_2^+$	C_6H_8 (1,3–Cyclohexadiene)	$C_2H_2+2H_2$	19.81±0.10	EI		2751
(0.10 eV average translational energy of decomposition at threshold)						
$C_4H_2^+$	C_6H_8 (1,4–Cyclohexadiene)	$C_2H_2+2H_2$	17.82±0.25	EI		2751
(0.20 eV average translational energy of decomposition at threshold)						
$C_4H_2^+$	$CH_3CH{=}CHCH{=}CHCH_3$		23.64±0.2	EI		2455

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_4H_2^+$	$C_6H_5CH{=}CH_2$ (Ethenylbenzene)	$2C_2H_2+H_2$	20.22±0.10	RPD		2914
(0.07 eV average translational energy of decomposition at threshold)						
$C_4H_2^+$	$C_6H_5CH{=}CH_2$ (Ethenylbenzene)	$2C_2H_2+H_2$	19.85±0.25	EI		2914
$C_4H_2^+$	C_8H_8 (Cyclooctatetraene)	$2C_2H_2+H_2$	17.11±0.10	RPD		2914
(0.12 eV average translational energy of decomposition at threshold)						
$C_4H_2^+$	C_8H_8 (Cyclobutenobenzene)	$2C_2H_2+H_2$	17.69±0.30	EI		2914
(0.05 eV average translational energy of decomposition at threshold)						
$C_4H_2^+$	C_8H_8 (Bicyclo[2.2.2]octatriene)	$2C_2H_2+H_2$	17.20±0.30	EI		2914
$C_4H_2^+$	C_8H_8 (*syn*–Tricyclo[4.2.0.$0^{2,5}$]octa–3,7–diene)	$2C_2H_2+H_2$	15.80±0.10	EI		2914
(0.14 eV average translational energy of decomposition at threshold)						
$C_4H_2^+$	C_8H_8 (*anti*–Tricyclo[4.2.0.$0^{2,5}$]octa–3,7–diene)	$2C_2H_2+H_2$	16.78±0.10	EI		2914
(0.14 eV average translational energy of decomposition at threshold)						
$C_4H_2^+$	C_8H_8 (Cubane)	$2C_2H_2+H_2$	14.33±0.20	EI		2914

See also – EI: 2105

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_4H_2^+$	C_5H_5N (Pyridine)	$HCN+H_2$	16.17±0.10	EI		1406
$C_4H_2^+$	$C_4H_4N_2$ (1,2–Diazine)	N_2+H_2	13.67±0.10	EI		1406
$C_4H_2^+$	$CH_3SC{\equiv}CCH{=}CH_2$		19.3±0.3	EI		2949
$C_4H_2^+$	C_6H_5SH (Mercaptobenzene)		21.0±0.3	EI		3286
$C_4H_2^+$	$C_2H_5SCH{=}CHC{\equiv}CH$		16.4±0.3	EI		2949
$C_4H_2^+$	$C_6H_5SSC_6H_5$ (Diphenyl disulfide)		23.6±0.3	EI		3286

$C_4D_2^+$

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_4D_2^+(^2\Pi_g)$	$CD{\equiv}CC{\equiv}CD$		10.180±0.003	S		2669
$C_4D_2^+(^2\Pi_g)$	$CD{\equiv}CC{\equiv}CD$		10.18±0.01	PE		2804, 2805
$C_4D_2^+(^2\Pi_u)$	$CD{\equiv}CC{\equiv}CD$		12.62±0.04	S		2669
$C_4D_2^+(^2\Pi_u)$	$CD{\equiv}CC{\equiv}CD$		12.62±0.01	PE		2804, 2805
$C_4D_2^+(^2\Sigma_u)$	$CD{\equiv}CC{\equiv}CD$		16.74±0.01	PE		2804, 2805
$C_4D_2^+(^2\Sigma_g)$	$CD{\equiv}CC{\equiv}CD$		19.8 (V)	PE		2804, 2805

4.3. The Positive Ion Table—Continued

$C_4H_3^+$

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_4H_3^+$	$CH_2=CHC\equiv CH$	H	12.59	EI		2102
$C_4H_3^+$	$CH_2=CHCH=CH_2$	H_2+H	16.25±0.05	EI		2455
$C_4H_3^+$	$C_2H_5C\equiv CH$	H_2+H	14.6±0.2	EI		13
$C_4H_3^+$	$CH_3C\equiv CCH_3$	H_2+H	15.1±0.2	EI		13
$C_4H_3^+$	trans-$CH_2=CHCH=CHCH_3$	CH_3+H_2	16.36±0.08	EI		2455
$C_4H_3^+$	$CH\equiv CCH=CHCH=CH_2$		18.27	EI		1197
$C_4H_3^+$	$C_2H_5C\equiv CC\equiv CH$		15.50	EI		1197
$C_4H_3^+$	$CH_3C\equiv CCH_2C\equiv CH$		15.70	EI		1197
$C_4H_3^+$	$CH_3C\equiv CC\equiv CCH_3$		15.04	EI		1197
$C_4H_3^+$	$CH\equiv CCH_2CH_2C\equiv CH$		15.45	EI		1197
$C_4H_3^+$	C_6H_6 (Benzene)		17.6±0.1	RPD		2520

See also – EI: 1197

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_4H_3^+$	$CH_2=CHCH=CHCH=CH_2$	$C_2H_2+H_2+H$?	16.54±0.15	RPD		2751
(0.21 eV average translational energy of decomposition at threshold)						
$C_4H_3^+$	C_6H_8 (1,3–Cyclohexadiene)	$C_2H_2+H_2+H$?	17.62±0.10	EI		2751
(0.13 eV average translational energy of decomposition at threshold)						
$C_4H_3^+$	C_6H_8 (1,4–Cyclohexadiene)	$C_2H_2+H_2+H$?	17.08±0.10	EI		2751
(0.09 eV average translational energy of decomposition at threshold)						
$C_4H_3^+$	$CH_3CH=CHCH=CHCH_3$		18.32±0.04	EI		2455
$C_4H_3^+$	$C_6H_5CH=CH_2$ (Ethenylbenzene)	$2C_2H_2+H$	19.61±0.10	EI		2914
(0.06 eV average translational energy of decomposition at threshold)						
$C_4H_3^+$	C_8H_8 (Cyclooctatetraene)	$2C_2H_2+H$	18.16±0.25	EI		2914
(0.08 eV average translational energy of decomposition at threshold)						
$C_4H_3^+$	C_8H_8 (Cyclobutenobenzene)	$2C_2H_2+H$	18.68±0.10	EI		2914
(0.18 eV average translational energy of decomposition at threshold)						
$C_4H_3^+$	C_8H_8 (Bicyclo[2.2.2]octatriene)	$2C_2H_2+H$	18.04±0.10	EI		2914
$C_4H_3^+$	C_8H_8 (syn–Tricyclo[4.2.0.0^{2,5}]octa–3,7–diene)	$2C_2H_2+H$	16.38±0.10	EI		2914
(0.10 eV average translational energy of decomposition at threshold)						
$C_4H_3^+$	C_8H_8 (anti–Tricyclo[4.2.0.0^{2,5}]octa–3,7–diene)	$2C_2H_2+H$	16.41±0.10	EI		2914
(0.10 eV average translational energy of decomposition at threshold)						
$C_4H_3^+$	C_8H_8 (Cubane)	$2C_2H_2+H$	14.96±0.10	EI		2914

See also – EI: 2105

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_4H_3^+$	C_5H_5N (Pyridine)	HCN+H	16.61±0.10	EI		1406
$C_4H_3^+$	$C_4H_4N_2$ (1,2–Diazine)	N_2+H	13.84±0.10	EI		1406
$C_4H_3^+$	$CH_3SCH{=}CHC{\equiv}CH$		15.3±0.3	EI		2949
$C_4H_3^+$	$CH_3SC{\equiv}CCH{=}CH_2$		15.6±0.3	EI		2949
$C_4H_3^+$	C_6H_5SH (Mercaptobenzene)		18.0±0.3	EI		3286
$C_4H_3^+$	$C_2H_5SCH{=}CHC{\equiv}CH$		16.4±0.3	EI		2949
$C_4H_3^+$	$C_2H_5SC{\equiv}CCH{=}CH_2$		16.5±0.3	EI		2949
$C_4H_3^+$	$C_6H_5SSC_6H_5$ (Diphenyl disulfide)		20.5±0.3	EI		3286

$C_4H_3^{+2}$

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_4H_3^{+2}$	$CH_2{=}CHCH{=}CH_2$		35.90±0.2	EI		2455

$C_4H_4^+$

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_4H_4^+$	$CH_2{=}C{=}C{=}CH_2$		9.25	EI		2723
$C_4H_4^+$	$CH_2{=}C{=}C{=}CH_2$		9.4	EI		2712
$C_4H_4^+$	$CH_2{=}CHC{\equiv}CH$		9.87	EI		411
$C_4H_4^+$	$CH_2{=}CHC{\equiv}CH$		9.9	EI		2723
$C_4H_4^+$	$CH_2{=}CHC{\equiv}CH$		9.9	EI		2712, 2752
$C_4H_4^+$	$CH_2{=}CHC{\equiv}CH$		9.9	EI		3009

See also – EI: 2535

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_4H_4^+$	C_4H_4 (Cyclobutadiene?)		8.2	EI		2712
$C_4H_4^+$	C_4H_4 (Cyclobutadiene?)		9.55	EI		2723
$C_4H_4^+$	C_4H_4 (Cyclobutadiene)		8.5	D		2843, 3056

There is disagreement on the identity of the C_4H_4 isomer, see refs. 2712, 2723, 2752, 3056.

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_4H_4^+$	CH_2=CHCH=CH_2	H_2	13.84±0.07	EI		2455
$C_4H_4^+$	$C_2H_5C{\equiv}CH$	H_2	10.9±0.2	EI		13
$C_4H_4^+$	$CH_3C{\equiv}CCH_3$	H_2	14.0±0.1	EI		13
$C_4H_4^+$	*trans*–CH_2=CHCH=$CHCH_3$		21.12±0.08	EI		2455
$C_4H_4^+$	$CH{\equiv}CCH$=CHCH=CH_2	C_2H_2	14.77	EI		1197
$C_4H_4^+$	$C_2H_5C{\equiv}CC{\equiv}CH$	C_2H_2	12	EI		1197
$C_4H_4^+$	$CH_3C{\equiv}CCH_2C{\equiv}CH$	C_2H_2	11.82	EI		1197
$C_4H_4^+$	$CH_3C{\equiv}CC{\equiv}CCH_3$	C_2H_2	12.12	EI		1197
$C_4H_4^+$	$CH{\equiv}CCH_2CH_2C{\equiv}CH$	C_2H_2	11.4	EI		1197
$C_4H_4^+$	C_6H_6 (Benzene)	C_2H_2	14.5±0.2	RPD		2520
See also – EI:	1197, 1238, 2103, 2833					
$C_4H_4^+$	CH_2=CHCH=CHCH=CH_2	C_2H_2+H_2	12.82±0.10	RPD		2751
(0.21 eV average translational energy of decomposition at threshold)						
$C_4H_4^+$	C_6H_8 (1,3–Cyclohexadiene)	C_2H_2+H_2	13.91±0.20	EI		2751
(0.10 eV average translational energy of decomposition at threshold)						
$C_4H_4^+$	C_6H_8 (1,4–Cyclohexadiene)	C_2H_2+H_2	13.55±0.10	EI		2751
(0.05 eV average translational energy of decomposition at threshold)						
$C_4H_4^+$	CH_3CH=CHCH=$CHCH_3$		15.41±0.08	EI		2455
$C_4H_4^+$	C_6H_5CH=CH_2 (Ethenylbenzene)	2C_2H_2	17.25±0.15	EI		2914
(0.07 eV average translational energy of decomposition at threshold)						
$C_4H_4^+$	C_8H_8 (Cyclooctatetraene)	2C_2H_2	15.10±0.10	RPD		2914
(0.11 eV average translational energy of decomposition at threshold)						
$C_4H_4^+$	C_8H_8 (Cyclobutenobenzene)	2C_2H_2	16.01±0.15	EI		2914
(0.19 eV average translational energy of decomposition at threshold)						
$C_4H_4^+$	C_8H_8 (Bicyclo[2.2.2]octatriene)	2C_2H_2	15.31±0.20	EI		2914
$C_4H_4^+$	C_8H_8 (*syn*–Tricyclo[4.2.0.0^{2,5}]octa–3,7–diene)	2C_2H_2	13.85±0.10	EI		2914
(0.13 eV average translational energy of decomposition at threshold)						
$C_4H_4^+$	C_8H_8 (*anti*–Tricyclo[4.2.0.0^{2,5}]octa–3,7–diene)	2C_2H_2	13.90±0.10	EI		2914
(0.13 eV average translational energy of decomposition at threshold)						
$C_4H_4^+$	C_8H_8 (Cubane)	2C_2H_2	12.88±0.15	EI		2914
See also – EI:	2105					
$C_4H_4^+$	$C_{10}H_8$ (Naphthalene)		19.6±0.20	EI		2112
$C_4H_4^+$	$C_{10}H_8$ (Azulene)		17.8±0.10	EI		2112

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_4H_4^+$	C_5H_5N (Pyridine)	HCN	13.28	EI		2833

See also – EI: 1406, 3013

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_4H_4^+$	$C_4H_4N_2$ (1,2–Diazine)	N_2	11.64±0.05	EI		1406
$C_4H_4^+$	$C_5H_4O_2$ (2–Oxa–3–oxobicyclo[2.2.0]hex–5–ene)		10.2	EI		2712
$C_4H_4^+$	C_6H_5F (Fluorobenzene)		17.00±0.1	EI		2103
$C_4H_4^+$	C_6H_5SH (Mercaptobenzene)		17.5±0.3	EI		3286
$C_4H_4^+$	C_6H_5Cl (Chlorobenzene)		17.57±0.1	EI		2103
$C_4H_4^+$	C_6H_5Br (Bromobenzene)		16.77±0.1	EI		2103

$C_4H_5^+$ $\Delta H^\circ_{f298} \sim 1003$ kJ mol^{-1} (240 kcal mol^{-1})

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_4H_5^+$	$CH_3CH{=}C{=}CH_2$	H	11.04±0.04	PI	1009	2644
$C_4H_5^+$	$CH_2{=}CHCH{=}CH_2$	H	11.39±0.05	PI	991	2013
$C_4H_5^+$	$CH_2{=}CHCH{=}CH_2$	H	11.56±0.04	PI	1008	2644

The two photoionization studies differ in their interpretation of the threshold.

See also – EI: 2455

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_4H_5^+$	$C_2H_5C{\equiv}CH$	H	11.6±0.1	EI		13
$C_4H_5^+$	$CH_3C{\equiv}CCH_3$	H	12.1±0.1	EI		13
$C_4H_5^+$	*trans*–$CH_2{=}CHCH{=}CHCH_3$	CH_3	12.57±0.05	EI		2455
$C_4H_5^+$	$CH_2{=}CHCH{=}CHCH{=}CH_2$	C_2H_2+H	13.60±0.10	EI		2751
(0.23 eV average translational energy of decomposition at threshold)						
$C_4H_5^+$	C_6H_8 (1,3–Cyclohexadiene)	C_2H_2+H	14.69±0.10	EI		2751
(0.04 eV average translational energy of decomposition at threshold)						
$C_4H_5^+$	C_6H_8 (1,4–Cyclohexadiene)	C_2H_2+H	14.48±0.10	EI		2751
(0.05 eV average translational energy of decomposition at threshold)						
$C_4H_5^+$	$CH_3CH{=}CHCH{=}CHCH_3$		13.23±0.05	EI		2455
$C_4H_5^+$	$C_5H_8{=}CH_2$ (Methylenecyclopentane)		12.69±0.17	EDD		2738
$C_4H_5^+$	$C_5H_7CH_3$ (1–Methylcyclopentene)		13.14±0.09	EDD		2738
$C_4H_5^+$	$C_5H_7CH_3$ (3–Methylcyclopentene)		12.69±0.20	EDD		2738
$C_4H_5^+$	C_6H_{10} (Cyclohexene)		13.31±0.15	EDD		2738
$C_4H_5^+$	$(C_3H_5)_2$ (Bicyclopropyl)		11.22±0.14	EDD		2738
$C_4H_5^+$	C_6H_{10} (Bicyclo[3.1.0]hexane)		12.62±0.11	EDD		2738

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_4H_5^+$	$C_6H_{10}=CH_2$ (Methylenecyclohexane)		13.10±0.10	EDD		2558
$C_4H_5^+$	$C_6H_9CH_3$ (1–Methylcyclohexene)		13.22±0.10	EDD		2558
$C_4H_5^+$	$C_6H_9CH_3$ (3–Methylcyclohexene)		13.42±0.07	EDD		2558
$C_4H_5^+$	$C_6H_9CH_3$ (4–Methylcyclohexene)		13.43±0.13	EDD		2558
$C_4H_5^+$	C_7H_{12} (Bicyclo[2.2.1]heptane)		13.44±0.11	EDD		2558
$C_4H_5^+$	C_7H_{12} (Bicyclo[4.1.0]heptane)		12.42±0.10	EDD		2558
$C_4H_5^+$	$(CH_3)_2C=CHCH=C(CH_3)_2$		14.60±0.04	EI		2455
$C_4H_5^+$	$CH_3SCH=CHC\equiv CH$		13.0±0.3	EI		2949
$C_4H_5^+$	$CH_3SC\equiv CCH=CH_2$		14.0±0.3	EI		2949
$C_4H_5^+$	$C_2H_5SCH=CHC\equiv CH$		13.1±0.3	EI		2949
$C_4H_5^+$	$C_2H_5SC\equiv CCH=CH_2$		13.7±0.3	EI		2949

$CH_3CH=C=CH_2^+$ **ΔH°_{f298} = 1053 kJ mol^{-1} (252 kcal mol^{-1})**
***trans*–$CH_2=CHCH=CH_2^+$** **ΔH°_{f298} = 985 kJ mol^{-1} (235 kcal mol^{-1})**
$C_2H_5C\equiv CH^+$ **ΔH°_{f298} = 1147 kJ mol^{-1} (274 kcal mol^{-1})**
$CH_3C\equiv CCH_3^+$ **ΔH°_{f298} = 1069 kJ mol^{-1} (255 kcal mol^{-1})**
$C_4H_6^+$ (*cis*–Cyclobutene) **ΔH°_{f298} = 1040 kJ mol^{-1} (248 kcal mol^{-1})**

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_4H_6^+$	$CH_3CH=C=CH_2$		9.23±0.02	PI	1053	2644

See also – EI: 462

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_4H_6^+$	*cis*–$CH_2=CHCH=CH_2$		~9.2	D		2842
$C_4H_6^+$	*trans*–$CH_2=CHCH=CH_2$ (Average of two Rydberg series limits)		9.062±0.01	S	985	3352
$C_4H_6^+$	*trans*–$CH_2=CHCH=CH_2$		9.070±0.01	PI	985	158, 182, 416
$C_4H_6^+$	*trans*–$CH_2=CHCH=CH_2$		9.075±0.005	PI	986	2013
$C_4H_6^+$	*trans*–$CH_2=CHCH=CH_2$		9.06±0.02	PI	984	2724
$C_4H_6^+$	*trans*–$CH_2=CHCH=CH_2$		9.07±0.02	PI	985	2644
$C_4H_6^+$	*trans*–$CH_2=CHCH=CH_2$		9.06	PE	984	3120
$C_4H_6^+$	*trans*–$CH_2=CHCH=CH_2$		9.07	PE	985	2842, 2843, 3056
$C_4H_6^+$	*trans*–$CH_2=CHCH=CH_2$		9.09±0.05	PE	987	2796
$C_4H_6^+$	*trans*–$CH_2=CHCH=CH_2$		9.09±0.03	EI		2455

See also – PE: 1130
PEN: 2430
EI: 224, 462, 2531, 2752

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_4H_6^+$	$C_2H_5C{\equiv}CH$		10.18	S	1147	1022
(Average of three Rydberg series limits)						
$C_4H_6^+$	$C_2H_5C{\equiv}CH$		10.18±0.01	PI	1147	162, 182, 416, 1022
$C_4H_6^+$	$C_2H_5C{\equiv}CH$		10.18	EM	1147	3380
See also – EI: 13						
$C_4H_6^+$	$CH_3C{\equiv}CCH_3$		9.56	EM	1069	3380
See also – EI: 13						
$C_4H_6^+$	C_4H_6 (*cis*–Cyclobutene)		9.43	PE	1040	3330
$C_4H_6^+$	*trans*–$CH_2{=}CHCH{=}CHCH_3$		13.10±0.1	EI		2455
$C_4H_6^+$	$CH_2{=}CHCH{=}CHCH{=}CH_2$	C_2H_2	12.25±0.30	EI		2751
$C_4H_6^+$	C_6H_8 (1,3–Cyclohexadiene)	C_2H_2	12.60±0.10	EI		2751
$C_4H_6^+$	C_6H_8 (1,4–Cyclohexadiene)	C_2H_2	12.17±0.10	EI		2751
$C_4H_6^+$	$CH_3CH{=}CHCH{=}CHCH_3$		11.53±0.07	EI		2455
$C_4H_6^+$	$C_5H_8{=}CH_2$ (Methylenecyclopentane)		10.88±0.07	EDD		2738
$C_4H_6^+$	$C_5H_7CH_3$ (1–Methylcyclopentene)		11.02±0.12	EDD		2738
$C_4H_6^+$	$C_5H_7CH_3$ (3–Methylcyclopentene)		10.69±0.07	EDD		2738
$C_4H_6^+$	C_6H_{10} (Cyclohexene)		10.67±0.06	EDD		2738
$C_4H_6^+$	$(C_3H_5)_2$ (Bicyclopropyl)		9.34±0.06	EDD		2738
$C_4H_6^+$	C_6H_{10} (Bicyclo[3.1.0]hexane)		10.28±0.05	EDD		2738
$C_4H_6^+$	$C_6H_{10}{=}CH_2$ (Methylenecyclohexane)		10.94±0.05	EDD		2558
$C_4H_6^+$	$C_6H_9CH_3$ (1–Methylcyclohexene)		11.02±0.08	EDD		2558
$C_4H_6^+$	$C_6H_9CH_3$ (3–Methylcyclohexene)		10.94±0.04	EDD		2558
$C_4H_6^+$	$C_6H_9CH_3$ (4–Methylcyclohexene)		10.82±0.12	EDD		2558
$C_4H_6^+$	C_7H_{12} (Bicyclo[2.2.1]heptane)		11.12±0.03	EDD		2558
$C_4H_6^+$	C_7H_{12} (Bicyclo[4.1.0]heptane)		10.10±0.09	EDD		2558
$C_4H_6^+$	$(CH_2)_4S$ (Tetramethylene sulfide)		11.9±0.2	EI		52

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
	$C_4H_7^+$	**$\Delta H^\circ_{f298} \sim 863$ kJ mol^{-1} (206 kcal mol^{-1})**				
$C_4H_7^+$	$CH_3CHCH=CH_2$		7.54	EM	855	3380
See also – EI:	108					
$C_4H_7^+$	$CH_2=C(CH_3)CH_2$		7.89	EM		3380
See also – EI:	108					
$C_4H_7^+$	C_4H_7		7.88±0.05	EI		123

This radical, identified in ref. 123 as cyclobutyl, may have isomerized to 2–methylallyl. F. P. Lossing, private communication.

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_4H_7^+$	$1-C_4H_8$	H	11.26	EM	868	3380
See also – EI:	194, 195					
$C_4H_7^+$	*cis*–$2-C_4H_8$	H	11.32	EM	867	3380
See also – EI:	194, 195					
$C_4H_7^+$	*iso*–C_4H_8	H	11.41	EM	866	3380
$C_4H_7^+$	$C_3H_5CH_3$ (Methylcyclopropane)	H	11.02	EM		3380
$C_4H_7^+$	C_4H_8 (Cyclobutane)	H	10.91	EM	861	3380
See also – EI:	123, 2742					
$C_4H_7^+$	$CH_3CH_2CH_2CH=CH_2$	CH_3	10.64	EM	863	3380
$C_4H_7^+$	*trans*–$C_2H_5CH=CHCH_3$	CH_3	10.68	EM	856	3380
$C_4H_7^+$	$(CH_3)_2CHCH=CH_2$	CH_3	10.74	EM	865	3380
$C_4H_7^+$	$C_2H_5C(CH_3)=CH_2$	CH_3	10.85	EM	868	3380
$C_4H_7^+$	$(CH_3)_2C=CHCH_3$	CH_3	10.84	EM	861	3380
$C_4H_7^+$	$C_3H_5C_2H_5$ (Ethylcyclopropane)	CH_3	10.34	EM		3380
$C_4H_7^+$	$C_3H_4(CH_3)_2$ (1,1–Dimethylcyclopropane)	CH_3	10.47	EM		3380
$C_4H_7^+$	$C_3H_4(CH_3)_2$ (1,1–Dimethylcyclopropane)	CH_3	11.37±0.02	EI		1146
$C_4H_7^+$	$C_3H_4(CH_3)_2$ (*cis*–1,2–Dimethylcyclopropane)	CH_3	11.32±0.03	EI		1146
$C_4H_7^+$	$C_3H_4(CH_3)_2$ (*trans*–1,2–Dimethylcyclopropane)	CH_3	11.38±0.04	EI		1146

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_4H_7^+$	C_5H_{10} (Cyclopentane)	CH_3	11.14	EM	855	3380
$C_4H_7^+$	$CH_3CH{=}CHCH{=}CHCH_3$		13.19±0.1	EI		2455
$C_4H_7^+$	$C_6H_{10}{=}CH_2$ (Methylenecyclohexane)		11.34±0.04	EDD		2558
$C_4H_7^+$	$C_6H_9CH_3$ (1–Methylcyclohexene)		11.48±0.05	EDD		2558
$C_4H_7^+$	$C_6H_9CH_3$ (3–Methylcyclohexene)		11.22±0.05	EDD		2558
$C_4H_7^+$	$C_6H_9CH_3$ (4–Methylcyclohexene)		11.24±0.04	EDD		2558
$C_4H_7^+$	C_7H_{12} (Bicyclo[2.2.1]heptane)		10.60±0.10	EDD		2558
$C_4H_7^+$	C_7H_{12} (Bicyclo[4.1.0]heptane)		10.27±0.08	EDD		2558
$C_4H_7^+$	n–C_7H_{16}		11.5±0.1	PI		2013
$C_4H_7^+$	$(CH_3)_2C{=}CHCH{=}C(CH_3)_2$		13.03±0.02	EI		2455
$C_4H_7^+$	n–C_4H_9CN	HCN+H	14.43	EI		2966
$C_4H_7^+$	n–C_4H_9NC		13.00	EDD		3214
$C_4H_7^+$	$(CH_2)_5O$ (1,5–Epoxypentane)	CH_2O+H	~12.2	EI		2694
$C_4H_7^+$	n–$C_5H_{11}F$		11.42	EI		2029
$C_4H_7^+$	$(CH_2)_4S$ (Tetramethylene sulfide)	SH	12.4±0.2	EI		52
$C_4H_7^+$	$CH_3CH{=}CHCH_2I$	I	9.15±0.05	EI		108
$C_4H_7^+$	$CH_2{=}C(CH_3)CH_2I$	I	9.40±0.05	EI		108

1–$C_4H_8^+$ $\Delta H^\circ_{f298} \sim 925$ kJ mol^{-1} (221 kcal mol^{-1})
2–$C_4H_8^+$ $\Delta H^\circ_{f298} \sim 871$ kJ mol^{-1} (208 kcal mol^{-1})
***iso*–$C_4H_8^+$ $\Delta H^\circ_{f298} \sim 871$ kJ mol^{-1} (208 kcal mol^{-1})**
$C_4H_8^+$(Cyclobutane) $\Delta H^\circ_{f298} = 997$ kJ mol^{-1} (238 kcal mol^{-1})

$C_4H_8^+$	1–C_4H_8		9.58±0.01	PI	924	133, 182, 416
$C_4H_8^+$	1–C_4H_8		9.61±0.02	PI	927	1120
$C_4H_8^+$	1–C_4H_8		9.59	PE	925	2843
$C_4H_8^+$	1–C_4H_8		9.62	PEN		2466
$C_4H_8^+$	1–C_4H_8		9.58	EM	924	3380

See also – PEN: 2430
EI: 62, 194, 195, 2941

$C_4H_8^+$	*cis*–2–C_4H_8		9.119	S	873	2663
$C_4H_8^+$	*cis*–2–C_4H_8		9.13±0.01	PI	874	182
$C_4H_8^+$	*cis*–2–C_4H_8		9.13	PI	874	168
$C_4H_8^+$	*cis*–2–C_4H_8		9.12	PE	873	2843
$C_4H_8^+$	*cis*–2–C_4H_8		9.10	EM	871	3380

See also – EI: 62, 194, 195, 2535, 2941

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_4H_8^+$	*trans*–2–C_4H_8		9.137	S	870	2663
(Average of two Rydberg series limits)						
$C_4H_8^+$	*trans*–2–C_4H_8		9.13±0.01	PI	870	182
$C_4H_8^+$	*trans*–2–C_4H_8		9.13	PI	870	168
$C_4H_8^+$	*trans*–2–C_4H_8		9.11	PE	868	3073, 3087
$C_4H_8^+$	*trans*–2–C_4H_8		9.12	PE	869	2843
See also – S:	3353					
EI:	62,411,2941					
$C_4H_8^+$	*iso*–C_4H_8		9.23±0.02	PI	874	182
$C_4H_8^+$	*iso*–C_4H_8		9.23	PI	874	168
$C_4H_8^+$	*iso*–C_4H_8		9.17	PE	868	2843
$C_4H_8^+$	*iso*–C_4H_8		9.19	EM	870	3380
See also – EI:	62, 2941, 3201					
$C_4H_8^+$	$C_3H_5CH_3$ (Methylcyclopropane)		9.46	EM		3380
See also – EI:	2941					
$C_4H_8^+$	C_4H_8 (Cyclobutane)		≤10.3	PI		3429
$C_4H_8^+$	C_4H_8 (Cyclobutane)		10.06	EM	997	3380
See also – EI:	123, 2742, 2941					
$C_4H_8^+$	*n*–C_5H_{12}	CH_4	10.93±0.03	PI		1120
(Threshold value approximately corrected to 0 K)						
$C_4H_8^+$	*iso*–C_5H_{12}	CH_4	10.735±0.02	PI		1120
(Threshold value approximately corrected to 0 K)						
$C_4H_8^+$	*neo*–C_5H_{12}	CH_4	10.39±0.02	PI		1120
(Threshold value approximately corrected to 0 K)						
$C_4H_8^+$	*n*–C_6H_{14}	C_2H_6	11.00±0.015	PI		1120
(Threshold value approximately corrected to 0 K)						
$C_4H_8^+$	*iso*–C_6H_{14}	C_2H_6	10.65±0.015	PI		1120
(Threshold value approximately corrected to 0 K)						
$C_4H_8^+$	$(C_2H_5)_2CHCH_3$	C_2H_6	10.58±0.015	PI		1120
(Threshold value approximately corrected to 0 K)						
$C_4H_8^+$	$C_2H_5C(CH_3)_3$	C_2H_6	10.23±0.015	PI		1120
(Threshold value approximately corrected to 0 K)						
$C_4H_8^+$	*n*–C_7H_{16}	C_3H_8	10.97±0.03	PI		1120
(Threshold value approximately corrected to 0 K)						
$C_4H_8^+$	*n*–C_7H_{16}	C_3H_8	10.56±0.05	PI		2013
$C_4H_8^+$	*n*–C_8H_{18}	C_4H_{10}	11.19±0.07	PI		1120
(Threshold value approximately corrected to 0 K)						
$C_4H_8^+$	*n*–C_4H_9NC		12.00	EDD		3214
$C_4H_8^+$	$(CH_2)_5O$ (1,5–Epoxypentane)	CH_2O?	11.88	EI		2694
$C_4H_8^+$	*tert*–$C_4H_9SiH_3$		9.89±0.05	EI		2182
$C_4H_8^+$	*n*–C_4H_9Cl	HCl	10.95	EI		3201
$C_4H_8^+$	*sec*–C_4H_9Cl	HCl	10.71	EI		3201

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_4H_8^+$	*iso*-C_4H_9Cl	HCl	10.77	EI		3201
$C_4H_8^+$	*tert*-C_4H_9Cl	HCl	9.56?	EI		3201
$C_4H_8^+$	*tert*-$C_4H_9SiCl_3$		10.26±0.2	EI		2182

At threshold the various $C_4H_8^+$ ions have different structures, see S. G. Lias and P. Ausloos, J. Res. NBS **75A**, 591 (1971) and ref. 2663.

$C_4D_8^+$

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_4D_8^+$	*trans*-2-C_4D_8		9.168	S		2663
(Average of two Rydberg series limits)						

n-$C_4H_9^+$ $\Delta H^\circ_{f298} \sim 839$ kJ mol^{-1} (200 kcal mol^{-1})
sec-$C_4H_9^+$ $\Delta H^\circ_{f298} \sim 768$ kJ mol^{-1} (183 kcal mol^{-1})
iso-$C_4H_9^+$ $\Delta H^\circ_{f298} \sim 830$ kJ mol^{-1} (198 kcal mol^{-1})
$tert$-$C_4H_9^+$ $\Delta H^\circ_{f298} \sim 697$ kJ mol^{-1} (167 kcal mol^{-1})

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_4H_9^+$	*n*-C_4H_9		8.01±0.05	EM	839	3104, 3379
$C_4H_9^+$	*n*-C_4H_9		8.01±0.05	RPD		2776

See also – EI: 141, 145, 2719

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_4H_9^+$	*sec*-C_4H_9		7.41±0.05	EM	768	3104, 3379

See also – EI: 141, 145, 2719, 3178

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_4H_9^+$	*iso*-C_4H_9		8.01±0.05	EM	830	3104, 3379

See also – EI: 141, 145, 2719, 3178, 3182

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_4H_9^+$	*tert*-C_4H_9		6.93±0.05	EM	697	3104, 3379

See also – EI: 141, 145, 2719, 3178

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_4H_9^+$	*n*-C_4H_{10}	H^-	10.9±0.1	PI		2606
(Threshold value approximately corrected to 0 K)						
$C_4H_9^+$	*n*-C_4H_{10}	H	11.65±0.1	PI	(780)	2606
(Threshold value approximately corrected to 0 K)						

See also – EI: 195

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_4H_9^+$	*iso*-C_4H_{10}	H	11.6	EI		195
$C_4H_9^+$	*n*-C_5H_{12}	CH_3	11.055±0.07	PI	(778)	1120
(Threshold value approximately corrected to 0 K)						
$C_4H_9^+$	*n*-C_5H_{12}	CH_3	10.98±0.05	EM	(771)	3104
$C_4H_9^+$	*iso*-C_5H_{12}	CH_3	11.145±0.07	PI	(779)	1120
(Threshold value approximately corrected to 0 K)						
$C_4H_9^+$	*neo*-C_5H_{12}	CH_3	10.565±0.02	PI	(711)	1120
(Threshold value approximately corrected to 0 K)						
$C_4H_9^+$	*neo*-C_5H_{12}	CH_3	10.56	EM	(711)	3104

See also – EI: 2101, 2980

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_4H_8^+$	*iso*-C_4H_9Cl	HCl	10.77	EI		3201
$C_4H_8^+$	*tert*-C_4H_9Cl	HCl	9.56?	EI		3201
$C_4H_8^+$	*tert*-$C_4H_9SiCl_3$		10.26±0.2	EI		2182

At threshold the various $C_4H_8^+$ ions have different structures, see S. G. Lias and P. Ausloos, J. Res. NBS **75A**, 591 (1971) and ref. 2663.

$C_4D_8^+$

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_4D_8^+$	*trans*-2-C_4D_8		9.168	S		2663
(Average of two Rydberg series limits)						

***n*-$C_4H_9^+$** **$\Delta H_{f298}^{\circ} \sim 839$ kJ mol^{-1} (200 kcal mol^{-1})**
***sec*-$C_4H_9^+$** **$\Delta H_{f298}^{\circ} \sim 768$ kJ mol^{-1} (183 kcal mol^{-1})**
***iso*-$C_4H_9^+$** **$\Delta H_{f298}^{\circ} \sim 830$ kJ mol^{-1} (198 kcal mol^{-1})**
***tert*-$C_4H_9^+$** **$\Delta H_{f298}^{\circ} \sim 697$ kJ mol^{-1} (167 kcal mol^{-1})**

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_4H_9^+$	*n*-C_4H_9		8.01±0.05	EM	839	3104, 3379
$C_4H_9^+$	*n*-C_4H_9		8.01±0.05	RPD		2776
See also – EI:	141, 145, 2719					
$C_4H_9^+$	*sec*-C_4H_9		7.41±0.05	EM	768	3104, 3379
See also – EI:	141, 145, 2719, 3178					
$C_4H_9^+$	*iso*-C_4H_9		8.01±0.05	EM	830	3104, 3379
See also – EI:	141, 145, 2719, 3178, 3182					
$C_4H_9^+$	*tert*-C_4H_9		6.93±0.05	EM	697	3104, 3379
See also – EI:	141, 145, 2719, 3178					
$C_4H_9^+$	*n*-C_4H_{10}	H^-	10.9±0.1	PI		2606
(Threshold value approximately corrected to 0 K)						
$C_4H_9^+$	*n*-C_4H_{10}	H	11.65±0.1	PI	(780)	2606
(Threshold value approximately corrected to 0 K)						
See also – EI:	195					
$C_4H_9^+$	*iso*-C_4H_{10}	H	11.6	EI		195
$C_4H_9^+$	*n*-C_5H_{12}	CH_3	11.055±0.07	PI	(778)	1120
(Threshold value approximately corrected to 0 K)						
$C_4H_9^+$	*n*-C_5H_{12}	CH_3	10.98±0.05	EM	(771)	3104
$C_4H_9^+$	*iso*-C_5H_{12}	CH_3	11.145±0.07	PI	(779)	1120
(Threshold value approximately corrected to 0 K)						
$C_4H_9^+$	*neo*-C_5H_{12}	CH_3	10.565±0.02	PI	(711)	1120
(Threshold value approximately corrected to 0 K)						
$C_4H_9^+$	*neo*-C_5H_{12}	CH_3	10.56	EM	(711)	3104
See also – EI:	2101, 2980					

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_4H_9^+$	$n-C_6H_{14}$	C_2H_5	11.025±0.07	PI	(789)	1120
(Threshold value approximately corrected to 0 K)						
$C_4H_9^+$	$n-C_6H_{14}$	C_2H_5	11.05	RPD		2977
$C_4H_9^+$	$iso-C_6H_{14}$	C_2H_5	10.73±0.02	PI	(753)	1120
(Threshold value approximately corrected to 0 K)						
$C_4H_9^+$	$(C_2H_5)_2CHCH_3$	C_2H_5	10.95±0.07	PI	(777)	1120
(Threshold value approximately corrected to 0 K)						
$C_4H_9^+$	$C_2H_5C(CH_3)_3$	C_2H_5	10.60±0.025	PI	(730)	1120
(Threshold value approximately corrected to 0 K)						
$C_4H_9^+$	$n-C_7H_{16}$	$n-C_3H_7$?	11.185±0.07	PI	(805)	1120
(Threshold value approximately corrected to 0 K)						
$C_4H_9^+$	$n-C_7H_{16}$	$n-C_3H_7$?	10.56±0.05	PI	(745)	2013
$C_4H_9^+$	$n-C_7H_{16}$	$n-C_3H_7$?	10.72	RPD		2977
$C_4H_9^+$	$n-C_8H_{18}$	$n-C_4H_9$?	11.40±0.07	PI	(826)	1120
(Threshold value approximately corrected to 0 K)						
$C_4H_9^+$	$n-C_8H_{18}$	$n-C_4H_9$?	11.12	RPD		2977
$C_4H_9^+$	$n-C_9H_{20}$		11.15	RPD		2977

Although the structure of the larger neutral fragments is uncertain, the results above suggest that no primary butyl fragment ions are formed. See also W. A. Chupka, J. Chem. Phys. **54**, 1936 (1971) and refs. 2977, 3104.

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_4H_9^+$	$C_2H_5CH=C=CHCH_2C(CH_3)_3$		11.7±0.05	EI		3007, 3008
$C_4H_9^+$	$cis-(CH_3)_3CCH=CHC(CH_3)_3$		11.12±0.07	EI		2533
$C_4H_9^+$	$trans-(CH_3)_3CCH=CHC(CH_3)_3$		11.23±0.05	EI		2533
$C_4H_9^+$	$(CH_3)_3CCH=C=CH(CH_2)_4CH_3$		12.0±0.05	EI		3007
$C_4H_9^+$	$(CH_3)_3CCH=C=CHCH_2C(CH_3)_3$		11.6±0.05	EI		3007
$C_4H_9^+$	$tert-C_4H_9NC$	CN	12.15	EDD		3214
$C_4H_9^+$	$n-C_4H_9COCH_3$		11.92	RPD		2977
$C_4H_9^+$	$(n-C_4H_9)_2O$		11.75±0.1	RPD		2776
$C_4H_9^+$	$(n-C_4H_9)_2CO$		11.82	RPD		2977
$C_4H_9^+$	$CH_3COO(CH_2)_3CH_3$		11.31±0.10	EI		305
$C_4H_9^+$	$n-C_4H_9ONO$		10.6	RPD		2018
$C_4H_9^+$	$tert-C_4H_9SiH_3$		10.25±0.02	EI		2182
$C_4H_9^+$	$tert-C_4H_9Si(CH_3)_3$		11.88	RPD		3187
$C_4H_9^+$	$n-C_4H_9Cl$	Cl?	10.95±0.05	EI		3201
$C_4H_9^+$	$sec-C_4H_9Cl$	Cl?	10.99±0.05	EI		3201
$C_4H_9^+$	$iso-C_4H_9Cl$	Cl?	11.40?	EI		3201
$C_4H_9^+$	$tert-C_4H_9Cl$	Cl?	10.80±0.07	EI		3201
$C_4H_9^+$	$tert-C_4H_9SiCl_3$		10.72±0.1	EI		2182
$C_4H_9^+$	$tert-C_4H_9Sn(CH_3)_3$		10.03±0.23	EI		2720
$C_4H_9^+$	$(n-C_4H_9)_2Hg$		10.55±0.1	EI		306

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
	$n-C_4H_{10}^+$	**$\Delta H^\circ_{f298} \leq 887$ kJ mol^{-1} (212 kcal mol^{-1})**				
	$iso-C_4H_{10}^+$	**$\Delta H^\circ_{f298} \leq 879$ kJ mol^{-1} (210 kcal mol^{-1})**				
$C_4H_{10}^+$	$n-C_4H_{10}$		10.55±0.05	PI		1120
(Value estimated from fig. 7 of this reference)						
$C_4H_{10}^+$	$n-C_4H_{10}$		10.55±0.05	PI		2606
(Value estimated from fig. 6 of this reference)						
$C_4H_{10}^+$	$n-C_4H_{10}$		10.63±0.03	PI		182, 416
$C_4H_{10}^+$	$n-C_4H_{10}$		10.50	PE	887	1130
$C_4H_{10}^+$	$n-C_4H_{10}$		10.67	PE		2843
See also – PE:	3060					
PEN:	2430, 2466, 2467					
EI:	195, 2587, 3356					
$C_4H_{10}^+$	$iso-C_4H_{10}$		10.57	PI		182
$C_4H_{10}^+$	$iso-C_4H_{10}$		~10.5	PI	~879	1120
(Value estimated from fig. 12 of this reference)						
$C_4H_{10}^+$	$iso-C_4H_{10}$		10.69	PE		2843
$C_4H_{10}^+$	$iso-C_4H_{10}$		10.78	PE		1130
$C_4H_{10}^+$	$iso-C_4H_{10}$		10.79	PE		2829
See also – PEN:	2430					
EI:	62, 195, 3356					
The ionization potentials are probably not adiabatic, see ref. 1120.						
		$C_5H_2^{+2}$				
$C_5H_2^{+2}$	$trans-CH_2=CHCH=CHCH_3$		32.64±0.1	EI		2455
		$C_5H_3^+$				
$C_5H_3^+$	$CH_3C\equiv CC\equiv CCH_3$	CH_3	13.55	EI		1197
$C_5H_3^+$	C_6H_6 (Benzene)	CH_3	15.7±0.1	RPD		2520
See also – EI:	2498					
$C_5H_3^+$	$CH_2=CHCH=CHCH=CH_2$	CH_3+H_2?	14.95±0.15	EI		2751
(0.18 eV average translational energy of decomposition at threshold)						
$C_5H_3^+$	C_6H_8 (1,3–Cyclohexadiene)	CH_3+H_2?	15.44±0.10	EI		2751
(0.07 eV average translational energy of decomposition at threshold)						
$C_5H_3^+$	C_6H_8 (1,4–Cyclohexadiene)	CH_3+H_2?	16.12±0.10	EI		2751
(0.20 eV average translational energy of decomposition at threshold)						
$C_5H_3^+$	$C_6H_5CH=CH_2$ (Ethenylbenzene)	$C_2H_2+CH_3$?	17.74±0.10	EI		2914
(0.09 eV average translational energy of decomposition at threshold)						
$C_5H_3^+$	C_8H_8 (Cyclooctatetraene)	$C_2H_2+CH_3$?	16.41±0.15	EI		2914
(0.15 eV average translational energy of decomposition at threshold)						

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_5H_3^+$	C_8H_8 (Cyclobutenobenzene)	$C_2H_2+CH_3$?	17.34±0.10	EI		2914
(0.20 eV average translational energy of decomposition at threshold)						
$C_5H_3^+$	C_8H_8 (Bicyclo[2.2.2]octatriene)		16.11±0.10	EI		2914
$C_5H_3^+$	C_8H_8 (*syn*–Tricyclo[4.2.0.0^{2,5}]octa–3,7–diene)	$C_2H_2+CH_3$?	14.07±0.10	EI		2914
(0.24 eV average translational energy of decomposition at threshold)						
$C_5H_3^+$	C_8H_8 (*anti*–Tricyclo[4.2.0.0^{2,5}]octa–3,7–diene)	$C_2H_2+CH_3$?	14.36±0.10	EI		2914
(0.24 eV average translational energy of decomposition at threshold)						
$C_5H_3^+$	C_8H_8 (Cubane)		13.60±0.10	EI		2914
See also – EI:	2105					
$C_5H_3^+$	C_6H_5SH (Mercaptobenzene)		22.8±0.3	EI		3286
$C_5H_3^+$	$C_6H_5SSC_6H_5$ (Diphenyl disulfide)		22.2±0.3	EI		3286

$C_5H_5^+$

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_5H_5^+$	C_5H_5 (Cyclopentadienyl radical)		8.56	EI		2732, 2940
$C_5H_5^+$	C_5H_5 (Cyclopentadienyl radical)		8.69±0.1	EI		68
$C_5H_5^+$	$CH{\equiv}CCH{=}CHCH_3$	H	11.57	EI		2541
(Metastable transition indicates zero kinetic energy release)						
$C_5H_5^+$	$CH_2{=}C(CH_3)C{\equiv}CH$	H	11.6	EI		3335
$C_5H_5^+$	C_5H_6 (Cyclopentadiene)	H	11.9±0.5	SD		1451
$C_5H_5^+$	C_5H_6 (Cyclopentadiene)	H	12.62	EI		2541
(Metastable transition indicates zero kinetic energy release)						
$C_5H_5^+$	C_5H_6 (Cyclopentadiene)	H	12.6	EI		68
$C_5H_5^+$	C_5H_6 (Cyclopentadiene)	H	12.9	EI		3335
$C_5H_5^+$	*trans*–$CH_2{=}CHCH{=}CHCH_3$	H_2+H	13.90±0.05	EI		2455
$C_5H_5^+$	$CH_2{=}C(CH_3)CH{=}CH_2$	H_2+H	13.9	EI		3335
$C_5H_5^+$	$CH_2{=}CHCH{=}CHCH{=}CH_2$	CH_3	12.25±0.10	EI		2751
(0.06 eV average translational energy of decomposition at threshold)						
$C_5H_5^+$	$C_2H_5CH{=}CHC{\equiv}CH$	CH_3	12.2	EI		3335
$C_5H_5^+$	$CH_3CH{=}C(CH_3)C{\equiv}CH$	CH_3	12.4	EI		3335
$C_5H_5^+$	$C_5H_5CH_3$ (Methylcyclopentadiene)	CH_3	13.5	EI		3335

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_5H_5^+$	C_6H_8 (1,3–Cyclohexadiene)	CH_3	13.02±0.10	EI		2751
(0.13 eV average translational energy of decomposition at threshold)						
$C_5H_5^+$	C_6H_8 (1,4–Cyclohexadiene)	CH_3	13.41±0.10	EI		2751
(0.07 eV average translational energy of decomposition at threshold)						
$C_5H_5^+$	C_6H_8 (1,4–Cyclohexadiene)	CH_3	13.6	EI		3335
$C_5H_5^+$	$CH_3CH=CHCH=CHCH_3$		13.79±0.04	EI		2455
$C_5H_5^+$	$C_5H_8=CH_2$ (Methylenecyclopentane)		13.45±0.19	EDD		2738
$C_5H_5^+$	$C_5H_7CH_3$ (1–Methylcyclopentene)		13.45±0.19	EDD		2738
$C_5H_5^+$	$C_5H_7CH_3$ (3–Methylcyclopentene)		13.35±0.05	EDD		2738
$C_5H_5^+$	C_6H_{10} (Cyclohexene)		13.57±0.11	EDD		2738
$C_5H_5^+$	$(C_3H_5)_2$ (Bicyclopropyl)		12.20±0.13	EDD		2738
$C_5H_5^+$	C_6H_{10} (Bicyclo[3.1.0]hexane)		13.20±0.12	EDD		2738
$C_5H_5^+$	$C_6H_5CH_3$ (Toluene)		16.7	EI		3335
$C_5H_5^+$	C_7H_8 (Cycloheptatriene)		16.0	EI		219
$C_5H_5^+$	C_7H_8 (Cycloheptatriene)		16.66	EI		3335
$C_5H_5^+$	C_7H_8 (Bicyclo[3.2.0]hepta–2,6–diene)		14.89	EI		219
$C_5H_5^+$	C_7H_8 (Bicyclo[3.2.0]hepta–2,6–diene)		14.9	EI		3335
$C_5H_5^+$	$C_6H_5NH_2$ (Aniline)	HCN+H	15.24	EI		2541
(Metastable transitions indicate zero kinetic energy release)						
$C_5H_5^+$	C_6H_5OH (Phenol)	CO+H	14.25	EI		2541
(Metastable transitions indicate ~0.2 eV kinetic energy release)						
$C_5H_5^+$	$C_6H_5OCH_3$ (Methoxybenzene)		13.5	EI		3335
$C_5H_5^+$	$CH_3SCH=CHC\equiv CH$		11.5±0.3	EI		2949
$C_5H_5^+$	C_6H_5SH (Mercaptobenzene)		17.3±0.3	EI		3286
$C_5H_5^+$	$(C_5H_5)_2TiCl_2$ (Bis(cyclopentadienyl)titanium dichloride)		13.0±0.4	EI		2479
$C_5H_5^+$	$(C_5H_5)_2ZrCl_2$ (Bis(cyclopentadienyl)zirconium dichloride)		13.6±0.2	EI		2479

$C_5H_5^{+2}$

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_5H_5^{+2}$	*trans*–$CH_2=CHCH=CHCH_3$		30.75±0.2	EI		2455

4.3. The Positive Ion Table—Continued

$C_5H_6^{+}$ (Cyclopentadiene) ΔH°_{f298} = 960 kJ mol^{-1} (229 kcal mol^{-1})

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_5H_6^{+}$	$CH_2=CHC\equiv CCH_3$		8.1	EI		3009
$C_5H_6^{+}$	$CH\equiv CCH=CHCH_3$		9.14	EI		2541
$C_5H_6^{+}$	C_5H_6 (Cyclopentadiene)		8.574±0.01	PI	961	2877
$C_5H_6^{+}$	C_5H_6 (Cyclopentadiene)		8.566±0.01	PE	960	3411
$C_5H_6^{+}$	C_5H_6 (Cyclopentadiene)		8.55	PE	959	2842, 2843

Price and Walsh, ref. 3351, found a Rydberg series giving an ionization potential of 8.62 eV. Their absorption spectrum has been reinterpreted by Derrick *et al.*, ref. 3411, to give limits of 8.566 and 10.620 eV, in agreement with the photoelectron spectra.

See also – PE: 3246, 3330
EI: 68, 2163, 2541

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_5H_6^{+}$	*trans*-$CH_2=CHCH=CHCH_3$	H_2	12.34±0.06	EI		2455
$C_5H_6^{+}$	C_7H_8 (Bicyclo[3.2.0]hepta-2,6-diene)		10.02	EI		219
$C_5H_6^{+}$	C_7H_{10} (1,3-Cycloheptadiene)		10.70	EI		219
$C_5H_6^{+}$	C_7H_{10} (Bicyclo[2.2.1]hept-2-ene)		9.58±0.15	EI		2155
$C_5H_6^{+}$	C_7H_{10} (Bicyclo[3.2.0]hept-6-ene)		10.15	EI		219
$C_5H_6^{+}$	$C_6H_5NH_2$ (Aniline)	HCN	12.3±0.1	PI		1160

See also – EI: 2541, 2972, 3238

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_5H_6^{+}$	C_6H_5OH (Phenol)	CO	11.67	EI		3238

See also – EI: 2541

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_5H_6^{+}$	C_6H_5SH (Mercaptobenzene)		13.4±0.3	EI		3286
$C_5H_6^{+}$	C_7H_9Cl (*endo*-5-Chlorobicyclo[2.2.1]hept-2-ene)		9.75±0.15	EI		2155
$C_5H_6^{+}$	C_7H_9Cl (*exo*-5-Chlorobicyclo[2.2.1]hept-2-ene)		9.77±0.15	EI		2155
$C_5H_6^{+}$	C_7H_9Cl (3-Chloronortricyclene)		10.15±0.15	EI		2155

$C_5H_5D^+$

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_5H_5D^+$	C_6H_5SD (Mercapto-d_1-benzene)		11.9±0.2	EI		1039

$C_5H_6^{+2}$

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_5H_6^{+2}$	*trans*-$CH_2=CHCH=CHCH_3$		25.41±0.2	EI		2455

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_5H_7^+$						
$C_5H_7^+$	CH_2=CHCH=CH_2		7.76	EI		2543
$C_5H_7^+$	C_5H_7 (3–Cyclopentenyl radical)		7.54	EI		2543
$C_5H_7^+$	*trans*–CH_2=CHCH=$CHCH_3$	H	10.93±0.02	EI		2455
$C_5H_7^+$	C_5H_8 (Cyclopentene)	H	11.19	EI		2543
$C_5H_7^+$	C_5H_8 (Bicyclo[1.1.1]pentane)	H	10.60	EI		2560
$C_5H_7^+$	CH_3CH=CHCH=$CHCH_3$	CH_3	10.72±0.05	EI		2455
$C_5H_7^+$	CH_2=$CHCH(CH_3)CH$=CH_2	CH_3	9.77	EI		2543
$C_5H_7^+$	C_5H_8=CH_2 (Methylenecyclopentane)	CH_3	9.65±0.03	EDD		2738
$C_5H_7^+$	$C_5H_7CH_3$ (1–Methylcyclopentene)	CH_3	9.99±0.09	EDD		2738
$C_5H_7^+$	$C_5H_7CH_3$ (3–Methylcyclopentene)	CH_3	9.67±0.11	EDD		2738
$C_5H_7^+$	$C_5H_7CH_3$ (3–Methylcyclopentene)	CH_3	10.52	EI		2543
$C_5H_7^+$	C_6H_{10} (Cyclohexene)	CH_3	10.18±0.12	EDD		2738
$C_5H_7^+$	$(C_3H_5)_2$ (Bicyclopropyl)	CH_3	9.12±0.08	EDD		2738
$C_5H_7^+$	C_6H_{10} (Bicyclo[3.1.0]hexane)	CH_3	9.68±0.07	EDD		2738
$C_5H_7^+$	C_6H_{10}=CH_2 (Methylenecyclohexane)	C_2H_5	10.45±0.11	EDD		2558
$C_5H_7^+$	$C_6H_9CH_3$ (1–Methylcyclohexene)	C_2H_5	10.47±0.07	EDD		2558
$C_5H_7^+$	$C_6H_9CH_3$ (3–Methylcyclohexene)	C_2H_5	10.43±0.05	EDD		2558
$C_5H_7^+$	$C_6H_9CH_3$ (4–Methylcyclohexene)	C_2H_5	10.43±0.10	EDD		2558
$C_5H_7^+$	C_7H_{12} (Bicyclo[2.2.1]heptane)	C_2H_5	10.60±0.10	EDD		2558
$C_5H_7^+$	C_7H_{12} (Bicyclo[4.1.0]heptane)	C_2H_5	9.53±0.07	EDD		2558
$C_5H_7^+$	CH_3CH=C=$CH(CH_2)_3CH_3$		13.8	EI		3008
$C_5H_7^+$	C_2H_5CH=C=$CHCH_2CH_2CH_3$		11.6	EI		3008
$C_5H_7^+$	$(CH_3)_2C$=CHCH=$C(CH_3)_2$	$C_2H_4+CH_3$	12.88±0.03	EI		2455
$C_5H_7^+$	CH_3CH=C=$CHCH_2CH_2CH(CH_3)_2$		12.7	EI		3008
$C_5H_7^+$	C_2H_5CH=C=$CHCH_2CH(CH_3)_2$		11.7	EI		3008
$C_5H_7^+$	C_9H_{16} (*cis*–Hexahydroindan)	$C_2H_5+C_2H_4$	12.21±0.05	EI		1184, 2028
$C_5H_7^+$	C_9H_{16} (*trans*–Hexahydroindan)	$C_2H_5+C_2H_4$	12.19±0.03	EI		1184, 2028
$C_5H_7^+$	$(C_5H_7)_2$ (3,3′–Bicyclopentenyl)	*cyclo*–C_5H_7	9.75	EI		2543
$C_5H_7^+$	C_2H_5CH=C=$CH(CH_2)_4CH_3$		11.9	EI		3008
$C_5H_7^+$	C_2H_5CH=C=$CHCH_2C(CH_3)_3$		13.5	EI		3008
$C_5H_7^+$	$C_6H_{11}OH$ (Cyclohexanol)	CH_3+H_2O	10.9	EI		3022

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
	CH_2= CHCH= CHCH$_3^+$	**ΔH$^\circ_{f298}$ ~ 905 kJ mol^{-1} (216 kcal mol^{-1})**				
	CH_2= C(CH$_3$)CH= CH$_2^+$	**ΔH$^\circ_{f298}$ = 929 kJ mol^{-1} (222 kcal mol^{-1})**				
	$C_5H_8^+$ (Cyclopentene)	**ΔH$^\circ_{f298}$ = 902 kJ mol^{-1} (216 kcal mol^{-1})**				
	$C_5H_8^+$ (Spiropentane)	**ΔH$^\circ_{f298}$ = 1097 kJ mol^{-1} (262 kcal mol^{-1})**				
$C_5H_8^+$	$C_2H_5CH=C=CH_2$		9.42	EI		62
$C_5H_8^+$	*cis*–$CH_2=CHCH=CHCH_3$		8.59	PE	907	2842, 2843
See also – EI:	62					
$C_5H_8^+$	*trans*–$CH_2=CHCH=CHCH_3$		8.56	PE	904	2842, 2843
See also – EI:	62, 2455					
$C_5H_8^+$	$CH_3CH=C=CHCH_3$		9.26	EI		62
$C_5H_8^+$	$CH_2=CHCH_2CH=CH_2$		9.58	EI		62
$C_5H_8^+$	$CH_2=C(CH_3)CH=CH_2$		8.844±0.01	S	929	3352
(Average of two Rydberg series limits)						
$C_5H_8^+$	$CH_2=C(CH_3)CH=CH_2$		8.845±0.005	PI	929	182
See also – EI:	2411					
$C_5H_8^+$	$C_4H_6=CH_2$ (Methylenecyclobutane)		9.16±0.02	PI		2877
$C_5H_8^+$	$C_4H_6=CH_2$ (Methylenecyclobutane)		9.12	PE		3343
$C_5H_8^+$	C_5H_8 (Cyclopentene)		9.01±0.01	PI	902	182
$C_5H_8^+$	C_5H_8 (Cyclopentene)		9.02±0.01	PI	903	2877
$C_5H_8^+$	C_5H_8 (Cyclopentene)		9.00	PE	901	2843
$C_5H_8^+$	C_5H_8 (Cyclopentene)		9.01±0.01	PE	902	3158
$C_5H_8^+$	C_5H_8 (*cis*–Cyclopentene)		9.01	PE	902	3330
See also – EI:	62, 411, 2531, 3342					
$C_5H_8^+$	C_5H_8 (Bicyclo[1.1.1]pentane)		9.65	EI		2560
$C_5H_8^+$	C_5H_8 (Spiropentane)		9.45	PE	1097	2843, 2951
$C_5H_8^+$	$C_6H_{10}=CH_2$ (Methylenecyclohexane)	C_2H_4	10.46±0.08	EDD		2558
$C_5H_8^+$	$C_6H_9CH_3$ (1–Methylcyclohexene)	C_2H_4	10.56±0.15	EDD		2558
$C_5H_8^+$	$C_6H_9CH_3$ (3–Methylcyclohexene)	C_2H_4	10.50±0.04	EDD		2558
$C_5H_8^+$	$C_6H_9CH_3$ (4–Methylcyclohexene)	C_2H_4	10.39±0.05	EDD		2558
$C_5H_8^+$	C_7H_{12} (Bicyclo[2.2.1]heptane)	C_2H_4	10.30±0.07	EDD		2558

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_5H_8^+$	C_7H_{12} (Bicyclo[4.1.0]heptane)	C_2H_4	9.37±0.07	EDD		2558

For a discussion of these fragment ion structures see ref. 2558.

$C_5H_8^+$	$CH_3CH=C=CH(CH_2)_3CH_3$		9.2	EI		3008
$C_5H_8^+$	$CH_3CH=C=CHCH_2CH_2CH(CH_3)_2$		9.9	EI		3008
$C_5H_8^+$	$C_4H_4(CH_3)_2(CH=CH_2)_2$ (*trans*–1,2–Diethenyl–1,2–dimethylcyclobutane)		9.4±0.1	EI		2411
$C_5H_8^+$	$C_2H_5CH=C=CHCH_2C(CH_3)_3$		12.6	EI		3008
$C_5H_8^+$	C_5H_9OH (Cyclopentanol)	H_2O	9.49	RPD		2999
$C_5H_8^+$	C_5H_9F (Fluorocyclopentane)	HF	10.56	EI		2029
$C_5H_8^+$	C_5H_9Cl (Chlorocyclopentane)	HCl	10.53	EI		2029
			$C_5H_8^{+2}$			
$C_5H_8^{+2}$	*trans*–$CH_2=CHCH=CHCH_3$		24.51±0.1	EI		2455
			$C_5H_9^+$			
$C_5H_9^+$	$C_2H_5CH=CHCH_2$		7.65	EI		2543
$C_5H_9^+$	C_5H_9 (Cyclopentyl radical)		7.79±0.03	EI		123
$C_5H_9^+$	$C_5H_9CH_3$ (Methylcyclopentane)	CH_3	10.95	EI		123
$C_5H_9^+$	$C_6H_{10}(CH_3)_2$ (*cis*–1,2–Dimethylcyclohexane)		12.12±0.05	EI		1145
$C_5H_9^+$	$C_6H_{10}(CH_3)_2$ (*trans*–1,2–Dimethylcyclohexane)		12.00±0.05	EI		1145
$C_5H_9^+$	*cis*–$(CH_3)_3CCH=CHC(CH_3)_3$		11.70±0.03	EI		2533
$C_5H_9^+$	*trans*–$(CH_3)_3CCH=CHC(CH_3)_3$		12.06±0.05	EI		2533

$CH_3CH_2CH_2CH=CH_2^+$ $\Delta H^\circ_{f298} = 895$ kJ mol^{-1} (214 kcal mol^{-1})
$C_2H_5CH=CHCH_3^+$ $\Delta H^\circ_{f298} \sim 829$ kJ mol^{-1} (198 kcal mol^{-1})
$(CH_3)_2CHCH=CH_2^+$ $\Delta H^\circ_{f298} = 889$ kJ mol^{-1} (213 kcal mol^{-1})
$C_2H_5C(CH_3)=CH_2^+$ $\Delta H^\circ_{f298} = 844$ kJ mol^{-1} (202 kcal mol^{-1})
$(CH_3)_2C=CHCH_3^+$ $\Delta H^\circ_{f298} = 795$ kJ mol^{-1} (190 kcal mol^{-1})
$C_5H_{10}^+$(Cyclopentane) $\Delta H^\circ_{f298} \sim 936$ kJ mol^{-1} (224 kcal mol^{-1})

$C_5H_{10}^+$	$CH_3CH_2CH_2CH=CH_2$		9.50±0.02	PI	896	182
$C_5H_{10}^+$	$CH_3CH_2CH_2CH=CH_2$		9.50±0.02	PI	896	1120
$C_5H_{10}^+$	$CH_3CH_2CH_2CH=CH_2$		9.48	EM	894	3380

See also – EI: 62

$C_5H_{10}^+$	*cis*–$C_2H_5CH=CHCH_3$		9.11	EI		62
$C_5H_{10}^+$	*trans*–$C_2H_5CH=CHCH_3$		8.92	EM	829	3380
$C_5H_{10}^+$	*trans*–$C_2H_5CH=CHCH_3$		9.06	EI		62

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_5H_{10}^+$	$(CH_3)_2CHCH=CH_2$		9.51±0.03	PI	889	182
$C_5H_{10}^+$	$(CH_3)_2CHCH=CH_2$		9.52	PE	890	2843
$C_5H_{10}^+$	$(CH_3)_2CHCH=CH_2$		9.52	EM	890	3380
See also – EI:	62					
$C_5H_{10}^+$	$C_2H_5C(CH_3)=CH_2$		9.12±0.02	PI	844	182
$C_5H_{10}^+$	$C_2H_5C(CH_3)=CH_2$		9.12±0.02	PI	844	2877
$C_5H_{10}^+$	$C_2H_5C(CH_3)=CH_2$		9.12	EM	844	3380
See also – EI:	62					
$C_5H_{10}^+$	$(CH_3)_2C=CHCH_3$		8.67±0.02	PI	794	182
$C_5H_{10}^+$	$(CH_3)_2C=CHCH_3$		8.68	PI	795	168
$C_5H_{10}^+$	$(CH_3)_2C=CHCH_3$		8.70	EM	797	3380
$C_5H_{10}^+$	$(CH_3)_2C=CHCH_3$		8.85±0.04	RPD		2410
See also – S: EI:	3353 62					
$C_5H_{10}^+$	$C_3H_5C_2H_5$ (Ethylcyclopropane)		9.50	EM		3380
$C_5H_{10}^+$	$C_3H_4(CH_3)_2$ (1,1–Dimethylcyclopropane)		9.08	EM		3380
$C_5H_{10}^+$	$C_3H_4(CH_3)_2$ (1,1–Dimethylcyclopropane)		9.76±0.02	EI		1146
$C_5H_{10}^+$	$C_3H_4(CH_3)_2$ (*cis*–1,2–Dimethylcyclopropane)		9.76±0.02	EI		1146
$C_5H_{10}^+$	$C_3H_4(CH_3)_2$ (*trans*–1,2–Dimethylcyclopropane)		9.73±0.02	EI		1146
$C_5H_{10}^+$	C_5H_{10} (Cyclopentane)		10.53±0.05	PI	939	182
$C_5H_{10}^+$	C_5H_{10} (Cyclopentane)		10.49	PE	935	2843
$C_5H_{10}^+$	C_5H_{10} (Cyclopentane)		10.50±0.01	PE	936	3158
$C_5H_{10}^+$	C_5H_{10} (Cyclopentane)		10.49	EM	935	3380
See also – EI:	123					

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_5H_{10}^+$	$n-C_6H_{14}$	CH_4	11.005±0.055	PI		1120
(Threshold value approximately corrected to 0 K)						
$C_5H_{10}^+$	$iso-C_6H_{14}$	CH_4	10.835±0.025	PI		1120
(Threshold value approximately corrected to 0 K)						
$C_5H_{10}^+$	$(C_2H_5)_2CHCH_3$	CH_4	10.70±0.055	PI		1120
(Threshold value approximately corrected to 0 K)						
$C_5H_{10}^+$	$C_2H_5C(CH_3)_3$	CH_4	10.28±0.02	PI		1120
(Threshold value approximately corrected to 0 K)						
$C_5H_{10}^+$	$(CH_3)_2CHCH(CH_3)_2$	CH_4	10.54±0.03	PI		1120
(Threshold value approximately corrected to 0 K)						
$C_5H_{10}^+$	$n-C_7H_{16}$	C_2H_6	11.035±0.025	PI		1120
(Threshold value approximately corrected to 0 K)						
$C_5H_{10}^+$	$n-C_7H_{16}$	C_2H_6	10.40±0.05	PI		2013
$C_5H_{10}^+$	$n-C_7H_{16}$	C_2H_6	10.33	RPD		2999
$C_5H_{10}^+$	$C_6H_{10}(CH_3)_2$ (*cis*–1,2–Dimethylcyclohexane)		11.62±0.08	EI		1145
$C_5H_{10}^+$	$C_6H_{10}(CH_3)_2$ (*trans*–1,2–Dimethylcyclohexane)		11.60±0.07	EI		1145
$C_5H_{10}^+$	$n-C_8H_{18}$	C_3H_8	11.08±0.03	PI		1120
(Threshold value approximately corrected to 0 K)						
$C_5H_{10}^+$	$cis-(CH_3)_3CCH{=}CHC(CH_3)_3$		9.15±0.06	EI		2533
$C_5H_{10}^+$	$trans-(CH_3)_3CCH{=}CHC(CH_3)_3$		9.60±0.05	EI		2533
$C_5H_{10}^+$	$n-C_5H_{11}F$	HF	10.07	EI		2029
$C_5H_{10}^+$	$n-C_5H_{11}Cl$	HCl	10.63	EI		2029
		$C_5H_{11}^+$				
$C_5H_{11}^+$	$n-C_3H_7CHCH_3$		7.73±0.1	EI		151
$C_5H_{11}^+$	$(C_2H_5)_2CH$		7.86±0.05	EI		151
$C_5H_{11}^+$	$C_2H_5C(CH_3)_2$		7.12±0.1	EI		151
$C_5H_{11}^+$	$neo-C_5H_{11}$		8.33±0.1	EI		151
$C_5H_{11}^+$	$n-C_6H_{14}$	CH_3	11.045±0.085	PI		1120
(Threshold value approximately corrected to 0 K)						
$C_5H_{11}^+$	$iso-C_6H_{14}$	CH_3	10.865±0.085	PI		1120
(Threshold value approximately corrected to 0 K)						
$C_5H_{11}^+$	$(C_2H_5)_2CHCH_3$	CH_3	10.86±0.085	PI		1120
(Threshold value approximately corrected to 0 K)						
$C_5H_{11}^+$	$C_2H_5C(CH_3)_3$	CH_3	10.555±0.045	PI		1120
(Threshold value approximately corrected to 0 K)						
$C_5H_{11}^+$	$(CH_3)_2CHCH(CH_3)_2$	CH_3	10.72±0.085	PI		1120
(Threshold value approximately corrected to 0 K)						
$C_5H_{11}^+$	$n-C_7H_{16}$	C_2H_5	10.96±0.085	PI		1120
(Threshold value approximately corrected to 0 K)						
$C_5H_{11}^+$	$n-C_7H_{16}$	C_2H_5	10.43±0.05	PI		2013
$C_5H_{11}^+$	$n-C_7H_{16}$	C_2H_5	10.66	RPD		2977

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_5H_{11}^+$	n-C_8H_{18}	C_3H_7	11.22±0.085	PI		1120
(Threshold value approximately corrected to 0 K)						
$C_5H_{11}^+$	n-C_8H_{18}	C_3H_7	11.03	RPD		2977
$C_5H_{11}^+$	n-C_9H_{20}	C_4H_9	11.10	RPD		2977
$C_5H_{11}^+$	n-$C_5H_{11}COCH_3$		11.16	EI		2977
$C_5H_{11}^+$	n-$C_5H_{11}COC_2H_5$		11.5±0.3	EI		2740
$C_5H_{11}^+$	n-$C_5H_{11}OOH$		11.3±0.1	EI		2464
$C_5H_{11}^+$	n-$C_3H_7CH(OOH)CH_3$		10.7±0.1	EI		2464
$C_5H_{11}^+$	$(C_2H_5)_2CHOOH$		10.9±0.1	EI		2464

n-$C_5H_{12}^+$ $\Delta H^\circ_{f298} = 853$ kJ mol^{-1} (204 kcal mol^{-1})
iso-$C_5H_{12}^+$ $\Delta H^\circ_{f298} = 841$ kJ mol^{-1} (201 kcal mol^{-1})
neo-$C_5H_{12}^+$ $\Delta H^\circ_{f298} \leq 835$ kJ mol^{-1} (200 kcal mol^{-1})

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_5H_{12}^+$	n-C_5H_{12}		10.35	PI	852	182
$C_5H_{12}^+$	n-C_5H_{12}		10.37	PE	854	2843

See also – PE: 3060

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_5H_{12}^+$	iso-C_5H_{12}		10.32	PI	841	182
$C_5H_{12}^+$	iso-C_5H_{12}		10.32	PE	841	2843

See also – EI: 62

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_5H_{12}^+$	neo-C_5H_{12}		10.35	PI	833	182
$C_5H_{12}^+$	neo-C_5H_{12}		10.40	PE	837	2843

The ionization potential is probably not adiabatic. The parent ion is not observed in electron impact mass spectra.

C_6H^+

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
C_6H^+	C_6H_6 (Benzene)		29±2	RPD		2520
C_6H^+	$C_6H_5SCH_3$ (Methylthiobenzene)		14.4	EI		307

$C_6H_2^+$

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_6H_2^+$	C_6H_2		9.8±0.1	EI		87
(Fragment from electron impact induced decomposition of benzene)						

See also – EI: 2635

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
			$C_6H_3^+$			
$C_6H_3^+$	$C_2H_5C{\equiv}CC{\equiv}CH$	H_2+H	17.92	EI		1197
$C_6H_3^+$	$CH_3C{\equiv}CC{\equiv}CCH_3$	H_2+H	17.99	EI		1197
$C_6H_3^+$	$C_{10}H_8$ (Naphthalene)		20.77±0.01	EI		2112
$C_6H_3^+$	$C_{10}H_8$ (Azulene)		19.2±0.15	EI		2112
$C_6H_3^+$	C_6H_5SH (Mercaptobenzene)		20.6±0.3	EI		3286
$C_6H_3^+$	C_6H_4FCl (1–Chloro–2–fluorobenzene)		16.67	EI		1185
$C_6H_3^+$	C_6H_4FCl (1–Chloro–3–fluorobenzene)		16.78	EI		1185
$C_6H_3^+$	C_6H_4FCl (1–Chloro–4–fluorobenzene)		16.81	EI		1185
			$C_6H_4^+$			
$C_6H_4^+$	$CH{\equiv}CCH{=}CHC{\equiv}CH$		9.60±0.2	RPD		2492
$C_6H_4^+$	C_6H_4 (Benzyne)		9.45±0.2	RPD		2492
See also – EI:	29, 87, 2635					
$C_6H_4^+$	$CH{\equiv}CCH{=}CHCH{=}CH_2$	H_2	13.72	EI		1197
$C_6H_4^+$	$C_2H_5C{\equiv}CC{\equiv}CH$	H_2	11.07	EI		1197
$C_6H_4^+$	$CH_3C{\equiv}CCH_2C{\equiv}CH$	H_2	11.02	EI		1197
$C_6H_4^+$	$CH_3C{\equiv}CC{\equiv}CCH_3$	H_2	11.35	EI		1197
$C_6H_4^+$	$CH{\equiv}CCH_2CH_2C{\equiv}CH$	H_2	11.17	EI		1197
$C_6H_4^+$	C_6H_6 (Benzene)	H_2	14.2±0.2	RPD		2520
$C_6H_4^+$	C_6H_6 (Benzene)	H_2	14.09±0.07	EI		1238
See also – EI:	1197, 2103					

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_6H_4^+$	$C_{10}H_8$ (Naphthalene)		18.2±0.15	EI		2112
$C_6H_4^+$	$C_{10}H_8$ (Azulene)		16.7±0.15	EI		2112
$C_6H_4^+$	$(C_6H_5)_2$ (Biphenyl)		18.05±0.3	EI		1238
$C_6H_4^+$	$C_{14}H_{10}$ (Phenanthrene)		29±1	RPD		2540
$C_6H_4^+$	C_6H_5CN (Benzoic acid nitrile)	HCN	14.60	EI		3238
See also – EI:	2420, 2972					
$C_6H_4^+$	$C_{10}H_6O_2$ (1,4–Naphthoquinone)		15.70±0.2	RPD		2492
$C_6H_4^+$	$C_8H_4O_3$ (1,2–Benzenedicarboxylic acid anhydride)		13.24±0.2	RPD		2492
$C_6H_4^+$	$C_6H_4(COOCH_3)_2$ (1,2–Benzenedicarboxylic acid dimethyl ester)		14.73±0.2	RPD		2492
$C_6H_4^+$	C_6H_5F (Fluorobenzene)	HF	15.37±0.1	EI		2103
$C_6H_4^+$	C_6H_5SH (Mercaptobenzene)		17.2±0.3	EI		3286
$C_6H_4^+$	C_6H_5Cl (Chlorobenzene)	HCl	14.87±0.2	EI		2103
$C_6H_4^+$	C_6H_5Br (Bromobenzene)	HBr	14.20±0.2	EI		2103
$C_6H_4^+$	$C_6H_4I_2$ (1,2–Diiodobenzene)		13.61±0.2	RPD		2492
$C_6H_4^+$	$C_6H_4I_2$ (1,3–Diiodobenzene)		13.40±0.2	RPD		2492
$C_6H_4^+$	$C_6H_4I_2$ (1,4–Diiodobenzene)		13.83±0.2	RPD		2492

$C_6H_2D_2^+$

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_6H_2D_2^+$	$C_6H_2D_3NC$ (Isocyanobenzene–*2,4,6–d_3*)		13.6±0.6	EI		2919

$C_6HD_3^+$

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_6HD_3^+$	$C_6H_2D_3NC$ (Isocyanobenzene–*2,4,6–d_3*)		13.6±0.6	EI		2919

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
			$C_6H_5^+$			
$C_6H_5^+$	C_6H_5 (Phenyl radical)		9.20	EI	*(1188)*	1079
See also – EI:	87, 2635					
$C_6H_5^+$	$CH{\equiv}CCH{=}CHCH{=}CH_2$	H	13.52	EI		1197
$C_6H_5^+$	$C_2H_5C{\equiv}CC{\equiv}CH$	H	11.50	EI		1197
$C_6H_5^+$	$CH_3C{\equiv}CCH_2C{\equiv}CH$	H	11.50	EI		1197
$C_6H_5^+$	$CH_3C{\equiv}CC{\equiv}CCH_3$	H	11.57	EI		1197
$C_6H_5^+$	$CH{\equiv}CCH_2CH_2C{\equiv}CH$	H	11.47	EI		1197
$C_6H_5^+$	C_6H_6 (Benzene)	H	13.80±0.03	PI	(1196)	3212
$C_6H_5^+$	C_6H_6 (Benzene)	H	13.8±0.1	PI	(~1196)	2013
$C_6H_5^+$	C_6H_6 (Benzene)	H	14.1±0.1	RPD		2520
See also – PI: EI:	3025 301, 1197, 1238, 2103, 2538, 3344					
$C_6H_5^+$	$CH_2{=}CHCH{=}CHCH{=}CH_2$	H_2+H	13.11±0.10	EI		2751
$C_6H_5^+$	$C_2H_5CH{=}CHC{\equiv}CH$	H_2+H	12.7	EI		3335
$C_6H_5^+$	$CH_3CH{=}C(CH_3)C{\equiv}CH$	H_2+H	12.7	EI		3335
$C_6H_5^+$	$C_5H_5CH_3$ (Methylcyclopentadiene)	H_2+H	14.0	EI		3335
$C_6H_5^+$	C_6H_8 (1,3–Cyclohexadiene)	H_2+H	13.92±0.10	EI		2751
$C_6H_5^+$	C_6H_8 (1,4–Cyclohexadiene)	H_2+H	13.92±0.10	EI		2751
$C_6H_5^+$	$C_6H_5CH_3$ (Toluene)	CH_3	13.7±0.1	EI		301, 3344
$C_6H_5^+$	C_7H_{10} (Bicyclo[2.2.1]hept–2–ene)		13.8±0.3	EI		2155
$C_6H_5^+$	$C_6H_5CH{=}CH_2$ (Ethenylbenzene)	C_2H_2+H	16.02±0.10	EI		2914
$C_6H_5^+$	C_8H_8 (Cyclooctatetraene)	C_2H_2+H	14.58±0.10	EI		2914
$C_6H_5^+$	C_8H_8 (Cyclobutenobenzene)	C_2H_2+H	15.58±0.10	EI		2914
$C_6H_5^+$	C_8H_8 (Bicyclo[2.2.2]octatriene)	C_2H_2+H	14.49±0.10	EI		2914
$C_6H_5^+$	C_8H_8 (*syn*–Tricyclo[4.2.0.0^{2,5}]octa–3,7–diene)	C_2H_2+H	12.41±0.10	EI		2914
$C_6H_5^+$	C_8H_8 (*anti*–Tricyclo[4.2.0.0^{2,5}]octa–3,7–diene)	C_2H_2+H	12.59±0.10	EI		2914
$C_6H_5^+$	C_8H_8 (Cubane)	C_2H_2+H	10.93±0.10	EI		2914
See also – EI:	2105					

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_6H_5^+$	$(CH_3)_2C{=}CHCH{=}C(CH_3)_2$		16.05±0.1	EI		2455
$C_6H_5^+$	$C_{10}H_8$ (Naphthalene)		18.45±0.05	EI		2112
$C_6H_5^+$	$C_{10}H_8$ (Azulene)		16.9±0.10	EI		2112
$C_6H_5^+$	$(C_6H_5)_2$ (Biphenyl)		18.2±0.5	EI		1238
$C_6H_5^+$	$C_6H_5C{\equiv}CC_6H_5$ (Diphenylacetylene)		20.7±0.1	EI		1238
$C_6H_5^+$	$C_6H_5N(CH_3)_2$ (*N*,*N*–Dimethylaniline)		15.7±0.1	EI		303, 3344
$C_6H_5^+$	C_6H_5CHO (Benzenecarbonal)	CHO?	13.51±0.12	EI		130
See also – EI:	308, 1237					
$C_6H_5^+$	$C_6H_5OC{\equiv}CH$ (Phenoxyacetylene)		12.2±0.1	EI		13
$C_6H_5^+$	$C_6H_5COCH_3$ (Acetophenone)		13.42±0.07	EI		2174
See also – EI:	308, 1237, 3344					
$C_6H_5^+$	$C_6H_5CH_2COCH_3$ (Benzyl methyl ketone)		13.66±0.02	EI		2174
$C_6H_5^+$	$(C_6H_5)_2O$ (Diphenyl ether)		14.85±0.05	EI		1237
$C_6H_5^+$	$(C_6H_5)_2CO$ (Benzophenone)		16.22±0.07	EI		1237
$C_6H_5^+$	$C_6H_5COOC_6H_5$ (Benzoic acid phenyl ester)		15.46±0.05	EI		1237
$C_6H_5^+$	$C_6H_5COCOC_6H_5$ (Diphenylglyoxal)		15.12±0.2	EI		1237
$C_6H_5^+$	$(C_6H_5O)_2CO$ (Carbonic acid diphenyl ester)		12.1±0.1	EI		1237
$C_6H_5^+$	$C_6H_5CONH_2$ (Benzoic acid amide)		13.5±0.1	EI		1168
$C_6H_5^+$	$C_6H_5COCHN_2$ (α–Diazoacetophenone)		14.07±0.14	EI		2174
$C_6H_5^+$	$C_6H_5NO_2$ (Nitrobenzene)		12.16	EI		3238
$C_6H_5^+$	C_6H_5F (Fluorobenzene)	F?	14.5±0.1	EI		301, 3344
See also – EI:	2103					
$C_6H_5^+$	$C_6H_5CF_3$ (α,α,α–Trifluorotoluene)		15.2±0.1	EI		301
See also – EI:	3344					
$C_6H_5^+$	$C_6H_5COCF_3$ (α,α,α–Trifluoroacetophenone)		12.0	EI		308

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_6H_5^+$	C_6H_5SH (Mercaptobenzene)	SH	14.7±0.3	EI		3286
$C_6H_5^+$	C_6H_5SD (Mercapto-d_1-benzene)	SD	13.3±0.2	EI		1039
$C_6H_5^+$	$C_2H_5SCH{=}CHC{\equiv}CH$		12.6±0.3	EI		2949
$C_6H_5^+$	C_6H_5Cl (Chlorobenzene)	Cl?	12.55±0.07	PI	(1141)	3212
$C_6H_5^+$	C_6H_5Cl (Chlorobenzene)	Cl?	13.2±0.1	EI		301, 3344

See also - EI: 2103, 2972, 3230, 3238

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_6H_5^+$	C_7H_9Cl (*endo*-5-Chlorobicyclo[2.2.1]hept-2-ene)		13.0±0.3	EI		2155
$C_6H_5^+$	C_7H_9Cl (*exo*-5-Chlorobicyclo[2.2.1]hept-2-ene)		13.0±0.3	EI		2155
$C_6H_5^+$	C_7H_9Cl (3-Chloronortricyclene)		12.7±0.3	EI		2155
$C_6H_5^+$	C_6H_5Br (Bromobenzene)	Br?	11.75±0.05	PI	(1127)	3212
$C_6H_5^+$	C_6H_5Br (Bromobenzene)	Br?	12.02	EI		3238

See also - EI: 301, 2103, 3230, 3344

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_6H_5^+$	C_6H_5I (Iodobenzene)	I?	11.06±0.04	PI	(1123)	3212
$C_6H_5^+$	C_6H_5I (Iodobenzene)	I?	11.46	EI		3238

See also - EI: 2103, 3230, 3238

The heat of formation of phenyl ion is very uncertain. Taking $D(C_6H_5{-}H) = 435$ kJ mol^{-1} (J. A. Kerr, Chem. Rev. **66**, 465 (1966)), the direct electron impact ionization of phenyl radical leads to a heat of formation of about 1188 kJ mol^{-1}, close to that from the photoionization of benzene. However, none of the photoionization thresholds have been corrected for kinetic shifts which may amount to roughly 50 kJ mol^{-1}. Further, the low thresholds of the halobenzenes may be due in part to ion-pair processes. Taking into consideration that the radical ionization potential determined by electron impact is probably too high by as much as 0.5 eV, we suggest a value for $\Delta H^\circ_{f298}(C_6H_5^+)$ of about 1140 kJ mol^{-1} (272 kcal mol^{-1}).

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
	$C_6H_6^+$ (Benzene)	**ΔH°_{f298} = 975 kJ mol^{-1} (233 kcal mol^{-1})**				
$C_6H_6^+$	$CH_2{=}CHC{\equiv}CCH{=}CH_2$		~10.5	S		3010
$C_6H_6^+$	$CH{\equiv}CCH{=}CHCH{=}CH_2$		9.50	EI		1197
$C_6H_6^+$	$C_2H_5C{\equiv}CC{\equiv}CH$		9.25	EI		1197
$C_6H_6^+$	$CH_3C{\equiv}CCH_2C{\equiv}CH$		9.75	EI		1197
$C_6H_6^+$	$CH_3C{\equiv}CC{\equiv}CCH_3$		9.20	EI		1197
$C_6H_6^{+*}$	$CH_3C{\equiv}CC{\equiv}CCH_3$		11.51±0.02	S		3152
$C_6H_6^+$	$CH{\equiv}CCH_2CH_2C{\equiv}CH$		10.35	EI		1197
$C_6H_6^+$	$C_4H_2({=}CH_2)_2$ (3,4–Dimethylenecyclobutene)		8.80	PE		3292
$C_6H_6^+$	$C_5H_4{=}CH_2$ (5–Methylenecyclopentadiene)		8.36	PE		3292
$C_6H_6^+(^2E_{1g})$	C_6H_6 (Benzene)		9.247±0.002	S	975	422, 423, 3376
(Average of four Rydberg series limits)						
$C_6H_6^+(^2E_{1g})$	C_6H_6 (Benzene)		9.242±0.005	S		344, 1114
(Average of two Rydberg series limits)						
$C_6H_6^+(^2E_{1g})$	C_6H_6 (Benzene)		9.248	S		1115
$C_6H_6^+(^2E_{2g})$	C_6H_6 (Benzene)		11.489	S		1115
See also – S:	344, 1114					
$C_6H_6^+(^2A_{1g})$	C_6H_6 (Benzene)		16.84	S		1115
$C_6H_6^+(^2E_{1g})$	C_6H_6 (Benzene)		9.241±0.001	PE		3080
$C_6H_6^+(^2E_{1g})$	C_6H_6 (Benzene)		9.24	PE		2806
$C_6H_6^+(^2E_{1g})$	C_6H_6 (Benzene)		9.25±0.02	PE		2838
$C_6H_6^+(^2E_{1g})$	C_6H_6 (Benzene)		9.24±0.01	PE		2843, 2844, 2942
$C_6H_6^+(^2E_{1g})$	C_6H_6 (Benzene)		9.25	PE		1130
$C_6H_6^+(^2E_{2g})$	C_6H_6 (Benzene)		11.490	PE		3080
$C_6H_6^+(^2E_{2g})$	C_6H_6 (Benzene)		11.48	PE		2806
$C_6H_6^+(^2E_{2g})$	C_6H_6 (Benzene)		11.51±0.04	PE		2838
$C_6H_6^+(^2E_{2g})$	C_6H_6 (Benzene)		11.50	PE		2843, 2844, 2942
$C_6H_6^+(^2E_{2g})$	C_6H_6 (Benzene)		11.49	PE		1130

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_6H_6^+(^2A_{2u})$	C_6H_6 (Benzene)		12.24 (V)	PE		2806
$C_6H_6^+(^2A_{2u})$	C_6H_6 (Benzene)		12.19?	PE		1130
$C_6H_6^+(^2E_{1u})$	C_6H_6 (Benzene)		13.88±0.04	PE		2838
$C_6H_6^+(^2E_{1u})$	C_6H_6 (Benzene)		13.87	PE		2843, 2844, 2942
$C_6H_6^+(^2E_{1u})$	C_6H_6 (Benzene)		13.67	PE		1130
$C_6H_6^+(^2B_{2u})$	C_6H_6 (Benzene)		14.87±0.06?	PE		2838
$C_6H_6^+(^2B_{2u})$	C_6H_6 (Benzene)		14.44?	PE		1130
$C_6H_6^+(^2B_{1u})$	C_6H_6 (Benzene)		15.4	PE		3080
$C_6H_6^+(^2B_{1u})$	C_6H_6 (Benzene)		15.54±0.06?	PE		2838
$C_6H_6^+(^2B_{1u})$	C_6H_6 (Benzene)		15.46?	PE		2843, 2844, 2942
$C_6H_6^+(^2A_{1g})$	C_6H_6 (Benzene)		16.9	PE		3080
$C_6H_6^+(^2A_{1g})$	C_6H_6 (Benzene)		16.83	PE		2806
$C_6H_6^+(^2A_{1g})$	C_6H_6 (Benzene)		16.84±0.05	PE		2838
$C_6H_6^+(^2A_{1g})$	C_6H_6 (Benzene)		16.84	PE		2843, 2844, 2942
$C_6H_6^+(^2A_{1g})$	C_6H_6 (Benzene)		16.73	PE		1130
$C_6H_6^+(^2E_{2g})$	C_6H_6 (Benzene)		18.22±0.08	PE		2838
$C_6H_6^+(^2E_{2g})$	C_6H_6 (Benzene)		18.43?	PE		2843, 2844, 2942
$C_6H_6^+(^2E_{2g})$	C_6H_6 (Benzene)		18.75	PE		1130
$C_6H_6^+(^2E_{2g})$	C_6H_6 (Benzene)		19.0 (V)	PE		3081

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_6H_6^+(^2E_{1u})$	C_6H_6 (Benzene)		22.5 (V)	PE		3081
$C_6H_6^+(^2A_{1g})$	C_6H_6 (Benzene)		28.8 (V)	PE		3081

The photoelectron spectrum of benzene has been the subject of much debate concerning both the form of the spectrum and the assignment of orbitals, see the discussion and references in S. D. Worley, Chem. Rev. **71**, 294 (1971). We have based our assignments on the independent work of B. Jonsson and E. Lindholm, Arkiv Fysik **39**, 65 (1969), R. M. Stevens, E. Switkes, E. A. Laws and W. N. Lipscomb, J. Am. Chem. Soc. **93**, 2603 (1971) and refs. 3080, 3081. The best published photoelectron spectra are to be found in refs. 2806, 3080, 3081.

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_6H_6^+(^2E_{1g})$	C_6H_6 (Benzene)		9.246±0.005	PI		2013
$C_6H_6^+(^2E_{1g})$	C_6H_6 (Benzene)		9.241±0.006	PI		1253
$C_6H_6^+(^2E_{1g})$	C_6H_6 (Benzene)		9.242±0.01	PI		54, 1118
$C_6H_6^+(^2E_{1g})$	C_6H_6 (Benzene)		9.245±0.01	PI		158, 182, 416
$C_6H_6^+(^2E_{1g})$	C_6H_6 (Benzene)		9.24±0.01	PI		3212
$C_6H_6^+(^2E_{1g})$	C_6H_6 (Benzene)		9.25±0.01	PI		2682
$C_6H_6^+(^2E_{1g})$	C_6H_6 (Benzene)		9.25±0.01	PI		2877
$C_6H_6^+(^2E_{1g})$	C_6H_6 (Benzene)		9.241	RPI		2773
$C_6H_6^+(^2E_{1g})$	C_6H_6 (Benzene)		9.26±0.02	RPD		2538
$C_6H_6^+(^2E_{1g})$	C_6H_6 (Benzene)		9.20±0.04	RPD		2407
$C_6H_6^+(^2E_{1g})$	C_6H_6 (Benzene)		9.36±0.05	RPD		3223

The RPI study of ref. 2773 also shows evidence of a state at 10.388±0.003 eV. This has been observed in some photoelectron spectra and not in others. It is probably due to autoionization, see ref. 2890.

See also – S: 2666, 3153
PI: 54, 190, 1142, 1159, 1160, 1166, 2612, 3025
PE: 1159, 2015, 2822, 2829, 2890, 3109, 3331
PEN: 2430, 2466
EI: 218, 301, 381, 383, 413, 1066, 1079, 1132, 1197, 1238, 2158, 2163, 2458, 2463, 2498, 2530, 2718, 2752, 2865, 2868, 2981, 2989, 3157, 3174
CTS: 1064, 2562, 2947

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_6H_6^+$	$CH_2=CHCH=CHCH=CH_2$	H_2	10.77±0.10	RPD		2751
$C_6H_6^+$	C_6H_8 (1,3–Cyclohexadiene)	H_2	10.12±0.10	RPD		2751
$C_6H_6^+$	C_6H_8 (1,3–Cyclohexadiene)	H_2	9.88±0.10	EI		2751
$C_6H_6^+$	C_6H_8 (1,4–Cyclohexadiene)	H_2	9.86±0.05	RPD		2751
$C_6H_6^+$	C_6H_8 (1,4–Cyclohexadiene)	H_2	9.61±0.10	EI		2751
$C_6H_6^+$	$C_6H_5CH=CH_2$ (Ethenylbenzene)	C_2H_2	12.38±0.05	RPD		2914
(0.28 eV average translational energy of decomposition at threshold)						
$C_6H_6^+$	$C_6H_5CH=CH_2$ (Ethenylbenzene)	C_2H_2	12.30±0.10	EI		2914
$C_6H_6^+$	C_8H_8 (Cyclooctatetraene)	C_2H_2	9.70±0.12	RPD		2914
(0.07 eV average translational energy of decomposition at threshold)						
$C_6H_6^+$	C_8H_8 (Cyclobutenobenzene)	C_2H_2	11.55±0.10	EI		2914
(0.30 eV average translational energy of decomposition at threshold)						
$C_6H_6^+$	C_8H_8 (Bicyclo[2.2.2]octatriene)	C_2H_2	10.50±0.10	EI		2914
$C_6H_6^+$	C_8H_8 (*syn*–Tricyclo[4.2.0.0^{2,5}]octa–3,7–diene)	C_2H_2	9.09±0.10	EI		2914
(0.29 eV average translational energy of decomposition at threshold)						
$C_6H_6^+$	C_8H_8 (*anti*–Tricyclo[4.2.0.0^{2,5}]octa–3,7–diene)	C_2H_2	9.01±0.10	EI		2914
(0.29 eV average translational energy of decomposition at threshold)						
$C_6H_6^+$	C_8H_8 (Cubane)	C_2H_2	9.00±0.10	EI		2914
See also – EI:	2105					
$C_6H_6^+$	$C_6H_5C_2H_5$ (Ethylbenzene)	C_2H_4?	11.0±0.1	PI		2612
$C_6H_6^+$	$C_{10}H_8$ (Naphthalene)		15.20±0.05	EI		2112
$C_6H_6^+$	$C_{10}H_8$ (Azulene)		13.86±0.05	EI		2112
$C_6H_6^+$	$C_6H_5OCH_3$ (Methoxybenzene)		11.30	EI		3238
$C_6H_6^+$	C_6H_5SH (Mercaptobenzene)		14.6±0.3	EI		3286
$C_6H_6^+$	$C_6H_5SCH_3$ (Methylthiobenzene)		12.0	EI		307
$C_6H_6^+$	$(C_6H_6)_2Cr$ (Bis(benzene)chromium)		10.1	EI		2981

$C_6H_5D^+$

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_6H_5D^+$	C_6H_5D (Benzene–d_1)		9.44	EI		413

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_6D_6^+$				
$C_6D_6^+(^2E_{1g})$	C_6D_6 (Benzene–d_6)		9.251±0.002	S		422, 423, 3376
(Average of four Rydberg series limits)						
$C_6D_6^+(^2E_{1g})$	C_6D_6 (Benzene–d_6)		9.246±0.005	S		1114
(Based upon the Rydberg series limit for benzene and an average isotopic shift of 33 cm^{-1})						
$C_6D_6^+(^2E_{1g})$	C_6D_6 (Benzene–d_6)		9.251	S		1115
$C_6D_6^+(^2E_{1g})$	C_6D_6 (Benzene–d_6)		9.245±0.01	PI		54, 1118
$C_6D_6^+(^2E_{2g})$	C_6D_6 (Benzene–d_6)		11.520	S		1115
$C_6D_6^+(^2A_{1g})$	C_6D_6 (Benzene–d_6)		16.87	S		1115
See also – PE: 3080						
		$C_6H_6^{+2}$				
$C_6H_6^{+2}$	C_6H_6 (Benzene)		≤26.1±0.8 (V)	AUG		3424
		$C_6H_5D^{+2}$				
$C_6H_5D^{+2}$	C_6H_5D (Benzene–d_1)		26.0±0.2	FD		212
		$C_6H_5D^{+3}$				
$C_6H_5D^{+3}$	C_6H_5D (Benzene–d_1)		44±5	NRE		212
		$C_6H_7^+$				
$C_6H_7^+$	$C_5H_4CH_3$ (Methylcyclopentadienyl radical)		8.54	EI		126
$C_6H_7^+$	$CH_2{=}CHCH{=}CHCH{=}CH_2$	H	9.96±0.15	EI		2751
$C_6H_7^+$	$C_2H_5CH{=}CHC{\equiv}CH$	H	10.7	EI		3335
$C_6H_7^+$	$CH_3CH{=}C(CH_3)C{\equiv}CH$	H	10.7	EI		3335
$C_6H_7^+$	$C_5H_5CH_3$ (Methylcyclopentadiene)	H	11.3	EI		3335
$C_6H_7^+$	C_6H_8 (1,3–Cyclohexadiene)	H	10.82±0.10	EI		2751
See also – EI: 3192, 3335, 3339						

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_6H_7^+$	C_6H_8 (1,4–Cyclohexadiene)	H	10.94±0.10	EI		2751
See also – EI:	3339					
$C_6H_7^+$	$CH_3CH{=}CHCH{=}CHCH_3$	H_2+H	13.42±0.02	EI		2455
$C_6H_7^+$	$C_5H_8{=}CH_2$ (Methylenecyclopentane)	H_2+H	11.66±0.16	EDD		2738
$C_6H_7^+$	$C_5H_7CH_3$ (1–Methylcyclopentene)	H_2+H	12.40±0.17	EDD		2738
$C_6H_7^+$	$C_5H_7CH_3$ (3–Methylcyclopentene)	H_2+H	11.75±0.04	EDD		2738
$C_6H_7^+$	C_6H_{10} (Cyclohexene)	H_2+H	12.13±0.10	EDD		2738
$C_6H_7^+$	$(C_3H_5)_2$ (Bicyclopropyl)	H_2+H	10.97±0.19	EDD		2738
$C_6H_7^+$	C_6H_{10} (Bicyclo[3.1.0]hexane)	H_2+H	11.60±0.15	EDD		2738
$C_6H_7^+$	$C_5H_4(CH_3)_2$ (1,2–Dimethylcyclopentadiene)	CH_3	10.7	EI		3335
$C_6H_7^+$	$C_5H_4(CH_3)_2$ (5,5–Dimethylcyclopentadiene)	CH_3	10.75	EI		3335
$C_6H_7^+$	$C_6H_7CH_3$ (1–Methyl–1,3–cyclohexadiene)	CH_3	10.67	EI		3339
$C_6H_7^+$	$C_6H_7CH_3$ (5–Methyl–1,3–cyclohexadiene)	CH_3	10.6	EI		3335
See also – EI:	3192					
$C_6H_7^+$	$C_6H_7CH_3$ (1–Methyl–1,4–cyclohexadiene)	CH_3	10.61	EI		3335
$C_6H_7^+$	C_7H_{10} (1,3–Cycloheptadiene)	CH_3	10.1	EI		3335
$C_6H_7^+$	C_7H_{10} (Bicyclo[2.2.1]hept–2–ene)	CH_3	11.2±0.15	EI		2155
$C_6H_7^+$	C_7H_{10} (Bicyclo[3.2.0]hept–6–ene)	CH_3	9.8	EI		3335
$C_6H_7^+$	$(CH_3)_2C{=}CHCH{=}C(CH_3)_2$		14.42±0.05	EI		2455
$C_6H_7^+$	$C_6H_4(CH_3)C_2H_5$ (1–Ethyl–4–methylbenzene)		15.3	EI		3335
$C_6H_7^+$	$C_6H_5CH_2OH$ (α–Hydroxytoluene)	CHO?	10.9	EI		3335
$C_6H_7^+$	$C_6H_5OCH_3$ (Methoxybenzene)	CO+H?	12.1	EI		3335
$C_6H_7^+$	$C_6H_4(OCH_3)CH_3$ (3–Methoxytoluene)		12.9	EI		3335
$C_6H_7^+$	$C_6H_4(OCH_3)CH_3$ (4–Methoxytoluene)		12.9	EI		3335
$C_6H_7^+$	$C_7H_7OCH_3$ (7–Methoxycycloheptatriene)		11.1	EI		3335
$C_6H_7^+$	C_7H_9Cl (*endo*–5–Chlorobicyclo[2.2.1]hept–2–ene)		10.9±0.15	EI		2155

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_6H_7^+$	C_7H_9Cl (*exo*–5–Chlorobicyclo[2.2.1]hept–2–ene)		10.8±0.15	EI		2155
$C_6H_7^+$	C_7H_9Cl (3–Chloronortricyclene)		10.25±0.15	EI		2155

$C_6H_8^+$(1,3–Cyclohexadiene) $\Delta H^\circ_{f298} = 904$ kJ mol^{-1} (216 kcal mol^{-1})

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_6H_8^+$	$CH_2{=}CHCH{=}CHCH{=}CH_2$		8.27±0.05	S		3010
$C_6H_8^+$	$CH_2{=}CHCH{=}CHCH{=}CH_2$		8.42±0.05	RPD		2751
$C_6H_8^+$	$C_5H_5CH_3$ (1–Methylcyclopentadiene)		8.43±0.05	EI		2163
$C_6H_8^+$	$C_5H_5CH_3$ (2–Methylcyclopentadiene)		8.46±0.05	EI		2163
$C_6H_8^+$	C_6H_8 (1,3–Cyclohexadiene)		8.25±0.03	PI	904	2877
$C_6H_8^+$	C_6H_8 (1,3–Cyclohexadiene)		8.25	PE	904	3330
$C_6H_8^+$	C_6H_8 (1,3–Cyclohexadiene)		8.28±0.05	RPD		2751

See also – EI: 2543

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_6H_8^+$	C_6H_8 (1,4–Cyclohexadiene)		8.82±0.02	PI		2877
$C_6H_8^+$	C_6H_8 (1,4–Cyclohexadiene)		8.80	PE		3327
$C_6H_8^+$	C_6H_8 (1,4–Cyclohexadiene)		8.65±0.05	RPD		2751

See also – EI: 2543

$C_6H_9^+$

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_6H_9^+$	C_6H_9 (3–Cyclohexenyl radical)		7.54	EI		2543
$C_6H_9^+$	C_6H_9 (4–Cyclohexenyl radical)		7.54	EI		2543
$C_6H_9^+$	$CH_3CH{=}CHCH{=}CHCH_3$	H	10.95±0.03	EI		2455
$C_6H_9^+$	$C_5H_8{=}CH_2$ (Methylenecyclopentane)	H	10.20±0.03	EDD		2738
$C_6H_9^+$	$C_5H_7CH_3$ (1–Methylcyclopentene)	H	10.59±0.13	EDD		2738
$C_6H_9^+$	$C_5H_7CH_3$ (3–Methylcyclopentene)	H	10.35±0.17	EDD		2738
$C_6H_9^+$	C_6H_{10} (Cyclohexene)	H	10.62±0.07	EDD		2738
$C_6H_9^+$	$(C_3H_5)_2$ (Bicyclopropyl)	H	9.33±0.15	EDD		2738
$C_6H_9^+$	C_6H_{10} (Bicyclo[3.1.0]hexane)	H	10.20±0.10	EDD		2738

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_6H_9^+$	$C_6H_{10}=CH_2$ (Methylenecyclohexane)	CH_3	10.27±0.08	EDD		2558
$C_6H_9^+$	$C_6H_9CH_3$ (1–Methylcyclohexene)	CH_3	10.27±0.09	EDD		2558
$C_6H_9^+$	$C_6H_9CH_3$ (3–Methylcyclohexene)	CH_3	9.98±0.07	EDD		2558
$C_6H_9^+$	$C_6H_9CH_3$ (4–Methylcyclohexene)	CH_3	10.12±0.10	EDD		2558
$C_6H_9^+$	C_7H_{12} (Bicyclo[2.2.1]heptane)	CH_3	10.17±0.06	EDD		2558
$C_6H_9^+$	C_7H_{12} (Bicyclo[4.1.0]heptane)	CH_3	9.30±0.09	EDD		2558
$C_6H_9^+$	$(CH_3)_2C=CHCH=C(CH_3)_2$		11.68±0.1	EI		2455
$C_6H_9^+$	C_9H_{16} (*cis*–Hexahydroindan)		11.99±0.05	EI		1184, 2028
$C_6H_9^+$	C_9H_{16} (*trans*–Hexahydroindan)		12.07±0.04	EI		1184, 2028

$CH_2=C(CH_3)C(CH_3)=CH_2^+$ $\Delta H^\circ_{f298} = 888$ kJ mol^{-1} (212 kcal mol^{-1})
$C_6H_{10}^+$ (1–Methylcyclopentene) $\Delta H^\circ_{f298} = 819$ kJ mol^{-1} (196 kcal mol^{-1})
$C_6H_{10}^+$ (Cyclohexene) $\Delta H^\circ_{f298} = 858$ kJ mol^{-1} (205 kcal mol^{-1})

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_6H_{10}^+$	$CH_3CH=CHCH=CHCH_3$		8.48±0.05	EI		2455
$C_6H_{10}^+$	$CH_2=C(CH_3)C(CH_3)=CH_2$ (Average of two Rydberg series limits)		8.709	S	888	3352
$C_6H_{10}^+$	$CH\equiv CC(CH_3)_3$		10.31±0.04	RPD		2408
$C_6H_{10}^+$	$C_5H_8=CH_2$ (Methylenecyclopentane)		8.94±0.01	PI		2877
$C_6H_{10}^+$	$C_5H_8=CH_2$ (Methylenecyclopentane)		8.51±0.01	PE		3158
$C_6H_{10}^+$	$C_5H_8=CH_2$ (Methylenecyclopentane)		9.05±0.02	EDD		2738
$C_6H_{10}^+$	$C_5H_7CH_3$ (1–Methylcyclopentene)		8.54±0.01	PE	819	3158
$C_6H_{10}^+$	$C_5H_7CH_3$ (1–Methylcyclopentene)		8.62±0.02	EDD		2738
$C_6H_{10}^+$	$C_5H_7CH_3$ (3–Methylcyclopentene)		8.99±0.04	EDD		2738

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_6H_{10}^+$	C_6H_{10} (Cyclohexene)		8.945±0.01	PI	858	182, 416
$C_6H_{10}^+$	C_6H_{10} (Cyclohexene)		8.945±0.01	PI	858	2877
$C_6H_{10}^+$	C_6H_{10} (*cis*–Cyclohexene)		8.94	PE		3330
$C_6H_{10}^+$	C_6H_{10} (Cyclohexene)		8.92	PE		3343
$C_6H_{10}^+$	C_6H_{10} (Cyclohexene)		8.99	RPD		2999
$C_6H_{10}^+$	C_6H_{10} (Cyclohexene)		8.92±0.02	EDD		2738

See also – S: 3353
PE: 1130, 3327
EI: 411, 3342

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_6H_{10}^+$	$(C_3H_5)_2$ (Bicyclopropyl)		9.04	PE		2951
$C_6H_{10}^+$	$(C_3H_5)_2$ (Bicyclopropyl)		8.80±0.02	EDD		2738
$C_6H_{10}^+$	C_6H_{10} (Bicyclo[3.1.0]hexane)		9.16±0.02	EDD		2738
$C_6H_{10}^+$	$C_6H_{10}(CH_3)_2$ (*cis*–1,2–Dimethylcyclohexane)	C_2H_6	10.62±0.04	EI		1145
$C_6H_{10}^+$	$C_6H_{10}(CH_3)_2$ (*trans*–1,2–Dimethylcyclohexane)	C_2H_6	10.87±0.08	EI		1145
$C_6H_{10}^+$	C_9H_{16} (*cis*–Hexahydroindan)	C_3H_6	10.79±0.03	EI		1184, 2028
$C_6H_{10}^+$	C_9H_{16} (*trans*–Hexahydroindan)	C_3H_6	11.00±0.02	EI		1184, 2028
$C_6H_{10}^+$	$C_{10}H_{18}$ (*cis*–Decalin)		10.89±0.02	EI		1182, 1183, 3337
$C_6H_{10}^+$	$C_{10}H_{18}$ (*trans*–Decalin)		11.29±0.02	EI		1182, 1183, 3337
$C_6H_{10}^+$	*cis*–$(CH_3)_3CCH=CHC(CH_3)_3$	C_4H_{10}	8.52±0.03	EI		2533
$C_6H_{10}^+$	*trans*–$(CH_3)_3CCH=CHC(CH_3)_3$	C_4H_{10}	8.76±0.08	EI		2533
$C_6H_{10}^+$	$C_6H_{11}OH$ (Cyclohexanol)	H_2O	9.47	RPD		2999

See also – EI: 3022

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_6H_{11}^+$				
$C_6H_{11}^+$	C_6H_{11} (Cyclohexyl radical)		7.66±0.05	EI		123
$C_6H_{11}^+$	C_6H_{12} (Cyclohexane)	H	11.66	EI		123
$C_6H_{11}^+$	$C_6H_{11}CH_3$ (Methylcyclohexane)	CH_3	10.95	EI		123
$C_6H_{11}^+$	$C_6H_{10}(CH_3)_2$ (*cis*–1,2–Dimethylcyclohexane)	C_2H_5	11.06±0.02	EI		1145
$C_6H_{11}^+$	$C_6H_{10}(CH_3)_2$ (*trans*–1,2–Dimethylcyclohexane)	C_2H_5	11.27±0.02	EI		1145
$C_6H_{11}^+$	*cis*–$(CH_3)_3CCH{=}CHC(CH_3)_3$		10.28±0.04	EI		2533
$C_6H_{11}^+$	*trans*–$(CH_3)_3CCH{=}CHC(CH_3)_3$		10.68±0.04	EI		2533
	1–$C_6H_{12}^+$	**ΔH°_{f298} = 871 kJ mol^{-1} (208 kcal mol^{-1})**				
	***trans*–3–$C_6H_{12}^+$**	**ΔH°_{f298} = 809 kJ mol^{-1} (193 kcal mol^{-1})**				
	$(CH_3)_2C{=}C(CH_3)_2^+$	**ΔH°_{f298} = 742 kJ mol^{-1} (177 kcal mol^{-1})**				
	$C_6H_{12}^+$ (Cyclohexane)	**ΔH°_{f298} ~ 827 kJ mol^{-1} (198 kcal mol^{-1})**				
$C_6H_{12}^+$	1–C_6H_{12}		9.45±0.02	PI	870	1120
$C_6H_{12}^+$	1–C_6H_{12}		9.46±0.02	PI	871	182
$C_6H_{12}^+$	*trans*–3–C_6H_{12}		8.945±0.01	PI	809	2877
$C_6H_{12}^+$	$(CH_3)_3CCH{=}CH_2$		9.62±0.04	RPD		2410
$C_6H_{12}^+$	$(CH_3)_2C{=}C(CH_3)_2$		8.30	PI	742	168
See also – S:	3353					
$C_6H_{12}^+$	$C_5H_9CH_3$ (Methylcyclopentane)		10.45	EI		123
$C_6H_{12}^+$	C_6H_{12} (Cyclohexane)		9.88±0.02	PI	830	182, 416
$C_6H_{12}^+$	C_6H_{12} (Cyclohexane)		9.79	PE	821	1130
$C_6H_{12}^+$	C_6H_{12} (Cyclohexane)		9.81	PE	823	2843
$C_6H_{12}^+$	C_6H_{12} (Cyclohexane)		9.89	PE	831	3343

The higher ionization potentials given in refs. 1130, 2843, 3327, 3343 are in disaccord.

See also – PE: 3327
EI: 123

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol⁻¹)	Ref.
$C_6H_{12}^+$	n–C_7H_{16}	CH_4	11.145±0.035	PI		1120
(Threshold value approximately corrected to 0 K)						
$C_6H_{12}^+$	$C_6H_{10}(CH_3)_2$ (*cis*–1,2–Dimethylcyclohexane)	C_2H_4	11.17±0.02	EI		1145
$C_6H_{12}^+$	$C_6H_{10}(CH_3)_2$ (*trans*–1,2–Dimethylcyclohexane)	C_2H_4	11.25±0.04	EI		1145
$C_6H_{12}^+$	n–C_8H_{18}	C_2H_6	10.81±0.03	PI		1120
(Threshold value approximately corrected to 0 K)						
$C_6H_{12}^+$	n–C_8H_{18}	C_2H_6	10.29	RPD		2999
$C_6H_{12}^+$	*cis*–$(CH_3)_3CCH{=}CHC(CH_3)_3$	C_4H_8	8.88±0.02	EI		2533
$C_6H_{12}^+$	*trans*–$(CH_3)_3CCH{=}CHC(CH_3)_3$	C_4H_8	9.15±0.06	EI		2533
$C_6H_{12}^+$	n–$C_{12}H_{26}$		10.40	RPD		2999

$C_6H_{13}^+$

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol⁻¹)	Ref.
$C_6H_{13}^+$	n–C_7H_{16}	CH_3	10.925±0.105	PI		1120
(Threshold value approximately corrected to 0 K)						
$C_6H_{13}^+$	n–C_7H_{16}	CH_3	10.7±0.1	PI		2013
$C_6H_{13}^+$	n–C_8H_{18}	C_2H_5	10.91±0.035	PI		1120
(Threshold value approximately corrected to 0 K)						
$C_6H_{13}^+$	n–C_9H_{20}		10.63	RPD		2977
$C_6H_{13}^+$	n–$C_6H_{13}COCH_3$		10.21	RPD		2977
$C_6H_{13}^+$	n–$C_6H_{13}OOH$		10.4±0.1	EI		2464
$C_6H_{13}^+$	n–$C_4H_9CH(OOH)CH_3$		10.0±0.1	EI		2464
$C_6H_{13}^+$	n–$C_3H_7CH(OOH)C_2H_5$		9.9±0.1	EI		2464

n–$C_6H_{14}^+$	**$\Delta H^\circ_{f298} \leq 815$ kJ mol^{-1} (195 kcal mol^{-1})**
iso–**$C_6H_{14}^+$**	**$\Delta H^\circ_{f298} \leq 802$ kJ mol^{-1} (192 kcal mol^{-1})**
$(C_2H_5)_2CHCH_3^+$	**$\Delta H^\circ_{f298} \leq 801$ kJ mol^{-1} (191 kcal mol^{-1})**
$C_2H_5C(CH_3)_3^+$	**$\Delta H^\circ_{f298} \leq 785$ kJ mol^{-1} (188 kcal mol^{-1})**
$(CH_3)_2CHCH(CH_3)_2^+$	**$\Delta H^\circ_{f298} \leq 789$ kJ mol^{-1} (189 kcal mol^{-1})**

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol⁻¹)	Ref.
$C_6H_{14}^+$	n–C_6H_{14}		10.18	PI	815	182
$C_6H_{14}^+$	n–C_6H_{14}		10.27	PE		2843

See also – PE: 3060
EI: 2977

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol⁻¹)	Ref.
$C_6H_{14}^+$	*iso*–C_6H_{14}		10.12	PI	802	182
$C_6H_{14}^+$	$(C_2H_5)_2CHCH_3$		10.08	PI	801	182
$C_6H_{14}^+$	$C_2H_5C(CH_3)_3$		10.06	PI	785	182
$C_6H_{14}^+$	$(CH_3)_2CHCH(CH_3)_2$		10.02	PI	789	182

The ionization potentials may not be adiabatic.

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_7H_5^+$						
$C_7H_5^+$	$(C_6H_5)_2$ (Biphenyl)		20.85±0.2	EI		1238
$C_7H_6^+$						
$C_7H_6^+$	$C_5H_4{=}C{=}CH_2$ (5–Vinylidenecyclopentadiene)		8.88	EI		3296
$C_7H_6^+$	$C_6H_4(OH)C{\equiv}CH$ (2–Ethynylphenol)	CO	11.25	EI		2541
(Metastable transition indicates zero kinetic energy release)						
$C_7H_6^+$	C_8H_6O (Benzofuran)	CO	12.52	EI		2541
(Metastable transition indicates zero kinetic energy release)						
$C_7H_6^+$	$C_9H_6O_2$ (Coumarin)	2CO	13.68	EI		2541
(Metastable transitions indicate ~0.3 eV kinetic energy release)						
$C_7H_7^+$						
$C_7H_7^+$	$C_5H_4CH{=}CH_2$ (Ethenylcyclopentadienyl radical)		8.44	EI		126
$C_7H_7^+$	$C_6H_5CH_2$ (Benzyl radical)		7.63	PI		2632
$C_7H_7^+$	$C_6H_5CH_2$ (Benzyl radical)		≤7.27±0.03	EM	(≤890)	3350
$C_7H_7^+$	$C_6H_5CH_2$ (Benzyl radical)		7.76±0.08	EI		69
$C_7H_7^+$	$C_6H_5CH_2$ (Benzyl radical)		7.45±0.1	D		2612
The disagreement between the PI and EM results is unexplained.						
$C_7H_7^+$	C_7H_7 (Cycloheptatrienyl radical)		6.240±0.01	S	(900)	2189
$C_7H_7^+$	C_7H_7 (Cycloheptatrienyl radical)		6.236±0.005	PI		2632
$C_7H_7^+$	C_7H_7 (Cycloheptatrienyl radical)		6.60±0.1	EI		68
$C_7H_7^+$	$C_6H_5CH_3$ (Toluene)	H	11.55±0.05	PI	(946)	3025
$C_7H_7^+$	$C_6H_5CH_3$ (Toluene)	H	11.7±0.1	RPD		2538
See also – PI:	2612					
EI:	2109, 3017, 3230, 3238, 3287					
$C_7H_7^+$	C_7H_8 (Cycloheptatriene)	H	≤10.0	PI	(≤929)	2612
$C_7H_7^+$	C_7H_8 (Cycloheptatriene)	H	10.1±0.2	EI		68
See also – EI:	219, 2108, 2109					

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_7H_7^+$	C_7H_8 (Bicyclo[2.2.1]hepta-2,5-diene)	H	9.6	EI		2109
$C_7H_7^+$	C_7H_8 (Bicyclo[2.2.1]hepta-2,5-diene)	H	9.75	EI		2185
$C_7H_7^+$	C_7H_8 (Bicyclo[3.2.0]hepta-2,6-diene)	H	9.66	EI		219
$C_7H_7^+$	C_7H_8 (Spiro[2.4]hepta-4,6-diene)	H	10.45±0.1	EI		1122
$C_7H_7^+$	C_7H_8 (Quadricyclene)	H	9.56	EI		2185
$C_7H_7^+$	C_7H_{10} (1,3-Cycloheptadiene)	H_2+H	13.37	EI		219
$C_7H_7^+$	C_7H_{10} (Bicyclo[2.2.1]hept-2-ene)	H_2+H	13.6±0.3	EI		2155
$C_7H_7^+$	$CH_2{=}C(CH_3)C{\equiv}CC(CH_3){=}CH_2$	CH_3	10.5±0.1	EI		1122
$C_7H_7^+$	$C_6H_5C_2H_5$ (Ethylbenzene)	CH_3	10.9±0.1	PI	(~939)	2612
See also - EI:	135, 1122, 3230, 3238					
$C_7H_7^+$	$C_6H_4(CH_3)_2$ (1,2-Dimethylbenzene)	CH_3	11.10±0.05	PI	(948)	3025
$C_7H_7^+$	$C_6H_4(CH_3)_2$ (1,2-Dimethylbenzene)	CH_3	11.2±0.1	RPD		2538
$C_7H_7^+$	$C_6H_4(CH_3)_2$ (1,3-Dimethylbenzene)	CH_3	11.25±0.1	PI	(960)	2612
$C_7H_7^+$	$C_6H_4(CH_3)_2$ (1,3-Dimethylbenzene)	CH_3	11.4±0.1	RPD		2538
See also - EI:	1122					
$C_7H_7^+$	$C_6H_4(CH_3)_2$ (1,4-Dimethylbenzene)	CH_3	11.05±0.05	PI	(942)	3025
$C_7H_7^+$	$C_6H_4(CH_3)_2$ (1,4-Dimethylbenzene)	CH_3	11.3±0.1	RPD		2538
See also - PI: EI:	2612 3230					
$C_7H_7^+$	$C_7H_7CH_3$ (7-Methylcycloheptatriene)	CH_3	9.5±0.2	EI		68
$C_7H_7^+$	$C_7H_7CH_3$ (7-Methylcycloheptatriene)	CH_3	10.0±0.1	EI		1122
$C_7H_7^+$	$C_7H_7CH_3$ (1-Methylspiro[2.4]hepta-4,6-diene)	CH_3	9.7±0.1	EI		1122
$C_7H_7^+$	$C_7H_7CH_3$ (4-Methylspiro[2.4]hepta-4,6-diene)	CH_3	9.8±0.1	EI		1122
$C_7H_7^+$	$C_7H_7CH_3$ (5-Methylspiro[2.4]hepta-4,6-diene)	CH_3	9.8±0.1	EI		1122
$C_7H_7^+$	$C_6H_5C_3H_7$ (Propylbenzene)		11.64	EI		3338
$C_7H_7^+$	$C_6H_5CH_2CH_2C_6H_5$ (1,2-Diphenylethane)	C_7H_7	10.6±0.2	EI		3288
$C_7H_7^+$	$(C_7H_7)_2$ (7,7′-Bicycloheptatrienyl)	C_7H_7	8.09±0.05	PI		2632

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_7H_7^+$	$C_{18}H_{30}$ (1–Phenyldodecane)		11.82±0.1	EI		2153
$C_7H_7^+$	$C_{18}H_{30}$ (3–Phenyldodecane)		12.05±0.1	EI		2153
$C_7H_7^+$	$C_{19}H_{32}$ (7–Phenyltridecane)		12.21±0.1	EI		2153
$C_7H_7^+$	$C_{26}H_{46}$ (1–Phenyleicosane)		11.83±0.1	EI		2153
$C_7H_7^+$	$C_{26}H_{46}$ (2–Phenyleicosane)		12.28±0.1	EI		2153
$C_7H_7^+$	$C_{26}H_{46}$ (3–Phenyleicosane)		12.24±0.1	EI		2153
$C_7H_7^+$	$C_{26}H_{46}$ (4–Phenyleicosane)		12.33±0.1	EI		2153
$C_7H_7^+$	$C_{26}H_{46}$ (5–Phenyleicosane)		12.34±0.1	EI		2153
$C_7H_7^+$	$C_{26}H_{46}$ (7–Phenyleicosane)		12.60±0.1	EI		2153
$C_7H_7^+$	$C_{26}H_{46}$ (9–Phenyleicosane)		12.09±0.1	EI		2153
$C_7H_7^+$	$C_6H_5CH_2ND_2$ (α–Amino–d_2–toluene)	ND_2	11.7±0.1	PI		1160
$C_7H_7^+$	$C_6H_5CH_2NHCH_3$ (Benzyl methyl amine)		12.61	EI		3338
$C_7H_7^+$	$C_6H_5CH_2CH_2C_6H_4NH_2$ (1–(3–Aminophenyl)–2–phenylethane)		~13	EI		3288
$C_7H_7^+$	$C_6H_5CH_2CH_2C_6H_4NH_2$ (1–(4–Aminophenyl)–2–phenylethane)		~15	EI		3288
$C_7H_7^+$	$C_6H_5CH_2CH_2C_6H_4CN$ (1–(3–Cyanophenyl)–2–phenylethane)		10.3±0.2	EI		3288
$C_7H_7^+$	$C_6H_5CH_2OH$ (α–Hydroxytoluene)	OH	11.7	EI		3237
$C_7H_7^+$	$C_6H_5CH_2OCH_3$ (α–Methoxytoluene)		11.65	EI		3338
$C_7H_7^+$	$C_6H_5CH_2OCH_3$ (α–Methoxytoluene)		11.78	EI		3287
$C_7H_7^+$	$C_6H_4(OCH_3)CH_3$ (4–Methoxytoluene)		12.59	EI		3287
$C_7H_7^+$	$C_7H_7OCH_3$ (7–Methoxycycloheptatriene)		11.23	EI		3287
$C_7H_7^+$	$C_6H_5CH_2OC_6H_5$ (Benzyl phenyl ether)		9.7	EI		2737
$C_7H_7^+$	$C_6H_5CH_2CH_2C_6H_4OH$ (1–(3–Hydroxyphenyl)–2–phenylethane)		10.9±0.2	EI		3288
$C_7H_7^+$	$C_6H_5CH_2CH_2C_6H_4OH$ (1–(4–Hydroxyphenyl)–2–phenylethane)		~15	EI		3288
$C_7H_7^+$	$C_6H_5CH_2OC_6H_4CH_3$ (Benzyl 3–tolyl ether)		9.9	EI		2737
$C_7H_7^+$	$C_6H_5CH_2OC_6H_4CH_3$ (Benzyl 4–tolyl ether)		9.8	EI		2737

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_7H_7^+$	$C_6H_5CH_2CH_2C_6H_4OCH_3$ (1–(4–Methoxyphenyl)–2–phenylethane)		~15	EI		3288
$C_7H_7^+$	$C_6H_5(CH_2)_3COOCH_3$ (4–Phenylbutanoic acid methyl ester)		13.41±0.2	EI		2497
$C_7H_7^+$	$C_6H_5CH_2OC_6H_4OH$ (Benzyl 3–hydroxyphenyl ether)		9.9	EI		2737
$C_7H_7^+$	$C_6H_5CH_2OC_6H_4OH$ (Benzyl 4–hydroxyphenyl ether)		9.9	EI		2737
$C_7H_7^+$	$C_6H_5CH_2OC_6H_4CHO$ (Benzyl 3–formylphenyl ether)		9.7	EI		2737
$C_7H_7^+$	$C_6H_5CH_2OC_6H_4CHO$ (Benzyl 4–formylphenyl ether)		9.7	EI		2737
$C_7H_7^+$	$C_6H_5CH_2OC_6H_4OCH_3$ (Benzyl 3–methoxyphenyl ether)		10.1	EI		2737
$C_7H_7^+$	$C_6H_5CH_2OC_6H_4OCH_3$ (Benzyl 4–methoxyphenyl ether)		10.0	EI		2737
$C_7H_7^+$	$C_6H_5CH_2OC_6H_4NH_2$ (3–Aminophenyl benzyl ether)		9.9	EI		2737
$C_7H_7^+$	$C_6H_5CH_2OC_6H_4NH_2$ (4–Aminophenyl benzyl ether)		9.9	EI		2737
$C_7H_7^+$	$C_6H_5CH_2CH_2C_6H_4NO_2$ (1–(4–Nitrophenyl)–2–phenylethane)		10.4±0.2	EI		3288
$C_7H_7^+$	$C_6H_5CH_2OC_6H_4NO_2$ (Benzyl 3–nitrophenyl ether)		9.9	EI		2737
$C_7H_7^+$	$C_6H_5CH_2OC_6H_4NO_2$ (Benzyl 4–nitrophenyl ether)		10.0	EI		2737
$C_7H_7^+$	$C_6H_5CH_2CH_2C_6H_4F$ (1–(4–Fluorophenyl)–2–phenylethane)		11.0±0.2	EI		3288
$C_7H_7^+$	$C_6H_5SCH_3$ (Methylthiobenzene)	SH	12.0	EI		307
$C_7H_7^+$	$C_6H_5CH_2SCH_3$ (α–Methylthiotoluene)		10.58	EI		3338
$C_7H_7^+$	$C_6H_5CH_2Cl$ (α–Chlorotoluene)	Cl?	10.40±0.05	PI	(901)	2612

See also – EI: 3230

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_7H_7^+$	$C_6H_4ClCH_3$ (2–Chlorotoluene)	Cl?	11.8	EI		3230
$C_7H_7^+$	$C_6H_4ClCH_3$ (3–Chlorotoluene)	Cl?	11.32±0.1	EI		2972
$C_7H_7^+$	$C_6H_4ClCH_3$ (3–Chlorotoluene)	Cl?	11.9	EI		3230
$C_7H_7^+$	$C_6H_4ClCH_3$ (4–Chlorotoluene)	Cl?	11.14±0.1	EI		2972
$C_7H_7^+$	$C_6H_4ClCH_3$ (4–Chlorotoluene)	Cl?	11.7	EI		3230
$C_7H_7^+$	C_7H_9Cl (*endo*–5–Chlorobicyclo[2.2.1]hept–2–ene)		12.5±0.3	EI		2155
$C_7H_7^+$	C_7H_9Cl (*exo*–5–Chlorobicyclo[2.2.1]hept–2–ene)		12.6±0.3	EI		2155
$C_7H_7^+$	C_7H_9Cl (3–Chloronortricyclene)		12.2±0.3	EI		2155

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_7H_7^+$	$C_6H_5CH_2CH_2C_6H_4Cl$ (1–(3–Chlorophenyl)–2–phenylethane)		10.4±0.2	EI		3288
$C_7H_7^+$	$C_6H_5CH_2OC_6H_4Cl$ (Benzyl 3–chlorophenyl ether)		9.6	EI		2737
$C_7H_7^+$	$C_6H_5CH_2OC_6H_4Cl$ (Benzyl 4–chlorophenyl ether)		9.7	EI		2737
$C_7H_7^+$	$C_6H_5CH_2Br$ (α–Bromotoluene)	Br?	9.1	EI		3230
See also – EI:	2973					
$C_7H_7^+$	$C_6H_4BrCH_3$ (2–Bromotoluene)	Br?	11.2	EI		3230
$C_7H_7^+$	$C_6H_4BrCH_3$ (3–Bromotoluene)	Br?	11.3	EI		3230
$C_7H_7^+$	$C_6H_4BrCH_3$ (4–Bromotoluene)	Br?	11.30	EI		3238
See also – EI:	3230					
$C_7H_7^+$	$C_6H_5CH_2CH_2C_6H_4Br$ (1–(4–Bromophenyl)–2–phenylethane)		10.5±0.2	EI		3288
$C_7H_7^+$	$C_6H_5CH_2I$ (α–Iodotoluene)	I?	9.2	EI		3230
$C_7H_7^+$	$C_6H_4ICH_3$ (2–Iodotoluene)	I?	11.3	EI		3230
$C_7H_7^+$	$C_6H_4ICH_3$ (3–Iodotoluene)	I?	11.3	EI		3230
$C_7H_7^+$	$C_6H_4ICH_3$ (4–Iodotoluene)	I?	11.3	EI		3230
$C_7H_7^+$	$C_6H_5CH_2CH_2C_6H_4I$ (1–(4–Iodophenyl)–2–phenylethane)		10.6±0.2	EI		3288

The $C_7H_7^+$ ion from most of these compounds is believed to have the seven–membered tropylium ion structure, see H. M. Grubb and S. Meyerson in "Mass Spectrometry of Organic Ions," ed. F. W. McLafferty (Academic Press, New York, 1963) Chap. 10. From the heat of formation of cycloheptatriene (182 kJ mol^{-1}), a C–H bond energy equal to that of the secondary bond in pentadiene which is 334 kJ mol^{-1} (D. M. Golden and S. W. Benson, Chem. Rev. **69**, 125 (1969)), and the spectroscopic ionization potential of cycloheptatrienyl radical given above (6.24 eV), one obtains $\Delta H^\circ_{f298}(C_7H_7^+)$ = 900 kJ mol^{-1}. From the heat of formation of benzyl radical, 188 kJ mol^{-1} (S. W. Benson and H. E. O'Neal, "Kinetic Data on Gas Phase Unimolecular Reactions," NSRDS–NBS 21 (U.S. Government Printing Office, Washington, D.C., 1970)), and the ionization potential determined by electron monochromator techniques (7.27 eV), we obtain $\Delta H^\circ_{f298}(C_7H_7^+)$ = 890 kJ mol^{-1}, which is equal to the cycloheptatrienyl value within the estimated errors of all the individual data. Except for the case of α–chlorotoluene, whose low threshold may be due in part to an ion–pair process, these values are significantly lower than values based on fragmentation processes, even the photoionization of toluene which gives 946 kJ mol^{-1} and of cycloheptatriene which gives 929 kJ mol^{-1}. The threshold values for these processes have not been corrected for kinetic shift which is expected to be significant here and will lead to too high a value. We suggest, therefore, a heat of formation of about 895 kJ mol^{-1} (214 kcal mol^{-1}) as the best value.

4.3. The Positive Ion Table—Continued

$C_7H_5D_2^+$

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_7H_5D_2^+$	$C_6H_5CD_2$ (Benzyl-α,α-d_2 radical)		7.71	EI		124

$C_7H_8^+$(Toluene) $\Delta H^\circ_{f298} = 901$ kJ mol^{-1} (215 kcal mol^{-1})

$C_7H_8^+$(Cycloheptatriene) $\Delta H^\circ_{f298} \sim 982$ kJ mol^{-1} (235 kcal mol^{-1})

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_7H_8^+$	$C_6H_5CH_3$ (Toluene) (Average of two Rydberg series limits)		8.82±0.05	S	901	3153
$C_7H_8^+$	$C_6H_5CH_3$ (Toluene)		8.821±0.01	PI	901	158, 182, 416
$C_7H_8^+$	$C_6H_5CH_3$ (Toluene)		8.82±0.02	PI	901	3025
$C_7H_8^+$	$C_6H_5CH_3$ (Toluene)		8.82	PI	901	168
$C_7H_8^+$	$C_6H_5CH_3$ (Toluene)		8.82	PE	901	2843
$C_7H_8^+$	$C_6H_5CH_3$ (Toluene)		8.80±0.04	RPD		2407

See also – S: 344
PI: 1142, 1159, 1166, 2612
PE: 1159, 2806, 3331
EI: 381, 383, 1066, 2025, 2109, 2158, 2163, 2463, 2538, 2865, 2989, 3157, 3223, 3230, 3238, 3287

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_7H_8^+$	C_7H_8 (Cycloheptatriene)		8.28	S	981	3099
$C_7H_8^+$	C_7H_8 (Cycloheptatriene)		8.20±0.05	PI	973	2612
$C_7H_8^+$	C_7H_8 (Cycloheptatriene)		8.40	PE	992	2951

See also – EI: 68, 219, 2109

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_7H_8^+$	C_7H_8 (Bicyclo[2.2.1]hepta-2,5-diene)		8.42±0.02	PI		2877
$C_7H_8^+$	C_7H_8 (Bicyclo[2.2.1]hepta-2,5-diene)		8.42	PE		3343

See also – PE: 2951, 3327
EI: 219, 2109, 2185, 2531

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_7H_8^+$	C_7H_8 (Bicyclo[3.2.0]hepta-2,6-diene)		8.92	EI		219
$C_7H_8^+$	C_7H_8 (Spiro[3.3]hepta-2,5-diene)		9.02	PE		2951
$C_7H_8^+$	C_7H_8 (Quadricyclene)		8.70	EI		2185
$C_7H_8^+$	C_7H_{10} (1,3-Cycloheptadiene)	H_2	10.8	EI		219

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_7H_8^+$	C_7H_{10} (Bicyclo[3.2.0]hept-6-ene)	H_2	9.4	EI		219
$C_7H_8^+$	$C_{18}H_{30}$ (1-Phenyldodecane)		10.75±0.1	EI		2153
$C_7H_8^+$	$C_{26}H_{46}$ (1-Phenyleicosane)		11.35±0.1	EI		2153
		$C_7H_8^{+2}$				
$C_7H_8^{+2}$	$C_6H_5CH_3$ (Toluene)		23.5±0.2	FD		212
		$C_7H_8^{+3}$				
$C_7H_8^{+3}$	$C_6H_5CH_3$ (Toluene)		42±5	NRE		212
		$C_7H_9^+$				
$C_7H_9^+$	$C_5H_4(CH_3)_2$ (1,2-Dimethylcyclopentadiene)	H	11.05	EI		3335
$C_7H_9^+$	$C_6H_7CH_3$ (1-Methyl-1,4-cyclohexadiene)	H	11.03	EI		3335
$C_7H_9^+$	C_7H_{10} (1,3-Cycloheptadiene)	H	11.30	EI		219
$C_7H_9^+$	C_7H_{10} (1,3-Cycloheptadiene)	H	11.30	EI		3335
$C_7H_9^+$	C_7H_{10} (Bicyclo[2.2.1]hept-2-ene)	H	11.5±0.15	EI		2155
$C_7H_9^+$	C_7H_{10} (Bicyclo[3.2.0]hept-6-ene)	H	10.67	EI		219
$C_7H_9^+$	C_7H_{10} (Bicyclo[3.2.0]hept-6-ene)	H	10.7	EI		3335
$C_7H_9^+$	$C_5H_3(CH_3)_3$ (1,2,3-Trimethylcyclopentadiene)	CH_3	10.8	EI		3335
$C_7H_9^+$	$C_6H_4(OCH_3)CH_3$ (3-Methoxytoluene)	CO+H?	11.7	EI		3335
$C_7H_9^+$	C_7H_9Cl (*endo*-5-Chlorobicyclo[2.2.1]hept-2-ene)	Cl	11.0±0.15	EI		2155
$C_7H_9^+$	C_7H_9Cl (*exo*-5-Chlorobicyclo[2.2.1]hept-2-ene)	Cl	11.1±0.15	EI		2155
$C_7H_9^+$	C_7H_9Cl (3-Chloronortricyclene)	Cl	10.7±0.15	EI		2155

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_7H_{10}^+$						
$C_7H_{10}^+$	$C_5H_4(CH_3)_2$ (1,2–Dimethylcyclopentadiene)		8.1±0.1	EI		2163
$C_7H_{10}^+$	$C_5H_4(CH_3)_2$ (5,5–Dimethylcyclopentadiene)		8.22±0.05	EI		2163
$C_7H_{10}^+$	C_7H_{10} (*cis,cis*–1,3–Cycloheptadiene)		8.31 (V)	PE		3330
$C_7H_{10}^+$	C_7H_{10} (1,3–Cycloheptadiene)		8.40	EI		219
See also – PE:	3328					
$C_7H_{10}^+$	C_7H_{10} (1,4–Cycloheptadiene)		8.85±0.03	PI		2877
$C_7H_{10}^+$	C_7H_{10} (Bicyclo[2.2.1]hept–2–ene)		8.81±0.02	PI		2877
$C_7H_{10}^+$	C_7H_{10} (Bicyclo[2.2.1]hept–2–ene)		8.82	PE		3343
$C_7H_{10}^+$	C_7H_{10} (Bicyclo[2.2.1]hept–2–ene)		8.83	PE		2951
$C_7H_{10}^+$	C_7H_{10} (Bicyclo[2.2.1]hept–2–ene)		8.95±0.15	EI		2155
$C_7H_{10}^+$	C_7H_{10} (Bicyclo[2.2.1]hept–2–ene)		8.98±0.1	EI		2531
$C_7H_{10}^+$	C_7H_{10} (Bicyclo[2.2.1]hept–2–ene)		9.05	EI		3341
See also – PE:	3327, 3328					
$C_7H_{10}^+$	C_7H_{10} (Bicyclo[3.2.0]hept–6–ene)		9.37	EI		219
$C_7H_{10}^+$	C_7H_{10} (Nortricyclene)		9.02	PE		2951
$C_7H_{11}^+$						
$C_7H_{11}^+$	$(CH_3)_2C=CHCH=C(CH_3)_2$	CH_3	10.80±0.03	EI		2455
$C_7H_{11}^+$	C_9H_{16} (*cis*–Hexahydroindan)	C_2H_5	11.71±0.05	EI		1184, 2028
$C_7H_{11}^+$	C_9H_{16} (*trans*–Hexahydroindan)	C_2H_5	11.80±0.05	EI		1184, 2028
$C_7H_{11}^+$	$C_7H_{11}Br$ (*endo*–2–Bromobicyclo[2.2.1]heptane)	Br	10.26±0.05	EI		2749
$C_7H_{11}^+$	$C_7H_{11}Br$ (*exo*–2–Bromobicyclo[2.2.1]heptane)	Br	10.27±0.05	EI		2749

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
	$C_7H_{12}^+$ (*cis*–Cycloheptene)	**ΔH°_{f298} = 847 kJ mol^{-1} (202 kcal mol^{-1})**				
$C_7H_{12}^+$	C_5H_8=$CHCH_3$ (Ethylidenecyclopentane)		8.49±0.02	PI		2877
$C_7H_{12}^+$	C_5H_8=$CHCH_3$ (Ethylidenecyclopentane)		8.51	PE		3343
$C_7H_{12}^+$	C_6H_{10}=CH_2 (Methylenecyclohexane)		8.97±0.01	PI		2877
$C_7H_{12}^+$	C_6H_{10}=CH_2 (Methylenecyclohexane)		8.94	PE		3343
$C_7H_{12}^+$	C_6H_{10}=CH_2 (Methylenecyclohexane)		9.04±0.03	EDD		2558
$C_7H_{12}^+$	$C_6H_9CH_3$ (1–Methylcyclohexene)		8.67±0.02	EDD		2558
$C_7H_{12}^+$	$C_6H_9CH_3$ (3–Methylcyclohexene)		8.94±0.03	EDD		2558
See also – EI:	2543					
$C_7H_{12}^+$	$C_6H_9CH_3$ (4–Methylcyclohexene)		8.91±0.01	PI		182
$C_7H_{12}^+$	$C_6H_9CH_3$ (4–Methylcyclohexene)		8.92±0.02	EDD		2558
See also – EI:	2543					
$C_7H_{12}^+$	C_7H_{12} (*cis*–Cycloheptene)		8.87	PE	847	3330
See also – EI:	2531, 3342					
$C_7H_{12}^+$	C_7H_{12} (Bicyclo[2.2.1]heptane)		9.74	PE		3343
$C_7H_{12}^+$	C_7H_{12} (Bicyclo[2.2.1]heptane)		9.80	PE		2951
$C_7H_{12}^+$	C_7H_{12} (Bicyclo[2.2.1]heptane)		9.93±0.02	EDD		2558
See also – PE:	3327					
$C_7H_{12}^+$	C_7H_{12} (Bicyclo[4.1.0]heptane)		9.03±0.02	EDD		2558
$C_7H_{12}^+$	C_9H_{16} (*cis*–Hexahydroindan)	C_2H_4	10.96±0.03	EI		1184, 2028
$C_7H_{12}^+$	C_9H_{16} (*trans*–Hexahydroindan)	C_2H_4	11.16±0.03	EI		1184, 2028
$C_7H_{12}^+$	$C_{10}H_{18}$ (*cis*–Decalin)	C_3H_6	10.72±0.02	EI		1182, 1183, 3337
$C_7H_{12}^+$	$C_{10}H_{18}$ (*trans*–Decalin)	C_3H_6	11.04±0.02	EI		1182, 1183, 3337

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_7H_{13}^+$				
$C_7H_{13}^+$	$C_6H_{10}(CH_3)_2$ (*cis*–1,2–Dimethylcyclohexane)	CH_3	10.78±0.02	EI		1145
$C_7H_{13}^+$	$C_6H_{10}(CH_3)_2$ (*trans*–1,2–Dimethylcyclohexane)	CH_3	10.84±0.02	EI		1145
$C_7H_{13}^+$	*cis*–$(CH_3)_3CCH{=}CHC(CH_3)_3$	C_3H_7	9.59±0.03	EI		2533
$C_7H_{13}^+$	*trans*–$(CH_3)_3CCH{=}CHC(CH_3)_3$	C_3H_7	10.04±0.05	EI		2533
	$C_7H_{14}^+$ (Methylcyclohexane)		**ΔH°_{f298} = 796 kJ mol^{-1} (190 kcal mol^{-1})**			
$C_7H_{14}^+$	$C_6H_{11}CH_3$ (Methylcyclohexane)		9.85±0.03	PI	796	182
See also – EI: 123						
		$C_7H_{15}^+$				
$C_7H_{15}^+$	*n*–C_8H_{18}	CH_3	~10.90±0.10	PI		1120
(Threshold value approximately corrected to 0 K)						
$C_7H_{15}^+$	*n*–$C_7H_{15}COCH_3$		10.00±0.1	RPD		2977
$C_7H_{15}^+$	*n*–$C_7H_{15}OOH$		10.6±0.1	EI		2464
$C_7H_{15}^+$	*n*–$C_5H_{11}CH(OOH)CH_3$		9.7±0.1	EI		2464
	n–$C_7H_{16}^+$		**ΔH°_{f298} ~ 776 kJ mol^{-1} (185 kcal mol^{-1})**			
$C_7H_{16}^+$	*n*–C_7H_{16}		9.90±0.05	PI	767	2013
$C_7H_{16}^+$	*n*–C_7H_{16}		10.08	PI	785	182
$C_7H_{16}^+$	*n*–C_7H_{16}		10.16	PE		2829
See also – PE: 1130						
		$C_8H_5^+$				
$C_8H_5^+$	$C_{10}H_8$ (Naphthalene)		18.07±0.05	EI		2112
$C_8H_5^+$	$C_{10}H_8$ (Azulene)		16.3±0.15	EI		2112

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
	$C_8H_6^+$ (Ethynylbenzene)	**ΔH°_{f298} = 1178 kJ mol^{-1} (282 kcal mol^{-1})**				
$C_8H_6^+$	$CH_3C{\equiv}CC{\equiv}CC{\equiv}CCH_3$		8.60±0.01	PE		2805
$C_8H_6^+$	$C_6H_5C{\equiv}CH$ (Ethynylbenzene)		8.815±0.005	PI	1178	182
$C_8H_6^+$	$C_6H_5CH{=}CH_2$ (Ethenylbenzene)	H_2	12.72±0.10	EI		2914
$C_8H_6^+$	C_8H_8 (Cyclooctatetraene)	H_2	11.70±0.10	EI		2914
$C_8H_6^+$	C_8H_8 (Cyclobutenobenzene)	H_2	11.84±0.10	RPD		2914
$C_8H_6^+$	C_8H_8 (Bicyclo[2.2.2]octatriene)	H_2	11.97±0.20	EI		2914
$C_8H_6^+$	C_8H_8 (*syn*–Tricyclo[4.2.0.0^{2,5}]octa–3,7–diene)	H_2	10.03±0.10	EI		2914
$C_8H_6^+$	C_8H_8 (*anti*–Tricyclo[4.2.0.0^{2,5}]octa–3,7–diene)	H_2	9.86±0.10	EI		2914
$C_8H_6^+$	C_8H_8 (Cubane)	H_2	8.92±0.10	EI		2914
See also – EI:	2105					
$C_8H_6^+$	$C_{10}H_8$ (Naphthalene)	C_2H_2	15.4±0.10	EI		2112
$C_8H_6^+$	$C_{10}H_8$ (Azulene)	C_2H_2	13.6±0.10	EI		2112
$C_8H_6^+$	$(C_6H_5)_2$ (Biphenyl)		18.10±0.05	EI		1238
$C_8H_6^+$	$C_6H_5C{\equiv}CC_6H_5$ (Diphenylacetylene)		17.8±0.1	EI		1238
		$C_8H_7^+$				
$C_8H_7^+$	$C_6H_5CH{=}CH_2$ (Ethenylbenzene)	H	12.41±0.10	EI		2914
$C_8H_7^+$	C_8H_8 (Cyclooctatetraene)	H	10.90±0.10	EI		2914
$C_8H_7^+$	C_8H_8 (Cyclobutenobenzene)	H	11.94±0.10	EI		2914
$C_8H_7^+$	C_8H_8 (Bicyclo[2.2.2]octatriene)	H	10.63±0.10	EI		2914
$C_8H_7^+$	C_8H_8 (*syn*–Tricyclo[4.2.0.0^{2,5}]octa–3,7–diene)	H	9.12±0.10	EI		2914
$C_8H_7^+$	C_8H_8 (*anti*–Tricyclo[4.2.0.0^{2,5}]octa–3,7–diene)	H	9.13±0.10	EI		2914
$C_8H_7^+$	C_8H_8 (Cubane)	H	8.96±0.10	EI		2914
See also – EI:	2105					

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
	$C_8H_8^{+\cdot}$(Ethenylbenzene)	**ΔH°_{f298} = 962 kJ mol^{-1} (230 kcal mol^{-1})**				
	$C_8H_8^{+\cdot}$(Cyclooctatetraene)	**ΔH°_{f298} = 1071 kJ mol^{-1} (256 kcal mol^{-1})**				
$C_8H_8^{+\cdot}$	$C_6H_5CH=CH_2$ (Ethenylbenzene)		8.47±0.02	PI	965	182
$C_8H_8^{+\cdot}$	$C_6H_5CH=CH_2$ (Ethenylbenzene)		8.43±0.01	PE	961	2843
$C_8H_8^{+\cdot}$	$C_6H_5CH=CH_2$ (Ethenylbenzene)		8.42	PE	960	3321
$C_8H_8^{+\cdot}$	$C_6H_5CH=CH_2$ (Ethenylbenzene)		8.53	CTS		2798
(Average of two values)						
See also – EI:	1066, 2914					
$C_8H_8^{+\cdot}$	C_8H_8 (Cyclooctatetraene)		7.99±0.02	PI	1069	182
$C_8H_8^{+\cdot}$	C_8H_8 (Cyclooctatetraene)		8.04	PE	1074	1130
$C_8H_8^{+\cdot}$	C_8H_8 (Cyclooctatetraene)		8.21	PE		2841, 2951
See also – PE: EI:	2796 381, 2752, 2865, 2914					
$C_8H_8^{+\cdot}$	C_8H_8 (Cyclobutenobenzene)		8.74±0.05	RPD		2914
$C_8H_8^{+\cdot}$	C_8H_8 (Bicyclo[2.2.2]octatriene)		8.23	PE		3291
$C_8H_8^{+\cdot}$	C_8H_8 (Bicyclo[2.2.2]octatriene)		8.24	PE		2951
$C_8H_8^{+\cdot}$	C_8H_8 (Bicyclo[2.2.2]octatriene)		7.95±0.10	EI		2914
$C_8H_8^{+\cdot}$	C_8H_8 (*syn*–Tricyclo[4.2.0.0^{2,5}]octa–3,7–diene)		8.20±0.10	EI		2914
See also – EI:	2723, 2752					
$C_8H_8^{+\cdot}$	C_8H_8 (*anti*–Tricyclo[4.2.0.0^{2,5}]octa–3,7–diene)		8.27±0.10	EI		2914
$C_8H_8^{+\cdot}$	C_8H_8 (Cubane)		8.74	PE		2843, 2951
$C_8H_8^{+\cdot}$	C_8H_8 (Cubane)		8.64±0.10	EI		2914
$C_8H_8^{+\cdot}$	C_8H_8 (Cubane)		8.74±0.15	EI		2105

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_8H_8^+$	$C_{10}H_{12}$ (1,2,3,4–Tetrahydronaphthalene)		11.31	EI		3338
$C_8H_8^+$	$C_{26}H_{46}$ (1–Phenyleicosane)		12.2±0.1	EI		2153
$C_8H_8^+$	$C_9H_{11}N$ (1,2,3,4–Tetrahydroisoquinoline)		11.10	EI		3338
$C_8H_8^+$	$C_9H_{10}O$ (Isochroman)		9.95	EI		3338
$C_8H_8^+$	$C_6H_5(CH_2)_3CHO$ (4–Phenylbutanal)	CH_2CHOH	9.60±0.2	EI		2522
$C_8H_8^+$	$C_6H_5(CH_2)_3COCH_3$ (5–Phenyl–2–pentanone)	$CH_2C(CH_3)OH$	9.58±0.2	EI		2522
$C_8H_8^+$	$C_6H_5CH_2CH_2COOH$ (3–Phenylpropanoic acid)	$HCOOH$	9.77±0.2	EI		2522
$C_8H_8^+$	$C_6H_5(CH_2)_3COOH$ (4–Phenylbutanoic acid)	$CH_2=CO+H_2O$	10.55±0.2	EI		2522
$C_8H_8^+$	$C_6H_5CH_2CH_2COOCH_3$ (3–Phenylpropanoic acid methyl ester)	$HCOOCH_3$	9.87±0.2	EI		2522
$C_8H_8^+$	$C_6H_5(CH_2)_3COOCH_3$ (4–Phenylbutanoic acid methyl ester)	$CH_2=CO+CH_3OH$	10.69±0.2	EI		2522

See also – EI: 2497

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_8H_8^+$	$C_9H_{10}S$ (Isothiochroman)		10.87	EI		3338

$C_8H_9^+$

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_8H_9^+$	$C_6H_4(CH_3)CH_2$ (3–Methylbenzyl radical)		7.65±0.03	EI		69
$C_8H_9^+$	$C_6H_4(CH_3)CH_2$ (4–Methylbenzyl radical)		7.46±0.03	EI		69
$C_8H_9^+$	$CH_2=C(CH_3)C\equiv CC(CH_3)=CH_2$	H	10.4±0.1	EI		1122
$C_8H_9^+$	$C_6H_5C_2H_5$ (Ethylbenzene)	H	12.1±0.1	PI		2612
$C_8H_9^+$	$C_6H_5C_2H_5$ (Ethylbenzene)	H	11.4±0.1	EI		1122
$C_8H_9^+$	$C_6H_4(CH_3)_2$ (1,2–Dimethylbenzene)	H	11.30±0.05	PI	(891)	3025

See also – EI: 2538

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_8H_9^+$	$C_6H_4(CH_3)_2$ (1,3–Dimethylbenzene)	H	11.7±0.1	PI		2612
$C_8H_9^+$	$C_6H_4(CH_3)_2$ (1,3–Dimethylbenzene)	H	11.84±0.1	EI		2970

See also – EI: 2538

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_8H_9^+$	$C_6H_4(CH_3)_2$ (1,4–Dimethylbenzene)	H	11.35±0.05	PI	(895)	3025
$C_8H_9^+$	$C_6H_4(CH_3)_2$ (1,4–Dimethylbenzene)	H	11.86±0.1	EI		2970

See also – PI: 2612
EI: 2538

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_8H_9^+$	$C_7H_7CH_3$ (7–Methylcycloheptatriene)	H	11.0±0.1	EI		1122
$C_8H_9^+$	$C_7H_7CH_3$ (1–Methylspiro[2.4]hepta–4,6–diene)	H	10.65±0.1	EI		1122
$C_8H_9^+$	$C_7H_7CH_3$ (4–Methylspiro[2.4]hepta–4,6–diene)	H	9.9±0.1	EI		1122
$C_8H_9^+$	$C_7H_7CH_3$ (5–Methylspiro[2.4]hepta–4,6–diene)	H	9.9±0.1	EI		1122
$C_8H_9^+$	C_8H_{10} (1,3,5–Cyclooctatriene)	H	10.8	EI		2973
$C_8H_9^+$	$C_6H_5C_3H_7$ (Isopropylbenzene)	CH_3	10.65	EI		3238
$C_8H_9^+$	$C_6H_4(CH_3)C_2H_5$ (1–Ethyl–4–methylbenzene)	CH_3	11.2±0.1	EI		1122
$C_8H_9^+$	$C_6H_4(CD_3)C_2H_5$ (1–Ethyl–4–methyl–d_3–benzene)	CD_3	11.2±0.1	EI		2144
$C_8H_9^+$	$C_6H_4(CH_3)CH_2CD_3$ (1–Ethyl–2,2,2–d_3–4–methylbenzene)	CD_3	11.2±0.1	EI		2144
$C_8H_9^+$	$C_{26}H_{46}$ (2–Phenyleicosane)		10.83±0.1	EI		2153
$C_8H_9^+$	$C_{26}H_{46}$ (3–Phenyleicosane)		11.28±0.1	EI		2153
$C_8H_9^+$	$C_6H_5CH_2CH_2COCH_3$ (4–Phenyl–2–butanone)	CH_3CO	10.37±0.2	EI		2522
$C_8H_9^+$	$C_6H_5CH(CH_3)CH_2COOCH_3$ (3–Phenylbutanoic acid methyl ester)		11.43±0.2	EI		2497
$C_8H_9^+$	$C_6H_4(CH_3)(CH_2)_3COOCH_3$ (4–(4–Tolyl)butanoic acid methyl ester)		12.50±0.2	EI		2497
$C_8H_9^+$	$C_6H_5CH_2CH_2Br$ (1–Bromo–2–phenylethane)	Br	10.1	EI		2973
$C_8H_9^+$	$C_6H_4BrC_2H_5$ (1–Bromo–4–ethylbenzene)	Br	10.80	EI		3238
$C_8H_9^+$	$C_6H_4(CH_3)CH_2Br$ (1–Bromomethyl–3–methylbenzene)	Br	9.44±0.1	EI		2970
$C_8H_9^+$	$C_6H_4(CH_3)CH_2Br$ (1–Bromomethyl–4–methylbenzene)	Br	9.44±0.1	EI		2970
$C_8H_9^+$	C_8H_9Br (7–Bromo–1,3,5–cyclooctatriene)	Br	9.6	EI		2973

This body of data is completely discordant. Tait, Shannon and Harrison, ref. 2970, suggest that the ion has a substituted tropylium structure, Akopyan and Vilesov, ref. 2612, suggest there are structural differences. Kinetic shift effects have not been considered. We suggest a tentative value of $\Delta H^\circ_{f298}(C_8H_9^+) \approx 893$ kJ mol^{-1} (213 kcal mol^{-1}).

4.3. The Positive Ion Table—Continued

$C_8H_{10}^+$(Ethylbenzene) ΔH°_{f298} = 875 kJ mol^{-1} (209 kcal mol^{-1})
$C_8H_{10}^+$(1,2–Dimethylbenzene) ΔH°_{f298} = 845 kJ mol^{-1} (202 kcal mol^{-1})
$C_8H_{10}^+$(1,3–Dimethylbenzene) ΔH°_{f298} = 843 kJ mol^{-1} (201 kcal mol^{-1})
$C_8H_{10}^+$(1,4–Dimethylbenzene) ΔH°_{f298} = 834 kJ mol^{-1} (199 kcal mol^{-1})

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_8H_{10}^+$	CH_2=CHCH=CHCH=CHCH=CH_2		~7.8	D		3010
$C_8H_{10}^+$	CH_2=C(CH_3)C≡CC(CH_3)=CH_2		8.95±0.1	EI		1122
$C_8H_{10}^+$	$C_6H_5C_2H_5$ (Ethylbenzene)		8.77±0.01	S	876	344
$C_8H_{10}^+$	$C_6H_5C_2H_5$ (Ethylbenzene)		8.76±0.01	PI	875	182
$C_8H_{10}^+$	$C_6H_5C_2H_5$ (Ethylbenzene)		8.75±0.05	PI	874	2612
See also – EI:	2522, 3230, 3238					
CTS:	2562					
$C_8H_{10}^+$	$C_6H_4(CH_3)_2$ (1,2–Dimethylbenzene)		8.58±0.01	S	847	344
$C_8H_{10}^+$	$C_6H_4(CH_3)_2$ (1,2–Dimethylbenzene)		8.555	PI	844	168
$C_8H_{10}^+$	$C_6H_4(CH_3)_2$ (1,2–Dimethylbenzene)		8.56±0.01	PI	845	182, 416
$C_8H_{10}^+$	$C_6H_4(CH_3)_2$ (1,2–Dimethylbenzene)		8.56±0.02	PI	845	1142, 1159, 1166, 3025
See also – S:	3153					
PE:	1159					
EI:	1066, 2163, 2538, 2865, 2989					
$C_8H_{10}^+$	$C_6H_4(CH_3)_2$ (1,3–Dimethylbenzene)		8.56	PI	843	168
$C_8H_{10}^+$	$C_6H_4(CH_3)_2$ (1,3–Dimethylbenzene)		8.56±0.01	PI	843	182, 416
$C_8H_{10}^+$	$C_6H_4(CH_3)_2$ (1,3–Dimethylbenzene)		8.55±0.05	PI	842	2612
See also – S:	344, 3153					
PI:	1142, 1159, 1166					
PE:	1159					
EI:	1066, 1122, 2538, 2865, 2989					
$C_8H_{10}^+$	$C_6H_4(CH_3)_2$ (1,4–Dimethylbenzene)		8.48	S	836	344
$C_8H_{10}^+$	$C_6H_4(CH_3)_2$ (1,4–Dimethylbenzene)		8.445	PI	833	168
$C_8H_{10}^+$	$C_6H_4(CH_3)_2$ (1,4–Dimethylbenzene)		8.445±0.015	PI	833	158, 182, 416
$C_8H_{10}^+$	$C_6H_4(CH_3)_2$ (1,4–Dimethylbenzene)		8.44±0.02	PI	832	1142, 1159, 1166, 3025

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_8H_{10}^+$	$C_6H_4(CH_3)_2$ (1,4–Dimethylbenzene)		8.52	CTS		2909

See also – S: 3153
PI: 2612
PE: 1159, 2806
EI: 1066, 2163, 2538, 2865, 2989, 3223, 3230

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_8H_{10}^+$	$C_7H_7CH_3$ (7–Methylcycloheptatriene)		8.39±0.1	EI		1122
$C_8H_{10}^+$	$C_7H_7CH_3$ (1–Methylspiro[2.4]hepta–4,6–diene)		8.40±0.1	EI		1122
$C_8H_{10}^+$	$C_7H_7CH_3$ (4–Methylspiro[2.4]hepta–4,6–diene)		8.02±0.1	EI		1122
$C_8H_{10}^+$	$C_7H_7CH_3$ (5–Methylspiro[2.4]hepta–4,6–diene)		8.07±0.1	EI		1122
$C_8H_{10}^+$	C_8H_{10} (Bicyclo[2.2.2]octa–2,5–diene)		8.87 (V)	PE		3327
$C_8H_{10}^+$	C_8H_{10} (Bicyclo[3.2.1]octa–2,6–diene)		8.44±0.01	PI		2877
$C_8H_{10}^+$	C_8H_{10} (Bicyclo[5.1.0]octa–2,5–diene)		8.43	PE		3329
$C_8H_{10}^+$	$C_6H_5CH_2CH_2CHO$ (3–Phenylpropanal)	CO	9.68±0.2	EI		2522

$C_8H_{12}^+$

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_8H_{12}^+$	$C_5H_3(CH_3)_3$ (1,2,3–Trimethylcyclopentadiene)		7.96±0.05	EI		2163
$C_8H_{12}^+$	$C_5H_3(CH_3)_3$ (1,5,5–Trimethylcyclopentadiene)		8.00±0.1	EI		2163
$C_8H_{12}^+$	$C_6H_9CH=CH_2$ (4–Ethenylcyclohexene)		8.93±0.02	PI		182
$C_8H_{12}^+$	C_8H_{12} (*cis,cis*–1,3–Cyclooctadiene)		8.68 (V)	PE		3330
$C_8H_{12}^+$	C_8H_{12} (1,4–Cyclooctadiene)		8.64±0.03	PI		2877
$C_8H_{12}^+$	C_8H_{12} (1,5–Cyclooctadiene)		9.1±0.1	EI		2698
$C_8H_{12}^+$	C_8H_{12} (Bicyclo[2.2.2]oct–2–ene)		8.92	PE		2951

See also – PE: 3327

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_8H_{12}^+$	C_8H_{12} (Bicyclo[3.2.1]oct–2–ene)		8.76±0.02	PI		2877
$C_8H_{12}^+$	C_8H_{12} (Tricyclo[3.2.1.0^{3,6}]octane)		8.75	PE		2951

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_8H_{13}^+$						
$C_8H_{13}^+$	$C_6H_8C_2H_5$? (6–Ethyl–2–cyclohexen–1–yl radical?)		7.5	EI		3002
$C_8H_{13}^+$	$(CH_3)_3CCH{=}C{=}CH(CH_2)_4CH_3$		10.1±0.05	EI		3007
$C_8H_{13}^+$	$(CH_3)_3CCH{=}C{=}CHCH_2C(CH_3)_3$		10.0±0.05	EI		3007
$C_8H_{14}^+$						
$C_8H_{14}^+$	$(CH_3)_2C{=}CHCH{=}C(CH_3)_2$		7.91±0.04	EI		2455
$C_8H_{14}^+$	$C_6H_{10}{=}CHCH_3$ (Ethylidenecyclohexane)		8.47±0.02	PI		2877
$C_8H_{14}^+$	$C_6H_{10}{=}CHCH_3$ (Ethylidenecyclohexane)		8.41	PE		3343
$C_8H_{14}^+$	C_8H_{14} (*cis*–Cyclooctene)		8.82	PE		3330
See also – EI:	2531, 3342					
$C_8H_{14}^+$	C_8H_{14} (Bicyclo[2.2.2]octane)		9.53	PE		2951
See also – PE:	2962, 3327					
$1{-}C_8H_{16}^+$ $\Delta H^\circ_{f298} = 827$ kJ mol^{-1} (198 kcal mol^{-1})						
$C_8H_{16}^+$	$1{-}C_8H_{16}$		9.43±0.01	PI	827	2877
$C_8H_{16}^+$	$C_6H_{10}(CH_3)_2$ (*cis*–1,2–Dimethylcyclohexane)		10.08±0.02	EI		1145
$C_8H_{16}^+$	$C_6H_{10}(CH_3)_2$ (*trans*–1,2–Dimethylcyclohexane)		10.08±0.03	EI		1145
$(CH_3)_2CHCH_2C(CH_3)_3^+$ $\Delta H^\circ_{f298} \sim 730$ kJ mol^{-1} (174 kcal mol^{-1})						
$C_8H_{18}^+$	$n{-}C_8H_{18}$		10.25	RPD		2977
$C_8H_{18}^+$	$(CH_3)_2CHCH_2C(CH_3)_3$		9.86	PI	727	182
$C_8H_{18}^+$	$(CH_3)_2CHCH_2C(CH_3)_3$		9.91	PE	732	1130
$C_9H_5^+$						
$C_9H_5^+$	$C_6H_5C{\equiv}CC_6H_5$ (Diphenylacetylene)		21.3±0.2	EI		1238

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
			$C_9H_7^+$			
$C_9H_7^+$	C_9H_7 (Indenyl radical)		8.35	EI		126
$C_9H_7^+$	$C_6H_4(CH_3)C{\equiv}CH$ (2–Ethynyltoluene)	H	11.36	EI		2541
(Metastable transition indicates zero kinetic energy release)						
$C_9H_7^+$	C_9H_8 (Indene)	H	12.53	EI		2541
(Metastable transition indicates zero kinetic energy release)						
$C_9H_7^+$	$(C_6H_5)_2$ (Biphenyl)		16.08±0.05	EI		1238
$C_9H_7^+$	$C_6H_5C{\equiv}CC_6H_5$ (Diphenylacetylene)		17.5±0.1	EI		1238
$C_9H_7^+$	$C_{14}H_{10}$ (Phenanthrene)		23.9±0.2	RPD		2540
$C_9H_7^+$	$C_{10}H_7NH_2$ (1–Aminonaphthalene)	HCN+H	14.15	EI		2541
(Metastable transitions indicate zero kinetic energy release)						
$C_9H_7^+$	$C_{10}H_7NH_2$ (2–Aminonaphthalene)	HCN+H	14.28	EI		2541
(Metastable transitions indicate zero kinetic energy release)						
$C_9H_7^+$	$C_{10}H_7OH$ (1–Hydroxynaphthalene)	CO+H	13.68	EI		2541
(Metastable transitions indicate ~0.1 eV kinetic energy release)						
$C_9H_7^+$	$C_{10}H_7OH$ (2–Hydroxynaphthalene)	CO+H	13.91	EI		2541
(Metastable transitions indicate ~0.2 eV kinetic energy release)						

Occolowitz and White, ref. 2541, conclude that the $C_9H_7^+$ ions from indene, 2–ethynyltoluene and the substituted naphthalenes have an ethynyltropylium structure rather than indenyl.

$C_9H_8^+$(Indene) **ΔH°_{f298} = 948 kJ mol^{-1} (227 kcal mol^{-1})**

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_9H_8^+$	$C_6H_4(CH_3)C{\equiv}CH$ (2–Ethynyltoluene)		8.90	EI		2541
$C_9H_8^+$	C_9H_8 (Indene)		8.13±0.05	PE	948	2847
$C_9H_8^+$	C_9H_8 (Indene)		8.14±0.01	PE	949	2942
$C_9H_8^+$	C_9H_8 (Indene)		8.62	EI		2541
$C_9H_8^+$	$C_{10}H_7NH_2$ (1–Aminonaphthalene)	HCN	12.56	EI		2541
(Metastable transition indicates zero kinetic energy release)						
$C_9H_8^+$	$C_{10}H_7NH_2$ (2–Aminonaphthalene)	HCN	12.59	EI		2541
(Metastable transition indicates zero kinetic energy release)						
$C_9H_8^+$	$C_{10}H_7OH$ (1–Hydroxynaphthalene)	CO	11.73	EI		2541
(Metastable transition indicates ~0.1 eV kinetic energy release)						

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_9H_8^+$	$C_{10}H_7OH$ (2–Hydroxynaphthalene)	CO	11.27	EI		2541
(Metastable transition indicates ~0.2 eV kinetic energy release)						
Occolowitz and White, ref. 2541, conclude that the $C_9H_8^+$ fragment ions above have a 2–ethynyltoluene structure rather than indene.						
	$C_9H_{10}^+$ (Isopropenylbenzene)		**ΔH°_{f298} = 919 kJ mol^{-1} (220 kcal mol^{-1})**			
$C_9H_{10}^+$	$C_6H_5C(CH_3)=CH_2$ (Isopropenylbenzene)		8.35±0.01	PI	919	182
$C_9H_{10}^+$	C_9H_{10} (Indan)		9.05±0.05	EI		3342
$C_9H_{10}^+$	C_9H_{10} (Bicyclo[4.2.1]nona–2,4,7–triene)		8.36 (V)	PE		3328
$C_9H_{10}^+$	$C_6H_5CH(CH_3)CH_2COOCH_3$ (3–Phenylbutanoic acid methyl ester)		9.72±0.2	EI		2497
$C_9H_{10}^+$	$C_6H_4(CH_3)(CH_2)_3COOCH_3$ (4–(4–Tolyl)butanoic acid methyl ester)		10.65±0.2	EI		2497
		$C_9H_{11}^+$				
$C_9H_{11}^+$	$C_6H_5C_4H_9$ (*tert*–Butylbenzene)	CH_3	10.26	EI		3238
$C_9H_{11}^+$	$C_6H_3(CH_3)_2CH_2CD_3$ (1,2–Dimethyl–4–ethyl–2,2,2–d_3–benzene)	CD_3	10.5	EI		2144
$C_9H_{11}^+$	$C_6H_3(CH_3)_2CH_2CD_3$ (1,4–Dimethyl–3–ethyl–2,2,2–d_3–benzene)	CD_3	10.5	EI		2144
$C_9H_{11}^+$	$C_6H_3(CH_3)_2CH_2CD_3$ (1,3–Dimethyl–5–ethyl–2,2,2–d_3–benzene)	CD_3	10.5	EI		2144
$C_9H_{11}^+$	$C_{18}H_{30}$ (3–Phenyldodecane)		10.42±0.1	EI		2153
$C_9H_{11}^+$	$C_{26}H_{46}$ (3–Phenyleicosane)		10.69±0.1	EI		2153
$C_9H_{11}^+$	$C_{26}H_{46}$ (4–Phenyleicosane)		11.36±0.1	EI		2153
$C_9H_{11}^+$	$C_6H_4(CH_3)CH(CH_3)CH_2COOCH_3$ (3–(4–Tolyl)butanoic acid methyl ester)		10.95±0.2	EI		2497
$C_9H_{11}^+$	$C_6H_5(CH_2)_3Br$ (1–Bromo–3–phenylpropane)	Br?	10.1	EI		2973
		$C_9H_8D_3^+$				
$C_9H_8D_3^+$	$C_6H_3(CH_3)_2CH_2CD_3$ (1,2–Dimethyl–4–ethyl–2,2,2–d_3–benzene)	CH_3	10.5	EI		2144
$C_9H_8D_3^+$	$C_6H_3(CH_3)_2CH_2CD_3$ (1,4–Dimethyl–3–ethyl–2,2,2–d_3–benzene)	CH_3	10.5	EI		2144
$C_9H_8D_3^+$	$C_6H_3(CH_3)_2CH_2CD_3$ (1,3–Dimethyl–5–ethyl–2,2,2–d_3–benzene)	CH_3	10.5	EI		2144

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_9H_7^+$				
$C_9H_7^+$	C_9H_7 (Indenyl radical)		8.35	EI		126
$C_9H_7^+$	$C_6H_4(CH_3)C{\equiv}CH$ (2–Ethynyltoluene)	H	11.36	EI		2541
(Metastable transition indicates zero kinetic energy release)						
$C_9H_7^+$	C_9H_8 (Indene)	H	12.53	EI		2541
(Metastable transition indicates zero kinetic energy release)						
$C_9H_7^+$	$(C_6H_5)_2$ (Biphenyl)		16.08±0.05	EI		1238
$C_9H_7^+$	$C_6H_5C{\equiv}CC_6H_5$ (Diphenylacetylene)		17.5±0.1	EI		1238
$C_9H_7^+$	$C_{14}H_{10}$ (Phenanthrene)		23.9±0.2	RPD		2540
$C_9H_7^+$	$C_{10}H_7NH_2$ (1–Aminonaphthalene)	HCN+H	14.15	EI		2541
(Metastable transitions indicate zero kinetic energy release)						
$C_9H_7^+$	$C_{10}H_7NH_2$ (2–Aminonaphthalene)	HCN+H	14.28	EI		2541
(Metastable transitions indicate zero kinetic energy release)						
$C_9H_7^+$	$C_{10}H_7OH$ (1–Hydroxynaphthalene)	CO+H	13.68	EI		2541
(Metastable transitions indicate ~0.1 eV kinetic energy release)						
$C_9H_7^+$	$C_{10}H_7OH$ (2–Hydroxynaphthalene)	CO+H	13.91	EI		2541
(Metastable transitions indicate ~0.2 eV kinetic energy release)						

Occolowitz and White, ref. 2541, conclude that the $C_9H_7^+$ ions from indene, 2–ethynyltoluene and the substituted naphthalenes have an ethynyltropylium structure rather than indenyl.

$C_9H_8^+$(Indene) **ΔH°_{f298} = 948 kJ mol^{-1} (227 kcal mol^{-1})**

$C_9H_8^+$	$C_6H_4(CH_3)C{\equiv}CH$ (2–Ethynyltoluene)		8.90	EI		2541
$C_9H_8^+$	C_9H_8 (Indene)		8.13±0.05	PE	948	2847
$C_9H_8^+$	C_9H_8 (Indene)		8.14±0.01	PE	949	2942
$C_9H_8^+$	C_9H_8 (Indene)		8.62	EI		2541
$C_9H_8^+$	$C_{10}H_7NH_2$ (1–Aminonaphthalene)	HCN	12.56	EI		2541
(Metastable transition indicates zero kinetic energy release)						
$C_9H_8^+$	$C_{10}H_7NH_2$ (2–Aminonaphthalene)	HCN	12.59	EI		2541
(Metastable transition indicates zero kinetic energy release)						
$C_9H_8^+$	$C_{10}H_7OH$ (1–Hydroxynaphthalene)	CO	11.73	EI		2541
(Metastable transition indicates ~0.1 eV kinetic energy release)						

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_9H_8^+$	$C_{10}H_7OH$ (2–Hydroxynaphthalene)	CO	11.27	EI		2541
(Metastable transition indicates ~0.2 eV kinetic energy release)						
Occolowitz and White, ref. 2541, conclude that the $C_9H_8^+$ fragment ions above have a 2–ethynyltoluene structure rather than indene.						
	$C_9H_{10}^+$ (Isopropenylbenzene)	**ΔH_{f298}° = 919 kJ mol^{-1} (220 kcal mol^{-1})**				
$C_9H_{10}^+$	$C_6H_5C(CH_3){=}CH_2$ (Isopropenylbenzene)		8.35±0.01	PI	919	182
$C_9H_{10}^+$	C_9H_{10} (Indan)		9.05±0.05	EI		3342
$C_9H_{10}^+$	C_9H_{10} (Bicyclo[4.2.1]nona–2,4,7–triene)		8.36 (V)	PE		3328
$C_9H_{10}^+$	$C_6H_5CH(CH_3)CH_2COOCH_3$ (3–Phenylbutanoic acid methyl ester)		9.72±0.2	EI		2497
$C_9H_{10}^+$	$C_6H_4(CH_3)(CH_2)_3COOCH_3$ (4–(4–Tolyl)butanoic acid methyl ester)		10.65±0.2	EI		2497
		$C_9H_{11}^+$				
$C_9H_{11}^+$	$C_6H_5C_4H_9$ (*tert*–Butylbenzene)	CH_3	10.26	EI		3238
$C_9H_{11}^+$	$C_6H_3(CH_3)_2CH_2CD_3$ (1,2–Dimethyl–4–ethyl–2,2,2–d_3–benzene)	CD_3	10.5	EI		2144
$C_9H_{11}^+$	$C_6H_3(CH_3)_2CH_2CD_3$ (1,4–Dimethyl–3–ethyl–2,2,2–d_3–benzene)	CD_3	10.5	EI		2144
$C_9H_{11}^+$	$C_6H_3(CH_3)_2CH_2CD_3$ (1,3–Dimethyl–5–ethyl–2,2,2–d_3–benzene)	CD_3	10.5	EI		2144
$C_9H_{11}^+$	$C_{18}H_{30}$ (3–Phenyldodecane)		10.42±0.1	EI		2153
$C_9H_{11}^+$	$C_{26}H_{46}$ (3–Phenyleicosane)		10.69±0.1	EI		2153
$C_9H_{11}^+$	$C_{26}H_{46}$ (4–Phenyleicosane)		11.36±0.1	EI		2153
$C_9H_{11}^+$	$C_6H_4(CH_3)CH(CH_3)CH_2COOCH_3$ (3–(4–Tolyl)butanoic acid methyl ester)		10.95±0.2	EI		2497
$C_9H_{11}^+$	$C_6H_5(CH_2)_3Br$ (1–Bromo–3–phenylpropane)	Br?	10.1	EI		2973
		$C_9H_8D_3^+$				
$C_9H_8D_3^+$	$C_6H_3(CH_3)_2CH_2CD_3$ (1,2–Dimethyl–4–ethyl–2,2,2–d_3–benzene)	CH_3	10.5	EI		2144
$C_9H_8D_3^+$	$C_6H_3(CH_3)_2CH_2CD_3$ (1,4–Dimethyl–3–ethyl–2,2,2–d_3–benzene)	CH_3	10.5	EI		2144
$C_9H_8D_3^+$	$C_6H_3(CH_3)_2CH_2CD_3$ (1,3–Dimethyl–5–ethyl–2,2,2–d_3–benzene)	CH_3	10.5	EI		2144

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
	$C_9H_{12}^+$ (Propylbenzene)		**ΔH°_{f298} = 849 kJ mol^{-1} (203 kcal mol^{-1})**			
	$C_9H_{12}^+$ (Isopropylbenzene)		**ΔH°_{f298} = 842 kJ mol^{-1} (201 kcal mol^{-1})**			
	$C_9H_{12}^+$ (1,2,3-Trimethylbenzene)		**ΔH°_{f298} = 809 kJ mol^{-1} (193 kcal mol^{-1})**			
	$C_9H_{12}^+$ (1,2,4-Trimethylbenzene)		**ΔH°_{f298} = 784 kJ mol^{-1} (187 kcal mol^{-1})**			
	$C_9H_{12}^+$ (1,3,5-Trimethylbenzene)		**ΔH°_{f298} = 794 kJ mol^{-1} (190 kcal mol^{-1})**			
$C_9H_{12}^+$	$C_6H_5C_3H_7$ (Propylbenzene)		8.72±0.01	PI	849	182, 416
See also – EI:	2522, 3338					
$C_9H_{12}^+$	$C_6H_5C_3H_7$ (Isopropylbenzene)		~8.76	S		344
$C_9H_{12}^+$	$C_6H_5C_3H_7$ (Isopropylbenzene)		8.69±0.01	PI	842	182, 416
See also – EI:	3238					
$C_9H_{12}^+$	$C_6H_3(CH_3)_3$ (1,2,3-Trimethylbenzene)		8.48±0.01	PI	809	168, 3154
See also – EI:	2163					
$C_9H_{12}^+$	$C_6H_3(CH_3)_3$ (1,2,4-Trimethylbenzene)		8.27±0.01	PI	784	168, 3154
See also – EI:	2163					
$C_9H_{12}^+$	$C_6H_3(CH_3)_3$ (1,3,5-Trimethylbenzene)		8.39±0.01	PI	793	168, 3154
$C_9H_{12}^+$	$C_6H_3(CH_3)_3$ (1,3,5-Trimethylbenzene)		8.40±0.01	PI	794	182
$C_9H_{12}^+$	$C_6H_3(CH_3)_3$ (1,3,5-Trimethylbenzene)		8.41±0.02	PI	795	1142, 1159, 1166
$C_9H_{12}^+$	$C_6H_3(CH_3)_3$ (1,3,5-Trimethylbenzene) (Average of two values)		8.47	CTS		3403
$C_9H_{12}^+$	$C_6H_3(CH_3)_3$ (1,3,5-Trimethylbenzene)		8.55	CTS		2909
See also – PI:	190, 416					
PE:	1159					
EI:	1066, 2163, 2511, 2865					
$C_9H_{12}^+$	C_9H_{12} (*cis,cis,cis*–1,4,7–Cyclononatriene)		8.42±0.03	PI		2877
$C_9H_{12}^+$	C_9H_{12} (*cis,cis,cis*–1,4,7–Cyclononatriene)		8.45	PE		3328
See also – EI:	3341					
$C_9H_{12}^+$	C_9H_{12} (Bicyclo[4.3.0]nona–3,7–diene)		8.78	PE		2951

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_9H_{14}^+$						
$C_9H_{14}^+$	$C_5H_2(CH_3)_4$ (1,2,3,4–Tetramethylcyclopentadiene)		7.8±0.1	EI		2163
$C_9H_{14}^+$	$C_5H_2(CH_3)_4$ (1,4,5,5–Tetramethylcyclopentadiene)		7.84±0.05	EI		2163
$C_9H_{14}^+$	C_9H_{14} (1,4–Cyclononadiene)		8.60±0.03	PI		2877
$C_9H_{16}^+$						
$C_9H_{16}^+$	C_9H_{16} (*cis*–Hexahydroindan)		10.13±0.03	EI		1184, 2028
$C_9H_{16}^+$	C_9H_{16} (*trans*–Hexahydroindan)		10.18±0.03	EI		1184, 2028
$C_9H_{17}^+$						
$C_9H_{17}^+$	*cis*–$(CH_3)_3CCH{=}CHC(CH_3)_3$	CH_3	10.53±0.02	EI		2533
$C_9H_{17}^+$	*trans*–$(CH_3)_3CCH{=}CHC(CH_3)_3$	CH_3	10.70±0.06	EI		2533
$C_9H_{20}^+$						
$C_9H_{20}^+$	*n*–C_9H_{20}		10.19	RPD		2977
$C_{10}H_6^+$						
$C_{10}H_6^+$	$C_{10}H_8$ (Naphthalene)	H_2	16.2±0.15	EI		2112
$C_{10}H_6^+$	$C_{10}H_8$ (Azulene)	H_2	14.7±0.10	EI		2112
$C_{10}H_6^+$	$C_6H_5C{\equiv}CC_6H_5$ (Diphenylacetylene)	$2C_2H_2$	18.23±0.1	EI		1238
$C_{10}H_6^+$	$C_{14}H_{10}$ (Phenanthrene)	$2C_2H_2$	20.80±0.3	RPD		2540
$C_{10}H_6^+$	$C_{14}H_{10}$ (Phenanthrene)	$2C_2H_2$	20.9±0.3	EI		1238
$C_{10}H_7^+$						
$C_{10}H_7^+$	$C_{10}H_8$ (Naphthalene)	H	15.4±0.10	EI		2112
$C_{10}H_7^+$	$C_{10}H_8$ (Azulene)	H	14.0±0.10	EI		2112

4.3. The Positive Ion Table—Continued

$C_{10}H_8^+$(Naphthalene) ΔH°_{f298} = 936 kJ mol^{-1} (224 kcal mol^{-1})
$C_{10}H_8^+$(Azulene) ΔH°_{f298} = 996 kJ mol^{-1} (238 kcal mol^{-1})

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_{10}H_8^+$	$C_{10}H_8$ (Naphthalene) (Average of five Rydberg series limits)		8.136±0.005	S	936	2686
$C_{10}H_8^+$	$C_{10}H_8$ (Naphthalene) (Average of three Rydberg series limits)		8.133	S	936	2661
$C_{10}H_8^+$	$C_{10}H_8$ (Naphthalene)		8.12±0.01	PI	934	182, 416
$C_{10}H_8^+$	$C_{10}H_8$ (Naphthalene)		8.14	PI	936	2661
$C_{10}H_8^+$	$C_{10}H_8$ (Naphthalene)		8.14±0.02	PI	936	1166
$C_{10}H_8^+$	$C_{10}H_8$ (Naphthalene)		8.15±0.01	PI	937	2651
$C_{10}H_8^+$	$C_{10}H_8$ (Naphthalene)		8.11±0.01	PE	933	2840, 2843, 2844, 2942
$C_{10}H_8^+$	$C_{10}H_8$ (Naphthalene)		8.12±0.05	PE	934	2847
$C_{10}H_8^+$	$C_{10}H_8$ (Naphthalene)		8.16±0.03	EDD		3174
$C_{10}H_8^+$	$C_{10}H_8$ (Naphthalene)		8.08	CTS		2909
$C_{10}H_8^+$	$C_{10}H_8$ (Naphthalene)		8.10	CTS		2947
$C_{10}H_8^+$	$C_{10}H_8$ (Naphthalene)		8.15	CTS		1064
$C_{10}H_8^+$	$C_{10}H_8$ (Naphthalene)		8.16	CTS		2910

See also – S: 344
EI: 413, 2112, 2458, 2538, 2847, 3011, 3284
CTS: 2562

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_{10}H_8^+$	$C_{10}H_8$ (Azulene) (Average of two Rydberg series limits)		7.408	S	995	1459, 2661
$C_{10}H_8^+$	$C_{10}H_8$ (Azulene) (Average of two Rydberg series limits)		7.431±0.006	S	997	1420

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_{10}H_8^+$	$C_{10}H_8$ (Azulene)		7.41	PI	995	2636, 2661
$C_{10}H_8^+$	$C_{10}H_8$ (Azulene)		7.42±0.05	PE	996	2847
$C_{10}H_8^+$	$C_{10}H_8$ (Azulene)		7.43±0.01	PE	997	2843, 2942
$C_{10}H_8^+$	$C_{10}H_8$ (Azulene)		7.4–7.5	CTS		2037
See also – EI:	2112, 2458, 2847					
$C_{10}H_8^+$	$(C_6H_5)_2$ (Biphenyl)		14.81±0.05	EI		1238
		$C_{10}D_8^+$				
$C_{10}D_8^+$	$C_{10}D_8$ (Naphthalene–d_8) (Average of five Rydberg series limits)		8.138±0.008	S		2686
		$C_{10}H_8^{+2}$				
$C_{10}H_8^{+2}$	$C_{10}H_8$ (Naphthalene)		22.8±0.2	FD		212
$C_{10}H_8^{+2}$	$C_{10}H_8$ (Naphthalene)		22.7	EI		413
		$C_{10}H_8^{+3}$				
$C_{10}H_8^{+3}$	$C_{10}H_8$ (Naphthalene)		40±5	NRE		212
		$C_{10}H_{10}^+$				
$C_{10}H_{10}^+$	$(C_5H_5)_2$ (5,5′–Bicyclopentadienyl)		7.75	EI		2732, 2940
$C_{10}H_{10}^+$	$C_{10}H_{10}$ (Bullvalene)		8.05	PE		3329
$C_{10}H_{10}^+$	$C_{10}H_{10}$ (Bullvalene)		8.13	PE		2951

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_{10}H_{12}^+$				
$C_{10}H_{12}^+$	$C_{10}H_{12}$ (1,2,3,4–Tetrahydronaphthalene)		8.73	EI		3338
$C_{10}H_{12}^+$	$C_{10}H_{12}$ (1,2,3,4–Tetrahydronaphthalene)		9.14±0.05	EI		3342
$C_{10}H_{12}^+$	$C_{10}H_{12}$ (1,4,5,8–Tetrahydronaphthalene)		8.2	PE		3326
$C_{10}H_{12}^+$	$C_{10}H_{12}$ (Dihydrobullvalene)		8.02	PE		3329
$C_{10}H_{12}^+$	$C_{10}H_{12}$ (Tricyclo[5.2.1.0^{2,6}]deca–3,8–diene)		8.79±0.05	PE		3246
$C_{10}H_{12}^+$	$C_6H_4(CH_3)CH(CH_3)CH_2COOCH_3$ (3–(4–Tolyl)butanoic acid methyl ester)		9.74±0.2	EI		2497
		$C_{10}H_{13}^+$				
$C_{10}H_{13}^+$	$C_6H_4(C_3H_7)CH_2$ (4–Isopropylbenzyl radical)		7.42±0.1	EI		69
$C_{10}H_{13}^+$	$C_{18}H_{30}$ (1–Phenyldodecane)		11.07±0.1	EI		2153
$C_{10}H_{13}^+$	$C_{26}H_{46}$ (1–Phenyleicosane)		10.86±0.1	EI		2153
$C_{10}H_{13}^+$	$C_{26}H_{46}$ (4–Phenyleicosane)		10.58±0.1	EI		2153

$C_{10}H_{14}^+$ (Butylbenzene) $\Delta H^\circ_{f298} = 825$ **kJ mol^{-1} (197 kcal mol^{-1})**
$C_{10}H_{14}^+$ (*sec*–Butylbenzene) $\Delta H^\circ_{f298} = 820$ **kJ mol^{-1} (196 kcal mol^{-1})**
$C_{10}H_{14}^+$ (Isobutylbenzene) $\Delta H^\circ_{f298} = 817$ **kJ mol^{-1} (195 kcal mol^{-1})**
$C_{10}H_{14}^+$ (*tert*–Butylbenzene) $\Delta H^\circ_{f298} = 815$ **kJ mol^{-1} (195 kcal mol^{-1})**
$C_{10}H_{14}^+$ (1,2,4,5–Tetramethylbenzene) $\Delta H^\circ_{f298} = 730$ **kJ mol^{-1} (174 kcal mol^{-1})**

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_{10}H_{14}^+$	$C_6H_5C_4H_9$ (Butylbenzene)		8.69±0.01	PI	825	182, 416
$C_{10}H_{14}^+$	$C_6H_5C_4H_9$ (Butylbenzene)		8.69±0.01	PI	825	3154
$C_{10}H_{14}^+$	$C_6H_5C_4H_9$ (*sec*–Butylbenzene)		8.68±0.01	PI	820	182
$C_{10}H_{14}^+$	$C_6H_5C_4H_9$ (*sec*–Butylbenzene)		8.68±0.01	PI	820	3154
$C_{10}H_{14}^+$	$C_6H_5C_4H_9$ (Isobutylbenzene)		8.69±0.01	PI	817	3154

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_{10}H_{14}^+$	$C_6H_5C_4H_9$ (*tert*–Butylbenzene)		8.68±0.01	PI	815	182
$C_{10}H_{14}^+$	$C_6H_5C_4H_9$ (*tert*–Butylbenzene)		8.68±0.01	PI	815	3154
See also – EI:	2407, 2463, 3238					
$C_{10}H_{14}^+$	$C_6H_2(CH_3)_4$ (1,2,3,5–Tetramethylbenzene)		8.47±0.05	EI		2163
$C_{10}H_{14}^+$	$C_6H_2(CH_3)_4$ (1,2,4,5–Tetramethylbenzene)		8.025±0.005	PI	729	182
$C_{10}H_{14}^+$	$C_6H_2(CH_3)_4$ (1,2,4,5–Tetramethylbenzene)		8.03	PI	730	168
$C_{10}H_{14}^+$	$C_6H_2(CH_3)_4$ (1,2,4,5–Tetramethylbenzene)		8.05±0.02	PI	731	1142, 1159, 1166
$C_{10}H_{14}^+$	$C_6H_2(CH_3)_4$ (1,2,4,5–Tetramethylbenzene)		8.50±0.05	EI		2163
$C_{10}H_{14}^+$	$C_6H_2(CH_3)_4$ (1,2,4,5–Tetramethylbenzene) (Average of three values)		8.37	CTS		2978
See also – PE:	1159					
$C_{10}H_{14}^+$	$C_{10}H_{14}$ (Tetrahydrobullvalene)		7.95	PE		3329
		$C_{10}H_{16}^+$				
$C_{10}H_{16}^+$	$C_5H(CH_3)_5$ (1,2,3,5,5– and 1,2,4,5,5–Pentamethylcyclopentadiene mixture)		7.77±0.05	EI		2163
$C_{10}H_{16}^+$	$C_{10}H_{16}$ (*cis*,*trans*–1,5–Cyclodecadiene)		8.90 (V)	PE		3330
$C_{10}H_{16}^+$	$C_{10}H_{16}$ (*cis*,*cis*–1,6–Cyclodecadiene)		8.68 (V)	PE		3330
$C_{10}H_{16}^+$	$C_{10}H_{16}$ (*trans*,*trans*–1,6–Cyclodecadiene)		8.05 (V)	PE		3330
$C_{10}H_{16}^+$	$C_{10}H_{16}$ (α–Pinene)		8.07	PE		1130
$C_{10}H_{16}^+$	$C_{10}H_{16}$ (Adamantane)		9.25	PE		2843, 2951
$C_{10}H_{16}^+$	$C_{10}H_{16}$ (Hexahydrobullvalene)		8.71	PE		3329

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
	$C_{10}H_{18}^+$ (*cis*–Decalin)	**ΔH°_{f298} = 738 kJ mol^{-1} (176 kcal mol^{-1})**				
	$C_{10}H_{18}^+$ (*trans*–Decalin)	**ΔH°_{f298} = 720 kJ mol^{-1} (172 kcal mol^{-1})**				
$C_{10}H_{18}^+$	$(CH_3)_3CC{\equiv}CC(CH_3)_3$		9.19±0.04	RPD		2408
$C_{10}H_{18}^+$	$C_{10}H_{18}$ (*cis*–Cyclodecene)		8.80	PE		3330
$C_{10}H_{18}^+$	$C_{10}H_{18}$ (*trans*–Cyclodecene)		8.80	PE		3330
$C_{10}H_{18}^+$	$C_{10}H_{18}$ (*cis*–Decalin)		9.40	PE	738	2840, 2843
See also – EI:	1182, 1183, 3337					
$C_{10}H_{18}^+$	$C_{10}H_{18}$ (*trans*–Decalin)		9.35	PE	720	2840, 2843
See also – EI:	1182, 1183, 3337					
		$C_{10}H_{20}^+$				
$C_{10}H_{20}^+$	*cis*–$(CH_3)_3CCH{=}CHC(CH_3)_3$		8.68±0.02	PI		2877
See also – EI:	2533					
$C_{10}H_{20}^+$	*trans*–$(CH_3)_3CCH{=}CHC(CH_3)_3$		8.734±0.01	PI		2877
See also – EI:	2410, 2533					
		$C_{11}H_7^+$				
$C_{11}H_7^+$	$C_6H_5C{\equiv}CC_6H_5$ (Diphenylacetylene)		17.52±0.1	EI		1238
$C_{11}H_7^+$	$C_{14}H_{10}$ (Phenanthrene)		21.10±0.2	RPD		2540
$C_{11}H_7^+$	$C_{14}H_{10}$ (Phenanthrene)		21.1±0.3	EI		1238
		$C_{11}H_9^+$				
$C_{11}H_9^+$	$C_{10}H_7CH_2$ (1–Naphthylmethyl radical)		7.35±0.1	EI		71
$C_{11}H_9^+$	$C_{10}H_7CH_2$ (2–Naphthylmethyl radical)		7.56±0.05	EI		69, 71
$C_{11}H_9^+$	$C_{10}H_7CH_3$ (1–Methylnaphthalene)	H	12.4±0.1	RPD		2538
$C_{11}H_9^+$	$C_{10}H_7CH_3$ (2–Methylnaphthalene)	H	13.2±0.2	RPD		2538
$C_{11}H_9^+$	$(C_6H_5O)_2CO$ (Carbonic acid diphenyl ester)		13.90±0.05	EI		1237

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
	$C_{11}H_{10}^+$ (1–Methylnaphthalene) **$C_{11}H_{10}^+$ (2–Methylnaphthalene)**		**ΔH°_{f298} = 885 kJ mol^{-1} (211 kcal mol^{-1})** **ΔH°_{f298} = 884 kJ mol^{-1} (211 kcal mol^{-1})**			
$C_{11}H_{10}^+$	$C_{10}H_7CH_3$ (1–Methylnaphthalene)		7.96±0.01	PI	885	182, 416
$C_{11}H_{10}^+$	$C_{10}H_7CH_3$ (1–Methylnaphthalene)		7.98	CTS		2909
See also – EI: 2538						
$C_{11}H_{10}^+$	$C_{10}H_7CH_3$ (2–Methylnaphthalene)		7.955±0.01	PI	884	182
See also – S: 344 EI: 2538 CTS: 2562						
$C_{11}H_{10}^+$	$(C_6H_5O)_2CO$ (Carbonic acid diphenyl ester)		12.41±0.1	EI		1237
			$C_{11}H_{14}^+$			
$C_{11}H_{14}^+$	$C_{11}H_{14}$ (Cycloheptenobenzene)		9.10±0.05	EI		3342
			$C_{11}H_{15}^+$			
$C_{11}H_{15}^+$	$C_{26}H_{46}$ (5–Phenyleicosane)		10.43±0.1	EI		2153
	$C_{11}H_{16}^+$ (Pentamethylbenzene)		**ΔH°_{f298} = 690 kJ mol^{-1} (165 kcal mol^{-1})**			
$C_{11}H_{16}^+$	$C_6H_5C_5H_{11}$ (Neopentylbenzene)		8.41±0.04	RPD		2407
$C_{11}H_{16}^+$	$C_6H(CH_3)_5$ (Pentamethylbenzene)		7.92±0.02	PI	690	1142, 1166
$C_{11}H_{16}^+$	$C_6H(CH_3)_5$ (Pentamethylbenzene)		7.92	PI	690	168
See also – EI: 2163						
			$C_{11}H_{18}^+$			
$C_{11}H_{18}^+$	$C_5(CH_3)_6$ (Hexamethylcyclopentadiene)		7.74±0.05	EI		2163
$C_{11}H_{18}^+$	$C_{11}H_{18}$ (2–Methylene–1,7,7–trimethylbicyclo[2.2.1]heptane)		8.62±0.01	PI		2877
$C_{11}H_{18}^+$	$C_{10}H_{15}CH_3$ (1–Methyladamantane)		9.24	PE		2951
$C_{11}H_{18}^+$	$C_{10}H_{15}CH_3$ (2–Methyladamantane)		9.24	PE		2951

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_{12}H_6^+$				
$C_{12}H_6^+$	$(C_6H_4CN)_2$ (4,4′–Dicyanobiphenyl)	2HCN	17.35	EI		3295
$C_{12}H_6^+$	$C_{16}H_6O_6$ (3,3′,4,4′–Biphenyltetracarboxylic acid dianhydride)	$2CO_2+2CO$	18.47	EI		3295
		$C_{12}H_7^+$				
$C_{12}H_7^+$	$C_6H_5C{\equiv}CC_6H_5$ (Diphenylacetylene)		17.46±0.06	EI		1238
$C_{12}H_7^+$	$C_{14}H_{10}$ (Phenanthrene)		18.80±0.1	RPD		2540
$C_{12}H_7^+$	$C_{14}H_{10}$ (Phenanthrene)		19.63±0.05	EI		1238
See also – EI:	2538					
	$C_{12}H_8^+$(Biphenylene) **$C_{12}H_8^+$(Acenaphthylene)**	**ΔH°_{f298} = 1211 kJ mol^{-1} (290 kcal mol^{-1})** **ΔH°_{f298} = 1032 kJ mol^{-1} (247 kcal mol^{-1})**				
$C_{12}H_8^+$	$C_{12}H_8$ (Biphenylene)		7.56±0.05	PE	1211	2796
See also – EI:	2458, 2847					
$C_{12}H_8^+$	$C_{12}H_8$ (Acenaphthylene)		8.02±0.01	PE	1032	2942
$C_{12}H_8^+$	$(C_6H_5)_2$ (Biphenyl)		16.89±0.08	EI		1238
$C_{12}H_8^+$	$C_6H_5C{\equiv}CC_6H_5$ (Diphenylacetylene)		15.58±0.05	EI		1238
$C_{12}H_8^+$	$C_{14}H_{10}$ (Phenanthrene)		15.65±0.2	RPD		2540
$C_{12}H_8^+$	$C_{14}H_{10}$ (Phenanthrene)		16.63±0.05	EI		1238
See also – EI:	2538					
$C_{12}H_8^+$	$(C_6H_5)_2CO$ (Benzophenone)		17.48±0.12	EI		1237
		$C_{12}H_8^{+2}$				
$C_{12}H_8^{+2}$	$(C_6H_5)_2$ (Biphenyl)		22.0±1.0	EI		1238
$C_{12}H_8^{+2}$	$C_6H_5C{\equiv}CC_6H_5$ (Diphenylacetylene)		20.5±0.1	EI		1238

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_{12}H_9^+$				
$C_{12}H_9^+$	$(C_6H_5)_2$ (Biphenyl)	H	14.36±0.05	EI		1238
$C_{12}H_9^+$	$(C_6H_5)_2CO$ (Benzophenone)	CO+H?	15.28±0.05	EI		1237
	$C_{12}H_{10}^+$ (Biphenyl) **$C_{12}H_{10}^+$ (Acenaphthene)**	**$\Delta H^\circ_{f298} \sim 976$ kJ mol^{-1} (233 kcal mol^{-1})** **$\Delta H^\circ_{f298} = 902$ kJ mol^{-1} (216 kcal mol^{-1})**				
$C_{12}H_{10}^+$	$(C_6H_5)_2$ (Biphenyl)		8.27±0.01	PI	980	182
$C_{12}H_{10}^+$	$(C_6H_5)_2$ (Biphenyl)		8.20±0.05	PE	973	2847
$C_{12}H_{10}^+$	$(C_6H_5)_2$ (Biphenyl)		8.23±0.01	PE	976	2942
$C_{12}H_{10}^+$	$(C_6H_5)_2$ (Biphenyl)		8.22±0.15	EI		2458
$C_{12}H_{10}^+$	$(C_6H_5)_2$ (Biphenyl)		8.4	CTS		2978
(Average of three values)						
$C_{12}H_{10}^+$	$(C_6H_5)_2$ (Biphenyl)		8.46	CTS		2562
$C_{12}H_{10}^+$	$(C_6H_5)_2$ (Biphenyl)		8.64	CTS		2909
See also – PE: EI:	3290 1238, 2438, 2634, 2847, 3286					
$C_{12}H_{10}^+$	$C_{12}H_{10}$ (Acenaphthene)		7.73±0.01	PE	902	2942
$C_{12}H_{10}^+$	$C_{12}H_{10}$ (Acenaphthene)		7.66	CTS		2909
$C_{12}H_{10}^+$	$(C_6H_5)_2CO$ (Benzophenone)	CO	12.24±0.13	EI		1237
		$C_{12}H_{10}^{+2}$				
$C_{12}H_{10}^{+2}$	$(C_6H_5)_2$ (Biphenyl)		21.9±0.3	EI		1238
		$C_{12}H_{11}^+$				
$C_{12}H_{11}^+$	$C_{10}H_6(CH_3)_2$ (1,4–Dimethylnaphthalene)	H	12.9±0.1	RPD		2538
$C_{12}H_{11}^+$	$C_{10}H_7CH_2CH_2OH$ (2–(4–Azulyl)ethanol)	OH	10.3	EI		3333

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
	$C_{12}H_{12}^+$					
$C_{12}H_{12}^+$	$C_{10}H_6(CH_3)_2$ (1,4–Dimethylnaphthalene)		7.78±0.03	RPD		2538
$C_{12}H_{12}^+$	$C_{10}H_6(CH_3)_2$ (2,3–Dimethylnaphthalene)		8.20±0.05	RPD		2538
$C_{12}H_{12}^+$	$C_{10}H_6(CH_3)_2$ (2,3–Dimethylnaphthalene)		8.11	CTS		2562
	$C_{12}H_{14}^+$					
$C_{12}H_{14}^+$	$C_{12}H_{14}$ (1,2:3,4–Dicyclopentenobenzene)		8.66±0.02	EI		3342
	$C_{12}H_{16}^+$					
$C_{12}H_{16}^+$	$C_{12}H_{16}$ (Cyclooctenobenzene)		8.97±0.03	EI		3342
	$C_{12}H_{18}^+$ (Hexamethylbenzene)		**ΔH°_{f298} = 652 kJ mol^{-1} (156 kcal mol^{-1})**			
$C_{12}H_{18}^+$	$(CH_3)_3CC{\equiv}CC{\equiv}CC(CH_3)_3$		8.82±0.04	RPD		2408
$C_{12}H_{18}^+$	$C_6(CH_3)_6$ (Hexamethylbenzene)		7.85±0.02	PI	652	1142
$C_{12}H_{18}^+$	$C_6(CH_3)_6$ (Hexamethylbenzene)		7.85	PI	652	168
$C_{12}H_{18}^+$	$C_6(CH_3)_6$ (Hexamethylbenzene)		7.87	EI		2511
$C_{12}H_{18}^+$	$C_6(CH_3)_6$ (Hexamethylbenzene) (Average of three values)		7.95	CTS		2978
See also – CTS: 2562						
	$C_{12}H_{20}^+$					
$C_{12}H_{20}^+$	$C_{12}H_{20}$ (2–Ethylidene–1,7,7–trimethylbicyclo[2.2.1]heptane)		8.22±0.01	PI		2877
	$C_{12}H_{22}^+$					
$C_{12}H_{22}^+$	$(C_6H_{11})_2$ (Bicyclohexyl)		9.41	PE		2951
	$C_{13}H_7^+$					
$C_{13}H_7^+$	$C_{14}H_{10}$ (Phenanthrene)		20.0±0.3	RPD		2540

4.3. The Positive Ion Table—Continued

$C_{13}H_8^+$

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_{13}H_8^+$	$C_{14}H_8N_2O$ (9–Diazo–10–oxophenanthrene)	$CO+N_2$	14.7±0.2	EI		2995

$C_{13}H_9^+$

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_{13}H_9^+$	$C_{13}H_9$ (Fluorenyl radical)		7.07	EI		126
$C_{13}H_9^+$	$C_{13}H_{10}$ (Fluorene)	H	12.5±0.1	EDD		2974
$C_{13}H_9^+$	$(C_6H_5)_2CH_2$ (Diphenylmethane)	H_2+H	14.9±0.1	EDD		2974
$C_{13}H_9^+$	$C_6H_5CH=CHC_6H_5$ (1,2–Diphenylethene)	CH_3	11.3±0.1	EDD		2974
$C_{13}H_9^+$	$C_{14}H_{12}$ (9,10–Dihydrophenanthrene)	CH_3	11.8±0.1	EDD		2974
$C_{13}H_9^+$	$C_{14}H_9CH_3$ (1–Methylphenanthrene)		15.8±0.2	RPD		2538
$C_{13}H_9^+$	$C_{14}H_9CH_3$ (2–Methylphenanthrene)		13.8±0.2	RPD		2538
$C_{13}H_9^+$	$C_{14}H_9CH_3$ (3–Methylphenanthrene)		13.4±0.2	RPD		2538
$C_{13}H_9^+$	$C_6H_5CH_2CH=CHC_6H_5$ (1,3–Diphenylpropene)	C_2H_5	13.75	EI		2498
$C_{13}H_9^+$	$C_{13}H_{10}N_4$ (1–Benzylideneamino–1,2,3–benzotriazole)		9.6±0.1	EDD		2974

A value for the heat of formation of $C_{13}H_9^+$ computed in ref. 2974 is based on an appearance potential of 9.0 eV for this process. Which appearance potential is the correct one is not known.

$C_{13}H_{10}^+$

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_{13}H_{10}^+$	$C_{13}H_{10}$ (Fluorene)		7.93±0.01	PE		2942
$C_{13}H_{10}^+$	$C_{13}H_{10}$ (Fluorene)		7.78	CTS		2562
$C_{13}H_{10}^+$	$C_{13}H_{10}$ (Fluorene)		8.42	CTS		2911

See also – EI: 126

$C_{13}H_{11}^+$

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_{13}H_{11}^+$	$(C_6H_5)_2CH$ (Diphenylmethyl radical)		7.32±0.1	EI		71
$C_{13}H_{11}^+$	$C_6H_5CH_2CH=CHC_6H_5$ (1,3–Diphenylpropene)	C_2H_3	12.40	EI		2498
$C_{13}H_{11}^+$	$C_6H_5C_6H_4(CH_2)_3COOCH_3$ (4–(4–Biphenylyl)butanoic acid methyl ester)		12.15±0.2	EI		2497

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_{13}H_{12}^+$				
$C_{13}H_{12}^+$	$(C_6H_5)_2CH_2$ (Diphenylmethane)		9.1 (V)	PE		3290
		$C_{13}H_{19}^+$				
$C_{13}H_{19}^+$	$C_6H_4(C_4H_9)_2$ (1,2-Di-*tert*-butylbenzene)	CH_3	10.64±0.07	EI		2416
$C_{13}H_{19}^+$	$C_6H_4(C_4H_9)_2$ (1,3-Di-*tert*-butylbenzene)	CH_3	11.70±0.07	EI		2416
$C_{13}H_{19}^+$	$C_6H_4(C_4H_9)_2$ (1,4-Di-*tert*-butylbenzene)	CH_3	11.69±0.07	EI		2416
$C_{13}H_{19}^+$	$C_{19}H_{32}$ (7-Phenyltridecane)		10.15±0.1	EI		2153
$C_{13}H_{19}^+$	$C_{26}H_{46}$ (7-Phenyleicosane)		10.28±0.1	EI		2153
		$C_{14}H_7^+$				
$C_{14}H_7^+$	$C_{14}H_{10}$ (Phenanthrene)	H_2+H	18.15±0.2	RPD		2540
		$C_{14}H_8^+$				
$C_{14}H_8^+$	$C_6H_5C{\equiv}CC_6H_5$ (Diphenylacetylene)	H_2	16.66±0.05	EI		1238
$C_{14}H_8^+$	$C_{14}H_{10}$ (Phenanthrene)	H_2	16.20±0.2	RPD		2540
$C_{14}H_8^+$	$C_{14}H_{10}$ (Phenanthrene)	H_2	18.58±0.1	EI		1238
See also – EI:	2538					
$C_{14}H_8^+$	$C_{15}H_8N_2O$ (9-Diazo-4,5-methylene-10-oxophenanthrene)	CO+N_2	13.8±0.2	EI		2995
		$C_{14}H_9^+$				
$C_{14}H_9^+$	$C_6H_5C{\equiv}CC_6H_5$ (Diphenylacetylene)	H	15.13±0.1	EI		1238
$C_{14}H_9^+$	$C_{14}H_{10}$ (Phenanthrene)	H	15.45±0.1	RPD		2540
$C_{14}H_9^+$	$C_{14}H_{10}$ (Phenanthrene)	H	16.25±0.1	EI		1238
See also – EI:	2538, 2539					

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_{14}H_{10}^+$				
$C_{14}H_{10}^+$	$C_6H_5C{\equiv}CC_6H_5$ (Diphenylacetylene)		7.91	PE		3412
$C_{14}H_{10}^+$	$C_6H_5C{\equiv}CC_6H_5$ (Diphenylacetylene)		8.85±0.05	EI		1238
$C_{14}H_{10}^+$	$C_{14}H_{10}$ (Anthracene)		7.15	S		2652
(Average of five Rydberg series limits)						
$C_{14}H_{10}^+$	$C_{14}H_{10}$ (Anthracene)		7.414	S		2661
(Average of three Rydberg series limits)						
$C_{14}H_{10}^+$	$C_{14}H_{10}$ (Anthracene)		7.5	PI		2661
$C_{14}H_{10}^+$	$C_{14}H_{10}$ (Anthracene)		7.41	PE		3412
$C_{14}H_{10}^+$	$C_{14}H_{10}$ (Anthracene)		7.55	EI		413
$C_{14}H_{10}^+$	$C_{14}H_{10}$ (Anthracene)		7.2	CTS		2037
$C_{14}H_{10}^+$	$C_{14}H_{10}$ (Anthracene)		7.23	CTS		3000
$C_{14}H_{10}^+$	$C_{14}H_{10}$ (Anthracene)		7.37	CTS		2562, 2947
$C_{14}H_{10}^+$	$C_{14}H_{10}$ (Anthracene)		7.40	CTS		2909
$C_{14}H_{10}^+$	$C_{14}H_{10}$ (Anthracene)		7.4	CTS		2978
$C_{14}H_{10}^+$	$C_{14}H_{10}$ (Anthracene)		7.42	CTS		1064
$C_{14}H_{10}^+$	$C_{14}H_{10}$ (Anthracene)		7.43	CTS		2910

The series assignments of refs. 2652 and 2661 are uncertain. We recommend a tentative value for the ionization potential of about 7.5 eV and an ion heat of formation at 298 K of approximately 954 kJ mol^{-1} (228 kcal mol^{-1}).

See also – EI: 3011

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_{14}H_{10}^{+}$	$C_{14}H_{10}$ (Phenanthrene)		7.69	S		2661
$C_{14}H_{10}^{+}$	$C_{14}H_{10}$ (Phenanthrene)		7.75	PI		2661
$C_{14}H_{10}^{+}$	$C_{14}H_{10}$ (Phenanthrene)		7.91±0.01	PE		2942
$C_{14}H_{10}^{+}$	$C_{14}H_{10}$ (Phenanthrene)		7.92	PE		3412
$C_{14}H_{10}^{+}$	$C_{14}H_{10}$ (Phenanthrene)		8.03±0.01	RPD		2538, 2539, 2540
$C_{14}H_{10}^{+}$	$C_{14}H_{10}$ (Phenanthrene)		8.03	EI		413
$C_{14}H_{10}^{+}$	$C_{14}H_{10}$ (Phenanthrene)		8.10±0.04	EI		1238
$C_{14}H_{10}^{+}$	$C_{14}H_{10}$ (Phenanthrene)		7.6	CTS		2910
$C_{14}H_{10}^{+}$	$C_{14}H_{10}$ (Phenanthrene)		8.02	CTS		3000
$C_{14}H_{10}^{+}$	$C_{14}H_{10}$ (Phenanthrene)		8.03	CTS		2978
(Average of three values)						
$C_{14}H_{10}^{+}$	$C_{14}H_{10}$ (Phenanthrene)		8.07	CTS		1064
$C_{14}H_{10}^{+}$	$C_{14}H_{10}$ (Phenanthrene)		8.08	CTS		2911
$C_{14}H_{10}^{+}$	$C_{14}H_{10}$ (Phenanthrene)		8.09	CTS		2947
$C_{14}H_{10}^{+}$	$C_{14}H_{10}$ (Phenanthrene)		8.22	CTS		2909

We recommend a tentative value for the ionization potential of about 7.8 eV and an ion heat of formation at 298 K of approximately 960 kJ mol^{-1} (229 kcal mol^{-1}).

See also – EI: 3011

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_{14}H_{10}^{+}$	$C_6H_5CH_2CH=CHC_6H_5$ (1,3-Diphenylpropene)		15.05	EI		2498

$C_{14}H_8D_2^{+}$

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_{14}H_8D_2^{+}$	$C_{14}H_8D_2$ (Phenanthrene-*9,10-d*$_2$)		8.03	RPD		2539

$C_{14}D_{10}^{+}$

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_{14}D_{10}^{+}$	$C_{14}D_{10}$ (Phenanthrene-*d*$_{10}$)		8.05	RPD		2539, 2540

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_{14}H_{10}^{+2}$				
$C_{14}H_{10}^{+2}$	$C_6H_5C{\equiv}CC_6H_5$ (Diphenylacetylene)		23.35±0.1	EI		1238
$C_{14}H_{10}^{+2}$	$C_{14}H_{10}$ (Anthracene)		21.1	EI		413
$C_{14}H_{10}^{+2}$	$C_{14}H_{10}$ (Phenanthrene)		23.1	EI		413
		$C_{14}H_{11}^{+}$				
$C_{14}H_{11}^{+}$	$C_6H_5CH_2CH{=}CHC_6H_5$ (1,3–Diphenylpropene)	CH_3	11.95	EI		2498
		$C_{14}H_{12}^{+}$				
$C_{14}H_{12}^{+}$	$C_6H_5CH{=}CHC_6H_5$ (1,2–Diphenylethene)		7.60	CTS		2562
$C_{14}H_{12}^{+}$	$C_6H_5CH{=}CHC_6H_5$ (1,2–Diphenylethene)		7.95	CTS		2978
(Average of three values)						
$C_{14}H_{12}^{+}$	$C_{14}H_{12}$ (9,10–Dihydrophenanthrene)		8.08±0.06	EI		3340
$C_{14}H_{12}^{+}$	$C_6H_5C_6H_4(CH_2)_3COOCH_3$ (4–(4–Biphenylyl)butanoic acid methyl ester)		10.90±0.2	EI		2497
		$C_{14}H_{13}^{+}$				
$C_{14}H_{13}^{+}$	$C_6H_5C_6H_4CH(CH_3)CH_2COOCH_3$ (3–(4–Biphenylyl)butanoic acid methyl ester)		10.87±0.2	EI		2497
		$C_{14}H_{14}^{+}$				
$C_{14}H_{14}^{+}$	$C_6H_5CH_2CH_2C_6H_5$ (1,2–Diphenylethane)		9.1 (V)	PE		3290
$C_{14}H_{14}^{+}$	$C_6H_5CH_2CH_2C_6H_5$ (1,2–Diphenylethane)		8.7±0.1	EI		3288
		$C_{14}H_{18}^{+}$				
$C_{14}H_{18}^{+}$	$C_{14}H_{18}$ (1,2,3,4,5,6,7,8–Octahydrophenanthrene)		8.79±0.02	EI		3342
		$C_{14}H_{20}^{+}$				
$C_{14}H_{20}^{+}$	$C_{14}H_{20}$ (Congressane)		8.93	PE		2843, 2951

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
			$C_{14}H_{22}^+$			
$C_{14}H_{22}^+$	$C_6H_4(C_4H_9)_2$ (1,2-Di-*tert*-butylbenzene)		8.60±0.07	EI		2416
$C_{14}H_{22}^+$	$C_6H_4(C_4H_9)_2$ (1,3-Di-*tert*-butylbenzene)		8.71±0.07	EI		2416
$C_{14}H_{22}^+$	$C_6H_4(C_4H_9)_2$ (1,4-Di-*tert*-butylbenzene)		8.74±0.07	EI		2416
			$C_{14}H_{24}^+$			
$C_{14}H_{24}^+$	$C_{10}H_{12}(CH_3)_4$ (1,3,5,7-Tetramethyladamantane)		9.23	PE		2951
			$C_{15}H_9^+$			
$C_{15}H_9^+$	$C_{14}H_9CH_3$ (1-Methylphenanthrene)	H_2+H	18.0±0.2	RPD		2538
$C_{15}H_9^+$	$C_{14}H_9CH_3$ (2-Methylphenanthrene)	H_2+H	16.6±0.2	RPD		2538
$C_{15}H_9^+$	$C_{14}H_9CH_3$ (3-Methylphenanthrene)	H_2+H	16.1±0.2	RPD		2538
$C_{15}H_9^+$	$C_{14}H_9CH_3$ (9-Methylphenanthrene)	H_2+H	16.5±0.2	RPD		2538
$C_{15}H_9^+$	$C_{14}H_8(CH_3)_2$ (2,3-Dimethylphenanthrene)		15.6±0.1	RPD		2538
$C_{15}H_9^+$	$C_{14}H_8(CH_3)_2$ (3,6-Dimethylphenanthrene)		18.2±0.1	RPD		2538
			$C_{15}H_{10}^+$			
$C_{15}H_{10}^+$	$C_{14}H_9CH_3$ (1-Methylphenanthrene)	H_2	14.7±0.2	RPD		2538
$C_{15}H_{10}^+$	$C_{14}H_9CH_3$ (2-Methylphenanthrene)	H_2	13.1±0.2	RPD		2538
$C_{15}H_{10}^+$	$C_{14}H_9CH_3$ (3-Methylphenanthrene)	H_2	13.6±0.2	RPD		2538
$C_{15}H_{10}^+$	$C_{14}H_9CH_3$ (9-Methylphenanthrene)	H_2	13.3±0.2	RPD		2538
$C_{15}H_{10}^+$	$C_{14}H_8(CH_3)_2$ (2,3-Dimethylphenanthrene)		15.1±0.1	RPD		2538
$C_{15}H_{10}^+$	$C_{14}H_8(CH_3)_2$ (2,5-Dimethylphenanthrene)		16.4±0.2	RPD		2538
$C_{15}H_{10}^+$	$C_{14}H_8(CH_3)_2$ (3,6-Dimethylphenanthrene)		16.2±0.1	RPD		2538
$C_{15}H_{10}^+$	$C_{14}H_8(CH_3)_2$ (4,5-Dimethylphenanthrene)		15.3±0.2	RPD		2538
$C_{15}H_{10}^+$	$C_{14}H_8(CH_3)_2$ (9,10-Dimethylphenanthrene)		18.0±0.1	RPD		2538

4.3. The Positive Ion Table—Continued

$C_{15}H_{11}^+$

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_{15}H_{11}^+$	$C_{14}H_9CH_3$ (1–Methylphenanthrene)	H	13.1±0.1	RPD		2538, 2539, 2540
$C_{15}H_{11}^+$	$C_{14}H_9CH_3$ (2–Methylphenanthrene)	H	12.9±0.1	RPD		2538, 2539, 2540
$C_{15}H_{11}^+$	$C_{14}H_9CH_3$ (3–Methylphenanthrene)	H	12.8±0.1	RPD		2538, 2539, 2540
$C_{15}H_{11}^+$	$C_{14}H_9CH_3$ (4–Methylphenanthrene)	H	12.2±0.2	RPD		2538
$C_{15}H_{11}^+$	$C_{14}H_9CH_3$ (9–Methylphenanthrene)	H	12.4±0.1	RPD		2538, 2539
$C_{15}H_{11}^+$	$C_{14}H_8(CH_3)_2$ (2,3–Dimethylphenanthrene)	CH_3	12.3±0.2	RPD		2538, 2539
$C_{15}H_{11}^+$	$C_{14}H_8(CH_3)_2$ (2,7–Dimethylphenanthrene)	CH_3	13.10	RPD		2539

See also – EI: 2538

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_{15}H_{11}^+$	$C_{14}H_8(CH_3)_2$ (3,6–Dimethylphenanthrene)	CH_3	13.0±0.05	RPD		2538, 2539
$C_{15}H_{11}^+$	$C_{14}H_8(CH_3)_2$ (4,5–Dimethylphenanthrene)	CH_3	10.8±0.1	RPD		2538
$C_{15}H_{11}^+$	$C_{14}H_8(CH_3)_2$ (9,10–Dimethylphenanthrene)	CH_3	12.0±0.1	RPD		2538, 2539

$C_{15}H_{12}^+$

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_{15}H_{12}^+$	$C_{14}H_9CH_3$ (1–Methylphenanthrene)		7.70±0.03	RPD		2538, 2539, 2540
$C_{15}H_{12}^+$	$C_{14}H_9CH_3$ (2–Methylphenanthrene)		7.70	RPD		2539, 2540

See also – EI: 2538

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_{15}H_{12}^+$	$C_{14}H_9CH_3$ (3–Methylphenanthrene)		7.90	RPD		2539, 2540

See also – EI: 2538

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_{15}H_{12}^+$	$C_{14}H_9CH_3$ (4–Methylphenanthrene)		7.70±0.02	RPD		2538
$C_{15}H_{12}^+$	$C_{14}H_9CH_3$ (9–Methylphenanthrene)		7.46±0.03	RPD		2538, 2539

$C_{15}H_9D_3^+$

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_{15}H_9D_3^+$	$C_{14}H_9CD_3$ (3–Methyl–d_3–phenanthrene)		7.85	RPD		2539

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_{15}H_{13}^+$						
$C_{15}H_{13}^+$	$C_6H_5CH_2CH=CHC_6H_5$ (1,3–Diphenylpropene)	H	11.65	EI		2498
$C_{15}H_{14}^+$						
$C_{15}H_{14}^+$	$C_6H_5CH_2CH=CHC_6H_5$ (1,3–Diphenylpropene)		8.30	EI		2498
$C_{15}H_{14}^+$	$C_6H_5C_6H_4CH(CH_3)CH_2COOCH_3$ (3–(4–Biphenylyl)butanoic acid methyl ester)		9.91±0.2	EI		2497
$C_{15}H_{18}^+$						
$C_{15}H_{18}^+$	$C_{15}H_{18}$ (Tricyclopentenobenzene)		8.36±0.02	EI		3342
$C_{15}H_{23}^+$						
$C_{15}H_{23}^+$	$C_{26}H_{46}$ (9–Phenyleicosane)		10.30±0.1	EI		2153
$C_{16}H_9^+$						
$C_{16}H_9^+$	$C_{14}H_8(CH_3)_2$ (4,5–Dimethylphenanthrene)	$2H_2$+H	12.5±0.2	RPD		2538
$C_{16}H_{10}^+$ (Fluoranthene)		**ΔH°_{f298} = 1047 kJ mol^{-1} (250 kcal mol^{-1})**				
$C_{16}H_{10}^+$	$C_{16}H_{10}$ (Fluoranthene)		7.80±0.01	PE	1047	2942
$C_{16}H_{10}^+$	$C_{16}H_{10}$ (Fluoranthene)		7.72	CTS		2562
$C_{16}H_{10}^+$	$C_{16}H_{10}$ (Pyrene)		7.72±0.3	EI		1069
$C_{16}H_{10}^+$	$C_{16}H_{10}$ (Pyrene)		7.31	CTS		2037
$C_{16}H_{10}^+$	$C_{16}H_{10}$ (Pyrene)		7.48	CTS		2909
$C_{16}H_{10}^+$	$C_{16}H_{10}$ (Pyrene)		7.53	CTS		2978
(Average of two values)						
$C_{16}H_{10}^+$	$C_{16}H_{10}$ (Pyrene)		7.55	CTS		2562, 2947
$C_{16}H_{10}^+$	$C_{16}H_{10}$ (Pyrene)		7.58	CTS		3000
$C_{16}H_{10}^+$	$C_{16}H_{10}$ (Pyrene)		7.70	CTS		1064

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_{16}H_{10}^+$	$C_{16}H_{10}$ (Pyrene)		7.72	CTS		2910
$C_{16}H_{10}^+$	$C_{14}H_8(CH_3)_2$ (4,5-Dimethylphenanthrene)	$2H_2$	13.0±0.2	RPD		2538
		$C_{16}H_{10}^{+2}$				
$C_{16}H_{10}^{+2}$	$C_{16}H_{10}$ (Pyrene)		24.00±0.5	EI		1069
		$C_{16}H_{12}^+$				
$C_{16}H_{12}^+$	$C_{14}H_8(CH_3)_2$ (2,5-Dimethylphenanthrene)	H_2	12.1±0.2	RPD		2538
		$C_{16}H_{13}^+$				
$C_{16}H_{13}^+$	$C_{14}H_8(CH_3)_2$ (2,3-Dimethylphenanthrene)	H	13.1±0.1	RPD		2538
$C_{16}H_{13}^+$	$C_{14}H_8(CH_3)_2$ (2,5-Dimethylphenanthrene)	H	13.0±0.2	RPD		2538
$C_{16}H_{13}^+$	$C_{14}H_8(CH_3)_2$ (2,7-Dimethylphenanthrene)	H	14.2±0.1	RPD		2538
$C_{16}H_{13}^+$	$C_{14}H_8(CH_3)_2$ (3,6-Dimethylphenanthrene)	H	13.8±0.2	RPD		2538
		$C_{16}H_{14}^+$				
$C_{16}H_{14}^+$	$C_6H_5(CH{=}CH)_2C_6H_5$ (1,4-Diphenyl-1,3-butadiene)		7.75	CTS		2978
$C_{16}H_{14}^+$	$C_{14}H_8(CH_3)_2$ (2,3-Dimethylphenanthrene)		7.80±0.03	RPD		2538, 2539
$C_{16}H_{14}^+$	$C_{14}H_8(CH_3)_2$ (2,5-Dimethylphenanthrene)		7.83±0.04	RPD		2538
$C_{16}H_{14}^+$	$C_{14}H_8(CH_3)_2$ (2,7-Dimethylphenanthrene)		7.98±0.05	RPD		2538, 2539
$C_{16}H_{14}^+$	$C_{14}H_8(CH_3)_2$ (3,6-Dimethylphenanthrene)		7.60±0.03	RPD		2538, 2539
$C_{16}H_{14}^+$	$C_{14}H_8(CH_3)_2$ (4,5-Dimethylphenanthrene)		7.53±0.04	RPD		2538
$C_{16}H_{14}^+$	$C_{14}H_8(CH_3)_2$ (9,10-Dimethylphenanthrene)		8.01±0.05	RPD		2538, 2539
		$C_{16}H_{16}^+$				
$C_{16}H_{16}^+$	$C_{16}H_{16}$ ([2.2]Paracyclophane)		~7.8	PE		3290

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_{16}H_{22}^+$				
$C_{16}H_{22}^+$	$C_{16}H_{22}$ (1,2:3,4–Dicycloheptenobenzene)		8.39±0.02	EI		3342
		$C_{16}H_{25}^+$				
$C_{16}H_{25}^+$	$C_{18}H_{30}$ (3–Phenyldodecane)		9.26±0.1	EI		2153
		$C_{17}H_{11}^+$				
$C_{17}H_{11}^+$	$C_6H_4(C_6H_5)_2$ (*o*–Terphenyl)		12.0±0.1	EI		2438
$C_{17}H_{11}^+$	$C_6H_5(C_6H_4)_2C_6H_5$ (*o*–Quaterphenyl)		13.0±0.2	EI		2438
		$C_{17}H_{27}^+$				
$C_{17}H_{27}^+$	$C_6H_3(C_4H_9)_3$ (1,2,4–Tri–*tert*–butylbenzene)	CH_3	11.14±0.07	EI		2416
$C_{17}H_{27}^+$	$C_6H_3(C_4H_9)_3$ (1,3,5–Tri–*tert*–butylbenzene)	CH_3	11.91±0.07	EI		2416
		$C_{18}H_{10}^+$				
$C_{18}H_{10}^+$	$C_6H_5(C_6H_4)_2C_6H_5$ (*o*–Quaterphenyl)		19.0±0.4	EI		2438
$C_{18}H_{10}^+$	$C_6H_5(C_6H_4)_2C_6H_5$ (*m*–Quaterphenyl)		18.3±0.3	EI		2438
		$C_{18}H_{12}^+$				
$C_{18}H_{12}^+$	$C_{18}H_{12}$ (Chrysene)		8.01±0.3	EI		1069
$C_{18}H_{12}^+$	$C_{18}H_{12}$ (Chrysene)		7.68	CTS		2909
$C_{18}H_{12}^+$	$C_{18}H_{12}$ (Chrysene)		7.72	CTS		3000
$C_{18}H_{12}^+$	$C_{18}H_{12}$ (Chrysene)		7.78	CTS		2978
(Average of two values)						
$C_{18}H_{12}^+$	$C_{18}H_{12}$ (Chrysene)		7.80	CTS		2562, 2947
$C_{18}H_{12}^+$	$C_{18}H_{12}$ (Chrysene)		7.82	CTS		1064
$C_{18}H_{12}^+$	$C_{18}H_{12}$ (Chrysene)		7.83	CTS		2910

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_{18}H_{12}^+$	$C_{18}H_{12}$ (3,4–Benzophenanthrene)		7.76	CTS		3000
$C_{18}H_{12}^+$	$C_{18}H_{12}$ (3,4–Benzophenanthrene)		7.86	CTS		2910
$C_{18}H_{12}^+$	$C_{18}H_{12}$ (9,10–Benzophenanthrene)		8.19±0.3	EI		1069
$C_{18}H_{12}^+$	$C_{18}H_{12}$ (9,10–Benzophenanthrene)		7.95	CTS		2978
(Average of two values)						
$C_{18}H_{12}^+$	$C_{18}H_{12}$ (9,10–Benzophenanthrene)		8.08	CTS		2909
$C_{18}H_{12}^+$	$C_{18}H_{12}$ (9,10–Benzophenanthrene)		8.09	CTS		2562, 2947
$C_{18}H_{12}^+$	$C_{18}H_{12}$ (9,10–Benzophenanthrene)		8.13	CTS		3000
$C_{18}H_{12}^+$	$C_{18}H_{12}$ (9,10–Benzophenanthrene)		8.17	CTS		2910
$C_{18}H_{12}^+$	$C_{18}H_{12}$ (1,2–Benzanthracene)		7.53±0.3	EI		1069
$C_{18}H_{12}^+$	$C_{18}H_{12}$ (1,2–Benzanthracene)		7.35	CTS		3000
$C_{18}H_{12}^+$	$C_{18}H_{12}$ (1,2–Benzanthracene)		7.45	CTS		2947
$C_{18}H_{12}^+$	$C_{18}H_{12}$ (1,2–Benzanthracene)		7.52	CTS		1064
$C_{18}H_{12}^+$	$C_{18}H_{12}$ (1,2–Benzanthracene)		7.53	CTS		2910
$C_{18}H_{12}^+$	$C_{18}H_{12}$ (1,2–Benzanthracene)		7.56	CTS		2909
$C_{18}H_{12}^+$	$C_{18}H_{12}$ (1,2–Benzanthracene)		7.6	CTS		2978
See also – EI:	3011					
$C_{18}H_{12}^+$	$C_{18}H_{12}$ (Naphthacene)		6.95±0.3	EI		1069
$C_{18}H_{12}^+$	$C_{18}H_{12}$ (Naphthacene)		6.64	CTS		3000
$C_{18}H_{12}^+$	$C_{18}H_{12}$ (Naphthacene)		6.94	CTS		1064
$C_{18}H_{12}^+$	$C_{18}H_{12}$ (Naphthacene)		6.95	CTS		2910
$C_{18}H_{12}^+$	$C_{18}H_{12}$ (Naphthacene)		7.00	CTS		2947
$C_{18}H_{12}^+$	$C_{18}H_{12}$ (Naphthacene)		7.0	CTS		2978
See also – S:	3046					
$C_{18}H_{12}^+$	$C_6H_4(C_6H_5)_2$ (*o*–Terphenyl)	H_2	11.7±0.1	EI		2438
$C_{18}H_{12}^+$	$C_6H_5(C_6H_4)_2C_6H_5$ (*o*–Quaterphenyl)		13.0±0.1	EI		2438

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_{18}H_{12}^{+}$	$C_6H_5(C_6H_4)_2C_6H_5$ (*m*–Quaterphenyl)		16.7±0.3	EI		2438
$C_{18}H_{12}^{+}$	$C_6H_5(C_6H_4)_4C_6H_5$ (*p*–Hexaphenyl)		18.5±0.3	EI		2438
		$C_{18}H_{12}^{+2}$				
$C_{18}H_{12}^{+2}$	$C_{18}H_{12}$ (Chrysene)		23.35±0.5	EI		1069
$C_{18}H_{12}^{+2}$	$C_{18}H_{12}$ (9,10–Benzophenanthrene)		24.10±1.0	EI		1069
$C_{18}H_{12}^{+2}$	$C_{18}H_{12}$ (1,2–Benzanthracene)		22.03±0.5	EI		1069
$C_{18}H_{12}^{+2}$	$C_{18}H_{12}$ (Naphthacene)		22.14±0.5	EI		1069
		$C_{18}H_{13}^{+}$				
$C_{18}H_{13}^{+}$	$C_6H_4(C_6H_5)_2$ (*o*–Terphenyl)	H	11.7±0.1	EI		2438
$C_{18}H_{13}^{+}$	$C_6H_5(C_6H_4)_2C_6H_5$ (*o*–Quaterphenyl)		12.8±0.1	EI		2438
$C_{18}H_{13}^{+}$	$C_6H_5(C_6H_4)_4C_6H_5$ (*p*–Hexaphenyl)		19.5±0.3	EI		2438
		$C_{18}H_{14}^{+}$				
$C_{18}H_{14}^{+}$	$C_6H_4(C_6H_5)_2$ (*o*–Terphenyl)		8.64±0.05	EI		2438
$C_{18}H_{14}^{+}$	$C_6H_4(C_6H_5)_2$ (*o*–Terphenyl)		8.43	CTS		2562
$C_{18}H_{14}^{+}$	$C_6H_4(C_6H_5)_2$ (*m*–Terphenyl)		8.80±0.05	EI		2438
$C_{18}H_{14}^{+}$	$C_6H_4(C_6H_5)_2$ (*p*–Terphenyl)		8.78±0.05	EI		2438
$C_{18}H_{14}^{+}$	$C_6H_4(C_6H_5)_2$ (*p*–Terphenyl)		8.29	CTS		2562
See also – S:	2661					
		$C_{18}H_{14}^{+2}$				
$C_{18}H_{14}^{+2}$	$C_6H_4(C_6H_5)_2$ (*o*–Terphenyl)		21.5±0.4	EI		2438
$C_{18}H_{14}^{+2}$	$C_6H_4(C_6H_5)_2$ (*m*–Terphenyl)		21.5±0.4	EI		2438
$C_{18}H_{14}^{+2}$	$C_6H_4(C_6H_5)_2$ (*p*–Terphenyl)		21.5±0.4	EI		2438

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_{18}H_{16}^+$						
$C_{18}H_{16}^+$	$C_6H_5(CH{=}CH)_3C_6H_5$ (1,6–Diphenyl–1,3,5–hexatriene)		7.6	CTS		2978
$C_{18}H_{18}^+$						
$C_{18}H_{18}^+$	$C_{18}H_{18}$ (1,6–Diphenylhexadiene)		8.2	CTS		2978
$C_{18}H_{24}^+$						
$C_{18}H_{24}^+$	$C_{18}H_{24}$ (Perhydro–9,10–benzophenanthrene)		8.60±0.03	EI		3342
$C_{18}H_{26}^+$						
$C_{18}H_{26}^+$	$C_{18}H_{26}$ (1,2:3,4–Dicyclooctenobenzene)		7.93±0.03	EI		3342
$C_{18}H_{29}^+$						
$C_{18}H_{29}^+$	$C_{26}H_{46}$ (9–Phenyleicosane)		10.12±0.1	EI		2153
$C_{18}H_{30}^+$						
$C_{18}H_{30}^+$	$C_{18}H_{30}$ (1–Phenyldodecane)		9.05±0.1	EI		2153
$C_{18}H_{30}^+$	$C_{18}H_{30}$ (3–Phenyldodecane)		8.95±0.1	EI		2153
$C_{18}H_{30}^+$	$C_6H_3(C_4H_9)_3$ (1,2,4–Tri–*tert*–butylbenzene)		8.60±0.07	EI		2416
$C_{18}H_{30}^+$	$C_6H_3(C_4H_9)_3$ (1,3,5–Tri–*tert*–butylbenzene)		8.56±0.07	EI		2416
$C_{19}H_{14}^+$						
$C_{19}H_{14}^+$	$C_{18}H_{11}CH_3$ (3–Methyl–1,2–benzanthracene)		7.43	CTS		2947
$C_{19}H_{14}^+$	$C_{18}H_{11}CH_3$ (4–Methyl–1,2–benzanthracene)		7.41	CTS		2947
$C_{19}H_{14}^+$	$C_{18}H_{11}CH_3$ (5–Methyl–1,2–benzanthracene)		7.39	CTS		2947
$C_{19}H_{14}^+$	$C_{18}H_{11}CH_3$ (6–Methyl–1,2–benzanthracene)		7.37	CTS		2947
$C_{19}H_{14}^+$	$C_{18}H_{11}CH_3$ (7–Methyl–1,2–benzanthracene)		7.37	CTS		2947

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_{19}H_{14}^+$	$C_{18}H_{11}CH_3$ (10–Methyl–1,2–benzanthracene)		7.29	CTS		2947
$C_{19}H_{14}^+$	$C_{18}H_{11}CH_3$ (2′–Methyl–1,2–benzanthracene)		7.39	CTS		2947
$C_{19}H_{14}^+$	$C_{18}H_{11}CH_3$ (3′–Methyl–1,2–benzanthracene)		7.43	CTS		2947
$C_{19}H_{14}^+$	$C_{18}H_{11}CH_3$ (4′–Methyl–1,2–benzanthracene)		7.43	CTS		2947
		$C_{19}H_{32}^+$				
$C_{19}H_{32}^+$	$C_{19}H_{32}$ (7–Phenyltridecane)		8.91±0.1	EI		2153
		$C_{20}H_{12}^+$				
$C_{20}H_{12}^+$	$C_{20}H_{12}$ (Perylene)		7.10±0.1	EI		2489
$C_{20}H_{12}^+$	$C_{20}H_{12}$ (Perylene)		6.83	CTS		3000
$C_{20}H_{12}^+$	$C_{20}H_{12}$ (Perylene)		6.85	CTS		2037
$C_{20}H_{12}^+$	$C_{20}H_{12}$ (Perylene)		7.03	CTS		2947
$C_{20}H_{12}^+$	$C_{20}H_{12}$ (Perylene)		7.06	CTS		2909
$C_{20}H_{12}^+$	$C_{20}H_{12}$ (Perylene)		7.10	CTS		1064
$C_{20}H_{12}^+$	$C_{20}H_{12}$ (Perylene)		7.11	CTS		2910
$C_{20}H_{12}^+$	$C_{20}H_{12}$ (Perylene)		7.15	CTS		2978
$C_{20}H_{12}^+$	$C_{20}H_{12}$ (1,2–Benzopyrene)		7.15	CTS		3000
$C_{20}H_{12}^+$	$C_{20}H_{12}$ (1,2–Benzopyrene)		7.19	CTS		2562, 2947
$C_{20}H_{12}^+$	$C_{20}H_{12}$ (1,2–Benzopyrene)		7.37	CTS		2910
$C_{20}H_{12}^+$	$C_{20}H_{12}$ (4,5–Benzopyrene)		7.56	CTS		2947
$C_{20}H_{12}^+$	$C_{20}H_{12}$ (4,5–Benzopyrene)		7.60	CTS		3000
$C_{20}H_{12}^+$	$C_{20}H_{12}$ (4,5–Benzopyrene)		7.73	CTS		2910
		$C_{20}H_{12}^{+2}$				
$C_{20}H_{12}^{+2}$	$C_{20}H_{12}$ (Perylene)		20.0	EI		2489

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_{20}H_{16}^+$						
$C_{20}H_{16}^+$	$C_{18}H_{10}(CH_3)_2$ (9,10–Dimethyl–1,2–benzanthracene)		7.43	CTS		2947
$C_{20}H_{18}^+$						
$C_{20}H_{18}^+$	$C_6H_5(CH{=}CH)_4C_6H_5$ (1,8–Diphenyl–1,3,5,7–octatetraene)		7.5	D		2978
$C_{20}H_{33}^+$						
$C_{20}H_{33}^+$	$C_{26}H_{46}$ (7–Phenyleicosane)		9.94±0.1	EI		2153
$C_{21}H_{16}^+$						
$C_{21}H_{16}^+$	$C_{20}H_{13}CH_3$ (20–Methylcholanthrene)		7.66	CTS		2562
$C_{21}H_{30}^+$						
$C_{21}H_{30}^+$	$C_{21}H_{30}$ (Tricycloheptenobenzene)		8.75±0.05	EI		3342
$C_{22}H_{12}^+$						
$C_{22}H_{12}^+$	$C_{22}H_{12}$ (4,5:10,11–Dibenzochrysene)		6.84	CTS		3000
$C_{22}H_{12}^+$	$C_{22}H_{12}$ (4,5:10,11–Dibenzochrysene)		7.01	CTS		2909
$C_{22}H_{12}^+$	$C_{22}H_{12}$ (4,5:10,11–Dibenzochrysene)		7.10	CTS		1064
$C_{22}H_{12}^+$	$C_{22}H_{12}$ (4,5:10,11–Dibenzochrysene)		7.11	CTS		2910
$C_{22}H_{12}^+$	$C_{22}H_{12}$ (1,12–Benzoperylene)		7.13	CTS		3000
$C_{22}H_{12}^+$	$C_{22}H_{12}$ (1,12–Benzoperylene)		7.35	CTS		2910
$C_{22}H_{14}^+$						
$C_{22}H_{14}^+$	$C_{22}H_{14}$ (1,2:3,4–Dibenzanthracene)		7.43	CTS		3000
$C_{22}H_{14}^+$	$C_{22}H_{14}$ (1,2:3,4–Dibenzanthracene)		7.6	CTS		2910

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_{22}H_{14}^+$	$C_{22}H_{14}$ (1,2:3,4–Dibenzanthracene)		7.61	CTS		2562, 2947
$C_{22}H_{14}^+$	$C_{22}H_{14}$ (1,2:5,6–Dibenzanthracene)		7.59±0.1	EI		2489
$C_{22}H_{14}^+$	$C_{22}H_{14}$ (1,2:5,6–Dibenzanthracene)		7.42	CTS		3000
$C_{22}H_{14}^+$	$C_{22}H_{14}$ (1,2:5,6–Dibenzanthracene)		7.57	CTS		1064
$C_{22}H_{14}^+$	$C_{22}H_{14}$ (1,2:5,6–Dibenzanthracene)		7.58	CTS		2910
$C_{22}H_{14}^+$	$C_{22}H_{14}$ (1,2:5,6–Dibenzanthracene)		7.80	CTS		2562, 2947
$C_{22}H_{14}^+$	$C_{22}H_{14}$ (1,2:6,7–Dibenzanthracene)		6.74	CTS		3000
$C_{22}H_{14}^+$	$C_{22}H_{14}$ (1,2:6,7–Dibenzanthracene)		7.03	CTS		2910
$C_{22}H_{14}^+$	$C_{22}H_{14}$ (1,2:7,8–Dibenzanthracene)		7.42	CTS		3000
$C_{22}H_{14}^+$	$C_{22}H_{14}$ (1,2:7,8–Dibenzanthracene)		7.58	CTS		2910
$C_{22}H_{14}^+$	$C_{22}H_{14}$ (1,2:7,8–Dibenzanthracene)		7.68	CTS		2562, 2947
$C_{22}H_{14}^+$	$C_{22}H_{14}$ (Pentacene)		6.55±0.1	EI		2489
$C_{22}H_{14}^+$	$C_{22}H_{14}$ (Pentacene)		6.23	CTS		3000
$C_{22}H_{14}^+$	$C_{22}H_{14}$ (Pentacene)		6.61	CTS		1064
$C_{22}H_{14}^+$	$C_{22}H_{14}$ (Pentacene)		6.62	CTS		2910
$C_{22}H_{14}^+$	$C_{22}H_{14}$ (Picene)		7.80±0.1	EI		2489
$C_{22}H_{14}^+$	$C_{22}H_{14}$ (Picene)		7.62	CTS		3000
$C_{22}H_{14}^+$	$C_{22}H_{14}$ (Picene)		7.75	CTS		2910
$C_{22}H_{14}^+$	$C_{22}H_{14}$ (Picene)		7.80	CTS		2947
$C_{22}H_{14}^+$	$C_{22}H_{14}$ (1,2:3,4–Dibenzophenanthrene)		7.57	CTS		3000
$C_{22}H_{14}^+$	$C_{22}H_{14}$ (1,2:5,6–Dibenzophenanthrene)		7.71	CTS		3000
$C_{22}H_{14}^+$	$C_{22}H_{14}$ (1,2:5,6–Dibenzophenanthrene)		7.82	CTS		2910
$C_{22}H_{14}^+$	$C_{22}H_{14}$ (1,2:6,7–Dibenzophenanthrene)		7.29	CTS		3000

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_{22}H_{14}^{+}$	$C_{22}H_{14}$ (2,3:5,6–Dibenzophenanthrene)		7.11	CTS		3000
$C_{22}H_{14}^{+}$	$C_{22}H_{14}$ (2,3:5,6–Dibenzophenanthrene)		7.33	CTS		2910
$C_{22}H_{14}^{+}$	$C_{22}H_{14}$ (2,3:6,7–Dibenzophenanthrene)		7.35	CTS		3000
$C_{22}H_{14}^{+}$	$C_{22}H_{14}$ (2,3:6,7–Dibenzophenanthrene)		7.53	CTS		2910
		$C_{22}H_{14}^{+2}$				
$C_{22}H_{14}^{+2}$	$C_{22}H_{14}$ (1,2:5,6–Dibenzanthracene)		20.8	EI		2489
$C_{22}H_{14}^{+2}$	$C_{22}H_{14}$ (Pentacene)		19.6	EI		2489
$C_{22}H_{14}^{+2}$	$C_{22}H_{14}$ (Picene)		21.5	EI		2489
		$C_{22}H_{20}^{+}$				
$C_{22}H_{20}^{+}$	$C_6H_5(CH{=}CH)_5C_6H_5$ (1,10–Diphenyl–1,3,5,7,9–decapentaene)		7.4	D		2978
		$C_{22}H_{37}^{+}$				
$C_{22}H_{37}^{+}$	$C_{26}H_{46}$ (5–Phenyleicosane)		9.99±0.1	EI		2153
		$C_{23}H_{13}^{+}$				
$C_{23}H_{13}^{+}$	$C_6H_5(C_6H_4)_2C_6H_5$ (*o*–Quaterphenyl)		15.5±0.2	EI		2438
		$C_{23}H_{15}^{+}$				
$C_{23}H_{15}^{+}$	$C_6H_5(C_6H_4)_2C_6H_5$ (*o*–Quaterphenyl)		12.7±0.1	EI		2438
		$C_{23}H_{39}^{+}$				
$C_{23}H_{39}^{+}$	$C_{26}H_{46}$ (4–Phenyleicosane)		9.76±0.1	EI		2153

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_{24}H_{12}^+$				
$C_{24}H_{12}^+$	$C_{24}H_{12}$ (Coronene)		7.68±0.05	EDD		2634
$C_{24}H_{12}^+$	$C_{24}H_{12}$ (Coronene)		7.65±0.1	EI		2489
$C_{24}H_{12}^+$	$C_{24}H_{12}$ (Coronene)		7.44	CTS		2947
$C_{24}H_{12}^+$	$C_{24}H_{12}$ (Coronene)		7.50	CTS		3000
$C_{24}H_{12}^+$	$C_{24}H_{12}$ (Coronene)		7.6	CTS		2978
$C_{24}H_{12}^+$	$C_{24}H_{12}$ (Coronene)		7.64	CTS		1064
$C_{24}H_{12}^+$	$C_{24}H_{12}$ (Coronene)		7.65	CTS		2910
		$C_{24}H_{12}^{+2}$				
$C_{24}H_{12}^{+2}$	$C_{24}H_{12}$ (Coronene)		21.0	EI		2489
		$C_{24}H_{14}^+$				
$C_{24}H_{14}^+$	$C_{24}H_{14}$ (1,2:4,5–Dibenzopyrene)		7.20	CTS		3000
$C_{24}H_{14}^+$	$C_{24}H_{14}$ (1,2:4,5–Dibenzopyrene)		7.27	CTS		2562, 2947
$C_{24}H_{14}^+$	$C_{24}H_{14}$ (1,2:4,5–Dibenzopyrene)		7.41	CTS		2910
$C_{24}H_{14}^+$	$C_{24}H_{14}$ (1,2:6,7–Dibenzopyrene)		6.75	CTS		3000
$C_{24}H_{14}^+$	$C_{24}H_{14}$ (1,2:6,7–Dibenzopyrene)		7.04	CTS		2910
$C_{24}H_{14}^+$	$C_{24}H_{14}$ (1,2:7,8–Dibenzopyrene)		7.06	CTS		3000
$C_{24}H_{14}^+$	$C_{24}H_{14}$ (1,2:7,8–Dibenzopyrene)		7.30	CTS		2910
$C_{24}H_{14}^+$	$C_{24}H_{14}$ (1,2:9,10–Dibenzopyrene)		7.03	CTS		3000
$C_{24}H_{14}^+$	$C_{24}H_{14}$ (1,2:9,10–Dibenzopyrene)		7.27	CTS		2910
$C_{24}H_{14}^+$	$C_{24}H_{14}$ (4,5:9,10–Dibenzopyrene)		7.62	CTS		3000
$C_{24}H_{14}^+$	$C_{24}H_{14}$ (4,5:9,10–Dibenzopyrene)		7.75	CTS		2910

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_{24}H_{14}^{+}$	$C_{24}H_{14}$ (1,12:4,5–Dibenzonaphthacene)		7.47	CTS		3000
$C_{24}H_{14}^{+}$	$C_{24}H_{14}$ (1,12:4,5–Dibenzonaphthacene)		7.60	CTS		2910
$C_{24}H_{14}^{+}$	$C_{24}H_{14}$ (1,2–Benzoperylene)		6.51	CTS		3000
$C_{24}H_{14}^{+}$	$C_{24}H_{14}$ (1,2–Benzoperylene)		6.84	CTS		2910
$C_{24}H_{14}^{+}$	$C_{24}H_{14}$ (Naphtho[2,3–*a*]pyrene)		6.70	CTS		3000
$C_{24}H_{14}^{+}$	$C_{24}H_{14}$ (Naphtho[2,3–*a*]pyrene)		7.00	CTS		2910
		$C_{24}H_{17}^{+}$				
$C_{24}H_{17}^{+}$	$C_6H_5(C_6H_4)_2C_6H_5$ (*o*–Quaterphenyl)	H	11.7±0.1	EI		2438
		$C_{24}H_{18}^{+}$				
$C_{24}H_{18}^{+}$	$C_6H_5(C_6H_4)_2C_6H_5$ (*o*–Quaterphenyl)		8.52±0.05	EI		2438
$C_{24}H_{18}^{+}$	$C_6H_5(C_6H_4)_2C_6H_5$ (*m*–Quaterphenyl)		8.51±0.05	EI		2438
$C_{24}H_{18}^{+}$	$C_6H_5(C_6H_4)_2C_6H_5$ (*p*–Quaterphenyl)		8.08±0.05	EI		2438
		$C_{24}H_{18}^{+2}$				
$C_{24}H_{18}^{+2}$	$C_6H_5(C_6H_4)_2C_6H_5$ (*o*–Quaterphenyl)		20.5±0.4	EI		2438
$C_{24}H_{18}^{+2}$	$C_6H_5(C_6H_4)_2C_6H_5$ (*m*–Quaterphenyl)		20.5±0.4	EI		2438
$C_{24}H_{18}^{+2}$	$C_6H_5(C_6H_4)_2C_6H_5$ (*p*–Quaterphenyl)		20.2±0.4	EI		2438
		$C_{24}H_{36}^{+}$				
$C_{24}H_{36}^{+}$	$C_{24}H_{36}$ (Tricyclooctenobenzene)		8.52±0.10	EI		3342
		$C_{24}H_{41}^{+}$				
$C_{24}H_{41}^{+}$	$C_{26}H_{46}$ (3–Phenyleicosane)		9.68±0.1	EI		2153

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_{25}H_{43}^{+}$						
$C_{25}H_{43}^{+}$	$C_{26}H_{46}$ (2–Phenyleicosane)		10.14±0.1	EI		2153
$C_{26}H_{14}^{+}$						
$C_{26}H_{14}^{+}$	$C_{26}H_{14}$ (1,12:2,3–Dibenzoperylene)		7.20	CTS		3000
$C_{26}H_{14}^{+}$	$C_{26}H_{14}$ (1,12:2,3–Dibenzoperylene)		7.41	CTS		2910
$C_{26}H_{14}^{+}$	$C_{26}H_{14}$ (3,4:9,10–Dibenzoperylene)		6.82	CTS		3000
$C_{26}H_{14}^{+}$	$C_{26}H_{14}$ (3,4:9,10–Dibenzoperylene)		7.10	CTS		2910
$C_{26}H_{16}^{+}$						
$C_{26}H_{16}^{+}$	$C_{26}H_{16}$ (Bifluorenylidene)		8.5±0.2	EI		3336
$C_{26}H_{16}^{+}$	$C_{26}H_{16}$ (1,2–Benzopentacene)		6.32	CTS		3000
$C_{26}H_{16}^{+}$	$C_{26}H_{16}$ (1,2–Benzopentacene)		6.69	CTS		2910
$C_{26}H_{16}^{+}$	$C_{26}H_{16}$ (3,4–Benzopentaphene)		7.28	CTS		3000
$C_{26}H_{16}^{+}$	$C_{26}H_{16}$ (3,4–Benzopentaphene)		7.47	CTS		2910
$C_{26}H_{16}^{+}$	$C_{26}H_{16}$ (2,3:8,9–Dibenzochrysene)		6.92	CTS		3000
$C_{26}H_{16}^{+}$	$C_{26}H_{16}$ (5,6:11,12–Dibenzochrysene)		7.42	CTS		3000
$C_{26}H_{16}^{+}$	$C_{26}H_{16}$ (5,6:11,12–Dibenzochrysene)		7.58	CTS		2910
$C_{26}H_{16}^{+}$	$C_{26}H_{16}$ (1,2:3,4–Dibenzonaphthacene)		6.80	CTS		3000
$C_{26}H_{16}^{+}$	$C_{26}H_{16}$ (1,2:3,4–Dibenzonaphthacene)		7.08	CTS		2910
$C_{26}H_{16}^{+}$	$C_{26}H_{16}$ (1,2:7,8–Dibenzonaphthacene)		6.82	CTS		3000
$C_{26}H_{16}^{+}$	$C_{26}H_{16}$ (1,2:7,8–Dibenzonaphthacene)		7.09	CTS		2910
$C_{26}H_{16}^{+}$	$C_{26}H_{16}$ (Hexaphene)		6.81	CTS		3000

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_{26}H_{16}^+$	$C_{26}H_{16}$ (Hexaphene)		7.09	CTS		2910
$C_{26}H_{16}^+$	$C_{26}H_{16}$ (1,2:3,4:5,6–Tribenzanthracene)		7.47	CTS		3000
$C_{26}H_{46}^+$						
$C_{26}H_{46}^+$	$C_{26}H_{46}$ (1–Phenyleicosane)		9.34±0.1	EI		2153
$C_{26}H_{46}^+$	$C_{26}H_{46}$ (2–Phenyleicosane)		9.22±0.1	EI		2153
$C_{26}H_{46}^+$	$C_{26}H_{46}$ (3–Phenyleicosane)		8.95±0.1	EI		2153
$C_{26}H_{46}^+$	$C_{26}H_{46}$ (4–Phenyleicosane)		9.01±0.1	EI		2153
$C_{26}H_{46}^+$	$C_{26}H_{46}$ (5–Phenyleicosane)		9.04±0.1	EI		2153
$C_{26}H_{46}^+$	$C_{26}H_{46}$ (7–Phenyleicosane)		8.97±0.1	EI		2153
$C_{26}H_{46}^+$	$C_{26}H_{46}$ (9–Phenyleicosane)		9.06±0.1	EI		2153
$C_{28}H_{14}^+$						
$C_{28}H_{14}^+$	$C_{28}H_{14}$ (Phenanthro[1,10,9,8–*opqra*]perylene)		6.42	CTS		1064
$C_{28}H_{16}^+$						
$C_{28}H_{16}^+$	$C_{28}H_{16}$ (6,7:13,14–Dibenzopentaphene)		7.17	CTS		3000
$C_{28}H_{16}^+$	$C_{28}H_{16}$ (6,7:13,14–Dibenzopentaphene)		7.38	CTS		2910
$C_{28}H_{16}^+$	$C_{28}H_{16}$ (1,2:7,8–Dibenzoperylene)		6.34	CTS		3000
$C_{28}H_{16}^+$	$C_{28}H_{16}$ (1,2:7,8–Dibenzoperylene)		6.70	CTS		2910
$C_{28}H_{16}^+$	$C_{28}H_{16}$ (1,2:10,11–Dibenzoperylene)		6.51	CTS		3000
$C_{28}H_{16}^+$	$C_{28}H_{16}$ (1,2:10,11–Dibenzoperylene)		6.84	CTS		2910
$C_{28}H_{16}^+$	$C_{28}H_{16}$ (2,3:8,9–Dibenzoperylene)		6.84	CTS		3000
$C_{28}H_{16}^+$	$C_{28}H_{16}$ (2,3:8,9–Dibenzoperylene)		7.11	CTS		2910

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
	$C_{30}H_{14}^+$					
$C_{30}H_{14}^+$	$C_{30}H_{14}$ (2,3:4,5–Dibenzocoronene)		6.37	CTS		3000
$C_{30}H_{14}^+$	$C_{30}H_{14}$ (2,3:4,5–Dibenzocoronene)		6.73	CTS		2910
	$C_{30}H_{16}^+$					
$C_{30}H_{16}^+$	$C_{30}H_{16}$ (Naphthaceno[2,1,12,11–*opqra*]naphthacene)		6.19	CTS		3000
$C_{30}H_{16}^+$	$C_{30}H_{16}$ (Naphthaceno[2,1,12,11–*opqra*]naphthacene)		6.58	CTS		2910
$C_{30}H_{16}^+$	$C_{30}H_{16}$ (Pyranthrene)		6.69	CTS		3000
$C_{30}H_{16}^+$	$C_{30}H_{16}$ (Pyranthrene)		6.98	CTS		1064
$C_{30}H_{16}^+$	$C_{30}H_{16}$ (Pyranthrene)		6.99	CTS		2910
$C_{30}H_{16}^+$	$C_{30}H_{16}$ (1,12:2,3:8,9–Tribenzoperylene)		7.03	CTS		3000
$C_{30}H_{16}^+$	$C_{30}H_{16}$ (1,12:2,3:8,9–Tribenzoperylene)		7.27	CTS		2910
	$C_{30}H_{18}^+$					
$C_{30}H_{18}^+$	$C_{30}H_{18}$ (1,2:3,4–Dibenzopentacene)		6.36	CTS		3000
$C_{30}H_{18}^+$	$C_{30}H_{18}$ (1,2:3,4–Dibenzopentacene)		6.72	CTS		2910
$C_{30}H_{18}^+$	$C_{30}H_{18}$ (1,2:8,9–Dibenzopentacene)		6.95±0.1	EI		2489
$C_{30}H_{18}^+$	$C_{30}H_{18}$ (1,2:8,9–Dibenzopentacene)		6.42	CTS		3000
$C_{30}H_{18}^+$	$C_{30}H_{18}$ (1,2:8,9–Dibenzopentacene)		6.77	CTS		2910
$C_{30}H_{18}^+$	$C_{30}H_{18}$ (3,4:9,10–Dibenzopentaphene)		7.28	CTS		3000
$C_{30}H_{18}^+$	$C_{30}H_{18}$ (3,4:9,10–Dibenzopentaphene)		7.47	CTS		2910
$C_{30}H_{18}^+$	$C_{30}H_{18}$ (Naphtho[2,3–*c*]pentaphene)		7.13	CTS		3000
$C_{30}H_{18}^+$	$C_{30}H_{18}$ (Naphtho[2,3–*c*]pentaphene)		7.35	CTS		2910

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_{30}H_{18}^{+2}$				
$C_{30}H_{18}^{+2}$	$C_{30}H_{18}$ (1,2:8,9–Dibenzopentacene)		19.0	EI		2489
		$C_{30}H_{22}^{+}$				
$C_{30}H_{22}^{+}$	$C_6H_5(C_6H_4)_3C_6H_5$ (*m*–Quinquephenyl)		8.45±0.05	EI		2438
$C_{30}H_{22}^{+}$	$C_6H_5(C_6H_4)_3C_6H_5$ (*p*–Quinquephenyl)		8.18±0.05	EI		2438
		$C_{30}H_{22}^{+2}$				
$C_{30}H_{22}^{+2}$	$C_6H_5(C_6H_4)_3C_6H_5$ (*m*–Quinquephenyl)		20.0±0.4	EI		2438
$C_{30}H_{22}^{+2}$	$C_6H_5(C_6H_4)_3C_6H_5$ (*p*–Quinquephenyl)		19.6±0.4	EI		2438
		$C_{32}H_{14}^{+}$				
$C_{32}H_{14}^{+}$	$C_{32}H_{14}$ (Ovalene)		7.24±0.1	EI		2489
$C_{32}H_{14}^{+}$	$C_{32}H_{14}$ (Ovalene)		7.01	CTS		1064
		$C_{32}H_{14}^{+2}$				
$C_{32}H_{14}^{+2}$	$C_{32}H_{14}$ (Ovalene)		19.6	EI		2489
		$C_{32}H_{18}^{+}$				
$C_{32}H_{18}^{+}$	$C_{32}H_{18}$ (16,17–Benzoheptaphene)		6.74	CTS		3000
$C_{32}H_{18}^{+}$	$C_{32}H_{18}$ (16,17–Benzoheptaphene)		7.03	CTS		2910
$C_{32}H_{18}^{+}$	$C_{32}H_{18}$ (Naphthaceno[2,1,12–*qra*]naphthacene)		6.23	CTS		3000
$C_{32}H_{18}^{+}$	$C_{32}H_{18}$ (Naphthaceno[2,1,12–*qra*]naphthacene)		6.62	CTS		2910
		$C_{34}H_{18}^{+}$				
$C_{34}H_{18}^{+}$	$C_{34}H_{18}$ (1,14:5,6:7,8:12,13–Tetrabenzopentacene)		6.06	CTS		3000

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_{34}H_{18}^+$	$C_{34}H_{18}$ (4,5:6,7:8,9:13,14–Tetrabenzopentaphene)		6.04	CTS		3000
$C_{34}H_{18}^+$	$C_{34}H_{18}$ (4,5:6,7:8,9:13,14–Tetrabenzopentaphene)		6.46	CTS		2910
$C_{34}H_{18}^+$	$C_{34}H_{18}$ (1,2:3,4:7,8:9,10–Tetrabenzoperylene)		6.77	CTS		3000
$C_{34}H_{18}^+$	$C_{34}H_{18}$ (1,2:3,4:7,8:9,10–Tetrabenzoperylene)		7.06	CTS		2910
	$C_{34}H_{20}^+$					
$C_{34}H_{20}^+$	$C_{34}H_{20}$ (Violanthrene)		6.86	CTS		1064
$C_{34}H_{20}^+$	$C_{34}H_{20}$ (Isoviolanthrene)		6.76	CTS		1064
	$C_{36}H_{18}^+$					
$C_{36}H_{18}^+$	$C_{36}H_{18}$ (Decacyclene)		7.27±0.1	EI		2489
	$C_{36}H_{18}^{+2}$					
$C_{36}H_{18}^{+2}$	$C_{36}H_{18}$ (Decacyclene)		20.1	EI		2489
	$C_{36}H_{22}^+$					
$C_{36}H_{22}^+$	$C_6H_5(C_6H_4)_4C_6H_5$ (*p*–Hexaphenyl)	$2H_2$	15.6±0.2	EI		2438
	$C_{36}H_{26}^+$					
$C_{36}H_{26}^+$	$C_6H_5(C_6H_4)_4C_6H_5$ (*p*–Hexaphenyl)		7.67±0.05	EI		2438
	$C_{36}H_{26}^{+2}$					
$C_{36}H_{26}^{+2}$	$C_6H_5(C_6H_4)_4C_6H_5$ (*p*–Hexaphenyl)		19.5±0.4	EI		2438
	$C_{42}H_{18}^+$					
$C_{42}H_{18}^+$	$C_{42}H_{18}$ (1,12:2,3:4,5:6,7:8,9:10,11–Hexabenzocoronene)		7.05±0.1	EI		2489

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_{42}H_{18}^{+2}$						
$C_{42}H_{18}^{+2}$	$C_{42}H_{18}$ (1,12:2,3:4,5:6,7:8,9:10,11-Hexabenzocoronene)		19.6	EI		2489
$C_{48}H_{34}^{+}$						
$C_{48}H_{34}^{+}$	$C_6H_5(C_6H_4)_6C_6H_5$ (*m*-Octaphenyl)		8.28±0.05	EI		2438
$C_{48}H_{34}^{+2}$						
$C_{48}H_{34}^{+2}$	$C_6H_5(C_6H_4)_6C_6H_5$ (*m*-Octaphenyl)		20.3±0.4	EI		2438
CB^{+}						
CB^{+}	CB		10.0±0.6	EI		2176
CB^{+}	CB		10.5	EI		1116
CB_2^{+}						
CB_2^{+}	CB_2		10.2±0.6	EI		2176
CB_2^{+}	CB_2		10.7	EI		1116
C_2B^{+}						
C_2B^{+}	C_2B		10.4±0.6	EI		2176
C_2B^{+}	C_2B		10.7	EI		1116
$C_2H_5Li_2^{+}$						
$C_2H_5Li_2^{+}$	$(C_2H_5Li)_4$		11.7±0.5	EI		1
$C_4H_{10}Li_3^{+}$						
$C_4H_{10}Li_3^{+}$	$(C_2H_5Li)_4$		11.7±0.5	EI		1
$C_6H_{15}Li_4^{+}$						
$C_6H_{15}Li_4^{+}$	$(C_2H_5Li)_4$	C_2H_5	8.0±0.5	EI		1
$C_8H_{20}Li_5^{+}$						
$C_8H_{20}Li_5^{+}$	$(C_2H_5Li)_6$		12.5±0.5	EI		1

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_{10}H_{25}Li_6^+$						
$C_{10}H_{25}Li_6^+$	$(C_2H_5Li)_6$	C_2H_5	7.7±0.5	EI		1
CH_2Be^+						
CH_2Be^+	$(CH_3)_2Be$	CH_4	11.92±0.05	EI		2874, 2913
CH_3Be^+						
CH_3Be^+	$(CH_3)_2Be$	CH_3	12.67±0.02	EI		2874, 2913
$C_2H_4Be^+$						
$C_2H_4Be^+$	$(C_2H_5)_2Be$	C_2H_6	10.35±0.03	EI		2874, 2913
$C_2H_5Be^+$						
$C_2H_5Be^+$	$(C_2H_5)_2Be$	C_2H_5	11.51±0.05	EI		2874, 2913
$C_2H_6Be^+$						
$C_2H_6Be^+$	$(CH_3)_2Be$		10.67±0.07	EI		2874, 2913
$C_3H_6Be^+$						
$C_3H_6Be^+$	$(n\text{-}C_3H_7)_2Be$	C_3H_8	9.86±0.05	EI		2874, 2913
$C_3H_6Be^+$	$(iso\text{-}C_3H_7)_2Be$	C_3H_8	9.60±0.01	EI		2874, 2913
$C_3H_7Be^+$						
$C_3H_7Be^+$	$(n\text{-}C_3H_7)_2Be$	C_3H_7	10.81±0.05	EI		2874, 2913
$C_3H_7Be^+$	$(iso\text{-}C_3H_7)_2Be$	C_3H_7	10.65±0.01	EI		2874, 2913
$C_4H_8Be^+$						
$C_4H_8Be^+$	$(iso\text{-}C_4H_9)_2Be$	C_4H_{10}	9.14±0.03	EI		2874, 2913
$C_4H_9Be^+$						
$C_4H_9Be^+$	$(iso\text{-}C_4H_9)_2Be$	C_4H_9	10.00±0.05	EI		2874, 2913

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_4H_{10}Be^+$				
$C_4H_{10}Be^+$	$(C_2H_5)_2Be$		9.46±0.05	EI		2874, 2913
		$C_6H_{14}Be^+$				
$C_6H_{14}Be^+$	$(n-C_3H_7)_2Be$		8.71±0.06	EI		2874, 2913
$C_6H_{14}Be^+$	$(iso-C_3H_7)_2Be$		8.80±0.02	EI		2874, 2913
		$C_8H_{18}Be^+$				
$C_8H_{18}Be^+$	$(iso-C_4H_9)_2Be$		8.74±0.05	EI		2874, 2913
		CH_3B^+				
CH_3B^+	$(CH_3)_3B$		17.0±0.5	EI		364
		$CH_{11}B_5^+$				
$CH_{11}B_5^+$	$1-B_5H_8CH_3$		9.80±0.02	RPD		3228
$CH_{11}B_5^+$	$2-B_5H_8CH_3$		10.25±0.02	RPD		3228
		$C_2H_6B^+$				
$C_2H_6B^+$	$(CH_3)_3B$	CH_3	10.3±0.2	EI		364
		$C_2H_{13}B_5^+$				
$C_2H_{13}B_5^+$	$1-B_5H_8C_2H_5$		9.67±0.05	RPD		3228
$C_2H_{13}B_5^+$	$2-B_5H_8C_2H_5$		9.87±0.01	RPD		3228
		$C_2H_{18}B_{10}^+$				
$C_2H_{18}B_{10}^+$	$B_{10}H_{13}C_2H_5$		9.0±0.5	EI		103
		$C_3H_9B^+$				
$C_3H_9B^+$	$(CH_3)_3B$		10.4	PE		3359
$C_3H_9B^+$	$(CH_3)_3B$		8.8±0.2	EI		364
		$C_4H_{10}B^+$				
$C_4H_{10}B^+$	$(C_2H_5)_3B$	C_2H_5	9.6±0.2	EI		364

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_6H_9B^+$				
$C_6H_9B^+$	$(C_2H_3)_3B$		9.7	PE		3359
		$C_6H_{15}B^+$				
$C_6H_{15}B^+$	$(C_2H_5)_3B$		9.6	PE		3359
$C_6H_{15}B^+$	$(C_2H_5)_3B$		9.0±0.2	EI		364
$C_6H_{15}B^+$	$(C_2H_5)_3B$		9.66±0.1	EI		2513, 3227
	N^+	**$\Delta H^\circ_{f0} = 1873.2$ kJ mol^{-1} (447.7 kcal mol^{-1})**				
N^+	N		14.534	S	1873.2	2113, 2681
N^+	N		14.55	PE		3076
N^+	N		14.56	EI		2780
See also – PI: 2760 EI: 2, 78, 154, 1133						
N^+	N_2	N	24.32±0.02	RPD	(1876)	49
N^+	N_2	N	24.32±0.03	RPD	(1876)	2431
The fragments are formed with no kinetic energy at threshold according to refs. 2021, 2431. See, however, ref. 2823.						
See also – PI: 163 EI: 78, 364, 2021, 2465, 2471, 2484, 2642, 2765, 2895						
N^+	N_2	N^+	48±2	RPD		2431
(~9 eV average translational energy of decomposition at threshold)						
N^+	NH_3	H_2+H	22.6±0.1	EI		132
N^+	HN_3		19.7±0.3	EI		340
N^+	CNC≡CCN		26.0±1.0	EI		154
N^+	CNC≡CC≡CCN		<19	EI		154
N^+	NO	O^-	19.55±0.04	RPD	(1871)	328
N^+	NO	O^-	19.94±0.14	RPD		2431
(0.6±0.2 eV average translational energy of decomposition at threshold)						
The discrepancy between refs. 328 and 2431 is unexplained.						
See also – EI: 200, 1378 D: 6						
N^+	NO	O	21.11±0.04	RPD	(1880)	328
N^+	NO	O	21.78±0.11	RPD		2431
(0.9±0.2 eV average translational energy of decomposition at threshold)						
The discrepancy between refs. 328 and 2431 is unexplained.						
See also – PI: 163 EI: 200, 2021						

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
N^+	NO	O^+	34.1±0.7	EI		2021
N^+	N_2O	NO	20.06	PI		2629

The thermochemical threshold for this process is 19.46 eV.

See also – PI: 163
EI: 2018

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
N^+	NF_3		22.2±0.2	EI		401
N^+	PN	P	20.0±0.5	EI		2465

N^{+2} **ΔH°_{f0} = 4729.3 kJ mol^{-1} (1130.3 kcal mol^{-1})**

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
N^{+2}	N		44.135	S	4729.3	2113
N^{+2}	N^+		29.601	S		2113
N^{+2}	N_2	N	63.63±0.20	EI		2431
(10.0±0.8 eV average translational energy of decomposition at threshold)						
N^{+2}	N_2	N	54.2±0.5	EI		2471
N^{+2}	N_2	N	$58.6^{+0.3}_{-2.0}$	NRE		2823
N^{+2}	N_2	N	63.2±0.5	EI		2471
(High kinetic energy ion)						
N^{+2}	N_2	N	65	NRE		2823
(High kinetic energy ion)						

See also – EI: 2765

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
N^{+2}	N_2^+	N	38.5±0.7	SEQ		2471
N^{+2}	NO	O	56.0±0.2	EI		2431
(3.8±1 eV average translational energy of decomposition at threshold)						
N^{+2}	NO	O	57.6±1.0	NRE		2823
N^{+2}	N_2O		57.1±1.0	NRE		3138
N^{+2}	NO_2		51.5±1	NRE		3138

$N_2^+(X^2\Sigma_g^+)$ ΔH°_{f0} = 1503.3 kJ mol^{-1} (359.3 kcal mol^{-1})
$N_2^+(A^2\Pi_{3/2u})$ ΔH°_{f0} = 1610.7 kJ mol^{-1} (385.0 kcal mol^{-1})
$N_2^+(A^2\Pi_{1/2u})$ ΔH°_{f0} = 1611.7 kJ mol^{-1} (385.2 kcal mol^{-1})
$N_2^+(B^2\Sigma_u^+)$ ΔH°_{f0} = 1809.1 kJ mol^{-1} (432.4 kcal mol^{-1})
$N_2^+(C^2\Sigma_u^+)$ ΔH°_{f0} = 2275.5 kJ mol^{-1} (543.8 kcal mol^{-1})

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$N_2^+(X^2\Sigma_g^+)$	N_2		15.5802	S	1503.3	3301
$N_2^+(X^2\Sigma_g^+)$	N_2		15.5803	S	1503.3	3143
$N_2^+(A^2\Pi_{3/2u})$	N_2		16.6933	S	1610.7	3143
$N_2^+(A^2\Pi_{1/2u})$	N_2		16.7035	S	1611.7	3143
$N_2^+(B^2\Sigma_u^+)$	N_2		18.7501	S	1809.1	3143
$N_2^+(C^2\Sigma_u^+)$	N_2		23.583	S	2275.5	—
(Based on $X^2\Sigma_g^+$ limit above and second negative bands from ref. 3309)						
$N_2^+(D^2\Pi_g)$	N_2		22.31	S	2153	—
(Based on average of $A^2\Pi_{3/2u}$ and $A^2\Pi_{1/2u}$ limits above and Janin–d'Incan bands from ref. 3302)						
$N_2^+(X^2\Sigma_g^+)$	N_2		15.58±0.01	PE		3171
$N_2^+(A^2\Pi_u)$	N_2		16.695±0.01	PE		3171
$N_2^+(B^2\Sigma_u^+)$	N_2		18.75±0.015	PE		3171

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$N_2^+(X^2\Sigma_g^+)$	N_2		15.58	PI		3031
$N_2^+(X^2\Sigma_g^+)$	N_2		15.56	PEN		2430
$N_2^+(A^2\Pi_u)$	N_2		16.7	PEN		2430
$N_2^+(B^2\Sigma_u^+)$	N_2		18.8	PEN		2430

See also – S: 2100, 2654, 3303
PI: 163, 2033
PE: 248, 2792, 2812, 2813, 2816, 2829, 2830, 2843, 2855, 3116
PEN: 2467, 3171
EI: 218, 383, 1012, 2431, 2465, 2471, 2557, 2895, 3131, 3133, 3435

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
N_2^+	N_2H_4	$2H_2$	16.2±0.1	EI		424, 3216
N_2^+	HN_3	NH	16.0±0.1	EI		340
N_2^+?	CH_3NHNH_2		13.2±0.3	EI		424, 3216
N_2^+	$CH_3N{=}NCH_3$		16.3±0.3	EI		2549
N_2^+?	$(CH_3)_2NNH_2$		13.2±0.1	EI		424, 3216
N_2^+?	$CH_3NHNHCH_3$		12.5±0.2	EI		424, 3216
N_2^+?	$(CH_3)_2NNHCH_3$		13.2±0.2	EI		424, 3216
N_2^+?	$(CH_3)_2NN(CH_3)_2$		13.1±0.2	EI		424, 3216
N_2^+	N_2O	O	17.29	PI		2619, 2624, 2629

See also – PI: 163
EI: 2697

N_2^{+2} $\Delta H_{f0}^\circ \sim 4126$ kJ mol^{-1} (986 kcal mol^{-1})

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
N_2^{+2}	N_2		42.9	AUG	~4139	3304
N_2^{+2}	N_2		44.2±0.5	RPD		2431
N_2^{+2}	N_2		42.7±0.2	NRE	~4120	2823
N_2^{+2}	N_2		42.7±0.1	FD	~4120	2785, 3130
N_2^{+2}	N_2		43.5±0.3	FD		212
N_2^{+2}	N_2		43.2±0.5	EI		2471
N_2^{+2}	N_2^+		27.2±0.5	SEQ		2471

N_2^{+3}

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
N_2^{+3}	N_2		84	AUG		3304

N_3^+

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
N_3^+	HN_3	H	16.0±0.2	EI		340
N_3^+	CH_3N_3	CH_3	17.6±0.5	EI		340

NH^+

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
NH^+	NH		13.10±0.05	EI		132
NH^+	NH		13.1±0.2	EI		2454

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
NH^+	NH		12.8	EI		2768, 2771, 2772
NH^+	NH_3	H_2	17.1±0.1	EI		132
NH^+	HN_3	N_2	14.4±0.2	EI		340
NH^+	$HNCO$	CO	17.26±0.15	EI		3365
NH^+	$HNCO$	CO	<17.7	EI		2797, 3012

NH_2^+ $\Delta H^\circ_{f0} \sim 1263$ kJ mol^{-1} (302 kcal mol^{-1})

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
NH_2^+	NH_2		11.4±0.1	EI		34
NH_2^+	NH_2		11.7	EI		2768, 2771, 2772
NH_2^+	NH_2		11.22	D		2631
NH_2^+	NH_3	H	15.73±0.02	PI	1263	2631
NH_2^+	NH_3	H	16.0±0.1	EI		34
NH_2^+	N_2H_4	NH_2	13.9±0.4	EI		34
NH_2^+	CH_3NH_2	CH_3	15.7	RPD		3345
(0.12 eV average translational energy of decomposition at threshold)						
NH_2^+	$(CH_3)_2NNH_2$		13.3±0.1	EI		303

$NH_3^+(^2A_1)$ $\Delta H^\circ_{f0} = 941$ kJ mol^{-1} (225 kcal mol^{-1})
$NH_3^+(^2E_1)$ $\Delta H^\circ_{f0} \sim 1401$ kJ mol^{-1} (335 kcal mol^{-1})

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$NH_3^+(^2A_1)$	NH_3		10.166	S	942	3053
$NH_3^+(^2A_1)$	NH_3		10.162±0.008	PI	941	2631
$NH_3^+(^2A_1)$	NH_3		10.154±0.01	PI	941	159
$NH_3^+(^2A_1)$	NH_3		10.16±0.02	PI	941	2727
$NH_3^+(^2A_1)$	NH_3		10.17	PI	942	3030
$NH_3^+(^2A_1)$	NH_3		10.175±0.01	PE	943	3054
$NH_3^+(^2A_1)$	NH_3		10.14	PE	939	3027, 3061
$NH_3^+(^2A_1)$	NH_3		10.16	PE	941	1130
$NH_3^+(^2E_1)$	NH_3		14.94±0.03	PE	1402	3054
$NH_3^+(^2E_1)$	NH_3		14.92	PE	1401	3027, 3061
$NH_3^+(^2E_1)$	NH_3		15.02	PE		1130

See also – S: 138, 1070
PI: 155, 158, 182, 297, 416
PE: 2853, 2854
PEN: 2430
EI: 14, 218, 411, 463, 2486

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
NH_3^+	$C_2H_5NH_2$		12.99	EI		2470

NH_2D^+

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
NH_2D^+	$CD_3CH_2NH_2$		13.3	EI		2470

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
			NHD_2^+			
NHD_2^+	CH_3ND_2	CH_2	13.40±0.4	EI		2429
			ND_3^+			
$ND_3^+(^2A_1)$	ND_3		10.180±0.01	PE		3054
$ND_3^+(^2A_1)$	ND_3		10.17	PE		3027, 3061
$ND_3^+(^2E_1)$	ND_3		14.94±0.03	PE		3054
$ND_3^+(^2E_1)$	ND_3		15.15	PE		3027, 3061
			NH_3^{+2}			
NH_3^{+2}	NH_3		33.7±0.2	FD		212
			N_2H^+			
N_2H^+	N_2H_4	H_2+H	14.8±0.3	EI		424, 3216
N_2H^+	HN_3	N	13.8±0.2	EI		340
N_2H^+?	CH_3NHNH_2		13.3±0.3	EI		424, 3216
			$N_2H_2^+$			
$N_2H_2^+$	N_2H_2		9.85±0.1	EI		33, 34
$N_2H_2^+$	N_2H_2		9.9	EI		2768, 2771, 2772
$N_2H_2^+$	N_2H_4	H_2	10.98±0.2	EI		33, 34
$N_2H_2^+$	N_2H_4	H_2	11.9±0.2	EI		424, 3216
$N_2H_2^+$?	CH_3NHNH_2		11.2±0.2	EI		424, 3216
$N_2H_2^+$	$(CH_3)_2NNH_2$	C_2H_6	8.6±0.1	PI		1141
$N_2H_2^+$?	$(CH_3)_2NNH_2$		12.9±0.1	EI		424, 3216
$N_2H_2^+$?	$CH_3NHNHCH_3$		11.0±0.2	EI		424, 3216
$N_2H_2^+$?	$(CH_3)_2NNHCH_3$		11.9±1.0	EI		424, 3216
$N_2H_2^+$?	$(CH_3)_2NN(CH_3)_2$		11.9±0.2	EI		424, 3216
$N_2H_2^+$	$n-C_4H_9N(CH_3)NH_2$	C_5H_{12}	9.5±0.2	PI		1141

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$N_2H_3^+$				
$N_2H_3^+$	N_2H_3		7.88±0.2	EI		34
$N_2H_3^+$	N_2H_3		7.6	EI		2768, 2771, 2772
$N_2H_3^+$	N_2H_4	H	10.6±0.1	PI		1141
$N_2H_3^+$	N_2H_4	H	11.18±0.1	EI		34
$N_2H_3^+$	N_2H_4	H	11.3±0.1	EI		424, 3216
$N_2H_3^+$	N_2H_4	H	11.3	EI		1455
$N_2H_3^+$	CH_3NHNH_2	CH_3	9.5±0.1	PI		1141
$N_2H_3^+$	CH_3NHNH_2	CH_3	10.7±0.3	EI		424, 3216
$N_2H_3^+$?	$CH_3NHNHCH_3$		10.2±0.2	EI		424, 3216
$N_2H_3^+$?	$(CH_3)_2NNHCH_3$		11.7±1.0	EI		424, 3216
		$N_2H_4^+$				
$N_2H_4^+$	N_2H_4		8.36±0.03	PI		2173
(Value obtained without mass analysis)						
$N_2H_4^+$	N_2H_4		8.74±0.06	PI		1141, 2173
(Value obtained with mass analysis)						
$N_2H_4^+$	N_2H_4		9.56±0.02	PI		1166
$N_2H_4^+$	N_2H_4		8.93	PE		3235
$N_2H_4^+$	N_2H_4		9.00±0.1	EI		424, 3216
$N_2H_4^+$	N_2H_4		8.8	EI		2768, 2771, 2772
$N_2H_4^+$	$(CH_3)_2NNHCH_3$		11.9±0.2	EI		424, 3216
$N_2H_4^+$	$(CH_3)_2NN(CH_3)_2$		12.3±0.1	EI		424, 3216
	HN_3^+	**ΔH_{f0}° = 1337 kJ mol^{-1} (319 kcal mol^{-1})**				
N_3H^+	HN_3		10.740±0.005	PE	1337	3067
See also – S:	3103					
EI:	340					
		$N_3H_3^+$				
$N_3H_3^+$	N_3H_3		9.6±0.1	EI		34

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
	CN^+ $\Delta H^\circ_{f0} = 1794$ kJ mol^{-1} (429 kcal mol^{-1})					
CN^+	CN		14.5±0.2	EI		154
CN^+	CN		14.2±0.3	EI		2145
CN^+	CN		14.03±0.02	D		2602
CN^+	CN		≤14.20±0.02	D		2621
CN^+	C_2N_2	CN	20.42±0.02	PI		2621
CN^+	C_2N_2	CN	20.4	RPD		3345
(0.21 eV average translational energy of decomposition at threshold)						
See also – EI:	154, 2145					
CN^+	$CNC\equiv CCN$		19.2±0.3	EI		154
CN^+	$CNC\equiv CC\equiv CCN$		20.0±1.0	EI		154
CN^+	HCN	H	19.43±0.01	PI	1794	2602
(Threshold value approximately corrected to 0 K)						
CN^+	HCN	H	19.40±0.02	PI		2623
CN^+	$CH\equiv CCN$	C_2H	19.8±0.2	EI		154
CN^+	C_3H_5CN (Cyclopropanecarboxylic acid nitrile)		19.5±0.4	EI		202
CN^+	FCN	F	19.21±0.02	PI		2621
CN^+	$ClCN$	Cl^-	15.5±0.2	EI		73
CN^+	$ClCN$	Cl	18.50±0.02	PI	(1802)	2621
CN^+	$ClCN$	Cl	18.3±0.2	EI		73
CN^+	$BrCN$	Br^-	14.6±0.1	EI		73
CN^+	$BrCN$	Br	18.3±0.1	EI		73
CN^+	ICN	I	18.1±0.1	EI		73
		C_2N^+				
C_2N^+	C_2N		~13	EI		154
C_2N^+	C_2N_2	N	19.5±0.1	EI		154
C_2N^+	$CNC\equiv CCN$		18.1±0.4	EI		154
C_2N^+	$CNC\equiv CC\equiv CCN$		17.0±0.1	EI		154
C_2N^+	CH_3NC		18.28	EDD		3214
C_2N^+	$(CH_2)_2NH$ (Ethylenimine)	H_2+3H?	23.0±0.4	EI		51
C_2N^+	$CH\equiv CCN$	CH?	18.0±0.5	EI		154
		C_3N^+				
C_3N^+	C_3N		~14.4	EI		154
C_3N^+	$CNC\equiv CCN$	CN	18.4±0.2	EI		154
C_3N^+	$CNC\equiv CC\equiv CCN$		22.0±0.5	EI		154
C_3N^+	$CH\equiv CCN$	H	18.2±0.3	EI		154
C_3N^+	$CH_2=CHCN$		21.6±0.1	EI		2954
		C_4N^+				
C_4N^+	C_4N		11.9±0.5	EI		154
C_4N^+	$CNC\equiv CCN$	N	18.8±0.5	EI		154
C_4N^+	$CNC\equiv CC\equiv CCN$		19.0±1.0	EI		154

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
C_5N^+						
C_5N^+	CNC≡CC≡CCN	CN	17.3±0.2	EI		154
C_6N^+						
C_6N^+	C_6N		12.2±0.1	EI		154
C_6N^+	CNC≡CC≡CCN	N	19.2±0.3	EI		154
$C_2N_2^+$ ΔH°_{f0} = 1597 kJ mol^{-1} (382 kcal mol^{-1})						
$C_2N_2^+$	C_2N_2		13.374±0.008	PI	1597	2621
$C_2N_2^+$	C_2N_2		13.36±0.01	PE	1596	2805
See also – S: 3152 EI: 154						
$C_4N_2^+$						
$C_4N_2^+$	CNC≡CCN		11.81±0.01	PE		2805
$C_4N_2^+$	CNC≡CCN		11.4±0.2	EI		154
These results are unusual since electron impact almost always gives a higher value than photoelectron spectroscopy.						
$C_6N_2^+$						
$C_6N_2^+$	CNC≡CC≡CCN		11.4±0.2	EI		154
BH_4N^+						
BH_4N^+	BH_2NH_2		11.0±0.1	EI		3184
BH_6N^+						
BH_6N^+	BH_3NH_3		10.33±0.04 (V)	PE		3044
$B_3H_6N_3^+$						
$B_3H_6N_3^+$	$B_3H_6N_3$ (Borazine)		9.88±0.02	PE		3105
$B_3H_6N_3^+$	$B_3H_6N_3$ (Borazine)		10.01±0.01	PE		3078
$B_3H_6N_3^+$	$B_3H_6N_3$ (Borazine)		9.77	EI		2511

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
	HCN^+	**ΔH°_{f0} = 1447 kJ mol^{-1} (346 kcal mol^{-1})**				
CHN^+	HCN		13.59±0.01	PI	1447	2623
CHN^+	HCN		13.60±0.01	PE	1448	2805
CHN^+	HCN		13.73±0.09	EI		411
See also – EI:	282					
CHN^+	CH_3N_3	N_2+H_2?	13.6±0.5	EI		340
		CDN^+				
CDN^+	DCN		13.60±0.01	PE		2805
		CH_2N^+				
CH_2N^+	CH_3NH_2	H_2+H	15.21±0.3	EI		2429
CH_2N^+	CH_3ND_2		15.14±0.08	EI		2429
CH_2N^+	$C_2H_5NH_2$		15.45	EI		2470
CH_2N^+	$CD_3CH_2NH_2$		14.5±0.5	EI		2470
CH_2N^+	$C_2D_5NH_2$		15.1	EI		2470
CH_2N^+	C_2H_5CN		14.88	EI		2966
CH_2N^+	$(CH_2)_3NH$ (Trimethylenimine)		13.1±0.2	EI		52
CH_2N^+	$(CH_2)_4NH$ (Pyrrolidine)		13.9±0.2	EI		52
CH_2N^+	$(C_2H_5)_2NH$		14.64	EI		2428
CH_2N^+	$CH_3N{=}NCH_3$		14.7±0.3	EI		2549
CH_2N^+	CH_3N_3	N_2+H	10.5±0.1	EI		340
		$CHDN^+$				
$CHDN^+$	CH_3ND_2		14.92±0.20	EI		2429
$CHDN^+$	$CH_3CD_2NH_2$		13.7±0.2	EI		2470
$CHDN^+$	$C_2D_5NH_2$		14.9	EI		2470
		CH_3N^+				
CH_3N^+	CH_3NH_2	H_2	13.30±0.2	EI		2429
CH_3N^+	$C_2H_5NH_2$	CH_4	13.5±0.2	EI		2470
CH_3N^+	$CD_3CH_2NH_2$	CHD_3	13.3±0.5	EI		2470
		CH_2DN^+				
CH_2DN^+	CH_3ND_2	HD	12.50±0.10	EI		2429
CH_2DN^+	$C_2D_5NH_2$	CD_4	12.87	EI		2470

4.3. The Positive Ion Table—Continued

$CH_2NH_2^+$ $\Delta H^\circ_{f298} \sim 745$ kJ mol^{-1} (178 kcal mol^{-1})

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
CH_4N^+	CH_3NH_2	H	10.3±0.1	RPD	(753)	3017
CH_4N^+	CH_3NH_2	H	10.82±0.15	EI		2429
CH_4N^+	$C_2H_5NH_2$	CH_3	9.71	PI	747	11
(Threshold value approximately corrected for thermal energy and kinetic shift)						
CH_4N^+	$C_2H_5NH_2$	CH_3	10.2±0.1	EI		2470
CH_4N^+	$CH_3CD_2NH_2$	CHD_2	10.0	EI		2470
CH_4N^+	$CD_3CH_2NH_2$	CD_3	9.8±0.1	EI		2470
CH_4N^+	$(CH_2)_3NH$ (Trimethylenimine)		12.3±0.2	EI		52
CH_4N^+	n-$C_3H_7NH_2$	C_2H_5	9.54	PI	743	11
(Threshold value approximately corrected for thermal energy and kinetic shift)						
CH_4N^+	$(CH_2)_4NH$ (Pyrrolidine)		12.7±0.2	EI		52
CH_4N^+	$(C_2H_5)_2NH$	$C_2H_4+CH_3$	13.10±0.10	EI		2428
CH_4N^+	$CH_2(NH_2)COOH$		10.23±0.09	EI		2587
CH_4N^+	$CH_2(NH_2)COOH$		10.1±0.2	EI		88

The ion structure is probably $CH_2NH_2^+$, see ref. 2429.

CH_3DN^+

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
CH_3DN^+	CH_3ND_2	D	11.52±0.60	EI		2429
CH_3DN^+	$CD_3CH_2NH_2$	CHD_2	9.82±0.1	EI		2470
CH_3DN^+	$(C_2H_5)_2ND$	$C_2H_4+CH_3$	13.15±0.1	EI		2428

$CH_2D_2N^+$

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$CH_2D_2N^+$	CH_3ND_2	H	10.10±0.30	EI		2429
$CH_2D_2N^+$	$CH_3CD_2NH_2$	CH_3	10.3±0.1	EI		2470
$CH_2D_2N^+$	$CD_3CH_2NH_2$	CH_2D?	11.6±0.3	EI		2470
$CH_2D_2N^+$	$C_2D_5NH_2$	CD_3	10.13	EI		2470
$CH_2D_2N^+$	$C_6H_5CH_2ND_2$ (α-Amino-d_2-toluene)		11.0±0.1	PI		1160

$CH_3NH_2^+$ $\Delta H^\circ_{f298} = 843$ kJ mol^{-1} (202 kcal mol^{-1})

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
CH_5N^+	CH_3NH_2		8.97±0.02	PI	843	159, 182, 416
CH_5N^+	CH_3NH_2		8.99	PE	844	3320
CH_5N^+	CH_3NH_2		9.36±0.02	EI		2429
CH_5N^+	CH_3NH_2		9.29	CTS		2562

See also – PE: 1130
PEN: 2430
EI: 14, 383, 384, 1072

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
CH_5N^+	CH_3NHNH_2	NH	11.3±0.1	PI		1141

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$CH_3D_2N^+$				
$CH_3D_2N^+$	CH_3ND_2		9.27±0.05	EI		2429
		C_2HN^+	**$\Delta H^\circ_{f0} \sim 1551$ kJ mol^{-1} (371 kcal mol^{-1})**			
C_2HN^+	CH_3CN	H_2	15.1±0.1	PI	~1551	2623
C_2HN^+	CH_3NC	H_2	14.46	EDD	1551	3214
C_2HN^+	$(CH_2)_2NH$ (Ethylenimine)		18.1±0.6	EI		51
		$C_2H_2N^+$				
$C_2H_2N^+$	CH_2CN		10.87±0.1	EI	(1263*)	125
$C_2H_2N^+$	CH_3CN	H	14.01±0.02	PI	(1221*)	2623
$C_2H_2N^+$	CH_3CN	H	14.28±0.05	EI	(1247*)	125
$C_2H_2N^+$	CH_3CN	H	13.54±0.08	EI	(1176*)	2704
See also – EI:	2966, 3017					
$C_2H_2N^+$	CH_3NC	H	13.21	EDD	(1206*)	3214
$C_2H_2N^+$	$(CH_2)_2NH$ (Ethylenimine)		17.0±0.2	EI		51
$C_2H_2N^+$	C_2H_5NC	CH_3	14.17	EDD		3214

The results of refs. 2623 and 2704 are unusual since electron impact almost always gives a higher value than photoionization.

*ΔH°_{f298}

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$CH_3CN^+(^2E)$ **CH_3NC^+**	**$\Delta H^\circ_{f0} \sim 1270$ kJ mol^{-1} (304 kcal mol^{-1})** **$\Delta H^\circ_{f0} = 1240$ kJ mol^{-1} (296 kcal mol^{-1})**			
$C_2H_3N^+(^2E)$	CH_3CN		12.19±0.01	PI	1271	2623
$C_2H_3N^+(^2E)$	CH_3CN		12.205±0.004	PI	1272	1253
$C_2H_3N^+(^2E)$	CH_3CN		12.22±0.01	PI	1274	182
$C_2H_3N^+(^2E)$	CH_3CN		12.12	PE	1264	2851
$C_2H_3N^+(^2E)$	CH_3CN		12.20 (V)	PE	1272	3045
$C_2H_3N^+(^2E)$	CH_3CN		12.23±0.05	EI		2704
$C_2H_3N^+(^2A_1)$	CH_3CN		13.11	PE	1359	2851
$C_2H_3N^+(^2A_1)$	CH_3CN		13.14	PE	1362	3045
$C_2H_3N^+(^2A_1)$	CH_3CN		15.12	PE	1553	2851
$C_2H_3N^+(^2A_1)$	CH_3CN		15.11	PE	1552	3045
$C_2H_3N^+(^2E)$	CH_3CN		16.98	PE	1733	2851

The assignments are those of ref. 2851.

See also – EI: 286, 411, 2171, 2966

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_2H_3N^+$	CH_3NC		11.24	PE	1240	3420
$C_2H_3N^+$	CH_3NC		11.83	EDD		3214
See also – EI:	2171					
$C_2H_3N^+$	$(CH_2)_2NH$ (Ethylenimine)		15.2±0.3	EI		51
$C_2H_3N^+$	n–C_3H_7CN		12.46	EI		2966
$C_2H_3N^+$	n–C_3H_7NC		12.05	EDD		3214
$C_2H_3N^+$	n–C_4H_9CN		12.26	EI		2966
$C_2H_3N^+$	n–C_4H_9NC		12.75	EDD		3214
$C_2H_3N^+$	$CH_3CH{=}NOH$	H_2O	12.9±0.2	EDD		3180
		$C_2D_3N^+$				
$C_2D_3N^+(^2E)$	CD_3CN		12.23 (V)	PE		3045
$C_2D_3N^+(^2E)$	CD_3CN		12.29±0.05	EI		2704
$C_2D_3N^+(^2A_1)$	CD_3CN		13.14	PE		3045
$C_2D_3N^+(^2A_1)$	CD_3CN		15.17	PE		3045
$C_2D_3N^+$	CD_3NC		11.25	PE		3420
		$C_2H_4N^+$				
$C_2H_4N^+$	$(CH_2)_2NH$ (Ethylenimine)	H	12.2±0.1	EI		51
$C_2H_4N^+$	$(CH_2)_3NH$ (Trimethylenimine)	CH_3	11.9±0.2	EI		52
$C_2H_4N^+$	iso–C_3H_7CN		12.70	EDD		3214
$C_2H_4N^+$	$(CH_2)_4NH$ (Pyrrolidine)	C_2H_5	13.0±0.2	EI		52
$C_2H_4N^+$	$tert$–C_4H_9CN		12.20	EDD		3214
$C_2H_4N^+$?	$(CH_3)_2NNH_2$		12.8±0.2	EI		424, 3216
$C_2H_4N^+$?	$CH_3NHNHCH_3$		12.1±0.5	EI		424, 3216
$C_2H_4N^+$?	$(CH_3)_2NNHCH_3$		11.7±0.2	EI		424, 3216
$C_2H_4N^+$?	$(CH_3)_2NN(CH_3)_2$		12.2±0.2	EI		424, 3216
$C_2H_4N^+$	$CH_3CH{=}NOH$	OH	11.3±0.2	EDD		3180

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
	$C_2H_5N^+$ (Ethylenimine)	**ΔH°_{f298} ~ 1045 kJ mol^{-1} (250 kcal mol^{-1})**				
$C_2H_5N^+$	$CH_3N{=}CH_2$		9.8±0.1	EI		2452
$C_2H_5N^+$	$(CH_2)_2NH$ (Ethylenimine)		9.52	PE	1045	3235
$C_2H_5N^+$	$(CH_2)_2NH$ (Ethylenimine)		9.94±0.15	EI		51
$C_2H_5N^+$	$(CH_2)_2NH$ (Ethylenimine)		9.8	EI		218
See also – PE:	2808					
$C_2H_5N^+$	$(CH_2)_4NH$ (Pyrrolidine)		12.3±0.2	EI		52
$C_2H_5N^+$?	$(CH_3)_2NNH_2$		8.8±0.1	PI		1141
$C_2H_5N^+$?	$(CH_3)_2NNH_2$		12.5±0.2	EI		424, 3216
		$C_2H_6N^+$				
$C_2H_6N^+$	$(CH_3)_2N$		9.42±0.1	EI		2452
$C_2H_6N^+$	$C_2H_5NH_2$	H	11.96±0.1	EI		2470
$C_2H_6N^+$	$(CH_3)_2NH$	H	10.1±0.1	RPD		3017
$C_2H_6N^+$	$(CH_3)_3N$	CH_3	12.3±0.1	EDD		2452
$C_2H_6N^+$	$(CH_3)_3N$	CH_3	12.3±0.1	EI		303
$C_2H_6N^+$	$(C_2H_5)_2NH$		13.65±0.08	EI		2428
$C_2H_6N^+$	$n{-}C_3H_7CH(NH_2)CH_3$		10.43±0.13	EI		2587
$C_2H_6N^+$?	$(CH_3)_2NNH_2$		9.0±0.2	PI		1141
$C_2H_6N^+$?	$(CH_3)_2NNH_2$		10.45±0.05	EDD		2452
$C_2H_6N^+$?	$(CH_3)_2NNH_2$		10.7±0.1	EI		303
$C_2H_6N^+$?	$(CH_3)_2NNH_2$		10.9±0.2	EI		424, 3216
$C_2H_6N^+$?	$(CH_3)_2NNHCH_3$		11.1±0.2	EI		424, 3216
$C_2H_6N^+$?	$(CH_3)_2NN(CH_3)_2$		11.2±0.1	EI		303
$C_2H_6N^+$?	$(CH_3)_2NN(CH_3)_2$		11.2±0.2	EI		424, 3216
$C_2H_6N^+$	$(CH_3)_2NN{=}NN(CH_3)_2$		9.85±0.1	EI		303
$C_2H_6N^+$	$HCON(CH_3)_2$		11.6±0.1	EI		303
$C_2H_6N^+$	$CH_3CON(CH_3)_2$		12.4±0.1	EI		303
$C_2H_6N^+$	$(CH_3)_2NNO$	NO?	10.3±0.05	EDD		2452
$C_2H_6N^+$	$(CH_3)_2NNO$	NO?	10.9±0.1	EI		303
$C_2H_6N^+$	$(CH_3)_2NNO_2$	NO_2?	10.68±0.05	EDD		2452
$C_2H_6N^+$	$(CH_3)_2NNO_2$	NO_2?	11.1±0.1	EI		303
		$C_2H_4D_2N^+$				
$C_2H_4D_2N^+$	$CH_3CD_2NH_2$	H	11.50±0.10	EI		2470
$C_2H_4D_2N^+$	$CD_3CH_2NH_2$	D	11.64±0.15	EI		2470
		$C_2H_3D_3N^+$				
$C_2H_3D_3N^+$	$CD_3CH_2NH_2$	H	11.80±0.13	EI		2470

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_2H_2D_4N^+$						
$C_2H_2D_4N^+$	$C_2D_5NH_2$	D	11.90±0.20	EI		2470
$C_2HD_5N^+$						
$C_2HD_5N^+$	$C_2D_5NH_2$	H	17.30	EI		2470
	$C_2H_5NH_2^+$ **$(CH_3)_2NH^+$**	**ΔH°_{f298} = 808 kJ mol^{-1} (193 kcal mol^{-1})** **ΔH°_{f298} = 777 kJ mol^{-1} (186 kcal mol^{-1})**				
$C_2H_7N^+$	$C_2H_5NH_2$		8.86±0.02	PI	808	159, 182
$C_2H_7N^+$	$C_2H_5NH_2$		9.19	PE		1130
$C_2H_7N^+$	$C_2H_5NH_2$		8.74	CTS		2562
See also – PI:	11, 86					
EI:	14, 2470					
$C_2H_7N^+$	$(CH_3)_2NH$		8.24±0.02	PI	777	159, 182
$C_2H_7N^+$	$(CH_3)_2NH$		8.25	PE	778	3320
$C_2H_7N^+$	$(CH_3)_2NH$		8.36	PE		1130
See also – PE:	3410					
EI:	14, 384, 2452, 3338					
$C_2H_7N^+$?	$(CH_3)_2NNH_2$		11.2±0.2	PI		1141
$C_2H_5D_2N^+$						
$C_2H_5D_2N^+$	$CH_3CD_2NH_2$		9.37±0.10	EI		2470
$C_2H_4D_3N^+$						
$C_2H_4D_3N^+$	$CD_3CH_2NH_2$		9.13±0.05	EI		2470
$C_2H_2D_5N^+$						
$C_2H_2D_5N^+$	$C_2D_5NH_2$		9.37	EI		2470
C_3HN^+						
C_3HN^+	$CH{\equiv}CCN$		11.60±0.01	PE		2805
C_3HN^+	$CH{\equiv}CCN$		11.6±0.2	EI		154
C_3HN^+	$CH_2{=}CHCN$		16.4±0.1	EI		2954
C_3HN^+	$CH_2{=}CFCN$		16.3±0.1	EI		2954
C_3HN^{+2}						
C_3HN^{+2}	$CH{\equiv}CCN$		32.3±0.2	EI		154

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_3H_2N^+$						
$C_3H_2N^+$	CH_2=CHCN	H	13.82±0.08	EI		1406
$C_3H_2N^+$	$C_4H_4N_2$ (1,3–Diazine)		15.01±0.10	EI		1406
$C_3H_2N^+$	$C_4H_4N_2$ (1,4–Diazine)		15.25±0.10	EI		1406
CH_2= $CHCN^+$ ΔH°_{f298} = 1238 kJ mol^{-1} (296 kcal mol^{-1})						
$C_3H_3N^+$	CH_2=CHCN		10.91±0.01	PI	1238	182
$C_3H_3N^+$	CH_2=CHCN		10.91	PE	1238	3045
See also – EI:	1406, 2954					
$C_3H_3N^+$	C_5H_5N (Pyridine)	C_2H_2	13.84±0.10	EI		1406
$C_3H_3N^+$	$C_4H_4N_2$ (1,3–Diazine)	HCN	12.87±0.10	EI		1406
$C_3H_3N^+$	$C_4H_4N_2$ (1,4–Diazine)	HCN	12.81±0.10	EI		1406
$C_3H_4N^+$						
$C_3H_4N^+$	CH_3CHCN		9.76±0.1	EI		125
$C_3H_4N^+$	CH_2CH_2CN		9.85±0.1	EI		125
$C_3H_4N^+$	C_2H_5CN	H	12.55±0.05	EI		2704
$C_3H_4N^+$	C_2H_5CN	H	13.00	EI		2966
$C_3H_4N^+$	C_2H_5NC	H	12.51	EDD		3214
$C_3H_4N^+$	*iso*–C_3H_7CN		13.25	EDD		3214
$C_3H_4N^+$	*n*–C_3H_7NC		12.09	EDD		3214
$C_3H_4N^+$	*n*–C_4H_9CN		12.12	EI		2966
$C_3H_4N^+$	*n*–C_4H_9NC		12.80	EDD		3214
$C_2H_5CN^+$ ΔH°_{f298} = 1194 kJ mol^{-1} (285 kcal mol^{-1})						
$C_3H_5N^+$	C_2H_5CN		11.84±0.02	PI	1193	182
$C_3H_5N^+$	C_2H_5CN		11.85	PE	1194	3045
See also – EI:	2171, 2704, 2966					
$C_3H_5N^+$	C_2H_5NC		11.38	EDD		3214
$C_3H_5N^+$	C_2H_5NC		11.2±0.1	EI		2171
$C_3H_5N^+$	*n*–C_4H_9CN		12.49	EI		2966
$C_3H_5N^+$	*n*–C_4H_9NC		11.80	EDD		3214
$C_3D_5N^+$						
$C_3D_5N^+$	C_2D_5CN		11.75±0.05	EI		2704

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_3H_6N^+$				
$C_3H_6N^+$	$(CH_2)_3NH$ (Trimethylenimine)	H	11.4±0.2	EI		52
		$C_3H_7N^+$				
$C_3H_7N^+$	*trans*-$CH_3CH=NCH_3$		9.1±0.1	PE		3087
See also – PE:	3073					
$C_3H_7N^+$	$(CH_2)_3NH$ (Trimethylenimine)		9.1±0.15	EI		52
$C_3H_7N^+$	$(CH_2)_3NH$ (Trimethylenimine)		8.9	EI		218
		$C_3H_8N^+$				
$C_3H_8N^+$	$(CH_3)_3N$	H	9.8±0.1	RPD		3017
$C_3H_8N^+$	$(C_2H_5)_2NH$	CH_3	9.55±0.10	EI		2428
		$C_3H_7DN^+$				
$C_3H_7DN^+$	$(C_2H_5)_2ND$		9.53±0.01	EI		2428
	$n-C_3H_7NH_2^+$ **$iso-C_3H_7NH_2^+$** **$(CH_3)_3N^+$**	**$\Delta H^\circ_{f298} = 777$ kJ mol^{-1} (186 kcal mol^{-1})** **$\Delta H^\circ_{f298} = 758$ kJ mol^{-1} (181 kcal mol^{-1})** **$\Delta H^\circ_{f298} = 730$ kJ mol^{-1} (174 kcal mol^{-1})**				
$C_3H_9N^+$	$n-C_3H_7NH_2$		8.78±0.02	PI	777	159, 182
See also – PI:	11, 86					
$C_3H_9N^+$	$iso-C_3H_7NH_2$		8.72±0.03	PI	758	159, 182
$C_3H_9N^+$	$iso-C_3H_7NH_2$		8.86	PE		1130
$C_3H_9N^+$	$(CH_3)_3N$		7.82±0.02	PI	731	159, 182, 416
$C_3H_9N^+$	$(CH_3)_3N$		7.80	PE	729	3320
See also – PE: EI: CTS:	1130, 3410 14, 384 2562					
		$C_4H_4N^+$				
$C_4H_4N^+$	$C_6H_5NH_2$ (Aniline)		12.3±0.1	PI		1160

4.3. The Positive Ion Table—Continued

$C_4H_5N^+$ (Pyrrole) **$\Delta H^\circ_{f298} = 900$ kJ mol^{-1} (215 kcal mol^{-1})**

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_4H_5N^+$	CH_2=$CHCH_2CN$		10.39±0.01	PI		182
$C_4H_5N^+$	CH_2=$CHCH_2CN$		10.18	PE		3045
$C_4H_5N^+$	C_3H_5CN (Cyclopropanecarboxylic acid nitrile)		11.2±0.2	EI		202
$C_4H_5N^+(^2A_2)$	C_4H_5N (Pyrrole)		8.209	S	900	3423
$C_4H_5N^+(^2A_2)$	C_4H_5N (Pyrrole)		8.20±0.01?	PI		182
$C_4H_5N^+(^2A_2)$	C_4H_5N (Pyrrole)		8.20±0.01	PI		3354
$C_4H_5N^+(^2A_2)$	C_4H_5N (Pyrrole)		8.209	PE	900	3423
$C_4H_5N^+(^2B_1)$	C_4H_5N (Pyrrole)		9.200	S		3423
$C_4H_5N^+(^2B_1)$	C_4H_5N (Pyrrole)		9.20	PE		3423

Additional higher ionization potentials are given in ref. 3423.

See also – PE: 2796, 2975, 3109, 3246, 3349
EI: 381, 2865, 3174, 3233

$C_4H_6N^+$

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_4H_6N^+$	$(CH_3)_2CCN$		9.15±0.1	EI		125
$C_4H_6N^+$	*n*-C_3H_7CN	H	13.00	EI		2966
$C_4H_6N^+$	*iso*-C_3H_7CN	H	12.55	EDD		3214
$C_4H_6N^+$	*n*-C_3H_7NC	H	11.96	EDD		3214
$C_4H_6N^+$	*tert*-C_4H_9CN	CH_3	12.60	EDD		3214

n-$C_3H_7CN^+$ **$\Delta H^\circ_{f298} \sim 1160$ kJ mol^{-1} (277 kcal mol^{-1})**

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_4H_7N^+$	*n*-C_3H_7CN		11.67±0.05	PI	1160	182
$C_4H_7N^+$	*n*-C_3H_7NC		11.33	EDD		3214
$C_4H_7N^+$	*n*-C_3H_7NC		11.1±0.1	EI		2171

$C_4H_8N^+$

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_4H_8N^+$	$(CH_2)_4NH$ (Pyrrolidine)	H	11.0±0.2	EI		52

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_4H_9N^+$				
$C_4H_9N^+$	$CH_3CH{=}NC_2H_5$		9.29	PE		1130
$C_4H_9N^+$	C_4H_9N (2,2–Dimethylethylenimine)		8.94	PE		3235
$C_4H_9N^+$	$(CH_2)_4NH$ (Pyrrolidine)		8.41	PE		1130
See also – EI:	52, 218					
		$C_4H_{10}N^+$				
$C_4H_{10}N^+$	$C_4H_{10}N$		5.9–6.7	SI		3229
This radical ion results from the surface ionization of $(C_2H_5)_2NH$, see ref. 3229.						
$C_4H_{10}N^+$	n–$C_3H_7CH(NH_2)CH_3$	CH_3	9.92±0.16	EI		2587
	n–$C_4H_9NH_2^+$	**$\Delta H^\circ_{f298} \sim 748$ kJ mol^{-1} (179 kcal mol^{-1})**				
	sec–$C_4H_9NH_2^+$	**$\Delta H^\circ_{f298} \sim 735$ kJ mol^{-1} (176 kcal mol^{-1})**				
	$tert$–$C_4H_9NH_2^+$	**$\Delta H^\circ_{f298} \sim 714$ kJ mol^{-1} (171 kcal mol^{-1})**				
	$(C_2H_5)_2NH^+$	**$\Delta H^\circ_{f298} = 700$ kJ mol^{-1} (167 kcal mol^{-1})**				
$C_4H_{11}N^+$	n–$C_4H_9NH_2$		8.71±0.03	PI	748	159, 182
$C_4H_{11}N^+$	n–$C_4H_9NH_2$		8.79	PE		1130
See also – EI: CTS:	2587 2562					
$C_4H_{11}N^+$	sec–$C_4H_9NH_2$		8.70	PI	735	182
$C_4H_{11}N^+$	iso–$C_4H_9NH_2$		8.70	PI		182
$C_4H_{11}N^+$	$tert$–$C_4H_9NH_2$		8.64	PI	714	182
$C_4H_{11}N^+$	$tert$–$C_4H_9NH_2$		8.83	PE		1130
See also – CTS:	2562					
$C_4H_{11}N^+$	$(C_2H_5)_2NH$		8.01±0.01	PI	700	159, 182
$C_4H_{11}N^+$	$(C_2H_5)_2NH$		8.51	PE		1130
See also – EI: CTS:	14, 2428 2562					
$C_4H_{11}N^+$	$(C_2H_5)_2NNH_2$	NH	11.2±0.1	PI		1141
		$C_4H_{10}DN^+$				
$C_4H_{10}DN^+$	$(C_2H_5)_2ND$		8.31±0.01	EI		2428

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
			$C_5H_3N^+$			
$C_5H_3N^+$	C_5H_5N (Pyridine)	H_2	12.42±0.10	EI		1406
			$C_5H_4N^+$			
$C_5H_4N^+$	C_5H_5N (Pyridine)	H	14.00±0.10	EI		1406
			$C_5H_2D_2N^+$			
$C_5H_2D_2N^+$	$C_6H_5CH_2ND_2$ (α–Amino–d_2–toluene)		11.0±0.2	PI		1160
	$C_5H_5N^+$ (Pyridine)	**ΔH°_{f298} = 1034 kJ mol^{-1} (247 kcal mol^{-1})**				
$C_5H_5N^+$	C_5H_5N (Pyridine)		9.266	S	1034	1115
$C_5H_5N^+$	C_5H_5N (Pyridine)		9.23±0.03	PI		416
$C_5H_5N^+$	C_5H_5N (Pyridine)		9.20±0.05	PI		1160
$C_5H_5N^+$	C_5H_5N (Pyridine)		9.30±0.01	PI		3325
$C_5H_5N^+$	C_5H_5N (Pyridine)		9.10±0.01	PI		2789
$C_5H_5N^+$	C_5H_5N (Pyridine)		9.28	PE		1130
$C_5H_5N^+$	C_5H_5N (Pyridine)		9.31	PE		2844
$C_5H_5N^+$	C_5H_5N (Pyridine)		9.10	PE		2789

Higher ionization potentials are given in refs. 1115, 1130, 2789, 2829, 2844, 2968, 3323 but they are not well established. Various PE studies are in disagreement among themselves and with the spectroscopic values of ref. 1115.

See also – S: 3153
PI: 182, 3323
PE: 2829, 2968, 3323
EI: 217, 383, 1406, 2481, 2865, 2989, 3013
CTS: 2562

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
			$C_5H_6N^+$			
$C_5H_6N^+$	$C_5H_4NH_2$ (Aminocyclopentadienyl radical)		7.55	EI		126
$C_5H_6N^+$	$C_4H_4NCH_3$ (N–Methylpyrrole)	H	11.2±0.1	PI		3354
$C_5H_6N^+$	$C_4H_4NCH_3$ (2–Methylpyrrole)	H	10.25±0.1	PI		3354

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_5H_7N^+$				
$C_5H_7N^+$	$C_4H_4NCH_3$ (*N*–Methylpyrrole)		8.09±0.01	PI		3354
$C_5H_7N^+$	$C_4H_4NCH_3$ (*N*–Methylpyrrole)		7.95±0.05	PE		3246
$C_5H_7N^+$	$C_4H_4NCH_3$ (2–Methylpyrrole)		7.78±0.01	PI		3354
$C_5H_7N^+$	$C_4H_4NCH_3$ (3–Methylpyrrole)		7.90±0.02	PI		3354
		$C_5H_8N^+$				
$C_5H_8N^+$	*n*–C_4H_9CN	H	12.47	EI		2966
$C_5H_8N^+$	*tert*–C_4H_9CN	H	12.05	EDD		3214
		$C_5H_9N^+$				
$C_5H_9N^+$	*n*–C_4H_9NC		11.71±0.05	EI		2481
$C_5H_9N^+$	*tert*–C_4H_9NC		10.50	EDD		3214
		$C_5H_{11}N^+$				
$C_5H_{11}N^+$	$(CH_3)_2C{=}NC_2H_5$		8.83	PE		1130
$C_5H_{11}N^+$	$(CH_2)_5NH$ (Piperidine)		8.7	EI		218
$C_5H_{11}N^+$	$(CH_2)_5NH$ (Piperidine)		9.15	CTS		2031
		$C_5H_{12}N^+$				
$C_5H_{12}N^+$	*n*–$C_4H_9N(CH_3)NH_2$	NH_2	9.0±0.1	PI		1141
$C_5H_{12}N^+$	*n*–$C_4H_9CH(NH_2)COOH$		9.76±0.05	EI		2587
$C_5H_{12}N^+$	*sec*–$C_4H_9CH(NH_2)COOH$		9.9±0.2	EI		88
		$C_5H_{13}N^+$				
$C_5H_{13}N^+$	*n*–$C_3H_7CH(NH_2)CH_3$		9.31±0.15	EI		2587
$C_5H_{13}N^+$	*n*–$C_4H_9N(CH_3)NH_2$	NH	10.5±0.1	PI		1141
		$C_6H_4N^+$				
$C_6H_4N^+$	C_5H_4CN (Cyanocyclopentadienyl radical)		9.44	EI		126

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_6H_6N^+$				
$C_6H_6N^+$	C_6H_5NH (Anilino radical)		8.26±0.1	EI		1011
$C_6H_6N^+$	$C_5H_4NCH_2$ (2–Pyridylmethyl radical)		8.17±0.1	EI		1011
$C_6H_6N^+$	$C_5H_4NCH_2$ (3–Pyridylmethyl radical)		7.92±0.1	EI		1011
$C_6H_6N^+$	$C_5H_4NCH_2$ (4–Pyridylmethyl radical)		8.40±0.15	EI		1011
$C_6H_6N^+$	$C_5H_4NCH_3$ (2–Methylpyridine)	H	12.38±0.1	EI		1011
$C_6H_6N^+$	$C_5H_4NCH_3$ (3–Methylpyridine)	H	12.31±0.1	EI		1011
$C_6H_6N^+$	$C_5H_4NCH_3$ (4–Methylpyridine)	H	12.22±0.1	EI		1011
$C_6H_6N^+$	$C_6H_4ClNH_2$ (3–Chloroaniline)	Cl	12.25±0.1	EI		2972
$C_6H_6N^+$	$C_6H_4ClNH_2$ (4–Chloroaniline)	Cl	12.37	EI		3238
$C_6H_6N^+$	$C_6H_4ClNH_2$ (4–Chloroaniline)	Cl	12.50±0.1	EI		2972
$C_6H_6N^+$	$C_6H_4BrNH_2$ (4–Bromoaniline)	Br	11.95	EI		3238

$C_6H_7N^+$ (Aniline) **$\Delta H^\circ_{f298} \sim 829$ kJ mol^{-1} (198 kcal mol^{-1})**
$C_6H_7N^+$ (2–Methylpyridine) **$\Delta H^\circ_{f298} \sim 969$ kJ mol^{-1} (232 kcal mol^{-1})**
$C_6H_7N^+$ (3–Methylpyridine) **$\Delta H^\circ_{f298} \sim 978$ kJ mol^{-1} (234 kcal mol^{-1})**
$C_6H_7N^+$ (4–Methylpyridine) **$\Delta H^\circ_{f298} \sim 974$ kJ mol^{-1} (233 kcal mol^{-1})**

$C_6H_7N^+$	$C_6H_5NH_2$ (Aniline)		7.70±0.02	PI	830	159, 182, 416
$C_6H_7N^+$	$C_6H_5NH_2$ (Aniline)		7.67±0.03	PI	827	1160
$C_6H_7N^+$	$C_6H_5NH_2$ (Aniline)		7.69±0.02	PI	829	1159, 1166
$C_6H_7N^+$	$C_6H_5NH_2$ (Aniline)		7.68?	PE		2796
$C_6H_7N^+$	$C_6H_5NH_2$ (Aniline)		7.61±0.05	SI		2741

See also – PE: 1159, 1160, 2806
EI: 1066, 2458, 2865, 2972, 3223
CTS: 1281, 2562, 2909, 2978

$C_6H_7N^+$	$C_5H_4NCH_3$ (2–Methylpyridine)		9.02±0.03	PI	969	182

See also – EI: 217, 2865, 2989

$C_6H_7N^+$	$C_5H_4NCH_3$ (3–Methylpyridine)		9.04±0.03	PI	978	182

See also – EI: 2865, 2989

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_6H_7N^+$	$C_5H_4NCH_3$ (4–Methylpyridine)		9.04±0.03	PI	974	182
See also – EI:	217, 2865, 2989					
$C_6H_7N^+$	$C_6H_5NHCOCH_3$ (*N*–Phenylacetic acid amide)		8.88±0.15	EI		1126
See also – EI:	3406					
		$C_6H_8N^+$				
$C_6H_8N^+$	$C_4H_3N(CH_3)_2$ (2,4–Dimethylpyrrole)	H	10.15±0.1	PI		3354
		$C_6H_9N^+$				
$C_6H_9N^+$	$C_4H_3N(CH_3)_2$ (2,4–Dimethylpyrrole)		7.54±0.02	PI		3354
		$C_6H_{10}N^+$				
$C_6H_{10}N^+$	n–$C_5H_{11}CN$	H	12.62	EI		2966
		$C_6H_{13}N^+$				
$C_6H_{13}N^+$	n–$C_3H_7CH{=}NC_2H_5$		9.00	PE		1130
$C_6H_{13}N^+$	*iso*–$C_3H_7CH{=}NC_2H_5$		8.94	PE		1130
$C_6H_{13}N^+$	$C_6H_{11}NH_2$ (Aminocyclohexane)		8.86	PE		1130
$C_6H_{13}N^+$	$(CH_2)_6NH$ (Azacycloheptane)		8.5	EI		218
	$(C_2H_5)_3N^+$	**$\Delta H^\circ_{f298} \sim 624$ kJ mol^{-1} (149 kcal mol^{-1})**				
$C_6H_{15}N^+$	$(n$–$C_3H_7)_2NH$		7.84±0.02	PI		159, 182
$C_6H_{15}N^+$	(*iso*–$C_3H_7)_2NH$		7.73±0.03	PI		159, 182
$C_6H_{15}N^+$	$(C_2H_5)_3N$		7.50±0.02	PI	624	159, 182
$C_6H_{15}N^+$	$(C_2H_5)_3N$		7.84	PE		1130
See also – EI: CTS:	14, 2158 2031, 2562					
		$C_7H_4N^+$				
$C_7H_4N^+$	C_6H_4ClCN (3–Chlorobenzoic acid nitrile)	Cl	13.83±0.1	EI		2972

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_7H_4N^+$	C_6H_4ClCN (4–Chlorobenzoic acid nitrile)	Cl	13.97±0.1	EI		2972
$C_7H_4N^+$	C_6H_4BrCN (4–Bromobenzoic acid nitrile)	Br	13.21	EI		3238
	$C_7H_5N^+$ (Benzoic acid nitrile)		**ΔH°_{f298} = 1155 kJ mol^{-1} (276 kcal mol^{-1})**			
$C_7H_5N^+$	C_6H_5CN (Benzoic acid nitrile)		9.705±0.01	PI	1155	182
$C_7H_5N^+$	C_6H_5CN (Benzoic acid nitrile)		10.02 (V)	PE		2806
See also – EI:	1066, 2420, 2972, 3223, 3238					
$C_7H_5N^+$	C_6H_5NC (Isocyanobenzene)		9.70±0.05	EI		2481
$C_7H_5N^+$	$C_6H_5CONH_2$ (Benzoic acid amide)	H_2O	10.19±0.10	EI		1126
$C_7H_5N^+$	$(C_6H_5)_2C_2N_2O$ (3,5–Diphenyl–1,2,4–oxadiazole)		10.2±0.1	EI		1125
			$C_7H_2D_3N^+$			
$C_7H_2D_3N^+$	$C_6H_2D_3NC$ (Isocyanobenzene–*2,4,6–d*$_3$)		9.9±0.2	EI		2919
			$C_7H_7N^+$			
$C_7H_7N^+$	$C_6H_5CH_2NH_2$ (α–Aminotoluene)	H_2	9.35±0.07	PI		1147
			$C_7H_8N^+$			
$C_7H_8N^+$	$C_6H_5CH_2NH_2$ (α–Aminotoluene)	H	9.21±0.07	PI		1147
$C_7H_8N^+$	$C_6H_5CH_2NH_2$ (α–Aminotoluene)	H	9.3±0.1	PI		1160
$C_7H_8N^+$	$C_6H_5NHCH_3$ (*N*–Methylaniline)	H	11.0±0.1	PI		1160
$C_7H_8N^+$	$C_6H_4(NH_2)CH_3$ (4–Aminotoluene)	H	10.80	EI		3238
$C_7H_8N^+$	$C_6H_5CH_2CH_2C_6H_4NH_2$ (1–(3–Aminophenyl)–2–phenylethane)		11.0±0.2	EI		3288
$C_7H_8N^+$	$C_6H_5CH_2CH_2C_6H_4NH_2$ (1–(4–Aminophenyl)–2–phenylethane)		9.1±0.2	EI		3288
$C_7H_8N^+$	$C_6H_4(NH_2)CH_2CH_2C_6H_4NH_2$ (1,2–Bis(4–aminophenyl)ethane)		9.3±0.2	EI		3288
$C_7H_8N^+$	$C_6H_4(NH_2)(CH_2)_3COOCH_3$ (4–(4–Aminophenyl)butanoic acid methyl ester)		10.92±0.2	EI		2497

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_7H_8N^+$	$C_6H_4(NH_2)CH_2CH_2C_6H_4NO_2$ (1–(4–Aminophenyl)–2–(4–nitrophenyl)ethane)		9.2±0.2	EI		3288

$C_7H_9N^+$

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_7H_9N^+$	$C_6H_5CH_2NH_2$ (α–Aminotoluene)		8.64±0.05	PI		1147, 1160, 1166
$C_7H_9N^+$	$C_6H_5CH_2NH_2$ (α–Aminotoluene)		8.73	PE		3235

See also – PI: 159
EI: 2025, 2458

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_7H_9N^+$	$C_6H_5NHCH_3$ (*N*–Methylaniline)		7.30±0.05	PI		1160
$C_7H_9N^+$	$C_6H_5NHCH_3$ (*N*–Methylaniline)		7.34±0.02	PI		1159, 1166
$C_7H_9N^+$	$C_6H_5NHCH_3$ (*N*–Methylaniline)		7.73 (V)	PE		2806

See also – PE: 1159, 1160
EI: 2458
CTS: 1281, 2978

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_7H_9N^+$	$C_6H_4(NH_2)CH_3$ (2–Aminotoluene)		7.68±0.1	EI		2458
$C_7H_9N^+$	$C_6H_4(NH_2)CH_3$ (2–Aminotoluene)		7.59±0.1	CTS		2485
$C_7H_9N^+$	$C_6H_4(NH_2)CH_3$ (2–Aminotoluene)		7.69	CTS		2909
$C_7H_9N^+$	$C_6H_4(NH_2)CH_3$ (2–Aminotoluene)		7.75	CTS		2978

See also – EI: 1066

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_7H_9N^+$	$C_6H_4(NH_2)CH_3$ (3–Aminotoluene)		7.50±0.02	PI		1166
$C_7H_9N^+$	$C_6H_4(NH_2)CH_3$ (3–Aminotoluene)		7.57±0.1	EI		2458
$C_7H_9N^+$	$C_6H_4(NH_2)CH_3$ (3–Aminotoluene)		7.68±0.1	CTS		2485
$C_7H_9N^+$	$C_6H_4(NH_2)CH_3$ (3–Aminotoluene)		7.75	CTS		2978

See also – EI: 1066, 2025

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_7H_9N^+$	$C_6H_4(NH_2)CH_3$ (4–Aminotoluene)		7.78 (V)	PE		2806
$C_7H_9N^+$	$C_6H_4(NH_2)CH_3$ (4–Aminotoluene)		7.60±0.1	EI		2458
$C_7H_9N^+$	$C_6H_4(NH_2)CH_3$ (4–Aminotoluene)		7.57±0.1	CTS		2485
$C_7H_9N^+$	$C_6H_4(NH_2)CH_3$ (4–Aminotoluene)		7.58	CTS		2909
$C_7H_9N^+$	$C_6H_4(NH_2)CH_3$ (4–Aminotoluene)		7.65	CTS		2978
See also – EI:	1066, 3223					
$C_7H_9N^+$	$C_5H_3N(CH_3)_2$ (2,3–Dimethylpyridine)		8.85±0.02	PI		182
See also – EI:	3232					
$C_7H_9N^+$	$C_5H_3N(CH_3)_2$ (2,4–Dimethylpyridine)		8.85±0.03	PI		182
See also – EI:	3232					
$C_7H_9N^+$	$C_5H_3N(CH_3)_2$ (2,6–Dimethylpyridine)		8.85±0.02	PI		182
See also – EI:	3232					
$C_7H_9N^+$	$C_6H_4(CH_3)NHCOCH_3$ (*N*–(3–Tolyl)acetic acid amide)		10.85±0.2	EI		3406
$C_7H_9N^+$	$C_6H_4(CH_3)NHCOCH_3$ (*N*–(4–Tolyl)acetic acid amide)		10.62±0.2	EI		3406

$C_7H_{11}N^+$

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_7H_{11}N^+$	$C_6H_{11}NC$ (Isocyanocyclohexane)		10.72±0.05	EI		2481

$C_7H_{13}N^+$

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_7H_{13}N^+$	$C_7H_{13}N$ (1–Azabicyclo[2.2.2]octane)		8.02 (V)	PE		2962

$C_8H_6N^+$

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_8H_6N^+$	$C_6H_4(CN)CH_2$ (3–Cyanobenzyl radical)		8.58±0.1	EI		69
$C_8H_6N^+$	$C_6H_4(CN)CH_2$ (4–Cyanobenzyl radical)		8.36±0.1	EI		69
$C_8H_6N^+$	$C_6H_5CH_2CH_2C_6H_4CN$ (1–(3–Cyanophenyl)–2–phenylethane)		~15	EI		3288

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_8H_6N^+$	$C_6H_4(CN)(CH_2)_3COOCH_3$ (4–(4–Cyanophenyl)butanoic acid methyl ester)		13.85±0.2	EI		2497
	$C_8H_7N^+$ (Indole) $\Delta H^\circ_{f298} = 936$ kJ mol^{-1} (224 kcal mol^{-1})					
$C_8H_7N^+$	$C_6H_5CH_2CN$ (Phenylacetic acid nitrile)		9.50±0.04	RPD		3223
$C_8H_7N^+$	$C_6H_5CH_2CN$ (Phenylacetic acid nitrile)		9.40±0.05	EI		2025
$C_8H_7N^+$	$C_6H_4(CH_3)CN$ (3–Methylbenzoic acid nitrile)		9.58±0.05	RPD		3223
$C_8H_7N^+$	$C_6H_4(CH_3)CN$ (3–Methylbenzoic acid nitrile)		9.66±0.05	EI		2025
$C_8H_7N^+$	$C_6H_4(CH_3)CN$ (4–Methylbenzoic acid nitrile)		9.56±0.05	RPD		3223
$C_8H_7N^+$	$C_6H_4(CH_3)CN$ (4–Methylbenzoic acid nitrile)		9.76	EI		1066
$C_8H_7N^+$	$C_6H_5CH_2NC$ (α–Isocyanotoluene)		9.61±0.05	EI		2481
$C_8H_7N^+$	$C_6H_4(CH_3)NC$ (Isocyanotoluene)		9.63±0.05	EI		2481
$C_8H_7N^+$	C_8H_7N (Indole)		7.75±0.05	PE	934	2796
$C_8H_7N^+$	C_8H_7N (Indole)		7.78	PE	937	3349
See also – CTS:	2562					
	$C_8H_9N^+$					
$C_8H_9N^+$	$C_6H_4(NH_2)(CH_2)_3COOCH_3$ (4–(4–Aminophenyl)butanoic acid methyl ester)		10.52±0.2	EI		2497
	$C_8H_{10}N^+$					
$C_8H_{10}N^+$	$C_6H_5N(CH_3)_2$ (*N*,*N*–Dimethylaniline)	H	10.75±0.05	PI		1160
See also – EI:	3238					
$C_8H_{10}N^+$	$C_6H_4(NH_2)CH_2CH_2Br$ (1–(4–Aminophenyl)–2–bromoethane)	Br	9.9	EI		2973

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_8H_{11}N^+$				
$C_8H_{11}N^+$	$C_6H_5CH_2NHCH_3$ (Benzyl methyl amine)		8.65	EI		3338
$C_8H_{11}N^+$	$C_6H_5NHC_2H_5$ (*N*–Ethylaniline)		7.56	CTS		1281
$C_8H_{11}N^+$	$C_6H_5NHC_2H_5$ (*N*–Ethylaniline)		7.5	CTS		2978
$C_8H_{11}N^+$	$C_6H_4(NH_2)C_2H_5$ (2–Ethylaniline)		7.57±0.1	CTS		2485
$C_8H_{11}N^+$	$C_6H_4(NH_2)C_2H_5$ (4–Ethylaniline)		7.62±0.1	CTS		2485
$C_8H_{11}N^+$	$C_6H_5N(CH_3)_2$ (*N*,*N*–Dimethylaniline)		7.14±0.03	PI		1159, 1166
$C_8H_{11}N^+$	$C_6H_5N(CH_3)_2$ (*N*,*N*–Dimethylaniline)		7.10±0.05	PI		1160
$C_8H_{11}N^+$	$C_6H_5N(CH_3)_2$ (*N*,*N*–Dimethylaniline)		7.51 (V)	PE		2806
$C_8H_{11}N^+$	$C_6H_5N(CH_3)_2$ (*N*,*N*–Dimethylaniline)		7.31	CTS		2909
$C_8H_{11}N^+$	$C_6H_5N(CH_3)_2$ (*N*,*N*–Dimethylaniline)		7.2	CTS		2037

See also – PE: 1159, 1160
EI: 2458, 2950, 3238
CTS: 1281, 2562, 2978

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_8H_{11}N^+$	$C_6H_4(CH_3)NHCH_3$ (*N*,2–Dimethylaniline)		7.58±0.1	EI		2458
$C_8H_{11}N^+$	$C_6H_4(CH_3)NHCH_3$ (*N*,3–Dimethylaniline)		7.45±0.1	EI		2458
$C_8H_{11}N^+$	$C_6H_4(CH_3)NHCH_3$ (*N*,4–Dimethylaniline)		7.58±0.1	EI		2458
$C_8H_{11}N^+$	$C_6H_3(CH_3)_2NH_2$ (2,3–Dimethylaniline)		7.51±0.1	CTS		2485
$C_8H_{11}N^+$	$C_6H_3(CH_3)_2NH_2$ (2,4–Dimethylaniline)		7.40±0.1	CTS		2485
$C_8H_{11}N^+$	$C_6H_3(CH_3)_2NH_2$ (2,5–Dimethylaniline)		7.50±0.1	CTS		2485
$C_8H_{11}N^+$	$C_6H_3(CH_3)_2NH_2$ (2,6–Dimethylaniline)		7.46±0.1	CTS		2485
$C_8H_{11}N^+$	$C_6H_3(CH_3)_2NH_2$ (3,5–Dimethylaniline)		7.61±0.1	CTS		2485

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_8H_{13}N^+$				
$C_8H_{13}N^+$	$C_4H_4NC_4H_9$ (*N*–Butylpyrrole)		7.87±0.02	PI		3354
		$C_8H_{19}N^+$				
$C_8H_{19}N^+$	$(n\text{–}C_4H_9)_2NH$		7.69±0.03	PI		159, 182
		$C_9H_7N^+$				
$C_9H_7N^+$	C_9H_7N (Quinoline)		8.62±0.01	PI		2651
$C_9H_7N^+$	C_9H_7N (Quinoline)		8.62	PE		2844
$C_9H_7N^+$	C_9H_7N (Quinoline)		8.67±0.05	PE		2847
See also – EI: CTS:	3174 2485, 2562					
$C_9H_7N^+$	C_9H_7N (Isoquinoline)		8.55±0.02	PI		2651
$C_9H_7N^+$	C_9H_7N (Isoquinoline)		8.54	PE		2844
$C_9H_7N^+$	C_9H_7N (Isoquinoline)		8.53±0.05	PE		2847
$C_9H_7N^+$	$C_6H_4(CN)(CH_2)_3COOCH_3$ (4–(4–Cyanophenyl)butanoic acid methyl ester)		11.20±0.2	EI		2497
		$C_9H_8N^+$				
$C_9H_8N^+$	$C_6H_4(CN)CH(CH_3)CH_2COOCH_3$ (3–(4–Cyanophenyl)butanoic acid methyl ester)		11.53±0.2	EI		2497
		$C_9H_9N^+$				
$C_9H_9N^+$	$C_6H_4(CH_3)CH_2CN$ (3–Tolylacetic acid nitrile)		9.18±0.04	RPD		3223
$C_9H_9N^+$	$C_6H_4(CH_3)CH_2CN$ (4–Tolylacetic acid nitrile)		9.16±0.06	RPD		3223
$C_9H_9N^+$	$C_6H_3(CH_3)_2CN$ (3,4–Dimethylbenzoic acid nitrile)		9.16±0.04	RPD		3223

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
			$C_9H_{11}N^+$			
$C_9H_{11}N^+$	$C_9H_{11}N$ (1,2,3,4–Tetrahydroquinoline)		7.61	EI		3338
$C_9H_{11}N^+$	$C_9H_{11}N$ (1,2,3,4–Tetrahydroisoquinoline)		8.63	EI		3338
			$C_9H_{13}N^+$			
$C_9H_{13}N^+$	$C_6H_5NHC_3H_7$ (*N*–Propylaniline)		7.54	CTS		1281
$C_9H_{13}N^+$	$C_6H_5NHC_3H_7$ (*N*–Propylaniline)		7.5	CTS		2978
$C_9H_{13}N^+$	$C_6H_5NHC_3H_7$ (*N*–Isopropylaniline)		7.5	CTS		2978
$C_9H_{13}N^+$	$C_6H_4(NH_2)C_3H_7$ (4–Isopropylaniline)		7.68±0.1	CTS		2485
$C_9H_{13}N^+$	$C_6H_5N(CH_3)C_2H_5$ (*N*–Ethyl–*N*–methylaniline)		7.37	CTS		1281
$C_9H_{13}N^+$	$C_6H_4(CH_3)N(CH_3)_2$ (*N*,*N*,2–Trimethylaniline)		7.37	CTS		1281
$C_9H_{13}N^+$	$C_6H_4(CH_3)N(CH_3)_2$ (*N*,*N*,3–Trimethylaniline)		7.35	CTS		1281
$C_9H_{13}N^+$	$C_6H_4(CH_3)N(CH_3)_2$ (*N*,*N*,4–Trimethylaniline)		7.48 (V)	PE		2806
$C_9H_{13}N^+$	$C_6H_4(CH_3)N(CH_3)_2$ (*N*,*N*,4–Trimethylaniline)		7.33	CTS		1281
			$C_9H_{21}N^+$			
$C_9H_{21}N^+$	$(n\text{–}C_3H_7)_3N$		7.23?	PI		159, 182
			$C_{10}H_9N^+$			
$C_{10}H_9N^+$	$C_{10}H_7NH_2$ (1–Aminonaphthalene)		7.26±0.1	CTS		2485
$C_{10}H_9N^+$	$C_{10}H_7NH_2$ (1–Aminonaphthalene)		7.39	CTS		2909
$C_{10}H_9N^+$	$C_{10}H_7NH_2$ (1–Aminonaphthalene)		7.4	CTS		2978
$C_{10}H_9N^+$	$C_{10}H_7NH_2$ (2–Aminonaphthalene)		7.37±0.1	CTS		2485
$C_{10}H_9N^+$	$C_{10}H_7NH_2$ (2–Aminonaphthalene)		7.5	CTS		2978
$C_{10}H_9N^+$	$C_6H_4(CN)CH(CH_3)CH_2COOCH_3$ (3–(4–Cyanophenyl)butanoic acid methyl ester)		9.51±0.2	EI		2497

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
	$C_{10}H_{15}N^+$					
$C_{10}H_{15}N^+$	$C_6H_5NHC_4H_9$ (*N*–Butylaniline)		7.53	CTS		1281
$C_{10}H_{15}N^+$	$C_6H_5NHC_4H_9$ (*N*–Butylaniline)		7.5	CTS		2978
$C_{10}H_{15}N^+$	$C_6H_4(NH_2)C_4H_9$ (4–*tert*–Butylaniline)		7.72±0.1	CTS		2485
$C_{10}H_{15}N^+$	$C_6H_5N(C_2H_5)_2$ (*N*,*N*–Diethylaniline)		7.51 (V)	PE		2806
$C_{10}H_{15}N^+$	$C_6H_5N(C_2H_5)_2$ (*N*,*N*–Diethylaniline)		6.99	CTS		1281
$C_{10}H_{15}N^+$	$C_6H_5N(C_2H_5)_2$ (*N*,*N*–Diethylaniline)		7.15	CTS		2978
$C_{10}H_{15}N^+$	$C_6H_4(C_2H_5)N(CH_3)_2$ (*N*,*N*–Dimethyl–4–ethylaniline)		7.38	CTS		1281
$C_{10}H_{15}N^+$	$C_6H_3(CH_3)_2N(CH_3)_2$ (*N*,*N*,2,4–Tetramethylaniline)		7.17	CTS		1281
$C_{10}H_{15}N^+$	$C_6H_3(CH_3)_2N(CH_3)_2$ (*N*,*N*,2,6–Tetramethylaniline)		7.22	CTS		1281
$C_{10}H_{15}N^+$	$C_6H_3(CH_3)_2N(CH_3)_2$ (*N*,*N*,3,5–Tetramethylaniline)		7.25	CTS		1281
	$C_{11}H_{15}N^+$					
$C_{11}H_{15}N^+$	$C_6H_5NHC_5H_9$ (*N*–Cyclopentylaniline)		7.45	CTS		2978
	$C_{11}H_{17}N^+$					
$C_{11}H_{17}N^+$	$C_6H_5NHC_5H_{11}$ (*N*–Pentylaniline)		7.5	CTS		2978
$C_{11}H_{17}N^+$	$C_6H_4(CH_3)N(C_2H_5)_2$ (*N*,*N*–Diethyl–4–methylaniline)		6.93	CTS		1281
$C_{11}H_{17}N^+$	$C_6H_4(C_3H_7)N(CH_3)_2$ (*N*,*N*–Dimethyl–4–isopropylaniline)		7.41	CTS		1281
	$C_{12}H_9N^+$					
$C_{12}H_9N^+$	$C_{12}H_9N$ (Carbazole)		7.6±0.1	EDD		2974
$C_{12}H_9N^+$	$C_{12}H_9N$ (Carbazole)		7.2±0.1	EI		3011
See also – CTS:	2911					
$C_{12}H_9N^+$	$C_{12}H_9N_3$ (1–Phenyl–1,2,3–benzotriazole)	N_2	9.65±0.1	EDD		2974
$C_{12}H_9N^+$	$C_{13}H_{10}N_4$ (2–Benzylideneamino–2,1,3–benzotriazole)		10.4±0.1	EDD		2974

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
	$C_{12}H_{11}N^+$ (Diphenylamine)	**$\Delta H^\circ_{f298} \sim 901$ kJ mol^{-1} (215 kcal mol^{-1})**				
$C_{12}H_{11}N^+$	$(C_6H_5)_2NH$ (Diphenylamine)		7.25±0.03	PI	901	1140
See also – CTS:	2909, 2978					
$C_{12}H_{11}N^+$	$C_6H_5C_6H_4NH_2$ (2–Aminobiphenyl)		7.55±0.1	CTS		2485
$C_{12}H_{11}N^+$	$C_6H_5C_6H_4NH_2$ (4–Aminobiphenyl)		7.49±0.1	CTS		2485
		$C_{12}H_{17}N^+$				
$C_{12}H_{17}N^+$	$C_6H_5NHC_6H_{11}$ (*N*–Cyclohexylaniline)		7.45	CTS		2978
		$C_{12}H_{19}N^+$				
$C_{12}H_{19}N^+$	$C_6H_5NHC_6H_{13}$ (*N*–Hexylaniline)		7.5	CTS		2978
$C_{12}H_{19}N^+$	$C_6H_5N(C_3H_7)_2$ (*N*,*N*–Dipropylaniline)		6.96	CTS		1281
$C_{12}H_{19}N^+$	$C_6H_5N(C_3H_7)_2$ (*N*,*N*–Dipropylaniline)		7.15	CTS		2978
$C_{12}H_{19}N^+$	$C_6H_4(C_4H_9)N(CH_3)_2$ (*N*,*N*–Dimethyl–4–*tert*–butylaniline)		7.43	CTS		1281
		$C_{13}H_7N^+$				
$C_{13}H_7N^+$	$(C_6H_4CN)_2$ (4,4′–Dicyanobiphenyl)	HCN	15.65	EI		3295
		$C_{13}H_9N^+$				
$C_{13}H_9N^+$	$C_{13}H_9N$ (Acridine)		7.39	CTS		2562
$C_{13}H_9N^+$	$C_{13}H_9N$ (Acridine)		7.98±0.1	CTS		2485
$C_{13}H_9N^+$	$C_{13}H_9N$ (Acridine)		8.04	CTS		2909
$C_{13}H_9N^+$	$C_{13}H_9N$ (3,4–Benzoquinoline)		8.38±0.1	CTS		2485
$C_{13}H_9N^+$	$C_{13}H_9N$ (5,6–Benzoquinoline)		8.38±0.1	CTS		2485
$C_{13}H_9N^+$	$C_{13}H_9N$ (6,7–Benzoquinoline)		7.58±0.1	CTS		2485
$C_{13}H_9N^+$	$C_{13}H_9N$ (7,8–Benzoquinoline)		8.34±0.1	CTS		2485

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of forma-tion (kJ mol^{-1})	Ref.
$C_{13}H_9N^+$	$C_{13}H_9N$ (5,6–Benzoisoquinoline)		8.32±0.1	CTS		2485
$C_{13}H_9N^+$	$C_{14}H_9NO_2$ (*N*–Phenylphthalic acid imide)	CO_2	11.0	EI		2412
		$C_{13}H_{11}N^+$				
$C_{13}H_{11}N^+$	$C_{12}H_8NCH_3$ (*N*–Methylcarbazole)		7.5±0.1	EI		3011
$C_{13}H_{11}N^+$	$C_{13}H_{11}N$ (9,10–Dihydroacridine)		7.24±0.03	PI		2728
		$C_{13}H_{19}N^+$				
$C_{13}H_{19}N^+$	$C_6H_5NHC_7H_{13}$ (*N*–Cycloheptylaniline)		7.45	CTS		2978
		$C_{13}H_{21}N^+$				
$C_{13}H_{21}N^+$	$C_6H_5NHC_7H_{15}$ (*N*–Heptylaniline)		7.5	CTS		2978
		$C_{14}H_9N^+$				
$C_{14}H_9N^+$	$C_{14}H_9N$ (4,5–Iminophenanthrene)		7.6±0.1	EI		3011
		$C_{14}H_{11}N^+$				
$C_{14}H_{11}N^+$	$C_{14}H_9NH_2$ (2–Aminophenanthrene)		7.55±0.1	CTS		2485
$C_{14}H_{11}N^+$	$C_{14}H_9NH_2$ (9–Aminophenanthrene)		7.19±0.1	CTS		2485
		$C_{14}H_{13}N^+$				
$C_{14}H_{13}N^+$	$C_6H_5CH{=}CHC_6H_4NH_2$ (1–(2–Aminophenyl)–2–phenylethene)		7.39±0.1	CTS		2485
		$C_{14}H_{15}N^+$				
$C_{14}H_{15}N^+$	$C_6H_5CH_2CH_2C_6H_4NH_2$ (1–(3–Aminophenyl)–2–phenylethane)		7.9±0.1 (V)	PE		3290
$C_{14}H_{15}N^+$	$C_6H_5CH_2CH_2C_6H_4NH_2$ (1–(3–Aminophenyl)–2–phenylethane)		7.6±0.1	EI		3288
$C_{14}H_{15}N^+$	$C_6H_5CH_2CH_2C_6H_4NH_2$ (1–(4–Aminophenyl)–2–phenylethane)		7.7±0.1	EI		3288

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_{14}H_{15}N^+$	$(C_6H_5CH_2)_2NH$ (Dibenzylamine)		8.22	PE		3235
$C_{14}H_{15}N^+$	$C_6H_5N(CH_3)CH_2C_6H_5$ (*N*–Benzyl–*N*–methylaniline)		7.44±0.1	EI		2458
		$C_{14}H_{23}N^+$				
$C_{14}H_{23}N^+$	$C_6H_5NHC_8H_{17}$ (*N*–Octylaniline)		7.5	CTS		2978
$C_{14}H_{23}N^+$	$C_6H_5N(C_4H_9)_2$ (*N*,*N*–Dibutylaniline)		6.95	CTS		1281
$C_{14}H_{23}N^+$	$C_6H_5N(C_4H_9)_2$ (*N*,*N*–Dibutylaniline)		7.15	CTS		2978
		$C_{15}H_{13}N^+$				
$C_{15}H_{13}N^+$	$C_6H_5CH_2CH_2C_6H_4CN$ (1–(3–Cyanophenyl)–2–phenylethane)		8.9±0.1	EI		3288
		$C_{15}H_{15}N^+$				
$C_{15}H_{15}N^+$	$C_{12}H_8NC_3H_7$ (*N*–Isopropylcarbazole) (Average of two values)		7.80	CTS		3299
$C_{15}H_{15}N^+$	$C_{12}H_8NC_3H_7$ (*N*–Isopropylcarbazole) (Average of three values)		7.4	CTS		3355
		$C_{15}H_{17}N^+$				
$C_{15}H_{17}N^+$	$(C_6H_5CH_2)_2NCH_3$ (Dibenzyl methyl amine)		7.85	PE		3235
		$C_{15}H_{25}N^+$				
$C_{15}H_{25}N^+$	$C_6H_5NHC_9H_{19}$ (*N*–Nonylaniline)		7.5	CTS		2978
		$C_{16}H_{11}N^+$				
$C_{16}H_{11}N^+$	$C_{16}H_{11}N$ (1,2–Benzocarbazole)		7.1±0.1	EI		3011
$C_{16}H_{11}N^+$	$C_{16}H_{11}N$ (2,3–Benzocarbazole)		7.05±0.1	EI		3011
$C_{16}H_{11}N^+$	$C_{16}H_{11}N$ (3,4–Benzocarbazole)		7.3±0.1	EI		3011
$C_{16}H_{11}N^+$	$C_{16}H_9NH_2$ (1–Aminopyrene)		6.82±0.1	CTS		2485
$C_{16}H_{11}N^+$	$C_{16}H_9NH_2$ (2–Aminopyrene)		7.43±0.1	CTS		2485

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_{16}H_{13}N^+$				
$C_{16}H_{13}N^+$	$C_{10}H_7NHC_6H_5$ (1–Naphthyl phenyl amine)		7.12	CTS		2909
$C_{16}H_{13}N^+$	$C_{10}H_7NHC_6H_5$ (2–Naphthyl phenyl amine)		7.15	CTS		2909
		$C_{16}H_{27}N^+$				
$C_{16}H_{27}N^+$	$C_6H_5NHC_{10}H_{21}$ (*N*–Decylaniline)		7.5	CTS		2978
$C_{16}H_{27}N^+$	$C_6H_5N(C_5H_{11})_2$ (*N*,*N*–Dipentylaniline)		7.1	CTS		2978
		$C_{17}H_{11}N^+$				
$C_{17}H_{11}N^+$	$C_{17}H_{11}N$ (1,2–Benzacridine)		8.07±0.1	CTS		2485
$C_{17}H_{11}N^+$	$C_{17}H_{11}N$ (3,4–Benzacridine)		8.07±0.1	CTS		2485
		$C_{17}H_{29}N^+$				
$C_{17}H_{29}N^+$	$C_6H_5NHC_{11}H_{23}$ (*N*–Undecylaniline)		7.5	CTS		2978
		$C_{18}H_{13}N^+$				
$C_{18}H_{13}N^+$	$C_{18}H_{11}NH_2$ (6–Aminochrysene)		6.99±0.1	CTS		2485
$C_{18}H_{13}N^+$	$C_{12}H_8NC_6H_5$ (*N*–Phenylcarbazole)		7.7±0.1	EI		3011
		$C_{18}H_{15}N^+$				
$C_{18}H_{15}N^+$	$(C_6H_5)_3N$ (Triphenylamine)		6.86±0.03	PI		1140
		$C_{18}H_{31}N^+$				
$C_{18}H_{31}N^+$	$C_6H_5NHC_{12}H_{25}$ (*N*–Dodecylaniline)		7.5	CTS		2978
$C_{18}H_{31}N^+$	$C_6H_5N(C_6H_{13})_2$ (*N*,*N*–Dihexylaniline)		7.1	CTS		2978

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_{19}H_{12}N^+$				
$C_{19}H_{12}N^+$	$C_{20}H_{13}NO_2$ (*N*–(2–Biphenylyl)phthalic acid imide)		9.8	EI		2412
		$C_{19}H_{21}N^+$				
$C_{19}H_{21}N^+$	$C_{19}H_{21}N$ (Nortriptylene)		8.39±0.11	CTS		2987
		$C_{20}H_{13}N^+$				
$C_{20}H_{13}N^+$	$C_{20}H_{13}N$ (1,2:5,6–Dibenzocarbazole)		6.9±0.1	EI		3011
$C_{20}H_{13}N^+$	$C_{20}H_{13}N$ (1,2:7,8–Dibenzocarbazole)		7.1±0.1	EI		3011
$C_{20}H_{13}N^+$	$C_{20}H_{13}N$ (3,4:5,6–Dibenzocarbazole)		7.1±0.1	EI		3011
$C_{20}H_{13}N^+$	$C_{20}H_{13}N$ (Naphtho[2,3–*b*]carbazole)		6.95±0.1	EI		3011
$C_{20}H_{13}N^+$	$C_{20}H_{13}N$ (Naphtho[2,3–*c*]carbazole)		7.0±0.1	EI		3011
		$C_{20}H_{23}N^+$				
$C_{20}H_{23}N^+$	$C_{20}H_{23}N$ (Amitriptylene)		8.32±0.08	CTS		2987
		$C_{21}H_{15}N^+$				
$C_{21}H_{15}N^+$	$C_{20}H_{12}NCH_3$ (*N*–Methyl–2,3:6,7–dibenzocarbazole)		6.95±0.1	EI		3011
$C_{21}H_{15}N^+$	$C_{20}H_{12}NCH_3$ (*N*–Methylnaphtho[2,3–*b*]carbazole)		7.2±0.1	EI		3011
		$C_{21}H_{21}N^+$				
$C_{21}H_{21}N^+$	$C_{21}H_{21}N$ (Cyproheptadine)		7.94±0.06	CTS		2987
		$C_{22}H_{39}N^+$				
$C_{22}H_{39}N^+$	$C_6H_5N(C_8H_{17})_2$ (*N*,*N*–Dioctylaniline)		7.1	CTS		2978

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_{24}H_{15}N^+$						
$C_{24}H_{15}N^+$	$C_{24}H_{15}N$ (Benzo[*b*]naphtho[2,3-*h*]carbazole)		7.1±0.1	EI		3011
$C_{24}H_{15}N^+$	$C_{24}H_{15}N$ (Anthra[2,3-*b*]carbazole)		6.5±0.1	EI		3011
$C_{24}H_{15}N^+$	$C_{24}H_{15}N$ (Anthra[2,3-*c*]carbazole)		7.3±0.1	EI		3011
$C_{26}H_{47}N^+$						
$C_{26}H_{47}N^+$	$C_6H_5N(C_{10}H_{21})_2$ (*N*,*N*-Didecylaniline)		7.1	CTS		2978
CHN_2^+						
CHN_2^+	CH_2N_2 (Diazomethane)	H	14.8±0.1	EI		314
CHN_2^+	CH_2N_2 (Diazirine)	H	14.2±0.1	EI		314
$CH_2N_2^+$ (Diazomethane)	**$\Delta H^\circ_{f298} = 1061$ kJ mol^{-1} (254 kcal mol^{-1})**					
$CH_2N_2^+$	CH_2N_2 (Diazomethane)		8.999±0.001	S	1061	1169
$CH_2N_2^+$	CH_2N_2 (Diazomethane)		9.03±0.05	EI		314
$CH_2N_2^+$	CH_2N_2 (Diazomethane)		9.2±0.3	EI		464
$CH_2N_2^+$	CH_2N_2 (Diazirine)		10.18±0.05	EI		314
$CH_2N_2^+$	CH_3NHNH_2		15.2±0.2	EI		424, 3216
$CH_3N_2^+$						
$CH_3N_2^+$	CH_3NHNH_2	H_2+H	9.2±0.2	PI		1141
$CH_3N_2^+$	CH_3NHNH_2	H_2+H	11.9±0.3	EI		424, 3216
$CH_3N_2^+$	$CH_3N{=}NCH_3$	CH_3	9.0±0.1	EI		304
$CH_3N_2^+$	$CH_3N{=}NCH_3$	CH_3	9.5±0.3	EI		2549
$CH_3N_2^+$	$CH_3NHNHCH_3$		9.7±0.5	EI		424, 3216
$CH_4N_2^+$						
$CH_4N_2^+$	CH_3NNH		9.28±0.1	EI		3178
See also - EI:	67					
$CH_4N_2^+$	CH_3NHNH_2	H_2	9.4±0.1	PI		1141
$CH_4N_2^+$	CH_3NHNH_2	H_2	9.92±0.1	EI		3178

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$CH_4N_2^+$	CH_3NHNH_2	H_2	10.4±0.2	EI		424, 3216
$CH_4N_2^+$	$CH_3NHNHCH_3$	CH_4	9.7±0.3	EI		424, 3216
$CH_4N_2^+$	$n-C_4H_9N(CH_3)NH_2$		9.6±0.1	PI		1141
		$CH_5N_2^+$				
$CH_5N_2^+$	CH_3NHNH		7.3±0.2	EI		3178
$CH_5N_2^+$	CH_3NHNH_2	H	9.2±0.1	PI		1141
$CH_5N_2^+$	CH_3NHNH_2	H	10.18±0.1	EI		3178
$CH_5N_2^+$	CH_3NHNH_2	H	10.2±0.1	EI		424, 3216
$CH_5N_2^+$	$(CH_3)_2NNH_2$	CH_3	8.4±0.1	PI		1141
$CH_5N_2^+$	$(CH_3)_2NNH_2$	CH_3	9.7±0.2	EI		424, 3216
$CH_5N_2^+$	$CH_3NHNHCH_3$	CH_3	9.1±0.2	EI		424, 3216
$CH_5N_2^+$	$n-C_4H_9N(CH_3)NH_2$		9.0±0.1	PI		1141
		$CH_6N_2^+$				
$CH_6N_2^+$	CH_3NHNH_2		7.67±0.02	PI		2173
(Value obtained without mass analysis)						
$CH_6N_2^+$	CH_3NHNH_2		8.00±0.06	PI		1141, 2173
(Value obtained with mass analysis)						
$CH_6N_2^+$	CH_3NHNH_2		8.67	PE		3235
$CH_6N_2^+$	CH_3NHNH_2		8.63±0.1	EI		424, 3216
		$C_2H_5N_2^+$				
$C_2H_5N_2^+$	$(CH_3)_2NNHCH_3$		11.1±0.4	EI		424, 3216
$C_2H_5N_2^+$	$(CH_3)_2NN(CH_3)_2$		12.4±0.2	EI		424, 3216
		$C_2H_6N_2^+$				
$C_2H_6N_2^+$	*trans*-$CH_3N=NCH_3$		8.7±0.1	PE		3087
$C_2H_6N_2^+$	$CH_3N=NCH_3$		8.65±0.1	EI		304
$C_2H_6N_2^+$	$CH_3N=NCH_3$		8.65±0.2	EI		2549
See also – PE: 3073						
$C_2H_6N_2^+$	$(CH_3)_2NNH_2$	H_2	9.5±0.1	PI		1141
$C_2H_6N_2^+$	$(CH_3)_2NN(CH_3)_2$	C_2H_6	10.5±0.1	EI		424, 3216
$C_2H_6N_2^+$	$n-C_4H_9N(CH_3)NH_2$	C_3H_8	9.5±0.2	PI		1141
		$C_2H_7N_2^+$				
$C_2H_7N_2^+$	$(CH_3)_2NNH$		6.4±0.2	EI		3178
$C_2H_7N_2^+$	$(CH_3)_2NNH$		6.6±0.3	EI		67
$C_2H_7N_2^+$	$(CH_3)_2NNH_2$	H	8.7±0.2	PI		1141
$C_2H_7N_2^+$	$(CH_3)_2NNH_2$	H	10.08±0.1	EI		3178
$C_2H_7N_2^+$	$(CH_3)_2NNH_2$	H	10.0±0.3	EI		67
$C_2H_7N_2^+$	$(CH_3)_2NNH_2$	H	10.2±0.2	EI		424, 3216

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_2H_7N_2^+$	$CH_3NHNHCH_3$	H	9.3±0.2	EI		424, 3216
$C_2H_7N_2^+$	$(CH_3)_2NNHCH_3$	CH_3	9.4±0.1	EI		424, 3216
$C_2H_7N_2^+$	$n\text{-}C_4H_9N(CH_3)NH_2$		9.1±0.1	PI		1141
	$(CH_3)_2NNH_2^+$	**$\Delta H^\circ_{f298} \sim 883$ kJ mol^{-1} (211 kcal mol^{-1})**				
	$CH_3NHNHCH_3^+$	**$\Delta H^\circ_{f298} \sim 888$ kJ mol^{-1} (212 kcal mol^{-1})**				
$C_2H_8N_2^+$	$(CH_3)_2NNH_2$		7.46±0.02	PI		2173
(Value obtained without mass analysis)						
$C_2H_8N_2^+$	$(CH_3)_2NNH_2$		7.67±0.05	PI		1141, 2173
(Value obtained with mass analysis)						
$C_2H_8N_2^+$	$(CH_3)_2NNH_2$		8.28	PE	883	3235
$C_2H_8N_2^+$	$(CH_3)_2NNH_2$		8.12±0.1	EI		424, 3216
$C_2H_8N_2^+$	$CH_3NHNHCH_3$		8.22	PE	888	3235
$C_2H_8N_2^+$	$CH_3NHNHCH_3$		7.75±0.1	EI		424, 3216
	$C_3H_4N_2^+$(Pyrazole)	**$\Delta H^\circ_{f298} \sim 1076$ kJ mol^{-1} (257 kcal mol^{-1})**				
$C_3H_4N_2^+$	$C_3H_4N_2$ (Pyrazole)		9.27±0.05	PE	1076	3246
See also – PE: 2975						
		$C_3H_7N_2^+$				
$C_3H_7N_2^+$	$(CH_3)_2NNHCH_3$	H_2+H	10.7±0.1	EI		424, 3216
$C_3H_7N_2^+$	$(CH_3)_2NN(CH_3)_2$		10.7±0.1	EI		424, 3216
		$C_3H_8N_2^+$				
$C_3H_8N_2^+$	$(CH_3)_2NNHCH_3$	H_2	8.2±0.1	EI		424, 3216
$C_3H_8N_2^+$	$(CH_3)_2NN(CH_3)_2$	CH_4	8.9±0.1	EI		424, 3216
		$C_3H_9N_2^+$				
$C_3H_9N_2^+$	$(CH_3)_2NNHCH_3$	H	8.9±0.1	EI		424, 3216
$C_3H_9N_2^+$	$(C_2H_5)_2NNH_2$	CH_3	8.0±0.1	PI		1141
$C_3H_9N_2^+$	$(CH_3)_2NN(CH_3)_2$	CH_3	9.1±0.1	EI		424, 3216
		$C_3H_{10}N_2^+$				
$C_3H_{10}N_2^+$	$(CH_3)_2NNHCH_3$		7.93±0.1	EI		424, 3216
		$C_4H_3N_2^+$				
$C_4H_3N_2^+$	$C_4H_4N_2$ (1,3–Diazine)	H	13.01±0.10	EI		1406

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_4H_3N_2^+$	$C_4H_4N_2$ (1,4–Diazine)	H	13.68±0.10	EI		1406

$C_4H_4N_2^+$(1,2–Diazine) $\Delta H^\circ_{f298} = 1119$ kJ mol^{-1} (267 kcal mol^{-1})
$C_4H_4N_2^+$(1,3–Diazine) $\Delta H^\circ_{f298} = 1099$ kJ mol^{-1} (263 kcal mol^{-1})
$C_4H_4N_2^+$(1,4–Diazine) $\Delta H^\circ_{f298} \sim 1089$ kJ mol^{-1} (260 kcal mol^{-1})

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_4H_4N_2^+$	$C_4H_4N_2$ (1,2–Diazine)		8.71±0.01	PI	1119	2651
$C_4H_4N_2^+$	$C_4H_4N_2$ (1,2–Diazine)		8.90	PE		2844

See also – EI: 1406, 3232

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_4H_4N_2^+$	$C_4H_4N_2$ (1,3–Diazine)		9.35±0.01	PI	1099	2651
$C_4H_4N_2^+$	$C_4H_4N_2$ (1,3–Diazine)		9.42	PE		2844

See also – EI: 1406, 3232

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_4H_4N_2^+$	$C_4H_4N_2$ (1,4–Diazine)		9.29±0.03	S		3332
$C_4H_4N_2^+$	$C_4H_4N_2$ (1,4–Diazine)		9.29±0.01	PI	1092	2651
$C_4H_4N_2^+$	$C_4H_4N_2$ (1,4–Diazine)		9.28±0.05	PE		2796
$C_4H_4N_2^+$	$C_4H_4N_2$ (1,4–Diazine)		9.216	PE	1085	3080
$C_4H_4N_2^+$	$C_4H_4N_2$ (1,4–Diazine)		9.36	PE		2844

The discrepancy between the PI result, ref. 2651, and the PE result, ref. 3080, is not understood.

See also – EI: 1406, 3232

$C_4H_{10}N_2^+$

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_4H_{10}N_2^+$	$(C_2H_5)_2NNH_2$	H_2	8.3±0.2	PI		1141

$C_4H_{11}N_2^+$

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_4H_{11}N_2^+$	$(C_2H_5)_2NNH_2$	H	8.9±0.1	PI		1141
$C_4H_{11}N_2^+$	n-$C_4H_9N(CH_3)NH_2$	CH_3	8.0±0.1	PI		1141

$C_4H_{12}N_2^+$

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_4H_{12}N_2^+$	$(C_2H_5)_2NNH_2$		7.59±0.05	PI		1141
$C_4H_{12}N_2^+$	$(CH_3)_2NN(CH_3)_2$		7.93	PE		3235
$C_4H_{12}N_2^+$	$(CH_3)_2NN(CH_3)_2$		7.76±0.05	EI		424, 3216

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_5H_6N_2^+$						
$C_5H_6N_2^+$	$C_5H_4NNH_2$ (4–Aminopyridine)		8.97±0.05	EI		217
$C_5H_{12}N_2^+$						
$C_5H_{12}N_2^+$	$n-C_4H_9N(CH_3)NH_2$	H_2	8.0±0.2	PI		1141
$C_5H_{13}N_2^+$						
$C_5H_{13}N_2^+$	$n-C_4H_9N(CH_3)NH_2$	H	8.0±0.3	PI		1141
$C_5H_{14}N_2^+$						
$C_5H_{14}N_2^+$ (Value obtained without mass analysis)	$n-C_4H_9N(CH_3)NH_2$		7.51±0.02	PI		2173
$C_5H_{14}N_2^+$ (Value obtained with mass analysis)	$n-C_4H_9N(CH_3)NH_2$		7.62±0.05	PI		1141, 2173
$C_6H_8N_2^+$ (Phenylhydrazine)	**$\Delta H^\circ_{f298} \sim 946$ kJ mol^{-1} (226 kcal mol^{-1})**					
$C_6H_8N_2^+$	$C_6H_4(NH_2)_2$ (1,2–Diaminobenzene)		8.00	EI		1066
$C_6H_8N_2^+$	$C_6H_4(NH_2)_2$ (1,2–Diaminobenzene)		7.35±0.1	CTS		2485
$C_6H_8N_2^+$	$C_6H_4(NH_2)_2$ (1,2–Diaminobenzene)		7.36	CTS		2909
$C_6H_8N_2^+$	$C_6H_4(NH_2)_2$ (1,2–Diaminobenzene)		7.45	CTS		2978
$C_6H_8N_2^+$	$C_6H_4(NH_2)_2$ (1,3–Diaminobenzene)		7.96	EI		1066
$C_6H_8N_2^+$	$C_6H_4(NH_2)_2$ (1,3–Diaminobenzene)		7.48±0.1	CTS		2485
$C_6H_8N_2^+$	$C_6H_4(NH_2)_2$ (1,4–Diaminobenzene)		7.58	EI		1066
$C_6H_8N_2^+$	$C_6H_4(NH_2)_2$ (1,4–Diaminobenzene)		7.04±0.1	CTS		2485
$C_6H_8N_2^+$	$C_6H_4(NH_2)_2$ (1,4–Diaminobenzene)		7.15	CTS		2978
$C_6H_8N_2^+$	$C_6H_5NHNH_2$ (Phenylhydrazine)		7.64±0.02	PI	941	1166
$C_6H_8N_2^+$	$C_6H_5NHNH_2$ (Phenylhydrazine)		7.74	PE	951	3235

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_6H_{12}N_2^+$						
$C_6H_{12}N_2^+$	$C_6H_{12}N_2$ (1,4–Diazabicyclo[2.2.2]octane)		7.52 (V)	PE		2962
$C_7H_6N_2^+$						
$C_7H_6N_2^+$	$C_6H_4(NH_2)CN$ (3–Aminobenzoic acid nitrile)		8.61±0.05	RPD		3223
$C_7H_6N_2^+$	$C_6H_4(NH_2)CN$ (4–Aminobenzoic acid nitrile)		8.64±0.04	RPD		3223
$C_7H_{10}N_2^+$						
$C_7H_{10}N_2^+$	$C_6H_5CH_2NHNH_2$ (Benzylhydrazine)		8.64	PE		3235
$C_7H_{10}N_2^+$	$C_6H_5N(CH_3)NH_2$ (1–Methyl–1–phenylhydrazine)		7.43	PE		3235
$C_8H_6N_2^+$						
$C_8H_6N_2^+$	$C_8H_6N_2$ (Cinnoline)		8.95±0.01	PI		2651
$C_8H_6N_2^+$	$C_8H_6N_2$ (Cinnoline)		8.51	PE		2844
$C_8H_6N_2^+$	$C_8H_6N_2$ (Quinazoline)		9.02	PE		2844
$C_8H_6N_2^+$	$C_8H_6N_2$ (Phthalazine)		9.22±0.01	PI		2651
$C_8H_6N_2^+$	$C_8H_6N_2$ (Phthalazine)		8.68	PE		2844
$C_8H_6N_2^+$	$C_8H_6N_2$ (Quinoxaline)		9.02±0.01	PI		2651
$C_8H_6N_2^+$	$C_8H_6N_2$ (Quinoxaline)		8.99	PE		2844
$C_8H_8N_2^+$						
$C_8H_8N_2^+$	$C_6H_4(NH_2)CH_2CN$ (3–Aminophenylacetic acid nitrile)		8.31±0.05	RPD		3223
$C_8H_8N_2^+$	$C_6H_4(NH_2)CH_2CN$ (4–Aminophenylacetic acid nitrile)		8.26±0.04	RPD		3223
$C_8H_{12}N_2^+$						
$C_8H_{12}N_2^+$	$C_6H_4(NH_2)N(CH_3)_2$ (1–Amino–4–dimethylaminobenzene)		≤6.46±0.02	PI		3372

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_8H_{20}N_2^+$						
$C_8H_{20}N_2^+$	$(n-C_4H_9)_2NNH_2$		7.47±0.05	PI		2173
(Value obtained without mass analysis)						
$C_9H_{10}N_2^+$						
$C_9H_{10}N_2^+$	$C_6H_4(CN)N(CH_3)_2$ (4–Dimethylaminobenzoic acid nitrile)		7.99±0.04	RPD		3223
$C_{10}H_{14}N_2^+$						
$C_{10}H_{14}N_2^+$	$C_6H_5N{=}NC_4H_9$ (Phenyl *tert*–butyl diimine)		7.75±0.02	RPD		3254
$C_{10}H_{16}N_2^+$						
$C_{10}H_{16}N_2^+$	$C_6H_4(N(CH_3)_2)_2$ (1,4–Bis(dimethylamino)benzene)		≤6.20±0.02	PI		3372
See also – CTS:	2037, 2978					
$C_{14}H_8N_2^+$						
$C_{14}H_8N_2^+$	$(C_6H_4CN)_2$ (4,4′–Dicyanobiphenyl)		10.40	EI		3295
$C_{14}H_{16}N_2^+$						
$C_{14}H_{16}N_2^+$	$C_6H_4(NH_2)CH_2CH_2C_6H_4NH_2$ (1,2–Bis(4–aminophenyl)ethane)		7.6±0.1	EI		3288
$C_{18}H_{10}N_2^+$						
$C_{18}H_{10}N_2^+$	$C_{18}H_{10}N_2$ (Acenaphtho[1,2–*b*]quinoxaline)		8.63±0.1	EI		2489
$C_{18}H_{10}N_2^{+2}$						
$C_{18}H_{10}N_2^{+2}$	$C_{18}H_{10}N_2$ (Acenaphtho[1,2–*b*]quinoxaline)		21.0	EI		2489
$C_{18}H_{22}N_2^+$						
$C_{18}H_{22}N_2^+$	$C_{18}H_{22}N_2$ (Pertofran)		7.39±0.06	CTS		2987

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_{19}H_{24}N_2^+$						
$C_{19}H_{24}N_2^+$	$C_{19}H_{24}N_2$ (Tofranil)		7.35±0.05	CTS		2987
$C_{19}H_{24}N_2^+$	$C_{19}H_{24}N_2$ (Tofranil)		8.03	CTS		2562
$C_{22}H_{12}N_2^+$						
$C_{22}H_{12}N_2^+$	$C_{22}H_{12}N_2$ (8,9–Benzacenaphtho[1,2–*b*]quinoxaline)		8.07±0.1	EI		2489
$C_{22}H_{12}N_2^{+2}$						
$C_{22}H_{12}N_2^{+2}$	$C_{22}H_{12}N_2$ (8,9–Benzacenaphtho[1,2–*b*]quinoxaline)		20.5	EI		2489
$C_{24}H_{14}N_2^+$						
$C_{24}H_{14}N_2^+$	$C_{24}H_{14}N_2$ (1,2:3,4:6,7–Tribenzophenazine)		7.79±0.1	EI		2489
$C_{24}H_{14}N_2^{+2}$						
$C_{24}H_{14}N_2^{+2}$	$C_{24}H_{14}N_2$ (1,2:3,4:6,7–Tribenzophenazine)		20.0	EI		2489
CHN_3^{+2}						
CHN_3^{+2}	CH_3N_3		~34	EI		340
$CH_3N_3^+$						
$CH_3N_3^+$	CH_3N_3		9.5±0.1	EI		340
$CH_5N_3^+$						
$CH_5N_3^+$	$NH{=}C(NH_2)_2$		9.10±0.05	EI		2515
$C_2H_6N_3^+$						
$C_2H_6N_3^+$	$(CH_3)_2NN{=}NN(CH_3)_2$		9.65±0.1	EI		303

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_2H_7N_3^+$				
$C_2H_7N_3^+$	$NH{=}C(NH_2)NHCH_3$		8.60±0.05	EI		2515
		$C_3H_3N_3^+$				
$C_3H_3N_3^+$	$C_3H_3N_3$ (1,3,5–Triazine)		10.07±0.05	EI		3232
		$C_3H_9N_3^+$				
$C_3H_9N_3^+$	$NH{=}C(NH_2)N(CH_3)_2$		8.18±0.05	EI		2515
$C_3H_9N_3^+$	$CH_3N{=}C(NH_2)NHCH_3$		8.39±0.05	EI		2515
		$C_4H_{11}N_3^+$				
$C_4H_{11}N_3^+$	$CH_3N{=}C(NH_2)N(CH_3)_2$		8.06±0.05	EI		2515
$C_4H_{11}N_3^+$	$CH_3N{=}C(NHCH_3)_2$		8.15±0.05	EI		2515
		$C_5H_{13}N_3^+$				
$C_5H_{13}N_3^+$	$NH{=}C(N(CH_3)_2)_2$		8.12±0.05	EI		2515
$C_5H_{13}N_3^+$	$CH_3N{=}C(NHCH_3)N(CH_3)_2$		7.97±0.05	EI		2515
		$C_6H_{15}N_3^+$				
$C_6H_{15}N_3^+$	$CH_3N{=}C(N(CH_3)_2)_2$		7.84±0.05	EI		2515
		$C_5H_4N_4^+$				
$C_5H_4N_4^+$	$C_5H_4N_4$ (Purine)		9.68±0.1	EI		2514, 3336
		$C_6H_{12}N_4^+$				
$C_6H_{12}N_4^+$	$C_6H_{12}N_4$ (Hexamethylenetetramine)		8.26	PE		2843
		$C_{10}H_{20}N_4^+$				
$C_{10}H_{20}N_4^+$	$C_{10}H_{20}N_4$ (1,1′,3,3′–Tetramethyl–$\Delta^{2,2'}$–bi(imidazolidine))		≤5.41±0.02	PI		3372

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol⁻¹)	Ref.
		$C_{10}H_{24}N_4^+$				
$C_{10}H_{24}N_4^+$	$((CH_3)_2N)_2C{=}C(N(CH_3)_2)_2$		≤5.36±0.02	PI		3372
		$C_5H_5N_5^+$				
$C_5H_5N_5^+$	$C_5H_3N_4NH_2$ (6–Aminopurine)		8.91±0.1	EI		2514, 3336
		$C_8H_8BN^+$				
$C_8H_8BN^+$	C_8H_8BN (10,9–Borazaronaphthalene)		8.24	PE		2840, 2843
		$C_8H_{16}BN^+$				
$C_8H_{16}BN^+$	$C_8H_{16}BN$ (9–Aza–10–boradecalin)		8.47	PE		2840, 2843
		$C_{10}H_{15}BN_2^{+2}$				
$C_{10}H_{15}BN_2^{+2}$	$C_{10}H_{15}BN_2$ (1,3–Dimethyl–2–phenyl–1,3,2–diazaborolidine)		23.5±1	EI		1418
		$C_3H_{12}BN_3^+$				
$C_3H_{12}BN_3^+$	$(CH_3NH)_3B$		8.04±0.08	EI		2863
		$C_3H_{12}B_3N_3^+$				
$C_3H_{12}B_3N_3^+$	$C_3H_{12}B_3N_3$ (*B*–Trimethylborazine)		9.30	EI		2511
$C_3H_{12}B_3N_3^+$	$C_3H_{12}B_3N_3$ (*N*–Trimethylborazine)		9.07	EI		2511
		$C_6H_{18}BN_3^+$				
$C_6H_{18}BN_3^+$	$((CH_3)_2N)_3B$		7.57±0.05	EI		2513
$C_6H_{18}BN_3^+$	$((CH_3)_2N)_3B$		7.75	EI		3227
$C_6H_{18}BN_3^+$	$((CH_3)_2N)_3B$		7.9±0.1	EI		2863
		$C_6H_{18}BN_3^{+2}$				
$C_6H_{18}BN_3^{+2}$	$((CH_3)_2N)_3B$		21±1	EI		1418

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
			$C_6H_{18}B_3N_3^+$			
$C_6H_{18}B_3N_3^+$	$C_6H_{18}B_3N_3$ (Hexamethylborazine)		8.77	EI		2511
	$O^+(^4S_{3/2})$		**$\Delta H_{f0}^\circ = 1560.7$ kJ mol^{-1} (373.0 kcal mol^{-1})**			
$O^+(^4S_{3/2})$	O		13.618	S	1560.7	2113
$O^+(^4S)$	O		13.62	PE		3076
See also – EI:	79, 2021, 2128, 2130, 2472, 2518					
$O^+(^2D_{5/2})$	O		16.942	S	1881.5	2113
$O^+(^2D)$	O		16.96	PE		3076
$O^+(^2P_{3/2})$	O		18.635	S	2044.8	2113
O^+	O_2	O^-	17.272±0.024	PI	(1561)	2614
O^+	O_2	O^-	17.25±0.01	PI	(1559)	2624, 2627
See also – PI:	163					
EI:	79, 200, 288, 2014					
D:	6					
O^+	O_2	O	18.8±0.4	PI		163
O^+	O_2	O	18.99±0.05	RPD		288
See also – EI:	79, 200, 2014					
O^+	H_2O	H_2	19.0±0.2	EI		2484
O^+	H_2O	2H?	26.5±0.3	EI		2484
O^+	H_2O	2H?	29.15±0.25	EI		3144
O^+	D_2O	2D?	29.25±0.3	EI		3144
O^+	H_2O_2	H_2O	17.0±1.0	EI		37
O^+	CO	C^-	23.20±0.05	RPD		2431
O^+	CO	C^-	23.41±0.17	RPD		2180, 2191
The thermochemical threshold for this process is 23.46 eV.						
See also – EI:	200, 1378					
O^+	CO	C	24.65±0.05	RPD		2431
O^+	CO	C	24.78±0.23	RPD		2180, 2191
The thermochemical threshold for this process is 24.73 eV.						
O^+	CO_2	CO	19.10±0.01	PI	(1564)	2624, 2627
See also – PI:	163					
EI:	2021, 2472					
O^+	C_3O_2		25.8±0.5	EI		2687
O^+	NO	N	20.11±0.03	RPD	(1559)	328
O^+	NO	N	20.46±0.10	RPD		2431
The fragments are formed with 0.5±0.3 eV kinetic energy at threshold according to ref. 2431. See, however, ref. 2823.						
See also – PI:	163					
EI:	2021					

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
O^+	N_2O	N_2	15.31	PI	(1563)	2629
See also – PI:	163					
EI:	58, 1451, 2697					
O^+	NO_2	NO	16.82	PI	(1569)	2629
See also – PI:	163					
EI:	2018, 2021					
O^+	CH_3NO_2		14.50±0.16	EI		90
O^+	CF_2O		35±1	EI		3236
O^+	CF_3OF		36±1	EI		3236
O^+	SO_2	SO	20.6	EI		418
O^+	$(CH_3)_2SO$		15.8±0.5	EI		3294
O^+	ClO_3F		22±1	EI		53
O^+	$POCl_3$		13±2	EI		1101
	O^{+2}	**ΔH°_{f0} = 4949.0 kJ mol^{-1} (1182.8 kcal mol^{-1})**				
O^{+2}	O		48.734	S	4949.0	2113
O^{+2}	$O^+(^4S_{3/2})$		35.116	S		2113
O^{+2}	$O^+(^4S)$		35.7	SEQ		2474
O^{+2}	$O^+(^2D_{5/2})$		31.792	S		2113
O^{+2}	$O^+(^2D)$		32.7	SEQ		2474
O^{+2}	$O^+(^2P_{3/2})$		30.099	S		2113
O^{+2}	$O^+(^2P)$		30.6	SEQ		2474
O^{+2}	O_2	O	52.7±0.5	NRE		2474
O^{+2}	CO	C	61.3±0.3	EI		2431
(1.6±0.7 eV average translational energy of decomposition at threshold)						
O^{+2}	NO	N	61.62±0.15	EI		2431
(5.4±1 eV average translational energy of decomposition at threshold)						
O^{+2}	NO	N	62.2±1.0	NRE		2823
O^{+2}	N_2O	2N?	60.5±1.0	NRE		3138
O^{+2}	NO_2	NO	52.1±1	NRE		3138
	O^{+3}	**ΔH°_{f0} = 10249.4 kJ mol^{-1} (2449.7 kcal mol^{-1})**				
O^{+3}	O		103.668	S	10249.4	2113
O^{+3}	O^{+2}		54.934	S		2113
O^{+3}	O_2	O?	130±3	EI		2474
	O^{+4}	**ΔH°_{f0} = 17718.7 kJ mol^{-1} (4234.9 kcal mol^{-1})**				
O^{+4}	O		181.080	S	17718.7	2113
O^{+4}	O^{+3}		77.412	S		2113, 3166
	O^{+5}	**ΔH°_{f0} = 28708.1 kJ mol^{-1} (6861.4 kcal mol^{-1})**				
O^{+5}	O		294.976	S	28708.1	2113
O^{+5}	O^{+4}		113.896	S		2113, 3166

4.3. The Positive Ion Table—Continued

$O_2^+(X^2\Pi_{3/2g})$ ΔH°_{f0} = 1165 kJ mol^{-1} (278 kcal mol^{-1})
$O_2^+(X^2\Pi_{1/2g})$ ΔH°_{f0} = 1167 kJ mol^{-1} (279 kcal mol^{-1})
$O_2^+(a^4\Pi_u)$ ΔH°_{f0} = 1553.8 kJ mol^{-1} (371.4 kcal mol^{-1})
$O_2^+(A^2\Pi_u)$ ΔH°_{f0} = 1646 kJ mol^{-1} (394 kcal mol^{-1})
$O_2^+(b^4\Sigma_g^-)$ ΔH°_{f0} = 1753.2 kJ mol^{-1} (419.0 kcal mol^{-1})
$O_2^+(B^2\Sigma_g^-)$ ΔH°_{f0} = 1958.3 kJ mol^{-1} (468.0 kcal mol^{-1})
$O_2^+(c^4\Sigma_u^-)$ ΔH°_{f0} = 2370.1 kJ mol^{-1} (566.5 kcal mol^{-1})

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$O_2^+(X^2\Pi_g)$	O_2		12.059±0.001	S		2048, 2758, 3305, 3306
$O_2^+(a^4\Pi_u)$	O_2		16.104	S	1553.8	—
(Based on $b^4\Sigma_g^-$ limit below and first negative bands from ref. 3309)						
$O_2^+(A^2\Pi_u)$	O_2		17.064	S	1646	—
(Based on average of $X^2\Pi_{3/2g}$ and $X^2\Pi_{1/2g}$ limits below and second negative bands from ref. 3306)						
$O_2^+(b^4\Sigma_g^-)$	O_2		18.1702±0.0002	S	1753.2	2678
$O_2^+(B^2\Sigma_g^-)$	O_2		20.2960±0.0009	S	1958.3	2678
O_2^{+*}?	O_2		20.996±0.005	S		2678
$O_2^+(c^4\Sigma_u^-)$	O_2		24.564±0.004	S	2370.1	3307
(Average of two Rydberg series limits)						
$O_2^+(X^2\Pi_g)$	O_2		12.065±0.003	PI		1032
$O_2^+(X^2\Pi_g)$	O_2		12.078±0.005	PI		2013
$O_2^+(X^2\Pi_g)$	O_2		12.072±0.008	PI		2624, 2627
$O_2^+(X^2\Pi_g)$	O_2		12.075±0.01	PI		182, 416
$O_2^+(X^2\Pi_{3/2g})$	O_2		12.071±0.005	PE	1165	3068
$O_2^+(X^2\Pi_{1/2g})$	O_2		12.095±0.005	PE	1167	3068
$O_2^+(X^2\Pi_g)$	O_2		12.070±0.005	PE		2827
$O_2^+(X^2\Pi_g)$	O_2		12.075	PE		2792
$O_2^+(X^2\Pi_g)$	O_2		12.08	PE		2830
$O_2^+(a^4\Pi_u)$	O_2		16.101±0.002	PE		3068
$O_2^+(a^4\Pi_u)$	O_2		16.11	PE		2792
$O_2^+(a^4\Pi_u)$	O_2		16.12	PE		2830
$O_2^+(A^2\Pi_u)$	O_2		17.045±0.004	PE		3068, 3069
$O_2^+(b^4\Sigma_g^-)$	O_2		18.171±0.003	PE		3068
$O_2^+(b^4\Sigma_g^-)$	O_2		18.19	PE		2792
$O_2^+(b^4\Sigma_g^-)$	O_2		18.17	PE		2830
$O_2^+(B^2\Sigma_g^-)$	O_2		20.296±0.004	PE		3068
$O_2^+(B^2\Sigma_g^-)$	O_2		20.33	PE		2792
$O_2^+(B^2\Sigma_g^-)$	O_2		20.29	PE		2827, 2830
$O_2^+(^2\Pi_u)$	O_2		23.5±0.3	PE		3095
$O_2^+(^2\Pi_u)$	O_2		24.0 (V)	PE		3068
$O_2^+(^2\Pi_u)$	O_2		~23.7 (V)	PE		3064
$O_2^+(c^4\Sigma_u^-)$	O_2		24.577±0.012	PE		3068
$O_2^+(c^4\Sigma_u^-)$	O_2		24.6±0.3	PE		3095

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
O_2^{+*}	O_2		27.3±0.3	PE		3095
O_2^{+*}	O_2		27.4 (V)	PE		3068

See general theoretical discussion of PE results in ref. 3064.

See also – S: 2099, 3006, 3303
PI: 163, 230, 297, 3093
PE: 1108, 1130, 2812, 2817
PEN: 2430
EM: 116, 1094
EI: 3, 31, 79, 119, 218, 287, 288, 364, 383, 1029, 2136, 2188, 2444, 2518, 2557, 3131, 3244, 3414

$O_2^+(X^2\Pi_g)$	$O_2(a^1\Delta_g)$		11.090±0.001	PI		2767
$O_2^+(X^2\Pi_g)$	$O_2(a^1\Delta_g)$		11.09±0.005	PE		3107
O_2^+	H_2O_2	H_2	15.8±0.5	EI		37
O_2^+	SO_2	S	17.5±0.3	EI		418
O_2^+	ClO_3F		15±1	EI		54

$O_2^{+2}(X^1\Sigma_g^+)$ $\Delta H^\circ_{f0} \sim 3595$ kJ mol^{-1} (859 kcal mol^{-1})

$O_2^{+2}(X^1\Sigma_g^+)$	O_2		37.4	AUG	~3609	3304
$O_2^{+2}(X^1\Sigma_g^+)$	O_2		36.3±0.5	NRE	~3502	2785
$O_2^{+2}(X^1\Sigma_g^+)$	O_2		37.2±0.5	NRE	~3589	2474
$O_2^{+2}(X^1\Sigma_g^+)$	O_2		37.4±0.2	EI	~3609	2474
$O_2^{+2}(X^1\Sigma_g^+)$	O_2^+		25.9±0.2	SEQ	~3665	2474
$O_2^{+2}(A^3\Sigma_u^+)$	O_2^+		29.9±0.2	SEQ		2474

O_3^+ $\Delta H^\circ_{f0} \sim 1368$ kJ mol^{-1} (327 kcal mol^{-1})

O_3^+	O_3		12.67	PI	1368	3146, 3308
O_3^+	O_3		12.89±0.10	RPD		20
O_3^+	O_3		12.80±0.05	EI		77

See also – PI: 416
PE: 1441
EI: 2516

OH^+ $\Delta H^\circ_{f0} = 1287$ kJ mol^{-1} (308 kcal mol^{-1})

OH^+	OH		13.18±0.1	EI		67, 2786
OH^+	OH		12.94	D		2631
OH^+	H_2O	H	18.05	PI	1287	2631
OH^+	H_2O	H	18.19±0.1	EI		67, 2786

See also – PI: 427
EI: 2066, 2484, 3144

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
OH^+	H_2O_2	OH	15.35±0.10	EI		37
OH^+	H_2O_2	OH	15.60±0.08	EI		2066
OH^+	CH_3COOH		15.1	EI		298

$H_2O^+(^2B_1)$ $\Delta H^\circ_{f0} = 978$ kJ mol^{-1} (234 kcal mol^{-1})
$H_2O^+(^2A_1)$ $\Delta H^\circ_{f0} \sim 1083$ kJ mol^{-1} (259 kcal mol^{-1})
$H_2O^+(^2B_2)$ $\Delta H^\circ_{f0} = 1423$ kJ mol^{-1} (340 kcal mol^{-1})

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$H_2O^+(^2B_1)$	H_2O		12.62±0.02	S	979	3140
$H_2O^+(^2B_1)$	H_2O		12.614±0.005	PI	978	2013
$H_2O^+(^2B_1)$	H_2O		12.597±0.010	PI	977	1253
$H_2O^+(^2B_1)$	H_2O		12.593±0.01	PI	976	2631
$H_2O^+(^2B_1)$	H_2O		12.616±0.01	PE	978	2836
$H_2O^+(^2B_1)$	H_2O		12.65	PEN		2430
$H_2O^+(^2B_1)$	H_2O		12.60±0.01	RPD		463
$H_2O^+(^2A_1)$	H_2O		13.7	PE	~1083	2836
$H_2O^+(^2A_1)$	H_2O		14.3	PEN		2430
$H_2O^+(^2B_2)$	H_2O		17.22	PE	1423	2836
$H_2O^+(^2B_2)$	H_2O		18.0	PEN		2430

See also – PI: 182, 230, 416, 427, 1103
PE: 1130, 2801, 2813, 2855
EI: 97, 1372, 2060, 2066, 2136, 2786, 2991, 3128, 3129, 3144, 3190, 3414

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
H_2O^+	H_2O_2	O	14.09±0.10	EI		37
H_2O^+	C_2H_5OH	C_2H_4	13.06	RPD		2999
H_2O^+	C_5H_9OH (Cyclopentanol)	C_5H_8	13.23	RPD		2999

$D_2O^+(^2B_1)$ $\Delta H^\circ_{f0} = 972$ kJ mol^{-1} (232 kcal mol^{-1})
$D_2O^+(^2A_1)$ $\Delta H^\circ_{f0} \sim 1076$ kJ mol^{-1} (257 kcal mol^{-1})
$D_2O^+(^2B_2)$ $\Delta H^\circ_{f0} = 1419$ kJ mol^{-1} (339 kcal mol^{-1})

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$D_2O^+(^2B_1)$	D_2O		12.637±0.005	PI	973	2013
$D_2O^+(^2B_1)$	D_2O		12.624±0.01	PE	972	2836
$D_2O^+(^2A_1)$	D_2O		13.7	PE	~1076	2836
$D_2O^+(^2B_2)$	D_2O		17.26	PE	1419	2836

See also – PE: 1130

H_2O^{+2}

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
(H_2O^{+2})	H_2O		39.2	AUG		3304

No H_2O^{+2} ions have been directly observed by mass spectrometric techniques.

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		HO_2^+				
HO_2^+	HO_2		11.53±0.02	EI		31, 36
HO_2^+	H_2O_2	H	15.36±0.05	EI		36, 37
See also – EI:	31					
		$H_2O_2^+$				
$H_2O_2^+$	H_2O_2		10.92±0.05	EI		37
$H_2O_2^+$	H_2O_2		11.26±0.05	EI		2066
		LiO^+				
LiO^+	LiO		8.6±1.0	EI		3257
LiO^+	LiO		9.0±0.5	EI		2565
		Li_2O^+				
Li_2O^+	Li_2O		6.3±1.0	EI		3257
Li_2O^+	Li_2O		6.8±0.2	EI		318
Li_2O^+	Li_2O		6.9±0.3	EI		1112
Li_2O^+	Li_2O		7.0±0.5	EI		2565
Li_2O^+	Li_2MoO_4	MoO_3?	10.8±1.0	EI		3257
Li_2O^+	Li_2WO_4	WO_3?	11.1±1.0	EI		3257
		BeO^+				
BeO^+	BeO		10.1±0.4	EI		1106
BeO^+	BeO		10.4	EI		3197
		Be_2O^+				
Be_2O^+	Be_2O		10.5±0.5	EI		1106
		$Be_2O_2^+$				
$Be_2O_2^+$	Be_2O_2		10.5	EI		3197
$Be_2O_2^+$	Be_2O_2		11.1±0.4	EI		1106
		$Be_3O_2^+$				
$Be_3O_2^+$	Be_3O_2		12.5±1.0	EI		1106

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$Be_3O_3^+$				
$Be_3O_3^+$	Be_3O_3		10.7±0.4	EI		1106
$Be_3O_3^+$	Be_3O_3		11.0	EI		3197
		$Be_4O_4^+$				
$Be_4O_4^+$	Be_4O_4		11.0	EI		3197
		$Be_5O_5^+$				
$Be_5O_5^+$	Be_5O_5		~11	EI		3197
		$Be_6O_6^+$				
$Be_6O_6^+$	Be_6O_6		~11	EI		3197
		BO^+				
BO^+	BO		12.8±1	EI		3206
BO^+	BO		13.5±0.5	EI		3199
		BO_2^+				
BO_2^+	$(CH_3O)_3B$		17.5±0.3	EI		115
		$B_2O_2^+$				
$B_2O_2^+$	B_2O_2		14±0.5	EI		3199
		BO_3^+				
BO_3^+	$(CH_3O)_3B$		12.7±1.0	EI		364
BO_3^+	$(CH_3O)_3B$		13.2±0.3	EI		115
		$B_2O_3^+$				
$B_2O_3^+$	B_2O_3		13.7–14	EI		3128
$B_2O_3^+$	B_2O_3		14±0.5	EI		3199

4.3. The Positive Ion Table—Continued

$CO^+(X^2\Sigma^+)$ $\Delta H^\circ_{f0} = 1238$ kJ mol^{-1} (296 kcal mol^{-1})
$CO^+(A^2\Pi_i)$ $\Delta H^\circ_{f0} = 1482$ kJ mol^{-1} (354 kcal mol^{-1})
$CO^+(B^2\Sigma^+)$ $\Delta H^\circ_{f0} = 1785$ kJ mol^{-1} (427 kcal mol^{-1})

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$CO^+(X^2\Sigma^+)$	CO		14.013±0.004	S	1238	2098
$CO^+(A^2\Pi_i)$	CO		16.537	S	1482	2098
$CO^+(B^2\Sigma^+)$	CO		19.675±0.004	S	1785	2098
$CO^+(X^2\Sigma^+)$	CO		13.985	PI		1382
$CO^+(X^2\Sigma^+)$	CO		14.01	PE		3171
$CO^+(X^2\Sigma^+)$	CO		14.00	PE		2830
$CO^+(X^2\Sigma^+)$	CO		14.01	PE		2792
$CO^+(X^2\Sigma^+)$	CO		14.0 (V)	PE		3094
$CO^+(A^2\Pi_i)$	CO		16.54±0.01	PE		3171
$CO^+(A^2\Pi_i)$	CO		16.54	PE		2830
$CO^+(A^2\Pi_i)$	CO		16.55	PE		2792
$CO^+(A^2\Pi_i)$	CO		17.2 (V)	PE		3094
$CO^+(B^2\Sigma^+)$	CO		19.67±0.01	PE		3171
$CO^+(B^2\Sigma^+)$	CO		19.65	PE		2830
$CO^+(B^2\Sigma^+)$	CO		19.69	PE		2792
$CO^+(B^2\Sigma^+)$	CO		19.8 (V)	PE		3094
$CO^+(C^2\Sigma^+)$	CO		38.9 (V)	PE		3094

See also – PI: 163, 182, 416, 2956
PE: 1108, 1130, 2812
PEN: 2430, 2467, 3171
EI: 3, 127, 1012, 1029, 1051, 1172, 2023, 2431, 2453, 2557, 2687, 2883

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
CO^+	CO_2	O^-?	19.5±0.2	PI		163
CO^+	C_3O_2		20.1±0.3	EI		2687
CO^+	HCHO		18.7±0.2	EI		204
CO^+	DCDO		18.8±0.3	EI		204
CO^+	CH_3OH	$2H_2$	14.31±0.05	EI		3176
CO^+	CH_3OH	$2H_2$	13.7	EI		46
CO^+	$CH_2{=}CO$		13.57±0.3	EI		2800
CO^+	CH_3CHO	CH_4	14.0±0.1	RPD		2576
CO^+	CH_3CHO	CH_4	13.9±0.1	SD		1404

See also – EI: 2883

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
CO^+	$(CH_2)_2O$ (1,2–Epoxyethane)	CH_4	12.6±0.4	EI		50
CO^+	CH_3COOH	CH_3OH	15.3±0.1	RPD		2576

CO^{+2} $\Delta H^\circ_{f0} \sim 3751$ kJ mol^{-1} (896 kcal mol^{-1})

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
CO^{+2}	CO		39.9	AUG	~3736	3304
CO^{+2}	CO		40.2	AUG	~3765	3304
CO^{+2}	CO		41.5±0.4	NRE		3139

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
CO^{+2}	CO		41.8±0.3	FD		212
CO^{+2}	$CO^+(A^2\Pi_i)$		25.0±0.4	SEQ		2016
		C_2O^+				
C_2O^+	C_3O_2	CO	15.1±0.1	EI		2687
C_2O^+	$Ni(CO)_4$		31.7±1	EI		2579
		C_3O^+				
C_3O^+	C_3O_2		15.9±0.3	EI		2687
	$CO_2^+(X^2\Pi_{3/2g})$	**ΔH°_{f0} = 935 kJ mol^{-1} (224 kcal mol^{-1})**				
	$CO_2^+(X^2\Pi_{1/2g})$	**ΔH°_{f0} = 938 kJ mol^{-1} (224 kcal mol^{-1})**				
	$CO_2^+(A^2\Pi_{3/2u})$	**ΔH°_{f0} = 1277 kJ mol^{-1} (305 kcal mol^{-1})**				
	$CO_2^+(A^2\Pi_{1/2u})$	**ΔH°_{f0} = 1278 kJ mol^{-1} (306 kcal mol^{-1})**				
	$CO_2^+(B^2\Sigma_u^+)$	**ΔH°_{f0} = 1351 kJ mol^{-1} (323 kcal mol^{-1})**				
	$CO_2^+(C^2\Sigma_g^+)$	**ΔH°_{f0} = 1478 kJ mol^{-1} (353 kcal mol^{-1})**				
$CO_2^+(X^2\Pi_{3/2g})$	CO_2		13.769±0.03	S	935	148
$CO_2^+(X^2\Pi_{1/2g})$	CO_2		13.792±0.03	S	938	148
$CO_2^+(A^2\Pi_{3/2u})$	CO_2		17.312	S	1277	1179
$CO_2^+(A^2\Pi_{1/2u})$	CO_2		17.323	S	1278	1179
$CO_2^+(B^2\Sigma_u^+)$	CO_2		18.076	S	1351	1179
(Average of two Rydberg series limits)						
See also – S: 148						
$CO_2^+(C^2\Sigma_g^+)$	CO_2		19.389	S	1478	148
(Average of three Rydberg series limits)						
$CO_2^+(X^2\Pi_g)$	CO_2		13.788±0.005	PE		2901
$CO_2^+(X^2\Pi_g)$	CO_2		13.78±0.01	PE		2848
$CO_2^+(X^2\Pi_g)$	CO_2		13.77	PE		2855
$CO_2^+(A^2\Pi_u)$	CO_2		17.323±0.005	PE		2901
$CO_2^+(A^2\Pi_u)$	CO_2		17.32±0.02	PE		2848
$CO_2^+(A^2\Pi_u)$	CO_2		17.32	PE		2855
$CO_2^+(B^2\Sigma_u^+)$	CO_2		18.082±0.005	PE		2901
$CO_2^+(B^2\Sigma_u^+)$	CO_2		18.05±0.02	PE		2848
$CO_2^+(B^2\Sigma_u^+)$	CO_2		18.05	PE		2855
$CO_2^+(C^2\Sigma_g^+)$	CO_2		19.400±0.005	PE		2901
$CO_2^+(C^2\Sigma_g^+)$	CO_2		19.36±0.03	PE		2848
$CO_2^+(X^2\Pi_{3/2g})$	CO_2		13.767±0.003	PI		3048
$CO_2^+(X^2\Pi_{1/2g})$	CO_2		13.786±0.003	PI		3048

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$CO_2^+(X^2\Pi_g)$	CO_2		13.75±0.05	EM		2427
See also – S:	409, 410					
PI:	163, 182, 230, 416, 2624, 2627, 3032					
PE:	92, 1130, 2839, 2856, 2875, 3019, 3026					
PEN:	2430, 2467					
EI:	3, 164, 169, 1029, 3131, 3435					
	CO_2^{+2}	$\Delta H^\circ_{f0} \sim 3188$ kJ mol^{-1} (762 kcal mol^{-1})				
CO_2^{+2}	CO_2		37.4	AUG	~3215	3304
CO_2^{+2}	CO_2		37.8	AUG	~3254	3304
CO_2^{+2}	CO_2		38.0±0.2	NRE	~3273	2476
CO_2^{+2}	CO_2		36.4±0.3	FD	~3119	212
CO_2^{+2}	CO_2		36.3±0.5	EI	~3109	2472
CO_2^{+2}	CO_2^+		23.0±0.6	SEQ	~3156	2472
		$C_2O_2^+$				
$C_2O_2^+$	C_3O_2		15.8	EI		2687
$C_2O_2^+$	$Ni(CO)_4$		21.6±0.5	EI		2579
	$C_3O_2^+$	$\Delta H^\circ_{f0} = 926$ kJ mol^{-1} (221 kcal mol^{-1})				
$C_3O_2^+$	C_3O_2		10.60	S	926	2668, 2717
$C_3O_2^+$	C_3O_2		10.60±0.03	PI	926	2717
$C_3O_2^+$	C_3O_2		10.60	PE	926	2807
See also – EI:	2687					
		$C_3O_2^{+2}$				
$C_3O_2^{+2}$	C_3O_2		33.0±0.2	EI		2687
	$NO^+(X^1\Sigma^+)$	$\Delta H^\circ_{f0} = 983.6$ kJ mol^{-1} (235.1 kcal mol^{-1})				
	$NO^+(a^3\Sigma^+)$	$\Delta H^\circ_{f0} = 1600$ kJ mol^{-1} (382 kcal mol^{-1})				
	$NO^+(b^3\Pi)$	$\Delta H^\circ_{f0} = 1687.4$ kJ mol^{-1} (403.3 kcal mol^{-1})				
	$NO^+(w^3\Delta)$	$\Delta H^\circ_{f0} = 1717$ kJ mol^{-1} (410 kcal mol^{-1})				
	$NO^+(b'\,^3\Sigma^-)$	$\Delta H^\circ_{f0} = 1786$ kJ mol^{-1} (427 kcal mol^{-1})				
	$NO^+(A'\,^1\Sigma^-)$	$\Delta H^\circ_{f0} = 1809$ kJ mol^{-1} (432 kcal mol^{-1})				
	$NO^+(W^1\Delta)$	$\Delta H^\circ_{f0} \sim 1833$ kJ mol^{-1} (438 kcal mol^{-1})				
	$NO^+(A^1\Pi)$	$\Delta H^\circ_{f0} = 1858$ kJ mol^{-1} (444 kcal mol^{-1})				
$NO^+(X^1\Sigma^+)$	NO		9.2639±0.0006	S	983.6	2764
$NO^+(X^1\Sigma^+)$	NO		9.267±0.005	S		1217
$NO^+(X^1\Sigma^+)$	NO		9.266±0.008	S		1148
$NO^+(X^1\Sigma^+)$	NO		9.267	RPI		2773

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$NO^+(X^1\Sigma^+)$	NO		9.250±0.005	PI		1032, 1253
$NO^+(X^1\Sigma^+)$	NO		9.25±0.02	PI		158, 182, 416
$NO^+(X^1\Sigma^+)$	NO		9.27	PE		3418
$NO^+(X^1\Sigma^+)$	NO		9.28±0.03	RPD		2431
$NO^+(X^1\Sigma^+)$	NO		9.25±0.15	EDD		3172
$NO^+(X^1\Sigma^+)$	NO		9.25±0.02	EI		2991
$NO^+(a^3\Sigma^+)$	NO		15.649	PE	1600	3123
$NO^+(a^3\Sigma^+)$	NO		15.67	PE		3418
$NO^+(b^3\Pi)$	NO		16.558±0.001	S	1687.4	1217
$NO^+(b^3\Pi)$	NO		16.558	PE	1687.4	3123
$NO^+(b^3\Pi)$	NO		16.585	PE		3418
$NO^+(w^3\Delta)$	NO		16.860	PE	1717	3123
$NO^+(w^3\Delta)$	NO		16.89	PE		3418
$NO^+(b'^3\Sigma^-)$	NO		17.585	PE	1786	3123
$NO^+(b'^3\Sigma^-)$	NO		~17.64	PE		3418
$NO^+(A'^1\Sigma^-)$	NO		17.820	PE	1809	3123
$NO^+(A'^1\Sigma^-)$	NO		~17.86	PE		3418
$NO^+(W^1\Delta)$	NO		~18.07	PE	~1833	3123
$NO^+(W^1\Delta)$	NO		~18.09	PE		3418
$NO^+(A^1\Pi)$	NO		18.328±0.005	S	1858	1217
$NO^+(A^1\Pi)$	NO		18.322	PE	1858	3123
$NO^+(A^1\Pi)$	NO		18.335	PE	1859	3418
$NO^+(c^3\Pi)$	NO		20.41	PE		3123
$NO^+(B^1\Pi)$	NO		21.72	PE		3123
$NO^+(B'^1\Sigma^+)$	NO		<22.5	PE		3123

The term assignments are those of Edqvist *et al.*, ref. 3123. The assignments of the states above 20 eV are questionable, see H. Lefebvre–Brion, Chem. Phys. Letters **9**, 463 (1971). See also K. P. Huber, Can. J. Phys. **46**, 1691 (1968) and discussion in refs. 3123, 3418.

See also – S: 3303, 3319
PI: 86, 157, 163, 227, 228, 297
PE: 1108, 1130, 1415, 2809, 2810, 2812, 2817, 2824, 2825, 2830, 2875, 3109
PEN: 2430, 2467
EI: 58, 328

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
NO$^+$	N$_2$O	N(^{4}S°)	15.01	PI		2624, 2629
NO$^+$	N$_2$O	N(^{4}S°)	13.75±0.10	RPD		2697
NO$^+$	N$_2$O	N(^{4}S°)	14.3±0.3	RPD		2693

The thermochemical threshold for this process is 14.19 eV. Kinetic energy measurements of the fragments are conflicting. Curran and Fox, ref. 2697, report zero kinetic energy for NO$^+$ up to 3 eV above threshold. However, Newton and Sciamanna, ref. 3138, and Coleman, Delderfield and Reuben, ref. 2693, report a metastable transition for $N_2O^+ \rightarrow NO^+ + N$ with an appearance potential of 15.1±0.2 or 15.7±0.5 eV, and a total kinetic energy of 1.05±0.05 eV. The discrepancies are unexplained.

NO$^+$	N$_2$O	N(^{2}D°)?	16.53	PI		2624, 2629
NO$^+$	N$_2$O	N(^{2}P°)?	17.74	PI		2624, 2629

See also – PI: 163
EI: 58, 3135

NO$^+$	NO$_2$	O	12.34	PI	(980)	2624, 2629

Newton and Sciamanna, ref. 3138, have observed metastable transitions corresponding to this process, with total kinetic energies of 0.5 and 1.1 eV. Whether these occur at threshold is problematic.

See also – PI: 163
EI: 139

NO$^+$	HNCO		15.76±0.15	EI		3365
NO$^+$	C$_2$H$_5$NO	C$_2$H$_5$	12.3±0.2	EDD		3180
NO$^+$	(CH$_3$)$_2$NNO		11.1±0.1	EI		303
NO$^+$	CH$_3$ONO	CH$_3$O	11.07±0.06	RPD		1139
NO$^+$	CH$_3$ONO	CH$_3$O	11.15	RPD		3347
(0.07±0.02 eV average translational energy of decomposition at threshold)						
NO$^+$	C$_2$H$_5$ONO	C$_2$H$_5$O	11.28±0.05	RPD		2776
NO$^+$	C$_2$H$_5$ONO	C$_2$H$_5$O	11.69±0.05	RPD		3347
(0.07±0.01 eV average translational energy of decomposition at threshold)						
NO$^+$	n-C$_4$H$_9$ONO		11.48±0.05	RPD		2776
NO$^+$	C$_6$H$_4$(NO$_2$)OH (3-Nitrophenol)		10.5±0.2	EI		2833
NO$^+$	FNO	F	11.6±0.2	EDD		3172
NO$^+$	ONF$_3$	3F?	15.21±0.02	PI		3038

NO^{+2} $\Delta H^\circ_{f0} \sim 3486$ kJ mol^{-1} (833 kcal mol^{-1})

NO^{+2}	NO		34.7	AUG	~3438	3304
NO^{+2}	NO		35.7	AUG	~3534	3304
NO^{+2}	NO		38.3±0.5	NRE		2823
NO^{+2}	NO		39.8±0.3	FD		212

4.3. The Positive Ion Table—Continued

$N_2O^+(X^2\Pi_{3/2})$ **ΔH°_{f0} = 1330 kJ mol^{-1} (318 kcal mol^{-1})**
$N_2O^+(X^2\Pi_{1/2})$ **ΔH°_{f0} = 1333 kJ mol^{-1} (319 kcal mol^{-1})**
$N_2O^+(A^2\Sigma^+)$ **ΔH°_{f0} = 1667 kJ mol^{-1} (398 kcal mol^{-1})**
$N_2O^+(B^2\Pi)$ **ΔH°_{f0} ~ 1793 kJ mol^{-1} (429 kcal mol^{-1})**
$N_2O^+(C^2\Sigma^+)$ **ΔH°_{f0} = 2025 kJ mol^{-1} (484 kcal mol^{-1})**

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$N_2O^+(X^2\Pi_{3/2})$	N_2O		12.894	S	1330	149
$N_2O^+(X^2\Pi_{1/2})$	N_2O		12.931	S	1333	149
$N_2O^+(A^2\Sigma^+)$	N_2O		16.392	S	1667	149
$N_2O^+(C^2\Sigma^+)$	N_2O		20.105	S	2025	149
(Average of two Rydberg series limits)						
$N_2O^+(X^2\Pi)$	N_2O		12.893±0.005	PE		2901
$N_2O^+(X^2\Pi)$	N_2O		12.891±0.008	PE		2875, 2902
$N_2O^+(A^2\Sigma^+)$	N_2O		16.389±0.005	PE		2901
$N_2O^+(A^2\Sigma^+)$	N_2O		16.410	PE		2875, 2902
$N_2O^+(B^2\Pi)$	N_2O		17.650±0.005	PE	1788	2901
$N_2O^+(B^2\Pi)$	N_2O		17.753	PE	1798	2875, 2902
$N_2O^+(C^2\Sigma^+)$	N_2O		20.113±0.005	PE		2901
$N_2O^+(C^2\Sigma^+)$	N_2O		20.147	PE		2875, 2902
$N_2O^+(X^2\Pi_{3/2})$	N_2O		12.888±0.007	PI		2624, 2629
$N_2O^+(X^2\Pi_{3/2})$	N_2O		12.882±0.008	PI		1253
$N_2O^+(X^2\Pi_{3/2})$	N_2O		12.89	PI		3033
$N_2O^+(X^2\Pi)$	N_2O		12.8±0.05	EM		2427

Other ionization potentials reported in refs. 2875, 2902 appear doubtful.

See also – S: 409, 410
PI: 157, 163, 182, 416
PE: 92, 1130, 2855, 2856, 3148
PEN: 2430
EI: 58, 1451, 2018, 2693, 2697, 3135

N_2O^{+2}

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
N_2O^{+2}	N_2O		36.4±0.5	NRE		3138

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
	$NO_2^+(X^1A_1)$	**$\Delta H_{f0}^\circ \leq$ 977 kJ mol^{-1} (233 kcal mol^{-1})**				
	$NO_2^+(^3B_2)$	**$\Delta H_{f0}^\circ =$ 1276 kJ mol^{-1} (305 kcal mol^{-1})**				
	$NO_2^+(^3A_2)$	**$\Delta H_{f0}^\circ =$ 1348 kJ mol^{-1} (322 kcal mol^{-1})**				
	$NO_2^+(^1A_2)$	**$\Delta H_{f0}^\circ =$ 1394 kJ mol^{-1} (333 kcal mol^{-1})**				
	$NO_2^+(^1B_2)$	**$\Delta H_{f0}^\circ \sim$ 1426 kJ mol^{-1} (341 kcal mol^{-1})**				
	$NO_2^+(^3B_2)$	**$\Delta H_{f0}^\circ =$ 1856 kJ mol^{-1} (444 kcal mol^{-1})**				
	$NO_2^+(^3A_1)$	**$\Delta H_{f0}^\circ =$ 2087 kJ mol^{-1} (499 kcal mol^{-1})**				
$NO_2^+(X^1A_1)$	NO_2		9.75±0.01	PI	977	2624, 2629

Ionization involves a bent–linear transition with a broad Franck–Condon envelope and weak onset. Thus the ionization potential may not be adiabatic. No reliable value is obtained from photoelectron spectroscopy, see refs. 2745, 2821, 3090, 3122, 3215, 3312.

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$NO_2^+(^3B_2)$	NO_2		12.863	PE	1277	3215
$NO_2^+(^3B_2)$	NO_2		12.85	PE	1276	3090
$NO_2^+(^3A_2)$	NO_2		13.60	PE	1348	3215
$NO_2^+(^3A_2)$	NO_2		13.60	PE	1348	3090
$NO_2^+(^1A_2)$	NO_2		14.070	PE	1394	3215
$NO_2^+(^1A_2)$	NO_2		14.07	PE	1394	3090
$NO_2^+(^1B_2)$	NO_2		14.446	PE	1430	3215
$NO_2^+(^1B_2)$	NO_2		14.37	PE	1423	3090
$NO_2^+(^3B_1?)$	NO_2		17.069	PE		3215
$NO_2^+(^3A_1, ^3B_1?)$	NO_2		16.99	PE		3090
$NO_2^+(^1B_1?)$	NO_2		17.13	PE		3215
$NO_2^+(^3A_1, ^3B_1?)$	NO_2		17.06	PE		3090
$NO_2^+(^3A_1?)$	NO_2		~17.5	PE		3215
$NO_2^+(^3B_2)$	NO_2		18.86±0.05	S	1856	1097
$NO_2^+(^3B_2)$	NO_2		18.864	PE	1856	3215
$NO_2^+(^3B_2)$	NO_2		18.86	PE	1856	3090
$NO_2^+(^1A_1?)$	NO_2		~20.7	PE		3215
$NO_2^+(^1B_2?)$	NO_2		~20.8	PE		3090
$NO_2^+(^3A_1)$	NO_2		21.26	PE	2087	3215
$NO_2^+(^3A_1)$	NO_2		21.26	PE	2087	3090
NO_2^{+*}	NO_2		~23.2	PE		3215

See also – S: 117, 3142
PI: 61, 117, 163, 182, 416
PE: 1130, 2821, 3122, 3312
EI: 58, 139, 218, 2018
D: 2745

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
NO_2^+	CH_3NO_2	CH_3	12.60±0.10	RPD		1241
NO_2^+	$(CH_3)_2NNO_2$		14.6±0.1	EI		303
NO_2^+	CH_3ONO_2	CH_3O	12.3	EI		2456
NO_2^+	$C_2H_5ONO_2$	C_2H_5O	11.40±0.12	EI		1004, 1013
NO_2^+	$C_2H_5ONO_2$	C_2H_5O	12.3	EI		2456
NO_2^+	*iso*-$C_3H_7ONO_2$	C_3H_7O	11.8	EI		2456
NO_2^+	*iso*-$C_4H_9ONO_2$	C_4H_9O	12.7	EI		2456
		BHO_2^+				
BHO_2^+	BHO_2		12.6±0.2	EI		3209
		$B_2HO_2^+$				
$B_2HO_2^+$	$B_3H_3O_3$ (Boroxine)		>20	EI		2175
		$B_3H_2O_3^+$				
$B_3H_2O_3^+$	$B_3H_3O_3$ (Boroxine)	H	14.5±0.5	EI		2175
		$B_3H_3O_3^+$				
$B_3H_3O_3^+$	$B_3H_3O_3$ (Boroxine)		13.5±0.5	EI		2175
	CHO^+	**$\Delta H^\circ_{f298} \sim 815$ kJ mol^{-1} (195 kcal mol^{-1})**				
CHO^+	CHO		9.83±0.18	EI		128
CHO^+	CHO		10.03±0.17	EI		128
See also – EI:	127					
CHO^+	HCHO	H	11.95±0.06	PI	~818	2724
See also – EI:	127, 204, 2550, 2883, 3224					
CHO^+	CH_3OH	H_2+H	14.0±0.2	RPD		2905
See also – EI:	46, 3176					
CHO^+	CH_2=CO	CH	16.07±0.4	EI		2800
CHO^+	CH_3CHO	CH_3	11.79±0.03	PI	~814	2724

Haney and Franklin, ref. 3347, have determined that this process has about 0.15 eV average translational energy of decomposition at threshold. The heat of formation given is corrected for this energy.
Matthews and Warneck, ref. 2724, did not correct for this but suggested that $\Delta H^\circ_{f298}(CH_3CHO)$ might be in error.

See also – EI: 130, 298, 2550, 2576, 2883, 3347

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
CHO^+	$(CH_2)_2O$ (1,2–Epoxyethane)	CH_3	12.2±0.1	EI		50
CHO^+	CH_2=CHCHO	C_2H_3	13.30±0.10	RPD		3347
(0.13 eV average translational energy of decomposition at threshold)						
See also – EI: 130						
CHO^+	C_3H_6O (1,2–Epoxypropane)		11.8±0.2	EI		50
CHO^+	$(CH_2)_3O$ (1,3–Epoxypropane)		12.6±0.2	EI		52
CHO^+	C_4H_6O (3,4–Epoxy–1–butene)		12.9±0.6	EI		153
CHO^+	C_6H_5CHO (Benzenecarbonal)		13.67±0.13	EI		130
See also – EI: 127						
CHO^+	HCOOH	OH	12.79±0.03	PI	~812	2724
Haney and Franklin, ref. 3347, have determined that this process has about 0.05 eV average translational energy of decomposition at threshold. The heat of formation given is corrected for this energy.						
See also – EI: 127, 3347						
CHO^+	CHOCHO	CHO?	12.72±0.12	EI		128
CHO^+	$HCOOCH_3$	CH_3O	13.47±0.05	RPD		3347
(0.17 eV average translational energy of decomposition at threshold)						
See also – EI: 305, 3224						
CHO^+	CH_3COCHO	CH_3CO	12.48±0.05	EI		128
CHO^+	$HCOOC_2H_5$		11.39±0.01	EI		305
CHO^+	CH_3COOCH_3		13.95±0.08	EI		305
See also – EI: 3224						
CHO^+	$HCOOCH_2CH_2CH_3$		11.56±0.06	EI		305
CHO^+	$C_4H_8O_2$ (1,2–Epoxy–3–methoxypropane)		14.4±0.2	EI		153

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
CHO^+	$HCOO(CH_2)_3CH_3$		11.47±0.11	EI		305
CHO^+	$C_3H_6O_3$ (1,3,5–Trioxane)		13.59±0.05	RPD		3324
CHO^+	$(CH_3O)_3B$		19.1±0.3	EI		115
CHO^+	HNCO	N	15.76±0.15	EI		3365
(0.5 eV average translational energy of decomposition at threshold)						

See also – EI: 2797, 3012

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
CHO^+	$HCON(CH_3)_2$		14.3±0.1	EI		303
CHO^+	$(CH_3O)_2CH_3PO$		18.9±0.8	EI		3211
CHO^+	$(CH_3O)_3PO$		17.3±0.4	EI		3211
CHO^+	$(CH_3)_2SO$		15±0.1	EI		3294
CHO^+	C_3H_5OCl (1–Chloro–2,3–epoxypropane)		12.0±0.5	EI		153
CHO^+	C_3H_5OBr (1–Bromo–2,3–epoxypropane)		11.8±0.2	EI		153

CDO^+

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
CDO^+	DCDO	D	13.10±0.12	EI		127, 204
CDO^+	CD_3OH		14.2±0.3	RPD		2905
CDO^+	DCOOH	OH	13.19±0.03	EI		2550

$HCHO^+(^2B_2)$ ΔH°_{f0} = 936 kJ mol^{-1} (224 kcal mol^{-1})
$HCHO^+(^2B_1)$ ΔH°_{f0} = 1247 kJ mol^{-1} (298 kcal mol^{-1})

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$CH_2O^+(^2B_2)$	HCHO		10.88±0.01	S	936	3141
(Average of two Rydberg series limits)						
$CH_2O^+(^2B_2)$	HCHO		10.87±0.01	PI	935	182, 416
$CH_2O^+(^2B_2)$	HCHO		10.87±0.01	PI	935	3425
$CH_2O^+(^2B_2)$	HCHO		10.88±0.02	PI	936	2724
$CH_2O^+(^2B_2)$	HCHO		10.884	PE	937	2803
$CH_2O^+(^2B_2)$	HCHO		10.86±0.02	RPD		2883
$CH_2O^+(^2B_1)$	HCHO		14.095	PE	1247	2803
$CH_2O^+(^2B_2?)$	HCHO		15.854	PE		2803
$CH_2O^+(^2A_1?)$	HCHO		16.254	PE		2803

The assignment of the third and fourth ionization potentials is uncertain, see refs. 2803, 3425.

See also – PI: 1166, 2729
PE: 2835, 3101
EI: 127, 204, 286, 2649, 3224

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
CH_2O^+	CH_3OH	H_2	12.45	PI		2647
(Threshold value approximately corrected to 0 K)						
The thermochemical threshold for this process is 11.67 eV.						
See also – EI: 46						
CH_2O^+	C_2H_5OH	CH_4	11.70	PI		2647
(Threshold value approximately corrected to 0 K)						
The thermochemical threshold for this process is 11.26 eV.						
See also – EI: 46						
CH_2O^+	C_3H_6O (1,2–Epoxypropane)	C_2H_4	11.6±0.3	EI		50
CH_2O^+	$HCOOCH_3$		13.6	EI		3224
CH_2O^+	$C_4H_8O_2$ (1,2–Epoxy–3–methoxypropane)		10.9±0.2	EI		153
CH_2O^+	$C_4H_8O_2$ (1,3–Dioxane)		11.82	EI		2422
CH_2O^+	$C_2H_5ONO_2$		11.76±0.65	EI		1013
CH_2O^+	$(CH_3)_2SO$		10.9±0.5	EI		3294
CD_2O^+						
$CD_2O^+(^2B_2)$	DCDO		10.904	PE		2803
$CD_2O^+(^2B_1)$	DCDO		14.095	PE		2803
$CD_2O^+(^2B_2?)$	DCDO		15.846	PE		2803
See also – EI: 127, 204						
CH_2OH^+ $\Delta H^\circ_{f0} = 720$ kJ mol^{-1} (172 kcal mol^{-1})						
CH_3O^+	CH_2OH		8.14±0.15	EI		2452
CH_3O^+	CH_3OH	H	11.67±0.03	PI	720	2647
(Threshold value approximately corrected to 0 K)						
CH_3O^+	CH_3OH	H	11.66±0.04	PI	719	2915
CH_3O^+	CH_3OH	H	11.67	RPD		2905
Studies on CH_3OD indicate that at threshold the ion structure is CH_2OD^+, see ref. 2915.						
See also – EI: 46, 97, 1100, 2709, 3017, 3176						
CH_3O^+	C_2H_5OH	CH_3	11.25	PI	(722)	2647
(Threshold value approximately corrected to 0 K)						
Haney and Franklin, ref. 3347, have determined that this process has about 0.04 eV average translational energy of decomposition at threshold. It is not known what fraction of this represents rotational effects. No correction has been made for this in the derived heat of formation.						
See also – EI: 46, 97, 1100, 2709, 3176, 3347						

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
CH_3O^+	$(CH_3)_2O$	CH_3	11.95±0.05	RPD		3347
(0.20 eV average translational energy of decomposition at threshold)						
See also – EI: 1100, 2018, 2709, 3224, 3435						
CH_3O^+	C_3H_6O (1,2–Epoxypropane)		13.4±0.2	EI		50
CH_3O^+	$(CH_2)_3O$ (1,3–Epoxypropane)		13.3±0.2	EI		52
CH_3O^+	n–C_3H_7OH	C_2H_5	~11.11	PI		11
(Threshold value approximately corrected for thermal energy and kinetic shift)						
CH_3O^+	n–C_3H_7OH	C_2H_5	~11.3	PI		2647
(Value estimated from fig. 6 of this reference, that given in table I is evidently in error)						
See also – EI: 46, 97, 1100, 2709						
CH_3O^+	iso–C_3H_7OH		12.5	EI		46
See also – EI: 2709						
CH_3O^+	$C_2H_5OCH_3$	C_2H_5	12.50	RPD		3347
(0.07 eV average translational energy of decomposition at threshold)						
See also – EI: 2709						
CH_3O^+	C_4H_6O (3,4–Epoxy–1–butene)		13.3±0.5	EI		153
CH_3O^+	n–C_4H_9OH		11.46	RPD		97
See also – EI: 1100						
CH_3O^+	sec–C_4H_9OH		12.5	EI		2709
CH_3O^+	$(C_2H_5)_2O$		12.1	EI		2709
See also – EI: 2196						
CH_3O^+	$HCOOCH_3$	CHO?	12.23	RPD		3347
(0.12 eV average translational energy of decomposition at threshold)						
See also – EI: 210, 305, 1100, 3224						
CH_3O^+	$HCOOC_2H_5$		12.02±0.1	EI		210
See also – EI: 1059, 3224						

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
CH_3O^+	CH_3COOCH_3		12.52±0.10	EI		305
See also – EI:	1100, 3176, 3224					
CH_3O^+	$HCOOCH(CH_3)_2$		13.45±0.1	EI		210
CH_3O^+	$C_4H_8O_2$ (1,2–Epoxy–3–methoxypropane)		13.9±0.4	EI		153
CH_3O^+	$C_3H_6O_3$ (1,3,5–Trioxane)		11.49±0.05	RPD		3324
CH_3O^+	$(CH_3O)_3B$		12.7±0.2	EI		115
CH_3O^+	CH_3ONO	NO	10.96	RPD		3347
(0.26 eV average translational energy of decomposition at threshold)						
See also – EI:	1100					
CH_3O^+	$(CH_3O)_2CH_3PO$		13.8±0.2	EI		3211
CH_3O^+	$(CH_3O)_3PO$		17.3±0.4	EI		3211
CH_3O^+	$(CH_3)_2SO$		12.2	EI		2685
See also – EI:	3294					
CH_3O^+	CH_2ClCH_2OH		11.51±0.1	EI		72
CH_3O^+	C_3H_5OCl (1–Chloro–2,3–epoxypropane)		13.4±0.2	EI		153
CH_3O^+	C_3H_5OBr (1–Bromo–2,3–epoxypropane)		12.5±0.2	EI		153

CH_2DO^+

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
CH_2DO^+	CH_3OD	H	11.676±0.04	PI		2915
CH_2DO^+	C_2H_5OD	CH_3	11.2	PI		3325
CH_2DO^+	$DCOOCH(CH_3)_2$		13.53±0.1	EI		210

CHD_2O^+

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
CHD_2O^+	CD_3OH	D	11.60	PI		3047
CHD_2O^+	CD_3OH	D	11.85	RPD		2905
CHD_2O^+	$C_2H_5OCD_3$		13.03±0.1	EI		2971
CHD_2O^+	*iso*–$C_3H_7OCD_3$		12.90±0.1	EI		2971
CHD_2O^+	*sec*–$C_4H_9OCD_3$		12.98±0.1	EI		2971

4.3. The Positive Ion Table—Continued

CH_3OH^+ $\Delta H^\circ_{f0} = 856$ kJ mol^{-1} (205 kcal mol^{-1})

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
CH_4O^+	CH_3OH		10.85±0.02	PI	857	158, 182, 416
CH_4O^+	CH_3OH		10.829±0.015	PI	855	2915, 2965
CH_4O^+	CH_3OH		10.84±0.02	PI	856	2647
CH_4O^+	CH_3OH		10.83	PE	855	1130, 2801
CH_4O^+	CH_3OH		10.83	PE	855	2843
CH_4O^+	CH_3OH		10.85	PE	857	3374
CH_4O^+	CH_3OH		10.85±0.02	PE	857	3289
CH_4O^+	CH_3OH		10.85	PEN		2430
CH_4O^+	CH_3OH		10.85	RPD		2905

See also – PI: 297
PE: 3132
EI: 28, 46, 164, 383, 384, 1072, 2018, 2060, 3176

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
CH_4O^+	$HCOOCH_3$	CO	11.53±0.1	EI		210

See also – EI: 3224

CH_3DO^+

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
CH_3DO^+	CH_3OD		10.84±0.02	PI		2915
CH_3DO^+	CH_3OD		11.13	RPD		2905

CHD_3O^+

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
CHD_3O^+	CD_3OH		10.98	RPD		2905

CD_4O^+

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
CD_4O^+	CD_3OD		10.98	RPD		2905

C_2HO^+

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
C_2HO^+	$CH_2=CO$	H	14.91±0.3	EI		2800
C_2HO^+	$C_4H_8O_2$ (1,2–Epoxy–3–methoxypropane)		13.0±0.3	EI		153

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
	$CH_2=CO^+$	**$\Delta H^\circ_{f0} \sim 871$ kJ mol^{-1} (208 kcal mol^{-1})**				
$C_2H_2O^+$	$CH_2=CO$		9.607±0.02	S	869	3151
$C_2H_2O^+$	$CH_2=CO$		9.64	PE	872	3058
See also – EI:	2800					
$C_2H_2O^+$	CH_3CHO	H_2	10.7±0.1	RPD		2576
$C_2H_2O^+$	$(CH_2)_2O$ (1,2–Epoxyethane)	2H?	14.0±0.3	EI	(~879)	50
$C_2H_2O^+$	$(CH_3)_2CO$	CH_4	10.7±0.1	RPD		2576
See also – EI:	1404					
$C_2H_2O^+$	C_3H_6O (1,2–Epoxypropane)		12.7±0.2	EI		50
$C_2H_2O^+$	C_4H_6O (3,4–Epoxy–1–butene)		9.8±0.4	EI		153
$C_2H_2O^+$	$n\text{-}C_4H_9OH$		11.23	RPD		97
$C_2H_2O^+$	CH_3COOCH_3		11.81±0.15	EI		3176
See also – EI:	3224					
$C_2H_2O^+$	$C_3H_6O_2$ (1,3–Dioxolane)		13.20	EI		2422
$C_2H_2O^+$	$C_4H_8O_2$ (1,2–Epoxy–3–methoxypropane)		12.3±0.3	EI		153
$C_2H_2O^+$	C_3H_5OCl (1–Chloro–2,3–epoxypropane)		12.1±0.1	EI		153
	CH_3CO^+	**$\Delta H^\circ_{f298} \sim 630$ kJ mol^{-1} (151 kcal mol^{-1})**				
$C_2H_3O^+$	CH_3CO		8.05±0.17	EI		128
$C_2H_3O^+$	CH_2CHO?		10.85	EI		2998
$C_2H_3O^+$	CH_3CHO	H	10.89	PI	(667)	2728
$C_2H_3O^+$	CH_3CHO	H	10.75±0.08	RPD	(653)	2576
$C_2H_3O^+$	CH_3CHO	H	10.5±0.2	SD		1404
See also – EI:	128, 130, 298, 2883, 2998					
$C_2H_3O^+$	$(CH_2)_2O$ (1,2–Epoxyethane)	H	12.1±0.2	EI		50
$C_2H_3O^+$	C_2H_5OH	H_2+H	14.5	EI		46

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_2H_3O^+$	$(CH_3)_2CO$	CH_3	10.37	PI	~630	1099
$C_2H_3O^+$	$(CH_3)_2CO$	CH_3	10.42	PI		2728
$C_2H_3O^+$	$(CH_3)_2CO$	CH_3	10.28	EDD		3174
$C_2H_3O^+$	$(CH_3)_2CO$	CH_3	10.2±0.1	SD		1404

Haney and Franklin, ref. 3347, have determined that this process has about 0.11 eV average translational energy of decomposition at threshold. The heat of formation given is corrected for this energy.

See also – PI: 95
EI: 128, 298, 2174, 2548, 2576, 2883, 2977, 3224, 3347

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_2H_3O^+$	$CH_2{=}CHOCH_3$	CH_3	11.44	EI		3435
$C_2H_3O^+$	C_3H_6O (1,2–Epoxypropane)	CH_3	10.9±0.2	EI		50
$C_2H_3O^+$	$CH_3COC{\equiv}CH$		11.85	EI		298
$C_2H_3O^+$	$CH_3COCH{=}CH_2$		12.40	EI		298
$C_2H_3O^+$	C_4H_6O (3,4–Epoxy–1–butene)		10.5±0.2	EI		153
$C_2H_3O^+$	$C_2H_5COCH_3$	C_2H_5	10.3	PI	(648)	95
$C_2H_3O^+$	$C_2H_5COCH_3$	C_2H_5	10.97	RPD		2977

See also – EI: 298, 2883

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_2H_3O^+$	$(CH_2)_4O$ (1,4–Epoxybutane)		12.8±0.2	EI		52
$C_2H_3O^+$	*n*–$C_3H_7COCH_3$		11.54	RPD		2977

See also – EI: 298

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_2H_3O^+$	*iso*–$C_3H_7COCH_3$	*iso*–C_3H_7	10.4	PI	(~667)	95
$C_2H_3O^+$	*n*–$C_4H_9COCH_3$		10.8	PI		95
$C_2H_3O^+$	*n*–$C_4H_9COCH_3$		11.65	RPD		2977
$C_2H_3O^+$	*n*–$C_5H_{11}COCH_3$		11.83	RPD		2977
$C_2H_3O^+$	$C_6H_5COCH_3$ (Acetophenone)		11.40±0.28	EI		2174

See also – EI: 298

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_2H_3O^+$	*n*–$C_6H_{13}COCH_3$		12.04	RPD		2977
$C_2H_3O^+$	*n*–$C_7H_{15}COCH_3$		12.24	RPD		2977
$C_2H_3O^+$	CH_3COOH	OH	11.4±0.15	RPD		2576
$C_2H_3O^+$	CH_3COOH	OH	11.75	RPD		3347

(0.10 eV average translational energy of decomposition at threshold)

See also – EI: 171, 298

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_2H_3O^+$	CH_3COCHO	CHO?	10.65±0.12	EI		128
$C_2H_3O^+$	$HCOOC_2H_5$		12.2	EI		3224
$C_2H_3O^+$	CH_3COOCH_3	CH_3O	11.37±0.05	RPD		3347
(0.07 eV average translational energy of decomposition at threshold)						
See also – EI:	305, 3176, 3224					
$C_2H_3O^+$	$C_3H_6O_2$ (1,3–Dioxolane)		14.14	EI		2422
$C_2H_3O^+$	$CH_3COCOCH_3$	CH_3CO	9.88	PI	(649)	1099
See also – EI:	128, 298					
$C_2H_3O^+$	$CH_3COOC_2H_5$		11.75±0.07	EI		305
See also – EI:	298, 1059, 3176					
$C_2H_3O^+$	$C_4H_8O_2$ (1,2–Epoxy–3–methoxypropane)		13.1±0.2	EI		153
$C_2H_3O^+$	$C_4H_8O_2$ (1,4–Dioxane)		12.92	EI		2422
$C_2H_3O^+$	$CH_3COOCOCH_3$		10.19±0.02	PI		3015
$C_2H_3O^+$	$C_5H_{10}O_3$ (1,3,6–Trioxocane)		13.16	EI		2422
$C_2H_3O^+$	$CH_3CON(CH_3)_2$		11.35±0.1	EI		303
$C_2H_3O^+$	CH_3COCHN_2		10.46±0.05	EI		2174
$C_2H_3O^+$	CH_3COF	F	12.3	EI		298
$C_2H_3O^+$	CH_3COCF_3	CF_3	11.45	EI		298
$C_2H_3O^+$	CH_3COCl	Cl	11.25	RPD		3347
(0.16 eV average translational energy of decomposition at threshold)						
See also – EI:	298					
$C_2H_3O^+$	CH_3COCH_2Cl		10.29±0.04	EI		2174
$C_2H_3O^+$	CH_3COBr	Br	10.60	EI		298
		$C_2D_3O^+$				
$C_2D_3O^+$	n–$C_3H_7CD_2COCD_3$		12.2±0.2	EI		2766
$C_2D_3O^+$	CD_3COOH	OH	12.97	EI		171

4.3. The Positive Ion Table—Continued

CH_3CHO^+ **$\Delta H^\circ_{f0} = 831.6$ kJ mol^{-1} (198.8 kcal mol^{-1})**
$C_2H_4O^+$ (1,2–Epoxyethane) **$\Delta H^\circ_{f0} = 979.4$ kJ mol^{-1} (234.1 kcal mol^{-1})**

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_2H_4O^+$	CH_3CHO		10.2291±0.0007	S	831.6	3020
$C_2H_4O^+$	CH_3CHO		10.21±0.01	PI		182, 416
$C_2H_4O^+$	CH_3CHO		10.20±0.03	PI		1166
$C_2H_4O^+$	CH_3CHO		10.25±0.03	PI		86
$C_2H_4O^+$	CH_3CHO		10.20±0.02	PI		2724
$C_2H_4O^+$	CH_3CHO		10.22±0.01	PI		2728
$C_2H_4O^+$	CH_3CHO		10.22±0.01	PE		3289
$C_2H_4O^+$	CH_3CHO		10.20	PE		2843

See also – EI: 127, 130, 286, 1404, 2026, 2576, 2649, 2883, 2998

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_2H_4O^+(^2B_2)$	$(CH_2)_2O$ (1,2–Epoxyethane)		10.566	S	979.4	101
$C_2H_4O^+(^2B_2)$	$(CH_2)_2O$ (1,2–Epoxyethane)		10.565±0.01	PI		101, 182, 416
$C_2H_4O^+(^2B_2)$	$(CH_2)_2O$ (1,2–Epoxyethane)		10.57	PE		2808
$C_2H_4O^+(^2A_1)$	$(CH_2)_2O$ (1,2–Epoxyethane)		11.7 (V)	PE		2808
$C_2H_4O^+(^2B_1)$	$(CH_2)_2O$ (1,2–Epoxyethane)		13.7 (V)	PE		2808
$C_2H_4O^+(^2A_2)$	$(CH_2)_2O$ (1,2–Epoxyethane)		~14.2 (V)	PE		2808
$C_2H_4O^+(^2A_1)$	$(CH_2)_2O$ (1,2–Epoxyethane)		16.6 (V)	PE		2808
$C_2H_4O^+(^2B_2)$	$(CH_2)_2O$ (1,2–Epoxyethane)		17.4 (V)	PE		2808

See also – PE: 1130
PEN: 2430
EI: 50

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_2H_4O^+$	*iso*–C_3H_7OH	CH_4	10.27±0.03	PI		2647

(Threshold value approximately corrected to 0 K)

The thermochemical threshold for this process is 10.50 eV, assuming the ion to have the acetaldehyde structure. This leads Refaey and Chupka, ref. 2647, to postulate instead formation of the oxonium ion, CH_2CHOH^+.

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_2H_4O^+$	$(CH_2)_4O$ (1,4–Epoxybutane)	C_2H_4	12.27	EI		2694
$C_2H_4O^+$	$C_3H_6O_2$ (1,3–Dioxolane)		11.56	EI		2422
$C_2H_4O^+$	$C_4H_8O_2$ (1,4–Dioxane)		10.90	EI		2422
$C_2H_4O^+$	$C_5H_{10}O_3$ (1,3,6–Trioxocane)		10.03	EI		2422

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
	CH_3CHOH^+ $\Delta H^\circ_{f0} \sim 608$ kJ mol^{-1} (145 kcal mol^{-1})					
$C_2H_5O^+$	C_2H_5O		9.11±0.05	RPD		2776
$C_2H_5O^+$	C_2H_5OH	H	10.78±0.02	PI	607	2647
(Threshold value approximately corrected to 0 K)						
See also – EI:	46, 97, 1100, 2709, 2776, 3176					
$C_2H_5O^+$	$(CH_3)_2O$	H	11.42±0.01	RPD		1139
See also – EI:	1100, 2709, 3017, 3224, 3435					
$C_2H_5O^+$	*n*-C_3H_7OH	CH_3	11.1±0.1	PI		2647
$C_2H_5O^+$	*n*-C_3H_7OH	CH_3	11.1	EI		46
See also – EI:	97					
$C_2H_5O^+$	*iso*-C_3H_7OH	CH_3	10.40	PI	610	2647
(Threshold value approximately corrected to 0 K)						
$C_2H_5O^+$	*iso*-C_3H_7OH	CH_3	10.70	RPD		3347
(0.03 eV average translational energy of decomposition at threshold)						
See also – EI:	46, 97, 2709					
$C_2H_5O^+$	$C_2H_5OCH_3$	CH_3	11.30	RPD		3347
(0.10 eV average translational energy of decomposition at threshold)						
$C_2H_5O^+$	$C_2H_5OCH_3$	CH_3	10.96	EI		2709
See also – EI:	1139					
$C_2H_5O^+$	*sec*-C_4H_9OH	C_2H_5	10.4	EI		2709
$C_2H_5O^+$	$(C_2H_5)_2O$	C_2H_5	11.8	EI		2709
See also – EI:	1100, 2196, 2776					
$C_2H_5O^+$	$(CH_2)_5O$ (1,5–Epoxypentane)		11.56	EI		2694
$C_2H_5O^+$	$HCOOC_2H_5$	CHO?	11.34	RPD		3347
(0.10 eV average translational energy of decomposition at threshold)						
See also – EI:	210, 305, 1100, 3224					
$C_2H_5O^+$	$DCOOC_2H_5$	CDO?	11.55±0.1	EI		210

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_2H_5O^+$	$C_3H_6O_2$ (1,3–Dioxolane)		12.45	EI		2422
$C_2H_5O^+$	$(CH_3O)_2CH_2$	CH_3O	11.1	EI		2709

See also – EI: 1139

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_2H_5O^+$	$HCOOCH(CH_3)_2$		11.53±0.1	EI		210
$C_2H_5O^+$	$CH_3COOC_2H_5$		10.8±0.1	EI		1100

See also – EI: 305, 2709, 3176

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_2H_5O^+$	$C_4H_8O_2$ (1,2–Epoxy–3–methoxypropane)		12.1±0.15	EI		153
$C_2H_5O^+$	C_2H_5ONO	NO	10.43±0.10	RPD		3347

(0.10 eV average translational energy of decomposition at threshold)

See also – EI: 2776

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_2H_5O^+$	$(CH_3O)_2CH_3PO$		16.3±0.1	EI		3211
$C_2H_5O^+$	$(CH_3O)_3PO$		14.0±0.2	EI		3211
$C_2H_5O^+$	$(C_2H_5O)_3PO$		16.8±0.2	EI		3211
$C_2H_5O^+$	$(CH_3)_2SO$		14±0.3	EI		3294
$C_2H_5O^+$	CH_3OCH_2Cl	Cl	10.79	RPD		3347

(0.14 eV average translational energy of decomposition at threshold)

$C_2H_4DO^+$

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_2H_4DO^+$	C_2H_5OD	H	10.8	PI		3325
$C_2H_4DO^+$	CH_3CD_2OH	D	10.8	PI		3047
$C_2H_4DO^+$	$DCOOC_2H_5$		12.33±0.1	EI		210

$C_2H_5OH^+$ ΔH°_{f0} = 793 kJ mol^{-1} (189 kcal mol^{-1})
$(CH_3)_2O^+$ ΔH°_{f0} ~ 795 kJ mol^{-1} (190 kcal mol^{-1})

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_2H_6O^+$	C_2H_5OH		10.48±0.05	PI	794	182
$C_2H_6O^+$	C_2H_5OH		10.47±0.02	PI	793	2647
$C_2H_6O^+$	C_2H_5OH		10.46±0.02	PE	792	3289
$C_2H_6O^+$	C_2H_5OH		10.46	PE	792	2843

See also – PI: 158, 416
PE: 1130, 3374
PEN: 2430, 2873
EI: 28, 46, 97, 383, 384, 2018, 2060, 3176

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_2H_6O^+$	$(CH_3)_2O$		9.96±0.05	S	795	2170
$C_2H_6O^+$	$(CH_3)_2O$		10.00±0.02	PI	799	182, 416
$C_2H_6O^+$	$(CH_3)_2O$		9.94±0.01	PE	793	3289
$C_2H_6O^+$	$(CH_3)_2O$		9.94	PE	793	2843

See also – PEN: 2430
EI: 2018, 3338, 3435

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol⁻¹)	Ref.
		$C_2H_5DO^+$				
$C_2H_5DO^+$	C_2H_5OD		10.49	PI		3325
		C_3HO^+				
C_3HO^+	$CH_3COC{\equiv}CH$	CH_3	11.0	EI		298
		$C_3H_3O^+$				
$C_3H_3O^+$	$CH_3COCH{=}CH_2$	CH_3	10.85	EI		298
		$C_3H_4O^+$				
$C_3H_4O^+$	$CH_2{=}CHCHO$ (Average of three Rydberg series limits)		10.103±0.006	S		3383
$C_3H_4O^+$	$CH_2{=}CHCHO$		10.10±0.01	PI		182, 416
$C_3H_4O^+$	$CH_2{=}CHCHO$		10.14±0.06	EI		130
See also – EI:	384					
$C_3H_4O^+$	$(CH_3)_2CO$	H_2	15.2±0.15	RPD		2576
$C_3H_4O^+$	C_2H_5COOH	H_2O	11.57	EI		3435
$C_3H_4O^+$	CH_3COCHN_2	N_2	9.86±0.03	EI		2174
	$C_2H_5CO^+$	**ΔH°_{f298} = 602 kJ mol^{-1} (144 kcal mol^{-1})**				
$C_3H_5O^+$	$(CH_3)_2CO$	H	13.1±0.2	RPD		2548, 2576
$C_3H_5O^+$	C_3H_6O (1,2–Epoxypropane)	H	11.5±0.3	EI		50
$C_3H_5O^+$	$C_2H_5COCH_3$	CH_3	10.18	PI	602	1099
$C_3H_5O^+$	$C_2H_5COCH_3$	CH_3	10.60	RPD		2977
See also – PI:	95					
EI:	298, 2883					
$C_3H_5O^+$	n–$C_3H_7COCH_3$	C_2H_5	10.58	RPD		2977
$C_3H_5O^+$	$C_6H_{11}OH$ (Cyclohexanol)		11.5	EI		3022
$C_3H_5O^+$	n–$C_5H_{11}COC_2H_5$		12.0±0.3	EI		2740
$C_3H_5O^+$	C_2H_5COOH	OH	12.20	EI		3435
$C_3H_5O^+$	$C_4H_8O_2$ (1,2–Epoxy–3–methoxypropane)	CH_3O	11.2±0.2	EI		153
$C_3H_5O^+$	$C_4H_8O_2$ (1,3–Dioxane)		12.17	EI		2422
$C_3H_5O^+$	$C_2H_5COCOCH_3$	CH_3CO	9.67	PI		1099
$C_3H_5O^+$	C_3H_5OCl (1–Chloro–2,3–epoxypropane)	Cl	11.4±0.3	EI		153
$C_3H_5O^+$	C_3H_5OBr (1–Bromo–2,3–epoxypropane)	Br	10.8±0.1	EI		153

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
	$C_2H_5CHO^+$	**ΔH°_{f298} = 770 kJ mol^{-1} (184 kcal mol^{-1})**				
	$(CH_3)_2CO^+$	**ΔH°_{f298} = 719 kJ mol^{-1} (172 kcal mol^{-1})**				
	$C_3H_6O^+$ (1,2–Epoxypropane)	**ΔH°_{f298} = 893 kJ mol^{-1} (214 kcal mol^{-1})**				
	$C_3H_6O^+$ (1,3–Epoxypropane)	**ΔH°_{f298} = 852 kJ mol^{-1} (204 kcal mol^{-1})**				
$C_3H_6O^+$	CH_2=$CHCH_2OH$		9.67±0.05?	PI		182
$C_3H_6O^+$	CH_2=$CHOCH_3$		8.93±0.02	PI		182
See also – EI:	3435					
$C_3H_6O^+$	C_2H_5CHO		9.98±0.01	PI	771	182
$C_3H_6O^+$	C_2H_5CHO		9.94	PE		2843
$C_3H_6O^+$	C_2H_5CHO		9.97±0.01	PE	770	3289
See also – EI:	130, 2522					
$C_3H_6O^+$	$(CH_3)_2CO$		9.705	S	719	158
$C_3H_6O^+$	$(CH_3)_2CO$		9.690±0.01	PI		158, 182, 416
$C_3H_6O^+$	$(CH_3)_2CO$		9.68±0.02	PI		95
$C_3H_6O^+$	$(CH_3)_2CO$		9.71±0.03	PI		1166
$C_3H_6O^+$	$(CH_3)_2CO$		9.71±0.01	PI		2728
$C_3H_6O^+$	$(CH_3)_2CO$		9.67	PE		1130
$C_3H_6O^+$	$(CH_3)_2CO$		9.68	PE		2843
$C_3H_6O^+$	$(CH_3)_2CO$		9.71±0.01	PE		3289
$C_3H_6O^+$	$(CH_3)_2CO$		9.74±0.03	EDD		3174
$C_3H_6O^+$	$(CH_3)_2CO$		9.7±0.1	SD		1404
See also – S:	3065					
PI:	86					
PEN:	2430					
EI:	384, 1254, 1256, 2026, 2174, 2433, 2548, 2649, 2883, 2977					
CTS:	2562					
$C_3H_6O^+$	C_3H_6O (1,2–Epoxypropane)		10.22±0.02	PI	893	182
See also – EI:	50					
$C_3H_6O^+$	$(CH_2)_3O$ (1,3–Epoxypropane)		9.668±0.005	S	852	2169
See also – EI:	52, 218					

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol⁻¹)	Ref.
$C_3H_6O^+$	n–$C_3H_7COCH_3$	C_2H_4	10.07	PI		95

The thermochemical threshold for the process leading to $(CH_3)_2CO^+$ is 10.67 eV. Murad and Inghram, ref. 95, suggest that the ion is formed in a more stable enol form by rearrangement.

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol⁻¹)	Ref.
$C_3H_6O^+$	n–$C_4H_9COCH_3$	C_3H_6	10.00	PI		95

The thermochemical threshold for the process leading to $(CH_3)_2CO^+$ is 10.56 eV. Murad and Inghram, ref. 95, suggest that the ion is formed in a more stable enol form by rearrangement.

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol⁻¹)	Ref.
$C_3H_6O^+$	*iso*–$C_4H_9COCH_3$	C_3H_6	10.1	PI		95
$C_3H_6O^+$	$C_4H_8O_2$ (1,2–Epoxy–3–methoxypropane)	CH_2O?	10.2±0.2	EI		153
$C_3H_6O^+$	$C_4H_8O_2$ (1,3–Dioxane)	CH_2O?	11.12	EI		2422
$C_3H_6O^+$	$C_4H_8O_2$ (1,4–Dioxane)	CH_2O	11	EI		2422
$C_3H_6O^+$	$(CH_3)_2C(OH)CH_2COCH_3$	$(CH_3)_2CO$?	9.60±0.03	PI		3015

Shigorin, *et al.*, ref. 3015, suggest that the ion has an enol structure.

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol⁻¹)	Ref.
$C_3H_6O^+$	$C_5H_{10}O_3$ (1,3,6–Trioxocane)		11.4	EI		2422

$C_3HD_5O^+$

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol⁻¹)	Ref.
$C_3HD_5O^+$	n–$C_3H_7CD_2COCD_3$	C_3H_6	10.4±0.2	EI		2766

$C_2H_5CHOH^+$ $\Delta H^\circ_{f0} \sim 585$ kJ mol^{-1} (140 kcal mol^{-1})
$(CH_3)_2COH^+$ $\Delta H^\circ_{f0} \sim 525$ kJ mol^{-1} (125 kcal mol^{-1})

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol⁻¹)	Ref.
$C_3H_7O^+$	n–C_3H_7O		9.20±0.05	RPD		2776
$C_3H_7O^+$	*iso*–C_3H_7O		9.20±0.05	RPD		2776
$C_3H_7O^+$	n–C_3H_7OH (Threshold value approximately corrected to 0 K)	H	10.72	PI	585	2647
$C_3H_7O^+$	n–C_3H_7OH	H	10.69	RPD		97

See also – PI: 11
EI: 46, 2776

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol⁻¹)	Ref.
$C_3H_7O^+$	*iso*–C_3H_7OH (Threshold value approximately corrected to 0 K)	H	10.6	PI	(~559)	2647
$C_3H_7O^+$	*iso*–C_3H_7OH	H	11.85	RPD		97

See also – EI: 46

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol⁻¹)	Ref.
$C_3H_7O^+$	$C_2H_5OCH_3$	H	10.3	EI		2709

See also – EI: 2971

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_3H_7O^+$	*sec*-C_4H_9OH	CH_3	10.7	EI		2709
$C_3H_7O^+$	*tert*-C_4H_9OH	CH_3	9.87	PI	525	3325
$C_3H_7O^+$	*tert*-C_4H_9OH	CH_3	10.2	EI		2709
$C_3H_7O^+$	*iso*-$C_3H_7OCH_3$	CH_3	10.34±0.1	EI		2971
$C_3H_7O^+$	$(C_2H_5)_2O$	CH_3	10.3	EI		2709
See also – EI:	2196, 2971					
$C_3H_7O^+$	$(CH_3)_2C(OH)C_2H_5$	C_2H_5	10.0	EI		2709
$C_3H_7O^+$	*sec*-$C_4H_9OCH_3$	C_2H_5	10.10±0.1	EI		2971
$C_3H_7O^+$	*iso*-$C_4H_9OC_2H_5$		10.31±0.1	EI		2971
$C_3H_7O^+$	(*n*-$C_3H_7)_2O$		12.93±0.1	RPD		2776
$C_3H_7O^+$	(*iso*-$C_3H_7)_2O$		11.59±0.05	RPD		2776
$C_3H_7O^+$	$DCOOCH_2CH_2CH_3$	CDO?	11.22	EI		3435
$C_3H_7O^+$	$C_4H_8O_2$ (1,3–Dioxane)	CHO?	12.17	EI		2422
$C_3H_7O^+$	$(CH_3O)_2CHCH_3$	CH_3O	10.63±0.04	RPD		1139
$C_3H_7O^+$	$CH_3COOCH_2CH_2CH_3$	CH_3CO	11.64±0.03	EI		305
$C_3H_7O^+$	$CH_3COOCH(CH_3)_2$	CH_3CO	10.65	EI		2709
See also – EI:	305					
$C_3H_7O^+$	$(CH_3)_2C(OH)CH_2COCH_3$	CH_3COCH_2?	9.71±0.02	PI		3015
	***n*-$C_3H_7OH^+$**	**$\Delta H^\circ_{f0} \sim 753$ kJ mol^{-1} (180 kcal mol^{-1})**				
	***iso*-$C_3H_7OH^+$**	**$\Delta H^\circ_{f0} \sim 731$ kJ mol^{-1} (175 kcal mol^{-1})**				
$C_3H_8O^+$	*n*-C_3H_7OH		10.20	PI	751	182
$C_3H_8O^+$	*n*-C_3H_7OH		10.22±0.04	PI	753	2647
$C_3H_8O^+$	*n*-C_3H_7OH		10.25	PE	756	2843
$C_3H_8O^+$	*n*-C_3H_7OH		10.32±0.02	PE		3289
The higher ionization potentials given in refs. 2843, 3374 are in serious disagreement.						
See also – PI:	11, 86					
PE:	3374					
EI:	46, 97, 384, 2018					
$C_3H_8O^+$	*iso*-C_3H_7OH		10.12±0.03	PI	728	2647
$C_3H_8O^+$	*iso*-C_3H_7OH		10.15±0.05?	PI	731	416
$C_3H_8O^+$	*iso*-C_3H_7OH		10.18	PE	734	2843
$C_3H_8O^+$	*iso*-C_3H_7OH		10.29±0.02	PE		3289
The higher ionization potentials given in refs. 2843, 3374 are in serious disagreement.						
See also – PI:	182					
PE:	3374					
EI:	97, 384					

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_4H_4O^+$ (Furan) ΔH°_{f298} = 823 kJ mol^{-1} (197 kcal mol^{-1})						
$C_4H_4O^+(^2A_2)$	C_4H_4O (Furan)		8.883	S	822	3421
$C_4H_4O^+(^2A_2)$	C_4H_4O (Furan)		8.89±0.01	PI	823	161, 182, 416
$C_4H_4O^+(^2A_2)$	C_4H_4O (Furan)		8.883	PE	822	3421
$C_4H_4O^+(^2A_2)$	C_4H_4O (Furan)		8.89±0.05	PE		3246
$C_4H_4O^+(^2A_2)$	C_4H_4O (Furan)		8.87±0.03	EDD		3174
$C_4H_4O^+(^2B_1)$	C_4H_4O (Furan)		10.308	S		3421
$C_4H_4O^+(^2B_1)$	C_4H_4O (Furan)		10.308	PE		3421
$C_4H_4O^+(^2B_1)$	C_4H_4O (Furan)		10.30±0.05	PE		3246
Additional higher ionization potentials are given in refs. 3246, 3421.						
See also – S: 161, 3351 PE: 2796, 2975, 3109 EI: 381, 383, 411, 2865, 3233						
$CH_3CH=CHCHO^+$ ΔH°_{f298} = 838 kJ mol^{-1} (200 kcal mol^{-1})						
$C_4H_6O^+$	$CH_3CH=CHCHO$		9.73±0.01	PI	838	182, 416
See also – EI: 384						
$C_4H_6O^+$	C_4H_6O (3,4–Epoxy–1–butene)		9.7±0.3	EI		153
$C_4H_6O^+$	C_4H_6O (Cyclobutanone)		9.354	S		3361
$C_4H_6O^+$	$CH_3COOC_2H_5$	H_2O	10.45	EI		3435

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_4H_7O^+$				
$C_4H_7O^+$	$(CH_2)_4O$ (1,4–Epoxybutane)	H	10.44	EI		2694
See also – EI:	52					
$C_4H_7O^+$	$n\text{–}C_3H_7COCH_3$	CH_3	10.03	PI	(567*)	95
See also – EI:	2977					
$C_4H_7O^+$	$iso\text{–}C_3H_7COCH_3$	CH_3	9.94	PI	(554*)	95
$C_4H_7O^+$	$n\text{–}C_4H_9COCH_3$	C_2H_5	10.03	PI	(580*)	95
$C_4H_7O^+$	$n\text{–}C_3H_7COC_2H_5$	C_2H_5	10.6±0.3	EI		2740
$C_4H_7O^+$	$(n\text{–}C_3H_7)_2CO$		10.61	RPD		2977
$C_4H_7O^+$	$n\text{–}C_3H_7COOCH_3$	CH_3O	11.20±0.2	EI		2497
See also – EI:	2496					
$C_4H_7O^+$	$C_5H_{10}O_2$ (1,3–Dioxepane)	CH_3O	10.55	EI		2694
$^*\Delta H^\circ_{f298}$						
		$C_4H_2D_5O^+$				
$C_4H_2D_5O^+$	$n\text{–}C_3H_7CD_2COCD_3$	C_2H_5	10.9±0.2	EI		2766
	$n\text{–}C_3H_7CHO^+$	**$\Delta H^\circ_{f298} \sim 740$ kJ mol^{-1} (177 kcal mol^{-1})**				
	$iso\text{–}C_3H_7CHO^+$	**$\Delta H^\circ_{f298} \sim 719$ kJ mol^{-1} (172 kcal mol^{-1})**				
	$C_2H_5COCH_3^+$	**$\Delta H^\circ_{f298} = 676$ kJ mol^{-1} (162 kcal mol^{-1})**				
	$C_4H_8O^+$ (1,4–Epoxybutane)	**$\Delta H^\circ_{f298} = 725$ kJ mol^{-1} (173 kcal mol^{-1})**				
$C_4H_8O^+$	$n\text{–}C_3H_7CHO$		9.86±0.02	PI	746	182
$C_4H_8O^+$	$n\text{–}C_3H_7CHO$		9.73±0.03	PE	734	3289
See also – EI:	2522					
$C_4H_8O^+$	$iso\text{–}C_3H_7CHO$		9.74±0.03	PI	721	182
$C_4H_8O^+$	$iso\text{–}C_3H_7CHO$		9.69±0.01	PE	716	3289
$C_4H_8O^+$	$C_2H_5COCH_3$		9.48±0.02	PI	676	95
$C_4H_8O^+$	$C_2H_5COCH_3$		9.53±0.01	PI		182
$C_4H_8O^+$	$C_2H_5COCH_3$		9.55±0.03	PI		1166
$C_4H_8O^+$	$C_2H_5COCH_3$		9.45±0.1	PI		86
$C_4H_8O^+$	$C_2H_5COCH_3$		9.51	PE		2843
$C_4H_8O^+$	$C_2H_5COCH_3$		9.54±0.01	PE		3289
See also – PI:	158, 416					
EI:	411, 2522, 2649, 2883, 2977					

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_4H_8O^+$	$(CH_2)_4O$ (1,4–Epoxybutane)		9.42±0.01	S	725	2169
$C_4H_8O^+$	$(CH_2)_4O$ (1,4–Epoxybutane)		9.54?	PI		182
See also – EI:	52, 218, 2694					
CTS:	2562					
$C_4H_8O^+$	$n-C_3H_7COC_2H_5$	C_2H_4	10.2±0.3	EI		2740
$C_4H_8O^+$	$n-C_4H_9COC_2H_5$	C_3H_6	10.3±0.3	EI		2740
$C_4H_8O^+$	$n-C_5H_{11}COC_2H_5$		10.5±0.3	EI		2740
$C_4H_8O^+$	$C_5H_{10}O_2$ (1,3–Dioxepane)	CH_2O	10.21	EI		2694
		$C_4H_9O^+$				
$C_4H_9O^+$	$n-C_4H_9O$		9.22±0.05	RPD		2776
$C_4H_9O^+$	$n-C_5H_{11}COC_2H_5$		9.8±0.3	EI		2740
$C_4H_9O^+$	$(n-C_4H_9)_2O$		12.96±0.1	RPD		2776
$C_4H_9O^+$	$(CH_3O)_2C(CH_3)_2$	CH_3O	10.28±0.05	RPD		1139
$C_4H_9O^+$	$n-C_4H_9ONO$	NO	9.94±0.05	RPD		2776
	$n-C_4H_9OH^+$	**ΔH°_{f0} ~ 725 kJ mol^{-1} (173 kcal mol^{-1})**				
	$iso-C_4H_9OH^+$	**ΔH°_{f298} ~ 690 kJ mol^{-1} (165 kcal mol^{-1})**				
	$tert-C_4H_9OH^+$	**ΔH°_{f0} ~ 680 kJ mol^{-1} (162 kcal mol^{-1})**				
	$(C_2H_5)_2O^+$	**ΔH°_{f298} = 666 kJ mol^{-1} (159 kcal mol^{-1})**				
$C_4H_{10}O^+$	$n-C_4H_9OH$		10.04	PI	723	182
$C_4H_{10}O^+$	$n-C_4H_9OH$		10.09±0.02	PE	728	3289
$C_4H_{10}O^+$	$n-C_4H_9OH$		10.37	PE		3374
See also – EI:	97					
$C_4H_{10}O^+$	$iso-C_4H_9OH$		10.09±0.02	PE	690	3289
$C_4H_{10}O^+$	$tert-C_4H_9OH$		9.97±0.02	PE	680	3289
$C_4H_{10}O^+$	$tert-C_4H_9OH$		10.23	PE		3374
$C_4H_{10}O^+$	$(C_2H_5)_2O$		9.53±0.02	PI	667	182, 416
$C_4H_{10}O^+$	$(C_2H_5)_2O$		9.51	PE	665	2843
$C_4H_{10}O^+$	$(C_2H_5)_2O$		9.50±0.01	PE	664	3289
See also – PI:	1166					
PE:	1130					
EI:	2196, 2776					

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_5H_6O^+$				
$C_5H_6O^+$	$C_4H_3OCH_3$ (2–Methylfuran)		8.39±0.01	PI		182
$C_5H_6O^+$	$C_4H_3OCH_3$ (2–Methylfuran)		8.31±0.09	EI		411
$C_5H_6O^+$	C_5H_6O (2–Cyclopenten–1–one)		9.34±0.02 (V)	PE		3407
$C_5H_6O^+$	C_5H_6O (3–Cyclopenten–1–one)		9.44±0.02 (V)	PE		3407
	$C_5H_8O^+$ (Cyclopentanone) **$C_5H_8O^+$ (Dihydropyran)**	**ΔH°_{f298} = 701 kJ mol^{-1} (168 kcal mol^{-1})** **ΔH°_{f298} = 680 kJ mol^{-1} (162 kcal mol^{-1})**				
$C_5H_8O^+$	C_5H_8O (Cyclopentanone)		9.26±0.01	PI	701	182
$C_5H_8O^+$	C_5H_8O (Cyclopentanone)		9.25±0.02	PE	700	3407
$C_5H_8O^+$	C_5H_8O (Cyclopentanone)		9.28±0.01	PE	703	3289
$C_5H_8O^+$	C_5H_8O (Dihydropyran)		8.34±0.01	PI	680	182
See also – CTS:	2031					
		$C_5H_9O^+$				
$C_5H_9O^+$	$(CH_2)_5O$ (1,5–Epoxypentane)	H	11.22	EI		2694
$C_5H_9O^+$	n–$C_4H_9COCH_3$	CH_3	9.66	PI	(510*)	95
See also – EI:	2977					
$C_5H_9O^+$	*iso*–$C_4H_9COCH_3$	CH_3	9.80	PI		95
$C_5H_9O^+$	n–$C_4H_9COC_2H_5$	C_2H_5	10.8±0.3	EI		2740
$C_5H_9O^+$	n–$C_5H_{11}COC_2H_5$		10.9±0.3	EI		2740
$C_5H_9O^+$	$(n$–$C_4H_9)_2CO$		10.86	RPD		2977
$C_5H_9O^+$	n–$C_4H_9COOCH_3$	CH_3O	11.18±0.2	EI		2497
*ΔH°_{f298}						
		$C_5H_7D_2O^+$				
$C_5H_7D_2O^+$	n–$C_3H_7CD_2COCD_3$	CD_3	10.2±0.2	EI		2766
		$C_5H_4D_5O^+$				
$C_5H_4D_5O^+$	n–$C_3H_7CD_2COCD_3$	CH_3	9.5±0.2	EI		2766

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
	n-$C_4H_9CHO^+$	**$\Delta H^\circ_{f298} \sim 717$ kJ mol^{-1} (171 kcal mol^{-1})**				
	n-$C_3H_7COCH_3^+$	**$\Delta H^\circ_{f298} = 647$ kJ mol^{-1} (155 kcal mol^{-1})**				
	***iso*-$C_3H_7COCH_3^+$**	**$\Delta H^\circ_{f298} = 635$ kJ mol^{-1} (152 kcal mol^{-1})**				
	$(C_2H_5)_2CO^+$	**$\Delta H^\circ_{f298} = 640$ kJ mol^{-1} (153 kcal mol^{-1})**				
	$C_5H_{10}O^+$ (1,5–Epoxypentane)	**$\Delta H^\circ_{f298} = 669$ kJ mol^{-1} (160 kcal mol^{-1})**				
$C_5H_{10}O^+$	n-C_4H_9CHO		9.82±0.05	PI	720	182
$C_5H_{10}O^+$	n-C_4H_9CHO		9.77±0.01	PE	715	3289
$C_5H_{10}O^+$	*iso*-C_4H_9CHO		9.71±0.05	PI		182
$C_5H_{10}O^+$	*iso*-C_4H_9CHO		9.68±0.02	PE		3289
$C_5H_{10}O^+$	*tert*-C_4H_9CHO		9.51±0.01	PE		3289
$C_5H_{10}O^+$	n-$C_3H_7COCH_3$		9.37±0.02	PI	645	95
$C_5H_{10}O^+$	n-$C_3H_7COCH_3$		9.39±0.02	PI	647	182
$C_5H_{10}O^+$	n-$C_3H_7COCH_3$		9.40±0.01	PE	648	3289
See also – PI:	1166					
EI:	2433, 2522, 2977					
$C_5H_{10}O^+$	*iso*-$C_3H_7COCH_3$		9.30±0.02	PI	635	95
$C_5H_{10}O^+$	*iso*-$C_3H_7COCH_3$		9.32±0.02	PI	637	182
$C_5H_{10}O^+$	*iso*-$C_3H_7COCH_3$		9.30±0.01	PE	635	3289
See also – EI:	2433					
$C_5H_{10}O^+$	$(C_2H_5)_2CO$		9.32±0.01	PI	641	182
$C_5H_{10}O^+$	$(C_2H_5)_2CO$		9.31±0.02	PE	640	3289
See also – EI:	2977, 3231					
$C_5H_{10}O^+$	$(CH_2)_5O$ (1,5–Epoxypentane)		9.25±0.01	S	669	2169
$C_5H_{10}O^+$	$(CH_2)_5O$ (1,5–Epoxypentane)		9.26±0.03	PI	670	182
See also – EI:	218, 2694					
$C_5H_{10}O^+$	n-$C_5H_{11}COC_2H_5$	C_3H_6	10.4±0.3	EI		2740
		$C_5H_{11}O^+$				
$C_5H_{11}O^+$	n-$C_5H_{11}OOH$	OH	10.0±0.1	EI		2464
$C_5H_{11}O^+$	n-$C_3H_7CH(OOH)CH_3$	OH	10.4±0.1	EI		2464
$C_5H_{11}O^+$	$(C_2H_5)_2CHOOH$	OH	10.2±0.1	EI		2464

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_6H_5O^+$				
$C_6H_5O^+$	C_6H_5O (Phenoxy radical)		8.84	EI		1079
$C_6H_5O^+$	$C_6H_5OCH_3$ (Methoxybenzene)	CH_3	11.86±0.1	EI		2970
$C_6H_5O^+$	$C_6H_5OCH_3$ (Methoxybenzene)	CH_3	11.92±0.1	EI		1079
$C_6H_5O^+$	$C_6H_5OC{\equiv}CH$ (Phenoxyacetylene)	C_2H	9.5±0.1	EI		13
$C_6H_5O^+$	C_6H_4BrOH (4–Bromophenol)	Br	12.17	EI		3238
	$C_6H_6O^+$ (Phenol)	**$\Delta H^\circ_{f298} = 724$ kJ mol^{-1} (173 kcal mol^{-1})**				
$C_6H_6O^+$	C_6H_5OH (Phenol)		8.50±0.01	PI	724	182, 416
$C_6H_6O^+$	C_6H_5OH (Phenol)		8.52±0.02	PI	726	1166
$C_6H_6O^+$	C_6H_5OH (Phenol)		8.52	PE	726	2843
$C_6H_6O^+$	C_6H_5OH (Phenol)		8.48±0.05	PE	722	2796
See also – PE: EI:	2806 1066, 2865, 3174, 3223, 3238					
$C_6H_6O^+$	$C_6H_5OC_2H_5$ (Ethoxybenzene)	C_2H_4	10.73	EI		2706
See also – EI:	2945					
$C_6H_6O^+$	$C_6H_5OC_3H_7$ (Propoxybenzene)	C_3H_6	10.21	EI		2706
$C_6H_6O^+$	$C_6H_5OC_4H_9$ (Butoxybenzene)		10.05	EI		2706
$C_6H_6O^+$	$(C_6H_5)_2O$ (Diphenyl ether)		13.88±0.15	EI		1237
		$C_6H_8O^+$				
$C_6H_8O^+$	$C_4H_2O(CH_3)_2$ (2,3–Dimethylfuran)		8.01±0.09	EI		411

4.3. The Positive Ion Table—Continued

$C_6H_{10}O^+$ (Cyclohexanone) **$\Delta H^\circ_{f298} = 653$ kJ mol^{-1} (156 kcal mol^{-1})**

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_6H_{10}O^+$	$(CH_3)_2C=CHCOCH_3$		9.08±0.03	PI		182
$C_6H_{10}O^+$	$(CH_3)_2C=CHCOCH_3$		8.89±0.05	EI		384
$C_6H_{10}O^+$	$C_6H_{10}O$ (Cyclohexanone)		9.14±0.01	PI	652	182
$C_6H_{10}O^+$	$C_6H_{10}O$ (Cyclohexanone)		9.16±0.01	PE	654	3289

See also – EI: 431

$C_6H_{11}O^+$

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_6H_{11}O^+$	$n-C_5H_{11}COCH_3$	CH_3	9.83	RPD		2977
$C_6H_{11}O^+$	$n-C_5H_{11}COC_2H_5$	C_2H_5	10.2±0.3	EI		2740

$n-C_4H_9COCH_3^+$ **$\Delta H^\circ_{f298} = 623$ kJ mol^{-1} (149 kcal mol^{-1})**
$tert-C_4H_9COCH_3^+$ **$\Delta H^\circ_{f298} = 593$ kJ mol^{-1} (142 kcal mol^{-1})**

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_6H_{12}O^+$	$n-C_4H_9COCH_3$		9.37±0.02	PI	624	95
$C_6H_{12}O^+$	$n-C_4H_9COCH_3$		9.34±0.03	PI	621	182
$C_6H_{12}O^+$	$n-C_4H_9COCH_3$		9.36±0.02	PE	623	3289

See also – EI: 1256, 2433, 2977

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_6H_{12}O^+$	$sec-C_4H_9COCH_3$		9.69	EI		1254, 2433
$C_6H_{12}O^+$	$iso-C_4H_9COCH_3$		9.30±0.02	PI		95
$C_6H_{12}O^+$	$iso-C_4H_9COCH_3$		9.30±0.03	PI		182
$C_6H_{12}O^+$	$iso-C_4H_9COCH_3$		9.34±0.01	PE		3289

See also – EI: 1256, 2433

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_6H_{12}O^+$	$tert-C_4H_9COCH_3$		9.17±0.03	PI	595	182
$C_6H_{12}O^+$	$tert-C_4H_9COCH_3$		9.14±0.01	PE	592	3289

See also – EI: 1254, 2433

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_6H_{12}O^+$	$C_6H_{11}OH$ (Cyclohexanol)		10.0	EI		3022

See also – D: 2908

$C_6H_7D_5O^+$

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_6H_7D_5O^+$	$iso-C_3H_7CD_2COCD_3$		9.35	EI		1256, 2433

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_6H_{13}O^+$						
$C_6H_{13}O^+$	$n-C_6H_{13}OOH$	OH	10.2±0.1	EI		2464
$C_6H_{13}O^+$	$n-C_4H_9CH(OOH)CH_3$	OH	9.7±0.1	EI		2464
$C_6H_{13}O^+$	$n-C_3H_7CH(OOH)C_2H_5$	OH	9.3±0.1	EI		2464
	$(n-C_3H_7)_2O^+$	**$\Delta H^\circ_{f298} \sim 604$ kJ mol^{-1} (144 kcal mol^{-1})**				
	$(iso-C_3H_7)_2O^+$	**$\Delta H^\circ_{f298} \sim 569$ kJ mol^{-1} (136 kcal mol^{-1})**				
$C_6H_{14}O^+$	$(n-C_3H_7)_2O$		9.27±0.05	PI	602	182
$C_6H_{14}O^+$	$(n-C_3H_7)_2O$		9.32±0.01	PE	606	3289
$C_6H_{14}O^+$	$(iso-C_3H_7)_2O$		9.20±0.05	PI	569	182
$C_6H_{14}O^+$	$(iso-C_3H_7)_2O$		9.16±0.05	RPD		2776
$C_7H_5O^+$						
$C_7H_5O^+$	C_6H_5CHO (Benzenecarbonal)	H	10.99	EI		3238
See also – EI:	130, 308, 1237					
$C_7H_5O^+$	$C_6H_5COCH_3$ (Acetophenone)	CH_3	9.91	EI		3334
See also – EI:	308, 1237, 2174, 2967, 3238					
$C_7H_5O^+$	$C_6H_5COCD_3$ (Acetophenone–$\alpha,\alpha,\alpha-d_3$)	CD_3	10.45	EI		308
$C_7H_5O^+$	$(C_6H_5)_2CO$ (Benzophenone)		12.00±0.05	EI		1237
$C_7H_5O^+$	$C_6H_5COOCH_3$ (Benzoic acid methyl ester)	CH_3O	10.80	EI		3238
See also – EI:	308					
$C_7H_5O^+$	$C_6H_5COOC_6H_5$ (Benzoic acid phenyl ester)		10.01±0.07	EI		1237
$C_7H_5O^+$	$C_6H_5COCOC_6H_5$ (Diphenylglyoxal)		9.70±0.05	EI		1237
$C_7H_5O^+$	$C_6H_5CONH_2$ (Benzoic acid amide)	NH_2	9.9±0.1	EI		1168
$C_7H_5O^+$	$C_6H_5CONHC_6H_5$ (*N*–Phenylbenzoic acid amide)		10.6±0.1	EI		2918
$C_7H_5O^+$	$C_6H_5COCHN_2$ (α–Diazoacetophenone)		10.42±0.18	EI		2174
$C_7H_5O^+$	$(C_6H_5)_2C_2N_2O$ (2,5–Diphenyl–1,3,4–oxadiazole)		12.1±0.2	EI		1125
$C_7H_5O^+$	$C_6H_5CONHC_6H_4OCH_3$ (*N*–(3–Methoxyphenyl)benzoic acid amide)		10.8±0.1	EI		2918
$C_7H_5O^+$	$C_6H_5CONHC_6H_4OCH_3$ (*N*–(4–Methoxyphenyl)benzoic acid amide)		11.2±0.1	EI		2918

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_7H_5O^+$	$C_6H_5CONHC_6H_4NO_2$ (*N*–(3–Nitrophenyl)benzoic acid amide)		10.2±0.1	EI		2918
$C_7H_5O^+$	$C_6H_5CONHC_6H_4NO_2$ (*N*–(4–Nitrophenyl)benzoic acid amide)		10.2±0.1	EI		2918
$C_7H_5O^+$	C_6H_5COF (Benzoic acid fluoride)	F	11.5	EI		308
$C_7H_5O^+$	$C_6H_5COCF_3$ (α,α,α–Trifluoroacetophenone)	CF_3	10.05	EI		308
$C_7H_5O^+$	C_6H_5COCl (Benzoic acid chloride)	Cl	10.5	EI		308

See also – EI: 130

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_7H_5O^+$	C_6H_5COBr (Benzoic acid bromide)	Br	10.0	EI		308

$C_7H_6O^+$

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_7H_6O^+$	C_6H_5CHO (Benzenecarbonal)		9.51±0.02?	PI		416
$C_7H_6O^+$	C_6H_5CHO (Benzenecarbonal)		9.53±0.03	PI		182
$C_7H_6O^+$	C_6H_5CHO (Benzenecarbonal)		9.60±0.02	PI		1166
$C_7H_6O^+$	C_6H_5CHO (Benzenecarbonal)		9.80 (V)	PE		2806
$C_7H_6O^+$	C_6H_5CHO (Benzenecarbonal)		9.53±0.03	RPD		2463

See also – EI: 127, 130, 308, 1237, 2026, 2718, 3238

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_7H_6O^+$	C_7H_6O (2,4,6–Cycloheptatrien–1–one)		9.68±0.02	EI		431

$C_7H_7O^+$

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_7H_7O^+$	$C_6H_4(OH)CH_3$ (3–Methylphenol)	H	12.33±0.1	EI		2970
$C_7H_7O^+$	$C_6H_4(OH)CH_3$ (4–Methylphenol)	H	12.41±0.1	EI		2970
$C_7H_7O^+$	$C_6H_4(OH)C_2H_5$ (3–Ethylphenol)	CH_3	10.80±0.1	EI		2970
$C_7H_7O^+$	$C_6H_4(OH)C_2H_5$ (4–Ethylphenol)	CH_3	10.83±0.1	EI		2970
$C_7H_7O^+$	$C_6H_5CH_2OCH_3$ (α–Methoxytoluene)	CH_3	11.47	EI		3287
$C_7H_7O^+$	$C_6H_4(OCH_3)CH_3$ (3–Methoxytoluene)	CH_3	11.33±0.1	EI		297
$C_7H_7O^+$	$C_6H_4(OCH_3)CH_3$ (4–Methoxytoluene)	CH_3	10.83±0.1	EI		297

See also – EI: 3287

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_7H_7O^+$	$C_7H_7OCH_3$ (7–Methoxycycloheptatriene)	CH_3	10.26	EI		3287
$C_7H_7O^+$	$C_6H_5CH_2CH_2C_6H_4OH$ (1–(3–Hydroxyphenyl)–2–phenylethane)		10.8±0.2	EI		3288
$C_7H_7O^+$	$C_6H_5CH_2CH_2C_6H_4OH$ (1–(4–Hydroxyphenyl)–2–phenylethane)		9.8±0.2	EI		3288
$C_7H_7O^+$	$C_6H_5CH_2OC_6H_4CH_3$ (Benzyl 3–tolyl ether)		11.9	EI		2737
$C_7H_7O^+$	$C_6H_5CH_2OC_6H_4CH_3$ (Benzyl 4–tolyl ether)		11.8	EI		2737
$C_7H_7O^+$	$C_6H_4(OH)(CH_2)_3COOCH_3$ (4–(4–Hydroxyphenyl)butanoic acid methyl ester)		11.69±0.2	EI		2497

$C_7H_8O^+$ (Methoxybenzene) **ΔH°_{f298} = 720 kJ mol^{-1} (172 kcal mol^{-1})**

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_7H_8O^+$	$C_6H_5OCH_3$ (Methoxybenzene)		8.20±0.02	PI	719	416
$C_7H_8O^+$	$C_6H_5OCH_3$ (Methoxybenzene)		8.22±0.02	PI	721	182
$C_7H_8O^+$	$C_6H_5OCH_3$ (Methoxybenzene)		8.21	PE	720	2843

See also – PE: 2806
EI: 1066, 2865, 3223, 3238

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_7H_8O^+$	$C_6H_5CH_2OH$ (α–Hydroxytoluene)		9.14±0.05	EI		2025

See also – D: 2908

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_7H_8O^+$	$C_6H_4(OH)CH_3$ (2–Methylphenol)		8.93	EI		1066
$C_7H_8O^+$	$C_6H_4(OH)CH_3$ (3–Methylphenol)		8.98	EI		1066
$C_7H_8O^+$	$C_6H_4(OH)CH_3$ (3–Methylphenol)		8.52±0.05	EI		2025
$C_7H_8O^+$	$C_6H_4(OH)CH_3$ (4–Methylphenol)		8.97	EI		1066
$C_7H_8O^+$	C_7H_8O (Bicyclo[2.2.1]hept–2–en–5–one)		8.90±0.02 (V)	PE		3408
$C_7H_8O^+$	C_7H_8O (Bicyclo[2.2.1]hept–2–en–7–one)		9.19±0.02 (V)	PE		3408
$C_7H_8O^+$	C_7H_8O (Nortricyclone)		9.01	PE		2951

$C_7H_{10}O^+$

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_7H_{10}O^+$	$C_7H_{10}O$ (Bicyclo[2.2.1]heptan–2–one)		8.94±0.02 (V)	PE		3408
$C_7H_{10}O^+$	$C_7H_{10}O$ (Bicyclo[2.2.1]heptan–7–one)		9.01±0.02 (V)	PE		3408

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
	$C_7H_{12}O^+$ (Cycloheptanone)		**$\Delta H^\circ_{f298} = 668$ kJ mol^{-1} (160 kcal mol^{-1})**			
$C_7H_{12}O^+$	$C_7H_{12}O$ (Cycloheptanone)		9.49±0.01	PE	668	3289
		$C_7H_{13}O^+$				
$C_7H_{13}O^+$	$n-C_6H_{13}COCH_3$	CH_3	9.85	RPD		2977
	$(iso-C_3H_7)_2CO^+$		**$\Delta H^\circ_{f298} = 553$ kJ mol^{-1} (132 kcal mol^{-1})**			
$C_7H_{14}O^+$	$n-C_5H_{11}COCH_3$		9.33±0.03	PI		182
$C_7H_{14}O^+$	$n-C_5H_{11}COCH_3$		9.79	RPD		2977
$C_7H_{14}O^+$	$n-C_4H_9COC_2H_5$		9.15±0.02	PE		3289
$C_7H_{14}O^+$	$(n-C_3H_7)_2CO$		9.15±0.02	PE		3289
$C_7H_{14}O^+$	$(n-C_3H_7)_2CO$		9.84	RPD		2977
$C_7H_{14}O^+$	$(iso-C_3H_7)_2CO$		8.96±0.01	PE	553	3289
		$C_7H_{15}O^+$				
$C_7H_{15}O^+$	$n-C_7H_{15}OOH$	OH	10.3±0.1	EI		2464
$C_7H_{15}O^+$	$n-C_5H_{11}CH(OOH)CH_3$	OH	9.7±0.1	EI		2464
		$C_8H_6O^+$				
$C_8H_6O^+$	C_8H_6O (Benzofuran)		8.29±0.05	PE		2796
$C_8H_6O^+$	C_8H_6O (Benzofuran)		8.42	PE		3349
See also – EI:	2541					
$C_8H_6O^+$	C_8H_6O (Benzocyclobutenone)		8.99	EI		3296
$C_8H_6O^+$	$C_6H_4(OH)C{\equiv}CH$ (2–Ethynylphenol)		8.71	EI		2541
$C_8H_6O^+$	$C_9H_6O_2$ (Coumarin)	CO	11.1	EI		2946
See also – EI:	2541					
$C_8H_6O^+$	$C_6H_5COCHN_2$ (α–Diazoacetophenone)	N_2	10.08±0.11	EI		2174

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
	$C_8H_7O^+$					
$C_8H_7O^+$	$C_6H_5CH_2COCH_3$ (Benzyl methyl ketone)	CH_3	9.90±0.17	EI		2174
$C_8H_7O^+$	$C_6H_4(CH_3)COCH_3$ (3–Methylacetophenone)	CH_3	10.10±0.1	EI		2967
$C_8H_7O^+$	$C_6H_4(CH_3)COCH_3$ (4–Methylacetophenone)	CH_3	9.72	EI		3334
See also – EI:	2967, 3238					
	$C_8H_8O^+$ (Acetophenone) $\Delta H^\circ_{f298} \sim 808$ **kJ mol^{-1} (193 kcal mol^{-1})**					
$C_8H_8O^+$	$C_6H_5COCH_3$ (Acetophenone)		9.27±0.03?	PI	808	182
$C_8H_8O^+$	$C_6H_5COCH_3$ (Acetophenone)		9.15±0.03	RPD		2463
See also – EI:	308, 1237, 2025, 2026, 2174, 2967, 3238, 3334					
$C_8H_8O^+$	$C_6H_4(CH_3)CHO$ (4–Methylbenzenecarbonal)		9.33±0.05	EI		2026
$C_8H_8O^+$	$C_6H_4(OH)(CH_2)_3COOCH_3$ (4–(4–Hydroxyphenyl)butanoic acid methyl ester)		10.65±0.2	EI		2497
	$C_8H_9O^+$					
$C_8H_9O^+$	$C_6H_4(OCH_3)CH_2$ (4–Methoxybenzyl radical)		6.82±0.1	EI		69
$C_8H_9O^+$	$C_6H_5CH_2OCH_3$ (α–Methoxytoluene)	H	10.65±0.1	EI		122
See also – EI:	3287					
$C_8H_9O^+$	$C_6H_4(OCH_3)CH_3$ (3–Methoxytoluene)	H	12.13±0.1	EI		122
$C_8H_9O^+$	$C_6H_4(OCH_3)CH_3$ (4–Methoxytoluene)	H	11.91	EI		3287
See also – EI:	122					
$C_8H_9O^+$	$C_7H_7OCH_3$ (7–Methoxycycloheptatriene)	H	9.70±0.1	EI		122
See also – EI:	3287					
$C_8H_9O^+$	$C_6H_4(OCH_3)C_2H_5$ (1–Ethyl–4–methoxybenzene)	CH_3	10.80±0.1	EI		122
$C_8H_9O^+$	$C_6H_5CH_2CH_2C_6H_4OCH_3$ (1–(4–Methoxyphenyl)–2–phenylethane)		9.6±0.2	EI		3288

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_8H_9O^+$	$C_6H_4(OCH_3)(CH_2)_3COOCH_3$ (4–(4–Methoxyphenyl)butanoic acid methyl ester)		11.11±0.2	EI		2497
$C_8H_9O^+$	$C_6H_4(OCH_3)CH_2Cl$ (α–Chloro–3–methoxytoluene)	Cl	9.85±0.1	EI		2970
$C_8H_9O^+$	$C_6H_4(OCH_3)CH_2Cl$ (α–Chloro–4–methoxytoluene)	Cl	8.69±0.1	EI		2970

$C_8H_7D_2O^+$

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_8H_7D_2O^+$	$C_6H_4(OCH_3)CD_3$ (1–Methoxy–3–methyl–d_3–benzene)	D	12.10±0.1	EI		122
$C_8H_7D_2O^+$	$C_6H_4(OCH_3)CD_3$ (1–Methoxy–4–methyl–d_3–benzene)	D	12.10±0.1	EI		122

$C_8H_6D_3O^+$

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_8H_6D_3O^+$	$C_6H_4(OCH_3)CD_3$ (1–Methoxy–3–methyl–d_3–benzene)	H	12.10±0.1	EI		122
$C_8H_6D_3O^+$	$C_6H_4(OCH_3)CD_3$ (1–Methoxy–4–methyl–d_3–benzene)	H	12.10±0.1	EI		122
$C_8H_6D_3O^+$	$C_6H_4(OCD_3)C_2H_5$ (1–Ethyl–3–methoxy–d_3–benzene)	CH_3	11.70±0.1	EI		122
$C_8H_6D_3O^+$	$C_6H_4(OCD_3)C_2H_5$ (1–Ethyl–4–methoxy–d_3–benzene)	CH_3	10.90±0.1	EI		122

$C_8H_{10}O^+$ (Ethoxybenzene) ΔH°_{f298} = 674 kJ mol^{-1} (161 kcal mol^{-1})

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_8H_{10}O^+$	$C_6H_5CH_2OCH_3$ (α–Methoxytoluene)		8.85±0.03	PI		416
$C_8H_{10}O^+$	$C_6H_5CH_2OCH_3$ (α–Methoxytoluene)		8.83±0.05	EI		2025
$C_8H_{10}O^+$	$C_6H_5CH_2OCH_3$ (α–Methoxytoluene)		8.76	EI		3287

See also – EI: 122, 3338

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_8H_{10}O^+$	$C_6H_4(OCH_3)CH_3$ (2–Methoxytoluene)		8.1±0.15	CTS		3373
$C_8H_{10}O^+$	$C_6H_4(OCH_3)CH_3$ (3–Methoxytoluene)		8.31±0.05	EI		2025
$C_8H_{10}O^+$	$C_6H_4(OCH_3)CH_3$ (3–Methoxytoluene)		8.1±0.15	CTS		3373

See also – EI: 122

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_8H_{10}O^+$	$C_6H_4(OCH_3)CH_3$ (4–Methoxytoluene)		7.83	EI		3287
$C_8H_{10}O^+$	$C_6H_4(OCH_3)CH_3$ (4–Methoxytoluene)		8.0±0.15	CTS		3373

See also – EI: 122

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_8H_{10}O^+$	$C_6H_5OC_2H_5$ (Ethoxybenzene)		8.13±0.02	PI	674	182
See also – EI:	2945					
$C_8H_{10}O^+$	$C_7H_7OCH_3$ (7–Methoxycycloheptatriene)		7.23	EI		3287
See also – EI:	122					
		$C_8H_{15}O^+$				
$C_8H_{15}O^+$	n–$C_7H_{15}COCH_3$	CH_3	10.03	RPD		2977
		$C_8H_{16}O^+$				
$C_8H_{16}O^+$	n–$C_6H_{13}COCH_3$		9.75	RPD		2977
	($tert$–$C_4H_9)_2O^+$	**ΔH°_{f298} = 498 kJ mol^{-1} (119 kcal mol^{-1})**				
$C_8H_{18}O^+$	(n–$C_4H_9)_2O$		9.28±0.05	RPD		2776
$C_8H_{18}O^+$	($tert$–$C_4H_9)_2O$		8.94±0.01	PE	498	3289
		$C_9H_{10}O^+$				
$C_9H_{10}O^+$	$C_6H_5CH_2CH_2CHO$ (3–Phenylpropanal)		9.13±0.1	EI		2522
$C_9H_{10}O^+$	$C_6H_5CH_2COCH_3$ (Benzyl methyl ketone)		9.14±0.09	EI		2174
$C_9H_{10}O^+$	$C_6H_5COC_2H_5$ (Ethyl phenyl ketone)		9.27±0.05	EI		2025
$C_9H_{10}O^+$	$C_6H_4(CH_3)COCH_3$ (3–Methylacetophenone)		9.15±0.05	EI		2035
See also – EI:	2967					
$C_9H_{10}O^+$	$C_6H_4(CH_3)COCH_3$ (4–Methylacetophenone)		9.14	EI		3238
See also – EI:	2967, 3334					
$C_9H_{10}O^+$	$C_9H_{10}O$ (Chroman)		8.43	EI		3338
$C_9H_{10}O^+$	$C_9H_{10}O$ (Isochroman)		8.90	EI		3338
$C_9H_{10}O^+$	$C_6H_4(OCH_3)(CH_2)_3COOCH_3$ (4–(4–Methoxyphenyl)butanoic acid methyl ester)		10.55±0.2	EI		2497

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_9H_{11}O^+$						
$C_9H_{11}O^+$	$C_{10}H_{14}O$ (Perillaldehyde)	CH_3	10.4	RPD		2979
$C_9H_{11}O^+$	$C_{10}H_{14}O$ (Isopiperitenone)	CH_3	10.0	RPD		2979
$C_9H_{11}O^+$	$C_{10}H_{14}O$ (Carvone)	CH_3	10.1	RPD		2979
$C_9H_{11}O^+$	$C_{10}H_{14}O$ (Eucarvone)	CH_3	11.1	RPD		2979
$C_9H_{11}O^+$	$C_{10}H_{14}O$ (Myrtenal)	CH_3	10.7	RPD		2979
$C_9H_{11}O^+$	$C_{10}H_{14}O$ (Verbenone)	CH_3	10.8	RPD		2979
$C_9H_{11}O^+$	$C_6H_4(OCH_3)CH(CH_3)CH_2COOCH_3$ (3–(4–Methoxyphenyl)butanoic acid methyl ester)		10.61±0.2	EI		2497
$C_9H_{11}O^+$	$C_6H_4(OCH_3)CH_2CH_2Br$ (1–Bromo–2–(3–methoxyphenyl)ethane)	Br	10.1	EI		2973
$C_9H_{11}O^+$	$C_6H_4(OCH_3)CH_2CH_2Br$ (1–Bromo–2–(4–methoxyphenyl)ethane)	Br	9.9	EI		2973
$C_9H_{13}O^+$						
$C_9H_{13}O^+$	$C_{10}H_{16}O$ (Caranone)	CH_3	10.5	RPD		2979
$C_9H_{15}O^+$						
$C_9H_{15}O^+$	$C_{10}H_{18}O$ (Isomenthone)	CH_3	11.4	RPD		2979
($tert$–$C_4H_9)_2CO^+$	**$\Delta H^\circ_{f298} = 495$ kJ mol^{-1} (118 kcal mol^{-1})**					
$C_9H_{18}O^+$	n–$C_7H_{15}COCH_3$		9.32±0.02	PE		3289
See also – EI:	2977					
$C_9H_{18}O^+$	$(n$–$C_4H_9)_2CO$		9.71	RPD		2977
$C_9H_{18}O^+$	$(tert$–$C_4H_9)_2CO$		8.71±0.02	PE	495	3289
$C_{10}H_{10}O^+$						
$C_{10}H_{10}O^+$	$C_{10}H_{10}O$ (Bullvalone)		8.72	PE		2951
$C_{10}H_{10}O^+$	$C_6H_5(CH_2)_3COOH$ (4–Phenylbutanoic acid)	H_2O	9.23±0.2	EI		2522
$C_{10}H_{10}O^+$	$C_6H_5(CH_2)_3COOCH_3$ (4–Phenylbutanoic acid methyl ester)	CH_3OH	9.12±0.2	EI		2522
See also – EI:	2497					

4.3. The Positive Ion Table—Continued

$C_{10}H_{11}O^+$

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_{10}H_{11}O^+$	$C_6H_5CH(CH_3)CH_2COOCH_3$ (3–Phenylbutanoic acid methyl ester)	CH_3O	11.02±0.2	EI		2497
$C_{10}H_{11}O^+$	$C_6H_5(CH_2)_3COOCH_3$ (4–Phenylbutanoic acid methyl ester)	CH_3O	11.11±0.3	EI		2496

See also – EI: 2497

$C_{10}H_{12}O^+$

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_{10}H_{12}O^+$	$C_6H_5(CH_2)_3CHO$ (4–Phenylbutanal)		8.83±0.1	EI		2522
$C_{10}H_{12}O^+$	$C_6H_5COC_3H_7$ (1–Phenyl–1–butanone)		9.38±0.2	EI		2534, 2567
$C_{10}H_{12}O^+$	$C_6H_5CH_2CH_2COCH_3$ (4–Phenyl–2–butanone)		9.00±0.1	EI		2522
$C_{10}H_{12}O^+$	$C_6H_4(OCH_3)CH(CH_3)CH_2COOCH_3$ (3–(4–Methoxyphenyl)butanoic acid methyl ester)		10.24±0.2	EI		2497

$C_{10}H_{14}O^+$

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_{10}H_{14}O^+$	$C_6H_5OC_4H_9$ (*tert*–Butoxybenzene)		8.75 (V)	PE		2806
$C_{10}H_{14}O^+$	$C_{10}H_{14}O$ (Perillaldehyde)		10.10	RPD		2979
$C_{10}H_{14}O^+$	$C_{10}H_{14}O$ (Isopiperitenone)		9.53	RPD		2979
$C_{10}H_{14}O^+$	$C_{10}H_{14}O$ (Carvone)		9.77	RPD		2979
$C_{10}H_{14}O^+$	$C_{10}H_{14}O$ (Eucarvone)		9.62	RPD		2979
$C_{10}H_{14}O^+$	$C_{10}H_{14}O$ (Myrtenal)		9.36	RPD		2979
$C_{10}H_{14}O^+$	$C_{10}H_{14}O$ (Verbenone)		9.83	RPD		2979
$C_{10}H_{14}O^+$	$C_{10}H_{14}O$ (Adamantanone)		8.76	PE		2951

$C_{10}H_{16}O^+$

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_{10}H_{16}O^+$	$C_{10}H_{16}O$ (Caranone)		9.74	RPD		2979
$C_{10}H_{16}O^+$	$C_{10}H_{15}OH$ (1–Adamantanol)		9.23	PE		2951
$C_{10}H_{16}O^+$	$C_{10}H_{15}OH$ (2–Adamantanol)		9.25	PE		2951

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_{10}H_{18}O^+$						
$C_{10}H_{18}O^+$	$C_{10}H_{18}O$ (Isomenthone)		9.86	RPD		2979
$C_{11}H_{12}O^+$						
$C_{11}H_{12}O^+$	$C_6H_4(CH_3)(CH_2)_3COOCH_3$ (4–(4–Tolyl)butanoic acid methyl ester)	CH_3OH	9.50±0.2	EI		2497
$C_{11}H_{13}O^+$						
$C_{11}H_{13}O^+$	$C_6H_4(C_4H_9)COOCH_3$ (4–*tert*–Butylbenzoic acid methyl ester)	CH_3O	11.02	EI		3238
$C_{11}H_{13}O^+$	$C_6H_4(CH_3)CH(CH_3)CH_2COOCH_3$ (3–(4–Tolyl)butanoic acid methyl ester)	CH_3O	11.16±0.2	EI		2497
$C_{11}H_{13}O^+$	$C_6H_4(CH_3)(CH_2)_3COOCH_3$ (4–(4–Tolyl)butanoic acid methyl ester)	CH_3O	11.18±0.2	EI		2497
$C_{11}H_{14}O^+$						
$C_{11}H_{14}O^+$	$C_6H_5(CH_2)_3COCH_3$ (5–Phenyl–2–pentanone)		8.95±0.1	EI		2522
$C_{11}H_{14}O^+$	$C_6H_5COC_4H_9$ (Phenyl *tert*–butyl ketone)		9.04±0.04	RPD		2407, 2463
$C_{11}H_{14}O^+$	$C_6H_4(CH_3)COC_3H_7$ (1–(4–Tolyl)–1–butanone)		8.75±0.2	EI		2534
$C_{11}H_{18}O^+$						
$C_{11}H_{18}O^+$	$C_{10}H_{14}(CH_3)OH$ (2–Methyl–2–adamantanol)		9.22	PE		2951
$C_{11}H_{22}O^+$						
$C_{11}H_{22}O^+$	n–$C_9H_{19}COCH_3$		9.29±0.01	PE		3289
$C_{12}H_8O^+$ (Dibenzofuran)	**$\Delta H^\circ_{f298} \sim 846$ kJ mol^{-1} (202 kcal mol^{-1})**					
$C_{12}H_8O^+$	$C_{12}H_8O$ (Dibenzofuran)		7.9±0.05	PE	~846	2796
$C_{12}H_8O^+$	$C_{12}H_8O$ (Dibenzofuran)		8.22	PE		3349

See also – CTS: 2911

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_{12}H_9O^+$						
$C_{12}H_9O^+$	$(C_6H_5)_2O$ (Diphenyl ether)	H	12.90±0.05	EI		1237
$C_{12}H_9O^+$	$(C_6H_5O)_2CO$ (Carbonic acid diphenyl ester)		12.51±0.05	EI		1237
$C_{12}H_{10}O^+$						
$C_{12}H_{10}O^+$	$(C_6H_5)_2O$ (Diphenyl ether)		8.10?	PE		2796
$C_{12}H_{10}O^+$	$(C_6H_5)_2O$ (Diphenyl ether)		8.82±0.05	EI		1237
$C_{12}H_{10}O^+$	$(C_6H_5O)_2CO$ (Carbonic acid diphenyl ester)	CO_2	10.78±0.05	EI		1237
$C_{12}H_{11}O^+$						
$C_{12}H_{11}O^+$	$C_{10}H_7CH_2CH_2OH$ (2–(4–Azulyl)ethanol)	H	10.3	EI		3333
$C_{12}H_{11}O^+$	$C_6H_4(CH_3)SO_3CH_2CH_2C_{10}H_7$ (4–Toluenesulfonic acid 4–azulylethyl ester)		10.5	EI		3333
$C_{12}H_{12}O^+$						
$C_{12}H_{12}O^+$	$C_{10}H_7CH_2CH_2OH$ (2–(4–Azulyl)ethanol)		7.1	EI		3333
$C_{13}H_6O^+$						
$C_{13}H_6O^+$	$C_{16}H_6O_6$ (3,3′,4,4′–Biphenyltetracarboxylic acid dianhydride)	$2CO_2+CO$	15.45	EI		3295
$C_{13}H_{10}O^+$						
$C_{13}H_{10}O^+$	$(C_6H_5)_2CO$ (Benzophenone)		9.46±0.05	EI		1237
$C_{13}H_{10}O^+$	$(C_6H_5)_2CO$ (Benzophenone)		9.35±0.04	EI		2026
$C_{13}H_{11}O^+$						
$C_{13}H_{11}O^+$	$C_6H_5OC_6H_4(CH_2)_3COOCH_3$ (4–(4–Phenoxyphenyl)butanoic acid methyl ester)		11.27±0.2	EI		2497

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_{13}H_{12}O^+$						
$C_{13}H_{12}O^+$	$C_6H_5CH_2OC_6H_5$ (Benzyl phenyl ether)		8.4	EI		2737
$C_{14}H_8O^+$						
$C_{14}H_8O^+$	$C_{14}H_8N_2O$ (9–Diazo–10–oxophenanthrene)	N_2	8.6±0.2	EI		2995
$C_{14}H_{10}O^+$						
$C_{14}H_{10}O^+$	$C_{14}H_9OH$ (1–Hydroxyanthracene)		7.70	EI		2706
$C_{14}H_{10}O^+$	$C_{14}H_9OH$ (2–Hydroxyanthracene)		7.73	EI		2706
$C_{14}H_{10}O^+$	$C_{14}H_{10}O$ (9,10–Dihydro–9–oxoanthracene)		9.43	EI		2706
$C_{14}H_{10}O^+$	$C_{14}H_9OC_2H_5$ (9–Ethoxyanthracene)	C_2H_4	9.86	EI		2706
$C_{14}H_{12}O^+$						
$C_{14}H_{12}O^+$	$C_6H_5COC_6H_4CH_3$ (4–Methylbenzophenone)		9.13±0.05	EI		2026
$C_{14}H_{12}O^+$	$C_6H_5OC_6H_4(CH_2)_3COOCH_3$ (4–(4–Phenoxyphenyl)butanoic acid methyl ester)		10.49±0.2	EI		2497
$C_{14}H_{14}O^+$						
$C_{14}H_{14}O^+$	$C_6H_5CH_2CH_2C_6H_4OH$ (1–(3–Hydroxyphenyl)–2–phenylethane)		8.3±0.1	EI		3288
$C_{14}H_{14}O^+$	$C_6H_5CH_2CH_2C_6H_4OH$ (1–(4–Hydroxyphenyl)–2–phenylethane)		8.3±0.1	EI		3288
$C_{14}H_{14}O^+$	$C_6H_5CH_2OC_6H_4CH_3$ (Benzyl 3–tolyl ether)		8.4	EI		2737
$C_{14}H_{14}O^+$	$C_6H_5CH_2OC_6H_4CH_3$ (Benzyl 4–tolyl ether)		8.2	EI		2737
$C_{15}H_8O^+$						
$C_{15}H_8O^+$	$C_{15}H_8N_2O$ (9–Diazo–4,5–methylene–10–oxophenanthrene)	N_2	8.6±0.2	EI		2995
$C_{15}H_{16}O^+$						
$C_{15}H_{16}O^+$	$C_6H_5CH_2CH_2C_6H_4OCH_3$ (1–(4–Methoxyphenyl)–2–phenylethane)		8.1±0.1	EI		3288

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_{16}H_{14}O^+$						
$C_{16}H_{14}O^+$	$C_{14}H_9OC_2H_5$ (1–Ethoxyanthracene)		7.52	EI		2706
$C_{16}H_{14}O^+$	$C_{14}H_9OC_2H_5$ (2–Ethoxyanthracene)		7.44	EI		2706
$C_{16}H_{14}O^+$	$C_{14}H_9OC_2H_5$ (9–Ethoxyanthracene)		7.44	EI		2706
$C_{16}H_{15}O^+$						
$C_{16}H_{15}O^+$	$C_6H_5C_6H_4(CH_2)_3COOCH_3$ (4–(4–Biphenylyl)butanoic acid methyl ester)	CH_3O	11.23±0.2	EI		2497
$C_{16}H_{16}O^+$						
$C_{16}H_{16}O^+$	$C_6H_5C_6H_4COC_3H_7$ (1–(4–Biphenylyl)–1–butanone)		8.44±0.2	EI		2534
$C_{17}H_{18}O^+$						
$C_{17}H_{18}O^+$	$C_6H_5CH_2C_6H_4COC_3H_7$ (1–(4–Benzylphenyl)–1–butanone)		8.69±0.2	EI		2567
CHO_2^+						
CHO_2^+	DCOOH	D	12.8±0.1	EI		2646
CHO_2^+	CH_3COOH	CH_3	12.27±0.05	RPD		3347
(Zero average translational energy of decomposition at threshold)						
CHO_2^+	CH_3COOH	CH_3	12.9±0.1	RPD		2576
See also – EI: 171						
CHO_2^+	CD_3COOH	CD_3	14.08	EI		171
CHO_2^+	$HCOOCH_3$	CH_3	15.9	EI		3224
CHO_2^+	C_2H_5COOH	C_2H_5	12.84	EI		3435
CHO_2^+	$HCOOCH_2CH_2CH_3$		12.34±0.04	EI		305
CDO_2^+						
CDO_2^+	DCOOH	H	12.4±0.1	EI		2646
CDO_2^+	$DCOOC_2H_5$	C_2H_5	12.15	EI		3435
$HCOOH^+$ $\Delta H^\circ_{f298} = 715$ kJ mol^{-1} (171 kcal mol^{-1})						
$CH_2O_2^+$	HCOOH		11.33	S	715	3434
$CH_2O_2^+$	HCOOH		11.05±0.01	PI		182, 416

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$CH_2O_2^+$	HCOOH		11.16±0.03	PI		2724
$CH_2O_2^+$	HCOOH		11.33	PE	715	2837

See also – PE: 3132
EI: 127, 2649, 3435

$CHDO_2^+$

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$CHDO_2^+$	DCOOH		11.57	EI		3435

$CH_3O_2^+$

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$CH_3O_2^+$	$HCOOC_2H_5$		11.3±0.1	EI		1100
$CH_3O_2^+$	$HCOOC_2H_5$		11.60±0.1	EI		210, 2709

See also – EI: 1059, 2778, 3224

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$CH_3O_2^+$	$HCOOCH_2CH_2CH_3$		11.0±0.1	EI		1100
$CH_3O_2^+$	$HCOOCH(CH_3)_2$		10.87±0.1	EI		210, 2709

$C_2H_2O_2^+$

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_2H_2O_2^+$	CHOCHO		9.48±0.08	EI		128

$C_2H_3O_2^+$

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_2H_3O_2^+$	$HCOOCH_3$	H	12.3	EI		3224
$C_2H_3O_2^+$	$HCOOC_2H_5$	CH_3	11.51±0.1	EI		1059
$C_2H_3O_2^+$	CH_3COOCH_3	CH_3	12.35±0.03	EI		3222

See also – EI: 305, 3176, 3224

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_2H_3O_2^+$	$CH_3COO(CH_2)_3CH_3$		12.33±0.12	EI		305
$C_2H_3O_2^+$	$(CH_3O)_2CO$	CH_3O	12.15±0.08	EI		3222
$C_2H_3O_2^+$	$CH_2(CN)COOCH_3$		11.72±0.03	EI		3222
$C_2H_3O_2^+$	$ClCOOCH_3$	Cl	11.78±0.05	EI		3222
$C_2H_3O_2^+$	$CH_2ClCOOCH_3$		11.50±0.05	EI		3222

CH_3COOH^+ ΔH°_{f0} = 581 kJ mol^{-1} (139 kcal mol^{-1})
$HCOOCH_3^+$ ΔH°_{f298} = 693 kJ mol^{-1} (166 kcal mol^{-1})

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_2H_4O_2^+$	$(HCHO)_2$		10.51±0.03	PI		1166
$C_2H_4O_2^+$	CH_3COOH		10.35±0.03	PI	580	416
$C_2H_4O_2^+$	CH_3COOH		10.37±0.03	PI	582	182

See also – EI: 171, 384, 2026, 2576, 2649

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_2H_4O_2^+$	$HCOOCH_3$		10.815±0.005	PI	693	182
See also – PI:	190					
EI:	210, 305, 411, 1100, 3224					
$C_2H_4O_2^+$	$CH_3COOC_2H_5$	C_2H_4	11.15±0.1	EI		1059
$C_2H_4O_2^+$	$CH_3COOCOCH_3$	$CH_2{=}CO$?	9.65±0.02	PI		3015
This threshold appears to be too low when compared to the $C_2H_4O_2^+$ parent ion thresholds.						
$C_2HD_3O_2^+$						
$C_2HD_3O_2^+$	CD_3COOH		10.71	EI		171
$C_2H_5O_2^+$						
$C_2H_5O_2^+$	$CH_3COOC_2H_5$		10.80±0.1	EI		1413, 2709
See also – EI:	1059, 1100, 3176, 3435					
$C_2H_5O_2^+$	$CH_3COOCH_2CH_2CH_3$		10.48±0.07	EI		305
See also – EI:	1100					
$C_2H_5O_2^+$	$CH_3COOCH(CH_3)_2$		10.42±0.1	EI		1413, 2709
See also – EI:	305					
$C_2H_5O_2^+$	$C_3H_6O_3$ (1,3,5–Trioxane)	CHO?	10.79±0.05	RPD		3324
$C_3H_4O_2^+$(3–Hydroxypropanoic acid lactone)			**ΔH°_{f298} = 653 kJ mol^{-1} (156 kcal mol^{-1})**			
$C_3H_4O_2^+$	CH_3COCHO		9.60±0.06	EI		128
$C_3H_4O_2^+$	$C_3H_4O_2$ (3–Hydroxypropanoic acid lactone)		9.70±0.01	PI	653	182
$C_3H_5O_2^+$						
$C_3H_5O_2^+$	C_2H_5COOH	H	11.70	EI		3435
$C_3H_5O_2^+$	$HCOOC_2H_5$	H	11.05±0.1	EI		1059
$C_3H_5O_2^+$	$C_3H_6O_2$ (1,3–Dioxolane)	H	10.38	EI		2422
$C_3H_5O_2^+$	$CH_3COOC_2H_5$	CH_3	10.95±0.1	EI		1059
$C_3H_5O_2^+$	$CH_3COOCH_2CH_2CH_3$	C_2H_5	11.29±0.04	EI		305
$C_3H_5O_2^+$	$CH_3COO(CH_2)_3CH_3$		11.70±0.05	EI		305
$C_3H_5O_2^+$	$C_4H_8O_3$ (1,3,5–Trioxepane)	CH_3O	11	EI		2422

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_3H_4DO_2^+$						
$C_3H_4DO_2^+$	$HCOOCD_2CH_3$	D	11.05±0.1	EI		1059
$C_3H_3D_2O_2^+$						
$C_3H_3D_2O_2^+$	$HCOOCD_2CH_3$	H	10.97±0.1	EI		1059
	$C_2H_5COOH^+$ **$HCOOC_2H_5^+$** **$CH_3COOCH_3^+$**	**$\Delta H^\circ_{f298} = 534$ kJ mol^{-1} (128 kcal mol^{-1})** **$\Delta H^\circ_{f298} = 652$ kJ mol^{-1} (156 kcal mol^{-1})** **$\Delta H^\circ_{f298} = 581$ kJ mol^{-1} (139 kcal mol^{-1})**				
$C_3H_6O_2^+$	C_2H_5COOH		10.24±0.03	PI	534	182
See also – EI:	2522					
$C_3H_6O_2^+$	$HCOOC_2H_5$		10.61±0.01	PI	652	182
See also – PI: EI:	190 210, 305, 1059, 1100, 3224					
$C_3H_6O_2^+$	CH_3COOCH_3		10.27±0.02	PI	581	182
See also – EI:	305, 1100, 2025, 2026, 2649, 3176, 3224					
$C_3H_6O_2^+$	$C_3H_6O_2$ (1,3–Dioxolane)		10.02	EI		2422
$C_3H_6O_2^+$	$n\text{-}C_3H_7COOCH_3$	C_2H_4	10.97±0.2	EI		2497
$C_3H_6O_2^+$	$C_5H_{10}O_2$ (1,3–Dioxepane)	C_2H_4	10.0	EI		2694
$C_3H_6O_2^+$	$n\text{-}C_4H_9COOCH_3$	C_3H_6	10.95±0.2	EI		2497
$C_3H_6O_2^+$	$C_6H_5(CH_2)_3COOCH_3$ (4–Phenylbutanoic acid methyl ester)		11.48±0.2	EI		2497
$C_3H_6O_2^+$	$C_6H_4(CH_3)(CH_2)_3COOCH_3$ (4–(4–Tolyl)butanoic acid methyl ester)		11.50±0.2	EI		2497
$C_3H_6O_2^+$	$C_6H_5C_6H_4(CH_2)_3COOCH_3$ (4–(4–Biphenylyl)butanoic acid methyl ester)		11.49±0.2	EI		2497
$C_3H_6O_2^+$	$CH_3CO(CH_2)_3COOCH_3$		11.50±0.2	EI		2497
$C_3H_6O_2^+$	$C_6H_5OC_6H_4(CH_2)_3COOCH_3$ (4–(4–Phenoxyphenyl)butanoic acid methyl ester)		11.20±0.2	EI		2497
$C_3H_6O_2^+$	$CH_3OCO(CH_2)_3COOCH_3$		11.59±0.2	EI		2497
$C_3H_6O_2^+$	$C_6H_4(CN)(CH_2)_3COOCH_3$ (4–(4–Cyanophenyl)butanoic acid methyl ester)		11.08±0.2	EI		2497
$C_3H_6O_2^+$	$C_6H_4(NO_2)(CH_2)_3COOCH_3$ (4–(4–Nitrophenyl)butanoic acid methyl ester)		11.07±0.2	EI		2497
$C_3H_6O_2^+$	$C_6H_4F(CH_2)_3COOCH_3$ (4–(4–Fluorophenyl)butanoic acid methyl ester)		11.34±0.2	EI		2497
$C_3H_4D_2O_2^+$						
$C_3H_4D_2O_2^+$	$HCOOCD_2CH_3$		10.75±0.1	EI		1059

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_3H_7O_2^+$				
$C_3H_7O_2^+$	$(CH_3O)_2CH_2$	H	10.38±0.03	RPD		1139
$C_3H_7O_2^+$	$(CH_3O)_2CHCH_3$	CH_3	10.34±0.07	RPD		1139
$C_3H_7O_2^+$	$C_2H_5COOC_2H_5$		10.4±0.1	EI		1100
See also – EI:	1059, 1413, 2709					
$C_3H_7O_2^+$	$C_2H_5COOCH(CH_3)_2$		10.40±0.1	EI		1413, 2709
$C_3H_7O_2^+$	$C_4H_8O_3$ (1,3,5–Trioxepane)	CHO?	9.98	EI		2422
$C_3H_7O_2^+$	$(CH_3O)_3CH$	CH_3O	10.36±0.06	RPD		1139
	$(CH_3O)_2CH_2^+$	**$\Delta H^\circ_{f298} \sim 616$ kJ mol^{-1} (147 kcal mol^{-1})**				
$C_3H_8O_2^+$	$(CH_3O)_2CH_2$		10.00±0.05	PI	616	182
	$C_4H_5O_2^+$	**$\Delta H^\circ_{f298} \sim 467$ kJ mol^{-1} (112 kcal mol^{-1})**				
$C_4H_5O_2^+$	$CH_3COCH_2COCH_3$	CH_3	10.24	PI	467	3015
$C_4H_5O_2^+$	$CH_3COCH_2COCH_3$	CH_3	10.7±0.1	EI		2731, 2959
$C_4H_5O_2^+$	$CF_3COCH_2COCH_3$	CF_3	10.6±0.2	EI		2959
	$CH_3COCOCH_3^+$ **$CH_3COOCH{=}CH_2^+$**	**$\Delta H^\circ_{f298} = 564$ kJ mol^{-1} (135 kcal mol^{-1})** **$\Delta H^\circ_{f298} \sim 571$ kJ mol^{-1} (136 kcal mol^{-1})**				
$C_4H_6O_2^+$	$CH_3COCOCH_3$		9.23±0.03	PI	563	182
$C_4H_6O_2^+$	$CH_3COCOCH_3$		9.25±0.03	PI	565	416
See also – EI:	128					
$C_4H_6O_2^+$	$CH_3COOCH{=}CH_2$		9.19±0.05?	PI	571	182
		$C_4H_7O_2^+$				
$C_4H_7O_2^+$	$C_4H_8O_2$ (1,3–Dioxane)	H	10.42	EI		2422
$C_4H_7O_2^+$	$C_4H_8O_2$ (1,4–Dioxane)	H	10.95	EI		2422
$C_4H_7O_2^+$	$CH_3COOCH(CH_3)_2$	CH_3	11.34±0.07	EI		305

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
	n-$C_3H_7COOH^+$	**$\Delta H^\circ_{f298} \sim 510$ kJ mol^{-1} (122 kcal mol^{-1})**				
	$CH_3COOC_2H_5^+$	**$\Delta H^\circ_{f298} = 532$ kJ mol^{-1} (127 kcal mol^{-1})**				
	$C_4H_8O_2^+$ (1,4–Dioxane)	**$\Delta H^\circ_{f298} = 566$ kJ mol^{-1} (135 kcal mol^{-1})**				
$C_4H_8O_2^+$	n-C_3H_7COOH		10.16±0.05	PI	510	182
See also – EI:	2522					
$C_4H_8O_2^+$	iso-C_3H_7COOH		10.02±0.05	PI		182
$C_4H_8O_2^+$	$HCOOCH_2CH_2CH_3$		10.54±0.01	PI		182
$C_4H_8O_2^+$	$CH_3COOC_2H_5$		10.09±0.02	PI	531	416
$C_4H_8O_2^+$	$CH_3COOC_2H_5$		10.11±0.02	PI	533	182
See also – EI:	305, 1059, 1100, 2018, 2025, 3176, 3435					
$C_4H_8O_2^+$	$C_2H_5COOCH_3$		10.15±0.03	PI		182
See also – EI:	2522					
$C_4H_8O_2^+$	$C_4H_8O_2$ (1,3–Dioxane)		10.33	EI		2422
$C_4H_8O_2^+$	$C_4H_8O_2$ (1,4–Dioxane)		9.13±0.03	PI	566	182
See also – EI:	218, 2422					
$C_4H_8O_2^+$	$C_5H_{10}O_3$ (1,3,6–Trioxocane)	CH_2O	9.92	EI		2422
		$C_4H_9O_2^+$				
$C_4H_9O_2^+$	$(CH_3O)_3CCH_3$	CH_3O	10.37±0.02	RPD		1139
	$(CH_3O)_2CHCH_3^+$	**$\Delta H^\circ_{f298} = 541$ kJ mol^{-1} (129 kcal mol^{-1})**				
$C_4H_{10}O_2^+$	$(CH_3O)_2CHCH_3$		9.65±0.03	PI	541	182
	$C_5H_4O_2^+$ (Furfural)	**$\Delta H^\circ_{f298} = 738$ kJ mol^{-1} (176 kcal mol^{-1})**				
$C_5H_4O_2^+$	$C_5H_4O_2$ (Furfural)		9.21±0.01	PI	738	182
$C_5H_4O_2^+$	$C_5H_4O_2$ (Furfural)		9.22	PE	739	2843
See also – EI:	411					
	$CH_3COCH_2COCH_3^+$	**$\Delta H^\circ_{f298} \sim 475$ kJ mol^{-1} (114 kcal mol^{-1})**				
$C_5H_8O_2^+$	$CH_3COCH_2COCH_3$		8.87±0.03	PI	477	182
$C_5H_8O_2^+$	$CH_3COCH_2COCH_3$		8.82±0.02	PI	472	3015
See also – EI:	2460, 2731, 2959					

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_5H_9O_2^+$				
$C_5H_9O_2^+$	$C_5H_{10}O_2$ (1,3–Dioxepane)	H	10.04	EI		2694
$C_5H_9O_2^+$	$(CH_3)_2C(OH)CH_2COCH_3$	CH_3	9.50±0.07	PI		3015
	$CH_3COOCH(CH_3)_2^+$	**$\Delta H^\circ_{f298} = 482$ kJ mol^{-1} (115 kcal mol^{-1})**				
	$C_2H_5COOC_2H_5^+$	**$\Delta H^\circ_{f298} = 539$ kJ mol^{-1} (129 kcal mol^{-1})**				
$C_5H_{10}O_2^+$	$HCOO(CH_2)_3CH_3$		10.50±0.02	PI		182
$C_5H_{10}O_2^+$	$HCOOCH_2CH(CH_3)_2$		10.46±0.02	PI		182
$C_5H_{10}O_2^+$	$CH_3COOCH_2CH_2CH_3$		10.04±0.03	PI		182
$C_5H_{10}O_2^+$	$CH_3COOCH(CH_3)_2$		9.99±0.03	PI	482	182
$C_5H_{10}O_2^+$	$C_2H_5COOC_2H_5$		10.00±0.02	PI	539	182
See also – EI:	1100					
$C_5H_{10}O_2^+$	n–$C_3H_7COOCH_3$		10.07±0.03	PI		182
See also – EI:	2496, 2497, 2522					
$C_5H_{10}O_2^+$	iso–$C_3H_7COOCH_3$		9.98±0.02	PI		182
$C_5H_{10}O_2^+$	$C_5H_{10}O_2$ (1,3–Dioxepane)		9.45	EI		2694
		$C_5H_{11}O_2^+$				
$C_5H_{11}O_2^+$	$C_5H_{11}O_2$ (Pentyl peroxy radical)		7.9±0.2	EI		2464
$C_5H_{11}O_2^+$	n–$C_5H_{11}OOH$	H	10.3±0.1	EI		2464
$C_5H_{11}O_2^+$	n–$C_3H_7CH(OOH)CH_3$	H	10.1±0.1	EI		2464
$C_5H_{11}O_2^+$	$(C_2H_5)_2CHOOH$	H	10.8±0.1	EI		2464
		$C_5H_{12}O_2^+$				
$C_5H_{12}O_2^+$	$(C_2H_5O)_2CH_2$		9.70±0.05	PI		182
	$C_6H_4O_2^+$ (1,4–Benzoquinone)	**$\Delta H^\circ_{f298} = 815$ kJ mol^{-1} (195 kcal mol^{-1})**				
$C_6H_4O_2^+$	$C_6H_4O_2$ (1,4–Benzoquinone)		9.67±0.02	PI	815	1166
$C_6H_4O_2^+$	$C_6H_4O_2$ (1,4–Benzoquinone)		9.95	PE		2843
		$C_6H_5O_2^+$				
$C_6H_5O_2^+$	$C_6H_4(OH)OCH_3$ (3–Methoxyphenol)	CH_3	11.92±0.1	EI		2970
$C_6H_5O_2^+$	$C_6H_4(OH)OCH_3$ (4–Methoxyphenol)	CH_3	11.01±0.1	EI		2970

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_6H_6O_2^+$				
$C_6H_6O_2^+$	$C_6H_4(OH)OC_2H_5$ (3–Ethoxyphenol)	C_2H_4	11.03±0.15	EI		2945
$C_6H_6O_2^+$	$C_6H_4(OH)OC_2H_5$ (4–Ethoxyphenol)	C_2H_4	10.84±0.15	EI		2945
		$C_6H_8O_2^+$				
$C_6H_8O_2^+$	$CH_3CO(CH_2)_3COOCH_3$	CH_3OH	9.75±0.2	EI		2497
		$C_6H_9O_2^+$				
$C_6H_9O_2^+$	$CH_3CO(CH_2)_3COOCH_3$	CH_3O	11.05±0.3	EI		2496
See also – EI:	2497					
	$CH_3COO(CH_2)_3CH_3^+$	**ΔH°_{f298} = 437 kJ mol^{-1} (104 kcal mol^{-1})**				
$C_6H_{12}O_2^+$	$CH_3COO(CH_2)_3CH_3$		9.56±0.03	PI	437	1166
$C_6H_{12}O_2^+$	$CH_3COO(CH_2)_3CH_3$		10.01?	PI		182
$C_6H_{12}O_2^+$	$CH_3COOCH_2CH(CH_3)_2$		9.97?	PI		182
$C_6H_{12}O_2^+$	$CH_3COOCH(CH_3)C_2H_5$		9.91±0.03	PI		182
$C_6H_{12}O_2^+$	n–$C_4H_9COOCH_3$		10.40±0.2	EI		2497
		$C_6H_{13}O_2^+$				
$C_6H_{13}O_2^+$	n–$C_6H_{13}OOH$	H	10.8±0.1	EI		2464
$C_6H_{13}O_2^+$	n–$C_4H_9CH(OOH)CH_3$	H	9.6±0.1	EI		2464
$C_6H_{13}O_2^+$	n–$C_3H_7CH(OOH)C_2H_5$	H	9.6±0.1	EI		2464
		$C_7H_5O_2^+$				
$C_7H_5O_2^+$	$C_6H_4(OH)COCH_3$ (4–Hydroxyacetophenone)	CH_3	9.84	EI		3334
$C_7H_5O_2^+$	$C_6H_4(OH)COCH_3$ (4–Hydroxyacetophenone)	CH_3	10.42	EI		3238
$C_7H_5O_2^+$	$C_6H_5CH_2OC_6H_4CHO$ (Benzyl 3–formylphenyl ether)		11.5	EI		2737
$C_7H_5O_2^+$	$C_6H_5CH_2OC_6H_4CHO$ (Benzyl 4–formylphenyl ether)		11.1	EI		2737

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_7H_6O_2^+$				
$C_7H_6O_2^+$	C_6H_5COOH (Benzoic acid)		9.73±0.09	EI		2026
$C_7H_6O_2^+$	$C_6H_4(OH)CHO$ (4–Hydroxybenzenecarbonal)		9.32±0.02	EI		2026
$C_7H_6O_2^+$	$C_7H_6O_2$ (2–Hydroxy–2,4,6–cycloheptatrien–1–one)		9.86±0.02	EI		431
		$C_7H_7O_2^+$				
$C_7H_7O_2^+$	$C_6H_4(OCH_3)_2$ (1,3–Dimethoxybenzene)	CH_3	11.57±0.1	EI		2970
$C_7H_7O_2^+$	$C_6H_4(OCH_3)_2$ (1,4–Dimethoxybenzene)	CH_3	10.37±0.1	EI		2970
$C_7H_7O_2^+$	$C_6H_5CH_2OC_6H_4OCH_3$ (Benzyl 3–methoxyphenyl ether)		10.4	EI		2737
$C_7H_7O_2^+$	$C_6H_5CH_2OC_6H_4OCH_3$ (Benzyl 4–methoxyphenyl ether)		10.6	EI		2737
		$C_7H_8O_2^+$				
$C_7H_8O_2^+$	$C_6H_4(OCH_3)OC_2H_5$ (1–Ethoxy–3–methoxybenzene)	C_2H_4	10.87±0.15	EI		2945
$C_7H_8O_2^+$	$C_6H_4(OCH_3)OC_2H_5$ (1–Ethoxy–4–methoxybenzene)	C_2H_4	10.52±0.15	EI		2945
		$C_7H_{15}O_2^+$				
$C_7H_{15}O_2^+$	$C_7H_{15}O_2$ (Heptyl peroxy radical)		8.3±0.2	EI		2464
$C_7H_{15}O_2^+$	n–$C_7H_{15}OOH$	H	11.1±0.1	EI		2464
$C_7H_{15}O_2^+$	n–$C_5H_{11}CH(OOH)CH_3$	H	10.7±0.1	EI		2464
		$C_8H_6O_2^+$				
$C_8H_6O_2^+$	$C_6H_4(CHO)_2$ (1,4–Benzenedicarboxaldehyde)		10.13±0.01	EI		2718
$C_8H_6O_2^+$	$C_9H_6O_3$ (7–Hydroxycoumarin)	CO	10.6	EI		2946

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
			$C_8H_7O_2^+$			
$C_8H_7O_2^+$	$C_6H_4(OCH_3)COCH_3$ (3–Methoxyacetophenone)	CH_3	10.67±0.1	EI		2967
$C_8H_7O_2^+$	$C_6H_4(OCH_3)COCH_3$ (4–Methoxyacetophenone)	CH_3	10.19±0.1	EI		2967
See also – EI:	3238					
			$C_8H_8O_2^+$			
$C_8H_8O_2^+$	$C_6H_4(OCH_3)CHO$ (4–Methoxybenzenecarbonal)		8.87 (V)	PE		2806
$C_8H_8O_2^+$	$C_6H_4(OCH_3)CHO$ (4–Methoxybenzenecarbonal)		8.60±0.03	EI		2026
$C_8H_8O_2^+$	$C_6H_5COCH_2OH$ (α–Hydroxyacetophenone)		9.33±0.05	EI		2025
$C_8H_8O_2^+$	$C_6H_4(OH)COCH_3$ (3–Hydroxyacetophenone)		8.67±0.05	EI		2025
$C_8H_8O_2^+$	$C_6H_4(OH)COCH_3$ (4–Hydroxyacetophenone)		8.70±0.03	EI		2026
See also – EI:	3238, 3334					
$C_8H_8O_2^+$	$C_6H_5COOCH_3$ (Benzoic acid methyl ester)		9.35±0.06	EI		2026
See also – EI:	308, 3238					
			$C_8H_{10}O_2^+$			
$C_8H_{10}O_2^+$	$C_6H_4(OH)OC_2H_5$ (3–Ethoxyphenol)		8.49±0.15	EI		2945
$C_8H_{10}O_2^+$	$C_6H_4(OH)OC_2H_5$ (4–Ethoxyphenol)		8.25±0.15	EI		2945
$C_8H_{10}O_2^+$	$C_6H_4(OCH_3)_2$ (1,2–Dimethoxybenzene)		7.8±0.15	CTS		3373
$C_8H_{10}O_2^+$	$C_6H_4(OCH_3)_2$ (1,3–Dimethoxybenzene)		8.0±0.15	CTS		3373
$C_8H_{10}O_2^+$	$C_6H_4(OCH_3)_2$ (1,4–Dimethoxybenzene)		7.90 (V)	PE		2806
$C_8H_{10}O_2^+$	$C_6H_4(OCH_3)_2$ (1,4–Dimethoxybenzene)		7.7±0.15	CTS		3373
See also – CTS:	3367					

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
			$C_9H_{10}O_2^+$			
$C_9H_{10}O_2^+$	$C_6H_5COCH_2OCH_3$ (α–Methoxyacetophenone)		8.60±0.05	EI		2025
$C_9H_{10}O_2^+$	$C_6H_4(OCH_3)COCH_3$ (3–Methoxyacetophenone)		8.53±0.05	EI		2025
See also – EI:	2967					
$C_9H_{10}O_2^+$	$C_6H_4(OCH_3)COCH_3$ (4–Methoxyacetophenone)		8.62±0.05	EI		2026
See also – EI:	2967, 3238, 3334					
$C_9H_{10}O_2^+$	$C_6H_5CH_2CH_2COOH$ (3–Phenylpropanoic acid)		8.95±0.1	EI		2522
$C_9H_{10}O_2^+$	$C_6H_4(CH_3)COOCH_3$ (2–Methylbenzoic acid methyl ester)		8.5	EI		3231
$C_9H_{10}O_2^+$	$C_6H_4(CH_3)COOCH_3$ (4–Methylbenzoic acid methyl ester)		8.94±0.04	EI		2026
			$C_9H_{12}O_2^+$			
$C_9H_{12}O_2^+$	$C_6H_4(OCH_3)OC_2H_5$ (1–Ethoxy–3–methoxybenzene)		8.24±0.15	EI		2945
$C_9H_{12}O_2^+$	$C_6H_4(OCH_3)OC_2H_5$ (1–Ethoxy–4–methoxybenzene)		8.03±0.15	EI		2945
			$C_{10}H_{11}O_2^+$			
$C_{10}H_{11}O_2^+$	$C_6H_4(OH)(CH_2)_3COOCH_3$ (4–(4–Hydroxyphenyl)butanoic acid methyl ester)	CH_3O	11.16±0.2	EI		2497
			$C_{10}H_{12}O_2^+$			
$C_{10}H_{12}O_2^+$	$C_6H_4(OH)COC_3H_7$ (1–(4–Hydroxyphenyl)–1–butanone)		8.65±0.2	EI		2534
$C_{10}H_{12}O_2^+$	$C_6H_5(CH_2)_3COOH$ (4–Phenylbutanoic acid)		9.00±0.1	EI		2522
$C_{10}H_{12}O_2^+$	$C_6H_5CH_2CH_2COOCH_3$ (3–Phenylpropanoic acid methyl ester)		9.05±0.1	EI		2522
			$C_{11}H_{13}O_2^+$			
$C_{11}H_{13}O_2^+$	$C_6H_4(C_4H_9)COOCH_3$ (4–*tert*–Butylbenzoic acid methyl ester)	CH_3	10.10	EI		3238
$C_{11}H_{13}O_2^+$	$C_6H_4(OCH_3)(CH_2)_3COOCH_3$ (4–(4–Methoxyphenyl)butanoic acid methyl ester)	CH_3O	11.10±0.5	EI		2496
See also – EI:	2497					

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_{11}H_{14}O_2^+$						
$C_{11}H_{14}O_2^+$	$C_6H_4(OCH_3)COC_3H_7$ (1–(4–Methoxyphenyl)–1–butanone)		8.33±0.2	EI		2534
$C_{11}H_{14}O_2^+$	$C_6H_5CH(CH_3)CH_2COOCH_3$ (3–Phenylbutanoic acid methyl ester)		8.70±0.2	EI		2497
$C_{11}H_{14}O_2^+$	$C_6H_5(CH_2)_3COOCH_3$ (4–Phenylbutanoic acid methyl ester)		8.57±0.3	EI		2496
See also – EI:	2497, 2522					
$C_{12}H_8O_2^+$						
$C_{12}H_8O_2^+$	$C_{12}H_8O_2$ (Diphenylene dioxide)		8.10±0.03	RPD		2538
$C_{12}H_8O_2^+$	$C_{12}H_8O_2$ (Diphenylene dioxide)		7.7	CTS		3300
$C_{12}H_{16}O_2^+$						
$C_{12}H_{16}O_2^+$	$C_6H_4(C_4H_9)COOCH_3$ (4–*tert*–Butylbenzoic acid methyl ester)		9.38	EI		3238
$C_{12}H_{16}O_2^+$	$C_6H_4(CH_3)CH(CH_3)CH_2COOCH_3$ (3–(4–Tolyl)butanoic acid methyl ester)		8.22±0.2	EI		2497
$C_{12}H_{16}O_2^+$	$C_6H_4(CH_3)(CH_2)_3COOCH_3$ (4–(4–Tolyl)butanoic acid methyl ester)		8.51±0.2	EI		2497
$C_{13}H_{10}O_2^+$						
$C_{13}H_{10}O_2^+$	$C_6H_5COC_6H_4OH$ (4–Hydroxybenzophenone)		8.59±0.05	EI		2026
$C_{13}H_{10}O_2^+$	$C_6H_5COOC_6H_5$ (Benzoic acid phenyl ester)		8.98±0.05	EI		1237
$C_{13}H_{12}O_2^+$						
$C_{13}H_{12}O_2^+$	$C_6H_5CH_2OC_6H_4OH$ (Benzyl 3–hydroxyphenyl ether)		8.4	EI		2737
$C_{13}H_{12}O_2^+$	$C_6H_5CH_2OC_6H_4OH$ (Benzyl 4–hydroxyphenyl ether)		8.2	EI		2737
$C_{14}H_{10}O_2^+$						
$C_{14}H_{10}O_2^+$	$C_6H_5COCOC_6H_5$ (Diphenylglyoxal)		8.78±0.05	EI		1237

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_{14}H_{12}O_2^+$				
$C_{14}H_{12}O_2^+$	$C_6H_5CH_2OC_6H_4CHO$ (Benzyl 3–formylphenyl ether)		8.6	EI		2737
$C_{14}H_{12}O_2^+$	$C_6H_5CH_2OC_6H_4CHO$ (Benzyl 4–formylphenyl ether)		8.7	EI		2737
		$C_{14}H_{14}O_2^+$				
$C_{14}H_{14}O_2^+$	$C_6H_5CH_2OC_6H_4OCH_3$ (Benzyl 3–methoxyphenyl ether)		8.3	EI		2737
$C_{14}H_{14}O_2^+$	$C_6H_5CH_2OC_6H_4OCH_3$ (Benzyl 4–methoxyphenyl ether)		8.0	EI		2737
		$C_{16}H_{15}O_2^+$				
$C_{16}H_{15}O_2^+$	$C_6H_5OC_6H_4(CH_2)_3COOCH_3$ (4–(4–Phenoxyphenyl)butanoic acid methyl ester)	CH_3O	11.17±0.2	EI		2497
		$C_{16}H_{16}O_2^+$				
$C_{16}H_{16}O_2^+$	$C_6H_5OC_6H_4COC_3H_7$ (1–(4–Phenoxyphenyl)–1–butanone)		8.55±0.2	EI		2534
		$C_{17}H_{18}O_2^+$				
$C_{17}H_{18}O_2^+$	$C_6H_5C_6H_4CH(CH_3)CH_2COOCH_3$ (3–(4–Biphenylyl)butanoic acid methyl ester)		8.00±0.2	EI		2497
$C_{17}H_{18}O_2^+$	$C_6H_5C_6H_4(CH_2)_3COOCH_3$ (4–(4–Biphenylyl)butanoic acid methyl ester)		8.27±0.2	EI		2497
		$C_{22}H_{26}O_2^+$				
$C_{22}H_{26}O_2^+$	$C_6H_4(COC_3H_7)CH_2CH_2C_6H_4COC_3H_7$ (1,2–Bis(4–butyrylphenyl)ethane)		8.91±0.2	EI		2567
	$C_3H_3O_3^+$	**$\Delta H^\circ_{f298} \sim 260$ kJ mol^{-1} (62 kcal mol^{-1})**				
$C_3H_3O_3^+$	$CH_3COOCOCH_3$	CH_3	10.14±0.02	PI	260	3015
		$C_3H_5O_3^+$				
$C_3H_5O_3^+$	$C_3H_6O_3$ (1,3,5–Trioxane)	H	10.59±0.05	RPD		3324

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_3H_6O_3^+$				
$C_3H_6O_3^+$	$C_3H_6O_3$ (1,3,5–Trioxane)		10.59±0.05	RPD		3324
		$C_4H_8O_3^+$				
$C_4H_8O_3^+$	$CH_3OCH_2COOCH_3$		9.56±0.05	EI		2025
$C_4H_8O_3^+$	$C_4H_8O_3$ (1,3,5–Trioxepane)		9.62	EI		2422
		$C_4H_9O_3^+$				
$C_4H_9O_3^+$	$(CH_3O)_3CH$	H	10.39±0.05	RPD		1139
$C_4H_9O_3^+$	$(CH_3O)_3CCH_3$	CH_3	10.39±0.10	RPD		1139
$C_4H_9O_3^+$	$(CH_3O)_4C$	CH_3O	10.32±0.10	RPD		1139
		$C_5H_{10}O_3^+$				
$C_5H_{10}O_3^+$	$C_5H_{10}O_3$ (1,3,6–Trioxocane)		9.23	EI		2422
		$C_6H_8O_3^+$				
$C_6H_8O_3^+$	$CH_3OCO(CH_2)_3COOCH_3$	CH_3OH	9.71±0.2	EI		2497
		$C_6H_9O_3^+$				
$C_6H_9O_3^+$	$CH_3OCO(CH_2)_3COOCH_3$	CH_3O	11.05±0.3	EI		2496
See also – EI:	2497					
		$C_7H_{12}O_3^+$				
$C_7H_{12}O_3^+$	$CH_3CO(CH_2)_3COOCH_3$		9.63±0.2	EI		2497
See also – EI:	2496					
		$C_8H_8O_3^+$				
$C_8H_8O_3^+$	$C_6H_4(OH)COOCH_3$ (2–Hydroxybenzoic acid methyl ester)		7.65	EI		3231

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_9H_{10}O_3^+$						
$C_9H_{10}O_3^+$	$C_6H_4(OCH_3)COOCH_3$ (4–Methoxybenzoic acid methyl ester)		8.43±0.04	EI		2026
$C_9H_{12}O_3^+$						
$C_9H_{12}O_3^+$	$C_6H_3(OCH_3)_3$ (1,2,3–Trimethoxybenzene)		8.2±0.15	CTS		3373
$C_9H_{12}O_3^+$	$C_6H_3(OCH_3)_3$ (1,2,4–Trimethoxybenzene)		7.49	CTS		3367
$C_9H_{12}O_3^+$	$C_6H_3(OCH_3)_3$ (1,2,4–Trimethoxybenzene)		7.5±0.15	CTS		3373
$C_9H_{12}O_3^+$	$C_6H_3(OCH_3)_3$ (1,3,5–Trimethoxybenzene)		7.96	CTS		3367
$C_{11}H_{14}O_3^+$						
$C_{11}H_{14}O_3^+$	$C_6H_4(OH)(CH_2)_3COOCH_3$ (4–(4–Hydroxyphenyl)butanoic acid methyl ester)		8.45±0.2	EI		2497
$C_{12}H_{16}O_3^+$						
$C_{12}H_{16}O_3^+$	$C_6H_4(OCH_3)CH(CH_3)CH_2COOCH_3$ (3–(4–Methoxyphenyl)butanoic acid methyl ester)		7.69±0.2	EI		2497
$C_{12}H_{16}O_3^+$	$C_6H_4(OCH_3)(CH_2)_3COOCH_3$ (4–(4–Methoxyphenyl)butanoic acid methyl ester)		7.8±0.5	EI		2496
See also – EI:	2497					
$C_{13}H_{10}O_3^+$						
$C_{13}H_{10}O_3^+$	$(C_6H_5O)_2CO$ (Carbonic acid diphenyl ester)		9.01±0.05	EI		1237
$C_{14}H_6O_3^+$						
$C_{14}H_6O_3^+$	$C_{16}H_6O_6$ (3,3′,4,4′–Biphenyltetracarboxylic acid dianhydride)	CO_2+CO	14.36	EI		3295
$C_{17}H_{18}O_3^+$						
$C_{17}H_{18}O_3^+$	$C_6H_5OC_6H_4(CH_2)_3COOCH_3$ (4–(4–Phenoxyphenyl)butanoic acid methyl ester)		7.94±0.2	EI		2497

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol⁻¹)	Ref.
$C_{10}H_{10}O_4^+$						
$C_{10}H_{10}O_4^+$	$C_6H_4(COOCH_3)_2$ (1,2–Benzenedicarboxylic acid dimethyl ester)		9.64±0.07	EI		2718
$C_{10}H_{10}O_4^+$	$C_6H_4(COOCH_3)_2$ (1,3–Benzenedicarboxylic acid dimethyl ester)		9.84±0.09	EI		2718
$C_{10}H_{10}O_4^+$	$C_6H_4(COOCH_3)_2$ (1,4–Benzenedicarboxylic acid dimethyl ester)		9.78±0.03	EI		2718
$C_{10}H_{14}O_4^+$						
$C_{10}H_{14}O_4^+$	$C_6H_2(OCH_3)_4$ (1,2,4,5–Tetramethoxybenzene)		7.25	CTS		3367
$C_{14}H_{10}O_4^+$						
$C_{14}H_{10}O_4^+$	$C_6H_5OCOCOOC_6H_5$ (Oxalic acid diphenyl ester)		7.94	CTS		2562
$C_{15}H_6O_4^+$						
$C_{15}H_6O_4^+$	$C_{16}H_6O_6$ (3,3′,4,4′–Biphenyltetracarboxylic acid dianhydride)	CO_2	11.36	EI		3295
$C_6H_{11}O_5^+$						
$C_6H_{11}O_5^+$	$C_7H_{14}O_6$ (α–Methyl–(D)–glucoside)	CH_3O	12.9±0.16	EI		2036
$C_6H_{11}O_5^+$	$C_7H_{14}O_6$ (β–Methyl–(D)–glucoside)	CH_3O	13.5±0.16	EI		2036
$C_{16}H_6O_6^+$						
$C_{16}H_6O_6^+$	$C_{16}H_6O_6$ (3,3′,4,4′–Biphenyltetracarboxylic acid dianhydride)		9.80	EI		3295
DNO^+						
DNO^+	DNO		10.29±0.14	EI		2510
HNO_3^+						
HNO_3^+	HNO_3		11.03±0.01?	PI		1253

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
CNO^+						
CNO^+	HNCO	H	<16.1	EI		2797, 3012
CNO^+	HNCO	H	16.66±0.15	EI		3365
CH_3BO^+						
CH_3BO^+	BH_3CO		11.92±0.02 (V)	PE		3044
$CH_5B_3O^+$						
$CH_5B_3O^+$	B_4H_8CO	BH_3	11.5±0.5	EI		3226
$CH_6B_4O^+$						
$CH_6B_4O^+$	B_4H_8CO	H_2	10.3±0.3	EI		3226
$CH_7B_4O^+$						
$CH_7B_4O^+$	B_4H_8CO	H	10.5±0.5	EI		3226
$CH_8B_4O^+$						
$CH_8B_4O^+$	B_4H_8CO		10.2±0.5	EI		3226
$C_2H_6BO^+$						
$C_2H_6BO^+$	$(CH_3O)_3B$		16.6±0.3	EI		115
$C_2H_5BO_2^+$						
$C_2H_5BO_2^+$	$(CH_3O)_3B$		13.2±0.2	EI		115
$C_2H_6BO_2^+$						
$C_2H_6BO_2^+$	$(CH_3O)_2BH$	H	9.0±0.2	EI		364
$C_2H_6BO_2^+$	$(CH_3O)_3B$	CH_3O	9.6±0.2	EI		364
$C_2H_6BO_2^+$	$(CH_3O)_3B$	CH_3O	13.0±0.2	EI		115
$C_2H_7BO_2^+$						
$C_2H_7BO_2^+$	$(CH_3O)_2BH$		9.7±1.0	EI		364

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_2H_6BO_3^+$						
$C_2H_6BO_3^+$	$(CH_3O)_3B$	CH_3	12.1±0.2	EI		115
$C_3H_9BO_3^+$						
$C_3H_9BO_3^+$	$(CH_3O)_3B$		8.9±0.2	EI		364
$C_3H_9BO_3^+$	$(CH_3O)_3B$		10.62	EI		3227
$C_3H_9BO_3^+$	$(CH_3O)_3B$		10.8±0.3	EI		115
$C_6H_{15}BO_3^+$						
$C_6H_{15}BO_3^+$	$(C_2H_5O)_3B$		10.13	EI		3227
$C_6H_{15}BO_3^+$	$(C_2H_5O)_3B$		10.47±0.12	EI		2702
$C_9H_{21}BO_3^+$						
$C_9H_{21}BO_3^+$	$(n\text{-}C_3H_7O)_3B$		10.02	EI		3227
$C_9H_{21}BO_3^+$	$(n\text{-}C_3H_7O)_3B$		10.62±0.15	EI		2702
$C_{12}H_{27}BO_3^+$						
$C_{12}H_{27}BO_3^+$	$(n\text{-}C_4H_9O)_3B$		10.72±0.74	EI		2702
$CHNO^+$						
$CHNO^+$	HNCO		11.60±0.01	PE		2797, 3012, 3067
See also – EI: 3365						
CH_2NO^+						
CH_2NO^+	C_2H_5NO	CH_3	10.55±0.2	EDD		3180
CH_2NO^+	$CH_3CH{=}NOH$	CH_3	13.0±0.2	EDD		3180
$HCONH_2^+$ $\Delta H^\circ_{f298} \sim 802$ kJ mol^{-1} (192 kcal mol^{-1})						
CH_3NO^+	CH_3NO		10.8±0.3	EI		2894
CH_3NO^+	$HCONH_2$		10.24	S	802	3108
CH_3NO^+	$HCONH_2$		10.25±0.02	PI	803	182
CH_3NO^+	$HCONH_2$		10.13	PE		2837
See also – CTS: 2562						

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_2H_3NO^+$						
$C_2H_3NO^+$	C_4H_7NO (4–Aminobutanoic acid lactam)	C_2H_4	10.7	PI		2728
$C_2H_4NO^+$						
$C_2H_4NO^+$	C_2H_5NO	H	11.2±0.2	EDD		3180
$C_2H_4NO^+$	$CH_3CH{=}NOH$	H	10.2±0.2	EDD		3180
$C_2H_5NO^+$						
$C_2H_5NO^+$	C_2H_5NO		10.3±0.2	EDD		3180
$C_2H_5NO^+$	$CH_3CH{=}NOH$		10.65±0.2	EDD		3180
$C_2H_5NO^+$	$HCONHCH_3$		9.79	PE		2837
$C_2H_5NO^+$	CH_3CONH_2		9.77±0.02	PI		182
See also – EI:	384, 2649					
$C_3H_3NO^+$						
$C_3H_3NO^+$	C_3H_3NO (Isoxazole)		9.99±0.05	PE		3246
See also – PE:	2975					
$HCON(CH_3)_2^+$ ΔH°_{f298} = 689 kJ mol^{-1} (165 kcal mol^{-1})						
$C_3H_7NO^+$	$HCON(CH_3)_2$		9.12±0.02	PI	688	182
$C_3H_7NO^+$	$HCON(CH_3)_2$		9.14	PE	690	2837
See also – CTS:	2562					
$C_3H_7NO^+$	$CH_3CONHCH_3$		8.90±0.02	PI		182
See also – EI:	2649					
$C_4H_6NO^+$						
$C_4H_6NO^+$	C_4H_7NO (4–Aminobutanoic acid lactam)	H	9.9	PI		2728
$C_4H_7NO^+$						
$C_4H_7NO^+$	C_4H_7NO (4–Aminobutanoic acid lactam)		9.32±0.02	PI		2728

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_4H_9NO^+$				
$C_4H_9NO^+$	$CH_3CON(CH_3)_2$		8.81±0.03	PI		182
$C_4H_9NO^+$	$CH_3CON(CH_3)_2$		8.81	CTS		2562
		$C_5H_5NO^+$				
$C_5H_5NO^+$	C_5H_4NOH (4–Hydroxypyridine)		9.70±0.05	EI		217
		$C_5H_9NO^+$				
$C_5H_9NO^+$	C_5H_9NO (5–Aminopentanoic acid lactam)		9.15±0.02	PI		2728
		$C_5H_{11}NO^+$				
$C_5H_{11}NO^+$	$HCON(C_2H_5)_2$		8.89±0.02	PI		182
		$C_6H_5NO^+$				
$C_6H_5NO^+$	C_6H_5NO (Nitrosobenzene)		8.87 (V)	PE		2806
$C_6H_5NO^+$	C_5H_4NCHO (2–Pyridinecarboxaldehyde)		9.75±0.05	EI		217
$C_6H_5NO^+$	C_5H_4NCHO (4–Pyridinecarboxaldehyde)		10.12±0.05	EI		217
		$C_6H_6NO^+$				
$C_6H_6NO^+$	$C_6H_4(NH_2)OCH_3$ (4–Methoxyaniline)	CH_3	9.67±0.1	EI		2970
See also – EI:	3238					
$C_6H_6NO^+$	$C_6H_5CH_2OC_6H_4NH_2$ (3–Aminophenyl benzyl ether)		10.1	EI		2737
$C_6H_6NO^+$	$C_6H_5CH_2OC_6H_4NH_2$ (4–Aminophenyl benzyl ether)		9.7	EI		2737
		$C_6H_7NO^+$				
$C_6H_7NO^+$	$C_6H_4(NH_2)OC_2H_5$ (3–Ethoxyaniline)	C_2H_4	10.71±0.15	EI		2945
$C_6H_7NO^+$	$C_6H_4(NH_2)OC_2H_5$ (4–Ethoxyaniline)	C_2H_4	10.43±0.15	EI		2945

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_6H_{11}NO^+$ (6–Aminohexanoic acid lactam) ΔH°_{f298} = 629 kJ mol^{-1} (150 kcal mol^{-1})						
$C_6H_{11}NO^+$	$C_6H_{11}NO$ (6–Aminohexanoic acid lactam)		9.07±0.02	PI	629	2728
$C_6H_{13}NO^+$						
$C_6H_{13}NO^+$	$CH_3CON(C_2H_5)_2$		8.60±0.02	PI		182
$C_7H_4NO^+$						
$C_7H_4NO^+$	$C_6H_4(CN)OCH_3$ (4–Methoxybenzoic acid nitrile)	CH_3	12.68±0.1	EI		2970
$C_7H_5NO^+$						
$C_7H_5NO^+$	C_6H_5NCO (Isocyanatobenzene)		8.77±0.02	PI		182
$C_7H_5NO^+$	$C_6H_4(CN)OH$ (3–Hydroxybenzoic acid nitrile)		9.39±0.05	RPD		3223
$C_7H_5NO^+$	$C_6H_4(CN)OH$ (4–Hydroxybenzoic acid nitrile)		9.40±0.05	RPD		3223
$C_7H_5NO^+$	$C_6H_4(CN)OC_2H_5$ (3–Ethoxybenzoic acid nitrile)	C_2H_4	11.31±0.15	EI		2945
$C_7H_5NO^+$	$C_6H_4(CN)OC_2H_5$ (4–Ethoxybenzoic acid nitrile)	C_2H_4	11.19±0.15	EI		2945
$C_7H_5NO^+$	$(C_6H_5)_2C_2N_2O$ (3,5–Diphenyl–1,2,4–oxadiazole)		10.8±0.1	EI		1125
$C_7H_6NO^+$						
$C_7H_6NO^+$	$C_6H_4(NH_2)COCH_3$ (3–Aminoacetophenone)	CH_3	11.01±0.2	EI		2967
$C_7H_6NO^+$	$C_6H_4(NH_2)COCH_3$ (4–Aminoacetophenone)	CH_3	9.34	EI		3334
$C_7H_6NO^+$	$C_6H_4(NH_2)COCH_3$ (4–Aminoacetophenone)	CH_3	10.20±0.2	EI		2967
See also – EI:	3238					
$C_7H_6NO^+$	$C_6H_4(NH_2)COOCH_3$ (4–Aminobenzoic acid methyl ester)	CH_3O	10.91	EI		3238

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
			$C_7H_7NO^+$			
$C_7H_7NO^+$	$C_6H_5CONH_2$ (Benzoic acid amide)		9.4±0.2	EI		1168
See also – EI:	1126					
$C_7H_7NO^+$	$C_6H_4(NH_2)CHO$ (4–Aminobenzenecarbonal)		8.25±0.02	EI		2026
$C_7H_7NO^+$	C_7H_7NO (2–Amino–2,4,6–cycloheptatrien–1–one)		9.43±0.02	EI		431
			$C_7H_9NO^+$			
$C_7H_9NO^+$	$C_6H_4(NH_2)OCH_3$ (2–Methoxyaniline)		7.46±0.1	CTS		2485
$C_7H_9NO^+$	$C_6H_4(NH_2)OCH_3$ (4–Methoxyaniline)		7.82	EI		1066
$C_7H_9NO^+$	$C_6H_4(NH_2)OCH_3$ (4–Methoxyaniline)		7.41±0.1	CTS		2485
$C_7H_9NO^+$	$C_6H_4(OCH_3)NHCOCH_3$ (*N*–(3–Methoxyphenyl)acetic acid amide)		10.68±0.2	EI		3406
$C_7H_9NO^+$	$C_6H_4(OCH_3)NHCOCH_3$ (*N*–(4–Methoxyphenyl)acetic acid amide)		10.68±0.2	EI		3406
			$C_8H_4NO^+$			
$C_8H_4NO^+$	$C_6H_4(CN)COOCH_3$ (4–Cyanobenzoic acid methyl ester)	CH_3O	11.60	EI		3238
			$C_8H_7NO^+$			
$C_8H_7NO^+$	$C_6H_4(CN)OCH_3$ (3–Methoxybenzoic acid nitrile)		9.05±0.04	RPD		3223
$C_8H_7NO^+$	$C_6H_4(CN)OCH_3$ (4–Methoxybenzoic acid nitrile)		9.08±0.05	RPD		3223
$C_8H_7NO^+$	$C_6H_4(OH)CH_2CN$ (4–Hydroxyphenylacetic acid nitrile)		9.01±0.05	RPD		3223
			$C_8H_9NO^+$			
$C_8H_9NO^+$	$C_6H_5NHCOCH_3$ (*N*–Phenylacetic acid amide)		8.39±0.10	EI		1126
See also – EI:	3406					

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_8H_9NO^+$	$C_6H_4(NH_2)COCH_3$ (3–Aminoacetophenone)		8.09±0.05	EI		2025
$C_8H_9NO^+$	$C_6H_4(NH_2)COCH_3$ (3–Aminoacetophenone)		8.56±0.2	EI		2967
$C_8H_9NO^+$	$C_6H_4(NH_2)COCH_3$ (4–Aminoacetophenone)		8.17±0.02	EI		2026
$C_8H_9NO^+$	$C_6H_4(NH_2)COCH_3$ (4–Aminoacetophenone)		8.33±0.1	EI		2967
See also – EI:	3238, 3334					
		$C_8H_{11}NO^+$				
$C_8H_{11}NO^+$	$C_6H_4(NH_2)OC_2H_5$ (3–Ethoxyaniline)		7.91±0.15	EI		2945
$C_8H_{11}NO^+$	$C_6H_4(NH_2)OC_2H_5$ (4–Ethoxyaniline)		7.67±0.15	EI		2945
$C_8H_{11}NO^+$	$C_6H_4(NH_2)OC_2H_5$ (4–Ethoxyaniline)		7.38±0.1	CTS		2485
		$C_9H_7NO^+$				
$C_9H_7NO^+$	$C_6H_5COCH_2CN$ (α–Cyanoacetophenone)		9.56±0.05	EI		2025
		$C_9H_9NO^+$				
$C_9H_9NO^+$	$C_6H_4(CN)OC_2H_5$ (3–Ethoxybenzoic acid nitrile)		8.92±0.15	EI		2945
$C_9H_9NO^+$	$C_6H_4(CN)OC_2H_5$ (4–Ethoxybenzoic acid nitrile)		8.89±0.15	EI		2945
$C_9H_9NO^+$	$C_6H_4(OCH_3)CH_2CN$ (4–Methoxyphenylacetic acid nitrile)		8.77±0.05	RPD		3223
		$C_9H_{11}NO^+$				
$C_9H_{11}NO^+$	$C_6H_4(CH_3)NHCOCH_3$ (*N*–(3–Tolyl)acetic acid amide)		8.29±0.2	EI		3406
$C_9H_{11}NO^+$	$C_6H_4(CH_3)NHCOCH_3$ (*N*–(4–Tolyl)acetic acid amide)		8.24±0.2	EI		3406
		$C_9H_{13}NO^+$				
$C_9H_{13}NO^+$	$C_6H_4(OCH_3)N(CH_3)_2$ (*N*,*N*–Dimethyl–methoxyaniline)		≤6.75±0.02	PI		3372

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_{10}H_{12}NO^+$				
$C_{10}H_{12}NO^+$	$C_6H_4(NH_2)(CH_2)_3COOCH_3$ (4–(4–Aminophenyl)butanoic acid methyl ester)	CH_3O	11.26±0.2	EI		2497
		$C_{10}H_{13}NO^+$				
$C_{10}H_{13}NO^+$	$C_6H_4(NH_2)COC_3H_7$ (1–(3–Aminophenyl)–1–butanone)		8.06±0.2	EI		2534
$C_{10}H_{13}NO^+$	$C_6H_4(NH_2)COC_3H_7$ (1–(4–Aminophenyl)–1–butanone)		8.01±0.2	EI		2534
		$C_{11}H_9NO^+$				
$C_{11}H_9NO^+$	$C_6H_4(CN)(CH_2)_3COOCH_3$ (4–(4–Cyanophenyl)butanoic acid methyl ester)	CH_3OH	9.56±0.2	EI		2497
		$C_{11}H_{10}NO^+$				
$C_{11}H_{10}NO^+$	$C_6H_4(CN)CH(CH_3)CH_2COOCH_3$ (3–(4–Cyanophenyl)butanoic acid methyl ester)	CH_3O	11.18±0.2	EI		2497
$C_{11}H_{10}NO^+$	$C_6H_4(CN)(CH_2)_3COOCH_3$ (4–(4–Cyanophenyl)butanoic acid methyl ester)	CH_3O	11.22±0.2	EI		2497
		$C_{13}H_9NO^+$				
$C_{13}H_9NO^+$	$C_{13}H_9NO$ (9,10–Dihydro–9–oxoacridine)		7.60±0.03	PI		2728
		$C_{13}H_{11}NO^+$				
$C_{13}H_{11}NO^+$	$C_6H_5CONHC_6H_5$ (*N*–Phenylbenzoic acid amide)		8.1±0.1	EI		2918
		$C_{13}H_{13}NO^+$				
$C_{13}H_{13}NO^+$	$C_6H_5CH_2OC_6H_4NH_2$ (3–Aminophenyl benzyl ether)		8.0	EI		2737
$C_{13}H_{13}NO^+$	$C_6H_5CH_2OC_6H_4NH_2$ (4–Aminophenyl benzyl ether)		7.6	EI		2737
		$C_{14}H_{11}NO^+$				
$C_{14}H_{11}NO^+$	$C_{14}H_{11}NO$ (9–Hydro–10–methyl–9–oxoacridine)		7.53±0.02	PI		2728

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_{15}H_{13}NO^+$						
$C_{15}H_{13}NO^+$	$C_{13}H_9CH_2CONH_2$ (2–Fluorenylacetic acid amide)		8.34	CTS		2562
$C_{15}H_{13}NO^+$	$C_{15}H_{13}NO$ (10–Ethyl–9–hydro–9–oxoacridine)		7.49±0.03	PI		2728
$C_{17}H_{11}NO^+$						
$C_{17}H_{11}NO^+$	$C_{17}H_{11}NO$ (Naphtho[2,3–*a*]–4–oxo–3–phenylazacyclobutene)		7.5±0.1	EI		2964
$C_{17}H_{11}NO^+$	$C_{17}H_{11}N_3O$ (Naphtho[2,3–*e*]–4–hydro–4–oxo–3–phenyl–1,2,3–triazine)	N_2	9.45±0.1	EI		2964
$C_{18}H_{21}NO^+$						
$C_{18}H_{21}NO^+$	$C_6H_4(NH_2)CH_2CH_2C_6H_4COC_3H_7$ (1–(4–Aminophenyl)–2–(4–butyrylphenyl)ethane)		8.14±0.2	EI		2567
$C_{19}H_{13}NO^+$						
$C_{19}H_{13}NO^+$	$C_{19}H_{13}NO$ (9–Hydro–9–oxo–10–phenylacridine)		7.46±0.02	PI		2728
$CH_4N_2O^+$						
$CH_4N_2O^+$	$(NH_2)_2CO$		10.27±0.05	EI		2515, 2867
$C_2HN_2O^+$						
$C_2HN_2O^+$	CH_3COCHN_2	CH_3	11.42±0.08	EI		2174
$C_2HN_2O^+$	$CH_2ClCOCHN_2$	CH_2Cl	10.95±0.15	EI		2174
$C_2HN_2O^+$	CCl_3COCHN_2	CCl_3	10.12±0.08	EI		2174
$C_2H_6N_2O^+$						
$C_2H_6N_2O^+$	$CH_3NHCONH_2$		9.73±0.05	EI		2515, 2867
$C_3H_4N_2O^+$						
$C_3H_4N_2O^+$	CH_3COCHN_2		9.40±0.03	EI		2174
$C_3H_8N_2O^+$						
$C_3H_8N_2O^+$	$(CH_3)_2NCONH_2$		9.10±0.05	EI		2515, 2867
$C_3H_8N_2O^+$	$(CH_3NH)_2CO$		9.42±0.05	EI		2515, 2867

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_4H_{10}N_2O^+$				
$C_4H_{10}N_2O^+$	$(CH_3)_2NCONHCH_3$		8.94±0.05	EI		2515, 2867
		$C_5H_{12}N_2O^+$				
$C_5H_{12}N_2O^+$	$((CH_3)_2N)_2CO$		8.74±0.05	EI		2515, 2867
		$C_8H_5N_2O^+$				
$C_8H_5N_2O^+$	$C_6H_5C_2N_2OC_3F_7$ (2–Perfluoropropyl–5–phenyl–1,3,4–oxadiazole)		11.8±0.2	EI		2156
$C_8H_5N_2O^+$	$C_6H_5C_2N_2OC_7F_{15}$ (2–Perfluoroheptyl–5–phenyl–1,3,4–oxadiazole)		12.1±0.1	EI		2156
		$C_8H_6N_2O^+$				
$C_8H_6N_2O^+$	$C_6H_5COCHN_2$ (α–Diazoacetophenone)		9.22±0.04	EI		2174
		$C_{14}H_{10}N_2O^+$				
$C_{14}H_{10}N_2O^+$	$(C_6H_5)_2C_2N_2O$ (3,5–Diphenyl–1,2,4–oxadiazole)		9.2±0.1	EI		1125
$C_{14}H_{10}N_2O^+$	$(C_6H_5)_2C_2N_2O$ (2,5–Diphenyl–1,3,4–oxadiazole)		8.9±0.3	EI		1125
		$C_{15}H_{12}N_2O^+$				
$C_{15}H_{12}N_2O^+$	$C_{15}H_{12}N_2O$ (Tegretol)		8.07±0.08	CTS		2987
		$C_4H_5N_3O^+$				
$C_4H_5N_3O^+$	$C_4H_5N_3O$ (Cytosine)		8.90±0.2	EI		2514, 3336
		$C_5H_4N_4O^+$				
$C_5H_4N_4O^+$	$C_5H_4N_4O$ (Hypoxanthine)		9.17±0.1	EI		2514, 3336
		$CH_2NO_2^+$				
$CH_2NO_2^+$	CH_3NO_2	H	11.97±0.02	EI		90

4.3. The Positive Ion Table—Continued

$CH_3NO_2^+$ $\Delta H^\circ_{f0} \sim 1011$ kJ mol^{-1} (242 kcal mol^{-1})

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$CH_3NO_2^+$	CH_3NO_2		11.08±0.03	PI	1008	182
$CH_3NO_2^+$	CH_3NO_2		11.130±0.006	PI	1013	1253
$CH_3NO_2^+$	CH_3NO_2		11.23±0.01	PE		2701

See also – PEN: 2430
EI: 90, 2018

$C_2H_5NO_2^+$ $\Delta H^\circ_{f298} \sim 953$ kJ mol^{-1} (228 kcal mol^{-1})
$C_2H_5ONO^+$ $\Delta H^\circ_{f298} = 912$ kJ mol^{-1} (218 kcal mol^{-1})

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_2H_5NO_2^+$	$C_2H_5NO_2$		10.88±0.05	PI	951	182
$C_2H_5NO_2^+$	$C_2H_5NO_2$		10.92±0.01	PE	955	2701

See also – EI: 2018

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_2H_5NO_2^+$	C_2H_5ONO		10.53±0.01	PE	912	2701
$C_2H_5NO_2^+$	$CH_2(NH_2)COOH$		9.25±0.10	EI		2587
$C_2H_5NO_2^+$	$CH_2(NH_2)COOH$		9.30	CTS		2562

See also – EI: 88

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n-$C_3H_7NO_2^+$ $\Delta H^\circ_{f298} \sim 915$ kJ mol^{-1} (219 kcal mol^{-1})
iso-$C_3H_7NO_2^+$ $\Delta H^\circ_{f298} \sim 896$ kJ mol^{-1} (214 kcal mol^{-1})

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_3H_7NO_2^+$	n-$C_3H_7NO_2$		10.81±0.03	PI	918	182
$C_3H_7NO_2^+$	n-$C_3H_7NO_2$		10.75±0.01	PE	913	2701

See also – EI: 2018

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_3H_7NO_2^+$	iso-$C_3H_7NO_2$		10.71±0.05	PI	893	182
$C_3H_7NO_2^+$	iso-$C_3H_7NO_2$		10.77±0.01	PE	899	2701
$C_3H_7NO_2^+$	n-C_3H_7ONO		10.34±0.01	PE		2701
$C_3H_7NO_2^+$	iso-C_3H_7ONO		10.23±0.01	PE		2701
$C_3H_7NO_2^+$	$CH_3CH(NH_2)COOH$		9.63	CTS		2562

$C_4H_5NO_2^+$

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_4H_5NO_2^+$	$CH_2(CN)COOCH_3$		10.87±0.05	EI		2025

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n-$C_4H_9NO_2^+$ $\Delta H^\circ_{f298} = 889$ kJ mol^{-1} (213 kcal mol^{-1})
sec-$C_4H_9NO_2^+$ $\Delta H^\circ_{f298} = 870$ kJ mol^{-1} (208 kcal mol^{-1})

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_4H_9NO_2^+$	n-$C_4H_9NO_2$		10.71±0.01	PE	889	2701
$C_4H_9NO_2^+$	sec-$C_4H_9NO_2$		10.71±0.01	PE	870	2701

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_5H_9NO_2^+$				
$C_5H_9NO_2^+$	$C_5H_9NO_2$ (Proline)		9.36	CTS		2562
		$C_6H_5NO_2^+$				
$C_6H_5NO_2^+$	$C_6H_5NO_2$ (Nitrobenzene)		9.92?	PI		182
$C_6H_5NO_2^+$	$C_6H_5NO_2$ (Nitrobenzene)		9.86±0.05	PE		3174
$C_6H_5NO_2^+$	$C_6H_5NO_2$ (Nitrobenzene)		10.26 (V)	PE		2806
$C_6H_5NO_2^+$	$C_6H_5NO_2$ (Nitrobenzene)		9.90±0.03	EDD		3174
$C_6H_5NO_2^+$	$C_6H_5NO_2$ (Nitrobenzene)		10.16±0.04	RPD		3223
See also – EI:	1066, 3231, 3238					
		$C_6H_{13}NO_2^+$				
$C_6H_{13}NO_2^+$	$n-C_4H_9CH(NH_2)COOH$		9.09±0.11	EI		2587
$C_6H_{13}NO_2^+$	$sec-C_4H_9CH(NH_2)COOH$		9.5±0.2	EI		88
		$C_7H_6NO_2^+$				
$C_7H_6NO_2^+$	$C_6H_4(NO_2)CH_2$ (3–Nitrobenzyl radical)		8.56±0.1	EI		69
$C_7H_6NO_2^+$	$C_6H_5CH_2CH_2C_6H_4NO_2$ (1–(4–Nitrophenyl)–2–phenylethane)		~16	EI		3288
$C_7H_6NO_2^+$	$C_6H_4(NH_2)CH_2CH_2C_6H_4NO_2$ (1–(4–Aminophenyl)–2–(4–nitrophenyl)ethane)		~15	EI		3288
$C_7H_6NO_2^+$	$C_6H_4(NO_2)(CH_2)_3COOCH_3$ (4–(4–Nitrophenyl)butanoic acid methyl ester)		14.01±0.2	EI		2497
$C_7H_6NO_2^+$	$C_6H_4(NO_2)CH_2CH_2C_6H_4NO_2$ (1,2–Bis(4–nitrophenyl)ethane)		11.3±0.2	EI		3288
		$C_7H_7NO_2^+$				
$C_7H_7NO_2^+$	$C_6H_4(NO_2)CH_3$ (3–Nitrotoluene)		9.65±0.05	EI		2025
$C_7H_7NO_2^+$	$C_6H_4(NO_2)CH_3$ (4–Nitrotoluene)		9.76±0.05	RPD		3223
See also – EI:	1066					
$C_7H_7NO_2^+$	$C_6H_4(NH_2)COOH$ (2–Aminobenzoic acid)		8.29	CTS		2562
$C_7H_7NO_2^+$	$C_6H_4(COOH)NHCOCH_3$ (*N*–(4–Carboxyphenyl)acetic acid amide)		10.58±0.2	EI		3406

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_8H_7NO_2^+$				
$C_8H_7NO_2^+$	$C_6H_4(NO_2)(CH_2)_3COOCH_3$ (4–(4–Nitrophenyl)butanoic acid methyl ester)		11.22±0.2	EI		2497
		$C_8H_8NO_2^+$				
$C_8H_8NO_2^+$	$C_6H_4(NO_2)CH(CH_3)CH_2COOCH_3$ (3–(4–Nitrophenyl)butanoic acid methyl ester)		11.55±0.2	EI		2497
$C_8H_8NO_2^+$	$C_6H_4(NO_2)CH_2CH_2Br$ (1–Bromo–2–(4–nitrophenyl)ethane)	Br	10.3	EI		2973
		$C_8H_9NO_2^+$				
$C_8H_9NO_2^+$	$C_6H_4(NH_2)COOCH_3$ (4–Aminobenzoic acid methyl ester)		8.08±0.01	EI		2026
See also – EI:	3238					
		$C_9H_7NO_2^+$				
$C_9H_7NO_2^+$	$C_6H_4(CN)COOCH_3$ (4–Cyanobenzoic acid methyl ester)		9.72	EI		3238
		$C_9H_9NO_2^+$				
$C_9H_9NO_2^+$	$C_6H_3(OCH_3)_2CN$ (3,4–Dimethoxybenzoic acid nitrile)		8.72±0.06	RPD		3223
$C_9H_9NO_2^+$	$C_6H_4(NO_2)CH(CH_3)CH_2COOCH_3$ (3–(4–Nitrophenyl)butanoic acid methyl ester)		9.47±0.2	EI		2497
		$C_9H_{11}NO_2^+$				
$C_9H_{11}NO_2^+$	$C_6H_4(OCH_3)NHCOCH_3$ (*N*–(3–Methoxyphenyl)acetic acid amide)		7.96±0.2	EI		3406
$C_9H_{11}NO_2^+$	$C_6H_4(OCH_3)NHCOCH_3$ (*N*–(4–Methoxyphenyl)acetic acid amide)		8.10±0.2	EI		3406
		$C_{11}H_{15}NO_2^+$				
$C_{11}H_{15}NO_2^+$	$C_6H_4(NH_2)(CH_2)_3COOCH_3$ (4–(4–Aminophenyl)butanoic acid methyl ester)		7.85±0.2	EI		2497
		$C_{12}H_{13}NO_2^+$				
$C_{12}H_{13}NO_2^+$	$C_6H_4(CN)CH(CH_3)CH_2COOCH_3$ (3–(4–Cyanophenyl)butanoic acid methyl ester)		9.20±0.2	EI		2497

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_{12}H_{13}NO_2^+$	$C_6H_4(CN)(CH_2)_3COOCH_3$ (4–(4–Cyanophenyl)butanoic acid methyl ester)		9.25±0.2	EI		2497
$C_{14}H_9NO_2^+$						
$C_{14}H_9NO_2^+$	$C_{14}H_9NO_2$ (*N*–Phenylphthalic acid imide)		8.8	EI		2412
$C_{14}H_{13}NO_2^+$						
$C_{14}H_{13}NO_2^+$	$C_6H_5CH_2CH_2C_6H_4NO_2$ (1–(4–Nitrophenyl)–2–phenylethane)		8.9±0.1	EI		3288
$C_{14}H_{13}NO_2^+$	$C_6H_5CONHC_6H_4OCH_3$ (*N*–(3–Methoxyphenyl)benzoic acid amide)		7.8±0.1	EI		2918
$C_{14}H_{13}NO_2^+$	$C_6H_5CONHC_6H_4OCH_3$ (*N*–(4–Methoxyphenyl)benzoic acid amide)		7.6±0.1	EI		2918
$C_{20}H_{13}NO_2^+$						
$C_{20}H_{13}NO_2^+$	$C_{20}H_{13}NO_2$ (*N*–(2–Biphenylyl)phthalic acid imide)		8.5	EI		2412
$C_{20}H_{13}NO_2^+$	$C_{20}H_{13}NO_2$ (*N*–(4–Biphenylyl)phthalic acid imide)		8.4	EI		2412
$C_4H_4N_2O_2^+$						
$C_4H_4N_2O_2^+$	$C_4H_4N_2O_2$ (Uracil)		9.82±0.1	EI		2514, 3336
$C_5H_6N_2O_2^+$						
$C_5H_6N_2O_2^+$	$C_5H_6N_2O_2$ (5–Methyluracil)		9.43±0.1	EI		2514, 3336
$C_6H_6N_2O_2^+$						
$C_6H_6N_2O_2^+$	$C_6H_4(NO_2)NH_2$ (2–Nitroaniline)		8.66	EI		1066
$C_6H_6N_2O_2^+$	$C_6H_4(NO_2)NH_2$ (3–Nitroaniline)		8.80	EI		1066
$C_6H_6N_2O_2^+$	$C_6H_4(NO_2)NH_2$ (4–Nitroaniline)		8.85	EI		1066
$C_6H_6N_2O_2^+$	$C_6H_4(NO_2)NHCOCH_3$ (*N*–(3–Nitrophenyl)acetic acid amide)		10.49±0.2	EI		3406
$C_6H_6N_2O_2^+$	$C_6H_4(NO_2)NHCOCH_3$ (*N*–(4–Nitrophenyl)acetic acid amide)		10.44±0.2	EI		3406

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_7H_4N_2O_2^+$						
$C_7H_4N_2O_2^+$	$C_6H_4(NO_2)CN$ (2–Nitrobenzoic acid nitrile)		10.52±0.05	RPD		3223
$C_7H_4N_2O_2^+$	$C_6H_4(NO_2)CN$ (3–Nitrobenzoic acid nitrile)		10.57±0.04	RPD		3223
$C_7H_4N_2O_2^+$	$C_6H_4(NO_2)CN$ (4–Nitrobenzoic acid nitrile)		10.59±0.05	RPD		3223
$C_8H_6N_2O_2^+$						
$C_8H_6N_2O_2^+$	$C_6H_4(NO_2)CH_2CN$ (4–Nitrophenylacetic acid nitrile)		10.11±0.04	RPD		3223
$C_{11}H_{12}N_2O_2^+$						
$C_{11}H_{12}N_2O_2^+$	$C_{11}H_{12}N_2O_2$ (Tryptophan)		8.43	CTS		2562
$C_{14}H_{14}N_2O_2^+$						
$C_{14}H_{14}N_2O_2^+$	$C_6H_4(NH_2)CH_2CH_2C_6H_4NO_2$ (1–(4–Aminophenyl)–2–(4–nitrophenyl)ethane)		7.8±0.1	EI		3288
$C_3H_3N_3O_2^+$						
$C_3H_3N_3O_2^+$	$C_3H_3N_3O_2$ (6–Azauracil)		10.18±0.1	EI		2514, 3336
$C_5H_4N_4O_2^+$						
$C_5H_4N_4O_2^+$	$C_5H_4N_4O_2$ (Xanthine)		9.30±0.2	EI		2514, 3336
$C_8H_{10}N_4O_2^+$						
$C_8H_{10}N_4O_2^+$	$C_8H_{10}N_4O_2$ (Caffeine)		8.50	CTS		2562
$CH_2NO_3^+$						
$CH_2NO_3^+$	CH_3ONO_2	H	11.7	EI		2456
$CH_2NO_3^+$	$C_2H_5ONO_2$	CH_3	10.13±0.11	EI		1013
$CH_2NO_3^+$	$C_2H_5ONO_2$	CH_3	11.4	EI		2456
$CH_2NO_3^+$	*iso*–$C_4H_9ONO_2$		11.5	EI		2456

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
	$CH_3ONO_2^+$ ΔH°_{f298} = 988 kJ mol^{-1} (236 kcal mol^{-1})					
$CH_3NO_3^+$	CH_3ONO_2		11.53±0.01	PE	988	2701
	$C_2H_5NO_3^+$					
$C_2H_5NO_3^+$	$C_2H_5ONO_2$		11.22?	PI		182
	n–$C_3H_7ONO_2^+$ ΔH°_{f298} = 894 kJ mol^{-1} (214 kcal mol^{-1})					
$C_3H_7NO_3^+$	n–$C_3H_7ONO_2$		11.07±0.02	PI	894	182
	$C_6H_5NO_3^+$					
$C_6H_5NO_3^+$	$C_6H_4(NO_2)OH$ (4–Nitrophenol)		9.52	EI		1066
$C_6H_5NO_3^+$	$C_6H_4(NO_2)OC_2H_5$ (1–Ethoxy–3–nitrobenzene)	C_2H_4	10.91±0.15	EI		2945
$C_6H_5NO_3^+$	$C_6H_4(NO_2)OC_2H_5$ (1–Ethoxy–4–nitrobenzene)	C_2H_4	10.97±0.15	EI		2945
	$C_7H_4NO_3^+$					
$C_7H_4NO_3^+$	$C_6H_4(NO_2)COCH_3$ (3–Nitroacetophenone)	CH_3	10.67±0.2	EI		2967
$C_7H_4NO_3^+$	$C_6H_4(NO_2)COCH_3$ (4–Nitroacetophenone)	CH_3	10.32	EI		3334
$C_7H_4NO_3^+$	$C_6H_4(NO_2)COCH_3$ (4–Nitroacetophenone)	CH_3	10.73±0.1	EI		2967
$C_7H_4NO_3^+$	$C_6H_4(NO_2)COOCH_3$ (4–Nitrobenzoic acid methyl ester)	CH_3O	11.52	EI		3238
	$C_7H_5NO_3^+$					
$C_7H_5NO_3^+$	$C_6H_4(NO_2)CHO$ (4–Nitrobenzenecarbonal)		10.27±0.01	EI		2026
	$C_8H_7NO_3^+$					
$C_8H_7NO_3^+$	$C_6H_4(NO_2)COCH_3$ (3–Nitroacetophenone)		9.89±0.05	EI		2025
See also – EI:	2967					
$C_8H_7NO_3^+$	$C_6H_4(NO_2)COCH_3$ (4–Nitroacetophenone)		10.07±0.02	EI		2026
See also – EI:	2967, 3334					

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
	$C_8H_9NO_3^+$					
$C_8H_9NO_3^+$	$C_6H_4(NO_2)OC_2H_5$ (1–Ethoxy–3–nitrobenzene)		9.11±0.15	EI		2945
$C_8H_9NO_3^+$	$C_6H_4(NO_2)OC_2H_5$ (1–Ethoxy–4–nitrobenzene)		9.22±0.15	EI		2945
	$C_9H_9NO_3^+$					
$C_9H_9NO_3^+$	$C_6H_4(COOH)NHCOCH_3$ (N–(4–Carboxyphenyl)acetic acid amide)		8.70±0.2	EI		3406
	$C_{10}H_{10}NO_3^+$					
$C_{10}H_{10}NO_3^+$	$C_6H_4(NO_2)CH(CH_3)CH_2COOCH_3$ (3–(4–Nitrophenyl)butanoic acid methyl ester)	CH_3O	11.11±0.2	EI		2497
$C_{10}H_{10}NO_3^+$	$C_6H_4(NO_2)(CH_2)_3COOCH_3$ (4–(4–Nitrophenyl)butanoic acid methyl ester)	CH_3O	11.18±0.2	EI		2497
See also – EI:	2496					
	$C_{10}H_{11}NO_3^+$					
$C_{10}H_{11}NO_3^+$	$C_6H_4(NO_2)COC_3H_7$ (1–(3–Nitrophenyl)–1–butanone)		9.88±0.2	EI		2534
$C_{10}H_{11}NO_3^+$	$C_6H_4(NO_2)COC_3H_7$ (1–(4–Nitrophenyl)–1–butanone)		9.86±0.2	EI		2534
	$C_{13}H_{11}NO_3^+$					
$C_{13}H_{11}NO_3^+$	$C_6H_5CH_2OC_6H_4NO_2$ (Benzyl 3–nitrophenyl ether)		9.0	EI		2737
$C_{13}H_{11}NO_3^+$	$C_6H_5CH_2OC_6H_4NO_2$ (Benzyl 4–nitrophenyl ether)		9.1	EI		2737
	$C_{18}H_{19}NO_3^+$					
$C_{18}H_{19}NO_3^+$	$C_6H_4(NO_2)CH_2CH_2C_6H_4COC_3H_7$ (1–(4–Butyrylphenyl)–2–(4–nitrophenyl)ethane)		9.10±0.2	EI		2567
	$C_8H_8N_2O_3^+$					
$C_8H_8N_2O_3^+$	$C_6H_4(NO_2)NHCOCH_3$ (*N*–(3–Nitrophenyl)acetic acid amide)		8.84±0.2	EI		3406
$C_8H_8N_2O_3^+$	$C_6H_4(NO_2)NHCOCH_3$ (*N*–(4–Nitrophenyl)acetic acid amide)		9.05±0.2	EI		3406

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
	$C_{13}H_{10}N_2O_3^+$					
$C_{13}H_{10}N_2O_3^+$	$C_6H_5CONHC_6H_4NO_2$ (*N*–(3–Nitrophenyl)benzoic acid amide)		8.5±0.1	EI		2918
$C_{13}H_{10}N_2O_3^+$	$C_6H_5CONHC_6H_4NO_2$ (*N*–(4–Nitrophenyl)benzoic acid amide)		8.6±0.1	EI		2918
	$C_9H_{12}N_4O_3^+$					
$C_9H_{12}N_4O_3^+$	$C_9H_{12}N_4O_3$ (Tetramethyluric acid)		7.87±0.1	EI		2514, 3336
$C_9H_{12}N_4O_3^+$	$C_9H_{12}N_4O_3$ (Tetramethyluric acid)		7.91	CTS		2562
	$C_8H_7NO_4^+$					
$C_8H_7NO_4^+$	$C_6H_4(NO_2)COOCH_3$ (4–Nitrobenzoic acid methyl ester)		9.70	EI		3238
See also – EI:	2026					
	$C_{11}H_{13}NO_4^+$					
$C_{11}H_{13}NO_4^+$	$C_6H_4(NO_2)CH(CH_3)CH_2COOCH_3$ (3–(4–Nitrophenyl)butanoic acid methyl ester)		9.36±0.2	EI		2497
$C_{11}H_{13}NO_4^+$	$C_6H_4(NO_2)(CH_2)_3COOCH_3$ (4–(4–Nitrophenyl)butanoic acid methyl ester)		8.88±0.3	EI		2496
$C_{11}H_{13}NO_4^+$	$C_6H_4(NO_2)(CH_2)_3COOCH_3$ (4–(4–Nitrophenyl)butanoic acid methyl ester)		9.30±0.2	EI		2497
	$C_{14}H_{12}N_2O_4^+$					
$C_{14}H_{12}N_2O_4^+$	$C_6H_4(NO_2)CH_2CH_2C_6H_4NO_2$ (1,2–Bis(4–nitrophenyl)ethane)		9.5±0.1	EI		3288
	$C_{33}H_{40}N_2O_9^+$					
$C_{33}H_{40}N_2O_9^+$	$C_{33}H_{40}N_2O_9$ (Reserpine)		7.88	CTS		2562

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
F^+	**$\Delta H^\circ_{f0} = 1757.9$ kJ mol^{-1} (420.1 kcal mol^{-1})**					
F^+	F		17.422	S	1757.9	2113
See also – EI:	2165					
F^+	F_2	F^-	15.6	PI		3274
F^+	F_2	F^-	15.48	PI		2630, 2744
See also – EI:	3149					
F^+	F_2 (Threshold value approximately corrected to 0 K)	F	19.008	PI	(1757.1)	3217, 3274
See also – PI: EI:	2630, 2744 3149					
F^+	BF_3		31.5±2	EI		440
F^+	CF_4		24.0±1.0	EI		2157
See also – EI:	24					
F^+	C_2F_4		29.5±1.0	EI		2571
F^+	C_2F_6		22.6	EI		1062
F^+	C_6F_6 (Hexafluorobenzene)		29.2±0.5	EI		1132
F^+	C_3F_8		23.5	EI		1062
F^+	C_4F_8 (Octafluorocyclobutane)		24.0	EI		1062
F^+	NF_3		25±1	EI		401
F^+	CF_2O		38±1	EI		3236
F^+	CF_3OF		36±1	EI		3236
F^+	CF_3Cl		31±1	EI		24
F^+	ClO_3F		27±3	EI		53
F^+	SF_5Cl		33.8±0.3	EI		2777
F^+	CF_3Br		29±1	EI		24
F^+	CF_3I		33±1	EI		24
F^{+2}	**$\Delta H^\circ_{f0} = 5132.0$ kJ mol^{-1} (1226.6 kcal mol^{-1})**					
F^{+2}	F		52.392	S	5132.0	2113
F^{+2}	F^+		34.970	S		2113, 3164
F^{+3}	**$\Delta H^\circ_{f0} = 11182.5$ kJ mol^{-1} (2672.7 kcal mol^{-1})**					
F^{+3}	F		115.099	S	11182.5	2113
F^{+3}	F^{+2}		62.707	S		2113, 3161

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$F_2^+(^2\Pi_{3/2g})$		**ΔH°_{f0} = 1514 kJ mol^{-1} (362 kcal mol^{-1})**				
$F_2^+(^2\Pi_g)$	F_2		15.7	S		355
$F_2^+(^2\Pi_{3/2g})$	F_2		15.686±0.006	PI	1513	3274
(Threshold value corrected for hot bands)						
$F_2^+(^2\Pi_{3/2g})$	F_2		15.69±0.01	PI	1514	2630, 2744, 3413
(Threshold value corrected for hot bands)						
$F_2^+(^2\Pi_{3/2g})$	F_2		15.70	PE		3275
$F_2^+(^2\Pi_{1/2g})$	F_2		15.74	PE		3275
$F_2^+(^2\Pi_u)$	F_2		18.4	PE		3275
$F_2^+(^2\Sigma?)$	F_2		21? (V)	PE		3275
See also – PE: 2815 EI: 75						
$HF^+(^2\Pi_{3/2})$ **$HF^+(^2\Sigma^+)$**		**ΔH°_{f0} = 1273 kJ mol^{-1} (304 kcal mol^{-1})** **ΔH°_{f0} = 1574 kJ mol^{-1} (376 kcal mol^{-1})**				
$HF^+(^2\Pi_{3/2})$	HF		16.007±0.010	PI	1273	3274
(Threshold value corrected for hot bands)						
$HF^+(^2\Pi)$	HF		15.92±0.01	PI		2744
$HF^+(^2\Pi)$	HF		16.045±0.01	PE		3086
$HF^+(^2\Pi)$	HF		16.05±0.01	PE		2819, 2820
$HF^+(^2\Pi)$	HF		16.06±0.01	PE		2815
$HF^+(^2\Sigma^+)$	HF		19.146	S	1576	3274
$HF^+(^2\Sigma^+)$	HF		19.118±0.005	RPI	1574	3274
$HF^+(^2\Sigma^+)$	HF		19.092±0.02	PE	1571	3086
$HF^+(^2\Sigma^+)$	HF		18.6	PE		2819, 2820
See also – EI: 463, 2436						
		DF^+				
$DF^+(^2\Pi_{3/2})$	DF		16.030±0.010	PI		3274
(Threshold value corrected for hot bands)						
$DF^+(^2\Pi)$	DF		16.053±0.01	PE		3086
$DF^+(^2\Pi)$	DF		16.06±0.01	PE		2820
$DF^+(^2\Sigma^+)$	DF		19.194	S		3274
$DF^+(^2\Sigma^+)$	DF		19.100±0.02	PE		3086
$DF^+(^2\Sigma^+)$	DF		18.90±0.05	PE		2819
		LiF^+				
LiF^+	LiF		11.3	EI		2179

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		Li_2F^+				
Li_2F^+	Li_2F_2	F	11.5	EI		2179
		BeF^+				
BeF^+	BeF		9.1±0.5	EI		2141
BeF^+	BeF_2	F	15.4±0.4	EI		2142
BeF^+	BeF_2	F	15.5	EI		2141
		BeF_2^+				
BeF_2^+	BeF_2		14.5±0.4	EI		2142
BeF_2^+	BeF_2		14.7±0.4	EI		2141
		BF^+ $\Delta H^\circ_{f0} \sim 937$ kJ mol^{-1} (224 kcal mol^{-1})				
BF^+	BF		$11.115^{+0.004}_{-0.002}$	S	947	2872
BF^+	BF		~11.45	S		3414
BF^+	BF		11.06±0.10	EI		3414
See also – EI:	440, 1297, 2432					
BF^+	BF_3	2F	25.2±0.2	EI		440
BF^+	B_2F_4	BF_3	12.75±0.01	PI	927	2626
		BF_2^+ $\Delta H^\circ_{f0} = 314$ kJ mol^{-1} (75 kcal mol^{-1})				
BF_2^+	BF_3	F	15.81±0.04	PI	314	2626
See also – EI:	362, 364, 440, 1297, 2040, 2432, 3200					
BF_2^+	B_2F_4	BF_2	12.94±0.01	PI		2626
BF_2^+	CH_3BF_2	CH_3	13.62±0.02	EI		1076
BF_2^+	$CH_2=CHBF_2$	C_2H_3	14.8±0.1	EI		1076
BF_2^+	$C_2H_5BF_2$	C_2H_5	14.3±0.2	EI		1076
BF_2^+	*iso*-$C_3H_7BF_2$	C_3H_7	14.6±0.2	EI		1076
BF_2^+	Si_2BF_7		14.67±0.1	RPD		2525
		BF_3^+ $\Delta H^\circ_{f0} = 367$ kJ mol^{-1} (88 kcal mol^{-1})				
BF_3^+	BF_3		15.55±0.04	PI	366	2626
BF_3^+	BF_3		15.57±0.02	PE	368	3375
See also – PE:	2802, 2834, 3119					
EI:	362, 364, 440, 2040, 2512, 2513, 3200, 3227					

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$B_2F_3^+$ $\Delta H^\circ_{f0} = -28$ kJ mol^{-1} (-7 kcal mol^{-1})						
$B_2F_3^+$	B_2F_4	F	15.40±0.01	PI	−28	2626
$B_2F_4^+$ $\Delta H^\circ_{f0} = -273$ kJ mol^{-1} (-65 kcal mol^{-1})						
$B_2F_4^+$	B_2F_4		12.07±0.01	PI	−273	2626
CF^+ $\Delta H^\circ_{f0} \sim 1126$ kJ mol^{-1} (269 kcal mol^{-1})						
CF^+	CF		~8.91±0.12	S	~1111	3110
CF^+	CF		~8.91	S	~1111	2149
CF^+	CF		9.23±0.08	D	1142	2746
(Based upon AP(CF^+/C_2F_4) − AP(CF_3^+/C_2F_4) = 0.06±0.01 eV and a "best value" of IP(CF_3) = 9.17±0.08 eV)						
See also – EI: 129						
CF^+	CF_4		22.6±0.5	EI		24
See also – EI: 129, 2157						
CF^+	C_2F_4	CF_3	13.76±0.01	PI	1140	2746
(Threshold value approximately corrected to 0 K)						
See also – EI: 419, 2586, 2601						
CF^+	C_2F_6		16.75	PI		2643
CF^+	C_2F_6		16.1	EI		2572
CF^+	C_3F_6		18.1	EI		1290
CF^+	C_3F_6 (Hexafluorocyclopropane)		17.3	EI		1290
CF^+	C_6F_6 (Hexafluorobenzene)		17.3±0.3	EI		1132
CF^+	C_3F_8		13.5?	EI		2572
CF^+	$C_6F_{11}CF_3$ (Perfluoromethylcyclohexane)		15.93±0.2	EI		2192
CF^+	$CH\equiv CF$	CH	17.0±0.1	EDD		3177
CF^+	C_2H_3F		15.43	EI		419
CF^+	CH_2F_2		18.8	EI		1288
CF^+	$CH_2{=}CF_2$		15.23	EI		419
CF^+	CHF_3		20.2±0.4	EI		43
See also – EI: 1288						
CF^+	C_2HF_3		15.2	EI		419
CF^+	FCN	N	16.35	PI	(1130)	2621

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
CF^+	$CF_2{=}CFCN$		13.3±0.1	EI		2954
CF^+	CF_2O		27.0±0.3	EI		3236
CF^+	CF_3OF		31.1±0.5	EI		3236
CF^+	$CH_2{=}CFCN$		14.2±0.1	EI		2954
CF^+	$CF_2{=}CHCN$		13.7±0.1	EI		2954
CF^+	CF_3SSCF_3		~16	EI		3202
CF^+	CF_3Cl		22.6±0.5	EI		24
CF^+	$CF_2ClCF{=}CF_2$		17.8	EI		1290
CF^+	CHF_2Cl		17.30±0.15	EI		43
CF^+	$CHFCl_2$		16.9±0.2	EI		43
CF^+	CF_3Br		22.9±0.5	EI		24
CF^+	CF_3I		19.9±0.3	EI		439
See also – EI:	24					
		C_3F^+				
C_3F^+	C_6F_6 (Hexafluorobenzene)		22±1?	EI		1132
		C_5F^+				
C_5F^+	C_6F_6 (Hexafluorobenzene)		29.0±0.5	EI		1132
	CF_2^+	$\Delta H^\circ_{f0} \sim 939$ kJ mol^{-1} (224 kcal mol^{-1})				
CF_2^+	CF_2		11.7±0.2	EDD	(~946)	2795
CF_2^+	CF_2		11.7±0.1	EI		2164
CF_2^+	CF_2		11.8±0.3	EI		2601
CF_2^+	CF_2		11.86±0.1	EI		1252
See also – EI:	129					
CF_2^+	CF_4		20.3±0.5	EI		24
See also – EI:	129, 1288, 2157					
CF_2^+	C_2F_4	CF_2	14.63±0.04	PI	939	2746
(Threshold value approximately corrected to 0 K)						
CF_2^+	C_2F_4	CF_2	15.0±0.3	EI		2601
CF_2^+	C_2F_4	CF_2	15.26±0.05	EI		1252
See also – EI:	214, 419, 2586					

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
CF_2^+	C_3F_6		19.8	EI		1290
CF_2^+	C_3F_6 (Hexafluorocyclopropane)		17.4	EI		1290
CF_2^+	$C_6F_{11}CF_3$ (Perfluoromethylcyclohexane)		13.93±0.2	EI		2192
CF_2^+	CH_2F_2	H_2	14.8±0.4	EI		2160
See also – EI:	1288					
CF_2^+	CHF_3		14.7±0.4	EI		2160
See also – EI:	43, 1288					
CF_2^+	C_2HF_3		19.28	EI		419
CF_2^+	CF_2O	O	25.6±0.3	EI		3236
CF_2^+	CF_3OF		28.0±0.5	EI		3236
CF_2^+	CF_3Cl		20±1	EI		24
CF_2^+	CHF_2Cl		16.1±0.3	EI		43
CF_2^+	CF_3Br		18.3±0.1	EI		439
See also – EI:	24					
CF_2^+	CF_3I		17.95±0.1	EI		439
See also – EI:	24					
		CF_2^{+2}				
CF_2^{+2}	CF_4		44.3±0.3	EI		2157
		$C_2F_2^+$				
$C_2F_2^+$	C_2F_2		11.4±0.5	EDD		2795
$C_2F_2^+$	C_2HF_3		14.83	EI		419
$C_2F_2^+$	CF_2=CHCN		15.9±0.1	EI		2954
		$C_3F_2^+$				
$C_3F_2^+$	C_6F_6 (Hexafluorobenzene)		18.9±0.5	EI		1132
		$C_4F_2^+$				
$C_4F_2^+$	C_6F_6 (Hexafluorobenzene)		18±1?	EI		1132

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.

$C_5F_2^+$

$C_5F_2^+$	C_6F_6 (Hexafluorobenzene)		22±1?	EI		1132

CF_3^+ $\Delta H^\circ_{f0} \sim 417$ kJ mol^{-1} (100 kcal mol^{-1})

CF_3^+	CF_3		9.25±0.04	PI		2638, 2746
CF_3^+	CF_3		9.11	D		2746

Walter, *et al.*, ref. 2746, recommend as "best value" 9.17±0.08 eV for the CF_3 adiabatic ionization potential. This leads to $\Delta H^\circ_{f0}(CF_3^+)$ = 417 kJ mol^{-1} adopted above.

CF_3^+	CF_3		9.8±0.2	EDD		2795

See also – EI: 129, 141, 441

CF_3^+	CF_4	F	≤15.35	PI	(≤477)	2746
CF_3^+	CF_4	F	15.52±0.02	PI		2643
CF_3^+	CF_4	F	15.56±0.01	PI		1235

See also – EI: 24, 129, 1288, 2157

CF_3^+	C_2F_4 (Threshold value approximately corrected to 0 K)	CF	13.70±0.02	PI	(415)	2746

See also – EI: 419, 1378, 2586, 2601

CF_3^+	C_2F_6	CF_3	13.62±0.015	PI	(446)	2643

See also – EI: 1062, 1288, 1419, 2572

CF_3^+	C_3F_6		15.0±0.1	EI		1067

See also – EI: 1290

CF_3^+	C_3F_6 (Hexafluorocyclopropane)		15.38	EI		1290
CF_3^+	C_6F_6 (Hexafluorobenzene)		17.1?	EI		1132
CF_3^+	C_3F_8		13.22	PI		2643
CF_3^+	C_3F_8		13.4±0.1	RPD		2790

See also – EI: 1062, 1419, 2572

CF_3^+	C_4F_8 (Octafluorocyclobutane)		15.7	EI		1062
CF_3^+	n-C_4F_{10}		13.22	PI		2643

See also – EI: 1419

CF_3^+	$C_6F_{11}CF_3$ (Perfluoromethylcyclohexane)		14.4±0.2	EI		2192

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
CF_3^+	CHF_3	H	14.14	PI	(467)	2643
CF_3^+	CHF_3	H	14.03±0.06	RPD		1139

See also – EI: 43, 441, 1288

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
CF_3^+	CH_3CF_3	CH_3	13.90±0.03	EI		1075
CF_3^+	$CH_2{=}CHCF_3$		15.0±0.2	EI		1075
CF_3^+	$C_2H_5CF_3$		14.8±0.1	EI		1075
CF_3^+	CF_3OF	OF?	14.8±0.2	EI		3236
CF_3^+	$(CF_3)_2CO$		14.26±0.10	EI		2864
CF_3^+	$(CF_3)_2S$		12.54±0.06	EI		3202
CF_3^+	CF_3SSCF_3		12.07±0.13	EI		3202
CF_3^+	CH_3SCF_3		13.07±0.09	EI		3202
CF_3^+	CH_3SSCF_3		12.50±0.08	EI		3202
CF_3^+	CF_3NSF_2		14.23±0.05	RPD		2443
CF_3^+	CF_3Cl	Cl	12.63	PI	(409)	2643

A discrepancy exists in ref. 2643 between the threshold wavelength and its equivalent energy; the wavelength has been assumed correct.

See also – EI: 24, 441

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
CF_3^+	$CF_2ClCF{=}CF_2$		15.63	EI		1290
CF_3^+	CF_3Br	Br	11.71	PI	(381)	2643

A discrepancy exists in ref. 2643 between the threshold wavelength and its equivalent energy; the wavelength has been assumed correct.

See also – EI: 24, 439, 441, 1131

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
CF_3^+	CF_3I	I	10.89±0.01	PI	(360)	2643

See also – EI: 24, 439, 1111

CF_3^{+2}

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
CF_3^{+2}	CF_4	F	42.7±0.3	EI		2157

$C_2F_3^+$ $\Delta H^\circ_{f0} \sim 796$ kJ mol^{-1} (190 kcal mol^{-1})

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_2F_3^+$	C_2F_4 (Threshold value approximately corrected to 0 K)	F	15.84±0.02	PI	796	2746

See also – EI: 419, 2586

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_2F_3^+$	C_3F_6	CF_3	16.1±0.2	EI		1067

See also – EI: 1290

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_2F_3^+$	C_3F_6 (Hexafluorocyclopropane)		18.3	EI		1290

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_2F_3^+$	n-C_4F_{10}		15.65	PI		2643
$C_2F_3^+$	$C_6F_{11}CF_3$ (Perfluoromethylcyclohexane)		14.1±0.2	EI		2192

$C_3F_3^+$

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_3F_3^+$	C_6F_6 (Hexafluorobenzene)		16.8±0.3	EI		1132
$C_3F_3^+$	$C_6F_{11}CF_3$ (Perfluoromethylcyclohexane)		16.6±0.2	EI		2192

$C_5F_3^+$

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_5F_3^+$	C_6F_6 (Hexafluorobenzene)		15.8±0.2	EI		1132

CF_4^+

The stable region of the CF_4^+ ion ground state surface is not accessible by a vertical transition from the CF_4 molecule; no CF_4^+ ions have been experimentally observed. One upper bound on the adiabatic ionization potential is the $CF_4 \rightarrow CF_3^+ + F$ photoionization threshold, $\leq$15.35 eV. The photoelectron spectra generally give a higher value. However, for a stable CF_4^+ ion the heat of formation must be less than the heat of formation of $CF_3^+ + F$. This gives an upper bound of 14.7 eV for the ionization potential. Photoelectron spectra are given in refs. 2850, 3059, 3063, 3092, 3117, 3119, 3362.

$C_2F_4^+$ $\Delta H_{f0}^\circ = 321$ kJ mol^{-1} (77 kcal mol^{-1})

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_2F_4^+$	C_2F_4		10.12	PI	321	168
$C_2F_4^+$	C_2F_4		10.12±0.01	PI	321	2746
$C_2F_4^+$	C_2F_4		10.11	PE	320	2885

See also – EI: 214, 419, 2586, 2601, 2795

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_2F_4^+$	C_2F_6		20.7	EI		2572
$C_2F_4^+$	C_3F_6		12.5±0.1	EI		1067

See also – EI: 1288, 1290

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_2F_4^+$	C_3F_6 (Hexafluorocyclopropane)		11.85	EI		1290
$C_2F_4^+$	C_3F_8		13.5±0.1	RPD		2790

See also – EI: 2572

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_2F_4^+$	C_4F_8 (Octafluorocyclobutane)		12.25	EI		1062

See also – EI: 1290

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_2F_4^+$	$C_6F_{11}CF_3$ (Perfluoromethylcyclohexane)		12.4±0.2	EI		2192
		$C_3F_4^+$				
$C_3F_4^+$	$C_6F_{11}CF_3$ (Perfluoromethylcyclohexane)		11.9±0.2	EI		2192
		$C_5F_4^+$				
$C_5F_4^+$	C_6F_6 (Hexafluorobenzene)		16.1±0.3	EI		1132
		$C_2F_5^+$				
$C_2F_5^+$	C_2F_5		9.98±0.1	EI		2164
$C_2F_5^+$	C_2F_6	F	15.46±0.02	PI	(69*)	2643
See also – EI:	1062, 1419, 2572					
$C_2F_5^+$	C_3F_8	CF_3	13.32	PI	(7*)	2643
$C_2F_5^+$	C_3F_8	CF_3	13.9±0.1	RPD		2790
See also – EI:	1062, 1419, 2572					
$C_2F_5^+$	$n-C_4F_{10}$		13.05	PI		2643
See also – EI:	1419					
$C_2F_5^+$	$C_6F_{11}CF_3$ (Perfluoromethylcyclohexane)		14.4±0.2	EI		2192
*ΔH°_{f298}						
		$C_3F_5^+$				
$C_3F_5^+$	C_3F_6	F	14.8±0.3	EI		1067
See also – EI:	1290					
$C_3F_5^+$	C_3F_6 (Hexafluorocyclopropane)	F	14.14	EI		1290
$C_3F_5^+$	C_4F_8 (Octafluorocyclobutane)		12.25	EI		1062
See also – EI:	1290					
$C_3F_5^+$	$n-C_4F_{10}$		15.65	PI		2643

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_3F_5^+$	$C_6F_{11}CF_3$ (Perfluoromethylcyclohexane)		13.9±0.2	EI		2192
$C_3F_5^+$	$CF_2ClCF{=}CF_2$	Cl	11.22	EI		1290
		$C_4F_5^+$				
$C_4F_5^+$	$C_6F_{11}CF_3$ (Perfluoromethylcyclohexane)		14.9±0.2	EI		2192
		$C_5F_5^+$				
$C_5F_5^+$	C_6F_6 (Hexafluorobenzene)	CF	17.2±0.2	EI		1132
		$C_6F_5^+$				
$C_6F_5^+$	C_6F_6 (Hexafluorobenzene)	F	16.9±0.1	EI		301
See also – EI:	1132					
$C_6F_5^+$	$C_6F_5COCF_3$ (Perfluoroacetophenone)		16.0	EI		308
$C_6F_5^+$	$C_6F_5COCH_3$ (2,3,4,5,6–Pentafluoroacetophenone)		16.7	EI		308
$C_6F_5^+$	$C_6F_5CONH_2$ (2,3,4,5,6–Pentafluorobenzoic acid amide)		16.3±0.3	EI		1168
$C_6F_5^+$	C_6F_5Cl (Chloropentafluorobenzene)	Cl	15.9±0.1	EI		301
$C_6F_5^+$	C_6F_5Br (Bromopentafluorobenzene)	Br	15.2±0.1	EI		301
		$C_3F_6^+$				
$C_3F_6^+$	C_3F_6		10.3±0.2	EI		1067
$C_3F_6^+$	C_3F_6		11.11	EI		1290
See also – EI:	1123, 2795					
$C_3F_6^+$	C_3F_6 (Hexafluorocyclopropane)		11.3	EI		1123, 1290
		$C_4F_6^+$				
$C_4F_6^+$	$CF_2{=}CFCF{=}CF_2$		~9.5	PE		3120
$C_4F_6^+$	$C_6F_{11}CF_3$ (Perfluoromethylcyclohexane)		13.4±0.2	EI		2192

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
	$C_6F_6^+$ (Hexafluorobenzene)		**$\Delta H^\circ_{f298} \sim 1$ kJ mol^{-1} (0 kcal mol^{-1})**			
$C_6F_6^+$	C_6F_6 (Hexafluorobenzene)		9.97	PI	5	168
$C_6F_6^+$	C_6F_6 (Hexafluorobenzene)		9.88±0.05	PE	−3	2838
See also - EI:	301, 1127, 1132					
		$C_3F_7^+$				
$C_3F_7^+$	$n-C_3F_7$		10.06±0.1	EI		2164
$C_3F_7^+$	$iso-C_3F_7$		10.5±0.1	EI		2164
$C_3F_7^+$	C_3F_8	F	15.44±0.02	PI	(−338*)	2643
$C_3F_7^+$	C_3F_8	F	15.7±0.1	RPD		2790
See also - EI:	1062, 1419, 2572					
$C_3F_7^+$	$n-C_4F_{10}$	CF_3	13.30	PI	(−405*)	2643
See also - EI:	1419					
*ΔH°_{f298}						
		$C_4F_7^+$				
$C_4F_7^+$	$C_6F_{11}CF_3$ (Perfluoromethylcyclohexane)		15.9±0.2	EI		2192
		$C_5F_7^+$				
$C_5F_7^+$	$C_6F_{11}CF_3$ (Perfluoromethylcyclohexane)		11.9±0.2	EI		2192
		$C_{11}F_7^+$				
$C_{11}F_7^+$	$(C_6F_5)_2$ (Perfluorobiphenyl)		17.2±0.1	EI		1127
	$C_3F_8^+$		**$\Delta H^\circ_{f298} \sim -457$ kJ mol^{-1} (−109 kcal mol^{-1})**			
$C_3F_8^+$	C_3F_8		13.38	PE	−457	2843
		$C_4F_8^+$				
$C_4F_8^+$	$2-C_4F_8$		11.25	PE		2843
$C_4F_8^+$	$C_6F_{11}CF_3$ (Perfluoromethylcyclohexane)		11.9±0.2	EI		2192

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_7F_8^+$				
$C_7F_8^+$	$C_6F_5CF_3$ (Perfluorotoluene)		10.4±0.1	EI		301
		$C_{12}F_8^+$				
$C_{12}F_8^+$	$(C_6F_5)_2$ (Perfluorobiphenyl)		18.4±0.3	EI		1127
		$C_4F_9^+$				
$C_4F_9^+$	n-C_4F_{10}	F	15.42	PI	(−750*)	2643
$*\Delta H^\circ_{f298}$						
		$C_5F_9^+$				
$C_5F_9^+$	$C_6F_{11}CF_3$ (Perfluoromethylcyclohexane)		13.9±0.2	EI		2192
		$C_6F_9^+$				
$C_6F_9^+$	$C_6F_{11}CF_3$ (Perfluoromethylcyclohexane)		12.9±0.2	EI		2192
		$C_{12}F_9^+$				
$C_{12}F_9^+$	$(C_6F_5)_2$ (Perfluorobiphenyl)	F	16.7±0.1	EI		1127
		$C_5F_{10}^+$				
$C_5F_{10}^+$	C_5F_{10} (Decafluorocyclopentane)		11.7	EI		299
$C_5F_{10}^+$	$C_6F_{11}CF_3$ (Perfluoromethylcyclohexane)		15.9±0.2	EI		2192
		$C_6F_{10}^+$				
$C_6F_{10}^+$	$C_6F_{11}CF_3$ (Perfluoromethylcyclohexane)		12.4±0.2	EI		2192

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_{12}F_{10}^+$				
$C_{12}F_{10}^+$	$(C_6F_5)_2$ (Perfluorobiphenyl)		10.0±0.1	EI		1127
		$C_6F_{11}^+$				
$C_6F_{11}^+$	$C_6F_{11}CF_3$ (Perfluoromethylcyclohexane)		13.9±0.2	EI		2192
		$C_{17}F_{11}^+$				
$C_{17}F_{11}^+$	$C_6F_4(C_6F_5)_2$ (Perfluoro–*p*–terphenyl)		18.2±0.1	EI		1127
		$C_6F_{12}^+$				
$C_6F_{12}^+$	C_6F_{12} (Dodecafluorocyclohexane)		13.2	EI		299
		$C_{18}F_{12}^+$				
$C_{18}F_{12}^+$	$C_6F_4(C_6F_5)_2$ (Perfluoro–*p*–terphenyl)		19.9	EI		1127
		$C_7F_{13}^+$				
$C_7F_{13}^+$	$C_6F_{11}CF_3$ (Perfluoromethylcyclohexane)	F	15.4±0.2	EI		2192
		$C_{18}F_{13}^+$				
$C_{18}F_{13}^+$	$C_6F_4(C_6F_5)_2$ (Perfluoro–*p*–terphenyl)	F	17.5±0.3	EI		1127
		$C_7F_{14}^+$				
$C_7F_{14}^+$	*n*–$C_5F_{11}CF=CF_2$		10.48±0.02?	PI		182
		$C_{18}F_{14}^+$				
$C_{18}F_{14}^+$	$C_6F_4(C_6F_5)_2$ (Perfluoro–*p*–terphenyl)		9.85±0.3	EI		1127

4.3. The Positive Ion Table—Continued

$C_{24}F_{18}^+$

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_{24}F_{18}^+$	$C_6F_5(C_6F_4)_2C_6F_5$ (Perfluoro–*p*–quaterphenyl)		9.9±0.1	EI		1127

NF^+ $\Delta H^\circ_{f0} \sim 1420$ kJ mol^{-1} (339 kcal mol^{-1})

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
NF^+	NF_2	F^-	11.8±0.2	EI		76
NF^+	NF_2	F	15.5±0.2	EI		76
NF^+	NF_2	F	15.0±0.2	EI		100
NF^+	*cis*–N_2F_2	NF	16.9±0.2	EI		76
NF^+	*trans*–N_2F_2	NF	17.0±0.2	EI		76
NF^+	NF_3	2F	17.54±0.02	PI	1420	3038
NF^+	NF_3	2F	17.9±0.3	EI		401

N_2F^+

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
N_2F^+	*cis*–N_2F_2	F	14.0±0.2	EI		76
N_2F^+	*trans*–N_2F_2	F	13.9±0.2	EI		76

$NF_2^+(^1A_1)$ $\Delta H^\circ_{f0} = 1167$ kJ mol^{-1} (279 kcal mol^{-1})

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$NF_2^+(^1A_1)$	NF_2		11.62±0.02	PE	1167	3363
$NF_2^+(^1A_1)$	NF_2		11.79±0.12	EDD		3173
$NF_2^+(^3B_1)$	NF_2		14.05±0.02	PE		3363

Additional higher ionization potentials are given in ref. 3363.

See also – EI: 76, 100

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$NF_2^+(^1A_1)$	NF_3	F	14.12±0.01	PI	1167	3038

See also – EI: 76, 100, 401

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$NF_2^+(^1A_1)$	N_2F_4	NF_2	12.63±0.1	EDD	(1177)	3173
$NF_2^+(^1A_1)$	N_2F_4	NF_2	12.7±0.2	EI		74
NF_2^+	NF_2NO	NO	12.12±0.12	EDD		3173
NF_2^+	SF_5NF_2		16.3±0.2	EI		1144
NF_2^+	FSO_2NF_2		14.6±0.3	EI		1144
NF_2^+	FSO_2ONF_2		13.3±0.1	EI		1144

$N_2F_2^+$

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$N_2F_2^+$	*trans*–N_2F_2		13.1±0.1	EI		76

NF_3^+ $\Delta H^\circ_{f0} = 1135$ kJ mol^{-1} (271 kcal mol^{-1})

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
NF_3^+	NF_3		13.00±0.02	PI	1135	3038
NF_3^+	NF_3		13.73±0.03 (V)	PE		3083

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
NF_3^+	NF_3		13.73 (V)	PE		3119
See also – S:	2662					
EI:	76, 401					
		$N_2F_3^+$				
$N_2F_3^+$	N_2F_4	F^-	12.0	EI		76
$N_2F_3^+$	N_2F_4	F	15.6	EI		76
		$N_2F_4^+$				
$N_2F_4^+$	N_2F_4		12.84 (V)	PE		3363
$N_2F_4^+$	N_2F_4		12.04±0.10	EI		74
		OF^+				
OF^+	OF_2	F	15.8±0.2	RPD		42, 2516
OF^+	OF_2	F	15.8±0.2	EI		2047
OF^+	O_2F_2	OF	17.5±0.2	RPD		42
OF^+	CF_3OF		38±1	EI		3236
		O_2F^+				
O_2F^+	O_2F		12.6±0.2	EI		2143
O_2F^+	O_2F_2	F	14.0±0.1	RPD		42
O_2F^+	O_2F_2	F	14.0±0.1	EI		2143
	$OF_2^+(^2B_1)$	**$\Delta H_{f0}^\circ = 1247$ kJ mol^{-1} (298 kcal mol^{-1})**				
$OF_2^+(^2B_1)$	OF_2		13.13	PE	1247	3404
See also – EI:	286, 2047, 2516					
		CHF^+				
CHF^+	CH_2F_2		17.7	EI		1288
CHF^+	C_2HF_3	CF_2?	15.38	EI		419
	CH_2F^+	**$\Delta H_{f298}^\circ \sim 838$ kJ mol^{-1} (200 kcal mol^{-1})**				
CH_2F^+	CH_2F		9.35	EI		141
CH_2F^+	CH_3F	H	13.37	PI	838	2637
CH_2F^+	CH_3F	H	13.25±0.06	RPD		1139
See also – EI:	160, 3017					

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
CH_2F^+	CH_2F_2	F	15.28	EI		1288
CH_2F^+	$CH_2{=}CF_2$	CF	15.08	EI		419
CH_2F^+	CH_3CF_3		15.6±0.2	EI		1075
CH_2F^+	$C_2H_5CF_3$		15.7±0.3	EI		1075
	$CH_3F^+(^2E)$	**$\Delta H^\circ_{f298} \sim 975$ kJ mol^{-1} (233 kcal mol^{-1})**				
$CH_3F^+(^2E)$	CH_3F		12.50	PI	972	2637
$CH_3F^+(^2E)$	CH_3F		12.54	PE	976	3092
$CH_3F^+(^2E)$	CH_3F		12.54	PE	976	3116
See also – S:	3346					
PE:	3119					
EI:	289, 2154					
		CD_3F^+				
$CD_3F^+(^2E)$	CD_3F		12.67	PE		3092
		C_2HF^+				
$C_2HF^+(^2\Pi)$	$CH{\equiv}CF$		11.26	PE		3071
$C_2HF^+(^2\Pi)$	$CH{\equiv}CF$		11.5±0.1	EDD		3177
C_2HF^+	C_2H_3F	H_2	14.04	EI		419
C_2HF^+	$CH_2{=}CF_2$	HF	14.44	EI		419
C_2HF^+	C_2HF_3		20.0	EI		419
C_2HF^+	$CH_2{=}CFCN$		13.6±0.1	EI		2954
		C_2HF^{+2}				
C_2HF^{+2}	$CH{\equiv}CF$		31.5±0.1	EDD		3177
		$C_2H_2F^+$				
$C_2H_2F^+$	C_2H_3F	H	14.02	EI		419
$C_2H_2F^+$	$CH_2{=}CF_2$	F	14.80	EI		419
$C_2H_2F^+$	CH_3CF_3		15.8±0.2	EI		1075
		$C_2H_3F^+$				
$C_2H_3F^+$	C_2H_3F		10.37±0.02	PI		268
$C_2H_3F^+$	C_2H_3F		10.37	PI		168
$C_2H_3F^+$	C_2H_3F		10.37	PE		2885
See also – EI:	268, 419					
$C_2H_3F^+$	CH_3CHF_2		14.8	EI		1288
$C_2H_3F^+$	$CH_2{=}CHCF_3$		13.85±0.02	EI		1075

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_2H_4F^+$				
$C_2H_4F^+$	CH_3CHF_2	F	14.9	EI		1288
		$C_3H_2F^+$				
$C_3H_2F^+$	C_6H_5F (Fluorobenzene)		15.77±0.1	EI		2103
		$C_3H_4F^+$				
$C_3H_4F^+$	$C_2H_5CF_3$		15.8±0.1	EI		1075
		$C_4H_3F^+$				
$C_4H_3F^+$	C_6H_5F (Fluorobenzene)	C_2H_2	14.73	EI		3238
See also – EI:	2103					
		$C_5H_4F^+$				
$C_5H_4F^+$	C_5H_4F (Fluorocyclopentadienyl radical)		8.82	EI		126
		$C_6H_4F^+$				
$C_6H_4F^+$	C_6H_5F (Fluorobenzene)	H	14.1	EI		3230
See also – EI:	2103					
$C_6H_4F^+$	$C_6H_4F_2$ (1,4-Difluorobenzene)	F	15.5±0.1	EI		301
$C_6H_4F^+$	C_6H_4ClF (1-Chloro-2-fluorobenzene)	Cl	13.94	EI		1185
$C_6H_4F^+$	C_6H_4ClF (1-Chloro-3-fluorobenzene)	Cl	13.35±0.1	EI		2972
See also – EI:	1185					
$C_6H_4F^+$	C_6H_4ClF (1-Chloro-4-fluorobenzene)	Cl	13.26±0.1	EI		2972
See also – EI:	1185					

4.3. The Positive Ion Table—Continued

$C_6H_5F^+$ (Fluorobenzene) **ΔH°_{f298} = 771 kJ mol^{-1} (184 kcal mol^{-1})**

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_6H_5F^+$	C_6H_5F (Fluorobenzene)		9.200±0.005	S	771	344
$C_6H_5F^+$	C_6H_5F (Fluorobenzene)		9.20	S		3371
$C_6H_5F^+$	C_6H_5F (Fluorobenzene)		9.182	PI		2682
$C_6H_5F^+$	C_6H_5F (Fluorobenzene)		9.195±0.01	PI		182
$C_6H_5F^+$	C_6H_5F (Fluorobenzene)		9.20	PI		168
$C_6H_5F^+$	C_6H_5F (Fluorobenzene)		9.21±0.04	PE		2838
$C_6H_5F^{+*}$	C_6H_5F (Fluorobenzene)		9.86	S		3371
$C_6H_5F^{+*}$	C_6H_5F (Fluorobenzene)		9.87±0.07	PE		2838

Additional higher ionization potentials are given in ref. 2838.

See also – PI: 416
PE: 2806, 2822, 3331
EI: 301, 3223, 3230, 3238

$C_7H_6F^+$

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_7H_6F^+$	$C_6H_4FCH_2$ (3–Fluorobenzyl radical)		8.18±0.06	EI		69
$C_7H_6F^+$	$C_6H_4FCH_2$ (4–Fluorobenzyl radical)		7.78±0.1	EI		69
$C_7H_6F^+$	$C_6H_5CH_2F$ (α–Fluorotoluene)	H	12.2	EI		3230
$C_7H_6F^+$	$C_6H_4FCH_3$ (2–Fluorotoluene)	H	12.3	EI		3230
$C_7H_6F^+$	$C_6H_4FCH_3$ (3–Fluorotoluene)	H	11.92±0.1	EI		2970

See also – EI: 3230

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_7H_6F^+$	$C_6H_4FCH_3$ (4–Fluorotoluene)	H	11.89±0.1	EI		2970

See also – EI: 3230

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_7H_6F^+$	$C_6H_5CH_2CH_2C_6H_4F$ (1–(4–Fluorophenyl)–2–phenylethane)		10.7±0.2	EI		3288
$C_7H_6F^+$	$C_6H_4F(CH_2)_3COOCH_3$ (4–(4–Fluorophenyl)butanoic acid methyl ester)		13.42±0.2	EI		2497
$C_7H_6F^+$	$C_6H_4FCH_2Br$ (α–Bromo–3–fluorotoluene)	Br	9.85±0.1	EI		2970

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_7H_6F^+$	$C_6H_4FCH_2Br$ (α–Bromo–4–fluorotoluene)	Br	9.93±0.1	EI		2970
	$C_7H_7F^+$ (4–Fluorotoluene)	**ΔH°_{f298} = 700 kJ mol^{-1} (167 kcal mol^{-1})**				
$C_7H_7F^+$	$C_6H_5CH_2F$ (α–Fluorotoluene)		9.4	EI		3230
$C_7H_7F^+$	$C_6H_4FCH_3$ (2–Fluorotoluene)		8.915±0.01	PI		182
See also – EI:	3230					
$C_7H_7F^+$	$C_6H_4FCH_3$ (3–Fluorotoluene)		8.915±0.01	PI		182
See also – EI:	2025, 3230					
$C_7H_7F^+$	$C_6H_4FCH_3$ (4–Fluorotoluene)		8.785±0.01	PI	700	182
See also – EI:	3223, 3230					
		$C_8H_7F^+$				
$C_8H_7F^+$	$C_6H_4F(CH_2)_3COOCH_3$ (4–(4–Fluorophenyl)butanoic acid methyl ester)		10.67±0.2	EI		2497
		$C_8H_8F^+$				
$C_8H_8F^+$	$C_6H_4FCH(CH_3)CH_2COOCH_3$ (3–(4–Fluorophenyl)butanoic acid methyl ester)		10.95±0.2	EI		2497
		$C_9H_9F^+$				
$C_9H_9F^+$	$C_6H_4FCH(CH_3)CH_2COOCH_3$ (3–(4–Fluorophenyl)butanoic acid methyl ester)		9.70±0.2	EI		2497
		$C_{14}H_{13}F^+$				
$C_{14}H_{13}F^+$	$C_6H_5CH_2CH_2C_6H_4F$ (1–(4–Fluorophenyl)–2–phenylethane)		8.8±0.1	EI		3288
		CHF_2^+				
CHF_2^+	CHF_2		9.45	EI		141
CHF_2^+	CH_2F_2	H	13.14±0.02	RPD		1139
CHF_2^+	CH_2F_2	H	13.1	EI		1288
CHF_2^+	CH_3CHF_2	CH_3	13.21	EI		1288

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
CHF_2^+	CHF_3	F	15.75	EI		1288
CHF_2^+	CHF_3	F	16.4±0.3	EI		43
CHF_2^+	C_2HF_3	CF	14.22	EI		419
CHF_2^+	$CH_2{=}CHCF_3$		14.9±0.1	EI		1075
CHF_2^+	$C_2H_5CF_3$		15.9±0.1	EI		1075
CHF_2^+	CHF_2Cl	Cl	12.59±0.15	EI		43
	$CH_2F_2^+(^2B_2)$		**ΔH°_{f0} = 787 kJ mol^{-1} (188 kcal mol^{-1})**			
$CH_2F_2^+(^2B_2)$	CH_2F_2		12.70	PE	786	3116
$CH_2F_2^+(^2B_2)$	CH_2F_2		12.72	PE	788	3092
See also – S:	3346					
PE:	3119					
EI:	1288					
		$CD_2F_2^+$				
$CD_2F_2^+(^2B_2)$	CD_2F_2		12.79	PE		3092
		$C_2HF_2^+$				
$C_2HF_2^+$	$CH_2{=}CF_2$	H	16.67	EI		419
$C_2HF_2^+$	C_2HF_3	F	16.13	EI		419
	$CH_2{=}CF_2^+$		**ΔH°_{f0} = 673 kJ mol^{-1} (161 kcal mol^{-1})**			
$C_2H_2F_2^+$	$CH_2{=}CF_2$		10.30	PI	672	168
$C_2H_2F_2^+$	$CH_2{=}CF_2$		10.31±0.02	PI	673	268
$C_2H_2F_2^+$	$CH_2{=}CF_2$		10.31	PE	673	2885
See also – EI:	268, 419					
$C_2H_2F_2^+$	CH_3CHF_2	H_2	16.5	EI		1288
$C_2H_2F_2^+$	CH_3CF_3	HF	11.2±0.1	EI		1075
		$C_2H_3F_2^+$				
$C_2H_3F_2^+$	CH_3CHF_2	H	12.33	EI		1288
$C_2H_3F_2^+$	CH_3CF_3	F	14.9±0.2	EI		1075
		$C_2H_4F_2^+$				
$C_2H_4F_2^+$	CH_3CHF_2		12.68	EI		1288

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_3HF_2^+$				
$C_3HF_2^+$	CH_2=$CHCF_3$		14.8±0.2	EI		1075
		$C_3H_2F_2^+$				
$C_3H_2F_2^+$	CH_2=$CHCF_3$		13.8±0.1	EI		1075
		$C_3H_3F_2^+$				
$C_3H_3F_2^+$	CH_2=$CHCF_3$		13.3±0.15	EI		1075
$C_3H_3F_2^+$	$C_2H_5CF_3$		13.6±0.1	EI		1075
		$C_3H_4F_2^+$				
$C_3H_4F_2^+$	$C_2H_5CF_3$		12.53±0.04	EI		1075
		$C_3H_5F_2^+$				
$C_3H_5F_2^+$	$C_2H_5CF_3$	F	14.9±0.2	EI		1075
		$C_4H_2F_2^+$				
$C_4H_2F_2^+$	$C_6H_4F_2$ (1,2–Difluorobenzene)	C_2H_2	15.27	EI		1185
$C_4H_2F_2^+$	$C_6H_4F_2$ (1,3–Difluorobenzene)	C_2H_2	15.30	EI		1185
$C_4H_2F_2^+$	$C_6H_4F_2$ (1,4–Difluorobenzene)	C_2H_2	15.27	EI		1185
		$C_6H_3F_2^+$				
$C_6H_3F_2^+$	$C_6H_3F_3$ (1,2,4–Trifluorobenzene)	F	15.2±0.1	EI		301
	$C_6H_4F_2^+$(1,2–Difluorobenzene) **$C_6H_4F_2^+$(1,4–Difluorobenzene)**		**ΔH°_{f298} = 604 kJ mol^{-1} (144 kcal mol^{-1})** **ΔH°_{f298} = 576 kJ mol^{-1} (138 kcal mol^{-1})**			
$C_6H_4F_2^+$	$C_6H_4F_2$ (1,2–Difluorobenzene)		9.31	PI	604	168
$C_6H_4F_2^+$	$C_6H_4F_2$ (1,2–Difluorobenzene)		9.74±0.02	EI		1185
$C_6H_4F_2^+$	$C_6H_4F_2$ (1,3–Difluorobenzene)		9.78±0.02	EI		1185
$C_6H_4F_2^+$	$C_6H_4F_2$ (1,4–Difluorobenzene)		9.15	PI	576	168

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_6H_4F_2^+$	$C_6H_4F_2$ (1,4–Difluorobenzene)		9.15±0.06	PE	576	2838
See also – PE:	2806					
EI:	301, 1185					
	$CHF_3^+(^2A_1)$	$\Delta H^\circ_{f0} = 656$ kJ mol^{-1} (157 kcal mol^{-1})				
$CHF_3^+(^2A_1)$	CHF_3		~13.84	S		3346
$CHF_3^+(^2A_1)$	CHF_3		13.86	PE	656	3116
$CHF_3^+(^2A_1)$	CHF_3		≥13.8	PE		3092
See also – PE:	3119					
	$C_2HF_3^+$	$\Delta H^\circ_{f298} = 483$ kJ mol^{-1} (115 kcal mol^{-1})				
$C_2HF_3^+$	C_2HF_3		10.14	PI	483	168
See also – EI:	419					
		$C_2H_2F_3^+$				
$C_2H_2F_3^+$	CF_3CH_2		10.6±0.1	EI		2164
		$C_3H_2F_3^+$				
$C_3H_2F_3^+$	CH_2=$CHCF_3$	H	12.69±0.05	EI		1075
		$C_3H_3F_3^+$				
$C_3H_3F_3^+$	CH_2=$CHCF_3$		10.9?	PI		168
$C_3H_3F_3^+$	CH_2=$CHCF_3$		11.24±0.04	EI		1075
		$C_6H_2F_3^+$				
$C_6H_2F_3^+$	$C_6H_2F_4$ (1,2,4,5–Tetrafluorobenzene)	F	15.9±0.1	EI		301
		$C_6H_3F_3^+$				
$C_6H_3F_3^+$	$C_6H_3F_3$ (1,2,4–Trifluorobenzene)		9.37	PI		168
$C_6H_3F_3^+$	$C_6H_3F_3$ (1,2,4–Trifluorobenzene)		9.30±0.05	PE		2838
$C_6H_3F_3^+$	$C_6H_3F_3$ (1,3,5–Trifluorobenzene)		9.3?	PI		168

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
	$C_7H_4F_3^+$					
$C_7H_4F_3^+$	$C_6H_4ClCF_3$ (3–Chloro–α,α,α–trifluorotoluene)	Cl	12.99±0.1	EI		2972
$C_7H_4F_3^+$	$C_6H_4ClCF_3$ (4–Chloro–α,α,α–trifluorotoluene)	Cl	12.89±0.1	EI		2972
	$C_7H_5F_3^+$(α,α,α–Trifluorotoluene)		**ΔH°_{f298} = 334 kJ mol^{-1} (80 kcal mol^{-1})**			
$C_7H_5F_3^+$	$C_6H_5CF_3$ (α,α,α–Trifluorotoluene)		9.685±0.005	S	334	344
$C_7H_5F_3^+$	$C_6H_5CF_3$ (α,α,α–Trifluorotoluene)		9.68±0.02	PI	334	182
See also – PE: EI:	2806, 3331 301					
	$C_7H_{11}F_3^+$					
$C_7H_{11}F_3^+$	$C_6H_{11}CF_3$ (Trifluoromethylcyclohexane)		10.46±0.02	PI		182
	$C_4H_2F_4^+$					
$C_4H_2F_4^+$	*trans*–CF_2=CHCH=CF_2		8.98	PE		3120
	$C_6HF_4^+$					
$C_6HF_4^+$	C_6HF_5 (Pentafluorobenzene)	F	16.5±0.1	EI		301
	$C_6H_2F_4^+$					
$C_6H_2F_4^+$	$C_6H_2F_4$ (1,2,3,4–Tetrafluorobenzene)		9.61	PI		168
$C_6H_2F_4^+$	$C_6H_2F_4$ (1,2,3,5–Tetrafluorobenzene)		9.55	PI		168
$C_6H_2F_4^+$	$C_6H_2F_4$ (1,2,4,5–Tetrafluorobenzene)		9.39	PI		168
	$C_6HF_5^+$(Pentafluorobenzene)		**ΔH°_{f298} = 143 kJ mol^{-1} (34 kcal mol^{-1})**			
$C_6HF_5^+$	C_6HF_5 (Pentafluorobenzene)		9.84	PI	143	168
See also – EI:	301					

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_7H_3F_5^+$						
$C_7H_3F_5^+$	$C_6F_5CH_3$ (2,3,4,5,6–Pentafluorotoluene)		9.6±0.1	EI		301
$C_8H_4F_6^+$						
$C_8H_4F_6^+$	$C_6H_4(CF_3)_2$ (1,4–Bis(trifluoromethyl)benzene)		10.43±0.05	EDD		2634
See also – PE:	3331					
CNF^+						
CNF^+	FCN		13.32±0.01	PI	(1309)	2621
C_2NF^+						
C_2NF^+	CF_2=CFCN		15.1±0.1	EI		2954
$C_2NF_2^+$						
$C_2NF_2^+$	CF_2=CFCN		14.9±0.1	EI		2954
$C_3NF_2^+$						
$C_3NF_2^+$	CF_2=CFCN	F	14.3±0.1	EI		2954
$C_3NF_2^+$	CF_2=CHCN	H	15.9±0.1	EI		2954
$C_3NF_3^+$						
$C_3NF_3^+$	CF_2=CFCN		10.6±0.1	EI		2954
$C_6NF_{15}^+$						
$C_6NF_{15}^+$	$(C_2F_5)_3N$		11.7?	PI		182
BOF^+						
BOF^+	BOF		13.4±0.5	EI		2040

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$B_2O_2F_2^+$				
$B_2O_2F_2^+$	$B_3O_3F_3$		16.60±0.2	EI		3200
See also – EI:	2040					
		$B_3O_3F_2^+$				
$B_3O_3F_2^+$	$B_3O_3F_3$	F	16.15±0.2	EI		3200
See also – EI:	2040					
		$B_2OF_3^+$				
$B_2OF_3^+$	$B_3O_3F_3$	BO_2	15.35±0.2	EI		3200
See also – EI:	2040					
		$B_3O_3F_3^+$				
$B_3O_3F_3^+$	$B_3O_3F_3$		13.91±0.1	EI		3200
See also – EI:	2040					
		$B_2OF_4^+$				
$B_2OF_4^+$	B_2OF_4		14.12±0.1	EI		3200
		COF^+				
COF^+	CF_2O	F	16.0±0.1	EI		3236
COF^+	CF_3OF		20.0±0.3	EI		3236
		COF_2^+				
COF_2^+	CF_2O		13.17±0.1	EI		2893
COF_2^+	CF_2O		14.6±0.1	EI		3236
COF_2^+	CF_3OF		18.4±0.2	EI		3236
		COF_3^+				
COF_3^+	CF_3OF	F	16.1±0.2	EI		3236
		$C_2OF_3^+$				
$C_2OF_3^+$	$(CF_3)_2CO$		12.04±0.12	EI		2864

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
			$C_7OF_5^+$			
$C_7OF_5^+$	$C_6F_5COCF_3$ (Perfluoroacetophenone)		11.15	EI		308
$C_7OF_5^+$	C_6F_5CHO (2,3,4,5,6–Pentafluorobenzenecarbonal)	H	11.6	EI		308
$C_7OF_5^+$	$C_6F_5COCH_3$ (2,3,4,5,6–Pentafluoroacetophenone)		11.25	EI		308
$C_7OF_5^+$	$C_6F_5CONH_2$ (2,3,4,5,6–Pentafluorobenzoic acid amide)		11.3±0.2	EI		1168
			$C_3OF_6^+$			
$C_3OF_6^+$	$(CF_3)_2CO$		11.68	PE		2843
			$C_8OF_8^+$			
$C_8OF_8^+$	$C_6F_5COCF_3$ (Perfluoroacetophenone)		11.05	EI		308
			NOF_2^+			
NOF_2^+	ONF_3	F	13.59±0.01	PI		3038
			NOF_3^+			
NOF_3^+	ONF_3		13.26±0.01	PI		3038
See also – PE:	3083, 3358					
			CH_2BF^+			
CH_2BF^+	CH_3BF_2		13.38±0.02	EI		1076
			CH_3BF^+			
CH_3BF^+	CH_3BF_2	F	15.05±0.1	EI		1076
			$C_2H_2BF^+$			
$C_2H_2BF^+$	$CH_2{=}CHBF_2$		12.69±0.05	EI		1076
$C_2H_2BF^+$	$C_2H_5BF_2$		12.0±0.2	EI		1076

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_2H_3BF^+$						
$C_2H_3BF^+$	$CH_2{=}CHBF_2$	F	11.9±0.2	EI		1076
$C_2H_3BF^+$	$C_2H_5BF_2$		12.0±0.2	EI		1076
$C_2H_3BF^+$	*iso*-$C_3H_7BF_2$		11.8±0.1	EI		1076
$C_2H_4BF^+$						
$C_2H_4BF^+$	$C_2H_5BF_2$		12.6±0.2	EI		1076
$C_2H_5BF^+$						
$C_2H_5BF^+$	$C_2H_5BF_2$	F	12.1±0.2	EI		1076
$CH_3BF_2^+$						
$CH_3BF_2^+$	CH_3BF_2		12.54±0.03	EI		1076
$C_2H_3BF_2^+$						
$C_2H_3BF_2^+$	$CH_2{=}CHBF_2$		11.06±0.03	EI		1076
$C_2H_3BF_2^+$	*iso*-$C_3H_7BF_2$	CH_4	12.80±0.05	EI		1076
$C_2H_4BF_2^+$						
$C_2H_4BF_2^+$	*iso*-$C_3H_7BF_2$	CH_3	12.58±0.05	EI		1076
$C_2H_5BF_2^+$						
$C_2H_5BF_2^+$	$C_2H_5BF_2$		11.8±0.05	EI		1076
$B_3H_3N_3F_3^+$						
$B_3H_3N_3F_3^+$	$B_3H_3N_3F_3$ (*B*–Trifluoroborazine)		10.46±0.01	PE		3105
C_3HNF^+						
C_3HNF^+	$CF_2{=}CHCN$	F	13.1±0.1	EI		2954
$C_3H_2NF^+$						
$C_3H_2NF^+$	$CH_2{=}CFCN$		10.7±0.1	EI		2954

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_6H_6NF^+$				
$C_6H_6NF^+$	$C_6H_4FNH_2$ (4–Fluoroaniline)		7.87±0.1	CTS		2485
		$C_7H_4NF^+$				
$C_7H_4NF^+$	C_6H_4FCN (3–Fluorobenzoic acid nitrile)		10.03±0.05	RPD		3223
$C_7H_4NF^+$	C_6H_4FCN (4–Fluorobenzoic acid nitrile)		9.99±0.05	RPD		3223
		$C_8H_6NF^+$				
$C_8H_6NF^+$	$C_6H_4FCH_2CN$ (4–Fluorophenylacetic acid nitrile)		9.65±0.04	RPD		3223
		$C_8H_{10}NF^+$				
$C_8H_{10}NF^+$	$C_6H_4FN(CH_3)_2$ (*N*,*N*–Dimethyl–4–fluoroaniline)		7.50	CTS		1281
		$C_3HNF_2^+$				
$C_3HNF_2^+$	CF_2=CHCN		10.6±0.1	EI		2954
		$C_8H_4NF_3^+$				
$C_8H_4NF_3^+$	$C_6H_4(CF_3)CN$ (4–Trifluoromethylbenzoic acid nitrile)		10.61±0.05	RPD		3223
		$C_8H_5NF_6^+$				
$C_8H_5NF_6^+$	$C_6H_5N(CF_3)_2$ (*N*,*N*–Bis(trifluoromethyl)aniline)		10.00 (V)	PE		2806
		$C_2H_5OF^+$				
$C_2H_5OF^+$	CH_2FCH_2OH		11.05	PE		3374
		$C_3H_5OF^+$				
$C_3H_5OF^+$	C_3H_5OF (1,2–Epoxy–3–fluoropropane)		10.74	PE		3374

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_6H_4OF^+$				
$C_6H_4OF^+$	$C_6H_4FOCH_3$ (1–Fluoro–4–methoxybenzene)	CH_3	11.53±0.1	EI		2970
		$C_6H_5OF^+$				
$C_6H_5OF^+$	C_6H_4FOH (2–Fluorophenol)		8.66±0.01	PI		182
		$C_7H_4OF^+$				
$C_7H_4OF^+$	$C_6H_4FCOCH_3$ (3–Fluoroacetophenone)	CH_3	10.37±0.1	EI		2967
$C_7H_4OF^+$	$C_6H_4FCOCH_3$ (4–Fluoroacetophenone)	CH_3	10.20±0.2	EI		2967
See also – EI:	3238					
		$C_7H_5OF^+$				
$C_7H_5OF^+$	C_6H_5COF (Benzoic acid fluoride)		10.6	EI		308
		$C_8H_7OF^+$				
$C_8H_7OF^+$	$C_6H_4FCOCH_3$ (3–Fluoroacetophenone)		9.76±0.1	EI		2967
$C_8H_7OF^+$	$C_6H_4FCOCH_3$ (4–Fluoroacetophenone)		9.57±0.2	EI		2967
See also – EI:	3238					
		$C_{10}H_9OF^+$				
$C_{10}H_9OF^+$	$C_6H_4F(CH_2)_3COOCH_3$ (4–(4–Fluorophenyl)butanoic acid methyl ester)	CH_3OH	9.41±0.2	EI		2497
		$C_{10}H_{10}OF^+$				
$C_{10}H_{10}OF^+$	$C_6H_4FCH(CH_3)CH_2COOCH_3$ (3–(4–Fluorophenyl)butanoic acid methyl ester)	CH_3O	11.15±0.2	EI		2497
$C_{10}H_{10}OF^+$	$C_6H_4F(CH_2)_3COOCH_3$ (4–(4–Fluorophenyl)butanoic acid methyl ester)	CH_3O	11.20±0.2	EI		2497

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_{10}H_{11}OF^+$						
$C_{10}H_{11}OF^+$	$C_6H_4FCOC_3H_7$ (1–(4–Fluorophenyl)–1–butanone)		9.09±0.2	EI		2534
$C_{11}H_{13}O_2F^+$						
$C_{11}H_{13}O_2F^+$	$C_6H_4FCH(CH_3)CH_2COOCH_3$ (3–(4–Fluorophenyl)butanoic acid methyl ester)		8.45±0.2	EI		2497
$C_{11}H_{13}O_2F^+$	$C_6H_4F(CH_2)_3COOCH_3$ (4–(4–Fluorophenyl)butanoic acid methyl ester)		8.76±0.2	EI		2497
$C_2H_3OF_3^+$						
$C_2H_3OF_3^+$	CF_3CH_2OH		13.8	D		2908
$C_3H_3OF_3^+$						
$C_3H_3OF_3^+$	CH_3COCF_3		10.67±0.01	PE		3289
$C_7H_5OF_3^+$						
$C_7H_5OF_3^+$	$C_6H_5OCF_3$ (Trifluoromethoxybenzene)		10.00 (V)	PE		2806
$C_8H_5OF_3^+$						
$C_8H_5OF_3^+$	$C_6H_5COCF_3$ (α,α,α–Trifluoroacetophenone)		10.25	EI		308
$C_4H_2O_2F_3^+$						
$C_4H_2O_2F_3^+$	$CF_3COCH_2COCH_3$	CH_3	11.7±0.1	EI		2959
$C_4H_2O_2F_3^+$	$CF_3COCH_2COCF_3$	CF_3	11.2±0.1	EI		2959
$C_5H_5O_2F_3^+$						
$C_5H_5O_2F_3^+$	$CF_3COCH_2COCH_3$		9.8±0.1	EI		2959
See also – EI:	2580					
$C_8H_3OF_5^+$						
$C_8H_3OF_5^+$	$C_6F_5COCH_3$ (2,3,4,5,6–Pentafluoroacetophenone)		11.25	EI		308

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_8H_5OF_5^+$				
$C_8H_5OF_5^+$	$C_6H_5OC_2F_5$ (Pentafluoroethoxybenzene)		9.97 (V)	PE		2806
		$C_5H_2O_2F_6^+$				
$C_5H_2O_2F_6^+$	$CF_3COCH_2COCF_3$		10.55±0.05	EI		2959
See also – EI:	2580					
		$C_5H_3OF_7^+$				
$C_5H_3OF_7^+$	n-$C_3F_7COCH_3$		10.58±0.03	PI		182
		$C_2H_6BNF_2^+$				
$C_2H_6BNF_2^+$	$(CH_3)_2NBF_2$		9.71	EI		3227
		$C_2H_7BNF_3^+$				
$C_2H_7BNF_3^+$	$(CH_3)_2NHBF_3$		12.18 (V)	PE		3410
		$C_3H_9BNF_3^+$				
$C_3H_9BNF_3^+$	$(CH_3)_3NBF_3$		12.21 (V)	PE		3410
		$C_2H_6BO_2F^+$				
$C_2H_6BO_2F^+$	$(CH_3O)_2BF$		10.92	EI		3227
		$CH_3BOF_2^+$				
$CH_3BOF_2^+$	CH_3OBF_2		11.97	EI		3227
		$C_7H_2NOF_5^+$				
$C_7H_2NOF_5^+$	$C_6F_5CONH_2$ (2,3,4,5,6–Pentafluorobenzoic acid amide)		10.0±0.1	EI		1168
		$C_{19}H_{10}N_4O_2F_6^+$				
$C_{19}H_{10}N_4O_2F_6^+$	$(C_6H_5C_2N_2O)_2C_3F_6$ (1,3–Bis(2–phenyl–1,3,4–oxadiazol–5–yl)perfluoropropane)		9.5±0.1	EI		2156

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_{11}H_5N_2OF_7^+$				
$C_{11}H_5N_2OF_7^+$	$C_6H_5C_2N_2OC_3F_7$ (2–Perfluoropropyl–5–phenyl–1,3,4–oxadiazole)		9.8±0.2	EI		2156
		$C_{15}H_5N_2OF_{15}^+$				
$C_{15}H_5N_2OF_{15}^+$	$C_6H_5C_2N_2OC_7F_{15}$ (2–Perfluoroheptyl–5–phenyl–1,3,4–oxadiazole)		9.9±0.1	EI		2156
	$Ne^+(^2P_{3/2})$ **$Ne^+(^2P_{1/2})$**	**ΔH°_{f0} = 2080.6 kJ mol^{-1} (497.3 kcal mol^{-1})** **ΔH°_{f0} = 2090.0 kJ mol^{-1} (499.5 kcal mol^{-1})**				
$Ne^+(^2P_{3/2})$	Ne		21.564	S	2080.6	2113
$Ne^+(^2P_{1/2})$	Ne		21.661	S	2090.0	2113
See also – PI:	163					
EI:	52, 383, 1012, 1051, 1172, 2032, 3435					
	Ne^{+2}	**ΔH°_{f0} = 6032.9 kJ mol^{-1} (1441.9 kcal mol^{-1})**				
Ne^{+2}	Ne		62.526	S	6032.9	2113
Ne^{+2}	Ne		62.5	EI		1240
Ne^{+2}	Ne^+		40.962	S		2113
Ne^{+2}	Ne^+		41±2	SEQ		2551
	Ne^{+3}	**ΔH°_{f0} = 12155 kJ mol^{-1} (2905 kcal mol^{-1})**				
Ne^{+3}	Ne		125.98	S	12155	2113
Ne^{+3}	Ne		129	EI		1240
Ne^{+3}	Ne^{+2}		63.45	S		2113
Ne^{+3}	Ne^{+2}		63±2	SEQ		2551
	Ne^{+4}	**ΔH°_{f0} = 21525 kJ mol^{-1} (5145 kcal mol^{-1})**				
Ne^{+4}	Ne		223.09	S	21525	2113
Ne^{+4}	Ne		246	EI		1240
Ne^{+4}	Ne^{+3}		97.11	S		2113
Ne^{+4}	Ne^{+3}		94±2	SEQ		2551
	Ne^{+5}	**ΔH°_{f0} = 33703 kJ mol^{-1} (8055 kcal mol^{-1})**				
Ne^{+5}	Ne		349.30	S	33703	2113
Ne^{+5}	Ne		900	EI		1240
Ne^{+5}	Ne^{+4}		126.21	S		2113
Ne^{+5}	Ne^{+4}		127±2	SEQ		2551

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
	Na^+	**ΔH°_{f0} = 603.9 kJ mol^{-1} (144.3 kcal mol^{-1})**				
Na^+	Na		5.139	S	603.9	2113
See also – EI:	2487, 3257					
Na^+	NaF	F	9.9±0.2	EI		2436
Na^+	NaCl	Cl	9.5±0.2	EI		2406
Na^+	NaI	I	8.138	PI		2610
(Threshold value corrected for hot bands)						
Na^+	NaI	I	8.7±0.3	EI		2001
	Na^{+2}	**ΔH°_{f0} = 5166.3 kJ mol^{-1} (1234.8 kcal mol^{-1})**				
Na^{+2}	Na		52.425	S	5166.3	2113
Na^{+2}	Na		52±1	NRE		99
Na^{+2}	Na^+		47.286	S		2113
	Na^{+3}	**ΔH°_{f0} = 12079 kJ mol^{-1} (2887 kcal mol^{-1})**				
Na^{+3}	Na		124.07	S	12079	2113
Na^{+3}	Na		125±2	NRE		99
Na^{+3}	Na^{+2}		71.64	S		2113
	Na_2^+	**ΔH°_{f0} = 613 kJ mol^{-1} (146 kcal mol^{-1})**				
Na_2^+	Na_2		~4.87	S		3179, 3183
Na_2^+	Na_2		4.90±0.01	PI	613	1189
Na_2^+	Na_2		4.9±0.1	PI		2585, 2633
Na_2^+	Na_2		4.79±0.1	EI		3416
		Na_3^+				
Na_3^+	Na_3		3.9±0.1	PI		2585, 2633
		Na_4^+				
Na_4^+	Na_4		4.2±0.1	PI		2585, 2633
		Na_5^+				
Na_5^+	Na_5		3.9–4.3	PI		2585
		Na_6^+				
Na_6^+	Na_6		4.05–4.35	PI		2585

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
Na_7^+						
Na_7^+	Na_7		3.9–4.15	PI		2585
Na_8^+						
Na_8^+	Na_8		4.0	PI		2585
NaO^+						
NaO^+	NaO		6.5±0.7	EI		3186
Na_2O^+						
Na_2O^+	Na_2O		5.5±0.5	EI		3186
Mg^+ $\Delta H^\circ_{f0} = 884.2$ kJ mol^{-1} (211.3 kcal mol^{-1})						
Mg^+	Mg		7.646	S	884.2	2113, 3126
Mg^+	Mg		7.52±0.2	SI		3021
See also – EI:	1104, 2432, 2620, 2990					
Mg^+	$MgCl_2$		16.31±0.10	EI		2991
Mg^+	$MgCl_2$		17.5±0.5	EI		178
Mg^+	$MgBr_2$		15.5±1	EI		178
MgF^+						
MgF^+	MgF		~7.68	S		3082
MgF^+	MgF		7.5±0.5	EI		2432
MgF^+	MgF		7.8±0.3	EI		1104, 2148
MgF^+	MgF		8.0±0.5	EI		2620
MgF^+	MgF_2	F	13.5±0.4	EI		178
MgF^+	MgF_2	F	13.5±1.0	EI		2432
MgF^+	MgF_2	F	13.7±0.4	EI		1104
MgF_2^+						
MgF_2^+	MgF_2		13.3±0.3	EI		2432
MgF_2^+	MgF_2		13.5±0.4	EI		178
MgF_2^+	MgF_2		14.0±0.5	EI		2620
$Mg_2F_3^+$						
$Mg_2F_3^+$	Mg_2F_4	F	14.0±0.5	EI		178

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
	Al^+	**ΔH°_{f0} = 901.6 kJ mol^{-1} (215.5 kcal mol^{-1})**				
Al^+	Al		5.986	S	901.6	2113, 2199
See also – S:	3270					
EI:	1104, 2128, 2141, 2165, 2518, 2699, 2707, 2715, 2990, 3199					
Al^+	AlF	F^-?	9.2±0.3	EI		2148
Al^+	$(CH_3)_3Al$		14.6±0.2	EI		2556
Al^+	$AlCl_3$		22.1±0.5	EI		2897
Al^+	$AlBr_3$		18.3±0.5	EI		2897
		AlC^+				
AlC^+	AlCN	N	~15	EI		2439
		AlN^+				
AlN^+	AlCN	C	~15	EI		2439
		AlO^+				
AlO^+	AlO		9.5±0.5	EI		2128, 2518
		Al_2O^+				
Al_2O^+	Al_2O		7.7±0.5	EI		2128, 2518
Al_2O^+	Al_2O		7.9±0.3	EI		2699
Al_2O^+	Al_2O		8.5±0.5	EI		3199
		$Al_2O_2^+$				
$Al_2O_2^+$	Al_2O_2		9.9±0.5	EI		2128
		AlF^+				
AlF^+	AlF		8.9±0.6	EI		2142
AlF^+	AlF		9.2	EI		2141
AlF^+	AlF		9.4±0.5	EI		2432
See also – EI:	1104, 2148					
		AlF_2^+				
AlF_2^+	AlF_2		9±1	EI		2148
AlF_2^+	AlF_3	F	15.2±0.3	EI		1104, 2148
AlF_2^+	AlF_3	F	15.5±1.0	EI		2432

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		CH_3Al^+				
CH_3Al^+	$(CH_3)_3Al$		13.9±0.3	EI		2556
		$C_2H_6Al^+$				
$C_2H_6Al^+$	$(CH_3)_3Al$	CH_3	10.1±0.3	EI		2556
		$C_3H_9Al^+$				
$C_3H_9Al^+$	$(CH_3)_3Al$		9.09±0.26	EI		2556
		$CNAl^+$				
$CNAl^+$	AlCN		7.4±0.3	EI		2439
		$BOAl^+$				
$BOAl^+$	AlBO		8.5±0.5	EI		3199
		BO_2Al^+				
BO_2Al^+	$AlBO_2$		9.5±0.5	EI		3199
		$C_{10}H_{14}O_4Al^+$				
$C_{10}H_{14}O_4Al^+$	$(CH_3COCHCOCH_3)_3Al$ (Tris(2,4-pentanedionato)aluminum)		9.1±0.2	EI		2460, 2959
		$C_{22}H_{38}O_4Al^+$				
$C_{22}H_{38}O_4Al^+$	$((CH_3)_3CCOCHCOC(CH_3)_3)_3Al$ (Tris(2,2,6,6-tetramethyl-3,5-heptanedionato)aluminum)		13.6±0.5	EI		2524
		$C_{15}H_{21}O_6Al^+$				
$C_{15}H_{21}O_6Al^+$	$(CH_3COCHCOCH_3)_3Al$ (Tris(2,4-pentanedionato)aluminum)		7.95±0.05	EI		2460, 2959
$C_{15}H_{21}O_6Al^+$	$(CH_3COCHCOCH_3)_3Al$ (Tris(2,4-pentanedionato)aluminum)		8.27±0.13	EI		2580
		$C_{25}H_{39}O_6Al^{+2}$				
$C_{25}H_{39}O_6Al^{+2}$	$((CH_3)_3CCOCHCOC(CH_3)_3)_3Al$ (Tris(2,2,6,6-tetramethyl-3,5-heptanedionato)aluminum)		27.8±0.5	EI		2524

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_{29}H_{48}O_6Al^+$						
$C_{29}H_{48}O_6Al^+$	$((CH_3)_3CCOCHCOC(CH_3)_3)_3Al$ (Tris(2,2,6,6-tetramethyl-3,5-heptanedionato)aluminum)		12.2±0.5	EI		2524
$C_{33}H_{57}O_6Al^+$						
$C_{33}H_{57}O_6Al^+$	$((CH_3)_3CCOCHCOC(CH_3)_3)_3Al$ (Tris(2,2,6,6-tetramethyl-3,5-heptanedionato)aluminum)		10.9±0.5	EI		2524
$C_{10}H_8O_4F_6Al^+$						
$C_{10}H_8O_4F_6Al^+$	$(CF_3COCHCOCH_3)_3Al$ (Tris(1,1,1-trifluoro-2,4-pentanedionato)aluminum)		10.2±0.1	EI		2959
$C_{15}H_{12}O_6F_9Al^+$						
$C_{15}H_{12}O_6F_9Al^+$	$(CF_3COCHCOCH_3)_3Al$ (Tris(1,1,1-trifluoro-2,4-pentanedionato)aluminum)		9.05±0.1	EI		2959
$C_{10}H_2O_4F_{12}Al^+$						
$C_{10}H_2O_4F_{12}Al^+$	$(CF_3COCHCOCF_3)_3Al$ (Tris(1,1,1,5,5,5-hexafluoro-2,4-pentanedionato)aluminum)		11.2±0.1	EI		2959
$C_{14}H_3O_6F_{15}Al^+$						
$C_{14}H_3O_6F_{15}Al^+$	$(CF_3COCHCOCF_3)_3Al$ (Tris(1,1,1,5,5,5-hexafluoro-2,4-pentanedionato)aluminum)	CF_3	10.7±0.1	EI		2959
$C_{15}H_3O_6F_{18}Al^+$						
$C_{15}H_3O_6F_{18}Al^+$	$(CF_3COCHCOCF_3)_3Al$ (Tris(1,1,1,5,5,5-hexafluoro-2,4-pentanedionato)aluminum)		10.21 (V)	PE		3169
$C_{15}H_3O_6F_{18}Al^+$	$(CF_3COCHCOCF_3)_3Al$ (Tris(1,1,1,5,5,5-hexafluoro-2,4-pentanedionato)aluminum)		9.80±0.1	EI		2959
$C_{15}H_3O_6F_{18}Al^+$	$(CF_3COCHCOCF_3)_3Al$ (Tris(1,1,1,5,5,5-hexafluoro-2,4-pentanedionato)aluminum)		10.30±0.11	EI		2580

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
	Si^+	$\Delta H^\circ_{f0} = 1237.8$ kJ mol^{-1} (295.8 kcal mol^{-1})				
Si^+	Si		8.151	S	1237.8	2113
See also – EI:	1116, 2707, 2714					
Si^+	SiH_4		13.56±0.08	RPD		2899
Si^+	SiH_4		11.7±0.2	EI		2116
Si^+	Si_2H_6		15.2±0.3	EI		2133
Si^+	$(CH_3)_3SiH$		13.7±0.3	EI		83
Si^+	$(CH_3)_4Si$		17.9	EI		2980
Si^+	$(C_2H_5)_4Si$		28.0	EI		2980
		Si_2^+				
Si_2^+	Si_2		7.3	EI		1116
Si_2^+	Si_2		7.4±0.3	EI		333
Si_2^+	Si_2H_6		13.0	RPD		2899
Si_2^+	Si_2H_6		12.2±0.3	EI		2133
Si_2^+	Si_2C	C	~15	EI		2943
		Si_3^+				
Si_3^+	Si_3		8.0±0.3	EI		333
		SiH^+				
SiH^+	SiH		8.01±0.08	D		3219
SiH^+	SiH_4		15.3±0.3	RPD		2899
SiH^+	SiH_4		16.1±0.2	EI		2116
SiH^+	$(CH_3)_3SiH$		14.2±0.2	EI		83
SiH^+	$(CH_3)_4Si$		18.2	EI		2980
SiH^+	$(C_2H_5)_4Si$		26.8	EI		2980
		SiH_2^+				
SiH_2^+	SiH_4	H_2	11.90±0.02	RPD		2899
SiH_2^+	SiH_4	H_2	11.91±0.02	EI		2182
SiH_2^+	SiH_4	H_2	12.1±0.2	EI		2116
SiH_2^+	Si_2H_6	SiH_4	11.95±0.10	RPD		2899
SiH_2^+	Si_2H_6	SiH_4	11.94±0.04	EI		2183
SiH_2^+	CH_3SiH_3	CH_4	11.50±0.05	RPD		2757, 2898
SiH_2^+	CH_3SiH_3	CH_4	11.62±0.1	EI		2182
SiH_2^+	$C_2H_5SiH_3$	C_2H_6	12.0±0.1	EI		2182
SiH_2^+	$(C_2H_5)_4Si$		25.7	EI		2980

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
SiH_3^+						
SiH_3^+	SiH_4	H	12.30±0.03	RPD		2899
SiH_3^+	SiH_4	H	11.8±0.2	EI		173, 2116
SiH_3^+	SiH_4	H	11.81±0.09	EI		2002
SiH_3^+	SiH_4	H	12.40±0.02	EI		2182
SiH_3^+	Si_2H_6	SiH_3	11.95±0.15	RPD		2899
SiH_3^+	Si_2H_6	SiH_3	11.3±0.2	EI		173
SiH_3^+	Si_2H_6	SiH_3	11.31±0.12	EI		2002
SiH_3^+	Si_2H_6	SiH_3	11.85±0.05	EI		2183
SiH_3^+	CH_3SiH_3	CH_3	12.80±0.1	EI		2182
SiH_3^+	$C_2H_5SiH_3$	C_2H_5	12.8±0.2	EI		2182
SiH_3^+	*iso*-$C_3H_7SiH_3$		13.1±0.2	EI		2182
SiH_3^+	$(CH_3)_3SiH$		14.3±0.5	EI		83
SiH_3^+	*tert*-$C_4H_9SiH_3$		13.7±0.2	EI		2182
SiH_3^+	$(CH_3)_4Si$		16.5	EI		2980
SiH_3^+	$(C_2H_5)_4Si$		20.6	EI		2980
SiH_3^+	H_3SiPH_2		11.5±0.2	EI		173
SiH_3^+	H_3GeSiH_3		12.01±0.09	EI		2002
SiH_4^+ $\Delta H^\circ_{f0} = 1168$ kJ mol^{-1} (279 kcal mol^{-1})						
SiH_4^+	SiH_4		11.66	PE	1168	3116
Si_2H^+						
Si_2H^+	Si_2H_6	$2H_2$+H	12.90±0.2	RPD		2899
$Si_2H_2^+$						
$Si_2H_2^+$	Si_2H_6	$2H_2$	11.80±0.10	RPD		2899
$Si_2H_3^+$						
$Si_2H_3^+$	Si_2H_6	H_2+H	12.50±0.10	RPD		2899
$Si_2H_4^+$						
$Si_2H_4^+$	Si_2H_6	H_2	10.85±0.10	RPD		2899
$Si_2H_5^+$						
$Si_2H_5^+$	Si_2H_6	H	11.40±0.10	RPD		2899
$Si_2H_6^+$						
$Si_2H_6^+$	Si_2H_6		10.15±0.10	RPD		2899
$Si_2H_6^+$	Si_2H_6		10.6±0.3	EI		2133

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
SiB^+						
SiB^+	SiB		7.8	EI		1116
SiC^+						
SiC^+	SiC		9.0	EI		1116
SiC^+	SiC		9.2±0.4	EI		333
SiC_2^+						
SiC_2^+	SiC_2		10.2±0.3	EI		333, 1116
Si_2C^+						
Si_2C^+	Si_2C		9.1	EI		1116
Si_2C^+	Si_2C		9.2±0.3	EI		333
$Si_2C_2^+$						
$Si_2C_2^+$	Si_2C_2		8.2±0.3	EI		333
$Si_2C_3^+$						
$Si_2C_3^+$	Si_2C_3		9.2±0.3	EI		333
Si_3C^+						
Si_3C^+	Si_3C		8.2±0.3	EI		333
Si_2N^+						
Si_2N^+	Si_2N		9.4±0.3	EI		2599
SiO^+						
SiO^+	SiO		~11.67	S		2714, 3414
(Based on a reinterpretation of the absorption spectrum of SiO which had previously led to a "provisional" value for the ionization potential of 10.51 eV, see ref. 2150)						
SiO^+	SiO		11.58±0.10	EI		3414
SiO^+	SiO		11.6±0.2	EI		2714

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol⁻¹)	Ref.
	SiF^+	**$\Delta H^\circ_{f0} \sim 705$ kJ mol^{-1} (168 kcal mol^{-1})**				
SiF^+	SiF		7.26	S	705	2149
SiF^+	SiF_4		28.75±0.1	RPD		2525
SiF^+	Si_2F_6		14.16±0.1	RPD		2525
SiF^+	Si_2BF_7		11.56±0.1	RPD		2525
		SiF_2^+				
SiF_2^+	SiF_2		11.29±0.1	RPD		2525
SiF_2^+	SiF_4		27.35±0.1	RPD		2525
SiF_2^+	Si_2F_6		13.02±0.1	RPD		2525
SiF_2^+	Si_3F_8		13.45±0.1	RPD		2525
SiF_2^+	Si_2BF_7		13.21±0.1	RPD		2525
		SiF_3^+				
SiF_3^+	SiF_4	F?	16.20±0.1	RPD		2525
SiF_3^+	Si_2F_6		14.30±0.1	RPD		2525
SiF_3^+	Si_3F_8		15.51±0.1	RPD		2525
SiF_3^+	Si_2BF_7		15.42±0.1	RPD		2525
	SiF_4^+	**$\Delta H^\circ_{f0} \sim -79$ kJ mol^{-1} (−19 kcal mol^{-1})**				
SiF_4^+	SiF_4		15.81±0.02	PE	−84	3362
SiF_4^+	SiF_4		15.92	PE	−73	3063
SiF_4^+	SiF_4		15.71±0.1	RPD		2525
See also – PE:	3059					
EI:	74					
		$Si_2F_4^+$				
$Si_2F_4^+$	Si_3F_8		11.43±0.1	RPD		2525
$Si_2F_4^+$	Si_2BF_7		11.32±0.1	RPD		2525
		$Si_2F_5^+$				
$Si_2F_5^+$	Si_2F_6	F?	12.89±0.1	RPD		2525
$Si_2F_5^+$	Si_3F_8		11.77±0.1	RPD		2525
$Si_2F_5^+$	Si_2BF_7		12.97±0.1	RPD		2525
		$Si_3F_7^+$				
$Si_3F_7^+$	Si_3F_8	F?	15.62±0.1	RPD		2525

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$Si_3F_8^+$						
$Si_3F_8^+$	Si_3F_8		10.84±0.1	RPD		2525
$CHSi^+$						
$CHSi^+$	$(CH_3)_3SiH$		11.7±0.5	EI		83
CH_2Si^+						
CH_2Si^+	$(CH_3)_3SiH$		10.6±0.3	EI		83
CH_3Si^+						
CH_3Si^+	CH_3SiH_3	H_2+H	14.05±0.05	RPD		2757, 2898
CH_3Si^+	$(CH_3)_2SiH_2$		14.00±0.15	RPD		2898
CH_3Si^+	$(CH_3)_3SiH$		13.40±0.10	RPD		2898
CH_3Si^+	$(CH_3)_3SiH$		12.4±0.3	EI		83
CH_3Si^+	$(CH_3)_4Si$		17.1±0.4	EI		82
CH_3Si^+	$(CH_3)_4Si$		17.3	EI		2980
CH_4Si^+						
CH_4Si^+	CH_3SiH_3	H_2	11.45±0.05	RPD		2757, 2898
CH_4Si^+	$(CH_3)_2SiH_2$		10.85±0.05	RPD		2898
CH_4Si^+	$(CH_3)_3SiH$		11.0±0.3	EI		83
CH_4Si^+	$(CH_3)_4Si$		16.3	EI		2980
CH_5Si^+						
CH_5Si^+	CH_3SiH_3	H	11.80±0.05	RPD		2757, 2898
CH_5Si^+	$(CH_3)_2SiH_2$	CH_3	11.51±0.05	RPD		2898
CH_5Si^+	$(CH_3)_3SiH$		12.8±0.5	EI		83
CH_5Si^+	$(CH_3)_4Si$	C_2H_4+CH_3	13.81±0.02	PI		3039
(Threshold value approximately corrected for hot bands)						
CH_5Si^+	$(CH_3)_4Si$	C_2H_4+CH_3	14.4	EI		2980
$C_2H_5Si^+$						
$C_2H_5Si^+$	$(C_2H_5)_4Si$		19.4	EI		2980
$C_2H_6Si^+$						
$C_2H_6Si^+$	$(CH_3)_2SiH_2$	H_2	10.71±0.05	RPD		2898
$C_2H_6Si^+$	$(CH_3)_3SiH$		10.50±0.05	RPD		2898
$C_2H_6Si^+$	$(CH_3)_3SiH$		10.3±0.2	EI		83
$C_2H_6Si^+$	$(CH_3)_4Si$		13.4	EI		2980
$C_2H_6Si^+$	$(CH_3)_4Si$		13.9±0.3	EI		82

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_2H_7Si^+$				
$C_2H_7Si^+$	$(CH_3)_2SiH_2$	H	11.12±0.05	RPD		2898
$C_2H_7Si^+$	$(CH_3)_2SiH_2$	H	11.94±0.04	RPD		1421
$C_2H_7Si^+$	$(CH_3)_3SiH$	CH_3	10.91±0.05	RPD		2898
$C_2H_7Si^+$	$(CH_3)_3SiH$	CH_3	11.70±0.06	RPD		1421
See also – EI:	83, 2689					
$C_2H_7Si^+$	$(CH_3)_4Si$		13.3	EI		2980
$C_2H_7Si^+$	$(C_2H_5)_4Si$		11.8	EI		2980
		$C_2H_8Si^+$				
$C_2H_8Si^+$	$C_2H_5SiH_3$		10.18±0.05	EI		2182
		$C_3H_9Si^+$				
$C_3H_9Si^+$	$(CH_3)_3SiH$	H	10.52±0.05	RPD		2898
$C_3H_9Si^+$	$(CH_3)_3SiH$	H	10.78±0.07	RPD		1421, 3187
$C_3H_9Si^+$	$(CH_3)_3SiH$	H	10.6±0.1	EI		2401, 2689
$C_3H_9Si^+$	$(CH_3)_3SiH$	H	10.72±0.1	EI		2055
See also – EI:	83					
$C_3H_9Si^+$	$(CH_3)_4Si$	CH_3	10.09±0.02	PI		3039
(Threshold value approximately corrected for hot bands)						
$C_3H_9Si^+$	$(CH_3)_4Si$	CH_3	10.25±0.05	RPD		2898
$C_3H_9Si^+$	$(CH_3)_4Si$	CH_3	10.63±0.13	RPD		1421, 3187
$C_3H_9Si^+$	$(CH_3)_4Si$	CH_3	10.4±0.1	EI		2401, 2689
$C_3H_9Si^+$	$(CH_3)_4Si$	CH_3	10.53±0.1	EI		2055
$C_3H_9Si^+$	$(CH_3)_4Si$	CH_3	10.53±0.20	EI		2720
See also – EI:	82, 2980					
$C_3H_9Si^+$	$(CH_3)_3SiC_2H_5$		10.53±0.09	RPD		1421, 3187
$C_3H_9Si^+$	$(CH_3)_3SiC_2H_5$		10.34±0.11	EI		2055
$C_3H_9Si^+$	*iso*–$C_3H_7Si(CH_3)_3$		10.56±0.16	RPD		1421, 3187
$C_3H_9Si^+$	*tert*–$C_4H_9Si(CH_3)_3$		10.53±0.09	RPD		1421, 3187
$C_3H_9Si^+$	$C_6H_5CH_2Si(CH_3)_3$ (α–Trimethylsilyltoluene)		10.05±0.1	EI		2055
$C_3H_9Si^+$	$(CH_3)_3SiSi(CH_3)_3$		10.69±0.04	RPD		1421, 3187
$C_3H_9Si^+$	$(CH_3)_3SiSi(CH_3)_3$		10.0±0.1	EI		2401, 2689
$C_3H_9Si^+$	$(CH_3)_3SiSi(CH_3)_3$		10.03±0.1	EI		2055, 2413
$C_3H_9Si^+$	$(CH_3)_3SiSi(CH_3)_3$		10.22±0.18	EI		2720
See also – EI:	2475					
$C_3H_9Si^+$	$(CH_3)_3SiSi(CH_3)_2C_2H_5$		10.1±0.1	EI		2418
$C_3H_9Si^+$	$(CH_3)_3SiN(C_2H_5)_2$		12.61±0.03	RPD		1421
$C_3H_9Si^+$	$(CH_3)_3SiOCH_3$		12.43±0.18	RPD		1421

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_3H_9Si^+$	$(CH_3)_3SiOSi(CH_3)_3$		15.36±0.13	RPD		1421
$C_3H_9Si^+$	$(CH_3)_3SiF$	F^-?	11.7±0.5	RPD		1421
$C_3H_9Si^+$	$(CH_3)_3SiCl$	Cl?	12.40±0.06	RPD		1421
$C_3H_9Si^+$	$(CH_3)_3SiCl$	Cl?	12.42±0.03	RPD		3187
$C_3H_9Si^+$	$(CH_3)_3SiCl$	Cl?	10.9±0.1	EI		2401, 2689
$C_3H_9Si^+$	$(CH_3)_3SiCl$	Cl?	11.5±0.2	EI		2055
$C_3H_9Si^+$	$(CH_3)_3SiGe(CH_3)_3$		10.19±0.12	EI		2720
$C_3H_9Si^+$	$(CH_3)_3SiBr$	Br?	10.69±0.06	RPD		1421
$C_3H_9Si^+$	$(CH_3)_3SiBr$	Br?	10.5±0.1	EI		2401, 2689
$C_3H_9Si^+$	$(CH_3)_3SiSn(CH_3)_3$		10.18±0.26	EI		2720
$C_3H_9Si^+$	$(CH_3)_3SiI$	I?	10.1±0.1	EI		2401, 2689
$C_3H_9Si^+$	$(CH_3)_3SiHgSi(CH_3)_3$		8.56±0.1	EI		2055

$C_3H_{10}Si^+$

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_3H_{10}Si^+$	*iso*-$C_3H_7SiH_3$		9.85±0.1	EI		2182
$C_3H_{10}Si^+$	$(CH_3)_3SiH$		10.11	PI		2413
$C_3H_{10}Si^+$	$(CH_3)_3SiH$		9.8±0.3	EI		83

See also – EI: 2689

$C_4H_{11}Si^+$

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_4H_{11}Si^+$	$(CH_3)_3SiC_2H_5$	CH_3	11.41±0.06	RPD		1421
$C_4H_{11}Si^+$	$(C_2H_5)_4Si$		12.5	EI		2980
$C_4H_{11}Si^+$	$(CH_3)_3SiSi(CH_3)_2C_2H_5$		9.7±0.1	EI		2418

$(CH_3)_4Si^+$ $\Delta H^\circ_{f298} = 712$ kJ mol^{-1} (170 kcal mol^{-1})

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_4H_{12}Si^+$	*tert*-$C_4H_9SiH_3$		9.5±0.2	EI		2182
$C_4H_{12}Si^+$	$(CH_3)_4Si$		9.86±0.02	PI	712	3039
(Threshold value approximately corrected for hot bands)						
$C_4H_{12}Si^+$	$(CH_3)_4Si$		9.74±0.05	RPD		2898
$C_4H_{12}Si^+$	$(CH_3)_4Si$		9.98±0.03	RPD		1421
$C_4H_{12}Si^+$	$(CH_3)_4Si$		9.85±0.16	EI		2720
$C_4H_{12}Si^+$	$(CH_3)_4Si$		9.9±0.1	EI		2689

See also – EI: 82, 218, 2900, 2980

$C_5H_{10}Si^+$

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_5H_{10}Si^+$	$(CH_3)_3SiC{\equiv}CH$		10.14±0.04	RPD		2408

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_5H_{12}Si^+$				
$C_5H_{12}Si^+$	$(CH_3)_3SiCH=CH_2$		9.82±0.04	RPD		2410
$C_5H_{12}Si^+$	$C_5H_{12}Si$ (1,1-Dimethylsilacyclobutane)		8.83±0.07	EI		2547
		$C_5H_{14}Si^+$				
$C_5H_{14}Si^+$	$(CH_3)_3SiC_2H_5$		9.70±0.01	RPD		1421
		$C_6H_{12}Si^+$				
$C_6H_{12}Si^+$	$(CH_3)_3SiCH_2C\equiv CH$		9.04±0.04	RPD		2408
		$C_6H_{14}Si^+$				
$C_6H_{14}Si^+$	$(CH_3)_3SiCH_2CH=CH_2$		8.85±0.04	RPD		2410
		$C_6H_{15}Si^+$				
$C_6H_{15}Si^+$	$(C_2H_5)_4Si$		11.0	EI		2980
		$C_6H_{16}Si^+$				
$C_6H_{16}Si^+$	*iso*-$C_3H_7Si(CH_3)_3$		9.50±0.03	RPD		1421
		$C_7H_{18}Si^+$				
$C_7H_{18}Si^+$	*tert*-$C_4H_9Si(CH_3)_3$		9.34±0.06	RPD		1421
		$C_8H_{20}Si^+$				
$C_8H_{20}Si^+$	$(C_2H_5)_4Si$		10.5	EI		2980
		$C_9H_{14}Si^+$				
$C_9H_{14}Si^+$	$C_6H_5Si(CH_3)_3$ (Trimethylsilylbenzene)		8.72±0.04	RPD		2407, 2463
		$C_9H_{18}Si^+$				
$C_9H_{18}Si^+$	$(CH_3)_3CC\equiv CSi(CH_3)_3$		9.35±0.04	RPD		2408

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_9H_{20}Si^+$				
$C_9H_{20}Si^+$	*trans*-$(CH_3)_3CCH=CHSi(CH_3)_3$		9.08±0.04	RPD		2410
		$C_{10}H_{16}Si^+$				
$C_{10}H_{16}Si^+$	$C_6H_5CH_2Si(CH_3)_3$ (α–Trimethylsilyltoluene)		7.96±0.04	RPD		2407, 2463
		$C_{11}H_{14}Si^+$				
$C_{11}H_{14}Si^+$	$C_6H_5C\equiv CSi(CH_3)_3$ (α–Trimethylsilylethynylbenzene)		8.16	RPD		2950
		$C_5H_{15}Si_2^+$				
$C_5H_{15}Si_2^+$	$(CH_3)_3SiSi(CH_3)_3$	CH_3	10.74±0.08	RPD		1421
		$C_6H_{16}Si_2^+$				
$C_6H_{16}Si_2^+$	$C_6H_{16}Si_2$ (1,1,3,3–Tetramethyl–1,3–disilacyclobutane)		8.56±0.07	EI		2547
		$C_6H_{18}Si_2^+$				
$C_6H_{18}Si_2^+$	$(CH_3)_3SiSi(CH_3)_3$		8.79±0.08	RPD		1421
$C_6H_{18}Si_2^+$	$(CH_3)_3SiSi(CH_3)_3$		8.00±0.01	EI		2900
$C_6H_{18}Si_2^+$	$(CH_3)_3SiSi(CH_3)_3$		8.35±0.12	EI		2720
		$C_8H_{18}Si_2^+$				
$C_8H_{18}Si_2^+$	$(CH_3)_3SiC\equiv CSi(CH_3)_3$		9.63±0.04	RPD		2408
		$C_8H_{20}Si_2^+$				
$C_8H_{20}Si_2^+$	$((CH_3)_3Si)_2C=CH_2$		9.25±0.04	RPD		2410
$C_8H_{20}Si_2^+$	*trans*-$(CH_3)_3SiCH=CHSi(CH_3)_3$		9.32±0.04	RPD		2410
		$C_9H_{20}Si_2^+$				
$C_9H_{20}Si_2^+$	$(CH_3)_3SiC\equiv CCH_2Si(CH_3)_3$		8.95±0.04	RPD		2408
		$C_{10}H_{18}Si_2^+$				
$C_{10}H_{18}Si_2^+$	$(CH_3)_3SiC\equiv CC\equiv CSi(CH_3)_3$		9.23±0.04	RPD		2408

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol⁻¹)	Ref.
$C_{10}H_{22}Si_2^+$						
$C_{10}H_{22}Si_2^+$	$(CH_3)_3SiCH_2C{\equiv}CCH_2Si(CH_3)_3$		8.85±0.04	RPD		2408
$C_{10}H_{24}Si_2^+$						
$C_{10}H_{24}Si_2^+$	*trans*–$(CH_3)_3SiCH_2CH{=}CHCH_2Si(CH_3)_3$		7.95±0.04	RPD		2410
$C_{11}H_{20}Si_2^+$						
$C_{11}H_{20}Si_2^+$	$C_6H_5Si_2(CH_3)_5$ ($\beta,\beta,\gamma,\gamma$–Tetramethyl–$\beta,\gamma$–disilapropylbenzene)		7.82	RPD		2950
$C_{12}H_{18}Si_2^+$						
$C_{12}H_{18}Si_2^+$	$(CH_3)_3SiC{\equiv}CC{\equiv}CC{\equiv}CSi(CH_3)_3$		8.90±0.04	RPD		2408
$C_{12}H_{22}Si_2^+$						
$C_{12}H_{22}Si_2^+$	$(CH_3)_3SiCH_2C{\equiv}CC{\equiv}CCH_2Si(CH_3)_3$		8.38±0.04	RPD		2408
$C_{12}H_{22}Si_2^+$	$C_6H_4(Si(CH_3)_3)_2$ (1,4–Bis(trimethylsilyl)benzene)		8.25	RPD		2950
$C_{12}H_{28}Si_2^+$						
$C_{12}H_{28}Si_2^+$	$((CH_3)_3Si)_2C{=}CHC(CH_3)_3$		8.72±0.04	RPD		2410
$C_{13}H_{24}Si_2^+$						
$C_{13}H_{24}Si_2^+$	$C_6H_5CH(Si(CH_3)_3)_2$ (α,α–Bis(trimethylsilyl)toluene)		7.63±0.04	RPD		2407
$C_{14}H_{26}Si_2^+$						
$C_{14}H_{26}Si_2^+$	$C_6H_4(CH_2Si(CH_3)_3)_2$ (1,2–Bis(2,2–dimethyl–2–silapropyl)benzene)		7.74	RPD		2950
$C_{14}H_{26}Si_2^+$	$C_6H_4(CH_2Si(CH_3)_3)_2$ (1,4–Bis(2,2–dimethyl–2–silapropyl)benzene)		7.25	RPD		2950
$C_8H_{20}Si_3^+$						
$C_8H_{20}Si_3^+$	$C_8H_{20}Si_3$ (2,2,6,6–Tetramethyl–2,4,6–trisilaspiro[3.3]heptane)		7.78±0.06	EI		2547

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_8H_{24}Si_3^+$						
$C_8H_{24}Si_3^+$	$Si_3(CH_3)_8$		7.53±0.01	EI		2900
$C_9H_{24}Si_3^+$						
$C_9H_{24}Si_3^+$	$C_9H_{24}Si_3$ (1,1,3,3,5,5–Hexamethyl–1,3,5–trisilacyclohexane)		9.39±0.03	EI		2547
$C_{11}H_{28}Si_3^+$						
$C_{11}H_{28}Si_3^+$	$((CH_3)_3Si)_2C{=}CHSi(CH_3)_3$		8.85±0.04	RPD		2410
$C_{16}H_{32}Si_3^+$						
$C_{16}H_{32}Si_3^+$	$C_6H_5C(Si(CH_3)_3)_3$ (α,α,α–Tris(trimethylsilyl)toluene)		7.52±0.04	RPD		2407
$C_{17}H_{34}Si_3^+$						
$C_{17}H_{34}Si_3^+$	$C_6H_5CH_2C(Si(CH_3)_3)_3$ (α,α,α–Tris(trimethylsilyl)ethylbenzene)		8.22±0.04	RPD		2407
$C_{10}H_{30}Si_4^+$						
$C_{10}H_{30}Si_4^+$	n–$Si_4(CH_3)_{10}$		7.29±0.01	EI		2900
$C_{10}H_{30}Si_4^+$	$CH_3Si(Si(CH_3)_3)_3$		7.41±0.01	EI		2900
$C_{11}H_{32}Si_4^+$						
$C_{11}H_{32}Si_4^+$	n–$Si_3(CH_3)_7CH_2Si(CH_3)_3$		7.38±0.01	EI		2900
$C_{12}H_{32}Si_4^+$						
$C_{12}H_{32}Si_4^+$	$C_{12}H_{32}Si_4$ (1,1,3,3,5,5,7,7–Octamethyl–1,3,5,7–tetrasilacyclooctane)		9.21±0.04	EI		2547
$C_{10}H_{30}Si_5^+$						
$C_{10}H_{30}Si_5^+$	$Si_5(CH_3)_{10}$ (Decamethylcyclopentasilane)		7.18±0.01	EI		2900

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_{12}H_{36}Si_5^+$				
$C_{12}H_{36}Si_5^+$	n-$Si_5(CH_3)_{12}$		7.11±0.01	EI		2900
$C_{12}H_{36}Si_5^+$	$Si(Si(CH_3)_3)_4$		7.41±0.01	EI		2900
		$C_{12}H_{36}Si_6^+$				
$C_{12}H_{36}Si_6^+$	$Si_6(CH_3)_{12}$ (Dodecamethylcyclohexasilane)		7.29±0.01	EI		2900
		$C_{14}H_{42}Si_6^+$				
$C_{14}H_{42}Si_6^+$	n-$Si_6(CH_3)_{14}$		7.02±0.02	EI		2900
		$C_{14}H_{42}Si_7^+$				
$C_{14}H_{42}Si_7^+$	$Si_7(CH_3)_{14}$ (Tetradecamethylcycloheptasilane)		7.39±0.01	EI		2900
		$C_{18}H_{54}Si_8^+$				
$C_{18}H_{54}Si_8^+$	n-$Si_8(CH_3)_{18}$		6.82±0.02	EI		2900
		$BCSi^+$				
$BCSi^+$	BCSi		9.9	EI		1116
		$CNSi^+$				
$CNSi^+$	SiCN		8.7±0.5	EI		3004
		$SiHF_2^+$				
$SiHF_2^+$	$SiHF_3$	F?	13.4±0.3	EI		2896
		$Si_2HF_4^+$				
$Si_2HF_4^+$	Si_2HF_5	F?	11.1±0.3	EI		2896
		$SiBF_4^+$				
$SiBF_4^+$	Si_2BF_7		11.95±0.1	RPD		2525

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$Si_2BF_6^+$						
$Si_2BF_6^+$	Si_2BF_7	F?	15.36±0.1	RPD		2525
$C_7H_{19}NSi^+$						
$C_7H_{19}NSi^+$	$(CH_3)_3SiN(C_2H_5)_2$		8.06±0.02	RPD		1421
$C_{11}H_{19}NSi^+$						
$C_{11}H_{19}NSi^+$	$C_6H_4(N(CH_3)_2)Si(CH_3)_3$ (1–Dimethylamino–4–trimethylsilylbenzene)		6.73	RPD		2950
$C_9H_{14}N_2Si^+$						
$C_9H_{14}N_2Si^+$	$C_6H_5N{=}NSi(CH_3)_3$ (Phenyl trimethylsilyl diimine)		7.05±0.02	RPD		3254
$C_3H_9OSi^+$						
$C_3H_9OSi^+$	$(CH_3)_3SiOCH_3$	CH_3	10.25±0.05	RPD		1421
$C_4H_{12}OSi^+$						
$C_4H_{12}OSi^+$	$(CH_3)_3SiOCH_3$		9.79±0.04	RPD		1421
$C_{10}H_{14}OSi^+$						
$C_{10}H_{14}OSi^+$	$C_6H_5COSi(CH_3)_3$ (Phenyl trimethylsilyl ketone)		8.20±0.04	RPD		2407, 2463
$C_5H_{15}OSi_2^+$						
$C_5H_{15}OSi_2^+$	$(CH_3)_3SiOSi(CH_3)_3$	CH_3	10.20±0.07	RPD		1421
$C_6H_{18}OSi_2^+$						
$C_6H_{18}OSi_2^+$	$(CH_3)_3SiOSi(CH_3)_3$		9.59±0.04	RPD		1421

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$CNOSi^+$						
$CNOSi^+$	OSiCN		7.4±0.5	EI		3004
$C_2H_6FSi^+$						
$C_2H_6FSi^+$	$(CH_3)_3SiF$	CH_3	11.11±0.05	RPD		1421
$C_3H_9FSi^+$						
$C_3H_9FSi^+$	$(CH_3)_3SiF$		10.55±0.06	RPD		1421
$CH_3F_2Si^+$						
$CH_3F_2Si^+$	$CH_3SiF_2Co(CO)_4$		17.0±0.4	EI		2581
P^+ $\Delta H^\circ_{f0} \sim 1326$ kJ mol^{-1} (317 kcal mol^{-1})						
P^+	P		10.486	S	~1326	2113
See also - EI:	8, 2699					
P^+	P_2	P	15.1±0.3	EI		2699
See also - EI:	8, 2465					
P^+	P_4		14	EI		8
See also - EI:	3370					
P^+	PH_3	H_2+H	15.9	EI		2486
See also - EI:	1033, 1036, 2116					
P^+	P_2H_4		16.7±0.3	EI		2133
P^+	P_2H_4		19.4±0.5	EI		2486
P^+	$(CH_3)_2PH$		11.9	EI		1036
P^+	$(C_2H_5)_2PP(C_2H_5)_2$		9.8±0.3	EI		2948
P^+	PCl_3		21.0±0.5	EI		1101
P^+	PCl_3		21.2±0.5	EI		192, 2506
P^+	$POCl_3$		21.4	EI		1101
P^+	$POCl_3$		28.1±0.5	EI		2506
P^+	PBr_3		20.1±0.5	EI		2506

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
	P^{+2}	**$\Delta H^\circ_{f0} \sim 3229$ kJ mol^{-1} (772 kcal mol^{-1})**				
P^{+2}	P		30.211	S	~3229	2113
P^{+2}	P^+		19.725	S		2113
See also – EI:	8					
P^{+2}	P_4		38	EI		8
P^{+2}	PH_3		42±2	NRE		1036
P^{+2}	PH_3		42±2	EI		1036
		P_2^+				
P_2^+	P_2		9.6±0.3	EI		2465
P_2^+	P_2		11.0±0.3	EI		2699
See also – EI:	8					
P_2^+	P_4		14.3	EI		8
See also – EI:	3370					
P_2^+	P_2H_2		11.9±0.4	EI		2486
P_2^+	P_2H_4		12.2	EI		1033
P_2^+	P_2H_4		13.2±0.2	EI		2486
P_2^+	P_2H_4		13.7±0.3	EI		2133
P_2^+	P_2Cl_4		19.7±0.4	EI		192
		P_3^+				
P_3^+	P_3		11.5	EI		8
P_3^+	P_4	P	14.3±0.3	EI		2465
P_3^+	P_4	P	14.5	EI		8
See also – EI:	3370					
	P_4^+	**$\Delta H^\circ_{f0} = 942$ kJ mol^{-1} (225 kcal mol^{-1})**				
P_4^+	P_4		9.08±0.05	PI	942	2880
P_4^+	P_4		9.2±0.3	EI		2465
See also – EI:	8, 3370					
		PH^+				
PH^+	PH_3	H_2	12.4±0.2	EI		2116
PH^+	PH_3	H_2	12.6±0.2	EI		2486
See also – EI:	1033, 1036, 2493					
PH^+	P_2H_4		17.4±0.5	EI		2486
PH^+	$(C_2H_5)_2PP(C_2H_5)_2$		11.0±0.3	EI		2948

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
PH^{+2}						
PH^{+2}	PH_3		25.1	NRE		1036
PH^{+2}	PH_3		21.2	EI		1036
PH_2^+ $\Delta H_{f0}^\circ = 1097$ kJ mol^{-1} (262 kcal mol^{-1})						
PH_2^+	PH_2		9.83±0.02	EM		2862
This ionization potential combined with $\Delta H_{f0}^\circ(PH_2^+)$ leads to $\Delta H_{f0}^\circ(PH_2) = 149$ kJ mol^{-1} (36 kcal mol^{-1}).						
PH_2^+	PH_2		9.96	EI		2862
PH_2^+	PH_3	H	13.47±0.05	EM	1097	2862
PH_2^+	PH_3	H	13.2±0.2	EI		173
PH_2^+	PH_3	H	13.2±0.2	EI		2486
PH_2^+	PH_3	H	13.6	EI		2862
See also – EI:	1033, 1036, 2116, 2493					
PH_2^+	P_2H_4		12.5±0.2	EI		173
PH_2^+	P_2H_4		15.3±0.5	EI		2486
PH_2^+	$(C_2H_5)_2PP(C_2H_5)_2$		9.3±0.3	EI		2948
PH_2^+	H_3SiPH_2		13.1±0.2	EI		173
PH_2^{+2}						
PH_2^{+2}	PH_3	H	34.0	NRE		1036
PH_2^{+2}	PH_3	H	32.7	EI		1036
PH_3^+ $\Delta H_{f0}^\circ \sim 976$ kJ mol^{-1} (233 kcal mol^{-1})						
PH_3^+	PH_3		9.98	PI	976	1091
PH_3^+	PH_3		10.13±0.02	PE		3085
PH_3^+	PH_3		10.28	PE		2853
PH_3^+	PH_3		9.97±0.02	EM	975	2862
PH_3^+	PH_3		10.05±0.05	RPD		2486
PH_3^+	PH_3		10.30±0.10	RPD		2493
PH_3^+	PH_3		10.10	EDD		2493
The ionization potential is somewhat uncertain. It is difficult to identify the 0–0 transition and to correct for hot bands, see ref. 3085.						
See also – EI:	218, 1033, 1036, 1407, 2116, 2493, 2597					
PH_3^+	$C_2H_5PH_2$	C_2H_4	11.2±0.2	EI		2045
PH_3^+	$C_2H_5PH_2$	C_2H_4	12.0±0.3	EI		2948
PH_3^+	$(C_2H_5)_2PH$		12.8±0.3	EI		2948
PH_3^+	$(C_2H_5)_3P$		14.2±0.3	EI		2948
PH_3^+	$(C_2H_5)_3P$		14.7±0.2	EI		2045
PH_3^+	$(CH_3)_2PP(CH_3)_2$		17.0±0.3	EI		2948
PH_3^+	$(C_2H_5)_2PP(C_2H_5)_2$		11.1±0.3	EI		2948

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		PH_2D^+				
PH_2D^+	PH_2D		10.1±0.2	EI		1033
		PHD_2^+				
PHD_2^+	PHD_2		10.2±0.2	EI		1033
		PD_3^+				
PD_3^+	PD_3		10.1±0.2	EI		1033
		PH_3^{+2}				
PH_3^{+2}	PH_3		15.6	NRE		1036
PH_3^{+2}	PH_3		15.0	EI		1036
		PH_4^+				
PH_4^+	PH_3+H^+			BH	(728)	1414
(Based on a proton affinity for PH_3 of 813.8±21 kJ mol^{-1} (194.5±5 kcal mol^{-1}))						
PH_4^+	P_3H_5		10.0±0.2	EI		2753
PH_4^+	$(CH_3)_3P$		14.2±0.2	EI		2045
PH_4^+	$(C_2H_5)_3P$		14.7±0.3	EI		2045
PH_4^+	$(C_2H_5)_2PP(C_2H_5)_2$		9.7±0.3	EI		2948
		P_2H^+				
P_2H^+	P_2H_2	H	13.3±0.4	EI		2486
P_2H^+	P_2H_4		13.2	EI		1033
P_2H^+	P_2H_4		13.6±0.3	EI		2133
P_2H^+	P_2H_4		14.6±0.3	EI		2486
P_2H^+	$(CH_3)_2PP(CH_3)_2$		15.8±0.3	EI		2948
P_2H^+	$(C_2H_5)_2PP(C_2H_5)_2$		13.8±0.3	EI		2948
P_2H^+	$(n\text{-}C_4H_9)_2PP(n\text{-}C_4H_9)_2$		17.0±0.3	EI		2948
		$P_2H_2^+$				
$P_2H_2^+$	P_2H_2		10.2±0.2	EI		2486
See also – EI:	1407					
$P_2H_2^+$	P_2H_4	H_2	10.5	EI		1033
$P_2H_2^+$	P_2H_4	H_2	11.1±0.2	EI		2486
$P_2H_2^+$	P_2H_4	H_2	12.7±0.3	EI		2133
$P_2H_2^+$	$(C_2H_5)_2PP(C_2H_5)_2$		11.4±0.3	EI		2948
$P_2H_2^+$	$(n\text{-}C_4H_9)_2PP(n\text{-}C_4H_9)_2$		15.2±0.3	EI		2948

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$P_2H_3^+$				
$P_2H_3^+$	P_2H_3		9.1	EI		1033
$P_2H_3^+$	P_2H_4	H	11.3±0.3	EI		2133
$P_2H_3^+$	P_2H_4	H	12.2±0.2	EI		2486, 2753
See also – EI:	1407					
$P_2H_3^+$	P_3H_5		10.6±0.1	EI		2753
$P_2H_3^+$	$(C_2H_5)_2PP(C_2H_5)_2$		11.8±0.3	EI		2948
		$P_2H_4^+$				
$P_2H_4^+$	P_2H_4		9.17±0.05	RPD		2486
$P_2H_4^+$	P_2H_4		8.7±0.3	EI		1033
$P_2H_4^+$	P_2H_4		10.6±0.3	EI		2133
See also – EI:	3431					
$P_2H_4^+$	$(C_2H_5)_2PP(C_2H_5)_2$		11.3±0.3	EI		2948
		$P_2H_3D^+$				
$P_2H_3D^+$	P_2H_3D		8.4±0.3	EI		1033
		$P_2H_2D_2^+$				
$P_2H_2D_2^+$	$P_2H_2D_2$		8.2±0.5	EI		1033
		$P_3H_5^+$				
$P_3H_5^+$	P_3H_5		8.7±0.1	EI		2753
See also – EI:	3431					
		PC^+				
PC^+	CH_3PH_2		14.5±0.3	EI		2045
PC^+	$C_2H_5PH_2$		12.0±0.3	EI		2045
PC^+	$(CH_3)_3P$		13.2±0.3	EI		2045
PC^+	$(C_2H_5)_3P$		19.1±0.5	EI		2045
		PN^+				
PN^+	PN		11.8±0.1	RPD		2465, 2570
See also – EI:	2465, 2916					

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
PN^{+2}						
PN^{+2}	PN		40.7±0.5	EI		2465
See also – EI:	2570					
PO^+						
PO^+	P_4O_6		18.0±0.5	EI		3370
PO^+	P_4O_{10}		23.6±0.5	EI		3370
PO^+	$(CH_3O)_2PHO$		16.3	EI		1036
PO^+	$(CH_3O)_2CH_3PO$		19.4±0.3	EI		3211
PO^+	$(CH_3O)_3PO$		19.6±0.3	EI		3211
PO^+	$POCl_3$		14.5±0.5	EI		1101
PO^+	$POCl_3$		16.6±0.4	EI		2506
PO_2^+						
PO_2^+	P_4O_6		23.0±0.5	EI		3370
PO_2^+	P_4O_{10}		22.5±0.5	EI		3370
PO_3^+						
PO_3^+	P_4O_{10}		33.0±0.5	EI		3370
PO_3^+	$(CH_3O)_2PHO$		13.5	EI		1036
P_2O^+						
P_2O^+	P_4O_6		23.6±0.5	EI		3370
$P_2O_2^+$						
$P_2O_2^+$	P_4O_6		18.8±0.5	EI		3370
$P_2O_2^+$	P_4O_{10}		29.5±0.5	EI		3370
$P_2O_3^+$						
$P_2O_3^+$	P_4O_6		17.5±0.5	EI		3370
$P_2O_3^+$	P_4O_{10}		28.0±0.5	EI		3370
$P_2O_4^+$						
$P_2O_4^+$	P_4O_{10}		24.3±0.5	EI		3370
$P_2O_5^+$						
$P_2O_5^+$	P_4O_{10}		22.9±0.5	EI		3370

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$P_3O_3^+$				
$P_3O_3^+$	P_4O_6		18.8±0.5	EI		3370
		$P_3O_4^+$				
$P_3O_4^+$	P_4O_6		16.1±0.5	EI		3370
$P_3O_4^+$	P_4O_{10}		34.0±0.5	EI		3370
		$P_3O_5^+$				
$P_3O_5^+$	P_4O_6		15.0±0.5	EI		3370
$P_3O_5^+$	P_4O_{10}		32.9±0.5	EI		3370
		$P_3O_6^+$				
$P_3O_6^+$	P_4O_{10}		22.3±0.5	EI		3370
		$P_3O_7^+$				
$P_3O_7^+$	P_4O_{10}		17.8±0.5	EI		3370
		$P_4O_6^+$				
$P_4O_6^+$	P_4O_6		10.6±0.5	EI		3370
$P_4O_6^+$	P_4O_{10}		32.8±0.5	EI		3370
		$P_4O_7^+$				
$P_4O_7^+$	P_4O_7		12.1±0.5	EI		3370
		$P_4O_8^+$				
$P_4O_8^+$	P_4O_8		12.4±0.5	EI		3370
		$P_4O_9^+$				
$P_4O_9^+$	P_4O_9		13.1±0.5	EI		3370
$P_4O_9^+$	P_4O_{10}	O	20.0±0.5	EI		3370
		$P_4O_{10}^+$				
$P_4O_{10}^+$	P_4O_{10}		13.6±0.5	EI		3370

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
PF^+						
PF^+	PSF_3		22.9±0.4	EI		2506
PF_2^+						
PF_2^+	PSF_3		17.2±0.3	EI		2506
PF_3^+						
PF_3^+	PF_3		9.71	PI		1091
PF_3^+	PF_3		12.28 (V)	PE		3119
PF_3^+	PF_3		12.3 (V)	PE		3043, 3084
PF_3^+	PF_3		12.31 (V)	PE		3070

The disagreement between the photoionization value and those obtained by photoelectron spectroscopy is not understood.

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
PF_3^+	PSF_3	S?	14.3±0.2	EI		2506
AlP^+						
AlP^+	AlP		8.4±0.4	EI		2152
CHP^+						
CHP^+	CH_3PH_2		14.7±0.3	EI		2045
CHP^+	$C_2H_5PH_2$		13.1±0.5	EI		2045
CHP^+	$C_2H_5PH_2$		17.0±0.3	EI		2948
CHP^+	$(CH_3)_2PH$		14.1	EI		1036
CHP^+	$(CH_3)_3P$		18.4±0.2	EI		2045
CH_2P^+						
CH_2P^+	CH_3PH_2		14.7±0.2	EI		2045
CH_2P^+	$C_2H_5PH_2$		12.7±0.4	EI		2045
CH_2P^+	$C_2H_5PH_2$		15.1±0.3	EI		2948
CH_2P^+	$(CH_3)_3P$		16.1±0.4	EI		2045
CH_2P^+	$(CH_3)_3P$		17±1	EI		1036
CH_2P^+	$(C_2H_5)_2PH$		18.1±0.3	EI		2948
CH_2P^+	$(C_2H_5)_3P$		21.1±0.3	EI		2948
CH_2P^+	$(CH_3)_2PP(CH_3)_2$		19.3±0.3	EI		2948
CH_2P^+	$(C_2H_5)_2PP(C_2H_5)_2$		14.7±0.3	EI		2948

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		CH_3P^+				
CH_3P^+	CH_3PH_2	H_2	12.2±0.2	EI		2045
CH_3P^+	$C_2H_5PH_2$		12.0±0.2	EI		2045
CH_3P^+	$C_2H_5PH_2$		13.2±0.3	EI		2948
CH_3P^+	$(CH_3)_2PH$		11.9	EI		1036
CH_3P^+	$(CH_3)_3P$		14.0±0.3	EI		2045
CH_3P^+	$(C_2H_5)_2PH$		16.8±0.3	EI		2948
CH_3P^+	$(C_2H_5)_3P$		17.9±0.5	EI		2045
CH_3P^+	$(C_2H_5)_3P$		21.4±0.3	EI		2948
CH_3P^+	$(CH_3)_2PP(CH_3)_2$		13.5±0.3	EI		2948
CH_3P^+	$(C_2H_5)_2PP(C_2H_5)_2$		10.9±0.3	EI		2948
		CH_4P^+				
CH_4P^+	CH_3PH_2	H	11.6±0.12	EI		2045
CH_4P^+	$C_2H_5PH_2$	CH_3	12.2±0.2	EI		2045
CH_4P^+	$C_2H_5PH_2$	CH_3	12.3±0.3	EI		2948
CH_4P^+	$(CH_3)_3P$		14.7±0.2	EI		2045
CH_4P^+	$(C_2H_5)_2PH$		14.4±0.3	EI		2948
CH_4P^+	$(C_2H_5)_3P$		15.8±0.2	EI		2045
CH_4P^+	$(C_2H_5)_3P$		16.2±0.3	EI		2948
CH_4P^+	$(CH_3)_2PP(CH_3)_2$		15.2±0.3	EI		2948
CH_4P^+	$(C_2H_5)_2PP(C_2H_5)_2$		13.1±0.3	EI		2948
		CH_5P^+				
CH_5P^+	CH_3PH_2		9.72±0.15	EI		2045
CH_5P^+	$(CH_3)_2PP(CH_3)_2$		16.8±0.3	EI		2948
CH_5P^+	$(C_2H_5)_2PP(C_2H_5)_2$		10.7±0.3	EI		2948
CH_5P^+	$(n\text{-}C_4H_9)_2PP(n\text{-}C_4H_9)_2$		13.3±0.3	EI		2948
		C_2HP^+				
C_2HP^+	$C_2H_5PH_2$		24.2±0.3	EI		2948
		$C_2H_2P^+$				
$C_2H_2P^+$	$C_2H_5PH_2$		15.8±0.3	EI		2045
$C_2H_2P^+$	$C_2H_5PH_2$		17.4±0.3	EI		2948
$C_2H_2P^+$	$(CH_3)_3P$		16.7±0.2	EI		2045
$C_2H_2P^+$	$(C_2H_5)_3P$		16.5±0.3	EI		2045
		$C_2H_3P^+$				
$C_2H_3P^+$	$C_2H_5PH_2$		12.9±0.4	EI		204
$C_2H_3P^+$	$C_2H_5PH_2$		13.7±0.3	EI		29
$C_2H_3P^+$	$(C_2H_5)_3P$		16.7±0.2	EI		[illegible]

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol⁻¹)	Ref.
$C_2H_4P^+$						
$C_2H_4P^+$	$C_2H_5PH_2$		12.9±0.3	EI		2045
$C_2H_4P^+$	$C_2H_5PH_2$		14.6±0.3	EI		2948
$C_2H_4P^+$	$(CH_3)_3P$		14.0±0.2	EI		2045
$C_2H_4P^+$	$(CH_3)_3P$		15±1	EI		1036
$C_2H_4P^+$	$(C_2H_5)_2PH$		15.6±0.3	EI		2948
$C_2H_4P^+$	$(C_2H_5)_3P$		16.0±0.2	EI		2045
$C_2H_4P^+$	$(C_2H_5)_3P$		17.5±0.3	EI		2948
$C_2H_4P^+$	$(CH_3)_2PP(CH_3)_2$		15.2±0.3	EI		2948
$C_2H_4P^+$	$(C_2H_5)_2PP(C_2H_5)_2$		12.5±0.3	EI		2948
$C_2H_5P^+$						
$C_2H_5P^+$	$C_2H_5PH_2$	H_2	12.0±0.2	EI		2045
$C_2H_5P^+$	$C_2H_5PH_2$	H_2	12.4±0.3	EI		2948
$C_2H_5P^+$	$(C_2H_5)_2PH$		12.0±0.3	EI		2948
$C_2H_5P^+$	$(C_2H_5)_3P$		13.4±0.5	EI		2045
$C_2H_5P^+$	$(C_2H_5)_3P$		14.6±0.3	EI		2948
$C_2H_5P^+$	$(CH_3)_2PP(CH_3)_2$		13.6±0.3	EI		2948
$C_2H_5P^+$	$(C_2H_5)_2PP(C_2H_5)_2$		12.8±0.3	EI		2948
$C_2H_6P^+$						
$C_2H_6P^+$	$C_2H_5PH_2$	H	12.0±0.3	EI		2045
$C_2H_6P^+$	$C_2H_5PH_2$	H	12.5±0.3	EI		2948
$C_2H_6P^+$	$(CH_3)_2PH$	H	12.2	EI		1036
$C_2H_6P^+$	$(CH_3)_3P$	CH_3	11.7±0.2	EI		2045
$C_2H_6P^+$	$(CH_3)_3P$	CH_3	11.8±0.2	EI		1036
$C_2H_6P^+$	$(C_2H_5)_2PH$		13.7±0.3	EI		2948
$C_2H_6P^+$	$(C_2H_5)_3P$		14.0±0.2	EI		2045
$C_2H_6P^+$	$(C_2H_5)_3P$		14.2±0.3	EI		2948
$C_2H_6P^+$	$(CH_3)_2PP(CH_3)_2$		13.3±0.3	EI		2948
$C_2H_6P^+$	$(C_2H_5)_2PP(C_2H_5)_2$		14.0±0.3	EI		2948
$C_2H_6P^+$	$(n-C_4H_9)_2PP(n-C_4H_9)_2$		17.8±0.3	EI		2948
$C_2H_7P^+$						
$C_2H_7P^+$	$C_2H_5PH_2$		9.47±0.5	EI		2045
$C_2H_7P^+$	$C_2H_5PH_2$		9.5±0.3	EI		2948
$C_2H_7P^+$	$(CH_3)_2PH$		9.7	EI		1036
$C_2H_7P^+$	$(C_2H_5)_2PH$		10.9±0.3	EI		2948
$C_2H_7P^+$	$(C_2H_5)_3P$		12.3±0.3	EI		2948
$C_2H_7P^+$	$(C_2H_5)_3P$		12.7±0.2	EI		2045
$C_3H_6P^+$						
	$(C_2H_5)_2PH$		13.2±0.3	EI		2948
	$(C_2H_5)_3P$		14.9±0.3	EI		2948
	$(CH_3)_2PP(CH_3)_2$		11.3±0.3	EI		2948
	$(C_2H_5)_2PP(C_2H_5)_2$		12.5±0.3	EI		2948

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_3H_8P^+$				
$C_3H_8P^+$	$(CH_3)_3P$	H	11.0±0.1	RPD		3017
$C_3H_8P^+$	$(CH_3)_3P$	H	10.2±0.5	EI		2045
$C_3H_8P^+$	$(CH_3)_3P$	H	11.8±0.2	EI		1036
$C_3H_8P^+$	$(C_2H_5)_2PH$	CH_3	12.1±0.3	EI		2948
$C_3H_8P^+$	$(C_2H_5)_3P$		13.8±0.5	EI		2045
		$C_3H_9P^+$				
$C_3H_9P^+$	$(CH_3)_3P$		8.60±0.2	EI		2045
$C_3H_9P^+$	$(CH_3)_3P$		9.2±0.5	EI		1036
		$C_4H_8P^+$				
$C_4H_8P^+$	$(C_2H_5)_3P$		14.5±0.3	EI		2948
		$C_4H_{10}P^+$				
$C_4H_{10}P^+$	$(C_2H_5)_2PH$	H	13.2±0.3	EI		2948
$C_4H_{10}P^+$	$(C_2H_5)_3P$	C_2H_5	11.4±0.3	EI		2045
$C_4H_{10}P^+$	$(C_2H_5)_3P$	C_2H_5	12.4±0.3	EI		2708, 2948
$C_4H_{10}P^+$	$(C_2H_5)_2PP(C_2H_5)_2$		13.3±0.3	EI		2708, 2948
		$C_4H_{11}P^+$				
$C_4H_{11}P^+$	$(C_2H_5)_2PH$		8.5±0.3	EI		2948
$C_4H_{11}P^+$	$(C_2H_5)_3P$		10.4±0.3	EI		2948
$C_4H_{11}P^+$	$(C_2H_5)_3P$		10.7±0.3	EI		2045
		$C_5H_{12}P^+$				
$C_5H_{12}P^+$	$(C_2H_5)_3P$	CH_3	11.8±0.3	EI		2948
$C_5H_{12}P^+$	$(C_2H_5)_3P$	CH_3	12.0±0.2	EI		2045
		$C_6H_{14}P^+$				
$C_6H_{14}P^+$	$(C_2H_5)_3P$	H	12.0±0.3	EI		2948
		$C_6H_{15}P^+$				
$C_6H_{15}P^+$	$(C_2H_5)_3P$		8.0±0.3	EI		2948
$C_6H_{15}P^+$	$(C_2H_5)_3P$		8.18±0.05	EI		2481
$C_6H_{15}P^+$	$(C_2H_5)_3P$		8.27±0.24	EI		2045
		$C_8H_{18}P^+$				
$C_8H_{18}P^+$	$(n-C_4H_9)_2PP(n-C_4H_9)_2$		11.5±0.3	EI		2948

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_9H_{21}P^+$				
$C_9H_{21}P^+$	$(iso\text{-}C_3H_7)_3P$		7.75±0.1	EI		2531, 2597
		$C_{12}H_{27}P^+$				
$C_{12}H_{27}P^+$	$(n\text{-}C_4H_9)_3P$		8.00±0.05	EI		2481
	$C_{18}H_{15}P^+$ (Triphenylphosphine)		**$\Delta H^\circ_{f298} \sim 1039$ kJ mol^{-1} (248 kcal mol^{-1})**			
$C_{18}H_{15}P^+$	$(C_6H_5)_3P$ (Triphenylphosphine)		7.36±0.05	PI	1039	1140
$C_{18}H_{15}P^+$	$(C_6H_5)_3P$ (Triphenylphosphine)		7.83	EI		2597
$C_{18}H_{15}P^+$	$(C_6H_5)_3P$ (Triphenylphosphine)		8.2±0.05	EI		2481
		$CH_3P_2^+$				
$CH_3P_2^+$	$(CH_3)_2PP(CH_3)_2$		13.5±0.3	EI		2948
$CH_3P_2^+$	$(C_2H_5)_2PP(C_2H_5)_2$		14.1±0.3	EI		2948
		$CH_4P_2^+$				
$CH_4P_2^+$	$(n\text{-}C_4H_9)_2PP(n\text{-}C_4H_9)_2$		13.8±0.3	EI		2948
		$CH_5P_2^+$				
$CH_5P_2^+$	$(n\text{-}C_4H_9)_2PP(n\text{-}C_4H_9)_2$		18.0±0.3	EI		2948
		$C_2H_5P_2^+$				
$C_2H_5P_2^+$	$(CH_3)_2PP(CH_3)_2$		13.5±0.3	EI		2948
$C_2H_5P_2^+$	$(C_2H_5)_2PP(C_2H_5)_2$		8.9±0.3	EI		2948
$C_2H_5P_2^+$	$(n\text{-}C_4H_9)_2PP(n\text{-}C_4H_9)_2$		12.6±0.3	EI		2948
		$C_2H_6P_2^+$				
$C_2H_6P_2^+$	$(CH_3)_2PP(CH_3)_2$		14.3±0.3	EI		2948
$C_2H_6P_2^+$	$(C_2H_5)_2PP(C_2H_5)_2$		16.7±0.3	EI		2948
$C_2H_6P_2^+$	$(n\text{-}C_4H_9)_2PP(n\text{-}C_4H_9)_2$		12.8±0.3	EI		2948
		$C_2H_7P_2^+$				
$C_2H_7P_2^+$	$(CH_3)_2PP(CH_3)_2$		13.2±0.3	EI		2948
$C_2H_7P_2^+$	$(C_2H_5)_2PP(C_2H_5)_2$		13.9±0.3	EI		2948

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_2H_8P_2^+$				
$C_2H_8P_2^+$	$(CH_3)_2PP(CH_3)_2$		10.0±0.3	EI		2948
$C_2H_8P_2^+$	$(C_2H_5)_2PP(C_2H_5)_2$		12.0±0.3	EI		2948
		$C_3H_7P_2^+$				
$C_3H_7P_2^+$	$(C_2H_5)_2PP(C_2H_5)_2$		13.0±0.3	EI		2948
$C_3H_7P_2^+$	$(n\text{-}C_4H_9)_2PP(n\text{-}C_4H_9)_2$		12.6±0.3	EI		2948
		$C_3H_8P_2^+$				
$C_3H_8P_2^+$	$(C_2H_5)_2PP(C_2H_5)_2$		11.5±0.3	EI		2948
$C_3H_8P_2^+$	$(n\text{-}C_4H_9)_2PP(n\text{-}C_4H_9)_2$		11.9±0.3	EI		2948
		$C_3H_9P_2^+$				
$C_3H_9P_2^+$	$(CH_3)_2PP(CH_3)_2$	CH_3	10.8±0.3	EI		2948
		$C_3H_{10}P_2^+$				
$C_3H_{10}P_2^+$	$(CH_3)_2PP(CH_3)_2$		10.6±0.3	EI		2948
		$C_4H_{10}P_2^+$				
$C_4H_{10}P_2^+$	$(n\text{-}C_4H_9)_2PP(n\text{-}C_4H_9)_2$		12.1±0.3	EI		2948
		$C_4H_{11}P_2^+$				
$C_4H_{11}P_2^+$	$(C_2H_5)_2PP(C_2H_5)_2$		12.3±0.3	EI		2948
$C_4H_{11}P_2^+$	$(n\text{-}C_4H_9)_2PP(n\text{-}C_4H_9)_2$		13.5±0.3	EI		2948
		$C_4H_{12}P_2^+$				
$C_4H_{12}P_2^+$	$(CH_3)_2PP(CH_3)_2$		8.6±0.3	EI		2948
$C_4H_{12}P_2^+$	$(C_2H_5)_2PP(C_2H_5)_2$		11.6±0.3	EI		2948
$C_4H_{12}P_2^+$	$(n\text{-}C_4H_9)_2PP(n\text{-}C_4H_9)_2$		12.8±0.3	EI		2948
		$C_5H_{11}P_2^+$				
$C_5H_{11}P_2^+$	$(C_2H_5)_2PP(C_2H_5)_2$		11.9±0.3	EI		2948

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_5H_{13}P_2^+$				
$C_5H_{13}P_2^+$	$(C_2H_5)_2PP(C_2H_5)_2$		12.1±0.3	EI		2948
$C_5H_{13}P_2^+$	$(n-C_4H_9)_2PP(n-C_4H_9)_2$		9.9±0.3	EI		2948
		$C_6H_{13}P_2^+$				
$C_6H_{13}P_2^+$	$(n-C_4H_9)_2PP(n-C_4H_9)_2$		11.3±0.3	EI		2948
		$C_6H_{14}P_2^+$				
$C_6H_{14}P_2^+$	$(C_2H_5)_2PP(C_2H_5)_2$		10.2±0.3	EI		2948
		$C_6H_{15}P_2^+$				
$C_6H_{15}P_2^+$	$(C_2H_5)_2PP(C_2H_5)_2$	C_2H_5	10.4±0.3	EI		2948
		$C_6H_{16}P_2^+$				
$C_6H_{16}P_2^+$	$(C_2H_5)_2PP(C_2H_5)_2$		9.8±0.3	EI		2948
		$C_6H_{17}P_2^+$				
$C_6H_{17}P_2^+$	$(C_2H_5)_2PP(C_2H_5)_2$		9.4±0.3	EI		2948
		$C_7H_{15}P_2^+$				
$C_7H_{15}P_2^+$	$(n-C_4H_9)_2PP(n-C_4H_9)_2$		14.7±0.3	EI		2948
		$C_7H_{16}P_2^+$				
$C_7H_{16}P_2^+$	$(n-C_4H_9)_2PP(n-C_4H_9)_2$		9.8±0.3	EI		2948
		$C_7H_{17}P_2^+$				
$C_7H_{17}P_2^+$	$(C_2H_5)_2PP(C_2H_5)_2$	CH_3	11.5±0.3	EI		2948
$C_7H_{17}P_2^+$	$(n-C_4H_9)_2PP(n-C_4H_9)_2$		12.0±0.3	EI		2948
		$C_8H_{18}P_2^+$				
$C_8H_{18}P_2^+$	$(n-C_4H_9)_2PP(n-C_4H_9)_2$		8.1±0.3	EI		2948

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_8H_{19}P_2^+$				
$C_8H_{19}P_2^+$	$(C_2H_5)_2PP(C_2H_5)_2$	H	8.2±0.3	EI		2948
$C_8H_{19}P_2^+$	$(n-C_4H_9)_2PP(n-C_4H_9)_2$		12.2±0.3	EI		2948
		$C_8H_{20}P_2^+$				
$C_8H_{20}P_2^+$	$(C_2H_5)_2PP(C_2H_5)_2$		7.8±0.3	EI		2948
See also – EI:	2708					
$C_8H_{20}P_2^+$	$(n-C_4H_9)_2PP(n-C_4H_9)_2$		10.3±0.3	EI		2948
		$C_9H_{19}P_2^+$				
$C_9H_{19}P_2^+$	$(n-C_4H_9)_2PP(n-C_4H_9)_2$		9.4±0.3	EI		2948
		$C_{12}H_{27}P_2^+$				
$C_{12}H_{27}P_2^+$	$(n-C_4H_9)_2PP(n-C_4H_9)_2$		10.6±0.3	EI		2948
		$C_{12}H_{28}P_2^+$				
$C_{12}H_{28}P_2^+$	$(n-C_4H_9)_2PP(n-C_4H_9)_2$		8.0±0.3	EI		2948
		$C_{16}H_{36}P_2^+$				
$C_{16}H_{36}P_2^+$	$(n-C_4H_9)_2PP(n-C_4H_9)_2$		7.1±0.3	EI		2948
		$PH_2O_2^+$				
$PH_2O_2^+$	$(CH_3O)_3PO$		15.1±0.3	EI		3211
		PHO_3^+				
PHO_3^+	$(CH_3O)_2PHO$		11.2	EI		1036
		$PH_2O_3^+$				
$PH_2O_3^+$	$(C_2H_5O)_3PO$		17.8±0.3	EI		3211
		$PH_3O_3^+$				
$PH_3O_3^+$	$(C_2H_5O)_3PO$		14.4±0.2	EI		3211

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$PH_4O_3^+$				
$PH_4O_3^+$	$(C_2H_5O)_3PO$		14.5±0.3	EI		3211
		$PH_4O_4^+$				
$PH_4O_4^+$	$(C_2H_5O)_3PO$		14.3±0.3	EI		3211
		$P_4H_2O_7^+$				
$P_4H_2O_7^+$	$P_4H_2O_7$		11.9±0.5	EI		3370
		$P_4H_2O_9^+$				
$P_4H_2O_9^+$	$P_4H_2O_9$		13.5±0.5	EI		3370
		$P_4H_2O_{10}^+$				
$P_4H_2O_{10}^+$	$P_4H_2O_{10}$		14.0±0.5	EI		3370
		$C_3F_9P^+$				
$C_3F_9P^+$	$(CF_3)_3P$		11.3±0.1	EI		1007
		$P_3N_3F_6^+$				
$P_3N_3F_6^+$	$(NPF_2)_3$ (Cyclo–tris(difluorophosphonitrile))		11.4±0.1 (V)	PE		2952
$P_3N_3F_6^+$	$(NPF_2)_3$ (Cyclo–tris(difluorophosphonitrile))		11.64±0.05	EI		2425
		$P_4N_4F_8^+$				
$P_4N_4F_8^+$	$(NPF_2)_4$ (Cyclo–tetrakis(difluorophosphonitrile))		10.7±0.1 (V)	PE		2952
$P_4N_4F_8^+$	$(NPF_2)_4$ (Cyclo–tetrakis(difluorophosphonitrile))		10.86±0.05	EI		2425
		$P_5N_5F_{10}^+$				
$P_5N_5F_{10}^+$	$(NPF_2)_5$ (Cyclo–pentakis(difluorophosphonitrile))		11.4±0.1 (V)	PE		2952
See also – EI:	2425					

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$P_6N_6F_{12}^+$						
$P_6N_6F_{12}^+$	$(NPF_2)_6$ (Cyclo–hexakis(difluorophosphonitrile))		10.9±0.1 (V)	PE		2952
See also – EI:	2425					
$P_7N_7F_{14}^+$						
$P_7N_7F_{14}^+$	$(NPF_2)_7$ (Cyclo–heptakis(difluorophosphonitrile))		11.3±0.1 (V)	PE		2952
$P_8N_8F_{16}^+$						
$P_8N_8F_{16}^+$	$(NPF_2)_8$ (Cyclo–octakis(difluorophosphonitrile))		10.9±0.1 (V)	PE		2952
POF_3^+ $\Delta H_{f0}^\circ = 28$ kJ mol^{-1} (7 kcal mol^{-1})						
POF_3^+	POF_3		12.75	PE	28	3358
See also – PE:	3084					
$SiPH_5^+$						
$SiPH_5^+$	H_3SiPH_2		10.0±0.2	EI		173
$C_6H_{18}N_3P_3^+$						
$C_6H_{18}N_3P_3^+$	$(NP(CH_3)_2)_3$ (Cyclo–tris(dimethylphosphonitrile))		8.35±0.05	EI		2952
$C_{12}H_{36}N_9P_3^+$						
$C_{12}H_{36}N_9P_3^+$	$(NP(N(CH_3)_2)_2)_3$ (Cyclo–tris(bis(dimethylamino)phosphonitrile))		7.85±0.05	EI		2952
$C_8H_{24}N_4P_4^+$						
$C_8H_{24}N_4P_4^+$	$(NP(CH_3)_2)_4$ (Cyclo–tetrakis(dimethylphosphonitrile))		7.99±0.05	EI		2952
$C_{16}H_{48}N_{12}P_4^+$						
$C_{16}H_{48}N_{12}P_4^+$	$(NP(N(CH_3)_2)_2)_4$ (Cyclo–tetrakis(bis(dimethylamino)phosphonitrile))		7.45±0.05	EI		2952

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
CH_4OP^+						
CH_4OP^+	$(CH_3O)_2CH_3PO$		16.9±0.2	EI		3211
$CH_4O_2P^+$						
$CH_4O_2P^+$	$(CH_3O)_2CH_3PO$		13.4±0.3	EI		3211
$CH_4O_2P^+$	$(CH_3O)_3PO$		15.1±0.2	EI		3211
$CH_5O_2P^+$						
$CH_5O_2P^+$	$(CH_3O)_2CH_3PO$		11.9	EI		3211
$CH_5O_2P^+$	$(CH_3O)_3PO$		13.9±0.4	EI		3211
$C_2H_6O_2P^+$						
$C_2H_6O_2P^+$	$(CH_3O)_2CH_3PO$		12.5±0.1	EI		3211
$C_2H_7O_2P^+$						
$C_2H_7O_2P^+$	$(CH_3O)_2CH_3PO$	CH_2O	11.5±0.2	EI		3211
$CH_4O_3P^+$						
$CH_4O_3P^+$	$(CH_3O)_2PHO$		11.9	EI		1036
$CH_4O_3P^+$	$(CH_3O)_3PO$		14.4±0.3	EI		3211
$C_2H_6O_3P^+$						
$C_2H_6O_3P^+$	$(CH_3O)_2PHO$	H	12.7	EI		1036
$C_2H_6O_3P^+$	$(CH_3O)_2CH_3PO$	CH_3	13.3±0.3	EI		3211
$C_2H_6O_3P^+$	$(CH_3O)_3PO$		14.1	EI		3211
$C_2H_6O_3P^+$	$(C_2H_5O)_3PO$		15.5±0.4	EI		3211
$C_2H_7O_3P^+$						
$C_2H_7O_3P^+$	$(CH_3O)_2PHO$		10.5	EI		1036
$C_2H_7O_3P^+$	$(CH_3O)_3PO$	CH_2O	11.9±0.2	EI		3211
$C_2H_7O_3P^+$	$(C_2H_5O)_3PO$		13.5±0.3	EI		3211
$C_2H_8O_3P^+$						
$C_2H_8O_3P^+$	$(C_2H_5O)_3PO$		13.6±0.2	EI		3211

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_3H_9O_3P^+$				
$C_3H_9O_3P^+$	$(CH_3O)_3P$		8.92	EI		3211
$C_3H_9O_3P^+$	$(CH_3O)_3P$		9.00±0.05	EI		2481, 2544
$C_3H_9O_3P^+$	$(CH_3O)_2CH_3PO$		10.48±0.20	EI		3211
		$C_4H_{10}O_3P^+$				
$C_4H_{10}O_3P^+$	$(C_2H_5O)_3PO$		12.7±0.2	EI		3211
		$C_4H_{11}O_3P^+$				
$C_4H_{11}O_3P^+$	$(C_2H_5O)_3PO$		11.6±0.4	EI		3211
		$C_4H_{12}O_3P^+$				
$C_4H_{12}O_3P^+$	$(C_2H_5O)_3PO$		12.3±0.2	EI		3211
		$C_6H_{15}O_3P^+$				
$C_6H_{15}O_3P^+$	$(C_2H_5O)_3P$		8.40±0.1	EI		2453
		$C_9H_{21}O_3P^+$				
$C_9H_{21}O_3P^+$	$(\mathit{iso}\text{-}C_3H_7O)_3P$		8.05	EI		2597
$C_9H_{21}O_3P^+$	$(\mathit{iso}\text{-}C_3H_7O)_3P$		8.46±0.05	EI		2481
		$C_{12}H_{27}O_3P^+$				
$C_{12}H_{27}O_3P^+$	$(n\text{-}C_4H_9O)_3P$		8.44±0.05	EI		2481
		$C_{18}H_{15}O_3P^+$				
$C_{18}H_{15}O_3P^+$	$(C_6H_5O)_3P$ (Triphenoxyphosphine)		8.60	EI		2597
		$C_2H_6O_4P^+$				
$C_2H_6O_4P^+$	$(C_2H_5O)_3PO$		13.5±0.3	EI		3211
		$C_2H_7O_4P^+$				
$C_2H_7O_4P^+$	$(C_2H_5O)_3PO$		12.8±0.2	EI		3211

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_2H_8O_4P^+$						
$C_2H_8O_4P^+$	$(C_2H_5O)_3PO$		12.7±0.2	EI		3211
$C_3H_9O_4P^+$						
$C_3H_9O_4P^+$	$(CH_3O)_3PO$		10.77±0.30	EI		3211
$C_4H_{12}O_4P^+$						
$C_4H_{12}O_4P^+$	$(C_2H_5O)_3PO$	C_2H_3	11.5±0.3	EI		3211
$C_5H_{12}O_4P^+$						
$C_5H_{12}O_4P^+$	$(C_2H_5O)_3PO$	CH_3	11.9±0.3	EI		3211
$C_6H_{15}O_4P^+$						
$C_6H_{15}O_4P^+$	$(C_2H_5O)_3PO$		10.06±0.27	EI		3211
$BH_3F_3P^+$						
$BH_3F_3P^+$	PF_3BH_3		12.0 (V)	PE		3043
$C_6H_{18}N_3O_6P_3^+$						
$C_6H_{18}N_3O_6P_3^+$	$(NP(OCH_3)_2)_3$ (Cyclo–tris(dimethoxyphosphonitrile))		9.29±0.05	EI		2952
$C_{36}H_{30}N_3O_6P_3^+$						
$C_{36}H_{30}N_3O_6P_3^+$	$(NP(OC_6H_5)_2)_3$ (Cyclo–tris(diphenoxyphosphonitrile))		8.83±0.05	EI		2952
$C_8H_{24}N_4O_8P_4^+$						
$C_8H_{24}N_4O_8P_4^+$	$(NP(OCH_3)_2)_4$ (Cyclo–tetrakis(dimethoxyphosphonitrile))		8.83±0.05	EI		2952
$C_{48}H_{40}N_4O_8P_4^+$						
$C_{48}H_{40}N_4O_8P_4^+$	$(NP(OC_6H_5)_2)_4$ (Cyclo–tetrakis(diphenoxyphosphonitrile))		8.70±0.05	EI		2952

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
			$C_{12}H_{12}N_3O_6F_{18}P_3^+$			
$C_{12}H_{12}N_3O_6F_{18}P_3^+$	$(NP(OCH_2CF_3)_2)_3$ (Cyclo–tris(bis(2,2,2–trifluoroethoxy)phosphonitrile))		10.43±0.05	EI		2952
			$C_{16}H_{16}N_4O_8F_{24}P_4^+$			
$C_{16}H_{16}N_4O_8F_{24}P_4^+$	$(NP(OCH_2CF_3)_2)_4$ (Cyclo–tetrakis(bis(2,2,2–trifluoroethoxy)phosphonitrile))		10.01±0.05	EI		2952
	S^+		**$\Delta H_{f0}^\circ = 1276$ kJ mol^{-1} (305 kcal mol^{-1})**			
S^+	S		10.360	S	1276	2113
See also – EI:	2472					
S^+	S_2 (Threshold value approximately corrected to 0 K)	S	14.74±0.01	PI	(1274)	2609
See also – EI:	2569					
S^+	H_2S	H_2	13.40±0.01	PI		2622
S^+	H_2S (Appearance potential of the corresponding metastable transition)	H_2	13.36±0.01	PI	(1271)	2622
See also – EI:	3134					
S^+	CS_2	CS	14.81±0.03	PI		2624, 2627
See also – EI:	2472, 2528, 3402					
S^+	SO_2	O_2	17.5±0.3	EI		418
S^+	$(CH_2)_2S$ (Ethylene sulfide)	C_2H_4	13.1±0.2	EI		51
S^+	C_2H_5SH		14.2±0.3	EI		3286
S^+	CH_3SSCH_3		15.0±0.3	EI		3286
S^+	COS	CO	13.65±0.03	PI	(1289)	2624, 2627
S^+	CF_3SSCF_3		~13	EI		3202
S^+	$(CH_3)_2SO$		10.8±0.3	EI		3294
S^+	SF_5Cl		33.2±0.5	EI		2777
S^+	SnS	Sn	16.5±2.0	EI		2139
S^+	PbS	Pb	16.0±2.0	EI		2139
	S_2^+		**$\Delta H_{f0}^\circ \sim 1031$ kJ mol^{-1} (246 kcal mol^{-1})**			
S_2^+	S_2		9.40±0.05	S	1035	2878
S_2^+	S_2		~9.32	S	~1027	3111
S_2^+	S_2 (Threshold value approximately corrected to 0 K)		9.36±0.02	PI	1031	2603, 2609
See also – EI:	319, 2022, 2139, 2172, 2469, 2482, 2569, 2747, 3155, 3249, 3402, 3428					

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
S_2^+	S_6		12.8±1.0	EI		1035
S_2^+	CS_2	C	14.9±0.3	EI		3402
S_2^+	CS_2	C	18.2±0.9	EI		2472
S_2^+	CS_2^+	C	9.6±0.6	SEQ		2472
S_2^+	CH_3SSCH_3		15.01±0.13	EI		3202
S_2^+	CH_3SSCH_3		15.4±0.3	EI		176
S_2^+	CH_3SSCH_3		15.9±0.3	EI		3286
S_2^+	$C_4H_8S_2$ (1,4–Dithiane)	$2C_2H_4$	12.4±0.2	EI		2969
S_2^+	$C_2H_5SSC_2H_5$		14.0±0.3	EI		3286
S_2^+	$C_2H_5SSC_2H_5$		14.9±0.4	EI		186
S_2^+	CH_3SSSCH_3		14.4±0.3	EI		84
S_2^+	CF_3SSCF_3		13.22±0.17	EI		3202

S_3^+ ΔH°_{f298} = 1067 kJ mol^{-1} (255 kcal mol^{-1})

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
S_3^+	S_3		9.68±0.03	PI	1067	2603
	(Threshold value approximately corrected to 0 K)					
S_3^+	S_3		9.9±0.4	EI		2482
S_3^+	S_6		13.3±0.5	EI		1035
S_3^+	S_8		12.6±0.5	EI		1035

S_4^+ ΔH°_{f298} ~ 1126 kJ mol^{-1} (269 kcal mol^{-1})

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
S_4^+	S_4		10.4±0.5	EI	(~1140)	2172
See also – EI:	2482					
S_4^+	S_6	S_2	11.94±0.05	PI	1126	2603
	(Threshold value approximately corrected to 0 K)					
See also – EI:	1035					
S_4^+	S_8		12.5±0.3	EI		1035

S_5^+ ΔH°_{f298} = 954 kJ mol^{-1} (228 kcal mol^{-1})

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
S_5^+	S_5		8.60±0.05	PI	954	2603
	(Threshold value approximately corrected to 0 K)					
See also – EI:	2482					
S_5^+	S_8	S_3	10.2	PI	(954)	2603
	(Threshold value approximately corrected to 0 K)					
See also – EI:	1035					

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
S_6^+ $\Delta H^\circ_{f298} = 971$ kJ mol^{-1} (232 kcal mol^{-1})						
S_6^+	S_6		9.00±0.03	PI	971	2603
(Threshold value approximately corrected to 0 K)						
S_6^+	S_6		8.5±0.3	EI		2172
S_6^+	S_6		9.7±0.3	EI		1035
See also – EI:	2482					
S_6^+	S_8	S_2	≤11.0	PI	(≤1035)	2603
S_6^+	S_8	S_2	10.1±0.3	EI		1035
S_7^+ $\Delta H^\circ_{f298} = 950$ kJ mol^{-1} (227 kcal mol^{-1})						
S_7^+	S_7		8.67±0.03	PI	950	2603
(Threshold value approximately corrected to 0 K)						
S_7^+	S_7		8.7±0.2	EI		2482
S_7^+	S_7		9.3±0.3	EI		1035
S_8^+ $\Delta H^\circ_{f0} = 978$ kJ mol^{-1} (234 kcal mol^{-1})						
S_8^+	S_8		9.04±0.03	PI	978	2603
(Threshold value approximately corrected to 0 K)						
S_8^+	S_8		9.6±0.2	EI		1035
S_8^+	S_8		7.3±0.3	EI		2172
See also – EI:	2482, 3155					
HS^+ $\Delta H^\circ_{f0} \sim 1145$ kJ mol^{-1} (274 kcal mol^{-1})						
HS^+	HS		10.41±0.03	S	~1147	2665
HS^+	HS		10.50±0.1	EI		120
HS^+	H_2S	H	14.27±0.02	PI	1143	2622
HS^+	H_2S	H	14.43±0.1	EI		120
See also – EI:	3134					
HS^+	$(CH_3)_2SO$		15.8±0.1	EI		3294
$H_2S^+(^2B_1)$ $\Delta H^\circ_{f0} = 993$ kJ mol^{-1} (237 kcal mol^{-1})						
$H_2S^+(^2B_1)$	H_2S		10.47±0.01	S	993	387, 3140, 3317
(Average of two Rydberg series limits)						
$H_2S^+(^2B_1)$	H_2S		10.43±0.01	PI		2622
$H_2S^+(^2B_1)$	H_2S		10.458±0.01	PI		158, 182, 416, 1103
$H_2S^+(^2B_1)$	H_2S		10.43	PE		3035, 3170
$H_2S^+(^2B_1)$	H_2S		10.42	PE		1130
$H_2S^+(^2B_1)$	H_2S		10.45±0.03	RPD		463

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$H_2S^+(^2A_1)$	H_2S		12.81	PE		3170
$H_2S^+(^2A_1)$	H_2S		12.76	PE		3035
$H_2S^+(^2A_1)$	H_2S		12.62	PE		1130
$H_2S^+(^2B_2)$	H_2S		14.79	PE		3170
$H_2S^+(^2B_2)$	H_2S		14.91	PE		3035
$H_2S^+(^2B_2)$	H_2S		14.82	PE		1130
H_2S^{+*}	H_2S		18.0?	PE		3035
H_2S^{+*}	H_2S		18.00?	PE		1130
H_2S^{+*}	H_2S		20.8	PE		3035
H_2S^{+*}	H_2S		20.12	PE		1130
See also – EI: 383, 2483, 3134, 3426						
H_2S^+	$(CH_2)_2S$ (Ethylene sulfide)	C_2H_2	13.4	RPD		3345
(0.07 eV average translational energy of decomposition at threshold)						
H_2S^+	$(CH_2)_2S$ (Ethylene sulfide)	C_2H_2	13.4±0.1	EI		51
H_2S^+	C_2H_5SH	C_2H_4	11.8±0.3	EI		3286
H_2S^+	$(CH_3)_2S$		14.29±0.04	EI		3202
H_2S^+	$(CH_3)_2SO$		11±0.1	EI		3294
		HDS^+				
HDS^+	HDS		10.3±0.2	EI		3134
		D_2S^+				
D_2S^+	D_2S		10.2±0.2	EI		3134
		$H_2S_2^+$				
$H_2S_2^+$	$C_2H_5SSC_2H_5$		11.9	EI		307
$H_2S_2^+$	$C_2H_5SSC_2H_5$		12.2±0.2	EI		186, 191
$H_2S_2^+$	$C_2H_5SSC_2H_5$		13.1±0.3	EI		3286
		BS^+				
BS^+	B_2S_3		17.2±0.2	EI		3428
		BS_2^+				
BS_2^+	B_2S_3	BS	13.6±0.2	EI		3428
BS_2^+	$(HBS_2)_3$?		16.4±0.3	EI		2483, 3426

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$B_2S_2^+$				
$B_2S_2^+$	B_2S_3	S	12.5±0.2	EI		3428
		$B_2S_3^+$				
$B_2S_3^+$	B_2S_3		9.4±0.2	EI		3428
$B_2S_3^+$	B_2S_3		10.4±0.2	EI		2147
$B_2S_3^+$	$(HBS_2)_3$		13.1±0.3	EI		2483, 3426
		$B_2S_3^{+2}$				
$B_2S_3^{+2}$	B_2S_3		24.4±0.2	EI		3428
		$B_3S_3^+$				
$B_3S_3^+$	$(HBS_2)_3$		13.0±0.3	EI		2483, 3426
		$B_2S_4^+$				
$B_2S_4^+$	$(HBS_2)_3$?		13.0±0.3	EI		2483, 3426
		$B_3S_4^+$				
$B_3S_4^+$	B_4S_6	BS_2	11.0±0.2	EI		3428
$B_3S_4^+$	$(HBS_2)_3$		15.0±0.3	EI		2483, 3426
		$B_3S_5^+$				
$B_3S_5^+$	$(HBS_2)_3$		15.2±0.3	EI		2483, 3426
		$B_4S_6^+$				
$B_4S_6^+$	B_4S_6		9.5±0.8	EI		2147
$B_4S_6^+$	B_4S_6		10.0±0.2	EI		3428
		$B_8S_{14}^+$				
$B_8S_{14}^+$	B_8S_{16}	S_2	11.0	EI		3427
		$B_8S_{16}^+$				
$B_8S_{16}^+$	B_8S_{16}		8.5	EI		3427

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
			CS^+			
CS^+	CS		~11.65	S	(~1394)	2878
CS^+	CS		11.8±0.2	EI		319
CS^+	CS		11.71±0.03	D		2624, 2627
See also – EI:	3402					
CS^+	CS_2	S	16.16±0.01	PI	(1399)	2624, 2627
CS^+	CS_2	S	16.15±0.10	RPD		2528
See also – EI:	2472, 3402					
CS^+	CS_2^+	S	9.6±0.6	SEQ		2472
CS^+	C_2H_5SH	CH_4+H_2	11.7±0.3	EI		3286
CS^+	CH_3SSCH_3	H_2S+CH_4	12.0±0.3	EI		3286
CS^+	$C_2H_5SSC_2H_5$	$C_2H_5SH+CH_4$	11.4±0.3	EI		3286
CS^+	CH_3NCS		15.6±0.4	EI		315
CS^+	C_2H_5NCS		16.1±0.5	EI		315
CS^+	$(CH_3)_2SO$		11.3±0.3	EI		3294

$CS_2^+(X^2\Pi_{3/2g})$ $\Delta H^\circ_{f0} = 1089$ kJ mol^{-1} (260 kcal mol^{-1})
$CS_2^+(X^2\Pi_{1/2g})$ $\Delta H^\circ_{f0} = 1094$ kJ mol^{-1} (262 kcal mol^{-1})
$CS_2^+(A^2\Pi_{3/2u})$ $\Delta H^\circ_{f0} = 1329$ kJ mol^{-1} (318 kcal mol^{-1})
$CS_2^+(A^2\Pi_{1/2u})$ $\Delta H^\circ_{f0} = 1331$ kJ mol^{-1} (318 kcal mol^{-1})
$CS_2^+(B^2\Sigma_u^+)$ $\Delta H^\circ_{f0} = 1513$ kJ mol^{-1} (362 kcal mol^{-1})
$CS_2^+(C^2\Sigma_g^+)$ $\Delta H^\circ_{f0} = 1679$ kJ mol^{-1} (401 kcal mol^{-1})

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$CS_2^+(X^2\Pi_{3/2g})$	CS_2		10.080	S	1089	149
$CS_2^+(X^2\Pi_{3/2g})$	CS_2		10.079	S	1089	3313
$CS_2^+(X^2\Pi_{1/2g})$	CS_2		10.134	S	1094	149
$CS_2^+(X^2\Pi_{1/2g})$	CS_2		10.133	S	1094	3313
$CS_2^+(A^2\Pi_{3/2u})$	CS_2		12.563	S	1329	3049
$CS_2^+(A^2\Pi_{1/2u})$	CS_2		12.586	S	1331	3049
$CS_2^+(B^2\Sigma_u^+)$	CS_2		14.475	S	1513	3049
(Average of three Rydberg series limits)						
$CS_2^+(B^2\Sigma_u^+)$	CS_2		14.476	S	1513	149
(Average of two Rydberg series limits)						
$CS_2^+(C^2\Sigma_g^+)$	CS_2		16.188	S	1678	3049
(Average of three Rydberg series limits)						
$CS_2^+(C^2\Sigma_g^+)$	CS_2		16.190	S	1679	149
(Average of three Rydberg series limits)						
CS_2^{+*}?	CS_2		19.381	S		3049
(Average of two Rydberg series limits)						
CS_2^{+*}?	CS_2		19.389	S		149
(Limit decreased by 1000 cm^{-1} as suggested in ref. 3049)						

This state was searched for but not found with photoelectron spectroscopy, see ref. 2901.

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$CS_2^+(X^2\Pi_{3/2g})$	CS_2		10.068±0.005	PE		2901
$CS_2^+(X^2\Pi_{3/2g})$	CS_2		10.084±0.01	PE		2848
$CS_2^+(X^2\Pi_{1/2g})$	CS_2		10.122±0.005	PE		2901
$CS_2^+(X^2\Pi_{1/2g})$	CS_2		10.136±0.01	PE		2848
$CS_2^+(A^2\Pi_u)$	CS_2		12.694±0.005	PE		2901
$CS_2^+(A^2\Pi_u)$	CS_2		12.63±0.02	PE		2848
$CS_2^+(B^2\Sigma_u^+)$	CS_2		14.478±0.005	PE		2901
$CS_2^+(B^2\Sigma_u^+)$	CS_2		14.47±0.01	PE		2848
$CS_2^+(C^2\Sigma_g^+)$	CS_2		16.196±0.005	PE		2901
$CS_2^+(C^2\Sigma_g^+)$	CS_2		16.19±0.01	PE		2848
$CS_2^+(D^2\Sigma_u^+?)$	CS_2		~17.0 (V)	PE		2901
$CS_2^+(X^2\Pi_{3/2g})$	CS_2		10.059±0.008	PI		2624, 2627
$CS_2^+(X^2\Pi_{3/2g})$	CS_2		10.075	PI		2528
$CS_2^+(X^2\Pi_{1/2g})$	CS_2		10.112±0.008	PI		2624, 2627
$CS_2^+(X^2\Pi_{1/2g})$	CS_2		10.13	PI		2528

See also – S: 409, 410
PI: 158, 182, 190, 416
PE: 92, 1130, 2839, 2856, 2875
PEN: 2430
EI: 164, 169, 2528, 3174, 3201, 3402

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
CS_2^+	$C_2H_5SSC_2H_5$		10.0±0.3	EI		3286

CS_2^{+2}

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
CS_2^{+2}	CS_2		27.45±0.2	NRE		1040
CS_2^{+2}	CS_2		25.5±0.3	EI		2472
CS_2^{+2}	CS_2^+		16.4±0.3	SEQ		2472

CS_2^{+3}

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
CS_2^{+3}	CS_2		53.6±0.5	NRE		1040

NS^+

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
NS^+	NS		9.85±0.28	D		2888
NS^+	NSF	F	11.80±0.05	RPD		2443
NS^+?	CH_3NCS		12.5±0.2	EI		315

4.3. The Positive Ion Table—Continued

SO^+ $\Delta H^\circ_{f0} = 1004$ kJ mol^{-1} (240 kcal mol^{-1})

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
SO^+	SO		10.0±0.1	S		2761
SO^+	SO		10.34±0.02	PE	1004	3241
SO^{+*}	SO		14.96±0.02	PE		3241
SO^{+*}	SO		~18?	PE		3241
SO^+	SO_2	O	15.81±0.02	PI	(984)	2622

See also – EI: 418, 2022, 2172

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
SO^+	S_2O	S	14.5±0.2	EI		2022, 2172
SO^+	SO_2F_2	2F+O	24.3±0.3	EI		418
SO^+	$(CH_3)_2SO$		11±0.1	EI		3294

$SO_2^+(^2A_1)$ $\Delta H^\circ_{f0} = 895$ kJ mol^{-1} (214 kcal mol^{-1})

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$SO_2^+(^2A_1)$	SO_2		12.34	S	896	3318
$SO_2^+(^2A_1)$	SO_2		12.32±0.01	PI	894	2622
$SO_2^+(^2A_1)$	SO_2		12.34±0.02	PI	896	182, 416, 3318
$SO_2^+(^2A_1)$	SO_2		12.30±0.01	PE	893	2848
SO_2^{+*}	SO_2		13.01±0.05	PE		2848
SO_2^{+*}	SO_2		$13.24^{+0.05}_{-0.15}$	PE		2848
SO_2^{+*}	SO_2		15.986±0.005	PE		2848
SO_2^{+*}	SO_2		16.326±0.005	PE		2848
SO_2^{+*}	SO_2		16.7?	PE		2848

The assignment of the excited states is somewhat uncertain, see ref. 2848.

See also – S: 3313
PI: 297
PE: 1130
PEN: 2430
EI: 418, 2022, 2172, 2487

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
SO_2^+	SO_2F_2	2F?	19.9±0.3	EI		418

SO_3^+

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
SO_3^+	SO_3		11.0±0.5	EI		2487

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
S_2O^+						
S_2O^+	S_2O		10.3±0.1	EI		2022, 2172
SF^+						
SF^+	SF		~14	EI		3220
SF^+	SF_2?		~18	EI		3220
SF^+	NSF	N	15.45±0.1	RPD		2443
SF_2^+						
SF_2^+	NSF_3		15.70±0.05	RPD		2443
SF_2^+	$NCNSF_2$		12.1±0.1	RPD		2443
SF_2^+	CF_3NSF_2		12.95±0.1	RPD		2443
SF_3^+						
SF_3^+	SF_4	F	12.70±0.03	RPD		2443
SF_3^+	SF_6	F_2+F?	19.80±0.10	RPD		3040, 3041
SF_3^+	NSF_3	N	13.46±0.03	RPD		2443
SF_3^+	SF_5NF_2	NF_2+F_2?	16.0±0.2	EI		1144
SF_4^+						
SF_4^+	SF_4		12.28±0.03	RPD		2443
SF_4^+	SF_6	2F?	18.50±0.10	RPD		3040, 3041
SF_4^+	SF_5NF_2	NF_3?	15.9±0.2	EI		1144
SF_5^+						
SF_5^+	SF_6	F	15.29	PI	(203)	2027
SF_5^+	SF_6	F	15.75±0.05	RPD		3040, 3041
SF_5^+	SF_6	F	15.85±0.15	RPD		196
SF_5^+	SF_5NF_2		12.0±0.2	EI		1144
SF_5^+	SF_5Cl	Cl	13.2±0.2	EI		2777

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		SF$_6^+$				
(SF$_6^+$)	SF$_6$		15.35±0.02	PE		2852, 2853
(SF$_6^+$)	SF$_6$		15.30	PE		3040, 3041
(SF$_6^+$)	SF$_6$		15.69 (V)	PE		3119
(SF$_6^{+}$*)	SF$_6$		16.16	S		3100
This ionization potential is based on maxima of a three–member Rydberg series with very broad bands ~5000–20000 cm^{-1} wide. It is not observed in photoelectron spectra, see refs. 3040, 3041, 3119.						
(SF$_6^{+}$*)	SF$_6$		16.71±0.02	PE		2852, 2853
(SF$_6^{+}$*)	SF$_6$		16.70	PE		3040, 3041
(SF$_6^{+}$*)	SF$_6$		16.96 (V)	PE		3119
(SF$_6^{+}$*)	SF$_6$		18.11±0.02	PE		2852, 2853
(SF$_6^{+}$*)	SF$_6$		18.10	PE		3040, 3041
(SF$_6^{+}$*)	SF$_6$		18.40 (V)	PE		3119
(SF$_6^{+}$*)	SF$_6$		18.50	PE		3040, 3041
(SF$_6^{+}$*)	SF$_6$		18.71 (V)	PE		3119
(SF$_6^{+}$*)	SF$_6$		19.50±0.02	PE		2852, 2853
(SF$_6^{+}$*)	SF$_6$		19.30	PE		3040, 3041
(SF$_6^{+}$*)	SF$_6$		19.68 (V)	PE		3119
(SF$_6^{+}$*)	SF$_6$		22.46	S		2653, 3119
(SF$_6^{+}$*)	SF$_6$		22.5 (V)	PE		3119
(SF$_6^{+}$*)	SF$_6$		26.83±0.04	S		2653
(SF$_6^{+}$*)	SF$_6$		26.8 (V)	PE		3119
No significant amount of SF$_6^+$ is found in the mass spectrum, see for example ref. 2027. The ion is strongly Jahn–Teller distorted. For tentative assignments of energy levels see ref. 3119. At the ionization threshold SF$_5^+$ is produced; compare PE results with SF$_5^+$ data above.						
		AlS$^+$				
AlS$^+$	AlS		9.5±0.5	EI		2449
		Al$_2$S$^+$				
Al$_2$S$^+$	Al$_2$S		9.0±0.5	EI		2449
		Al$_2$S$_2^+$				
Al$_2$S$_2^+$	Al$_2$S$_2$		9.5±0.5	EI		2449

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
PS^+						
PS^+	PSF_3		19.2±0.5	EI		2506
$BH_2S_2^+$						
$BH_2S_2^+$	$(HBS_2)_3$	HBS_2+BS_2	11.8±0.3	EI		2483, 3426
$B_2HS_2^+$						
$B_2HS_2^+$	$(HBS_2)_3$?		16.6±0.3	EI		2483, 3426
$BH_3S_3^+$						
$BH_3S_3^+$	H_3BS_3		9.9±0.3	EI		2483, 3426
$B_2HS_3^+$						
$B_2HS_3^+$	$(HBS_2)_3$		13.1±0.3	EI		2483, 3426
$B_2HS_4^+$						
$B_2HS_4^+$	$(HBS_2)_3$?		11.4±0.3	EI		2483, 3426
$B_2H_2S_4^+$						
$B_2H_2S_4^+$	$(HBS_2)_3$	HBS_2	10.5±0.3	EI		2483, 3426
$B_2H_2S_5^+$						
$B_2H_2S_5^+$	$H_2B_2S_5$		8.9±0.3	EI		2483, 3426
$B_3HS_5^+$						
$B_3HS_5^+$	$(HBS_2)_3$		11.2±0.3	EI		2483, 3426
$B_3H_2S_5^+$						
$B_3H_2S_5^+$	$(HBS_2)_3$		11.5±0.3	EI		2483, 3426
$B_3H_2S_6^+$						
$B_3H_2S_6^+$	$(HBS_2)_3$	H	12.3±0.3	EI		2483, 3426

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$B_3H_3S_6^+$				
$B_3H_3S_6^+$	$(HBS_2)_3$		9.3±0.3	EI		2483, 3426
		CHS^+				
CHS^+	CH_3SH		15.8±0.5	EI		2791
CHS^+	$(CH_2)_2S$ (Ethylene sulfide)	CH_3	12.3±0.2	EI		51
CHS^+	C_2H_5SH		17.7±0.3	EI		3286
CHS^+	$(CH_3)_2S$		14.16±0.08	EI		3202
See also – EI:	84					
CHS^+	C_3H_6S (Propylene sulfide)		14.1±0.2	EI		188
CHS^+	$(CH_2)_3S$ (Trimethylene sulfide)		13.9±0.2	EI		52
CHS^+	$C_2H_5SCH_3$		15.9±0.4	EI		176
CHS^+	C_4H_4S (Thiophene)		13.0±0.2	EI		2166
CHS^+	$CH_3SCH_2CH{=}CH_2$		13.8±0.3	EI		186
CHS^+	$(CH_2)_4S$ (Tetramethylene sulfide)		13.8±0.2	EI		52
CHS^+	$n\text{-}C_3H_7SCH_3$		15.2±0.4	EI		176
CHS^+	$iso\text{-}C_3H_7SCH_3$		16.4±0.4	EI		186
CHS^+	$(C_2H_5)_2S$		15.3±0.5	EI		84
CHS^+	$CH_3SCH{=}CHC{\equiv}CH$		15.5±0.3	EI		2949
CHS^+	$CH_3SC{\equiv}CCH{=}CH_2$		14.9±0.3	EI		2949
CHS^+	C_6H_5SD (Mercapto–d_1–benzene)		12.7±0.2	EI		1039
CHS^+	$C_2H_5SCH{=}CHC{\equiv}CH$		13.8±0.3	EI		2949
CHS^+	$C_2H_5SC{\equiv}CCH{=}CH_2$		14.2±0.3	EI		2949
CHS^+	$C_6H_5SCH_3$ (Methylthiobenzene)		14.5	EI		307
CHS^+	$C_6H_5SC_2H_5$ (Ethylthiobenzene)		12.5	EI		307
CHS^+	CH_3SSCH_3		13.43±0.09	EI		3202
See also – EI:	176, 307, 3286					
CHS^+	$C_2H_5SSC_2H_5$		16.4±0.3	EI		3286
See also – EI:	186					
CHS^+	$C_6H_5SSC_6H_5$ (Diphenyl disulfide)		21.0±0.3	EI		3286
CHS^+	CH_3SSSCH_3		14.5±0.3	EI		84
CHS^+	CH_3NCS		12.9±0.2	EI		315
CHS^+	C_2H_5NCS		15.2±0.5	EI		315
CHS^+	$(CH_3)_2SO$		14.8±0.1	EI		3294
CHS^+	C_4H_8OS (1,4–Oxathiane)		14.1	EI		2969

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
CHS^+	CH_3SCF_3		14.88±0.06	EI		3202
CHS^+	CH_3SSCF_3		14.83±0.08	EI		3202
		CDS^+				
CDS^+	C_6H_5SD (Mercapto–d_1–benzene)		12.7±0.2	EI		1039
		CH_2S^+				
CH_2S^+	CH_2S		9.44±0.05	EI		2499
CH_2S^+	$(CH_2)_2S$ (Ethylene sulfide)		12.7±0.2	EI		51
CH_2S^+	C_2H_5SH		11.2±0.3	EI		3286
CH_2S^+	$(CH_3)_2S$		10.97±0.13	EI		3202
See also – EI:	84					
CH_2S^+	C_3H_6S (Propylene sulfide)		12.4±0.3	EI		188
CH_2S^+	$(CH_2)_3S$ (Trimethylene sulfide)		10.4±0.1	EI		2499
See also – EI:	52					
CH_2S^+	$C_2H_5SCH_3$		13.6±0.3	EI		176
CH_2S^+	$CH_3SCH_2CH{=}CH_2$		11.4±0.3	EI		186
CH_2S^+	$(CH_2)_4S$ (Tetramethylene sulfide)		13.0±0.2	EI		52
CH_2S^+	n–$C_3H_7SCH_3$		14.1±0.3	EI		176
CH_2S^+	iso–$C_3H_7SCH_3$		15.5±0.4	EI		186
CH_2S^+	$(C_2H_5)_2S$		12.5±0.3	EI		84
CH_2S^+	CH_3SSCH_3		10.61±0.11	EI		3202
See also – EI:	176, 3286					
CH_2S^+	$C_4H_8S_2$ (1,4–Dithiane)		13±0.3	EI		2969
CH_2S^+	$C_2H_5SSC_2H_5$		16.6±0.3	EI		3286
CH_2S^+	CH_3SSSCH_3		13.4±0.3	EI		84
CH_2S^+	$(CH_3)_2SO$		11.5±0.1	EI		3294
CH_2S^+	C_4H_8OS (1,4–Oxathiane)		12.2±0.3	EI		2969
CH_2S^+	CH_3SCF_3		~14	EI		3202
CH_2S^+	CH_3SSCF_3		13.43±0.24	EI		3202

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		CH_3S^+				
CH_3S^+	CH_3S		8.06±0.1	EI		120
CH_3S^+	CH_3SH	H	11.6±0.1	RPD		3017
See also – EI:	2685, 2791					
CH_3S^+	C_2H_5SH	CH_3	11.41±0.1	EI		2504
See also – EI:	2685, 3286					
CH_3S^+	$(CH_3)_2S$	CH_3	11.08±0.1	EI		2504
See also – EI:	84, 120, 307, 2685, 3202					
CH_3S^+	CH_3SCD_3	CD_3	11.0	EI		307
CH_3S^+	C_3H_6S (Propylene sulfide)		13.5±0.2	EI		188
CH_3S^+	$(CH_2)_3S$ (Trimethylene sulfide)		12.3±0.15	EI		52
CH_3S^+	$C_2H_5SCH_3$		14.7±0.2	EI		176
CH_3S^+	$CH_3SCH_2CH{=}CH_2$		11.9±0.2	EI		186
CH_3S^+	$(CH_2)_4S$ (Tetramethylene sulfide)		14.0±0.2	EI		52
CH_3S^+	$n\text{-}C_3H_7SCH_3$		14.0±0.2	EI		176
See also – EI:	2587					
CH_3S^+	$iso\text{-}C_3H_7SCH_3$		15.3±0.2	EI		186
CH_3S^+	$(C_2H_5)_2S$		12.31±0.1	EI		2504
See also – EI:	84, 307, 3286					
CH_3S^+	$(n\text{-}C_3H_7)_2S$		12.65	EI		307
CH_3S^+	CH_3SSCH_3		11.12±0.1	EI		120
See also – EI:	176, 307, 2504, 2685, 3202, 3286					
CH_3S^+	$C_2H_5SSC_2H_5$		15.5±0.3	EI		3286
CH_3S^+	CH_3SSSCH_3		12.9±0.2	EI		84
CH_3S^+	$(CH_3)_2SO$		11.4	EI		2685
See also – EI:	3294					
CH_3S^+	C_4H_8OS (1,4–Oxathiane)		12.6	EI		2969
CH_3S^+	CH_3SCF_3		11.78±0.03	EI		3202
CH_3S^+	CH_3SSCF_3		12.84±0.11	EI		3202
CH_3S^+	$CH_3SCH_2CH_2CH(NH_2)COOH$		13.0±0.2	EI		2587

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
CH_2DS^+						
CH_2DS^+	CH_3SCD_3	CHD_2	11.05	EI		307
CHD_2S^+						
CHD_2S^+	CD_3SH	D	12.01±0.1	EI		2504
CHD_2S^+	CH_3SCD_3	CH_2D	11.55	EI		307
CD_3S^+						
CD_3S^+	CD_3SH	H	11.76±0.1	EI		2504
CD_3S^+	CH_3SCD_3	CH_3	11.15	EI		307
CD_3S^+	$C_2H_5SCD_3$		12.69±0.1	EI		2504
CH_3SH^+ $\Delta H^\circ_{f0} = 899$ kJ mol^{-1} (215 kcal mol^{-1})						
CH_4S^+	CH_3SH		9.443±0.002	S	899	3317
(Average of three Rydberg series limits)						
CH_4S^+	CH_3SH		9.440±0.005	PI	899	182
See also – EI: 2791						
CH_4S^+	$C_2H_5SCH_3$		10.43±0.1	EI		2504
See also – EI: 176						
CH_4S^+	$CH_3SCH_2CH{=}CH_2$		11.5±0.2	EI		186
CH_4S^+	$n\text{-}C_3H_7SCH_3$		10.45±0.1	EI		2504
See also – EI: 176						
CH_4S^+	$iso\text{-}C_3H_7SCH_3$		12.0±0.2	EI		186
CH_4S^+	CH_3SSCH_3		9.72±0.09	EI		3202
See also – EI: 176, 307, 3286						
CHD_3S^+						
CHD_3S^+	CD_3SH		9.54±0.1	EI		2504
CHD_3S^+	$C_2H_5SCD_3$		10.48±0.1	EI		2504

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
CH_5S^+						
CH_5S^+	$C_2H_5SCH_3$		10.7±0.3	EI		2504
See also – EI:	176					
CH_5S^+	n–$C_3H_7SCH_3$		10.23±0.1	EI		2504
See also – EI:	176					
CH_5S^+	*iso*–$C_3H_7SCH_3$		12.1±0.2	EI		186
CH_5S^+	CH_3SSCH_3		11.44±0.15	EI		3202
See also – EI:	176, 3286					
C_2HS^+						
C_2HS^+	$(CH_3)_2SO$		10.9±0.3	EI		3294
$C_2H_2S^+$						
$C_2H_2S^+$	$(CH_2)_2S$ (Ethylene sulfide)		15.0±0.2	EI		51
$C_2H_2S^+$	C_3H_6S (Propylene sulfide)		15.6±0.4	EI		188
$C_2H_2S^+$	C_4H_4S (Thiophene)		10.8±0.2	EI		2166
$C_2H_2S^+$	$(CH_2)_4S$ (Tetramethylene sulfide)		17.0±0.3	EI		52
$C_2H_2S^+$	$CH_3SCH{=}CHC{\equiv}CH$		12.3±0.3	EI		2949
$C_2H_2S^+$	$C_2H_5SCH{=}CHC{\equiv}CH$		12.1±0.3	EI		2949
$C_2H_2S^+$	$C_2H_5SSC_2H_5$		18.6±0.5	EI		186
$C_2H_2S^+$	$(CH_3)_2SO$		13±0.3	EI		3294
$C_2H_3S^+$						
$C_2H_3S^+$	$(CH_2)_2S$ (Ethylene sulfide)	H	11.4±0.2	EI		51
$C_2H_3S^+$	C_2H_5SH		18.3±0.3	EI		3286
$C_2H_3S^+$	C_3H_6S (Propylene sulfide)		12.3±0.3	EI		188
$C_2H_3S^+$	$C_2H_5SCH_3$		13.4±0.4	EI		176
$C_2H_3S^+$	$(CH_2)_4S$ (Tetramethylene sulfide)		15.7±0.4	EI		52
$C_2H_3S^+$	*iso*–$C_3H_7SCH_3$		16.1±0.3	EI		186
$C_2H_3S^+$	$(C_2H_5)_2S$		14.6±0.4	EI		84
See also – EI:	3286					
$C_2H_3S^+$	$CH_3SCH{=}CHC{\equiv}CH$		10.8±0.3	EI		2949
$C_2H_3S^+$	$C_2H_5SCH{=}CHC{\equiv}CH$		13.8±0.3	EI		2949

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_2H_3S^+$	$C_2H_5SSC_2H_5$		16.2±0.3	EI		186
See also – EI:	3286					
$C_2H_3S^+$	$C_6H_5SSC_6H_5$ (Diphenyl disulfide)		20.5±0.3	EI		2949
$C_2H_3S^+$	$(CH_3)_2SO$		11±0.3	EI		3294
$C_2H_3S^+$	C_4H_8OS (1,4–Oxathiane)		12.6	EI		2969
		$C_2H_4S^+$				
$C_2H_4S^+$	$(CH_2)_2S$ (Ethylene sulfide)		8.87±0.15	EI		51
See also – EI:	218					
$C_2H_4S^+$	C_2H_5SH		14.0±0.3	EI		3286
$C_2H_4S^+$	$(CH_2)_4S$ (Tetramethylene sulfide)		11.7±0.3	EI		52
$C_2H_4S^+$	$(C_2H_5)_2S$		11.2±0.2	EI		84
See also – EI:	3286					
$C_2H_4S^+$	$C_4H_8S_2$ (1,4–Dithiane)		10.9±0.2	EI		2969
$C_2H_4S^+$	$C_2H_5SSC_2H_5$		11.6	EI		307
See also – EI:	186					
$C_2H_4S^+$	$(CH_3)_2SO$		11.1±0.5	EI		3294
$C_2H_4S^+$	C_4H_8OS (1,4–Oxathiane)		10.4±0.3	EI		2969
		$C_2H_5S^+$				
$C_2H_5S^+$	C_2H_5SH	H	11.5	EI		2685
See also – EI:	3286					
$C_2H_5S^+$	$(CH_3)_2S$	H	11.2±0.1	RPD		3017
$C_2H_5S^+$	$(CH_3)_2S$	H	11.50±0.1	EI		2504
See also – EI:	84, 2685, 3202, 3294					
$C_2H_5S^+$	*iso*–C_3H_7SH	CH_3	10.74±0.1	EI		2504
$C_2H_5S^+$	$C_2H_5SCH_3$	CH_3	10.74	EI		2504
See also – EI:	176					

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_2H_5S^+$	$C_2H_5SCD_3$	CD_3	10.75±0.1	EI		2504
$C_2H_5S^+$	$CH_3SCH_2CH=CH_2$		12.0±0.2	EI		186
$C_2H_5S^+$	$n-C_3H_7SCH_3$	C_2H_5	10.97±0.1	EI		2504
See also – EI:	176, 2587					
$C_2H_5S^+$	$iso-C_3H_7SCH_3$		13.5±0.3	EI		186
$C_2H_5S^+$	$(C_2H_5)_2S$	C_2H_5	11.05	EI		307
See also – EI:	84					
$C_2H_5S^+$	$C_2H_5SC_2D_5$	C_2D_5	10.72±0.1	EI		2504
$C_2H_5S^+$	$(n-C_3H_7)_2S$		12.2	EI		307
$C_2H_5S^+$	CH_3SSCH_3		10.0	EI		2685
See also – EI:	176, 307, 3202, 3286					
$C_2H_5S^+$	$C_4H_8S_2$ (1,4–Dithiane)		10.6±0.2	EI		2969
$C_2H_5S^+$	$C_2H_5SSC_2H_5$		10.47	EI		2504
See also – EI:	186, 307, 3286					
$C_2H_5S^+$	$(CH_3)_2SO$		10.5	EI		2685
See also – EI:	3294					
$C_2H_5S^+$	C_4H_8OS (1,4–Oxathiane)		10.3±0.2	EI		2969
$C_2H_5S^+$	$CH_3SCH_2CH_2CH(NH_2)COOH$		12.43±0.10	EI		2587
		$C_2H_2D_3S^+$				
$C_2H_2D_3S^+$	$C_2H_5SCD_3$	CH_3	10.84±0.1	EI		2504
		$C_2HD_4S^+$				
$C_2HD_4S^+$	C_2D_5SH	D	11.85±0.1	EI		2504
	$C_2H_5SH^+$ **$(CH_3)_2S^+$**	**$\Delta H^\circ_{f0} = 867$ kJ mol^{-1} (207 kcal mol^{-1})** **$\Delta H^\circ_{f0} = 817$ kJ mol^{-1} (195 kcal mol^{-1})**				
$C_2H_6S^+$	C_2H_5SH		9.285±0.005	PI	867	182
$C_2H_6S^+$	C_2H_5SH		9.31±0.1	EI		2504
See also – EI:	384, 3286					

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_2H_6S^+$	$(CH_3)_2S$		8.685±0.005	PI	817	182
$C_2H_6S^+$	$(CH_3)_2S$		8.68±0.03	PE		3034
$C_2H_6S^+$	$(CH_3)_2S$		8.71±0.1	EI		2504

See also – S: 3317
PEN: 2430
EI: 84, 307, 2505, 3202, 3338

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_2H_6S^+$	$(C_2H_5)_2S$		10.4±0.2	EI		84

See also – EI: 307, 3286

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_2H_6S^+$	$C_2H_5SSC_2H_5$		11.4±0.3	EI		3286
$C_2H_6S^+$	$(CH_3)_2SO$	O	11.6±0.1	EI		3294

$C_2H_3D_3S^+$

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_2H_3D_3S^+$	CH_3SCD_3		8.72±0.1	EI		2504

See also – EI: 307

C_3HS^+

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
C_3HS^+	$CH_3SC{\equiv}CCH{=}CH_2$		17.4±0.3	EI		2949
C_3HS^+	C_6H_5SH (Mercaptobenzene)		19.8±0.3	EI		3286
C_3HS^+	$C_2H_5SCH{=}CHC{\equiv}CH$		13.5±0.3	EI		2949
C_3HS^+	$C_2H_5SC{\equiv}CCH{=}CH_2$		13.6±0.3	EI		2949

$C_3H_2S^+$

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_3H_2S^+$	C_6H_5SH (Mercaptobenzene)		17.0±0.3	EI		3286

$C_3H_3S^+$

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_3H_3S^+$	C_6H_5SH (Mercaptobenzene)		15.5±0.3	EI		3286
$C_3H_3S^+$	$C_6H_5SSC_6H_5$ (Diphenyl disulfide)		18.6±0.3	EI		3286

$C_3H_5S^+$

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_3H_5S^+$	C_3H_6S (Propylene sulfide)	H	11.2±0.3	EI		188
$C_3H_5S^+$	$CH_3SCH_2CH{=}CH_2$	CH_3	11.0±0.2	EI		186
$C_3H_5S^+$	$C_4H_8S_2$ (1,4–Dithiane)		10.7±0.1	EI		2969

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
	$C_3H_6S^+$ (Trimethylene sulfide)		**$\Delta H^\circ_{f298} = 896$ kJ mol^{-1} (214 kcal mol^{-1})**			
$C_3H_6S^+$	C_3H_6S (Propylene sulfide)		8.6±0.2	EI		188
$C_3H_6S^+$	$(CH_2)_3S$ (Trimethylene sulfide)		8.65	S	896	2677
(Average of two Rydberg series limits)						
See also – EI:	52, 218, 2499					
$C_3H_6S^+$	$C_4H_8S_2$ (1,4–Dithiane)		11.4±0.2	EI		2969
$C_3H_6S^+$	C_4H_8OS (1,4–Oxathiane)		11±0.1	EI		2969
		$C_3H_7S^+$				
$C_3H_7S^+$	n–$C_3H_7SCH_3$	CH_3	11.7±0.2	EI		176
$C_3H_7S^+$	*iso*–$C_3H_7SCH_3$	CH_3	11.7±0.2	EI		186
$C_3H_7S^+$	$(C_2H_5)_2S$	CH_3	10.65	EI		307
See also – EI:	84, 3286					
$C_3H_7S^+$	$(n$–$C_3H_7)_2S$		11.55	EI		307
	n–$C_3H_7SH^+$ **$C_2H_5SCH_3^+$**		**$\Delta H^\circ_{f298} = 819$ kJ mol^{-1} (196 kcal mol^{-1})** **$\Delta H^\circ_{f298} = 765$ kJ mol^{-1} (183 kcal mol^{-1})**			
$C_3H_8S^+$	n–C_3H_7SH		9.195±0.005	PI	819	182
$C_3H_8S^+$	$C_2H_5SCH_3$		8.55±0.01	PI	765	182
$C_3H_8S^+$	$C_2H_5SCH_3$		8.54±0.1	EI		2504
See also – EI:	176, 2587					
$C_3H_8S^+$	$(n$–$C_3H_7)_2S$		10.4	EI		307
		C_4HS^+				
C_4HS^+	$CH_3SCH{=}CHC{\equiv}CH$		20.7±0.3	EI		2949
C_4HS^+	$CH_3SC{\equiv}CCH{=}CH_2$		19.0±0.3	EI		2949
C_4HS^+	$C_2H_5SC{\equiv}CCH{=}CH_2$		21.2±0.3	EI		2949
		$C_4H_2S^+$				
$C_4H_2S^+$	$CH_3SCH{=}CHC{\equiv}CH$		16.8±0.3	EI		2949
$C_4H_2S^+$	$CH_3SC{\equiv}CCH{=}CH_2$		16.1±0.3	EI		2949
$C_4H_2S^+$	C_6H_5SH (Mercaptobenzene)		17.6±0.3	EI		2949
$C_4H_2S^+$	$C_2H_5SCH{=}CHC{\equiv}CH$		17.6±0.3	EI		2949
$C_4H_2S^+$	$C_2H_5SC{\equiv}CCH{=}CH_2$		17.4±0.3	EI		2949

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_4H_3S^+$						
$C_4H_3S^+$	$CH_3SCH{=}CHC{\equiv}CH$	CH_3	11.8±0.3	EI		2949
$C_4H_3S^+$	$CH_3SC{\equiv}CCH{=}CH_2$	CH_3	11.6±0.3	EI		2949
$C_4H_3S^+$	$C_2H_5SCH{=}CHC{\equiv}CH$		13.4±0.3	EI		2949
$C_4H_3S^+$	$C_2H_5SC{\equiv}CCH{=}CH_2$		13.2±0.3	EI		2949
$C_4H_3S^+$	$C_6H_5SSC_6H_5$ (Diphenyl disulfide)		19.0±0.3	EI		3286
$C_4H_4S^+$ (Thiophene)	**$\Delta H^\circ_{f298} \sim 972$ kJ mol^{-1} (232 kcal mol^{-1})**					
$C_4H_4S^+$	C_4H_4S (Thiophene)		8.95±0.02	S	979	3351
$C_4H_4S^+$	C_4H_4S (Thiophene)		8.860±0.005	PI	971	182
$C_4H_4S^+$	C_4H_4S (Thiophene)		8.872±0.01	PE	972	3381, 3422
$C_4H_4S^+$	C_4H_4S (Thiophene)		8.87±0.05	PE	972	2796
$C_4H_4S^+$	C_4H_4S (Thiophene)		8.80±0.05	PE	965	3246
See also – EI:	2166, 2865, 3233, 3240					
CTS:	2031, 3369					
$C_4H_4S^+$	C_6H_5SH (Mercaptobenzene)		13.2±0.3	EI		3286
$C_4H_4S^+$	C_6H_5SD (Mercapto-d_1-benzene)		11.8±0.2	EI		1039
$C_4H_4S^+$	$C_2H_5SCH{=}CHC{\equiv}CH$		10.8±0.3	EI		2949
$C_4H_4S^+$	$C_2H_5SC{\equiv}CCH{=}CH_2$		10.6±0.3	EI		2949
$C_4H_4S^+$	$C_4H_3SC_2H_5$ (2-Ethylthiophene)		11.5±0.2	EI		2166
$C_4H_4S^+$	$C_4H_3SC_3H_7$ (2-Propylthiophene)		11.1±0.2	EI		2166
$C_4H_4S^+$	$C_4H_3SC_4H_9$ (2-Butylthiophene)		11.0±0.2	EI		2166
$C_4H_4S^+$	$C_6H_5SSC_6H_5$ (Diphenyl disulfide)		14.1±0.3	EI		3286
$C_4H_3DS^+$						
$C_4H_3DS^+$	C_6H_5SD (Mercapto-d_1-benzene)		11.8	EI		1039
$C_4H_6S^+$						
$C_4H_6S^+$	C_4H_8OS (1,4-Oxathiane)	H_2O	9.9±0.1	EI		2969

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_4H_7S^+$				
$C_4H_7S^+$	$(CH_2)_4S$ (Tetramethylene sulfide)	H	12.4±0.3	EI		52
		$C_4H_8S^+$				
$C_4H_8S^+$	$CH_3SCH_2CH{=}CH_2$		8.70±0.2	EI		186
$C_4H_8S^+$	$(CH_2)_4S$ (Tetramethylene sulfide)		8.57±0.15	EI		52
See also – EI:	218					
	$n\text{-}C_4H_9SH^+$ **$(C_2H_5)_2S^+$**	**$\Delta H^\circ_{f298} = 794$ kJ mol^{-1} (190 kcal mol^{-1})** **$\Delta H^\circ_{f298} = 730$ kJ mol^{-1} (174 kcal mol^{-1})**				
$C_4H_{10}S^+$	$n\text{-}C_4H_9SH$		9.14±0.02	PI	794	182
$C_4H_{10}S^+$	$n\text{-}C_3H_7SCH_3$		8.8±0.15	EI		176
See also – EI:	2587					
$C_4H_{10}S^+$	$iso\text{-}C_3H_7SCH_3$		8.7±0.2	EI		186
$C_4H_{10}S^+$	$(C_2H_5)_2S$		8.430±0.005	PI	730	182
See also – EI:	84, 307, 2505, 3286					
		$C_4H_5D_5S^+$				
$C_4H_5D_5S^+$	$C_2H_5SC_2D_5$		8.55±0.1	EI		2504
		$C_5H_3S^+$				
$C_5H_3S^+$	C_6H_5SH (Mercaptobenzene)		15.1±0.3	EI		3286
		$C_5H_4S^+$				
$C_5H_4S^+$	$C_6H_5SSC_6H_5$ (Diphenyl disulfide)		15.5±0.3	EI		3286
		$C_5H_5S^+$				
$C_5H_5S^+$	$CH_3SCH{=}CHC{\equiv}CH$	H	11.0±0.3	EI		2949
$C_5H_5S^+$	$CH_3SC{\equiv}CCH{=}CH_2$	H	10.8±0.3	EI		2949
$C_5H_5S^+$	$C_2H_5SCH{=}CHC{\equiv}CH$	CH_3	10.0±0.3	EI		2949
$C_5H_5S^+$	$C_2H_5SC{\equiv}CCH{=}CH_2$	CH_3	10.8±0.3	EI		2949
$C_5H_5S^+$	$C_4H_3SC_2H_5$ (2–Ethylthiophene)	CH_3	11.4±0.2	EI		2166

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_5H_5S^+$	$C_4H_3SC_3H_7$ (2–Propylthiophene)	C_2H_5	11.4±0.2	EI		2166
$C_5H_5S^+$	$C_4H_3SC_4H_9$ (2–Butylthiophene)		11.3±0.2	EI		2166
$C_5H_5S^+$	$C_6H_5SSC_6H_5$ (Diphenyl disulfide)		17.2±0.3	EI		3286
$C_5H_5S^+$	$C_4H_3S(CH_2)_3COOCH_3$ (4–(2–Thienyl)butanoic acid methyl ester)		13.25±0.2	EI		2497
	$C_5H_6S^+$ (2–Methylthiophene) **$C_5H_6S^+$ (3–Methylthiophene)**	**$\Delta H^\circ_{f298} \sim 869$ kJ mol^{-1} (208 kcal mol^{-1})** **$\Delta H^\circ_{f298} \sim 893$ kJ mol^{-1} (214 kcal mol^{-1})**				
$C_5H_6S^+$	$C_4H_3SCH_3$ (2–Methylthiophene)		8.14	PE	869	3246
See also – EI: CTS:	3240 3369					
$C_5H_6S^+$	$C_4H_3SCH_3$ (3–Methylthiophene)		8.40	PE	893	3246
See also – CTS:	3369					
		$C_5H_9S^+$				
$C_5H_9S^+$	$(n\text{–}C_3H_7)_2S$		10.9	EI		307
		$C_5H_{11}S^+$				
$C_5H_{11}S^+$	$(n\text{–}C_3H_7)_2S$	CH_3	11.55	EI		307
		$C_5H_{12}S^+$				
$C_5H_{12}S^+$	$n\text{–}C_3H_7SC_2H_5$		8.50±0.05	RPD		2505
		$C_6H_4S^+$				
$C_6H_4S^+$	C_6H_5SH (Mercaptobenzene)		17.2±0.3	EI		3286
		$C_6H_5S^+$				
$C_6H_5S^+$	C_6H_5S (Phenylthio radical)		8.63±0.1	EI		120
$C_6H_5S^+$	C_6H_5SH (Mercaptobenzene)	H	14.7±0.3	EI		3286
$C_6H_5S^+$	C_6H_5SD (Mercapto–d_1–benzene)	D	12.2	EI		1039

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_6H_5S^+$	$C_6H_5SCH_3$ (Methylthiobenzene)		12.1±0.1	EI		120
See also – EI:	307					
$C_6H_5S^+$	$C_6H_5SC_2H_5$ (Ethylthiobenzene)		12.2	EI		307
$C_6H_5S^+$	$C_6H_5SSC_6H_5$ (Diphenyl disulfide)		14.4±0.3	EI		3286
	$C_6H_6S^+$ (Mercaptobenzene)	**$\Delta H^\circ_{f298} = 914$ kJ mol^{-1} (219 kcal mol^{-1})**				
$C_6H_6S^+$	C_6H_5SH (Mercaptobenzene)		8.32±0.01	PI	914	190
See also – PI: EI:	182 2865, 3286					
$C_6H_6S^+$	$C_6H_5SC_2H_5$ (Ethylthiobenzene)		10.77	EI		2706
See also – EI:	307					
$C_6H_6S^+$	$C_6H_5SC_3H_7$ (Propylthiobenzene)		10.46	EI		2706
$C_6H_6S^+$	$C_6H_5SC_4H_9$ (Butylthiobenzene)		10.33	EI		2706
$C_6H_6S^+$	$C_6H_5SSC_6H_5$ (Diphenyl disulfide)		11.6±0.3	EI		3286
$C_6H_6S^+$	$C_4H_3S(CH_2)_3COOCH_3$ (4–(2–Thienyl)butanoic acid methyl ester)		10.70±0.2	EI		2497
		$C_6H_5DS^+$				
$C_6H_5DS^+$	C_6H_5SD (Mercapto–d_1–benzene)		8.5±0.1	EI		1039
		$C_6H_7S^+$				
$C_6H_7S^+$	$C_2H_5SCH{=}CHC{\equiv}CH$	H	10.3±0.3	EI		2949
		$C_6H_8S^+$				
$C_6H_8S^+$	$C_4H_3SC_2H_5$ (2–Ethylthiophene)		8.8±0.2	EI		2166

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
	$(n\text{-}C_3H_7)_2S^+$	**$\Delta H^\circ_{f298} = 675$ kJ mol^{-1} (161 kcal mol^{-1})**				
$C_6H_{14}S^+$	$(n\text{-}C_3H_7)_2S$		8.30±0.02	PI	675	182
$C_6H_{14}S^+$	$(n\text{-}C_3H_7)_2S$		8.45±0.05	RPD		2505
See also - EI:	307					
$C_6H_{14}S^+$	$(iso\text{-}C_3H_7)_2S$		8.38±0.05	RPD		2505
		$C_7H_7S^+$				
$C_7H_7S^+$	$C_6H_5SC_2H_5$ (Ethylthiobenzene)		11.7	EI		307
		$C_7H_8S^+$				
$C_7H_8S^+$	$C_6H_5SCH_3$ (Methylthiobenzene)		8.9	EI		307
$C_7H_8S^+$	$C_6H_5SCH_3$ (Methylthiobenzene)		7.9±0.15	CTS		3373
		$C_7H_{10}S^+$				
$C_7H_{10}S^+$	$C_4H_3SC_3H_7$ (2–Propylthiophene)		8.6±0.2	EI		2166
		$C_7H_{16}S^+$				
$C_7H_{16}S^+$	$(CH_3)_2CHCH_2SCH_2CH_2CH_3$		8.40±0.05	RPD		2505
		$C_8H_6S^+$				
$C_8H_6S^+$	C_8H_6S (2,3–Benzothiophene)		8.17±0.05	PE		2796
		$C_8H_{10}S^+$				
$C_8H_{10}S^+$	$C_6H_5CH_2SCH_3$ (α–Methylthiotoluene)		8.64	EI		3338
$C_8H_{10}S^+$	$C_6H_5SC_2H_5$ (Ethylthiobenzene)		8.8	EI		307
		$C_8H_{12}S^+$				
$C_8H_{12}S^+$	$C_4H_3SC_4H_9$ (2–Butylthiophene)		8.5±0.2	EI		2166

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_8H_{18}S^+$				
$C_8H_{18}S^+$	$(n-C_4H_9)_2S$		8.40±0.05	RPD		2505
$C_8H_{18}S^+$	$(iso-C_4H_9)_2S$		8.36±0.05	RPD		2505
		$C_9H_{10}S^+$				
$C_9H_{10}S^+$	$C_9H_{10}S$ (Thiochroman)		8.02	EI		3338
$C_9H_{10}S^+$	$C_9H_{10}S$ (Isothiochroman)		8.70	EI		3338
		$C_{11}H_7S^+$				
$C_{11}H_7S^+$	$C_6H_5SSC_6H_5$ (Diphenyl disulfide)		13.8±0.3	EI		3286
		$C_{12}H_8S^+$				
$C_{12}H_8S^+$	$C_{12}H_8S$ (Dibenzothiophene)		8.14	CTS		2911
$C_{12}H_8S^+$	$C_6H_5SSC_6H_5$ (Diphenyl disulfide)		14.8±0.3	EI		3286
		$C_{12}H_9S^+$				
$C_{12}H_9S^+$	$C_6H_5SSC_6H_5$ (Diphenyl disulfide)		12.6±0.3	EI		3286
		$C_{12}H_{10}S^+$				
$C_{12}H_{10}S^+$	$(C_6H_5)_2S$? (Diphenyl sulfide?)		9.9±0.3	EI		3286
(Probably formed by thermal decomposition of diphenyl disulfide)						
		$CH_3S_2^+$				
$CH_3S_2^+$	CH_3SSCH_3	CH_3	11.45	EI		307
See also – EI:	176, 3202, 3286					
$CH_3S_2^+$	$C_2H_5SSC_2H_5$		13.8±0.3	EI		3286
See also – EI:	186					
$CH_3S_2^+$	CH_3SSSCH_3		12.3±0.2	EI		84
$CH_3S_2^+$	CH_3SSCF_3		11.29±0.20	EI		3202

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol⁻¹)	Ref.
		$CH_4S_2^+$				
$CH_4S_2^+$	CH_3SSSCH_3		10.8±0.2	EI		84
		$C_2H_4S_2^+$				
$C_2H_4S_2^+$	$C_4H_8S_2$ (1,4–Dithiane)		10.95±0.1	EI		2969
		$C_2H_5S_2^+$				
$C_2H_5S_2^+$	$C_2H_5SSC_2H_5$		11.5	EI		307
See also – EI:	3286					
		$C_2H_6S_2^+$				
$C_2H_6S_2^+$	CH_3SSCH_3		8.46±0.03?	PI		182
$C_2H_6S_2^+$	CH_3SSCH_3		8.71±0.03	PE		3034
See also – EI:	176, 307, 411, 2685, 3202, 3286					
$C_2H_6S_2^+$	$C_2H_5SSC_2H_5$		10.8±0.3	EI		186
See also – EI:	307, 3286					
		$C_3H_5S_2^+$				
$C_3H_5S_2^+$	$C_4H_8S_2$ (1,4–Dithiane)		10.2±0.1	EI		2969
		$C_4H_8S_2^+$				
$C_4H_8S_2^+$	$C_4H_8S_2$ (1,4–Dithiane)		8.75±0.1	EI		2969
$C_4H_8S_2^+$	$C_4H_8S_2$? (1,4–Dithiane?)		8.5	EI		218
		$C_4H_{10}S_2^+$				
$C_4H_{10}S_2^+$	$C_2H_5SSC_2H_5$		8.27±0.03?	PI		182
$C_4H_{10}S_2^+$	$C_2H_5SSC_2H_5$		8.30±0.15	EI		186
See also – EI:	307, 3286					

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_6H_4S_2^+$				
$C_6H_4S_2^+$	$C_6H_4S_2$ (Thiophthene)		9.15	EI		3284
		$C_8H_6S_2^+$				
$C_8H_6S_2^+$	$(C_4H_3S)_2$ (2,2′-Bithiophene)		7.83	CTS		3369
$C_8H_6S_2^+$	$(C_4H_3S)_2$ (2,3′-Bithiophene)		7.91	CTS		3369
$C_8H_6S_2^+$	$(C_4H_3S)_2$ (3,3′-Bithiophene)		7.99	CTS		3369
		$C_9H_6S_2^+$				
$C_9H_6S_2^+$	$C_9H_6S_2$ (4*H*–Cyclopenta[2,1–*b*:3,4–*b*′]dithiophene)		7.42	CTS		3369
$C_9H_6S_2^+$	$C_9H_6S_2$ (7*H*–Cyclopenta[1,2–*b*:3,4–*b*′]dithiophene)		7.51	CTS		3369
$C_9H_6S_2^+$	$C_9H_6S_2$ (7*H*–Cyclopenta[1,2–*b*:4,3–*b*′]dithiophene)		7.59	CTS		3369
		$C_9H_8S_2^+$				
$C_9H_8S_2^+$	$(C_4H_3S)_2CH_2$ (2,2′–Dithienylmethane)		9.05	CTS		3369
$C_9H_8S_2^+$	$(C_4H_3S)_2CH_2$ (2,3′–Dithienylmethane)		8.97	CTS		3369
$C_9H_8S_2^+$	$(C_4H_3S)_2CH_2$ (3,3′–Dithienylmethane)		8.84	CTS		3369
		$C_{12}H_8S_2^+$				
$C_{12}H_8S_2^+$	$C_{12}H_8S_2$ (Thianthrene)		7.80±0.03	RPD		2538
$C_{12}H_8S_2^+$	$C_{12}H_8S_2$ (Thianthrene)		7.9	CTS		3300
		$C_{12}H_{10}S_2^+$				
$C_{12}H_{10}S_2^+$	$C_6H_5SSC_6H_5$ (Diphenyl disulfide)		9.4±0.3	EI		3286
		$CH_3S_3^+$				
$CH_3S_3^+$	CH_3SSSCH_3	CH_3	11.4±0.2	EI		84

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_2H_6S_3^+$				
$C_2H_6S_3^+$	CH_3SSSCH_3		8.73±0.03	PE		3034
$C_2H_6S_3^+$	CH_3SSSCH_3		8.80±0.15	EI		84
		$C_7H_8S_3^+$				
$C_7H_8S_3^+$	$C_7H_8S_3$ (2,5–Dimethyl–6a–thiathiophthene)		7.47	EI		3284
		$C_{12}H_{10}S_3^+$				
$C_{12}H_{10}S_3^+$	$C_{12}H_{10}S_3$ (2–Methyl–5–phenyl–6a–thiathiophthene)		7.43	EI		3284
		$C_{17}H_{12}S_3^+$				
$C_{17}H_{12}S_3^+$	$C_{17}H_{12}S_3$ (2,5–Diphenyl–6a–thiathiophthene)		7.39	EI		3284
		$C_{12}H_{10}S_4^+$				
$C_{12}H_{10}S_4^+$	$C_{12}H_{10}S_4$ (2–Methylthio–5–phenyl–6a–thiathiophthene)		7.24	EI		3284
		CNS^+				
CNS^+	CH_3NCS		14.9±0.5	EI		315
CNS^+	C_2H_5NCS		14.6±0.4	EI		315
		C_2NS^+				
C_2NS^+	CH_3NCS		14.1±0.3	EI		315
C_2NS^+	C_2H_5NCS		16.3±0.2	EI		315
		HSO^+				
HSO^+	$(CH_3)_2SO$		11.1±0.3	EI		3294
		H_2SO^+				
H_2SO^+	$(CH_3)_2SO$		10.9±0.3	EI		3294
		H_3SO^+				
H_3SO^+	$(CH_3)_2SO$		10.9±0.5	EI		3294

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
	$COS^+(X^2\Pi_{3/2})$	ΔH°_{f0} = 937 kJ mol^{-1} (224 kcal mol^{-1})				
	$COS^+(X^2\Pi_{1/2})$	ΔH°_{f0} = 941 kJ mol^{-1} (225 kcal mol^{-1})				
	$COS^+(A^2\Pi)$	ΔH°_{f0} = 1313 kJ mol^{-1} (314 kcal mol^{-1})				
	$COS^+(B^2\Sigma^+)$	ΔH°_{f0} = 1406 kJ mol^{-1} (336 kcal mol^{-1})				
	$COS^+(C^2\Sigma^+)$	ΔH°_{f0} = 1590 kJ mol^{-1} (380 kcal mol^{-1})				
$COS^+(X^2\Pi_{3/2})$	COS		11.184±0.01	S	937	2680
$COS^+(X^2\Pi_{1/2})$	COS		11.230±0.01	S	941	2680
See also – S: 149						
$COS^+(B^2\Sigma^+)$	COS		16.041	S	1406	149
(Average of four Rydberg series limits)						
$COS^+(C^2\Sigma^+)$	COS		17.938	S	1589	149
$COS^+(X^2\Pi_{3/2})$	COS		11.189±0.005	PE	937	2901
$COS^+(X^2\Pi_{1/2})$	COS		11.233±0.005	PE	942	2901
$COS^+(A^2\Pi)$	COS		15.080±0.005	PE	1313	2901
$COS^+(B^2\Sigma^+)$	COS		16.042±0.005	PE	1406	2901
$COS^+(C^2\Sigma^+)$	COS		17.960±0.005	PE	1591	2901
A band reported in ref. 92 at 19.9 eV is due to a light source impurity, see ref. 2901.						
$COS^+(X^2\Pi_{3/2})$	COS		11.175±0.01	PI		2680
$COS^+(X^2\Pi_{3/2})$	COS		11.18±0.01	PI		2624, 2627
$COS^+(X^2\Pi_{1/2})$	COS		11.215±0.01	PI		2680
$COS^+(X^2\Pi_{1/2})$	COS		11.22	PI		2624, 2627
See also – S: 409, 410 PI: 182, 190 PE: 92, 2839, 2856, 2875 PEN: 2430, 2467						
		CFS^+				
CFS^+	CH_3SCF_3		15.32±0.13	EI		3202
		CF_2S^+				
CF_2S^+	CF_3SSCF_3		10.93±0.17	EI		3202
		CF_3S^+				
CF_3S^+	CF_3SSCF_3		14.43±0.08	EI		3202
		$C_2F_5S^+$				
$C_2F_5S^+$	$(CF_3)_2S$	F	~15	EI		3202

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_2F_6S^+$				
$C_2F_6S^+$	$(CF_3)_2S$		11.11±0.03	PE		3034
$C_2F_6S^+$	$(CF_3)_2S$		11.28±0.04	EI		3202
		CFS_2^+				
CFS_2^+	CF_3SSCF_3		15.60±0.10	EI		3202
		$CF_2S_2^+$				
$CF_2S_2^+$	CF_3SSCF_3	CF_4	11.28±0.06	EI		3202
		$CF_3S_2^+$				
$CF_3S_2^+$	CF_3SSCF_3	CF_3	13.31±0.05	EI		3202
$CF_3S_2^+$	CH_3SSCF_3	CH_3	14.77±0.12	EI		3202
		$C_2F_5S_2^+$				
$C_2F_5S_2^+$	CF_3SSCF_3	F	14.64±0.07	EI		3202
		$C_2F_6S_2^+$				
$C_2F_6S_2^+$	CF_3SSCF_3		10.60±0.03	PE		3034
$C_2F_6S_2^+$	CF_3SSCF_3		10.68±0.19	EI		3202
		$C_2F_6S_3^+$				
$C_2F_6S_3^+$	CF_3SSSCF_3		10.16±0.03	PE		3034
		$C_2F_6S_4^+$				
$C_2F_6S_4^+$	$CF_3SSSSCF_3$		9.75±0.03	PE		3034
		NSF^+				
NSF^+	NSF		11.36±0.03	RPD		2443
NSF^+	NSF_3		16.82±0.05	RPD		2443
		NSF_2^+				
NSF_2^+	NSF_3	F	15.47±0.04	RPD		2443
NSF_2^+	CF_3NSF_2	CF_3	13.90±0.08	RPD		2443

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		NSF_3^+				
NSF_3^+	NSF_3		12.46±0.03	RPD		2443
		SOF^+				
SOF^+	SO_2F_2		18.6±0.1	EI		418
		SO_2F^+				
SO_2F^+	SO_2F_2	F	15.1±0.2	EI		418
SO_2F^+	FSO_2NF_2		13.1±0.1	EI		1144
SO_2F^+	FSO_2ONF_2		13.3±0.2	EI		1144
SO_2F^+	$(FSO_2)_2NF$		13.5±0.1	EI		1144
		$SO_2F_2^+$				
$SO_2F_2^+$	SO_2F_2		13.3±0.1	EI		418
		PSF_2^+				
PSF_2^+	PSF_3	F	16.0±0.2	EI		2506
		PSF_3^+				
PSF_3^+	PSF_3		11.1±0.3	EI		2506
		$C_3H_9BS_3^+$				
$C_3H_9BS_3^+$	$(CH_3S)_3B$		9.24	EI		3227
	$HNCS^+$	**$\Delta H^\circ_{f298} \sim 1097$ kJ mol^{-1} (262 kcal mol^{-1})**				
$CHNS^+$	HNCS		10.05±0.1	PE	1097	3067
$CHNS^+$	C_2H_5NCS	C_2H_4	11.38±0.15	EI		193, 315
		CH_2NS^+				
CH_2NS^+	C_2H_5NCS		12.0±0.3	EI		315
		C_2HNS^+				
C_2HNS^+	C_2H_5NCS		14.0±0.2	EI		315

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		C_2HNS^{+2}				
C_2HNS^{+2}	CH_3NCS		28.0±0.5	EI		315
		$C_2H_2NS^+$				
$C_2H_2NS^+$	CH_3SCN	H	12.6±0.1	RPD		3017
$C_2H_2NS^+$	CH_3NCS	H	11.9±0.2	EI		315
$C_2H_2NS^+$	C_2H_5NCS	CH_3	12.5±0.2	EI		315
	CH_3SCN^+	**$\Delta H^\circ_{f298} = 1131$ kJ mol^{-1} (270 kcal mol^{-1})**				
	CH_3NCS^+	**$\Delta H^\circ_{f298} = 1023$ kJ mol^{-1} (245 kcal mol^{-1})**				
$C_2H_3NS^+$	CH_3SCN		10.065±0.01	PI	1131	182
$C_2H_3NS^+$	CH_3NCS		9.25±0.03	PI	1023	182
$C_2H_3NS^+$	CH_3NCS		9.13±0.15	EI		315
		$C_3H_5NS^+$				
$C_3H_5NS^+$	C_2H_5SCN		9.89±0.01	PI		182
$C_3H_5NS^+$	C_2H_5NCS		9.14±0.03	PI		182
$C_3H_5NS^+$	C_2H_5NCS		9.10±0.15	EI		193, 315
		$C_4H_{10}NS^+$				
$C_4H_{10}NS^+$	$CH_3SCH_2CH_2CH(NH_2)COOH$		9.68±0.15	EI		2587
See also – EI:	88					
		$C_7H_5NS^+$				
$C_7H_5NS^+$	C_6H_5NCS (Isothiocyanic acid phenyl ester)		8.520±0.005	PI		182
$C_7H_5NS^+$	C_7H_5NS (Benzothiazole)		8.72±0.05	PE		2796
$C_7H_5NS^+$	C_7H_5NS (Benzothiazole)		8.65	CTS		1211
		$C_8H_7NS^+$				
$C_8H_7NS^+$	$C_6H_5CH_2SCN$ (Thiocyanic acid benzyl ester)		9.06±0.05	EI		2025

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_{12}H_9NS^+$				
$C_{12}H_9NS^+$	$C_{12}H_9NS$ (Phenothiazine)		7.625	S		2661
$C_{12}H_9NS^+$	$C_{12}H_9NS$ (Phenothiazine)		7.7	PI		2661
$C_{12}H_9NS^+$	$C_{12}H_9NS$ (Phenothiazine)		6.96±0.19	CTS		2987
See also – CTS:	2562, 2909					
		$C_{18}H_{19}NS^+$				
$C_{18}H_{19}NS^+$	$C_{18}H_{19}NS$ (Chlorprothixene)		7.68±0.03	CTS		2987
		$CH_4N_2S^+$				
$CH_4N_2S^+$	$(NH_2)_2CS$		8.50±0.05	EI		1390, 2515, 2867
		$C_2H_6N_2S^+$				
$C_2H_6N_2S^+$	$CH_3NHCSNH_2$		8.29±0.05	EI		1390, 2515, 2867
		$C_3H_6N_2S^+$				
$C_3H_6N_2S^+$	$CH_2{=}CHNHCSNH_2$		8.29±0.05	EI		1390
		$C_3H_8N_2S^+$				
$C_3H_8N_2S^+$	$(CH_3)_2NCSNH_2$		8.34±0.05	EI		1390, 2515, 2867
$C_3H_8N_2S^+$	$(CH_3NH)_2CS$		8.17±0.05	EI		1390, 2515, 2867
		$C_4H_{10}N_2S^+$				
$C_4H_{10}N_2S^+$	$(CH_3)_2NCSNHCH_3$		7.93±0.05	EI		1390, 2515, 2867

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_5H_{12}N_2S^+$				
$C_5H_{12}N_2S^+$	$C_5H_{12}N_2S$ (Diethyl–2–thiourea)		7.98±0.05	EI		1390
$C_5H_{12}N_2S^+$	$((CH_3)_2N)_2CS$		7.95±0.05	EI		1390, 2515, 2867
		$C_{17}H_{20}N_2S^+$				
$C_{17}H_{20}N_2S^+$	$C_{17}H_{20}N_2S$ (Promazine)		7.23±0.12	CTS		2987
$C_{17}H_{20}N_2S^+$	$C_{17}H_{20}N_2S$ (Promethazine)		7.25±0.10	CTS		2987
		$C_{18}H_{20}N_2S^+$				
$C_{18}H_{20}N_2S^+$	$C_{18}H_{20}N_2S$ (Methdilazine)		7.25±0.10	CTS		2987
		$C_{18}H_{22}N_2S^+$				
$C_{18}H_{22}N_2S^+$	$C_{18}H_{22}N_2S$ (Trimeprazine)		7.28±0.03	CTS		2987
		$C_{21}H_{26}N_2S_2^+$				
$C_{21}H_{26}N_2S_2^+$	$C_{21}H_{26}N_2S_2$ (Thioridazine)		7.20±0.05	CTS		2987
		CH_2OS^+				
CH_2OS^+	$(CH_3)_2SO$	CH_4	11.8±0.1	EI		3294
		CH_3OS^+				
CH_3OS^+	$(CH_3)_2SO$	CH_3	11.9±0.1	EI		3294

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
CH_3COSH^+ ΔH°_{f298} = 783 kJ mol^{-1} (187 kcal mol^{-1})						
$C_2H_4OS^+$	CH_3COSH		10.00±0.02	PI	783	182
$C_2H_4OS^+$	$(CH_3)_2SO$	H_2	10.9±0.5	EI		3294
$C_2H_4OS^+$	C_4H_8OS (1,4–Oxathiane)	C_2H_4	10.2±0.2	EI		2969
$C_2H_5OS^+$						
$C_2H_5OS^+$	$(CH_3)_2SO$	H	12.6±0.1	EI		3294
$C_2H_6OS^+$						
$C_2H_6OS^+$	$(CH_3)_2SO$		9.9±0.1	EI		3294
$C_4H_8OS^+$						
$C_4H_8OS^+$	C_4H_8OS (1,4–Oxathiane)		8.8±0.05	EI		2969
$C_5H_6OS^+$						
$C_5H_6OS^+$	$C_4H_3SOCH_3$ (2–Methoxythiophene)		8.30	EI		3240
$C_8H_9OS^+$						
$C_8H_9OS^+$	$C_4H_3S(CH_2)_3COOCH_3$ (4–(2–Thienyl)butanoic acid methyl ester)	CH_3O	11.05±0.3	EI		2496
See also – EI: 2497						
$C_{12}H_8OS^+$						
$C_{12}H_8OS^+$	$C_{12}H_8OS$ (Phenoxathiin)		7.98±0.03	RPD		2538
$C_{12}H_8OS^+$	$C_{12}H_8OS$ (Phenoxathiin)		7.6	CTS		3300
$C_{12}H_8OS^+$	$C_{12}H_8OS$ (Phenoxathiin)		7.85	CTS		3401
$C_{13}H_{10}OS^+$						
$C_{13}H_{10}OS^+$	$C_{13}H_{10}OS$ (2–Methylphenoxathiin)		7.78	CTS		3401

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_9H_{12}O_2S^+$				
$C_9H_{12}O_2S^+$	$C_4H_3S(CH_2)_3COOCH_3$ (4–(2–Thienyl)butanoic acid methyl ester)		8.43±0.3	EI		2496
See also – EI: 2497						
		$C_4H_{10}O_3S^+$				
$C_4H_{10}O_3S^+$	$(C_2H_5O)_2SO$		9.68?	PI		182
		$C_{19}H_{18}O_3S^+$				
$C_{19}H_{18}O_3S^+$	$C_6H_4(CH_3)SO_3CH_2CH_2C_{10}H_7$ (4–Toluenesulfonic acid 4–azulylethyl ester)		7.3	EI		3333
		$C_4H_3FS^+$				
$C_4H_3FS^{+*}$ (F lone pair IP)	C_4H_3SF (2–Fluorothiophene)		13.8 (V)	D		3246
		$C_2H_3F_2S^+$				
$C_2H_3F_2S^+$	CH_3SCF_3	F	15.7±0.24	EI		3202
		CHF_3S^+				
CHF_3S^+	CF_3SH		11.35±0.1	EI		3034
		$C_2H_3F_3S^+$				
$C_2H_3F_3S^+$	CH_3SCF_3		9.88±0.03	PE		3034
$C_2H_3F_3S^+$	CH_3SCF_3		9.75±0.11	EI		3202
		$C_2H_3F_2S_2^+$				
$C_2H_3F_2S_2^+$	CH_3SSCF_3	F	~15	EI		3202
		$C_2H_3F_3S_2^+$				
$C_2H_3F_3S_2^+$	CH_3SSCF_3		9.60±0.03	PE		3034
$C_2H_3F_3S_2^+$	CH_3SSCF_3		9.58±0.14	EI		3202
		SiH_2FS^+				
SiH_2FS^+	SiF_2H_2S	F	12.3±0.3	EI		2896

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$SiHF_2S^+$				
$SiHF_2S^+$	SiF_2H_2S	H	11.9±0.3	EI		2896
		$SiH_2F_2S^+$				
$SiH_2F_2S^+$	SiF_2H_2S		10.7±0.3	EI		2896
		$Si_2H_2F_3S^+$				
$Si_2H_2F_3S^+$	$Si_2F_4H_2S$	F	11.3±0.3	EI		2896
		$Si_2H_2F_4S^+$				
$Si_2H_2F_4S^+$	$Si_2F_4H_2S$		10.6±0.3	EI		2896
		$SiH_2F_2S_2^+$				
$SiH_2F_2S_2^+$	$SiF_2H_2S_2$		10.7±0.3	EI		2896
		$C_4H_3NO_2S^+$				
$C_4H_3NO_2S^+$	$C_4H_3SNO_2$ (2–Nitrothiophene)		9.77	EI		3240
		$C_5H_{11}NO_2S^+$				
$C_5H_{11}NO_2S^+$	$CH_3SCH_2CH_2CH(NH_2)COOH$		8.63±0.10	EI		2587
		$CH_3BF_2S^+$				
$CH_3BF_2S^+$	CH_3SBF_2		10.59	EI		3227
		$C_2H_6BFS_2^+$				
$C_2H_6BFS_2^+$	$(CH_3S)_2BF$		9.79	EI		3227
		$C_{21}H_{24}N_3F_3S^+$				
$C_{21}H_{24}N_3F_3S^+$	$C_{21}H_{24}N_3F_3S$ (Stelazine)		7.43±0.37	CTS		2987

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_{12}H_7OFS^+$				
$C_{12}H_7OFS^+$	$C_{12}H_7OSF$ (2–Fluorophenoxathiin)		8.00	CTS		3401
	Cl^+	**$\Delta H^\circ_{f0} = 1371.1$ kJ mol^{-1} (327.7 kcal mol^{-1})**				
Cl^+	Cl		12.967	S	1371.1	2113, 3114
See also – S: EI:	2656, 3089, 3118 196, 440, 3178					
Cl^+	Cl_2	Cl^-	11.86±0.04	RPD	(1373)	288, 292
Cl^+	HCl	H	17.34±0.01	PI		2637
Estimating a 0 K threshold of 17.37 eV one obtains $\Delta H^\circ_{f0}(Cl^+) \approx 1368$ kJ mol^{-1}.						
See also – EI:	440					
Cl^+	CCl_4	CCl_3	16.10±0.2	RPD		196
Cl^+	ClF	F^-	12.04	PI	(1358)	3037
Cl^+	ClF	F	15.50±0.04	PI	(1364)	3037
(Threshold value approximately corrected to 0 K)						
Cl^+	$MgCl_2$		19±1.0	EI		178
Cl^+	PCl_3		19.8±0.4	EI		1101
See also – EI:	192, 2506					
Cl^+	CH_3Cl	CH_3	16.6±0.05	RPD		2154
Cl^+	C_2H_5Cl		23.4±0.3	EI		356
Cl^+	$CH_3C{\equiv}CCl$		18.4±0.5	EI		13
Cl^+	$CHCl_3$		22.0±0.3	EI		43
Cl^+	ClCN	CN^-	13.6±0.1	EI		73
Cl^+	ClCN	CN	17.32±0.02	PI		2621
See also – EI:	73					
Cl^+	CF_3Cl		21±1	EI		24
Cl^+	ClO_3F		23.0±0.2	EI		53
Cl^+	$POCl_3$		19±1	EI		1101
Cl^+	SF_5Cl		20.8±0.3	EI		2777
Cl^+	CHF_2Cl		20.5±0.3	EI		43
Cl^+	$CHFCl_2$		23.0±0.3	EI		43
Cl^+	$ZnCl_2$		19.6±0.3	EI		2506
Cl^+	$GeCl_2$		15.5±0.5	EI		2568
Cl^+	$GeCl_4$		21±1	EI		2568
Cl^+	$HgCl_2$		17.7±0.3	EI		2506
Cl^+	TlCl	Tl	16.9±0.1	RPD		2159

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
	$Cl_2^+(^2\Pi_{3/2g})$	**ΔH_{f0}° = 1109 kJ mol^{-1} (265 kcal mol^{-1})**				
	$Cl_2^+(^2\Pi_{1/2g})$	**ΔH_{f0}° = 1117 kJ mol^{-1} (267 kcal mol^{-1})**				
	$Cl_2^+(^2\Pi_u)$	**ΔH_{f0}° = 1347 kJ mol^{-1} (322 kcal mol^{-1})**				
	$Cl_2^+(^2\Sigma_g^+)$	**ΔH_{f0}° = 1517 kJ mol^{-1} (363 kcal mol^{-1})**				
$Cl_2^+(^2\Pi_{3/2g})$	Cl_2		11.48±0.01	PI	1108	182, 416
$Cl_2^+(^2\Pi_{3/2g})$	Cl_2		11.48±0.01	PI	1108	3413
(Threshold value corrected for hot bands)						
$Cl_2^+(^2\Pi_{3/2g})$	Cl_2		11.51±0.01	PE	1111	3409
$Cl_2^+(^2\Pi_{3/2g})$	Cl_2		11.49	PE	1109	3275
$Cl_2^+(^2\Pi_{1/2g})$	Cl_2		11.59±0.01	PE	1118	3409
$Cl_2^+(^2\Pi_{1/2g})$	Cl_2		11.57	PE	1116	3275
$Cl_2^+(^2\Pi_u)$	Cl_2		13.96±0.02	PE	1347	3409
$Cl_2^+(^2\Pi_u)$	Cl_2		14.0	PE		3275
$Cl_2^+(^2\Sigma_g^+)$	Cl_2		15.72±0.02	PE	1517	3409
$Cl_2^+(^2\Sigma_g^+)$	Cl_2		15.8	PE		3275
See also – PE:	2815, 3277					
EI:	75, 292, 440					
		Cl_2^{+2}				
Cl_2^{+2}	Cl_2		32.6	EI		75
	$HCl^+(^2\Pi_{3/2})$	**ΔH_{f0}° = 1137 kJ mol^{-1} (272 kcal mol^{-1})**				
	$HCl^+(^2\Pi_{1/2})$	**ΔH_{f0}° = 1145 kJ mol^{-1} (274 kcal mol^{-1})**				
	$HCl^+(^2\Sigma^+)$	**ΔH_{f0}° = 1475 kJ mol^{-1} (353 kcal mol^{-1})**				
$HCl^+(^2\Pi_{3/2})$	HCl		12.74±0.01	PI	1137	182, 416
$HCl^+(^2\Pi_{3/2})$	HCl		12.742±0.010	PI	1137	1253
$HCl^+(^2\Pi_{3/2})$	HCl		12.748±0.005	PE	1138	2892
$HCl^+(^2\Pi_{3/2})$	HCl		12.74±0.01	PE	1137	2819
$HCl^+(^2\Pi_{1/2})$	HCl		12.828±0.005	PE	1146	2892
$HCl^+(^2\Pi_{1/2})$	HCl		12.82±0.01	PE	1145	2819
$HCl^+(^2\Sigma^+)$	HCl		16.254±0.005	PE	1476	2892
$HCl^+(^2\Sigma^+)$	HCl		16.23	PE	1474	2819
See also – PI:	2637					
PE:	2815					
EI:	39, 2991					
		DCl^+				
$DCl^+(^2\Pi_{3/2})$	DCl		12.756±0.005	PE		2892
$DCl^+(^2\Pi_{1/2})$	DCl		12.835±0.005	PE		2892
$DCl^+(^2\Sigma^+)$	DCl		16.271±0.005	PE		2892

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
HCl^{+2}						
HCl^{+2}	HCl		35.5±0.5	NRE		212
$LiCl^{+}$						
$LiCl^{+}$	LiCl		10.1	EI		2179
Li_2Cl^{+}						
Li_2Cl^{+}	Li_2Cl_2	Cl	10.6	EI		2179
$BeCl^{+}$						
$BeCl^{+}$	BeCl		9.5±0.5	EI		2715
$BeCl^{+}$	$BeCl_2$	Cl	14.3±0.5	EI		2715
$BeCl_2^{+}$						
$BeCl_2^{+}$	$BeCl_2$		12.4±0.4	EI		2715
$Be_2Cl_3^{+}$						
$Be_2Cl_3^{+}$	Be_2Cl_4	Cl	13.8±0.6	EI		2715
$Be_2Cl_4^{+}$						
$Be_2Cl_4^{+}$	Be_2Cl_4		12.8±0.4	EI		2715
BCl^{+} **$\Delta H_{f0}^{\circ} \sim 1130$ kJ mol^{-1} (270 kcal mol^{-1})**						
BCl^{+}	BCl_3	2Cl?	18.37±0.02	PI	1130	2628
See also – EI:	206, 440					
BCl^{+}	B_2Cl_4	BCl_3	13.71±0.04	PI	(1236)	2628
This process apparently includes excess energy.						
BCl_2^{+} **$\Delta H_{f0}^{\circ} = 664$ kJ mol^{-1} (159 kcal mol^{-1})**						
BCl_2^{+}	BCl_3	Cl	12.30±0.02	PI	664	2628
See also – EI:	206, 440					
BCl_2^{+}	B_2Cl_4	BCl_2	11.32±0.02	PI		2628

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		BCl_2^{+2}				
BCl_2^{+2}	BCl_3	Cl	33.77±0.07	EI		440
	$B_2Cl_2^+$	**$\Delta H^\circ_{f0} \sim 934$ kJ mol^{-1} (223 kcal mol^{-1})**				
$B_2Cl_2^+$	B_2Cl_4	2Cl?	17.24±0.03	PI	934	2628
	$BCl_3^+(^2A_2')$	**$\Delta H^\circ_{f0} \sim 718$ kJ mol^{-1} (172 kcal mol^{-1})**				
$BCl_3^+(^2A_2')$	BCl_3		11.60±0.02	PI	716	2628
$BCl_3^+(^2A_2')$	BCl_3		11.64±0.02	PE	720	3375
$BCl_3^+(^2E'')$	BCl_3		12.19±0.04	PE		3375
$BCl_3^+(^2E')$	BCl_3		12.66±0.01 (V)	PE		3375
$BCl_3^+(^2A_2'')$	BCl_3		14.22±0.02	PE		3375
$BCl_3^+(^2E')$	BCl_3		15.32±0.02	PE		3375
$BCl_3^+(^2E')$	BCl_3		15.72±0.04 (V)	PE		3375
$BCl_3^+(^2A_1')$	BCl_3		17.74±0.05	PE		3375

There is disagreement on some of the assignments, see refs. 2834, 3119.
Additional fine structure is resolved in ref. 3119.

See also – PE: 2834, 3119
EI: 206, 440, 2512, 2513, 3227

	$B_2Cl_3^+$	**$\Delta H^\circ_{f0} = 502$ kJ mol^{-1} (120 kcal mol^{-1})**				
$B_2Cl_3^+$	B_2Cl_4	Cl	11.52±0.02	PI	502	2628
	$B_2Cl_4^+$	**$\Delta H^\circ_{f0} = 506$ kJ mol^{-1} (121 kcal mol^{-1})**				
$B_2Cl_4^+$	B_2Cl_4		10.32±0.02	PI	506	2628

See also – PE: 3417

		CCl^+				
CCl^+	CCl		12.9±0.10	EI		129
CCl^+	CCl_2	Cl	16.3±0.2	EI		319
CCl^+	$CCl{\equiv}CCl$	CCl	15.4±0.1	EDD		3177
CCl^+	CCl_4	Cl_2+Cl?	19.35±0.05	EI		129
CCl^+	CCl_4	Cl_2+Cl?	19.4±0.1	EI		319
CCl^+	$CH{\equiv}CCl$	CH	17.2±0.1	EDD		3177
CCl^+	$CHCl_3$		16.3±0.2	EI		43
CCl^+	ClCN	N	17.2±0.2	EI		73
CCl^+	$CHFCl_2$		18.3±0.2	EI		43
CCl^+	$CCl{\equiv}CBr$	CBr	16.4±0.1	EDD		3177
CCl^+	$CCl{\equiv}CI$	CI	17.5±0.1	EDD		3177

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		CCl_2^+				
CCl_2^+	CCl_2		9.76	EI		2578
See also – EI:	129, 319					
CCl_2^+	CCl_4		15.4	EI		2578
See also – EI:	129, 319					
CCl_2^+	C_2Cl_4		14.7	EI		2578
CCl_2^+	$CHCl_3$		12.2	EI		2578
		$C_2Cl_2^+$				
$C_2Cl_2^+(^2\Pi_{3/2u})$	$CCl{\equiv}CCl$		10.09 (V)	PE		3121
$C_2Cl_2^+(^2\Pi_{3/2u})$	$CCl{\equiv}CCl$		10.3±0.1	EDD		3177
$C_2Cl_2^+(^2\Pi_{3/2g})$	$CCl{\equiv}CCl$		13.44 (V)	PE		3121
$C_2Cl_2^+(^2\Pi_{3/2u})$	$CCl{\equiv}CCl$		14.45 (V)	PE		3121
$C_2Cl_2^+(^2\Sigma_g^+)$	$CCl{\equiv}CCl$		16.76 (V)	PE		3121
$C_2Cl_2^+(^2\Sigma_u^+)$	$CCl{\equiv}CCl$		17.81 (V)	PE		3121
		$C_2Cl_2^{+2}$				
$C_2Cl_2^{+2}$	$CCl{\equiv}CCl$		27.6±0.1	EDD		3177
		CCl_3^+				
CCl_3^+	CCl_3		8.78±0.05	EI		441
CCl_3^+	CCl_4	Cl	11.65±0.10	RPD		196
CCl_3^+	CCl_4	Cl	11.67±0.1	EI		441
CCl_3^+	CCl_4	Cl	11.90±0.07	EI		129
CCl_3^+	$CHCl_3$	H	11.70±0.09?	RPD		1139
CCl_3^+	C_2HCl_5	$CHCl_2$	11.54±0.1	EI		72
CCl_3^+	$CFCl_3$	F	12.77±0.15	RPD		185
CCl_3^+	CCl_3COCHN_2		11.0	EI		2174
CCl_3^+	CCl_3Br	Br	10.90±0.1	EI		441
		CCl_4^+ $\Delta H^\circ_{f0} = 1006$ kJ mol^{-1} (240 kcal mol^{-1})				
CCl_4^+	CCl_4		11.47±0.01	PI	1006	182, 416
CCl_4^+	CCl_4		11.47±0.08	PE	1006	3362
CCl_4^+	CCl_4		11.47	PE	1006	2843

Orbital assignments are discussed in R. N. Dixon, J. N. Murrell and B. Narayan, Mol. Phys. **20**, 611 (1971).

See also – PE: 3117, 3119
PEN: 2430

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
	$C_2Cl_4^+$	**ΔH°_{f0} = 889 kJ mol^{-1} (212 kcal mol^{-1})**				
$C_2Cl_4^+$	C_2Cl_4		9.32±0.01	PI	888	182
$C_2Cl_4^+$	C_2Cl_4		9.32	PI	888	168
$C_2Cl_4^+$	C_2Cl_4		9.34	PE	890	2885
		NCl_3^+				
NCl_3^+	NCl_3		10.7 (V)	PE		3119
		ClO^+				
ClO^+	ClO		11.1±0.1	EI		2451, 2488
ClO^+	ClO_2	O	13.5±0.1	EI		2488
ClO^+	Cl_2O	Cl	12.5±0.1	EI		2451
ClO^+	ClO_3F		18.0±0.5	EI		53
		ClO_2^+				
ClO_2^+	ClO_2		10.7±0.1	EI		2451, 2488
ClO_2^+	ClO_3F		15.7±0.5	EI		53
		ClO_3^+				
ClO_3^+	Cl_2O_7		13.00±0.05	EI		2451
ClO_3^+	ClO_3F	F	14.3±0.2	EI		53
	Cl_2O^+	**ΔH°_{f0} = 1138 kJ mol^{-1} (272 kcal mol^{-1})**				
Cl_2O^+	Cl_2O		10.94	PE	1138	3404
Cl_2O^+	Cl_2O		11.16±0.1	EI		2451
	ClF^+	**ΔH°_{f0} = 1166 kJ mol^{-1} (279 kcal mol^{-1})**				
ClF^+	ClF		12.65±0.01	PI	1166	3037
(Threshold value corrected for hot bands)						
ClF^+	ClF		12.7±0.3	EI		357
		ClF_2^+				
ClF_2^+	ClF_3	F	12.8±0.3	EI		357
		ClF_3^+				
ClF_3^+	ClF_3		13.0±0.2	EI		357

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
	$NaCl^+$	**$\Delta H^\circ_{f0} \sim 681$ kJ mol^{-1} (163 kcal mol^{-1})**				
$NaCl^+$	$NaCl$		8.92±0.06	PI	681	2610
		$MgCl^+$				
$MgCl^+$	$MgCl$		7.49±0.10	EI		2991
$MgCl^+$	$MgCl$		7.5±0.5	EI		2990
$MgCl^+$	$MgCl_2$	Cl	12.38±0.10	EI		2991
$MgCl^+$	$MgCl_2$	Cl	12.4±0.2	EI		2990
$MgCl^+$	$MgCl_2$	Cl	11.5±0.5	EI		178
		$MgCl_2^+$				
$MgCl_2^+$	$MgCl_2$		11.58±0.10	EI		2991
$MgCl_2^+$	$MgCl_2$		11.5±0.2	EI		2990
$MgCl_2^+$	$MgCl_2$		11.1±0.2	EI		178
		$Mg_2Cl_3^+$				
$Mg_2Cl_3^+$	Mg_2Cl_4	Cl	11.2±0.3	EI		178
		$AlCl^+$				
$AlCl^+$	$AlCl$		9.4±0.4	EI		2715
$AlCl^+$	$AlCl$		9.5±0.3	EI		2990
$AlCl^+$	$AlCl_3$		19.7±0.5	EI		2897
		$AlCl_2^+$				
$AlCl_2^+$	$AlCl_3$	Cl	13.4±0.5	EI		2897
		$AlCl_3^+$				
$AlCl_3^+$	$AlCl_3$		12.8±0.5	EI		2897
		$Al_2Cl_5^+$				
$Al_2Cl_5^+$	Al_2Cl_6	Cl	13.1±0.5	EI		2897
		$SiCl_3^+$				
$SiCl_3^+$	$SiCl_4$	Cl	12.48±0.02	EI		2182
$SiCl_3^+$	Si_2Cl_6	$SiCl_3$	11.55±0.1	EI		2183
$SiCl_3^+$	$SiHCl_3$	H	11.91±0.03	EI		2182
$SiCl_3^+$	CH_3SiCl_3	CH_3	11.90±0.08	EI		2182
$SiCl_3^+$	$C_2H_5SiCl_3$	C_2H_5	12.10±0.03	EI		2182
$SiCl_3^+$	*iso*-$C_3H_7SiCl_3$		13.1±0.2	EI		2182
$SiCl_3^+$	*tert*-$C_4H_9SiCl_3$		13.0±0.1	EI		2182

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$SiCl_4^+$		**ΔH°_{f0} = 483 kJ mol^{-1} (115 kcal mol^{-1})**				
$SiCl_4^+$	$SiCl_4$		11.79±0.01	PE	483	3362
See also – PE: 3117						
		PCl^+				
PCl^+	PCl_3		16.83±0.3	EI		192
PCl^+	PCl_3		16.8±0.3	EI		2506
PCl^+	PCl_3		16.5±0.5	EI		1101
PCl^+	P_2Cl_4		15.7±0.3	EI		192
PCl^+	$POCl_3$		17±1	EI		1101
PCl^+	$POCl_3$		20.2±0.4	EI		2506
		P_2Cl^+				
P_2Cl^+	P_2Cl_4	Cl_2+Cl?	16.1±0.4	EI		192
		PCl_2^+				
PCl_2^+	PCl_3	Cl^-	11.8±0.5	EI		1101
PCl_2^+	PCl_3	Cl	12.32±0.2	EI		192
PCl_2^+	PCl_3	Cl	12.3±0.2	EI		2506
PCl_2^+	P_2Cl_4	PCl_2	11.68±0.2	EI		192
PCl_2^+	$POCl_3$		13.3±0.5	EI		1101
		$P_2Cl_2^+$				
$P_2Cl_2^+$	P_2Cl_4		13.9±0.3	EI		192
		PCl_3^+				
PCl_3^+	PCl_3		9.91	PI		1091
PCl_3^+	PCl_3		10.18±0.10	PE		3168
See also – PE: 3119 EI: 192, 1101, 2453, 2506, 2597						
PCl_3^+	$POCl_3$	O	12.3±0.5	EI		1101
		$P_2Cl_3^+$				
$P_2Cl_3^+$	P_2Cl_4	Cl	11.7±0.3	EI		192

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$P_2Cl_4^+$				
$P_2Cl_4^+$	P_2Cl_4		9.36±0.2	EI		192
		$B_5H_8Cl^+$				
$B_5H_8Cl^+$	$1{-}B_5H_8Cl$		9.48±0.10	RPD		3228
$B_5H_8Cl^+$	$2{-}B_5H_8Cl$		9.90±0.05	RPD		3228
		$CHCl^+$				
$CHCl^+$	$CHCl_3$		17.5±0.2	EI		43
$CHCl^+$	$CHFCl_2$		19.0±0.2	EI		43
		CH_2Cl^+				
CH_2Cl^+	CH_2Cl		9.32	EI		141
CH_2Cl^+	CH_2Cl		9.70±0.09	EI		131
CH_2Cl^+	CH_3Cl	H	12.98±0.07	RPD		1139
See also – EI:	72, 160, 356, 3017					
CH_2Cl^+	C_2H_5Cl	CH_3	13.20±0.2	EI		72
CH_2Cl^+	C_2H_5Cl	CH_3	13.6±0.2	EI		356
CH_2Cl^+	CH_2Cl_2	Cl	12.12±0.1	EI		72
CH_2Cl^+	CH_2Cl_2	Cl	12.89±0.03	EI		131
CH_2Cl^+	CH_2ClCH_2Cl	CH_2Cl	12.52±0.1	EI		72
CH_2Cl^+	CH_3COCH_2Cl		13.8±0.07	EI		2174
CH_2Cl^+	C_3H_5OCl (1–Chloro–2,3–epoxypropane)		12.5±0.1	EI		153
CH_2Cl^+	$CH_2ClCOCHN_2$		12.2±0.1	EI		2174
CH_2Cl^+	CH_2ClBr	Br	11.56±0.1	EI		72
	$CH_3Cl^+(^2E_{3/2})$	**$\Delta H^\circ_{f0} \sim 1014$ kJ mol^{-1} (242 kcal mol^{-1})**				
$CH_3Cl^+(^2E_{3/2})$	CH_3Cl		11.220±0.01	S	1010	2064
$CH_3Cl^+(^2E_{3/2})$	CH_3Cl		11.265±0.003	PI	1014	1253
$CH_3Cl^+(^2E_{3/2})$	CH_3Cl		11.28±0.01	PI	1015	182, 416
$CH_3Cl^+(^2E_{3/2})$	CH_3Cl		11.28	PI	1015	1399, 2637
$CH_3Cl^+(^2E_{3/2})$	CH_3Cl		11.26	PE	1014	2843
$CH_3Cl^+(^2E_{3/2})$	CH_3Cl		11.29	PE	1016	3057
$CH_3Cl^+(^2E_{1/2})$	CH_3Cl		11.305±0.01	S		2064
$CH_3Cl^+(^2E_{1/2})$	CH_3Cl		11.37	PE		3057

Additional higher ionization potentials are given in ref. 3057.

See also – PI: 190
PE: 3119
PEN: 2430, 2466
EI: 72, 289, 364, 2146, 2154, 2776, 3201

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		CH_2DCl^+				
CH_2DCl^+	CH_2DCl		11.29	PI		2637
		CHD_2Cl^+				
CHD_2Cl^+	CHD_2Cl		11.30	PI		2637
		CD_3Cl^+				
CD_3Cl^+	CD_3Cl		11.30	PI		2637
		C_2HCl^+				
$C_2HCl^+(^2\Pi)$	$CH\equiv CCl$		10.63	PE		3071
$C_2HCl^+(^2\Pi)$	$CH\equiv CCl$		10.7±0.1	EDD		3177
See also – S:	2775					
C_2HCl^+	*cis*–CHCl=CHCl	HCl	13.27±0.05	EI		114
C_2HCl^+	*trans*–CHCl=CHCl	HCl	13.39±0.05	EI		114
		C_2HCl^{+2}				
C_2HCl^{+2}	$CH\equiv CCl$		29.0±0.1	EDD		3177
		$C_2H_2Cl^+$				
$C_2H_2Cl^+$	*cis*–CHCl=CHCl	Cl	12.29±0.05	EI		114
$C_2H_2Cl^+$	*trans*–CHCl=CHCl	Cl	12.61±0.05	EI		114
	$C_2H_3Cl^+$	**ΔH°_{f0} = 1008 kJ mol^{-1} (241 kcal mol^{-1})**				
$C_2H_3Cl^+$	C_2H_3Cl		10.00±0.01	S	1008	261
(Average of two Rydberg series limits)						
$C_2H_3Cl^+$	C_2H_3Cl		10.00±0.01	S	1008	2670
(Average of four Rydberg series limits)						
$C_2H_3Cl^+$	C_2H_3Cl		9.995±0.01	PI		182
$C_2H_3Cl^+$	C_2H_3Cl		9.995	PI		168
$C_2H_3Cl^+$	C_2H_3Cl		10.00±0.02	PI		268
$C_2H_3Cl^+$	C_2H_3Cl		10.00±0.01	PI		2670
$C_2H_3Cl^+$	C_2H_3Cl		10.00	PE		2885
See also – EI:	268, 2793					

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_2D_3Cl^+$				
$C_2D_3Cl^+$	C_2D_3Cl		10.02±0.02	PI		268
$C_2D_3Cl^+$	C_2D_3Cl		10.10±0.03	EI		268
	$C_2H_5Cl^+$	**$\Delta H^\circ_{f0} = 961$ kJ mol^{-1} (230 kcal mol^{-1})**				
$C_2H_5Cl^+$	C_2H_5Cl		10.97±0.02	PI	961	416
$C_2H_5Cl^+$	C_2H_5Cl		10.98±0.01	PI	962	190
$C_2H_5Cl^+$	C_2H_5Cl		10.98±0.02	PI	962	182
See also – EI:	72, 160, 356, 2146, 3201					
		$C_3H_3Cl^+$				
$C_3H_3Cl^+$	$CH_3C{\equiv}CCl$		9.9±0.1	EI		13
	n-$C_3H_7Cl^+$ **iso-$C_3H_7Cl^+$**	**$\Delta H^\circ_{f298} \sim 914$ kJ mol^{-1} (218 kcal mol^{-1})** **$\Delta H^\circ_{f298} \sim 894$ kJ mol^{-1} (214 kcal mol^{-1})**				
$C_3H_7Cl^+$	n-C_3H_7Cl		10.82±0.03	PI	914	182
$C_3H_7Cl^+$	n-C_3H_7Cl		10.78±0.04	EI		2146, 3201
See also – EI:	72					
$C_3H_7Cl^+$	iso-C_3H_7Cl		10.78±0.02	PI	894	182
$C_3H_7Cl^+$	iso-C_3H_7Cl		10.77±0.03	EI		2146, 3201
See also – EI:	160, 2776					
		$C_4H_5Cl^+$				
$C_4H_5Cl^+$	$CH_2{=}CClCH{=}CH_2$ (Average of two Rydberg series limits)		8.828±0.01	S		3352
	n-$C_4H_9Cl^+$ **sec-$C_4H_9Cl^+$** **iso-$C_4H_9Cl^+$** **$tert$-$C_4H_9Cl^+$**	**$\Delta H^\circ_{f298} \sim 882$ kJ mol^{-1} (211 kcal mol^{-1})** **$\Delta H^\circ_{f298} \sim 866$ kJ mol^{-1} (207 kcal mol^{-1})** **$\Delta H^\circ_{f298} \sim 869$ kJ mol^{-1} (208 kcal mol^{-1})** **$\Delta H^\circ_{f298} \sim 840$ kJ mol^{-1} (201 kcal mol^{-1})**				
$C_4H_9Cl^+$	n-C_4H_9Cl		10.67±0.03	PI	882	182
$C_4H_9Cl^+$	n-C_4H_9Cl		10.50±0.07	EI		2146
See also – EI:	3201					
$C_4H_9Cl^+$	sec-C_4H_9Cl		10.65±0.03	PI	866	182
$C_4H_9Cl^+$	sec-C_4H_9Cl		10.52±0.1	EI		2146
See also – EI:	3201					

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_4H_9Cl^+$	*iso*–C_4H_9Cl		10.66±0.03	PI	869	182
$C_4H_9Cl^+$	*iso*–C_4H_9Cl		10.48±0.1	EI		2146

See also – EI: 3201

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_4H_9Cl^+$	*tert*–C_4H_9Cl		10.61±0.03	PI	840	182
$C_4H_9Cl^+$	*tert*–C_4H_9Cl		10.3±0.1	EI		2146, 3201

$C_5H_4Cl^+$

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_5H_4Cl^+$	C_5H_4Cl (Chlorocyclopentadienyl radical)		8.78	EI		126

$C_5H_5Cl^+$

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_5H_5Cl^+$	$C_6H_4ClNH_2$ (4–Chloroaniline)	HCN	12.24	EI		3238

$C_6H_4Cl^+$

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_6H_4Cl^+$	$C_6H_4Cl_2$ (1,3–Dichlorobenzene)	Cl	13.29±0.1	EI		2972
$C_6H_4Cl^+$	$C_6H_4Cl_2$ (1,4–Dichlorobenzene)	Cl	13.24±0.1	EI		2972
$C_6H_4Cl^+$	C_6H_4ClBr (1–Bromo–4–chlorobenzene)	Br	12.70	EI		3238

$C_6H_5Cl^+$ (Chlorobenzene) **$\Delta H^\circ_{f298} \sim 926$ kJ mol^{-1} (221 kcal mol^{-1})**

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_6H_5Cl^+$	C_6H_5Cl (Chlorobenzene)		9.05	S	925	2666
$C_6H_5Cl^+$	C_6H_5Cl (Chlorobenzene)		9.035	PI	924	2682
$C_6H_5Cl^+$	C_6H_5Cl (Chlorobenzene)		9.08±0.01	PI	928	3212
$C_6H_5Cl^+$	C_6H_5Cl (Chlorobenzene)		9.07±0.02	PI	927	182, 416
$C_6H_5Cl^+$	C_6H_5Cl (Chlorobenzene)		9.07	PI	927	168

See also – S: 3153
PE: 2015, 2806, 2826, 3212, 3247, 3331
EI: 301, 1066, 2972, 3223, 3230, 3238

$C_7H_6Cl^+$

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_7H_6Cl^+$	$C_6H_4ClCH_2$ (4–Chlorobenzyl radical)		7.95±0.1	EI		69
$C_7H_6Cl^+$	$C_6H_5CH_2CH_2C_6H_4Cl$ (1–(3–Chlorophenyl)–2–phenylethane)		~13	EI		3288

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
	$C_7H_7Cl^+$ (α–Chlorotoluene)	**$\Delta H^\circ_{f298} \sim 897$ kJ mol^{-1} (214 kcal mol^{-1})**				
$C_7H_7Cl^+$	$C_6H_5CH_2Cl$ (α–Chlorotoluene)		9.10±0.05	PI	897	2612
See also – EI:	2025, 3230					
$C_7H_7Cl^+$	$C_6H_4ClCH_3$ (2–Chlorotoluene)		8.83±0.02	PI		182
See also – EI:	3230					
$C_7H_7Cl^+$	$C_6H_4ClCH_3$ (3–Chlorotoluene)		8.83±0.02	PI		182
See also – EI:	2025, 2972, 3230					
$C_7H_7Cl^+$	$C_6H_4ClCH_3$ (4–Chlorotoluene)		8.69±0.02	PI		416
$C_7H_7Cl^+$	$C_6H_4ClCH_3$ (4–Chlorotoluene)		8.70±0.02	PI		182
See also – PE: EI:	2806 1066, 2972, 3223, 3230					
		$C_7H_9Cl^+$				
$C_7H_9Cl^+$	C_7H_9Cl (*endo*–5–Chlorobicyclo[2.2.1]hept–2–ene)		9.1±0.15	EI		2155
$C_7H_9Cl^+$	C_7H_9Cl (*exo*–5–Chlorobicyclo[2.2.1]hept–2–ene)		9.15±0.15	EI		2155
$C_7H_9Cl^+$	C_7H_9Cl (3–Chloronortricyclene)		9.51±0.15	EI		2155
		$C_8H_8Cl^+$				
$C_8H_8Cl^+$	$C_6H_4ClCH(CH_3)CH_2COOCH_3$ (3–(4–Chlorophenyl)butanoic acid methyl ester)		11.13±0.2	EI		2497
$C_8H_8Cl^+$	$C_6H_4ClCH_2CH_2Br$ (1–Bromo–2–(3–chlorophenyl)ethane)	Br	10.3	EI		2973
$C_8H_8Cl^+$	$C_6H_4ClCH_2CH_2Br$ (1–Bromo–2–(4–chlorophenyl)ethane)	Br	10.1	EI		2973
		$C_9H_9Cl^+$				
$C_9H_9Cl^+$	$C_6H_4ClCH(CH_3)CH_2COOCH_3$ (3–(4–Chlorophenyl)butanoic acid methyl ester)		9.90±0.2	EI		2497

4.3. The Positive Ion Table—Continued

$C_{14}H_{13}Cl^+$

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_{14}H_{13}Cl^+$	$C_6H_5CH_2CH_2C_6H_4Cl$ (1–(3–Chlorophenyl)–2–phenylethane)		8.7±0.1	EI		3288

$CHCl_2^+$

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$CHCl_2^+$	$CHCl_2$		9.30	EI		141
$CHCl_2^+$	$CHCl_2$		9.54±0.10	EI		131
$CHCl_2^+$	CH_2Cl_2	H	12.12±0.05?	RPD		1139
$CHCl_2^+$	CH_2Cl_2	H	13.00±0.10	EI		131
$CHCl_2^+$	$CHCl_3$	Cl	11.64±0.20	EI		43
$CHCl_2^+$	$CHCl_3$	Cl	11.70±0.1	EI		72
$CHCl_2^+$	$CHCl_3$	Cl	12.43±0.02	EI		131
$CHCl_2^+$	$CHCl_2CHCl_2$	$CHCl_2$	11.55±0.1	EI		72
$CHCl_2^+$	$CHCl_2Br$	Br	11.02±0.1	EI		72

$CH_2Cl_2^+$ $\Delta H^\circ_{f0} = 1009$ kJ mol^{-1} (241 kcal mol^{-1})

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$CH_2Cl_2^+$	CH_2Cl_2		11.35±0.02	PI	1010	182, 416
$CH_2Cl_2^+$	CH_2Cl_2		11.33	PE	1008	2843
$CH_2Cl_2^+$	CH_2Cl_2		11.36	PEN		2430

Orbital assignments are discussed in R. N. Dixon, J. N. Murrell and B. Narayan, Mol. Phys. **20**, 611 (1971).

See also – PE: 3119
EI: 72

CH_2= CCl_2^+ $\Delta H^\circ_{f0} = 960$ kJ mol^{-1} (229 kcal mol^{-1})
***cis*–CHCl= $CHCl^+$ $\Delta H^\circ_{f0} = 942$ kJ mol^{-1} (225 kcal mol^{-1})**
***trans*–CHCl= $CHCl^+$ $\Delta H^\circ_{f0} \sim 943$ kJ mol^{-1} (225 kcal mol^{-1})**

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_2H_2Cl_2^+$	CH_2=CCl_2 (Average of four Rydberg series limits)		9.86	S	960	2675
$C_2H_2Cl_2^+$	CH_2=CCl_2		9.79	PI		168
$C_2H_2Cl_2^+$	CH_2=CCl_2		9.83	PE		2885
$C_2H_2Cl_2^+$	CH_2=CCl_2		9.74	PE		3001

See also – S: 269

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_2H_2Cl_2^+$	*cis*–CHCl=CHCl		9.66	S	942	2673
$C_2H_2Cl_2^+$	*cis*–CHCl=CHCl		9.65±0.01	PI		182
$C_2H_2Cl_2^+$	*cis*–CHCl=CHCl		9.65	PI		168
$C_2H_2Cl_2^+$	*cis*–CHCl=CHCl		9.66±0.02	PI		114, 268, 1058, 1190
$C_2H_2Cl_2^+$	*cis*–CHCl=CHCl		9.65	PE		2885
$C_2H_2Cl_2^+$	*cis*–CHCl=CHCl		9.68	PE		3001

See also – S: 261, 3433
EI: 114, 268, 1058, 1190, 3213

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_2H_2Cl_2^+$	*trans*-CHCl=CHCl		~9.6	S		2672
$C_2H_2Cl_2^+$	*trans*-CHCl=CHCl		9.63	PI	941	168
$C_2H_2Cl_2^+$	*trans*-CHCl=CHCl		9.64±0.02	PI	942	114, 268, 1058, 1190
$C_2H_2Cl_2^+$	*trans*-CHCl=CHCl		9.66±0.03	PI	944	182
$C_2H_2Cl_2^+$	*trans*-CHCl=CHCl		9.64	PE	942	2885
$C_2H_2Cl_2^+$	*trans*-CHCl=CHCl		9.69	PE	947	3001
See also – S:	261, 3433					
EI:	114, 268, 1058, 1190, 3213					
	$CH_2ClCH_2Cl^+$	**$\Delta H^\circ_{f0} \sim 954$ kJ mol^{-1} (228 kcal mol^{-1})**				
$C_2H_4Cl_2^+$	CH_2ClCH_2Cl		11.12±0.05	PI	954	182
See also – EI:	72					
		$C_3H_4Cl_2^+$				
$C_3H_4Cl_2^+$	CH_2=$CClCH_2Cl$		9.82±0.03?	PI		182
		$C_3H_6Cl_2^+$				
$C_3H_6Cl_2^+$	$CH_3CHClCH_2Cl$		10.87±0.05	PI		182
$C_3H_6Cl_2^+$	$CH_3CHClCH_2Cl$		10.73	PE		3374
$C_3H_6Cl_2^+$	$(CH_2Cl)_2CH_2$		10.85±0.05	PI		182
$C_3H_6Cl_2^+$	$(CH_2Cl)_2CH_2$		10.93	PE		3374
		$C_4H_8Cl_2^+$				
$C_4H_8Cl_2^+$	$CH_2ClCH_2CH_2CH_2Cl$		11.03	PE		3374
	$C_6H_4Cl_2^+$ (1,2-Dichlorobenzene) **$C_6H_4Cl_2^+$ (1,3-Dichlorobenzene)** **$C_6H_4Cl_2^+$ (1,4-Dichlorobenzene)**	**ΔH°_{f298} = 905 kJ mol^{-1} (216 kcal mol^{-1})** **ΔH°_{f298} = 906 kJ mol^{-1} (217 kcal mol^{-1})** **ΔH°_{f298} = 886 kJ mol^{-1} (212 kcal mol^{-1})**				
$C_6H_4Cl_2^+$	$C_6H_4Cl_2$ (1,2-Dichlorobenzene)		9.06	PI	904	168
$C_6H_4Cl_2^+$	$C_6H_4Cl_2$ (1,2-Dichlorobenzene)		9.07±0.01	PI	905	182
See also – S:	3153					
EI:	1066					
$C_6H_4Cl_2^+$	$C_6H_4Cl_2$ (1,3-Dichlorobenzene)		9.12±0.01	PI	906	182
See also – EI:	2972					

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_6H_4Cl_2^+$	$C_6H_4Cl_2$ (1,4–Dichlorobenzene)		8.94±0.01	PI	886	182
$C_6H_4Cl_2^+$	$C_6H_4Cl_2$ (1,4–Dichlorobenzene)		8.95	PI	887	168

See also – PE: 2806, 2826, 3247
EI: 2972

$CHCl_3^+$ ΔH°_{f0} = 1003 kJ mol^{-1} (240 kcal mol^{-1})

$CHCl_3^+$	$CHCl_3$		11.42±0.03	PI	1004	182, 416
$CHCl_3^+$	$CHCl_3$		11.40	PE	1002	2843
$CHCl_3^+$	$CHCl_3$		11.50	PEN		2430

Orbital assignments are discussed in R. N. Dixon, J. N. Murrell and B. Narayan, Mol. Phys. **20**, 611 (1971).

See also – PE: 3119
EI: 43

$C_2HCl_3^+$ ΔH°_{f0} = 909 kJ mol^{-1} (217 kcal mol^{-1})

$C_2HCl_3^+$	C_2HCl_3		9.45±0.01	PI	907	182
$C_2HCl_3^+$	C_2HCl_3		9.47±0.01	PI	909	416
$C_2HCl_3^+$	C_2HCl_3		9.45	PI	907	168
$C_2HCl_3^+$	C_2HCl_3		9.48	PE	910	2885

See also – S: 261, 2674
PEN: 2430

$C_6H_3Cl_3^+$

$C_6H_3Cl_3^+$	$C_6H_3Cl_3$ (1,3,5–Trichlorobenzene)		9.5±0.15	CTS		3373

$C_2H_2Cl_4^+$

$C_2H_2Cl_4^+$	$CHCl_2CHCl_2$		11.10±0.05	EI		72

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
	$ClCN^+(^2\Pi_{3/2})$	**ΔH°_{f0} = 1328 kJ mol^{-1} (317 kcal mol^{-1})**				
	$ClCN^+(^2\Pi_{1/2})$	**ΔH°_{f0} = 1331 kJ mol^{-1} (318 kcal mol^{-1})**				
	$ClCN^+(^2\Sigma^+)$	**ΔH°_{f0} = 1469 kJ mol^{-1} (351 kcal mol^{-1})**				
	$ClCN^+(^2\Pi_{3/2})$	**ΔH°_{f0} = 1597 kJ mol^{-1} (382 kcal mol^{-1})**				
$CNCl^+(^2\Pi_{3/2})$	ClCN		12.34±0.01	PI	1328	2621
$CNCl^+(^2\Pi_{3/2})$	ClCN		12.34	PE	1328	3045
$CNCl^+(^2\Pi_{3/2})$	ClCN		12.37±0.02	PE		3091
$CNCl^+(^2\Pi_{1/2})$	ClCN		12.37	PE	1331	3045
$CNCl^+(^2\Sigma^+)$	ClCN		13.80	PE	1469	3045
$CNCl^+(^2\Sigma^+)$	ClCN		13.80±0.02	PE	1469	3091
$CNCl^+(^2\Pi_{3/2})$	ClCN		15.13	PE	1597	3045
$CNCl^+(^2\Pi_{3/2})$	ClCN		15.37±0.02 (V)	PE		3091
$CNCl^+(^2\Sigma^+)$	ClCN		19.03 (V)	PE		3045
$CNCl^+(^2\Sigma^+)$	ClCN		19.0±0.1 (V)	PE		3091
See also – EI:	73					
		$C_2NCl_3^+$				
$C_2NCl_3^+$	CCl_3CN		11.96 (V)	PE		3045
		$ClOH^+$				
$ClOH^+$	ClOH		11.7±0.2	EI		2488
		$COCl_2^+$				
$COCl_2^+$	CCl_2O		11.7	PEN		2430

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
BF_2Cl^+						
BF_2Cl^+	BF_2Cl		12.43±0.1	EI		2513
BF_2Cl^+	BF_2Cl		13.06±0.11	EI		2512, 3227
$BFCl_2^+$						
$BFCl_2^+$	$BFCl_2$		12.18±0.10	EI		2512, 2513, 3227
$CFCl^+$						
$CFCl^+$	$CFCl_3$		17.41±0.15	RPD		185
$CFCl^+$	CHF_2Cl		15.9±0.3	EI		43
CF_2Cl^+						
CF_2Cl^+	CF_3Cl	F	15.0±0.4	EI		24
CF_2Cl^+	CF_3Cl	F	16.15	EI		2976
CF_2Cl^+	CF_2Cl_2	Cl	12.55	EI		2976
CF_2Cl^+	CF_2ClCF_2Cl		12.33	EI		2976
CF_2Cl^+	$(CF_2Cl)_2CO$		12.5	EI		2976
CF_3Cl^+						
CF_3Cl^+	CF_3Cl		12.39	PI		2643
CF_3Cl^+	CF_3Cl		12.91±0.03	PI		182
A discrepancy exists in ref. 2643 between the threshold wavelength and its equivalent energy; the wavelength has been assumed correct. The disagreement between the two PI values is not understood.						
See also – EI: 24, 439						
$C_2F_3Cl^+$ $\Delta H_{f0}^\circ = 397$ kJ mol^{-1} (95 kcal mol^{-1})						
$C_2F_3Cl^+$	C_2F_3Cl		9.84	PE	397	2885
See also – EI: 214						
$C_3F_5Cl^+$						
$C_3F_5Cl^+$	$CF_2ClCF=CF_2$		10.79	EI		1290
$C_6F_5Cl^+$						
$C_6F_5Cl^+$	C_6F_5Cl (Chloropentafluorobenzene)		10.4±0.1	EI		301

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$CFCl_2^+$						
$CFCl_2^+$	$CFCl_3$	Cl	11.97±0.07	RPD		185
$CF_2Cl_2^+$ **$\Delta H^\circ_{f0} \sim 715$ kJ mol^{-1} (171 kcal mol^{-1})**						
$CF_2Cl_2^+$	CF_2Cl_2		12.31±0.05	PI	715	182
$CF_2{=}CCl_2^+$ **$\Delta H^\circ_{f298} = 616$ kJ mol^{-1} (147 kcal mol^{-1})**						
$C_2F_2Cl_2^+$	$CF_2{=}CCl_2$		9.69±0.01	S	616	3360
(Average of two Rydberg series limits)						
$C_2F_2Cl_2^+$	$CF_2{=}CCl_2$		9.65	PE		2885
See also – EI: 214						
$C_4F_6Cl_2^+$						
$C_4F_6Cl_2^+$	$CF_3CCl{=}CClCF_3$		10.36±0.01?	PI		182
$CFCl_3^+$ **$\Delta H^\circ_{f0} = 863$ kJ mol^{-1} (206 kcal mol^{-1})**						
$CFCl_3^+$	$CFCl_3$		11.77±0.02	PI	863	182
$CFCl_2CF_2Cl^+$ **$\Delta H^\circ_{f298} = 397$ kJ mol^{-1} (95 kcal mol^{-1})**						
$C_2F_3Cl_3^+$	CF_3CCl_3		11.78±0.03	PI		182
$C_2F_3Cl_3^+$	$CFCl_2CF_2Cl$		11.99±0.02	PI	397	182
ClO_3F^+						
ClO_3F^+	ClO_3F		13.6±0.2	EI		53
$P_3N_3Cl_5^+$						
$P_3N_3Cl_5^+$	$(NPCl_2)_3$ (Cyclo–tris(dichlorophosphonitrile))	Cl	11.06±0.1	EI		2782
$P_3N_3Cl_5^+$	$(NPCl_2)_2(NPClBr)$ (Cyclo–bis(dichlorophosphonitrile)bromochlorophosphonitrile)	Br	10.49±0.1	EI		2782
$P_3N_3Cl_6^+$						
$P_3N_3Cl_6^+$	$(NPCl_2)_3$ (Cyclo–tris(dichlorophosphonitrile))		10.26±0.05	EI		2425, 2952
$P_3N_3Cl_6^+$	$(NPCl_2)_3$ (Cyclo–tris(dichlorophosphonitrile))		10.27±0.1	EI		2782

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$P_4N_4Cl_8^+$						
$P_4N_4Cl_8^+$	$(NPCl_2)_4$ (Cyclo–tetrakis(dichlorophosphonitrile))		9.80±0.05	EI		2425, 2952
$P_5N_5Cl_{10}^+$						
$P_5N_5Cl_{10}^+$	$(NPCl_2)_5$ (Cyclo–pentakis(dichlorophosphonitrile))		9.83±0.05	EI		2425, 2952
$P_6N_6Cl_{12}^+$						
$P_6N_6Cl_{12}^+$	$(NPCl_2)_6$ (Cyclo–hexakis(dichlorophosphonitrile))		9.81±0.05	EI		2425, 2952
$P_7N_7Cl_{14}^+$						
$P_7N_7Cl_{14}^+$	$(NPCl_2)_7$ (Cyclo–heptakis(dichlorophosphonitrile))		9.80±0.05	EI		2425, 2952
$POCl^+$						
$POCl^+$	$POCl_3$		15.6±0.3	EI		2506
$POCl_2^+$						
$POCl_2^+$	$POCl_3$		12.8±0.3	EI		2506
$POCl_2^+$	$POCl_3$		13.3±0.2	EI		1101
$POCl_3^+$						
$POCl_3^+$	$POCl_3$		11.4±0.3	EI		2506
$POCl_3^+$	$POCl_3$		13.1±0.2	EI		1101
SF_4Cl^+						
SF_4Cl^+	SF_5Cl	F	15.9±0.1	EI		2777
$C_4H_{10}BCl^+$						
$C_4H_{10}BCl^+$	$(C_2H_5)_2BCl$		10.28±0.1	EI		2513, 3227

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_6H_5BCl^+$				
$C_6H_5BCl^+$	$C_6H_5BCl_2$ (Phenylboron dichloride)		12.88±0.14	EI		2722
		$C_2H_5BCl_2^+$				
$C_2H_5BCl_2^+$	$C_2H_5BCl_2$		10.80±0.3	EI		2513, 3227
		$C_2H_2NCl^+$				
$C_2H_2NCl^+$	CH_2ClCN		12.05 (V)	PE		3045
		$C_5H_4NCl^+$				
$C_5H_4NCl^+$	C_5H_4NCl (2–Chloropyridine)		9.91±0.05	EI		217
$C_5H_4NCl^+$	C_5H_4NCl (4–Chloropyridine)		10.15±0.05	EI		217
		$C_6H_6NCl^+$				
$C_6H_6NCl^+$	$C_6H_4ClNH_2$ (2–Chloroaniline)		7.9	CTS		2978
$C_6H_6NCl^+$	$C_6H_4ClNH_2$ (3–Chloroaniline)		8.09±0.1	EI		2972
$C_6H_6NCl^+$	$C_6H_4ClNH_2$ (4–Chloroaniline)		8.18 (V)	PE		2806
$C_6H_6NCl^+$	$C_6H_4ClNH_2$ (4–Chloroaniline)		7.77±0.1	CTS		2485
$C_6H_6NCl^+$	$C_6H_4ClNH_2$ (4–Chloroaniline)		8.00	CTS		2909
See also – PE: 2826 EI: 2972, 3231						
$C_6H_6NCl^+$	$C_6H_4ClNHCOCH_3$ (*N*–(3–Chlorophenyl)acetic acid amide)		10.90±0.2	EI		3406
$C_6H_6NCl^+$	$C_6H_4ClNHCOCH_3$ (*N*–(4–Chlorophenyl)acetic acid amide)		10.60±0.2	EI		3406

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_7H_4NCl^+$				
$C_7H_4NCl^+$	C_6H_4ClCN (2–Chlorobenzoic acid nitrile)		10.26±0.06	RPD		3223
$C_7H_4NCl^+$	C_6H_4ClCN (3–Chlorobenzoic acid nitrile)		9.93±0.04	RPD		3223
See also – EI:	2972					
$C_7H_4NCl^+$	C_6H_4ClCN (4–Chlorobenzoic acid nitrile)		9.94±0.05	RPD		3223
See also – EI:	2972					
		$C_8H_6NCl^+$				
$C_8H_6NCl^+$	$C_6H_4ClCH_2CN$ (3–Chlorophenylacetic acid nitrile)		9.48±0.05	RPD		3223
$C_8H_6NCl^+$	$C_6H_4ClCH_2CN$ (4–Chlorophenylacetic acid nitrile)		9.43±0.05	RPD		3223
		$C_8H_{10}NCl^+$				
$C_8H_{10}NCl^+$	$C_6H_4ClN(CH_3)_2$ (4–Chloro–*N*,*N*–dimethylaniline)		7.38	CTS		1281
		$C_{18}H_{26}N_3Cl^+$				
$C_{18}H_{26}N_3Cl^+$	$C_{18}H_{26}N_3Cl$ (Chloroquine)		7.84	CTS		2562

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
			$C_2HNCl_2^+$			
$C_2HNCl_2^+$	$CHCl_2CN$		12.21 (V)	PE		3045
			$C_7H_3NCl_2^+$			
$C_7H_3NCl_2^+$	$C_6H_3Cl_2CN$ (2,6–Dichlorobenzoic acid nitrile)		10.09±0.05	RPD		3223
			$C_8H_5NCl_2^+$			
$C_8H_5NCl_2^+$	$C_6H_3Cl_2CH_2CN$ (2,6–Dichlorophenylacetic acid nitrile)		9.73±0.06	RPD		3223
			$C_2H_2OCl^+$			
$C_2H_2OCl^+$	CH_3COCH_2Cl	CH_3	11.97±0.11	EI		2174
$C_2H_2OCl^+$	$CH_2ClCOCHN_2$		11.66±0.04	EI		2174
		CH_3COCl^+	**$\Delta H^\circ_{f0} \sim 829$ kJ mol^{-1} (198 kcal mol^{-1})**			
$C_2H_3OCl^+$	CH_2ClCHO		10.48±0.03	PE		3289
$C_2H_3OCl^+$	CH_3COCl		11.02±0.05	PI	829	182
$C_2H_3OCl^+$	CH_3COCl		11.05	PEN		2430
$C_2H_3OCl^+$	CH_3COCl		11.08±0.06	EI		2026
			$C_2H_5OCl^+$			
$C_2H_5OCl^+$	CH_2ClCH_2OH		10.90	PE		3374
See also – D:	2908					
	$C_3H_5OCl^+$ (1–Chloro–2,3–epoxypropane)		**$\Delta H^\circ_{f298} = 919$ kJ mol^{-1} (220 kcal mol^{-1})**			
$C_3H_5OCl^+$	CH_3COCH_2Cl		9.98±0.01	PE		3289
$C_3H_5OCl^+$	CH_3COCH_2Cl		9.98±0.13	EI		2174
$C_3H_5OCl^+$	CH_3COCH_2Cl		10.00±0.01	EI		2026
$C_3H_5OCl^+$	C_3H_5OCl (1–Chloro–2,3–epoxypropane)		10.64	PE	919	3374

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_4H_3OCl^+$				
$C_4H_3OCl^+$	C_4H_3OCl (2–Chlorofuran)		8.75	PE		3331
		$C_4H_6OCl^+$				
$C_4H_6OCl^+$	$CH_2ClCH_2CH_2COOCH_3$	CH_3O	11.28±0.3	EI		2496
		$C_6H_4OCl^+$				
$C_6H_4OCl^+$	$C_6H_5CH_2OC_6H_4Cl$ (Benzyl 3–chlorophenyl ether)		12.6	EI		2737
$C_6H_4OCl^+$	$C_6H_5CH_2OC_6H_4Cl$ (Benzyl 4–chlorophenyl ether)		12.7	EI		2737
		$C_6H_5OCl^+$				
$C_6H_5OCl^+$	C_6H_4ClOH (2–Chlorophenol)		9.28	EI		1066
$C_6H_5OCl^+$	C_6H_4ClOH (4–Chlorophenol)		8.69 (V)	PE		2806
$C_6H_5OCl^+$	C_6H_4ClOH (4–Chlorophenol)		9.07	EI		1066
See also – PE:	2826					
$C_6H_5OCl^+$	$C_6H_4ClOC_2H_5$ (1–Chloro–3–ethoxybenzene)	C_2H_4	10.70±0.15	EI		2945
$C_6H_5OCl^+$	$C_6H_4ClOC_2H_5$ (1–Chloro–4–ethoxybenzene)	C_2H_4	10.77±0.15	EI		2945
		$C_7H_4OCl^+$				
$C_7H_4OCl^+$	$C_6H_4ClCOCH_3$ (3–Chloroacetophenone)	CH_3	10.36±0.1	EI		2967
$C_7H_4OCl^+$	$C_6H_4ClCOCH_3$ (4–Chloroacetophenone)	CH_3	10.04	EI		3334
$C_7H_4OCl^+$	$C_6H_4ClCOCH_3$ (4–Chloroacetophenone)	CH_3	10.36±0.1	EI		2967
$C_7H_4OCl^+$	$C_6H_4ClCOCH_3$ (4–Chloroacetophenone)	CH_3	10.69	EI		3238
$C_7H_4OCl^+$	$C_6H_4ClCOOCH_3$ (4–Chlorobenzoic acid methyl ester)	CH_3O	11.02	EI		3238

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
			$C_7H_5OCl^+$			
$C_7H_5OCl^+$	C_6H_4ClCHO (4–Chlorobenzenecarbonal)		9.59 (V)	PE		2806
$C_7H_5OCl^+$	C_6H_4ClCHO (4–Chlorobenzenecarbonal)		9.61±0.01	EI		2026
$C_7H_5OCl^+$	C_6H_5COCl (Benzoic acid chloride)		9.70±0.01	EI		2026
See also – EI:	308					
			$C_7H_7OCl^+$			
$C_7H_7OCl^+$	$C_6H_4ClOCH_3$ (1–Chloro–2–methoxybenzene)		8.3±0.15	CTS		3373
$C_7H_7OCl^+$	$C_6H_4ClOCH_3$ (1–Chloro–4–methoxybenzene)		8.25±0.15	CTS		3373
			$C_8H_7OCl^+$			
$C_8H_7OCl^+$	$C_6H_5COCH_2Cl$ (α–Chloroacetophenone)		9.44±0.05	EI		2025
$C_8H_7OCl^+$	$C_6H_5COCH_2Cl$ (α–Chloroacetophenone)		9.65±0.01	EI		2026
$C_8H_7OCl^+$	$C_6H_4ClCOCH_3$ (3–Chloroacetophenone)		9.51±0.1	EI		2967
$C_8H_7OCl^+$	$C_6H_4ClCOCH_3$ (4–Chloroacetophenone)		9.47±0.05	EI		2026
$C_8H_7OCl^+$	$C_6H_4ClCOCH_3$ (4–Chloroacetophenone)		9.58±0.1	EI		2967
$C_8H_7OCl^+$	$C_6H_4ClCOCH_3$ (4–Chloroacetophenone)		9.64±0.15	EI		3334
$C_8H_7OCl^+$	$C_6H_4ClCOCH_3$ (4–Chloroacetophenone)		9.63	EI		3238
$C_8H_7OCl^+$	$C_6H_4(CH_3)COCl$ (4–Methylbenzoic acid chloride)		9.37±0.01	EI		2026
			$C_8H_9OCl^+$			
$C_8H_9OCl^+$	$C_6H_4ClOC_2H_5$ (1–Chloro–3–ethoxybenzene)		8.59±0.15	EI		2945
$C_8H_9OCl^+$	$C_6H_4ClOC_2H_5$ (1–Chloro–4–ethoxybenzene)		8.46±0.15	EI		2945
			$C_{10}H_{10}OCl^+$			
$C_{10}H_{10}OCl^+$	$C_6H_4ClCH(CH_3)CH_2COOCH_3$ (3–(4–Chlorophenyl)butanoic acid methyl ester)	CH_3O	11.09±0.2	EI		2497

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_{10}H_{11}OCl^+$				
$C_{10}H_{11}OCl^+$	$C_6H_4ClCOC_3H_7$ (1–(4–Chlorophenyl)–1–butanone)		9.03±0.2	EI		2534
		$C_{10}H_{13}OCl^+$				
$C_{10}H_{13}OCl^+$	$C_6H_4ClOC_4H_9$ (1–Chloro–4–*tert*–butoxybenzene)		8.72 (V)	PE		2806
See also – PE:	2826					
		$C_{13}H_9OCl^+$				
$C_{13}H_9OCl^+$	$C_6H_5COC_6H_4Cl$ (4–Chlorobenzophenone)		9.68±0.01	EI		2026
		$C_{13}H_{11}OCl^+$				
$C_{13}H_{11}OCl^+$	$C_6H_5CH_2OC_6H_4Cl$ (Benzyl 3–chlorophenyl ether)		8.5	EI		2737
$C_{13}H_{11}OCl^+$	$C_6H_5CH_2OC_6H_4Cl$ (Benzyl 4–chlorophenyl ether)		8.3	EI		2737
		$C_2H_4O_2Cl^+$				
$C_2H_4O_2Cl^+$	$CH_2ClCOOC_2H_5$	C_2H_3	10.97	EI		1059
		$C_3H_5O_2Cl^+$				
$C_3H_5O_2Cl^+$	$CH_2ClCOOCH_3$		10.53±0.05	EI		2025
		$C_5H_9O_2Cl^+$				
$C_5H_9O_2Cl^+$	$CH_2ClCH_2CH_2COOCH_3$		10.29±0.3	EI		2496
		$C_8H_7O_2Cl^+$				
$C_8H_7O_2Cl^+$	$C_6H_4(OCH_3)COCl$ (4–Methoxybenzoic acid chloride)		8.87±0.05	EI		2026
$C_8H_7O_2Cl^+$	$C_6H_4ClCOOCH_3$ (4–Chlorobenzoic acid methyl ester)		9.57	EI		3238
		$C_{11}H_{13}O_2Cl^+$				
$C_{11}H_{13}O_2Cl^+$	$C_6H_4ClCH(CH_3)CH_2COOCH_3$ (3–(4–Chlorophenyl)butanoic acid methyl ester)		8.42±0.2	EI		2497

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_3H_4OCl_2^+$				
$C_3H_4OCl_2^+$	$(CH_2Cl)_2CO$		10.03±0.02	PE		3289
		$C_7H_4OCl_2^+$				
$C_7H_4OCl_2^+$	$C_6H_4ClCOCl$ (4–Chlorobenzoic acid chloride)		9.58±0.03	EI		2026
		$C_2H_3OCl_3^+$				
$C_2H_3OCl_3^+$	CCl_3CH_2OH		13.6	D		2908
		$C_{10}H_6O_4Cl_4^+$				
$C_{10}H_6O_4Cl_4^+$	$C_6Cl_4(COOCH_3)_2$ (2,3,5,6–Tetrachloro–1,4–benzenedicarboxylic acid dimethyl ester)		9.57	EI		2718
		$CHFCl^+$				
$CHFCl^+$	CHF_2Cl	F	15.11±0.15	EI		43
$CHFCl^+$	$CHFCl_2$	Cl	12.69±0.15	EI		43
		$C_2H_2FCl^+$				
$C_2H_2FCl^+$	*cis*–CHF=CHCl		9.87±0.01	PI		182
$C_2H_2FCl^+$	*cis*–CHF=CHCl		9.86±0.02	PI		268
See also – EI:	268, 3213					
$C_2H_2FCl^+$	*trans*–CHF=CHCl		9.87±0.01	PI		182
$C_2H_2FCl^+$	*trans*–CHF=CHCl		9.87±0.02	PI		268
See also – EI:	268, 3213					
		$C_6H_4FCl^+$				
$C_6H_4FCl^+$	C_6H_4FCl (1–Chloro–2–fluorobenzene)		9.155±0.01	PI		182
See also – EI:	1185					
$C_6H_4FCl^+$	C_6H_4FCl (1–Chloro–3–fluorobenzene)		9.21±0.01	PI		182
See also – EI:	1185, 2972					

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_6H_4FCl^+$	C_6H_4FCl (1–Chloro–4–fluorobenzene)		9.26 (V)	PE		2806
See also – PE:	2826					
EI:	1185, 2972					
	CHF_2Cl^+	**$\Delta H^\circ_{f0} \sim 726$ kJ mol^{-1} (174 kcal mol^{-1})**				
CHF_2Cl^+	CHF_2Cl		12.45±0.05	PI	726	182
See also – EI:	43					
	$CF_2=CHCl^+$	**$\Delta H^\circ_{f0} = 639$ kJ mol^{-1} (153 kcal mol^{-1})**				
$C_2HF_2Cl^+$	$CF_2=CHCl$		9.84	PE	639	2885
$C_2HF_2Cl^+$	*cis*–CHF=CFCl		9.86±0.02	PI		268
See also – EI:	268					
$C_2HF_2Cl^+$	*trans*–CHF=CFCl		9.83±0.02	PI		268
See also – EI:	268					
		$C_2H_3F_2Cl^+$				
$C_2H_3F_2Cl^+$	CH_3CF_2Cl		11.98±0.01	PI		182
		$C_7H_4F_3Cl^+$				
$C_7H_4F_3Cl^+$	$C_6H_4ClCF_3$ (3–Chloro–α,α,α–trifluorotoluene)		9.76±0.1	EI		2972
$C_7H_4F_3Cl^+$	$C_6H_4ClCF_3$ (4–Chloro–α,α,α–trifluorotoluene)		9.80 (V)	PE		2806
$C_7H_4F_3Cl^+$	$C_6H_4ClCF_3$ (4–Chloro–α,α,α–trifluorotoluene)		9.82±0.1	EI		2972
See also – PE:	2826					
		$C_4H_2F_7Cl^+$				
$C_4H_2F_7Cl^+$	*n*–$C_3F_7CH_2Cl$		11.84±0.02	PI		182
		$CHFCl_2^+$				
$CHFCl_2^+$	$CHFCl_2$		12.39±0.20	EI		43
		$C_3OF_4Cl_2^+$				
$C_3OF_4Cl_2^{+\cdot}$	$(CF_2Cl)_2CO$		10.71±0.01	PE		3289

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_3OF_3Cl_3^+$				
$C_3OF_3Cl_3^+$	CF_3COCCl_3		10.80±0.01	PE		3289
		$C_2H_6SiCl^+$				
$C_2H_6SiCl^+$	$(CH_3)_3SiCl$	CH_3	11.00±0.16	RPD		1421
$C_2H_6SiCl^+$	$(CH_3)_3SiCl$	CH_3	10.6±0.1	EI		2689
		$C_3H_9SiCl^+$				
$C_3H_9SiCl^+$	$(CH_3)_3SiCl$		10.58±0.04	RPD		1421
$C_3H_9SiCl^+$	$(CH_3)_3SiCl$		9.9±0.1	EI		2689
		$CH_3SiCl_3^+$				
$CH_3SiCl_3^+$	CH_3SiCl_3		11.36±0.03	EI		2182
		$C_2H_3SiCl_3^+$				
$C_2H_3SiCl_3^+$	$C_2H_3SiCl_3$		10.79±0.02?	PI		182

Because of ambiguity in the nomenclature of ref. 182 the structural formula may be either $CH_2{=}CHSiCl_3$ or $CCl_2{=}CClSiH_3$.

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_2H_5SiCl_3^+$				
$C_2H_5SiCl_3^+$	$C_2H_5SiCl_3$		10.74±0.04	EI		2182
		$C_3H_7SiCl_3^+$				
$C_3H_7SiCl_3^+$	*iso*-$C_3H_7SiCl_3$		10.28±0.1	EI		2182
		$C_{12}H_{10}PCl^+$				
$C_{12}H_{10}PCl^+$	$(C_6H_5)_2PCl$ (Chlorodiphenylphosphine)		8.75±0.05	EI		2481
		$C_6H_5PCl_2^+$				
$C_6H_5PCl_2^+$	$C_6H_5PCl_2$ (Dichloro(phenyl)phosphine)		9.45±0.05	EI		2481
		CH_3SCl^+				
CH_3SCl^+	CH_3SCl		9.2±0.1	EI		3034

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_4H_3SCl^+$				
$C_4H_3SCl^+$	C_4H_3SCl (2–Chlorothiophene)		8.68±0.01	PI		182, 416
$C_4H_3SCl^+$	C_4H_3SCl (2–Chlorothiophene)		8.70±0.05	PE		3246
See also – EI:	3240					
		$C_4H_2SCl_2^+$				
$C_4H_2SCl_2^+$	$C_4H_2SCl_2$ (2,5–Dichlorothiophene)		8.60±0.05	PE		3246
		CF_3SCl^+				
CF_3SCl^+	CF_3SCl		10.7±0.1	EI		3034
		$C_4H_{12}BN_2Cl^+$				
$C_4H_{12}BN_2Cl^+$	$((CH_3)_2N)_2BCl$		8.15	EI		3227
See also – EI:	2513, 2863					
		$C_2H_6BNCl_2^+$				
$C_2H_6BNCl_2^+$	$(CH_3)_2NBCl_2$		9.57	EI		3227
See also – EI:	2513, 2863					
		$C_2H_6BO_2Cl^+$				
$C_2H_6BO_2Cl^+$	$(CH_3O)_2BCl$		10.83	EI		3227
		$C_4H_{10}BO_2Cl^+$				
$C_4H_{10}BO_2Cl^+$	$(C_2H_5O)_2BCl$		10.52	EI		3227
		$C_6H_{14}BO_2Cl^+$				
$C_6H_{14}BO_2Cl^+$	$(n-C_3H_7O)_2BCl$		10.45	EI		3227

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$CH_3BOCl_2^+$						
$CH_3BOCl_2^+$	CH_3OBCl_2		11.55	EI		3227
$C_2H_5BOCl_2^+$						
$C_2H_5BOCl_2^+$	$C_2H_5OBCl_2$		11.27	EI		3227
$C_3H_7BOCl_2^+$						
$C_3H_7BOCl_2^+$	n–$C_3H_7OBCl_2$		11.22	EI		3227
$C_6H_4NOCl^+$						
$C_6H_4NOCl^+$	C_6H_4ClNO (1–Chloro–4–nitrosobenzene)		9.02 (V)	PE		2806
See also – PE:	2826					
$C_8H_8NOCl^+$						
$C_8H_8NOCl^+$	$C_6H_4ClNHCOCH_3$ (*N*–(3–Chlorophenyl)acetic acid amide)		8.65±0.2	EI		3406
$C_8H_8NOCl^+$	$C_6H_4ClNHCOCH_3$ (*N*–(4–Chlorophenyl)acetic acid amide)		8.31±0.2	EI		3406
$C_3H_3N_2OCl^+$						
$C_3H_3N_2OCl^+$	$CH_2ClCOCHN_2$		9.92±0.1	EI		2174
$C_6H_4NO_2Cl^+$						
$C_6H_4NO_2Cl^+$	$C_6H_4ClNO_2$ (1–Chloro–4–nitrobenzene)		9.99 (V)	PE		2806
$C_7H_4NO_3Cl^+$						
$C_7H_4NO_3Cl^+$	$C_6H_4(NO_2)COCl$ (4–Nitrobenzoic acid chloride)		10.66±0.01	EI		2026
$C_3HN_2OCl_3^+$						
$C_3HN_2OCl_3^+$	CCl_3COCHN_2		9.95±0.06	EI		2174

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_2H_6BS_2Cl^+$				
$C_2H_6BS_2Cl^+$	$(CH_3S)_2BCl$		9.64	EI		3227
		$CH_3BSCl_2^+$				
$CH_3BSCl_2^+$	CH_3SBCl_2		10.45	EI		3227
		$C_{17}H_{19}N_2SCl^+$				
$C_{17}H_{19}N_2SCl^+$	$C_{17}H_{19}N_2SCl$ (Chlorpromazine)		7.38±0.13	CTS		2987
		$C_{20}H_{24}N_3SCl^+$				
$C_{20}H_{24}N_3SCl^+$	$C_{20}H_{24}N_3SCl$ (Prochlorperazine)		7.25	CTS		2987
		$C_{12}H_7OSCl^+$				
$C_{12}H_7OSCl^+$	$C_{12}H_7OSCl$ (2–Chlorophenoxathiin)		7.96	CTS		3401
		$C_2H_6BNFCl^+$				
$C_2H_6BNFCl^+$	$(CH_3)_2NBFCl$		9.65	EI		3227
		CH_3BOFCl^+				
CH_3BOFCl^+	CH_3OBFCl		11.96	EI		3227
		$C_{21}H_{24}N_3OSCl^+$				
$C_{21}H_{24}N_3OSCl^+$	$C_{21}H_{24}N_3OSCl$ (Pipamazine)		7.15±0.10	CTS		2987
		$C_{23}H_{28}N_3O_2SCl^+$				
$C_{23}H_{28}N_3O_2SCl^+$	$C_{23}H_{28}N_3O_2SCl$ (Thiopropazate)		7.31±0.14	CTS		2987

4.3. The Positive Ion Table—Continued

$Ar^+(^2P_{3/2})$ ΔH°_{f0} = 1520.5 kJ mol^{-1} (363.4 kcal mol^{-1})
$Ar^+(^2P_{1/2})$ ΔH°_{f0} = 1537.7 kJ mol^{-1} (367.5 kcal mol^{-1})

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$Ar^+(^2P_{3/2})$	Ar		15.759	S	1520.5	2113, 3055, 3112
$Ar^+(^2P_{3/2})$	Ar		15.757±0.005	PE		2810, 2875
$Ar^+(^2P_{3/2})$	Ar		15.79	PE		248
$Ar^+(^2P_{3/2})$	Ar		15.78±0.03	EDD		2557
$Ar^+(^2P_{3/2})$	Ar		15.74±0.05	EDD		2634
$Ar^+(^2P_{1/2})$	Ar		15.937	S	1537.7	2113, 3055, 3112
$Ar^+(^2P_{1/2})$	Ar		15.93	PE		248

See also – PI: 163, 230, 1118, 2034, 2200
EI: 3, 35, 52, 224, 2032, 2895, 2991

Ar^{+2} ΔH°_{f0} = 4186.4 kJ mol^{-1} (1000.6 kcal mol^{-1})

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
Ar^{+2}	Ar		43.388	S	4186.4	2113
Ar^{+2}	Ar		41.4	EM		2993
Ar^{+2}	Ar		43.4±0.3	RPD		198
Ar^{+2}	Ar		43.3	NRE		211
Ar^{+2}	Ar		43	EI		1240
Ar^{+2}	Ar^+		27.629	S		2113, 3136
Ar^{+2}	Ar^+		27±2	SEQ		2551

Ar^{+3} ΔH°_{f0} = 8117 kJ mol^{-1} (1940 kcal mol^{-1})

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
Ar^{+3}	Ar		84.13	S	8117	2113
Ar^{+3}	Ar		84.8±0.5	RPD		198
Ar^{+3}	Ar		83.7±0.5	NRE		25
Ar^{+3}	Ar		84.0	NRE		211
Ar^{+3}	Ar		84.3	EI		1040
Ar^{+3}	Ar		85	EI		1240
Ar^{+3}	Ar^{+2}		40.74	S		2113
Ar^{+3}	Ar^{+2}		38±2	SEQ		2551

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
	Ar^{+4}	**$\Delta H^\circ_{f0} = 13888$ kJ mol^{-1} (3319 kcal mol^{-1})**				
Ar^{+4}	Ar		143.94	S	13888	2113
Ar^{+4}	Ar		150.0±5	RPD		198
Ar^{+4}	Ar		147	EI		1240
Ar^{+4}	Ar^{+3}		59.81	S		2113
Ar^{+4}	Ar^{+3}		55±2	SEQ		2551
	Ar^{+5}	**$\Delta H^\circ_{f0} = 21127$ kJ mol^{-1} (5049 kcal mol^{-1})**				
Ar^{+5}	Ar		218.96	S	21127	2113
Ar^{+5}	Ar		285	EI		1240
Ar^{+5}	Ar^{+4}		75.02	S		2113
Ar^{+5}	Ar^{+4}		73±2	SEQ		2551
	Ar^{+6}	**$\Delta H^\circ_{f0} = 29908$ kJ mol^{-1} (7148 kcal mol^{-1})**				
Ar^{+6}	Ar		309.97	S	29908	2113
Ar^{+6}	Ar		430	EI		1240
Ar^{+6}	Ar^{+5}		91.007	S		2113
Ar^{+6}	Ar^{+5}		89±2	SEQ		2551
	Ar_2^+	**$\Delta H^\circ_{f0} \leq 1419$ kJ mol^{-1} (339 kcal mol^{-1})**				
Ar_2^+	Ar+Ar*		14.710±0.009	PI	≤1419	2763
	K^+	**$\Delta H^\circ_{f0} = 508.9$ kJ mol^{-1} (121.6 kcal mol^{-1})**				
K^+	K		4.341	S	508.9	2113
See also – EI:	2487, 3189					
K^+	KF	F	9.5±0.3	EI		2436
K^+	KCl	Cl	9.1±0.3	EI		2406
K^+	KCl	Cl	10.6	EI		2860
K^+	KOH	OH	7.80±0.15	EI		3189
K^+	KI	I	8.6±0.3	EI		2001
		K_2^+				
K_2^+	K_2		~4.1	S		3179
K_2^+	K_2		4.0±0.1	PI		2633
See also – PI:	2615					

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		K_3^+				
K_3^+	K_3		3.4±0.1	PI		2633
		K_4^+				
K_4^+	K_4		3.6±0.1	PI		2633
		K_2O^+				
K_2O^+	K_2O		~5	EI		2445
K_2O^+	$K_2(OH)_2$	H_2O?	7.6±0.2	EI		3189
K_2O^+	K_2SO_4		13.0±0.5	EI		2487
		$K_2O_2^+$				
$K_2O_2^+$	K_2O_2		~5	EI		2445
		NaK^+				
NaK^+	NaK		4.5±0.1	PI		2633
		Na_2K^+				
Na_2K^+	Na_2K		3.6±0.1	PI		2633
		NaK_2^+				
NaK_2^+	NaK_2		3.4±0.1	PI		2633
		$Na_2K_2^+$				
$Na_2K_2^+$	Na_2K_2		4.1±0.1	PI		2633
		KCl^+				
KCl^+	KCl		8.0±0.3	EI		2406
KCl^+	KCl		10.1	EI		2860
		K_2Cl^+				
K_2Cl^+	K_2Cl_2	Cl	10.4	EI		2860

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
KOH^+						
KOH^+	KOH		7.50±0.15	EI		3189
K_2OH^+						
K_2OH^+	$K_2(OH)_2$	OH	7.80±0.15	EI		3189
$K_2SO_4^+$						
$K_2SO_4^+$	K_2SO_4		7.4±0.5	EI		2487
Ca^+	**$\Delta H_{f0}^\circ = 767.6$ kJ mol^{-1} (183.5 kcal mol^{-1})**					
Ca^+	Ca		6.113	S	767.6	2113, 3125
Ca^+	Ca		6.21±0.09	SI		3021
See also – S:	3270					
EI:	1297, 2141, 2178, 2532, 2592, 2594, 2595, 2620, 2990, 3203, 3204					
Ca^+	$CaCl_2$	2Cl	15.94±0.10	EI		2991
Ca^{+2}	**$\Delta H_{f0}^\circ = 1913.0$ kJ mol^{-1} (457.2 kcal mol^{-1})**					
Ca^{+2}	Ca		17.984	S	1913.0	2113
See also – EI:	2178					
Ca^{+2}	Ca^+		11.871	S		2113
CaO^+						
CaO^+	CaO		6.5	EI		1244, 2123
CaF^+						
CaF^+	CaF		6.0±0.5	EI		1297, 2141, 2532, 2620
See also – EI:	2165, 2592, 2594, 2595, 3203					
CaF^+	CaF_2	F	12.5±0.8	EI		1297, 2141
See also – EI:	2165					

4.3. The Positive Ion Table—Continued

$CaCl^+$

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$CaCl^+$	$CaCl$		6.01±0.10	EI		2991
$CaCl^+$	$CaCl$		5.5±0.5	EI		3204
$CaCl^+$	$CaCl$		5.6±0.5	EI		2990
$CaCl^+$	$CaCl_2$	Cl	10.96±0.10	EI		2991
$CaCl^+$	$CaCl_2$	Cl	11.0±0.2	EI		2990

$CaCl_2^+$

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$CaCl_2^+$	$CaCl_2$		10.33±0.10	EI		2991
$CaCl_2^+$	$CaCl_2$		10.5±0.3	EI		2990

See also – EI: 3204

$CaOH^+$

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$CaOH^+$	$CaOH$		5.90±0.1	D		3242, 3419

Sc^+ $\Delta H^\circ_{f0} = 1007$ kJ mol^{-1} (241 kcal mol^{-1})

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
Sc^+	Sc		6.54	S	1007	2113

See also – EI: 2594, 2600, 2721

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
Sc^+	ScF_3		28.0±0.7	EI		2009, 2600

ScF^+

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
ScF^+	ScF		6.3	EI		2594
ScF^+	ScF		6.5±0.3	EI		2600
ScF^+	ScF_3		16.0±0.7	EI		2009, 2600

ScF_2^+

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
ScF_2^+	ScF_2		7.0±0.3	EI		2594, 2600
ScF_2^+	ScF_3	F	13.5±0.7	EI		2009, 2594, 2600

Ti^+ $\Delta H^\circ_{f0} = 1125$ kJ mol^{-1} (269 kcal mol^{-1})

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
Ti^+	Ti		6.82	S	1125	2113
Ti^+	Ti		6.6±0.2	EI		2527
Ti^+	TiO?		11.5±0.2	EI		2527
Ti^+	TiO_2?		20±0.2	EI		2527
Ti^+	TiF_3		21.3	EI		2592
Ti^+	$TiCl_4$	4Cl	25.0±0.3	EI		2506

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
Ti^{+2} ΔH°_{f0} = 2435 kJ mol^{-1} (582 kcal mol^{-1})						
Ti^{+2}	Ti		20.40	S	2435	2113
Ti^{+2}	Ti		21.5±1	EI		2527
Ti^{+2}	Ti^{+}		13.58	S		2113
Ti^{+2}	$TiCl_4$		39.1±1.3	EI		2506
Ti^{+3} ΔH°_{f0} = 5088 kJ mol^{-1} (1216 kcal mol^{-1})						
Ti^{+3}	Ti		47.89	S	5088	2113
Ti^{+3}	Ti		50±1	EI		2527
Ti^{+3}	Ti^{+2}		27.491	S		2113
TiC_2^+						
TiC_2^+	TiC_2		8.7±0.5	EI		3208
TiC_4^+						
TiC_4^+	TiC_4		9.0±1.0	EI		3208
TiN^+						
TiN^+	TiN		6±2	EI		3207
TiO^+						
TiO^+	TiO		5.5±0.5	EI		2527
TiO^+	TiO_2?		8±0.5	EI		2527
TiO_2^+						
TiO_2^+	TiO_2		9±0.2	EI		2527
TiF^+						
TiF^+	TiF_3		15.5	EI		2592
TiF_2^+						
TiF_2^+	TiF_2		12.2±0.5	EI		2592
TiF_2^+	TiF_3	F	14.0	EI		2592
TiF_3^+						
TiF_3^+	TiF_3		10.5±0.5	EI		2592

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$TiCl^+$				
$TiCl^+$	$TiCl_4$		20.6±0.3	EI		2506
$TiCl^+$	$(C_5H_5)_2TiCl_2$ (Bis(cyclopentadienyl)titanium dichloride)		21.6±0.4	EI		2479
		$TiCl^{+2}$				
$TiCl^{+2}$	$TiCl_4$		35.6±0.9	EI		2506
		$TiCl_2^+$				
$TiCl_2^+$	$TiCl_4$		16.7±0.3	EI		2506
$TiCl_2^+$	$(C_5H_5)_2TiCl_2$ (Bis(cyclopentadienyl)titanium dichloride)		19.7±0.4	EI		2479
		$TiCl_2^{+2}$				
$TiCl_2^{+2}$	$TiCl_4$		32.1±0.8	EI		2506
		$TiCl_3^+$				
$TiCl_3^+$	$TiCl_4$	Cl?	13.3±0.3	EI		2506
		$TiCl_3^{+2}$				
$TiCl_3^{+2}$	$TiCl_4$	Cl	30.0±0.5	EI		2506
		$TiCl_4^+$				
$TiCl_4^+$	$TiCl_4$		11.78±0.04 (V)	PE		3079
$TiCl_4^+$	$TiCl_4$		11.7 (V)	PE		3117
$TiCl_4^+$	$TiCl_4$		11.65±0.15	EI		2506
		$C_{10}H_{10}Ti^+$				
$C_{10}H_{10}Ti^+$	$(C_5H_5)_3Ti$ (Tris(cyclopentadienyl)titanium)		8.27±0.2	EI		2640
		$C_{15}H_{15}Ti^+$				
$C_{15}H_{15}Ti^+$	$(C_5H_5)_3Ti$ (Tris(cyclopentadienyl)titanium)		6.47±0.1	EI		2640

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_{10}H_{14}O_4Ti^+$				
$C_{10}H_{14}O_4Ti^+$	$(CH_3COCHCOCH_3)_3Ti$ (Tris(2,4–pentanedionato)titanium)		11.8±0.1	EI		2460
		$C_{15}H_{21}O_6Ti^+$				
$C_{15}H_{21}O_6Ti^+$	$(CH_3COCHCOCH_3)_3Ti$ (Tris(2,4–pentanedionato)titanium)		7.1±0.1	EI		2460
		$C_3H_3ClTi^+$				
$C_3H_3ClTi^+$	$(C_5H_5)_2TiCl_2$ (Bis(cyclopentadienyl)titanium dichloride)		~19.5	EI		2479
		$C_5H_5ClTi^+$				
$C_5H_5ClTi^+$	$(C_5H_5)_2TiCl_2$ (Bis(cyclopentadienyl)titanium dichloride)		16.3±0.3	EI		2479
		$C_{10}H_{10}ClTi^+$				
$C_{10}H_{10}ClTi^+$	$(C_5H_5)_2TiCl_2$ (Bis(cyclopentadienyl)titanium dichloride)	Cl	10.8±0.3	EI		2479
		$C_5H_5Cl_2Ti^+$				
$C_5H_5Cl_2Ti^+$	$(C_5H_5)_2TiCl_2$ (Bis(cyclopentadienyl)titanium dichloride)		11.8±0.2	EI		2479
		$C_{10}H_{10}Cl_2Ti^+$				
$C_{10}H_{10}Cl_2Ti^+$	$(C_5H_5)_2TiCl_2$ (Bis(cyclopentadienyl)titanium dichloride)		8.98±0.16	EI		2479
		V^+ $\Delta H^\circ_{f0} = 1161$ kJ mol^{-1} (278 kcal mol^{-1})				
V^+	V		6.74	S	1161	2113
See also – EI:	2530					
V^+	$(C_5H_5)_2V$ (Bis(cyclopentadienyl)vanadium)		14.5±0.5	EI		2683
V^+	$(C_6H_6)_2V$ (Bis(benzene)vanadium)		13.6±0.3	EI		2530
V^+	$C_5H_5VC_7H_7$ (Cycloheptatrienyl(cyclopentadienyl)vanadium)		13.8±0.3	EI		2530

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
V^+	$V(CO)_6$	6CO	15.5±0.2	EI		2403
V^+	$C_5H_5V(CO)_4$ (Cyclopentadienylvanadium tetracarbonyl)		19.4±0.4	EI		1381
		VC^+				
VC^+	$V(CO)_6$		23.8±0.8	EI		2403
		VC_2^+				
VC_2^+	VC_2		8.6±0.5	EI		2997
		VCl_4^+				
VCl_4^+	VCl_4		9.41±0.04 (V)	PE		3079
		$C_3H_3V^+$				
$C_3H_3V^+$	$C_5H_5V(CO)_4$ (Cyclopentadienylvanadium tetracarbonyl)		18.9±0.3	EI		1381
		$C_5H_5V^+$				
$C_5H_5V^+$	C_5H_5V (Cyclopentadienylvanadium)		7.8±0.5	EI		2530
$C_5H_5V^+$	$(C_5H_5)_2V$ (Bis(cyclopentadienyl)vanadium)		12.65±0.1	EI		2683
$C_5H_5V^+$	$C_5H_5VC_7H_7$ (Cycloheptatrienyl(cyclopentadienyl)vanadium)		9.2±0.8	EI		2530
$C_5H_5V^+$	$C_5H_5V(CO)_4$ (Cyclopentadienylvanadium tetracarbonyl)	4CO	14.2±0.2	EI		1381
		$C_6H_6V^+$				
$C_6H_6V^+$	C_6H_6V (Benzenevanadium)		6.3±0.5	EI		2530
$C_6H_6V^+$	$(C_6H_6)_2V$ (Bis(benzene)vanadium)		10.5±0.2	EI		2530
$C_6H_6V^+$	$C_5H_5VC_7H_7$ (Cycloheptatrienyl(cyclopentadienyl)vanadium)		11.0±0.2	EI		2530
		$C_{10}H_{10}V^+$				
$C_{10}H_{10}V^+$	$(C_5H_5)_2V$ (Bis(cyclopentadienyl)vanadium)		7.33±0.1	EI		2683

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_{12}H_{12}V^+$				
$C_{12}H_{12}V^+$	$(C_6H_6)_2V$ (Bis(benzene)vanadium)		6.26±0.1	EI		2530
$C_{12}H_{12}V^+$	$C_5H_5VC_7H_7$ (Cycloheptatrienyl(cyclopentadienyl)vanadium)		7.24±0.1	EI		2530
		VCO^+				
VCO^+	$V(CO)_6$	5CO	13.8±0.2	EI		2403
		$VC_2O_2^+$				
$VC_2O_2^+$	$V(CO)_6$	4CO	12.3±0.2	EI		2403
		$VC_3O_3^+$				
$VC_3O_3^+$	$V(CO)_6$	3CO	10.98±0.15	EI		2403
		$VC_4O_4^+$				
$VC_4O_4^+$	$V(CO)_6$	2CO	9.70±0.2	EI		2403
		$VC_5O_5^+$				
$VC_5O_5^+$	$V(CO)_6$	CO	8.24±0.15	EI		2403
		$VC_6O_6^+$				
$VC_6O_6^+$	$V(CO)_6$		7.52 (V)	PE		2849
$VC_6O_6^+$	$V(CO)_6$		7.53±0.15	EI		2403
		$C_6H_5OV^+$				
$C_6H_5OV^+$	$C_5H_5V(CO)_4$ (Cyclopentadienylvanadium tetracarbonyl)	3CO	10.7±0.3	EI		1381
		$C_7H_5O_2V^+$				
$C_7H_5O_2V^+$	$C_5H_5V(CO)_4$ (Cyclopentadienylvanadium tetracarbonyl)	2CO	9.7±0.3	EI		1381

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
	$C_9H_5O_4V^+$					
$C_9H_5O_4V^+$	$C_5H_5V(CO)_4$ (Cyclopentadienylvanadium tetracarbonyl)		8.2±0.3	EI		1381
	$C_{10}H_{14}O_4V^+$					
$C_{10}H_{14}O_4V^+$	$(CH_3COCHCOCH_3)_3V$ (Tris(2,4–pentanedionato)vanadium)		11.8±0.1	EI		2460
	$C_{15}H_{21}O_6V^+$					
$C_{15}H_{21}O_6V^+$	$(CH_3COCHCOCH_3)_3V$ (Tris(2,4–pentanedionato)vanadium)		7.72±0.10	EI		2580
$C_{15}H_{21}O_6V^+$	$(CH_3COCHCOCH_3)_3V$ (Tris(2,4–pentanedionato)vanadium)		7.9±0.1	EI		2460
Cr^+	**ΔH°_{f0} = 1047.3 kJ mol^{-1} (250.3 kcal mol^{-1})**					
Cr^+	Cr		6.766	S	1047.3	2113
See also – EI:	1249, 2530					
Cr^+	CrF_3		20.1±0.3	EI		2591
Cr^+	$(C_5H_5)_2Cr$ (Bis(cyclopentadienyl)chromium)		14.6±0.3	EI		2683
Cr^+	$C_5H_5CrC_6H_6$ (Benzenecyclopentadienylchromium)		13.9±0.3	EI		2530
Cr^+	$(C_6H_6)_2Cr$ (Bis(benzene)chromium)		9.9±0.3	EI		2981
Cr^+	$(C_6H_6)_2Cr$ (Bis(benzene)chromium)		10.8±0.3	EI		2530, 3281
Cr^+	$C_5H_5CrC_7H_7$ (Cycloheptatrienyl(cyclopentadienyl)chromium)		12.2±0.3	EI		2530
Cr^+	$C_6H_6Cr(C_6H_5)_2$ (Benzenebiphenylchromium)		11.6±0.2	EI		3281
Cr^+	$(C_6H_3(CH_3)_3)_2Cr$ (Bis(1,3,5–trimethylbenzene)chromium)		12.1±0.2	EI		3281
Cr^+	$((C_6H_5)_2)_2Cr$ (Bis(biphenyl)chromium)		12.3±0.2	EI		3281
Cr^+	$(C_6(CH_3)_6)_2Cr$ (Bis(hexamethylbenzene)chromium)		14.0±0.4	EI		3281
Cr^+	$Cr(CO)_6$	6CO	14.7±0.1	EI		2023
Cr^+	$Cr(CO)_6$	6CO	15.1±0.2	EI		2403
Cr^+	$Cr(CO)_6$	6CO	17.07	EI		2500
Cr^+	$Cr(CO)_6$	6CO	17.7±0.3	EI		1107
Cr^+	CrO_2F_2		22.13±0.07	EI		2788
See also – EI:	30					

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
Cr^+	CrO_2Cl_2		19.15±0.07	EI		2788
See also – EI: 30						
Cr^+	$C_6H_6Cr(CO)_3$ (Benzenechromium tricarbonyl)		12.9±0.2	EI		2608
Cr^+	$CH_3OC(CH_3)Cr(CO)_5$		13.6±0.4	EI		2641
Cr^{+2} ΔH°_{f0} = 2640 kJ mol^{-1} (631 kcal mol^{-1})						
Cr^{+2}	Cr		23.27	S	2640	2113
Cr^{+2}	Cr^+		16.50	S		2113
Cr^{+2}	CrO_2F_2		45.8	EI		2788
Cr^{+2}	CrO_2Cl_2		44.2	EI		2788
CrC^+						
CrC^+	$Cr(CO)_6$		23.15±0.3	EI		2403
CrO^+						
CrO^+	CrO		8.4±0.5	EI		2130
CrO^+	CrO_2	O	13.5	EI		2130
CrO^+	$Cr(CO)_6$		23.45±0.3	EI		2403
CrO^+	CrO_2F_2		23.84±0.05	EI		2788
See also – EI: 30						
CrO^+	CrO_2Cl_2		18.30±0.10	EI		2788
See also – EI: 30						
CrO^{+2}						
CrO^{+2}	CrO_2F_2		40.7	EI		2788
CrO^{+2}	CrO_2Cl_2		39.6	EI		2788
CrO_2^+						
CrO_2^+	CrO_2		10.3±0.5	EI		2130
CrO_2^+	CrO_2F_2		19.89±0.08	EI		2788
See also – EI: 30						
CrO_2^+	CrO_2Cl_2		14.18±0.08	EI		2788
See also – EI: 30						

4.3. The Positive Ion Table—Continued

CrO_2^{+2}

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
CrO_2^{+2}	CrO_2F_2		37.6	EI		2788

CrO_3^+

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
CrO_3^+	CrO_3		11.6±0.5	EI		2130

CrF^+

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
CrF^+	CrF		8.4±0.3	EI		1249
CrF^+	CrF_3		14.0±0.3	EI		2591
CrF^+	CrO_2F_2		17.94±0.04	EI		2788

See also – EI: 30

CrF^{+2}

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
CrF^{+2}	CrO_2F_2		42.6	EI		2788

CrF_2^+

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
CrF_2^+	CrF_2		10.1±0.3	EI		1249
CrF_2^+	CrF_3	F	13.5±0.3	EI		2591
CrF_2^+	CrO_2F_2	O_2	14.24±0.04	EI		2788

See also – EI: 30

CrF_3^+

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
CrF_3^+	CrF_3		12.2±0.3	EI		2591

$CrCl^+$

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$CrCl^+$	CrO_2Cl_2		16.52±0.07	EI		2788

See also – EI: 30

$CrCl^{+2}$

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$CrCl^{+2}$	CrO_2Cl_2		41.2	EI		2788

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$CrCl_2^+$				
$CrCl_2^+$	CrO_2Cl_2	O_2	14.00±0.10	EI		2788
See also – EI:	30					
		$CrCl_2^{+2}$				
$CrCl_2^{+2}$	CrO_2Cl_2		36.0	EI		2788
		CH_3Cr^+				
CH_3Cr^+	$CH_3OC(CH_3)Cr(CO)_5$		15.6±0.3	EI		2641
		$C_5H_5Cr^+$				
$C_5H_5Cr^+$	C_5H_5Cr (Cyclopentadienylchromium)		6.4±0.5	EI		2530
$C_5H_5Cr^+$	C_5H_5Cr (Cyclopentadienylchromium)		7.0±0.5	EI		2530
$C_5H_5Cr^+$	$(C_5H_5)_2Cr$ (Bis(cyclopentadienyl)chromium)		12.81±0.1	EI		2683
$C_5H_5Cr^+$	$C_5H_5CrC_6H_6$ (Benzenecyclopentadienylchromium)		9.3±0.2	EI		2530
$C_5H_5Cr^+$	$C_5H_5CrC_7H_7$ (Cycloheptatrienyl(cyclopentadienyl)chromium)		10.4±0.6	EI		2530
		$C_6H_6Cr^+$				
$C_6H_6Cr^+$	C_6H_6Cr (Benzenechromium)		6.4±0.5	EI		2530
$C_6H_6Cr^+$	$(C_6H_6)_2Cr$ (Bis(benzene)chromium)		8.8±0.2	EI		2530, 3281
$C_6H_6Cr^+$	$(C_6H_6)_2Cr$ (Bis(benzene)chromium)		8.9	EI		2981
$C_6H_6Cr^+$	$(C_6H_6)_2Cr$ (Bis(benzene)chromium)		9.2±0.2	EI		2545
$C_6H_6Cr^+$	$C_6H_6Cr(CO)_3$ (Benzenechromium tricarbonyl)	3CO	10.5±0.2	EI		2608
$C_6H_6Cr^+$	$C_6H_6Cr(CO)_3$ (Benzenechromium tricarbonyl)	3CO	10.8±0.2	EI		2545
		$C_9H_{12}Cr^+$				
$C_9H_{12}Cr^+$	$(C_6H_3(CH_3)_3)_2Cr$ (Bis(1,3,5–trimethylbenzene)chromium)		9.3±0.1	EI		3281

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_{10}H_{10}Cr^+$						
$C_{10}H_{10}Cr^+$	$(C_5H_5)_2Cr$ (Bis(cyclopentadienyl)chromium)		6.26±0.1	EI		2683
$C_{10}H_{10}Cr^+$	$C_5H_5CrC_7H_7$ (Cycloheptatrienyl(cyclopentadienyl)chromium)	C_2H_2	12.2	EI		2530
$C_{11}H_{11}Cr^+$						
$C_{11}H_{11}Cr^+$	$C_5H_5CrC_6H_6$ (Benzenecyclopentadienylchromium)		6.13±0.1	EI		2530
$C_{12}H_{10}Cr^+$						
$C_{12}H_{10}Cr^+$	$C_6H_6Cr(C_6H_5)_2$ (Benzenebiphenylchromium)		8.9±0.1	EI		3281
$C_{12}H_{10}Cr^+$	$((C_6H_5)_2)_2Cr$ (Bis(biphenyl)chromium)		9.5±0.1	EI		3281
$C_{12}H_{12}Cr^+$						
$C_{12}H_{12}Cr^+$	$(C_6H_6)_2Cr$ (Bis(benzene)chromium)		4.9	EI		2981
$C_{12}H_{12}Cr^+$	$(C_6H_6)_2Cr$ (Bis(benzene)chromium)		5.70±0.1	EI		2545
$C_{12}H_{12}Cr^+$	$(C_6H_6)_2Cr$ (Bis(benzene)chromium)		5.91±0.1	EI		2530, 3281
$C_{12}H_{12}Cr^+$	$C_5H_5CrC_7H_7$ (Cycloheptatrienyl(cyclopentadienyl)chromium)		5.96±0.1	EI		2530
$C_{12}H_{12}Cr^{+2}$						
$C_{12}H_{12}Cr^{+2}$	$(C_6H_6)_2Cr$ (Bis(benzene)chromium)		15.8	EI		2981
$C_{12}H_{18}Cr^+$						
$C_{12}H_{18}Cr^+$	$(C_6(CH_3)_6)_2Cr$ (Bis(hexamethylbenzene)chromium)		10.3±0.2	EI		3281
$C_{18}H_{16}Cr^+$						
$C_{18}H_{16}Cr^+$	$C_6H_6Cr(C_6H_5)_2$ (Benzenebiphenylchromium)		5.94±0.05	EI		3281

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_{18}H_{24}Cr^+$				
$C_{18}H_{24}Cr^+$	$(C_6H_3(CH_3)_3)_2Cr$ (Bis(1,3,5-trimethylbenzene)chromium)		5.47±0.05	EI		3281
		$C_{24}H_{20}Cr^+$				
$C_{24}H_{20}Cr^+$	$((C_6H_5)_2)_2Cr$ (Bis(biphenyl)chromium)		5.87±0.1	EI		3281
		$C_{24}H_{36}Cr^+$				
$C_{24}H_{36}Cr^+$	$(C_6(CH_3)_6)_2Cr$ (Bis(hexamethylbenzene)chromium)		5.19±0.05	EI		3281
		$CrCO^+$				
$CrCO^+$	$Cr(CO)_6$	5CO	13.3±0.2	EI		2023
$CrCO^+$	$Cr(CO)_6$	5CO	13.63±0.2	EI		2403
$CrCO^+$	$Cr(CO)_6$	5CO	14.12	EI		2500
$CrCO^+$	$Cr(CO)_6$	5CO	14.9±0.2	EI		1107
$CrCO^+$	$CH_3OC(CH_3)Cr(CO)_5$		13.9±0.2	EI		2641
		$CrCO^{+2}$				
$CrCO^{+2}$	$Cr(CO)_6$		30.8±1.0	EI		2403
		$CrC_2O_2^+$				
$CrC_2O_2^+$	$Cr(CO)_6$	4CO	11.56±0.2	EI		2023
$CrC_2O_2^+$	$Cr(CO)_6$	4CO	11.94±0.1	EI		2403
$CrC_2O_2^+$	$Cr(CO)_6$	4CO	12.56	EI		2500
$CrC_2O_2^+$	$Cr(CO)_6$	4CO	13.1±0.2	EI		1107
		$CrC_3O_3^+$				
$CrC_3O_3^+$	$Cr(CO)_6$	3CO	~10.42	EI		2500
$CrC_3O_3^+$	$Cr(CO)_6$	3CO	10.62±0.15	EI		2023
$CrC_3O_3^+$	$Cr(CO)_6$	3CO	11.1±0.2	EI		2403
		$CrC_4O_4^+$				
$CrC_4O_4^+$	$Cr(CO)_6$	2CO	~9.52	EI		2500
$CrC_4O_4^+$	$Cr(CO)_6$	2CO	9.64±0.1	EI		2403
$CrC_4O_4^+$	$Cr(CO)_6$	2CO	9.97±0.04	EI		2023

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$CrC_5O_5^+$				
$CrC_5O_5^+$	$Cr(CO)_6$	CO	8.95±0.1	EI		2403
$CrC_5O_5^+$	$Cr(CO)_6$	CO	9.17±0.04	EI		2023
$CrC_5O_5^+$	$Cr(CO)_6$	CO	~9.32	EI		2500
See also – PI:	2886					
$Cr(CO)_6^+$		**$\Delta H^\circ_{f298} = -220$ kJ mol^{-1} (−53 kcal mol^{-1})**				
$CrC_6O_6^+$	$Cr(CO)_6$		8.142±0.017	PI	−220	2886
(Threshold value approximately corrected for hot bands)						
$CrC_6O_6^+$	$Cr(CO)_6$		8.40 (V)	PE		3029
See also – PI:	1167					
EI:	1107, 2023, 2403, 2500					
		$CrOF^+$				
$CrOF^+$	CrO_2F_2		19.09±0.03	EI		2788
See also – EI:	30					
		$CrOF^{+2}$				
$CrOF^{+2}$	CrO_2F_2		38.4	EI		2788
		CrO_2F^+				
CrO_2F^+	CrO_2F_2	F	15.72±0.10	EI		2788
See also – EI:	30					
		CrO_2F^{+2}				
CrO_2F^{+2}	CrO_2F_2	F	36.4	EI		2788
		$CrOF_2^+$				
$CrOF_2^+$	CrO_2F_2	O	16.29±0.08	EI		2788
See also – EI:	30					

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$CrO_2F_2^+$				
$CrO_2F_2^+$	CrO_2F_2		12.91±0.03	EI		2788
See also – EI:	30					
		$CrOCl^+$				
$CrOCl^+$	CrO_2Cl_2		14.80±0.05	EI		2788
See also – EI:	30					
		$CrOCl^{+2}$				
$CrOCl^{+2}$	CrO_2Cl_2		35.7	EI		2788
		CrO_2Cl^+				
CrO_2Cl^+	CrO_2Cl_2	Cl	13.69±0.06	EI		2788
See also – EI:	30					
		CrO_2Cl^{+2}				
CrO_2Cl^{+2}	CrO_2Cl_2	Cl	32.7	EI		2788
		$CrOCl_2^+$				
$CrOCl_2^+$	CrO_2Cl_2	O	15.52±0.11	EI		2788
See also – EI:	30					
		$CrO_2Cl_2^+$				
$CrO_2Cl_2^+$	CrO_2Cl_2		11.99±0.04	EI		2788
See also – EI:	30					
		$CrO_2Cl_2^{+2}$				
$CrO_2Cl_2^{+2}$	CrO_2Cl_2		30.9	EI		2788
		$C_2H_3OCr^+$				
$C_2H_3OCr^+$	$CH_3OC(CH_3)Cr(CO)_5$		13.9±0.2	EI		2641

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
			$C_3H_6OCr^+$			
$C_3H_6OCr^+$	$CH_3OC(CH_3)Cr(CO)_5$	5CO	12.2±0.2	EI		2641
			$C_7H_6OCr^+$			
$C_7H_6OCr^+$	$C_6H_6Cr(CO)_3$ (Benzenechromium tricarbonyl)	2CO	8.5±0.1	EI		2608
			$C_4H_6O_2Cr^+$			
$C_4H_6O_2Cr^+$	$CH_3OC(CH_3)Cr(CO)_5$	4CO	10.7±0.1	EI		2641
			$C_5H_6O_3Cr^+$			
$C_5H_6O_3Cr^+$	$CH_3OC(CH_3)Cr(CO)_5$	3CO	9.96±0.1	EI		2641
			$C_8H_5O_3Cr^+$			
$C_8H_5O_3Cr^+$	$C_5H_5Cr(CO)_3$ (Cyclopentadienylchromium tricarbonyl)		7.30	EI		3005
			$C_9H_6O_3Cr^+$			
$C_9H_6O_3Cr^+$	$C_6H_6Cr(CO)_3$ (Benzenechromium tricarbonyl)		7.30±0.1	EI		2608
$C_9H_6O_3Cr^+$	$C_6H_6Cr(CO)_3$ (Benzenechromium tricarbonyl)		7.41±0.06	CTS		3403
See also – EI:	2545, 3005					
			$C_{10}H_8O_3Cr^+$			
$C_{10}H_8O_3Cr^+$	$C_6H_5CH_3Cr(CO)_3$ (Toluenechromium tricarbonyl)		7.19	EI		3005, 3280
$C_{10}H_8O_3Cr^+$	$C_6H_5CH_3Cr(CO)_3$ (Toluenechromium tricarbonyl)		7.39±0.05	CTS		3403
$C_{10}H_8O_3Cr^+$	$C_7H_8Cr(CO)_3$ (Cycloheptatrienechromium tricarbonyl)		7.10	EI		3005, 3280
			$C_{11}H_{10}O_3Cr^+$			
$C_{11}H_{10}O_3Cr^+$	$C_6H_4(CH_3)_2Cr(CO)_3$ (1,3–Dimethylbenzenechromium tricarbonyl)		7.35±0.04	CTS		3403
$C_{11}H_{10}O_3Cr^+$	$C_6H_4(CH_3)_2Cr(CO)_3$ (1,4–Dimethylbenzenechromium tricarbonyl)		7.35±0.04	CTS		3403

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_{12}H_{12}O_3Cr^+$						
$C_{12}H_{12}O_3Cr^+$	$C_6H_3(CH_3)_3Cr(CO)_3$ (1,3,5–Trimethylbenzenechromium tricarbonyl)		7.05	EI		3005
$C_{12}H_{12}O_3Cr^+$	$C_6H_3(CH_3)_3Cr(CO)_3$ (1,3,5–Trimethylbenzenechromium tricarbonyl)		7.33±0.02	CTS		3403
$C_{13}H_{14}O_3Cr^+$						
$C_{13}H_{14}O_3Cr^+$	$C_6H_5C_4H_9Cr(CO)_3$ (*tert*–Butylbenzenechromium tricarbonyl)		7.08	EI		3005
$C_{15}H_{10}O_3Cr^+$						
$C_{15}H_{10}O_3Cr^+$	$(C_6H_5)_2Cr(CO)_3$ (Biphenylchromium tricarbonyl)		7.27	EI		3005
$C_{15}H_{10}O_3Cr^+$	$(C_6H_5)_2Cr(CO)_3$ (Biphenylchromium tricarbonyl)		7.35±0.06	CTS		3403
$C_{15}H_{18}O_3Cr^+$						
$C_{15}H_{18}O_3Cr^+$	$C_6(CH_3)_6Cr(CO)_3$ (Hexamethylbenzenechromium tricarbonyl)		6.88	EI		3005
$C_{15}H_{18}O_3Cr^+$	$C_6(CH_3)_6Cr(CO)_3$ (Hexamethylbenzenechromium tricarbonyl)		7.24±0.05	CTS		3403
$C_{21}H_{30}O_3Cr^+$						
$C_{21}H_{30}O_3Cr^+$	$C_6(C_2H_5)_6Cr(CO)_3$ (Hexaethylbenzenechromium tricarbonyl)		7.27±0.05	CTS		3403
$C_6H_6O_4Cr^+$						
$C_6H_6O_4Cr^+$	$CH_3OC(CH_3)Cr(CO)_5$	2CO	8.86±0.1	EI		2641
$C_{10}H_8O_4Cr^+$						
$C_{10}H_8O_4Cr^+$	$C_6H_5OCH_3Cr(CO)_3$ (Methoxybenzenechromium tricarbonyl)		7.11	EI		3005
$C_{10}H_8O_4Cr^+$	$C_6H_5OCH_3Cr(CO)_3$ (Methoxybenzenechromium tricarbonyl)		7.38±0.05	CTS		3403
$C_{10}H_{14}O_4Cr^+$						
$C_{10}H_{14}O_4Cr^+$	$(CH_3COCHCOCH_3)_3Cr$ (Tris(2,4–pentanedionato)chromium)		11.3±0.1	EI		2460, 2519, 2959

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_{11}H_8O_4Cr^+$						
$C_{11}H_8O_4Cr^+$	$C_6H_5COCH_3Cr(CO)_3$ (Acetophenonechromium tricarbonyl)		7.44	EI		3005
$C_{11}H_{10}O_4Cr^+$						
$C_{11}H_{10}O_4Cr^+$	$C_7H_7OCH_3Cr(CO)_3$ (*endo*–7–Methoxycycloheptatrienechromium tricarbonyl)		7.03	EI		3280
$C_{11}H_{10}O_4Cr^+$	$C_7H_7OCH_3Cr(CO)_3$ (*exo*–7–Methoxycycloheptatrienechromium tricarbonyl)		7.16	EI		3280
$C_{12}H_{18}O_4Cr^+$						
$C_{12}H_{18}O_4Cr^+$	$(CH_3COC(CH_3)COCH_3)_3Cr$ (Tris(3–methyl–2,4–pentanedionato)chromium)		10.7±0.10	EI		2519
$C_7H_6O_5Cr^+$						
$C_7H_6O_5Cr^+$	$CH_3OC(CH_3)Cr(CO)_5$	CO	7.92±0.05	EI		2641
$C_{11}H_8O_5Cr^+$						
$C_{11}H_8O_5Cr^+$	$C_6H_5COOCH_3Cr(CO)_3$ (Benzoic acid methyl ester chromium tricarbonyl)		7.41	EI		3005
$C_{13}H_{12}O_5Cr^+$						
$C_{13}H_{12}O_5Cr^+$	$C_7H_7CH_2COOCH_3Cr(CO)_3$ (*endo*–7–Cycloheptatrienylacetic acid methyl ester chromium tricarbonyl)		7.12	EI		3280
$C_{13}H_{12}O_5Cr^+$	$C_7H_7CH_2COOCH_3Cr(CO)_3$ (*exo*–7–Cycloheptatrienylacetic acid methyl ester chromium tricarbonyl)		7.21	EI		3280
$C_{13}H_{14}O_5Cr^+$						
$C_{13}H_{14}O_5Cr^+$	$C_6H_2(OCH_3)_2(CH_3)_2Cr(CO)_3$ (1,4–Dimethoxy–2,5–dimethylbenzenechromium tricarbonyl)		7.27±0.02	CTS		3403
$C_{21}H_{28}O_5Cr^+$						
$C_{21}H_{28}O_5Cr^+$	$C_{18}H_{28}O_2Cr(CO)_3$ (15,17–Dimethyl–2,13–dioxabicyclo[12.2.2]octadeca–14,16,17–trienechromium tricarbonyl)		7.29±0.02	CTS		3403
$C_8H_6O_6Cr^+$						
$C_8H_6O_6Cr^+$	$CH_3OC(CH_3)Cr(CO)_5$		7.46±0.05	EI		2641

4.3. The Positive Ion Table

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_{13}H_8O_6Cr^+$				
$C_{13}H_8O_6Cr^+$	$C_6H_5C(OCH_3)Cr(CO)_5$ (α–Methoxybenzylidenechromium pentacarbonyl)		7.26	EI		2641
		$C_{15}H_{21}O_6Cr^+$				
$C_{15}H_{21}O_6Cr^+$	$(CH_3COCHCOCH_3)_3Cr$ (Tris(2,4–pentanedionato)chromium)		7.87±0.12	EI		2580
$C_{15}H_{21}O_6Cr^+$	$(CH_3COCHCOCH_3)_3Cr$ (Tris(2,4–pentanedionato)chromium)		8.10±0.05	EI		2460, 2519, 2959
		$C_{18}H_{27}O_6Cr^+$				
$C_{18}H_{27}O_6Cr^+$	$(CH_3COC(CH_3)COCH_3)_3Cr$ (Tris(3–methyl–2,4–pentanedionato)chromium)		7.81±0.05	EI		2519
		$C_9H_7NO_3Cr^+$				
$C_9H_7NO_3Cr^+$	$C_6H_5NH_2Cr(CO)_3$ (Anilinechromium tricarbonyl)		7.05	EI		3005
		$C_{11}H_{11}NO_3Cr^+$				
$C_{11}H_{11}NO_3Cr^+$	$C_6H_5N(CH_3)_2Cr(CO)_3$ (*N*,*N*–Dimethylanilinechromium tricarbonyl)		6.92	EI		3005
$C_{11}H_{11}NO_3Cr^+$	$C_6H_5N(CH_3)_2Cr(CO)_3$ (*N*,*N*–Dimethylanilinechromium tricarbonyl)		7.28±0.02	CTS		3403
		$C_{13}H_{16}N_2O_3Cr^+$				
$C_{13}H_{16}N_2O_3Cr^+$	$C_6H_4(N(CH_3)_2)_2Cr(CO)_3$ (1,4–Bis(dimethylamino)benzenechromium tricarbonyl)		6.46	EI		3005
$C_{13}H_{16}N_2O_3Cr^+$	$C_6H_4(N(CH_3)_2)_2Cr(CO)_3$ (1,4–Bis(dimethylamino)benzenechromium tricarbonyl)		7.14±0.05	CTS		3403
		$C_7H_5NO_5Cr^+$				
$C_7H_5NO_5Cr^+$	$NH_2C(CH_3)Cr(CO)_5$		7.35	EI		2641
		$C_8H_7NO_5Cr^+$				
$C_8H_7NO_5Cr^+$	$CH_3NHC(CH_3)Cr(CO)_5$		7.30	EI		2641
		$C_9H_9NO_5Cr^+$				
$C_9H_9NO_5Cr^+$	$C_2H_5NHC(CH_3)Cr(CO)_5$		7.11	EI		2641
$C_9H_9NO_5Cr^+$	$(CH_3)_2NC(CH_3)Cr(CO)_5$		7.15	EI		2641

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_{10}H_{11}NO_5Cr^+$						
$C_{10}H_{11}NO_5Cr^+$	*iso*–$C_3H_7NHC(CH_3)Cr(CO)_5$		7.08	EI		2641
$C_{11}H_{13}NO_5Cr^+$						
$C_{11}H_{13}NO_5Cr^+$	*tert*–$C_4H_9NHC(CH_3)Cr(CO)_5$		6.98	EI		2641
$C_{11}H_{13}NO_5Cr^+$	$(C_2H_5)_2NC(CH_3)Cr(CO)_5$		7.01	EI		2641
$C_{12}H_{11}NO_5Cr^+$						
$C_{12}H_{11}NO_5Cr^+$	$C_6H_{11}NCCr(CO)_5$ (Isocyanocyclohexanechromium pentacarbonyl)		7.62	EI		2544
$C_{13}H_9NO_5Cr^+$						
$C_{13}H_9NO_5Cr^+$	$C_6H_5NHC(CH_3)Cr(CO)_5$ (1–Anilinoethylidenechromium pentacarbonyl)		7.02	EI		2641
$C_{13}H_{15}NO_5Cr^+$						
$C_{13}H_{15}NO_5Cr^+$	$C_6H_{11}NHC(CH_3)Cr(CO)_5$ (1–Cyclohexylaminoethylidenechromium pentacarbonyl)		7.04	EI		2641
$C_{14}H_{11}NO_5Cr^+$						
$C_{14}H_{11}NO_5Cr^+$	$C_6H_5CH_2NHC(CH_3)Cr(CO)_5$ (1–Benzylaminoethylidenechromium pentacarbonyl)		7.09	EI		2641
$C_{14}H_{11}NO_5Cr^+$	$C_6H_4(CH_3)NHC(CH_3)Cr(CO)_5$ (1–(4–Methylanilino)ethylidenechromium pentacarbonyl)		6.81	EI		2641
$C_{14}H_{11}NO_6Cr^+$						
$C_{14}H_{11}NO_6Cr^+$	$C_6H_4(OCH_3)NHC(CH_3)Cr(CO)_5$ (1–(4–Methoxyanilino)ethylidenechromium pentacarbonyl)		6.90	EI		2641
$C_{10}H_{12}N_2O_8Cr^+$						
$C_{10}H_{12}N_2O_8Cr^+$	$(CH_3COC(NO_2)COCH_3)_3Cr$ (Tris(3–nitro–2,4–pentanedionato)chromium)		11.6±0.10	EI		2519
$C_{15}H_{18}N_3O_{12}Cr^+$						
$C_{15}H_{18}N_3O_{12}Cr^+$	$(CH_3COC(NO_2)COCH_3)_3Cr$ (Tris(3–nitro–2,4–pentanedionato)chromium)		8.63±0.05	EI		2519

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_9H_5O_3FCr^+$						
$C_9H_5O_3FCr^+$	$C_6H_5FCr(CO)_3$ (Fluorobenzenechromium tricarbonyl)		7.47	EI		3005
$C_{10}H_8O_4F_6Cr^+$						
$C_{10}H_8O_4F_6Cr^+$	$(CF_3COCHCOCH_3)_3Cr$ (Tris(1,1,1-trifluoro-2,4-pentanedionato)chromium)		11.9±0.1	EI		2519, 2959
$C_{15}H_{12}O_6F_9Cr^+$						
$C_{15}H_{12}O_6F_9Cr^+$	$(CF_3COCHCOCH_3)_3Cr$ (Tris(1,1,1-trifluoro-2,4-pentanedionato)chromium)		9.09±0.05	EI		2519, 2959
$C_{10}H_2O_4F_{12}Cr^+$						
$C_{10}H_2O_4F_{12}Cr^+$	$(CF_3COCHCOCF_3)_3Cr$ (Tris(1,1,1,5,5,5-hexafluoro-2,4-pentanedionato)chromium)		14.3±0.1	EI		2519, 2959
$C_{15}H_3O_6F_{18}Cr^+$						
$C_{15}H_3O_6F_{18}Cr^+$	$(CF_3COCHCOCF_3)_3Cr$ (Tris(1,1,1,5,5,5-hexafluoro-2,4-pentanedionato)chromium)		9.19±0.02	PE		3168
$C_{15}H_3O_6F_{18}Cr^+$	$(CF_3COCHCOCF_3)_3Cr$ (Tris(1,1,1,5,5,5-hexafluoro-2,4-pentanedionato)chromium)		9.97±0.08	EI		2580
$C_{15}H_3O_6F_{18}Cr^+$	$(CF_3COCHCOCF_3)_3Cr$ (Tris(1,1,1,5,5,5-hexafluoro-2,4-pentanedionato)chromium)		10.13±0.05	EI		2519, 2959
See also – PE:	3169					
$C_{12}H_{14}O_3SiCr^+$						
$C_{12}H_{14}O_3SiCr^+$	$C_6H_5Si(CH_3)_3Cr(CO)_3$ (Trimethylsilylbenzenechromium tricarbonyl)		7.15	EI		3005
$C_{11}H_{15}O_5PCr^+$						
$C_{11}H_{15}O_5PCr^+$	$(C_2H_5)_3PCr(CO)_5$		7.63±0.05	EI		2481
$C_{17}H_{27}O_5PCr^+$						
$C_{17}H_{27}O_5PCr^+$	$(n\text{-}C_4H_9)_3PCr(CO)_5$		7.37±0.05	EI		2481
$C_8H_9O_8PCr^+$						
$C_8H_9O_8PCr^+$	$(CH_3O)_3PCr(CO)_5$		7.80	EI		2544

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_{11}H_{15}O_8PCr^+$						
$C_{11}H_{15}O_8PCr^+$	$(C_2H_5O)_3PCr(CO)_5$		7.62	EI		2544
$C_{17}H_{27}O_8PCr^+$						
$C_{17}H_{27}O_8PCr^+$	$(n-C_4H_9O)_3PCr(CO)_5$		7.63±0.05	EI		2481
$C_{10}H_{18}O_{10}P_2Cr^+$						
$C_{10}H_{18}O_{10}P_2Cr^+$	$((CH_3O)_3P)_2Cr(CO)_4$		7.30	EI		2716
$C_{16}H_{30}O_{10}P_2Cr^+$						
$C_{16}H_{30}O_{10}P_2Cr^+$	$((C_2H_5O)_3P)_2Cr(CO)_4$		7.23	EI		2716
$C_{13}H_8O_5SCr^+$						
$C_{13}H_8O_5SCr^+$	$C_6H_5SC(CH_3)Cr(CO)_5$ (1–Phenylthioethylidenechromium pentacarbonyl)		7.83	EI		2641
$C_9H_5O_3ClCr^+$						
$C_9H_5O_3ClCr^+$	$C_6H_5ClCr(CO)_3$ (Chlorobenzenechromium tricarbonyl)		7.37	EI		3005
$C_{10}H_{12}O_4Cl_2Cr^+$						
$C_{10}H_{12}O_4Cl_2Cr^+$	$(CH_3COCClCOCH_3)_3Cr$ (Tris(3–chloro–2,4–pentanedionato)chromium)		11.1±0.10	EI		2519
$C_{15}H_{18}O_6Cl_3Cr^+$						
$C_{15}H_{18}O_6Cl_3Cr^+$	$(CH_3COCClCOCH_3)_3Cr$ (Tris(3–chloro–2,4–pentanedionato)chromium)		8.16±0.05	EI		2519
$C_{14}H_8NO_5F_3Cr^+$						
$C_{14}H_8NO_5F_3Cr^+$	$C_6H_4(CF_3)NHC(CH_3)Cr(CO)_5$ (1–(4–Trifluoromethylanilino)ethylidenechromium pentacarbonyl)		7.85	EI		2641
$C_{13}H_8NO_5ClCr^+$						
$C_{13}H_8NO_5ClCr^+$	$C_6H_4ClNHC(CH_3)Cr(CO)_5$ (1–(4–Chloroanilino)ethylidenechromium pentacarbonyl)		7.40	EI		2641

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
Mn^+ $\Delta H^\circ_{f0} = 996.7$ kJ mol^{-1} (238.2 kcal mol^{-1})						
Mn^+	Mn		7.435	S	996.7	2113
See also – EI:	2161, 2523, 2683, 2795, 3023					
Mn^+	MnF_2		13.0±0.5	EI		2859
Mn^+	MnF_3		19.5±0.5	EI		2591
Mn^+	$(C_5H_5)_2Mn$ (Bis(cyclopentadienyl)manganese)		13.6±0.3	EI		2683
Mn^+	$C_5H_5MnC_6H_6$ (Benzenecyclopentadienylmanganese)		14.1±0.3	EI		2530
Mn^+	$C_5H_5MnC_6H_6$ (Benzenecyclopentadienylmanganese)		17.9	EI		2417
Mn^+	$Mn_2(CO)_{10}$		20.8±0.4	EI		2739
Mn^+	$Mn_2(CO)_{10}$		22.13	EI		2563
Mn^+	$C_5H_5Mn(CO)_3$ (Cyclopentadienylmanganese tricarbonyl)		14.4±0.5	EI		2531
See also – EI:	1381					
Mn^+	$Mn(CO)_5Cl$		~14.8	EI		2501
Mn^+	$Mn(CO)_5Br$		16.5	EI		2501
Mn^+	$Mn(CO)_5I$		16.2	EI		2501
Mn^+	$ReMn(CO)_{10}$		25.67	EI		2563
Mn_2^+						
Mn_2^+	$Mn_2(CO)_{10}$	10CO	18.73	EI		2563
Mn_2^+	$Mn_2(CO)_{10}$	10CO	18.8±0.3	EI		2739
MnF^+						
MnF^+	MnF		8.1±0.5	EI		3023
MnF^+	MnF		8.7±0.3	EI		2161
MnF^+	MnF		9.5±0.5	EI		2523
MnF^+	MnF_2	F	13.5±0.5	EI		2859
MnF^+	MnF_2	F	14.5±0.5	EI		3023
MnF^+	MnF_2	F	14.5	EI		2161
MnF^+	MnF_3		14.2±0.3	EI		2591
MnF_2^+						
MnF_2^+	MnF_2		11.5±0.3	EI		2161
MnF_2^+	MnF_2		11.7±0.5	EI		3023
MnF_2^+	MnF_2		12.5±0.5	EI		2859
MnF_2^+	MnF_2		13.4±0.5	EI		2523
MnF_2^+	MnF_3	F	13.7±0.3	EI		2591
MnF_3^+						
MnF_3^+	MnF_3		12±0.8	EI		2591

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
			$MnCl^+$			
$MnCl^+$	$Mn(CO)_5Cl$	5CO	13.8	EI		2501
			$C_5H_5Mn^+$			
$C_5H_5Mn^+$	$(C_5H_5)_2Mn$ (Bis(cyclopentadienyl)manganese)		11.09±0.1	EI		2683
$C_5H_5Mn^+$	$C_5H_5MnC_6H_6$ (Benzenecyclopentadienylmanganese)		9.4±0.2	EI		2530
$C_5H_5Mn^+$	$C_5H_5MnC_6H_6$ (Benzenecyclopentadienylmanganese)		12.3	EI		2417
$C_5H_5Mn^+$	$C_5H_5Mn(CO)_3$ (Cyclopentadienylmanganese tricarbonyl)	3CO	11.0±0.3	EI		2531
See also – EI:	1381					
			$C_6H_7Mn^+$			
$C_6H_7Mn^+$	$C_5H_5MnC_6H_6$ (Benzenecyclopentadienylmanganese)		12.1	EI		2417
			$C_9H_{11}Mn^+$			
$C_9H_{11}Mn^+$	$C_5H_5Mn(CO)C_4H_6$ (1,3–Butadienecyclopentadienylmanganese carbonyl)	CO	7.41±0.1	EI		2531
			$C_{10}H_{10}Mn^+$			
$C_{10}H_{10}Mn^+$	$(C_5H_5)_2Mn$ (Bis(cyclopentadienyl)manganese)		7.32±0.1	EI		2683
			$C_{10}H_{13}Mn^+$			
$C_{10}H_{13}Mn^+$	$C_5H_5Mn(CO)_2C_5H_8$ (Cyclopentadienyl(cyclopentene)manganese dicarbonyl)	2CO	8.11±0.1	EI		2531
			$C_{11}H_{11}Mn^+$			
$C_{11}H_{11}Mn^+$	$C_5H_5MnC_6H_6$ (Benzenecyclopentadienylmanganese)		6.92±0.1	EI		2530
$C_{11}H_{11}Mn^+$	$C_5H_5MnC_6H_6$ (Benzenecyclopentadienylmanganese)		7.1	EI		2417
			$C_{12}H_{13}Mn^+$			
$C_{12}H_{13}Mn^+$	$C_5H_5Mn(CO)_2C_7H_8$ (Bicyclo[2.2.1]hepta–2,5–dienecyclopentadienylmanganese dicarbonyl)	2CO	7.93±0.1	EI		2531

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_{12}H_{15}Mn^+$						
$C_{12}H_{15}Mn^+$	$C_5H_5Mn(CO)_2C_7H_{10}$ (Bicyclo[2.2.1]hept−2−enecyclopentadienylmanganese dicarbonyl)	2CO	7.80±0.1	EI		2531
$C_{12}H_{17}Mn^+$						
$C_{12}H_{17}Mn^+$	$C_5H_5Mn(CO)_2C_7H_{12}$ (Cycloheptenecyclopentadienylmanganese dicarbonyl)	2CO	7.98±0.1	EI		2531
$C_{13}H_{19}Mn^+$						
$C_{13}H_{19}Mn^+$	$C_5H_5Mn(CO)_2C_8H_{14}$ (Cyclooctenecyclopentadienylmanganese dicarbonyl)	2CO	7.88±0.1	EI		2531
$MnCO^+$						
$MnCO^+$	$Mn_2(CO)_{10}$		17.5±0.2	EI		2739
$MnCO^+$	$Mn_2(CO)_{10}$		18.21	EI		2563
$MnCO^+$	$Mn(CO)_5Cl$		~12.1	EI		2501
$MnCO^+$	$Mn(CO)_5Br$		15.13	EI		2501
$MnCO^+$	$Mn(CO)_5I$		14.4	EI		2501
$MnCO^+$	$ReMn(CO)_{10}$		19.05	EI		2563
$MnC_2O_2^+$						
$MnC_2O_2^+$	$Mn_2(CO)_{10}$		14.80	EI		2563
$MnC_3O_3^+$						
$MnC_3O_3^+$	$Mn(CO)_5Cl$		~9.7	EI		2501
$MnC_3O_3^+$	$Mn(CO)_5Br$		9.9	EI		2501
$MnC_3O_3^+$	$Mn(CO)_5I$		12.13	EI		2501
$MnC_5O_5^+$						
$MnC_5O_5^+$	$Mn(CO)_5$		8.2	EI		3251
$MnC_5O_5^+$	$Mn(CO)_5$		8.44±0.10	EI		2404, 2870
$MnC_5O_5^+$	$Mn_2(CO)_{10}$		9.26±0.1	EI		2404, 2870
$MnC_5O_5^+$	$Mn_2(CO)_{10}$		9.40	EI		2563, 3234, 3251
$MnC_5O_5^+$	$Mn(CO)_5Cl$	Cl	11.4	EI		3251
$MnC_5O_5^+$	$ReMn(CO)_{10}$		10.50	EI		3234
$Mn_2C_2O_2^+$						
$Mn_2C_2O_2^+$	$Mn_2(CO)_{10}$	8CO	16.43	EI		2563

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$Mn_2C_3O_3^+$						
$Mn_2C_3O_3^+$	$Mn_2(CO)_{10}$	7CO	15.34	EI		2563
$Mn_2C_4O_4^+$						
$Mn_2C_4O_4^+$	$Mn_2(CO)_{10}$	6CO	13.98	EI		2563
$Mn_2C_4O_4^+$	$Mn_2(CO)_{10}$	6CO	14.0±0.2	EI		2739
$Mn_2C_5O_5^+$						
$Mn_2C_5O_5^+$	$Mn_2(CO)_{10}$	5CO	11.91	EI		2563
$Mn_2C_5O_5^+$	$Mn_2(CO)_{10}$	5CO	12.6±0.2	EI		2739
$Mn_2C_{10}O_{10}^+$						
$Mn_2C_{10}O_{10}^+$	$Mn_2(CO)_{10}$		8.02 (V)	PE		2879
$Mn_2C_{10}O_{10}^+$	$Mn_2(CO)_{10}$		8.42±0.1	EI		2870
$Mn_2C_{10}O_{10}^+$	$Mn_2(CO)_{10}$		8.46±0.03	EI		3234
$Mn_2C_{10}O_{10}^+$	$Mn_2(CO)_{10}$		8.55±0.10	EI		2739
See also – EI:	2563					
$C_7H_{12}NMn^+$						
$C_7H_{12}NMn^+$	$C_5H_5Mn(CO)_2(CH_3)_2NH$ (Cyclopentadienyl(dimethylamine)manganese dicarbonyl)	2CO	7.42±0.1	EI		2531
$C_{12}H_{16}NMn^+$						
$C_{12}H_{16}NMn^+$	$C_5H_5Mn(CO)_2C_6H_{11}NC$ (Cyclopentadienyl(isocyanocyclohexane)manganese dicarbonyl)	2CO	7.82±0.1	EI		2531
$C_6H_5OMn^+$						
$C_6H_5OMn^+$	$C_5H_5Mn(CO)_3$ (Cyclopentadienylmanganese tricarbonyl)	2CO	9.46±0.2	EI		2531
See also – EI:	1381					
$C_{10}H_{11}OMn^+$						
$C_{10}H_{11}OMn^+$	$C_5H_5Mn(CO)C_4H_6$ (1,3–Butadienecyclopentadienylmanganese carbonyl)		6.60±0.1	EI		2531
$C_5H_7O_2Mn^+$						
$C_5H_7O_2Mn^+$	$(CH_3COCHCOCH_3)_2Mn$ (Bis(2,4–pentanedionato)manganese)		13.7±0.1	EI		2731

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_7H_5O_2Mn^+$						
$C_7H_5O_2Mn^+$	$C_5H_5Mn(CO)_2C_5H_8$ (Cyclopentadienyl(cyclopentene)manganese dicarbonyl)		8.11±0.1	EI		2531
$C_7H_5O_2Mn^+$	$C_5H_5Mn(CO)_3$ (Cyclopentadienylmanganese tricarbonyl)	CO	8.77±0.1	EI		2531
$C_{12}H_{13}O_2Mn^+$						
$C_{12}H_{13}O_2Mn^+$	$C_5H_5Mn(CO)_2C_5H_8$ (Cyclopentadienyl(cyclopentene)manganese dicarbonyl)		7.29±0.1	EI		2531
$C_{14}H_{13}O_2Mn^+$						
$C_{14}H_{13}O_2Mn^+$	$C_5H_5Mn(CO)_2C_7H_8$ (Bicyclo[2.2.1]hepta–2,5–dienecyclopentadienylmanganese dicarbonyl)		7.27±0.1	EI		2531
$C_{14}H_{15}O_2Mn^+$						
$C_{14}H_{15}O_2Mn^+$	$C_5H_5Mn(CO)_2C_7H_{10}$ (Bicyclo[2.2.1]hept–2–enecyclopentadienylmanganese dicarbonyl)		7.19±0.1	EI		2531
$C_{14}H_{17}O_2Mn^+$						
$C_{14}H_{17}O_2Mn^+$	$C_5H_5Mn(CO)_2C_7H_{12}$ (Cycloheptenecyclopentadienylmanganese dicarbonyl)		7.12±0.1	EI		2531
$C_{15}H_{19}O_2Mn^+$						
$C_{15}H_{19}O_2Mn^+$	$C_5H_5Mn(CO)_2C_8H_{14}$ (Cyclooctenecyclopentadienylmanganese dicarbonyl)		7.00±0.1	EI		2531
$C_8H_5O_3Mn^+$						
$C_8H_5O_3Mn^+$	$C_5H_5Mn(CO)_3$ (Cyclopentadienylmanganese tricarbonyl)		8.12±0.1	EI		2531
$C_8H_5O_3Mn^+$	$C_5H_5Mn(CO)_3$ (Cyclopentadienylmanganese tricarbonyl)		8.3±0.4	EI		1381
$C_9H_7O_3Mn^+$						
$C_9H_7O_3Mn^+$	$C_5H_5Mn(CO)_2C_4H_2O_3$ (Cyclopentadienyl(maleic acid anhydride)manganese dicarbonyl)	2CO	8.73±0.1	EI		2531
$C_9H_{11}O_4Mn^+$						
$C_9H_{11}O_4Mn^+$	$(CH_3COCHCOCH_3)_2Mn$ (Bis(2,4–pentanedionato)manganese)	CH_3	11.7±0.1	EI		2731

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
	$C_{10}H_{14}O_4Mn^+$					
$C_{10}H_{14}O_4Mn^+$	$(CH_3COCHCOCH_3)_2Mn$ (Bis(2,4–pentanedionato)manganese)		8.34±0.05	EI		2731
$C_{10}H_{14}O_4Mn^+$	$(CH_3COCHCOCH_3)_3Mn$ (Tris(2,4–pentanedionato)manganese)		≥8.7±0.1	EI		2460
	$C_5HO_5Mn^+$					
$C_5HO_5Mn^+$	$HMn(CO)_5$		9.00 (V)	PE		2879
	$C_6H_3O_5Mn^+$					
$C_6H_3O_5Mn^+$	$CH_3Mn(CO)_5$		8.46 (V)	PE		2879
	$C_{11}H_5O_5Mn^+$					
$C_{11}H_5O_5Mn^+$	$C_6H_5Mn(CO)_5$ (Phenylmanganese pentacarbonyl)		8.22±0.05	EI		3250
	$C_{11}H_7O_5Mn^+$					
$C_{11}H_7O_5Mn^+$	$C_5H_5Mn(CO)_2C_4H_2O_3$ (Cyclopentadienyl(maleic acid anhydride)manganese dicarbonyl)		8.04±0.1	EI		2531
	$C_{15}H_{21}O_6Mn^+$					
$C_{15}H_{21}O_6Mn^+$	$(CH_3COCHCOCH_3)_3Mn$ (Tris(2,4–pentanedionato)manganese)		7.85±0.05	EI		2460
$C_{15}H_{21}O_6Mn^+$	$(CH_3COCHCOCH_3)_3Mn$ (Tris(2,4–pentanedionato)manganese)		7.95±0.10	EI		2580
	$C_6O_5F_3Mn^+$					
$C_6O_5F_3Mn^+$	$CF_3Mn(CO)_5$		9.20 (V)	PE		2879
	$C_7O_6F_3Mn^+$					
$C_7O_6F_3Mn^+$	$CF_3COMn(CO)_5$		9.0 (V)	PE		2879
	$C_{14}H_{26}PMn^+$					
$C_{14}H_{26}PMn^+$	$C_5H_5Mn(CO)_2(C_3H_7)_3P$ (Cyclopentadienyl(triisopropylphosphine)manganese dicarbonyl)	2CO	7.80±0.1	EI		2531
	$COClMn^+$					
$COClMn^+$	$Mn(CO)_5Cl$	4CO	11.3	EI		2501

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_2O_2ClMn^+$				
$C_2O_2ClMn^+$	$Mn(CO)_5Cl$	3CO	10.6	EI		2501
		$C_5O_5ClMn^+$				
$C_5O_5ClMn^+$	$Mn(CO)_5Cl$		8.83 (V)	PE		2879
$C_5O_5ClMn^+$	$Mn(CO)_5Cl$		9.12±0.08	EI		2501
		$C_9H_{12}NO_2Mn^+$				
$C_9H_{12}NO_2Mn^+$	$C_5H_5Mn(CO)_2(CH_3)_2NH$ (Cyclopentadienyl(dimethylamine)manganese dicarbonyl)		6.55±0.1	EI		2531
		$C_{14}H_{16}NO_2Mn^+$				
$C_{14}H_{16}NO_2Mn^+$	$C_5H_5Mn(CO)_2C_6H_{11}NC$ (Cyclopentadienyl(isocyanocyclohexane)manganese dicarbonyl)		7.01±0.1	EI		2531
		$C_7H_8O_2PMn^+$				
$C_7H_8O_2PMn^+$	$C_5H_5Mn(CO)_2PH_3$ (Cyclopentadienyl(phosphine)manganese dicarbonyl)		7.28±0.05	EI		2597
		$C_{16}H_{26}O_2PMn^+$				
$C_{16}H_{26}O_2PMn^+$	$C_5H_5Mn(CO)_2(C_3H_7)_3P$ (Cyclopentadienyl(triisopropylphosphine)manganese dicarbonyl)		6.55±0.1	EI		2531
$C_{16}H_{26}O_2PMn^+$	$C_5H_5Mn(CO)_2(C_3H_7)_3P$ (Cyclopentadienyl(triisopropylphosphine)manganese dicarbonyl)		6.90±0.05	EI		2597
		$C_{25}H_{20}O_2PMn^+$				
$C_{25}H_{20}O_2PMn^+$	$C_5H_5Mn(CO)_2(C_6H_5)_3P$ (Cyclopentadienyl(triphenylphosphine)manganese dicarbonyl)		6.93±0.05	EI		2597
		$C_{16}H_{26}O_5PMn^+$				
$C_{16}H_{26}O_5PMn^+$	$C_5H_5Mn(CO)_2(C_3H_7O)_3P$ (Cyclopentadienyl(triisopropoxyphosphine)manganese dicarbonyl)		7.17±0.05	EI		2597
		$C_{25}H_{20}O_5PMn^+$				
$C_{25}H_{20}O_5PMn^+$	$C_5H_5Mn(CO)_2(C_6H_5O)_3P$ (Cyclopentadienyl(triphenoxyphosphine)manganese dicarbonyl)		7.40±0.05	EI		2597

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
			$C_7H_{11}OSMn^+$			
$C_7H_{11}OSMn^+$	$C_5H_5Mn(CO)_2(CH_3)_2SO$ (Cyclopentadienyl(dimethylsulfoxide)manganese dicarbonyl)	2CO	7.68±0.1	EI		2531
			$C_9H_{11}O_3SMn^+$			
$C_9H_{11}O_3SMn^+$	$C_5H_5Mn(CO)_2(CH_3)_2SO$ (Cyclopentadienyl(dimethylsulfoxide)manganese dicarbonyl)		7.12±0.1	EI		2531
			$C_7H_5O_2PCl_3Mn^+$			
$C_7H_5O_2PCl_3Mn^+$	$C_5H_5Mn(CO)_2PCl_3$ (Cyclopentadienyl(trichlorophosphine)manganese dicarbonyl)		8.12±0.05	EI		2597
	Fe^+	**ΔH°_{f0} = 1173.3 kJ mol^{-1} (280.4 kcal mol^{-1})**				
Fe^+	Fe		7.870	S	1173.3	2113
Fe^+	FeF_2		16.5±0.3	EI		1280
Fe^+	FeF_3		20.5±0.3	EI		2591
Fe^+	$FeCl_2$		16.5±0.5	EI		397
Fe^+	$(C_5H_5)_2Fe$ (Bis(cyclopentadienyl)iron)		14.4±0.5	EI		2683
Fe^+	$Fe(CO)_5$	5CO	14.23±0.1	PI		2956
(Threshold value approximately corrected for hot bands)						
Fe^+	$Fe(CO)_5$	5CO	14.7±0.1	EI		2023
Fe^+	$Fe(CO)_5$	5CO	15.31±0.1	EI		2403
Fe^+	$Fe(CO)_5$	5CO	15.99	EI		2500
Fe^+	$Fe(CO)_5$	5CO	16.1±0.2	EI		112
Fe^+	$FeBr_2$		16.6±0.5	EI		174
			Fe_2^+			
Fe_2^+	Fe_2		5.90±0.2	EI		2917
			FeC^+			
FeC^+	$Fe(CO)_5$		23.6±0.3	EI		2403
			FeO^+			
FeO^+	FeO		8±1	EI		3366
			FeF^+			
FeF^+	FeF_2	F	12.6±0.3	EI		1280
FeF^+	FeF_3		16.0±0.3	EI		2591

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		FeF_2^+				
FeF_2^+	FeF_2		11.3±0.3	EI		1280
FeF_2^+	FeF_3	F	13.7±0.3	EI		2591
		FeF_3^+				
FeF_3^+	FeF_3		12.5±0.3	EI		2591
		$Fe_2F_5^+$				
$Fe_2F_5^+$	Fe_2F_6	F	12.1±0.5	EI		2591
		$FeCl^+$				
$FeCl^+$	$FeCl_2$	Cl	12.8±0.5	EI		397
		$FeCl_2^+$				
$FeCl_2^+$	$FeCl_2$		11.5±0.5	EI		397
		$Fe_2Cl_3^+$				
$Fe_2Cl_3^+$	Fe_2Cl_4	Cl	12.0±1.0	EI		397
		$Fe_2Cl_4^+$				
$Fe_2Cl_4^+$	Fe_2Cl_4		10.5±1.0	EI		397
		$C_3H_3Fe^+$				
$C_3H_3Fe^+$	$(C_5H_5)_2Fe$ (Bis(cyclopentadienyl)iron)		18.9±0.1	EI		2683
		$C_5H_5Fe^+$				
$C_5H_5Fe^+$	$(C_5H_5)_2Fe$ (Bis(cyclopentadienyl)iron)		12.8±1	EI		2545
$C_5H_5Fe^+$	$(C_5H_5)_2Fe$ (Bis(cyclopentadienyl)iron)		13.78±0.1	EI		2683
$C_5H_5Fe^+$	$C_5H_5FeC_4H_4N$ (Cyclopentadienyl(pyrrolyl)iron)		12.6±0.2	EI		3252
		$C_8H_8Fe^+$				
$C_8H_8Fe^+$	$(C_5H_5)_2Fe$ (Bis(cyclopentadienyl)iron)		13.27±0.1	EI		2683

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_{10}H_{10}Fe^+$						
$C_{10}H_{10}Fe^+$	$(C_5H_5)_2Fe$ (Bis(cyclopentadienyl)iron)		6.99	EI		2453
$C_{10}H_{10}Fe^+$	$(C_5H_5)_2Fe$ (Bis(cyclopentadienyl)iron)		7.15±0.1	EI		2683
$C_{10}H_{10}Fe^+$ (Average of two values)	$(C_5H_5)_2Fe$ (Bis(cyclopentadienyl)iron)		6.97	CTS		3403
$C_{11}H_{12}Fe^+$						
$C_{11}H_{12}Fe^+$	$C_5H_5FeC_5H_4CH_3$ (Cyclopentadienyl(methylcyclopentadienyl)iron)		6.76	CTS		3403
$C_{12}H_{14}Fe^+$						
$C_{12}H_{14}Fe^+$	$(C_5H_4CH_3)_2Fe$ (Bis(methylcyclopentadienyl)iron)		6.65	CTS		3403
$C_{16}H_{22}Fe^+$						
$C_{16}H_{22}Fe^+$	$(C_5H_4C_3H_7)_2Fe$ (Bis(propylcyclopentadienyl)iron)		6.85	CTS		3403
$FeCO^+$						
$FeCO^+$	$Fe(CO)_5$	4CO	11.53±0.1	PI		2956
$FeCO^+$	$Fe(CO)_5$	4CO	12.9±0.1	EI		2023
$FeCO^+$	$Fe(CO)_5$	4CO	13.39±0.07	EI		2403
$FeCO^+$	$Fe(CO)_5$	4CO	13.76	EI		2500
$FeCO^+$	$Fe(CO)_5$	4CO	14.0±0.2	EI		112
$FeCO^{+2}$						
$FeCO^{+2}$	$Fe(CO)_5$		30.2±2	EI		112
$FeC_2O_2^+$						
$FeC_2O_2^+$	$Fe(CO)_5$	3CO	10.68±0.1	PI		2956
$FeC_2O_2^+$	$Fe(CO)_5$	3CO	10.92±0.04	EI		2023
$FeC_2O_2^+$	$Fe(CO)_5$	3CO	11.12	EI		2500
$FeC_2O_2^+$	$Fe(CO)_5$	3CO	11.27±0.05	EI		2403
$FeC_2O_2^+$	$Fe(CO)_5$	3CO	11.8±0.2	EI		112

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$FeC_3O_3^+$				
$FeC_3O_3^+$	$Fe(CO)_5$	2CO	9.87±0.1	PI		2956
$FeC_3O_3^+$	$Fe(CO)_5$	2CO	9.89±0.05	EI		2023
$FeC_3O_3^+$	$Fe(CO)_5$	2CO	10.01±0.04	EI		2403
$FeC_3O_3^+$	$Fe(CO)_5$	2CO	10.04	EI		2500
$FeC_3O_3^+$	$Fe(CO)_5$	2CO	10.3±0.3	EI		112
		$FeC_4O_4^+$				
$FeC_4O_4^+$	$Fe(CO)_4$		8.48	EI		2546
$FeC_4O_4^+$	$Fe(CO)_5$	CO	8.77±0.1	PI		2956
$FeC_4O_4^+$	$Fe(CO)_5$	CO	9.10	EI		2546
See also – PI:	2886					
EI:	112, 2023, 2403, 2500					
	$Fe(CO)_5^+$	**ΔH°_{f298} = 36 kJ mol^{-1} (9 kcal mol^{-1})**				
$FeC_5O_5^+$	$Fe(CO)_5$		7.95±0.03	PI		1167
$FeC_5O_5^+$	$Fe(CO)_5$		7.96±0.02	PI		2886
$FeC_5O_5^+$	$Fe(CO)_5$		7.98±0.01	PI	36	2956
$FeC_5O_5^+$	$Fe(CO)_5$		8.00±0.08	PE		2886
See also – EI:	112, 2023, 2403, 2500					
		$Fe_2C_9O_9^+$				
$Fe_2C_9O_9^+$	$Fe_2(CO)_9$		7.91±0.01	EI		3250
		$C_9H_9NFe^+$				
$C_9H_9NFe^+$	$C_5H_5FeC_4H_4N$ (Cyclopentadienyl(pyrrolyl)iron)		7.17±0.1	EI		3252
		$C_5H_7O_2Fe^+$				
$C_5H_7O_2Fe^+$	$(CH_3COCHCOCH_3)_2Fe$ (Bis(2,4-pentanedionato)iron)		13.9±0.1	EI		2731, 2959
		$C_7H_4O_3Fe^+$				
$C_7H_4O_3Fe^+$	$C_4H_4Fe(CO)_3$ (Cyclobutadieneiron tricarbonyl)		8.04	PE		2843, 3056

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_7H_6O_3Fe^+$				
$C_7H_6O_3Fe^+$	*cis*–CH_2=CHCH=$CH_2Fe(CO)_3$		8.04	PE		2843, 3056
$C_7H_6O_3Fe^+$	$(CH_2)_3CFe(CO)_3$		8.32±0.02	PE		2845
		$C_8H_8O_3Fe^+$				
$C_8H_8O_3Fe^+$	CH_2=CHCH=$CHCH_3Fe(CO)_3$		7.84	PE		2843
		$C_9H_8O_3Fe^+$				
$C_9H_8O_3Fe^+$	$C_6H_8Fe(CO)_3$ (1,3–Cyclohexadieneiron tricarbonyl)		8.0±0.2	EI		2963
		$C_8H_4O_4Fe^+$				
$C_8H_4O_4Fe^+$	$C_4H_3CHOFe(CO)_3$ (Cyclobutadienecarboxaldehydeiron tricarbonyl)		8.32	PE		2843
		$C_9H_6O_4Fe^+$				
$C_9H_6O_4Fe^+$	$C_4H_3COCH_3Fe(CO)_3$ (Cyclobutadienyl methyl ketone iron tricarbonyl)		8.27	PE		2843
		$C_9H_{11}O_4Fe^+$				
$C_9H_{11}O_4Fe^+$	$(CH_3COCHCOCH_3)_2Fe$ (Bis(2,4–pentanedionato)iron)		11.7±0.1	EI		2731, 2959
		$C_{10}H_{14}O_4Fe^+$				
$C_{10}H_{14}O_4Fe^+$	$(CH_3COCHCOCH_3)_2Fe$ (Bis(2,4–pentanedionato)iron)		7.50±0.04	EI		2992
$C_{10}H_{14}O_4Fe^+$	$(CH_3COCHCOCH_3)_2Fe$ (Bis(2,4–pentanedionato)iron)		8.10±0.05	EI		2460, 2731, 2959
$C_{10}H_{14}O_4Fe^+$	$(CH_3COCHCOCH_3)_3Fe$ (Tris(2,4–pentanedionato)iron)		≥9.4±0.1	EI		2460, 2959
		$C_{15}H_{21}O_6Fe^+$				
$C_{15}H_{21}O_6Fe^+$	$(CH_3COCHCOCH_3)_3Fe$ (Tris(2,4–pentanedionato)iron)		8.45±0.05	EI		2460, 2959
$C_{15}H_{21}O_6Fe^+$	$(CH_3COCHCOCH_3)_3Fe$ (Tris(2,4–pentanedionato)iron)		8.64±0.11	EI		2580

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$CN_2O_3Fe^+$				
$CN_2O_3Fe^+$?	$Fe(CO)_2(NO)_2$		9.46±0.09	PI		2886
Because mass analysis was not employed, identification of this ion is uncertain.						
		$C_2N_2O_4Fe^+$				
$C_2N_2O_4Fe^+$	$Fe(CO)_2(NO)_2$		8.25±0.12	PI		2886
$C_2N_2O_4Fe^+$	$Fe(CO)_2(NO)_2$		8.45±0.1	EI		2453
		$C_7H_5NO_3Fe^+$				
$C_7H_5NO_3Fe^+$	$C_4H_3NH_2Fe(CO)_3$ (Aminocyclobutadieneiron tricarbonyl)		7.77	PE		2843
		$C_5H_4O_2F_3Fe^+$				
$C_5H_4O_2F_3Fe^+$	$(CF_3COCHCOCH_3)_2Fe$ (Bis(1,1,1–trifluoro–2,4–pentanedionato)iron)		14.5±0.1	EI		2959
		$C_9H_8O_4F_3Fe^+$				
$C_9H_8O_4F_3Fe^+$	$(CF_3COCHCOCH_3)_2Fe$ (Bis(1,1,1–trifluoro–2,4–pentanedionato)iron)		12.6±0.1	EI		2959
		$C_{10}H_8O_4F_6Fe^+$				
$C_{10}H_8O_4F_6Fe^+$	$(CF_3COCHCOCH_3)_2Fe$ (Bis(1,1,1–trifluoro–2,4–pentanedionato)iron)		8.49±0.03	EI		2992
$C_{10}H_8O_4F_6Fe^+$	$(CF_3COCHCOCH_3)_2Fe$ (Bis(1,1,1–trifluoro–2,4–pentanedionato)iron)		8.75±0.1	EI		2959
$C_{10}H_8O_4F_6Fe^+$	$CH_3COCHCOCH_3FeCF_3COCHCOCF_3$ (1,1,1,5,5,5–Hexafluoro–2,4–pentanedionato(2,4–pentanedionato)iron)		8.70±0.04	EI		2992
$C_{10}H_8O_4F_6Fe^+$	$(CF_3COCHCOCH_3)_3Fe$ (Tris(1,1,1–trifluoro–2,4–pentanedionato)iron)		9.2±0.1?	EI		2959
		$C_9H_2O_4F_9Fe^+$				
$C_9H_2O_4F_9Fe^+$	$(CF_3COCHCOCF_3)_2Fe$ (Bis(1,1,1,5,5,5–hexafluoro–2,4–pentanedionato)iron)		13.2±0.2	EI		2959
		$C_{15}H_{12}O_6F_9Fe^+$				
$C_{15}H_{12}O_6F_9Fe^+$	$(CF_3COCHCOCH_3)_3Fe$ (Tris(1,1,1–trifluoro–2,4–pentanedionato)iron)		9.10±0.05	EI		2959
$C_{15}H_{12}O_6F_9Fe^+$	$(CF_3COCHCOCH_3)_3Fe$ (Tris(1,1,1–trifluoro–2,4–pentanedionato)iron)		9.38±0.11	EI		2580

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_{10}H_2O_4F_{12}Fe^+$						
$C_{10}H_2O_4F_{12}Fe^+$	$(CF_3COCHCOCF_3)_2Fe$ (Bis(1,1,1,5,5,5–hexafluoro–2,4–pentanedionato)iron)		9.48±0.07	EI		2992
$C_{10}H_2O_4F_{12}Fe^+$	$(CF_3COCHCOCF_3)_2Fe$ (Bis(1,1,1,5,5,5–hexafluoro–2,4–pentanedionato)iron)		9.7±0.1	EI		2959
$C_{10}H_2O_4F_{12}Fe^+$	$(CF_3COCHCOCF_3)_3Fe$ (Tris(1,1,1,5,5,5–hexafluoro–2,4–pentanedionato)iron)		10.2±0.1?	EI		2959
$C_{14}H_3O_6F_{15}Fe^+$						
$C_{14}H_3O_6F_{15}Fe^+$	$(CF_3COCHCOCF_3)_3Fe$ (Tris(1,1,1,5,5,5–hexafluoro–2,4–pentanedionato)iron)		11.1±0.1	EI		2959
$C_{15}H_3O_6F_{18}Fe^+$						
$C_{15}H_3O_6F_{18}Fe^+$	$(CF_3COCHCOCF_3)_3Fe$ (Tris(1,1,1,5,5,5–hexafluoro–2,4–pentanedionato)iron)		8.28 (V)	PE		3169
This value may be spurious, see ref. 3239.						
$C_{15}H_3O_6F_{18}Fe^+$	$(CF_3COCHCOCF_3)_3Fe$ (Tris(1,1,1,5,5,5–hexafluoro–2,4–pentanedionato)iron)		10.13±0.03 (V)	PE		3239
$C_{15}H_3O_6F_{18}Fe^+$	$(CF_3COCHCOCF_3)_3Fe$ (Tris(1,1,1,5,5,5–hexafluoro–2,4–pentanedionato)iron)		10.14 (V)	PE		3169
$C_{15}H_3O_6F_{18}Fe^+$	$(CF_3COCHCOCF_3)_3Fe$ (Tris(1,1,1,5,5,5–hexafluoro–2,4–pentanedionato)iron)		10.2±0.1	EI		2959
$C_{15}H_3O_6F_{18}Fe^+$	$(CF_3COCHCOCF_3)_3Fe$ (Tris(1,1,1,5,5,5–hexafluoro–2,4–pentanedionato)iron)		10.34±0.10	EI		2580
$C_{16}H_{27}O_4PFe^+$						
$C_{16}H_{27}O_4PFe^+$	$(n\text{–}C_4H_9)_3PFe(CO)_4$		7.29±0.05	EI		2481, 2716
$C_7H_9O_7PFe^+$						
$C_7H_9O_7PFe^+$	$(CH_3O)_3PFe(CO)_4$		7.65±0.05	EI		2481, 2716
$C_{10}H_{15}O_7PFe^+$						
$C_{10}H_{15}O_7PFe^+$	$(C_2H_5O)_3PFe(CO)_4$		7.43±0.05	EI		2481, 2716
$C_9H_{18}O_9P_2Fe^+$						
$C_9H_{18}O_9P_2Fe^+$	$((CH_3O)_3P)_2Fe(CO)_3$		7.33	EI		2716
$C_{10}H_{12}O_6P_2Fe_2^+$						
$C_{10}H_{12}O_6P_2Fe_2^+$	$((CH_3)_2P)_2Fe_2(CO)_6$		7.73±0.01	EI		3250

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_{14}H_{20}O_6P_2Fe_2^+$				
$C_{14}H_{20}O_6P_2Fe_2^+$	$((C_2H_5)_2P)_2Fe_2(CO)_6$		7.67±0.02	EI		3250
		$C_{30}H_{20}O_6P_2Fe_2^+$				
$C_{30}H_{20}O_6P_2Fe_2^+$	$((C_6H_5)_2P)_2Fe_2(CO)_6$ (Bis(diphenylphosphino)diiron hexacarbonyl)		7.70±0.03	EI		3250
		$C_8H_6O_6S_2Fe_2^+$				
$C_8H_6O_6S_2Fe_2^+$	$(CH_3S)_2Fe_2(CO)_6$		8.07±0.01	EI		3250
		$C_{12}H_{14}O_6S_2Fe_2^+$				
$C_{12}H_{14}O_6S_2Fe_2^+$	$(\textit{iso}-C_3H_7S)_2Fe_2(CO)_6$		8.05±0.01	EI		3250
		$C_{18}H_{10}O_6S_2Fe_2^+$				
$C_{18}H_{10}O_6S_2Fe_2^+$	$(C_6H_5S)_2Fe_2(CO)_6$ (Bis(phenylthio)diiron hexacarbonyl)		7.90±0.01	EI		3250
		$C_4O_4PCl_3Fe^+$				
$C_4O_4PCl_3Fe^+$	$PCl_3Fe(CO)_4$		8.05±0.05	EI		2481, 2716
		$C_{12}H_{27}N_2O_2PFe^+$				
$C_{12}H_{27}N_2O_2PFe^+$	$(n-C_4H_9)_3PFe(CO)(NO)_2$	CO	7.70	EI		2480
		$C_3H_9N_2O_5PFe^+$				
$C_3H_9N_2O_5PFe^+$	$(CH_3O)_3PFe(CO)(NO)_2$	CO	8.20	EI		2480
$C_3H_9N_2O_5PFe^+$	$((CH_3O)_3P)_2Fe(NO)_2$		9.75	EI		2480
		$C_6H_{15}N_2O_5PFe^+$				
$C_6H_{15}N_2O_5PFe^+$	$(C_2H_5O)_3PFe(CO)(NO)_2$	CO	8.15	EI		2480
$C_6H_{15}N_2O_5PFe^+$	$((C_2H_5O)_3P)_2Fe(NO)_2$		9.45	EI		2480
		$C_{12}H_{27}N_2O_5PFe^+$				
$C_{12}H_{27}N_2O_5PFe^+$	$(n-C_4H_9O)_3PFe(CO)(NO)_2$	CO	7.85	EI		2480

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_4H_9N_2O_6PFe^+$				
$C_4H_9N_2O_6PFe^+$	$(CH_3O)_3PFe(CO)(NO)_2$		7.66±0.05	EI		2481
		$C_7H_{15}N_2O_6PFe^+$				
$C_7H_{15}N_2O_6PFe^+$	$(C_2H_5O)_3PFe(CO)(NO)_2$		7.50±0.1	EI		2453, 2716
		$C_{13}H_{27}N_2O_6PFe^+$				
$C_{13}H_{27}N_2O_6PFe^+$	$(n-C_4H_9O)_3PFe(CO)(NO)_2$		7.52±0.05	EI		2481
$C_{13}H_{27}N_2O_6PFe^+$	$(n-C_4H_9O)_3PFe(CO)(NO)_2$		7.57	EI		2716
		$C_6H_{18}N_2O_8P_2Fe^+$				
$C_6H_{18}N_2O_8P_2Fe^+$	$((CH_3O)_3P)_2Fe(NO)_2$		7.25	EI		2480
		$C_{12}H_{30}N_2O_8P_2Fe^+$				
$C_{12}H_{30}N_2O_8P_2Fe^+$	$((C_2H_5O)_3P)_2Fe(NO)_2$		7.02	EI		2480, 2716
		$C_{24}H_{15}O_6PSFe_2^+$				
$C_{24}H_{15}O_6PSFe_2^+$	$(C_6H_5)_2P(C_6H_5S)Fe_2(CO)_6$ (Diphenylphosphino(phenylthio)diiron hexacarbonyl)		7.81±0.05	EI		3250
Co^+		**$\Delta H^\circ_{f0} = 1181$ kJ mol^{-1} (282 kcal mol^{-1})**				
Co^+	Co		7.86	S	1181	2113
See also – EI:	2444					
Co^+	$(C_5H_5)_2Co$ (Bis(cyclopentadienyl)cobalt)		14.66±0.2	EI		2683
Co^+	$Co_2(CO)_8$		16.9±0.4	EI		2739
Co^+	$C_5H_5Co(CO)_2$ (Cyclopentadienylcobalt dicarbonyl)		16.8±0.3	EI		1381
Co^+	$HCo(CO)_4$		17.8±0.3	EI		2583
Co^+	$HCo(PF_3)_4$		17.8±0.3	EI		2583
Co^+	$SiF_3Co(CO)_4$		17.8±0.2	EI		2582
Co^+	$SiCl_3Co(CO)_4$		19.2±0.3	EI		3255
Co^+	$CH_3SiF_2Co(CO)_4$		19.5±0.3	EI		2581
Co^+	$HCo(CO)_3PF_3$		17.8±0.3	EI		2583
Co^+	$HCo(CO)_2(PF_3)_2$		18.2±0.3	EI		2583
Co^+	$HCo(CO)(PF_3)_3$		17.8±0.3	EI		2583

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		Co_2^+				
Co_2^+	$Co_2(CO)_8$	8CO	17.8±0.4	EI		2739
		CoH^+				
CoH^+	$HCo(CO)_4$	4CO	15.2±0.3	EI		2583
CoH^+	$HCo(PF_3)_4$		16.0±0.3	EI		2583
CoH^+	$HCo(CO)_3PF_3$		14.6±0.3	EI		2583
CoH^+	$HCo(CO)_2(PF_3)_2$		14.9±0.3	EI		2583
CoH^+	$HCo(CO)(PF_3)_3$		15.6±0.3	EI		2583
		CoO^+				
CoO^+	CoO		9.0	EI		2444
		CoF^+				
CoF^+	$SiF_3Co(CO)_4$		21.0±0.3	EI		2582
		CH_3Co^+				
CH_3Co^+	$CH_3SiF_2Co(CO)_4$		16.6±0.3	EI		2581
		$C_3H_3Co^+$				
$C_3H_3Co^+$	$(C_5H_5)_2Co$ (Bis(cyclopentadienyl)cobalt)		17.62±0.1	EI		2683
$C_3H_3Co^+$	$C_5H_5Co(CO)_2$ (Cyclopentadienylcobalt dicarbonyl)		16.8±0.3	EI		1381
		$C_5H_5Co^+$				
$C_5H_5Co^+$	C_5H_5Co (Cyclopentadienylcobalt)		10.1	EI		2546
$C_5H_5Co^+$	$(C_5H_5)_2Co$ (Bis(cyclopentadienyl)cobalt)		12.3±1	EI		2545
$C_5H_5Co^+$	$(C_5H_5)_2Co$ (Bis(cyclopentadienyl)cobalt)		14.00±0.1	EI		2683
$C_5H_5Co^+$	$C_5H_5Co(CO)_2$ (Cyclopentadienylcobalt dicarbonyl)	2CO	10.8±0.2	EI		2545, 2546
$C_5H_5Co^+$	$C_5H_5Co(CO)_2$ (Cyclopentadienylcobalt dicarbonyl)	2CO	11.7±0.2	EI		1381

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
			$C_{10}H_{10}Co^+$			
$C_{10}H_{10}Co^+$	$(C_5H_5)_2Co$ (Bis(cyclopentadienyl)cobalt)		5.95±0.1	EI		2545
$C_{10}H_{10}Co^+$	$(C_5H_5)_2Co$ (Bis(cyclopentadienyl)cobalt)		6.21±0.1	EI		2683
			$LiCoO^+$			
$LiCoO^+$	$LiCoO_2$	O	16.0±0.5	EI		2565
			$LiCoO_2^+$			
$LiCoO_2^+$	$LiCoO_2$		11.0±0.5	EI		2565
			$CoCO^+$			
$CoCO^+$	$Co_2(CO)_8$		14.4±0.5	EI		2739
$CoCO^+$	$C_5H_5Co(CO)_2$ (Cyclopentadienylcobalt dicarbonyl)		16.5±0.4	EI		1381
$CoCO^+$	$HCo(CO)_4$		15.0±0.3	EI		2583
$CoCO^+$	$SiF_3Co(CO)_4$		15.9±0.2	EI		2582
$CoCO^+$	$CH_3SiF_2Co(CO)_4$		16.4±0.4	EI		2581
$CoCO^+$	$HCo(CO)_3PF_3$		15.5±0.2	EI		2583
$CoCO^+$	$HCo(CO)_2(PF_3)_2$		15.3±0.3	EI		2583
$CoCO^+$	$HCo(CO)(PF_3)_3$		15.9±0.2	EI		2583
			$CoC_2O_2^+$			
$CoC_2O_2^+$	$Co_2(CO)_8$		12.7±0.4	EI		2739
$CoC_2O_2^+$	$HCo(CO)_4$		12.9±0.3	EI		2583
$CoC_2O_2^+$	$SiF_3Co(CO)_4$		14.0±0.2	EI		2582
$CoC_2O_2^+$	$SiCl_3Co(CO)_4$		14.3±0.3	EI		3255
$CoC_2O_2^+$	$CH_3SiF_2Co(CO)_4$		14.7±0.3	EI		2581
$CoC_2O_2^+$	$HCo(CO)_3PF_3$		14.0±0.2	EI		2583
$CoC_2O_2^+$	$HCo(CO)_2(PF_3)_2$		13.6±0.2	EI		2583
			$CoC_3O_3^+$			
$CoC_3O_3^+$	$Co_2(CO)_8$		10.9±0.3	EI		2739
$CoC_3O_3^+$	$HCo(CO)_4$		12.1±0.3	EI		2583
$CoC_3O_3^+$	$HCo(CO)_3PF_3$		12.1±0.2	EI		2583
			$CoC_4O_4^+$			
$CoC_4O_4^+$	$Co(CO)_4$		8.30±0.1	EI		2405, 2870
$CoC_4O_4^+$	$Co_2(CO)_8$		8.80±0.1	EI		2405, 2870

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		Co_2CO^+				
Co_2CO^+	$Co_2(CO)_8$	7CO	16.7±0.3	EI		2739
		$Co_2C_2O_2^+$				
$Co_2C_2O_2^+$	$Co_2(CO)_8$	6CO	14.7±0.5	EI		2739
		$Co_2C_4O_4^+$				
$Co_2C_4O_4^+$	$Co_2(CO)_8$	4CO	12.2±0.3	EI		2739
		$Co_2C_5O_5^+$				
$Co_2C_5O_5^+$	$Co_2(CO)_8$	3CO	10.1±0.4	EI		2739
		$Co_2C_6O_6^+$				
$Co_2C_6O_6^+$	$Co_2(CO)_8$	2CO	9.4±0.3	EI		2739
		$Co_2C_7O_7^+$				
$Co_2C_7O_7^+$	$Co_2(CO)_8$	CO	8.6±0.3	EI		2739
		$Co_2C_8O_8^+$				
$Co_2C_8O_8^+$	$Co_2(CO)_8$		8.12±0.22	EI		2739
$Co_2C_8O_8^+$	$Co_2(CO)_8$		8.26±0.1	EI		2870
		$CoSiF_3^+$				
$CoSiF_3^+$	$SiF_3Co(CO)_4$	4CO	15.1±0.1	EI		2582
		$CoPF_3^+$				
$CoPF_3^+$	$HCo(PF_3)_4$		15.8±0.3	EI		2583
$CoPF_3^+$	$HCo(CO)_3PF_3$		15.7±0.2	EI		2583
$CoPF_3^+$	$HCo(CO)_2(PF_3)_2$		15.9±0.2	EI		2583
$CoPF_3^+$	$HCo(CO)(PF_3)_3$		15.7±0.5	EI		2583
		$CoP_2F_6^+$				
$CoP_2F_6^+$	$HCo(PF_3)_4$		14.3±0.3	EI		2583
$CoP_2F_6^+$	$HCo(CO)(PF_3)_3$		14.5±0.2	EI		2583

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$CoSiCl_3^+$						
$CoSiCl_3^+$	$SiCl_3Co(CO)_4$	4CO	13.3±0.3	EI		3255
$CHOCo^+$						
$CHOCo^+$	$HCo(CO)_4$	3CO	12.8±0.3	EI		2583
$CHOCo^+$	$HCo(CO)_3PF_3$		12.1±0.2	EI		2583
$CHOCo^+$	$HCo(CO)_2(PF_3)_2$		12.3±0.2	EI		2583
$CHOCo^+$	$HCo(CO)(PF_3)_3$		12.0±0.2	EI		2583
$C_6H_5OCo^+$						
$C_6H_5OCo^+$	$C_5H_5Co(CO)_2$ (Cyclopentadienylcobalt dicarbonyl)	CO	10.1±0.2	EI		1381
$C_2HO_2Co^+$						
$C_2HO_2Co^+$	$HCo(CO)_4$	2CO	11.2±0.2	EI		2583
$C_2HO_2Co^+$	$HCo(CO)_3PF_3$		12.4±0.3	EI		2583
$C_2HO_2Co^+$	$HCo(CO)_2(PF_3)_2$		11.6±0.2	EI		2583
$C_5H_7O_2Co^+$						
$C_5H_7O_2Co^+$	$(CH_3COCHCOCH_3)_2Co$ (Bis(2,4–pentanedionato)cobalt)		13.9±0.2	EI		2731
$C_7H_5O_2Co^+$						
$C_7H_5O_2Co^+$	$C_5H_5Co(CO)_2$ (Cyclopentadienylcobalt dicarbonyl)		7.78±0.1	EI		2545
$C_7H_5O_2Co^+$	$C_5H_5Co(CO)_2$ (Cyclopentadienylcobalt dicarbonyl)		8.3±0.2	EI		1381
$C_{11}H_{19}O_2Co^+$						
$C_{11}H_{19}O_2Co^+$	$((CH_3)_3CCOCHCOC(CH_3)_3)_3Co$ (Tris(2,2,6,6–tetramethyl–3,5–heptanedionato)cobalt)		27.0±0.5	EI		2524
$C_3HO_3Co^+$						
$C_3HO_3Co^+$	$HCo(CO)_4$	CO	9.4±0.2	EI		2583
$C_3HO_3Co^+$	$HCo(CO)_3PF_3$		9.9±0.2	EI		2583
$C_4HO_4Co^+$						
$C_4HO_4Co^+$	$HCo(CO)_4$		8.7±0.1	EI		2583

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_9H_{11}O_4Co^+$				
$C_9H_{11}O_4Co^+$	$(CH_3COCHCOCH_3)_2Co$ (Bis(2,4–pentanedionato)cobalt)		11.5±0.1	EI		2731
		$C_{10}H_{14}O_4Co^+$				
$C_{10}H_{14}O_4Co^+$	$(CH_3COCHCOCH_3)_2Co$ (Bis(2,4–pentanedionato)cobalt)		8.54±0.05	EI		2731
$C_{10}H_{14}O_4Co^+$	$(CH_3COCHCOCH_3)_3Co$ (Tris(2,4–pentanedionato)cobalt)		10.7±0.3	EI		2460
		$C_{18}H_{29}O_4Co^+$				
$C_{18}H_{29}O_4Co^+$	$((CH_3)_3CCOCHCOC(CH_3)_3)_3Co$ (Tris(2,2,6,6–tetramethyl–3,5–heptanedionato)cobalt)		17.4±0.5	EI		2524
		$C_{22}H_{38}O_4Co^+$				
$C_{22}H_{38}O_4Co^+$	$((CH_3)_3CCOCHCOC(CH_3)_3)_3Co$ (Tris(2,2,6,6–tetramethyl–3,5–heptanedionato)cobalt)		13.2±0.5	EI		2524
		$C_{15}H_{21}O_6Co^+$				
$C_{15}H_{21}O_6Co^+$	$(CH_3COCHCOCH_3)_3Co$ (Tris(2,4–pentanedionato)cobalt)		7.80±0.05	EI		2460
		$C_{33}H_{57}O_6Co^+$				
$C_{33}H_{57}O_6Co^+$	$((CH_3)_3CCOCHCOC(CH_3)_3)_3Co$ (Tris(2,2,6,6–tetramethyl–3,5–heptanedionato)cobalt)		8.4±0.5	EI		2524
		$C_2NO_3Co^+$				
$C_2NO_3Co^+$	$Co(CO)_2NO$		9.30	EI		2546
$C_2NO_3Co^+$	$Co(CO)_3NO$	CO	9.65	EI		2546
See also – PI:	2886					
		$C_3NO_4Co^+$				
$C_3NO_4Co^+$	$Co(CO)_3NO$		8.11±0.03	PI		2886
$C_3NO_4Co^+$	$Co(CO)_3NO$		8.75±0.1	EI		2453

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$CoHPF_3^+$				
$CoHPF_3^+$	$HCo(PF_3)_4$		14.4±0.3	EI		2583
$CoHPF_3^+$	$HCo(CO)_3PF_3$	3CO	13.8±0.2	EI		2583
$CoHPF_3^+$	$HCo(CO)_2(PF_3)_2$		13.6±0.3	EI		2583
$CoHPF_3^+$	$HCo(CO)(PF_3)_3$		13.6±0.2	EI		2583
		$CoHP_2F_6^+$				
$CoHP_2F_6^+$	$HCo(PF_3)_4$		12.7±0.2	EI		2583
$CoHP_2F_6^+$	$HCo(CO)(PF_3)_3$		12.6±0.2	EI		2583
		$CoHP_3F_9^+$				
$CoHP_3F_9^+$	$HCo(PF_3)_4$		10.4±0.2	EI		2583
$CoHP_3F_9^+$	$HCo(CO)(PF_3)_3$	CO	11.1±0.2	EI		2583
		$CoHP_4F_{12}^+$				
$CoHP_4F_{12}^+$	$HCo(PF_3)_4$		9.2±0.2	EI		2583
		$C_{15}H_3O_6F_{18}Co^+$				
$C_{15}H_3O_6F_{18}Co^+$	$(CF_3COCHCOCF_3)_3Co$ (Tris(1,1,1,5,5,5–hexafluoro–2,4–pentanedionato)cobalt)		9.56 (V)	PE		3169
$C_{15}H_3O_6F_{18}Co^+$	$(CF_3COCHCOCF_3)_3Co$ (Tris(1,1,1,5,5,5–hexafluoro–2,4–pentanedionato)cobalt)		10.12±0.15	EI		2580
		$CH_3F_2SiCo^+$				
$CH_3F_2SiCo^+$	$CH_3SiF_2Co(CO)_4$	4CO	14.5±0.4	EI		2581
		$C_4O_4F_2SiCo^+$				
$C_4O_4F_2SiCo^+$	$CH_3SiF_2Co(CO)_4$		13.8±0.2	EI		2581
		COF_3SiCo^+				
COF_3SiCo^+	$SiF_3Co(CO)_4$	3CO	13.8±0.2	EI		2582
		$C_3O_3F_3SiCo^+$				
$C_3O_3F_3SiCo^+$	$SiF_3Co(CO)_4$	CO	10.4±0.1	EI		2582

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_4O_4F_3SiCo^+$						
$C_4O_4F_3SiCo^+$	$SiF_3Co(CO)_4$		9.7±0.1	EI		2582
COF_3PCo^+						
COF_3PCo^+	$HCo(CO)_3PF_3$		14.3±0.3	EI		2583
COF_3PCo^+	$HCo(CO)_2(PF_3)_2$		14.0±0.3	EI		2583
COF_3PCo^+	$HCo(CO)(PF_3)_3$		14.1±0.3	EI		2583
$COSiCl_3Co^+$						
$COSiCl_3Co^+$	$SiCl_3Co(CO)_4$	3CO	11.8±0.2	EI		3255
$C_2O_2SiCl_3Co^+$						
$C_2O_2SiCl_3Co^+$	$SiCl_3Co(CO)_4$	2CO	10.6±0.2	EI		3255
$C_3O_3SiCl_3Co^+$						
$C_3O_3SiCl_3Co^+$	$SiCl_3Co(CO)_4$	CO	9.4±0.1	EI		3255
$C_4O_4SiCl_3Co^+$						
$C_4O_4SiCl_3Co^+$	$SiCl_3Co(CO)_4$		9.0±0.1	EI		3255
$C_2H_3OF_2SiCo^+$						
$C_2H_3OF_2SiCo^+$	$CH_3SiF_2Co(CO)_4$	3CO	12.9±0.2	EI		2581
$C_3H_3O_2F_2SiCo^+$						
$C_3H_3O_2F_2SiCo^+$	$CH_3SiF_2Co(CO)_4$	2CO	10.7±0.3	EI		2581
$C_4H_3O_3F_2SiCo^+$						
$C_4H_3O_3F_2SiCo^+$	$CH_3SiF_2Co(CO)_4$	CO	10.0±0.1	EI		2581
$C_5H_3O_4F_2SiCo^+$						
$C_5H_3O_4F_2SiCo^+$	$CH_3SiF_2Co(CO)_4$		9.0±0.1	EI		2581

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_8H_{15}NO_3PCo^+$						
$C_8H_{15}NO_3PCo^+$	$(C_2H_5)_3PCo(CO)_2NO$		7.62±0.05	EI		2481
$C_{14}H_{27}NO_3PCo^+$						
$C_{14}H_{27}NO_3PCo^+$	$(n-C_4H_9)_3PCo(CO)_2NO$		7.51±0.05	EI		2481
$C_5H_9NO_6PCo^+$						
$C_5H_9NO_6PCo^+$	$(CH_3O)_3PCo(CO)_2NO$		7.92±0.05	EI		2481
$C_8H_{15}NO_6PCo^+$						
$C_8H_{15}NO_6PCo^+$	$(C_2H_5O)_3PCo(CO)_2NO$		7.82±0.05	EI		2481
$C_{11}H_{21}NO_6PCo^+$						
$C_{11}H_{21}NO_6PCo^+$	$(iso-C_3H_7O)_3PCo(CO)_2NO$		7.64±0.05	EI		2481
$C_7H_{18}NO_8P_2Co^+$						
$C_7H_{18}NO_8P_2Co^+$	$((CH_3O)_3P)_2Co(CO)NO$		7.26	EI		2716
$C_{13}H_{30}NO_8P_2Co^+$						
$C_{13}H_{30}NO_8P_2Co^+$	$((C_2H_5O)_3P)_2Co(CO)NO$		7.13	EI		2716
$C_{19}H_{42}NO_8P_2Co^+$						
$C_{19}H_{42}NO_8P_2Co^+$	$((iso-C_3H_7O)_3P)_2Co(CO)NO$		7.22	EI		2716
$CHOF_3PCo^+$						
$CHOF_3PCo^+$	$HCo(CO)_3PF_3$	2CO	12.5±0.3	EI		2583
$CHOF_3PCo^+$	$HCo(CO)_2(PF_3)_2$		12.4±0.2	EI		2583
$CHOF_3PCo^+$	$HCo(CO)(PF_3)_3$		12.3±0.3	EI		2583
$C_2HO_2F_3PCo^+$						
$C_2HO_2F_3PCo^+$	$HCo(CO)_3PF_3$	CO	10.3±0.3	EI		2583
$C_2HO_2F_3PCo^+$	$HCo(CO)_2(PF_3)_2$		10.1±0.2	EI		2583

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_3HO_3F_3PCo^+$				
$C_3HO_3F_3PCo^+$	$HCo(CO)_3PF_3$		9.8±0.2	EI		2583
		$CHOF_6P_2Co^+$				
$CHOF_6P_2Co^+$	$HCo(CO)_2(PF_3)_2$	CO	10.3±0.3	EI		2583
$CHOF_6P_2Co^+$	$HCo(CO)(PF_3)_3$		10.4±0.3	EI		2583
		$C_2HO_2F_6P_2Co^+$				
$C_2HO_2F_6P_2Co^+$	$HCo(CO)_2(PF_3)_2$		9.6±0.2	EI		2583
		$CHOF_9P_3Co^+$				
$CHOF_9P_3Co^+$	$HCo(CO)(PF_3)_3$		10.2±0.1	EI		2583
		$C_2NO_3PCl_3Co^+$				
$C_2NO_3PCl_3Co^+$	$PCl_3Co(CO)_2NO$		8.40±0.1	EI		2453
	Ni^+	**ΔH°_{f0} = 1164.3 kJ mol^{-1} (278.3 kcal mol^{-1})**				
Ni^+	Ni		7.635	S	1164.3	2113
See also – EI:	2125, 2188					
Ni^+	NiF_2		16.7±0.3	EI		2162
Ni^+	$NiCl_2$		15.7±0.5	EI		2125
Ni^+	$(C_5H_5)_2Ni$ (Bis(cyclopentadienyl)nickel)		13.65±0.2	EI		2683
Ni^+	$(C_5H_5)_2Ni$ (Bis(cyclopentadienyl)nickel)		13.6	EI		2732, 2940
Ni^+	$Ni(CO)_4$	4CO	13.75±0.1	PI		2956
(Threshold value approximately corrected for hot bands)						
Ni^+	$Ni(CO)_4$	4CO	14.45±0.15	EI		2579
Ni^+	$Ni(CO)_4$	4CO	15.1±0.3	EI		2403
Ni^+	$Ni(CO)_4$	4CO	15.51	EI		2500
Ni^+	$Ni(CO)_4$	4CO	16.0±0.3	EI		112
Ni^+	$Ni(PF_3)_4$		17.3	EI		2507
		NiC^+				
NiC^+	$Ni(CO)_4$		22.1±0.3	EI		2579
NiC^+	$Ni(CO)_4$		24.2±0.2	EI		2403

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		NiC_2^+				
NiC_2^+	$Ni(CO)_4$		30.1±1	EI		2579
		NiO^+				
NiO^+	NiO		9.5±0.3	EI		2188
NiO^+	$Ni(CO)_4$		26.4±1	EI		2579
		NiF^+				
NiF^+	NiF_2	F	13.0±0.3	EI		2162
		NiF_2^+				
NiF_2^+	NiF_2		11.5±0.3	EI		2162
		$NiCl^+$				
$NiCl^+$	NiCl		11.4±0.5	EI		2125
$NiCl^+$	$NiCl_2$	Cl	12.7±0.5	EI		2125
		$NiCl_2^+$				
$NiCl_2^+$	$NiCl_2$		11.2±0.5	EI		2125
		$C_3H_3Ni^+$				
$C_3H_3Ni^+$	$(C_5H_5)_2Ni$ (Bis(cyclopentadienyl)nickel)		17.16±0.2	EI		2683
		$C_5H_5Ni^+$				
$C_5H_5Ni^+$	C_5H_5Ni (Cyclopentadienylnickel)		7.8	EI		2732, 2940
$C_5H_5Ni^+$	$(C_5H_5)_2Ni$ (Bis(cyclopentadienyl)nickel)		12.59±0.1	EI		2683
$C_5H_5Ni^+$	$(C_5H_5)_2Ni$ (Bis(cyclopentadienyl)nickel)		11.9±1	EI		2545
$C_5H_5Ni^+$	$(C_5H_5)_2Ni$ (Bis(cyclopentadienyl)nickel)		12.4	EI		2732, 2940
		$C_8H_8Ni^+$				
$C_8H_8Ni^+$	$(C_5H_5)_2Ni$ (Bis(cyclopentadienyl)nickel)		12.19±0.1	EI		2683

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_{10}H_{10}Ni^+$						
$C_{10}H_{10}Ni^+$	$(C_5H_5)_2Ni$ (Bis(cyclopentadienyl)nickel)		6.75	EI		2453
$C_{10}H_{10}Ni^+$	$(C_5H_5)_2Ni$ (Bis(cyclopentadienyl)nickel)		7.16±0.1	EI		2683
$C_{10}H_{10}Ni^+$	$(C_5H_5)_2Ni$ (Bis(cyclopentadienyl)nickel)		6.8	EI		2732, 2940
$LiNiO^+$						
$LiNiO^+$	$LiNiO_2$	O	14.0±0.5	EI		2565
$LiNiO_2^+$						
$LiNiO_2^+$	$LiNiO_2$		10.8±0.5	EI		2565
$NiCO^+$						
$NiCO^+$	$Ni(CO)_4$	3CO	11.65±0.1	PI		2956
$NiCO^+$	$Ni(CO)_4$	3CO	12.17±0.15	EI		2579
$NiCO^+$	$Ni(CO)_4$	3CO	12.84	EI		2500
$NiCO^+$	$Ni(CO)_4$	3CO	12.96±0.10	EI		2403
$NiCO^+$	$Ni(CO)_4$	3CO	13.5±0.2	EI		112
$NiCO^{+2}$						
$NiCO^{+2}$	$Ni(CO)_4$		30.2±0.5	EI		2579
NiC_2O^+						
NiC_2O^+	$Ni(CO)_4$		20.6±0.3	EI		2579
NiC_2O^{+2}						
NiC_2O^{+2}	$Ni(CO)_4$		38.5±0.5	EI		2579
$NiC_2O_2^+$						
$NiC_2O_2^+$	$Ni(CO)_4$	2CO	10.10±0.1	PI		2956
$NiC_2O_2^+$	$Ni(CO)_4$	2CO	10.21±0.15	EI		2579
$NiC_2O_2^+$	$Ni(CO)_4$	2CO	10.48±0.05	EI		2403
$NiC_2O_2^+$	$Ni(CO)_4$	2CO	10.63	EI		2500
$NiC_2O_2^+$	$Ni(CO)_4$	2CO	10.7±0.2	EI		112

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$NiC_2O_2^{+2}$						
$NiC_2O_2^{+2}$	$Ni(CO)_4$		27.2±0.5	EI		2579
$NiC_2O_2^{+2}$	$Ni(CO)_4$		28.3±1	EI		112
$NiC_3O_2^+$						
$NiC_3O_2^+$	$Ni(CO)_4$		20.1±0.5	EI		2579
$NiC_3O_3^+$						
$NiC_3O_3^+$	$Ni(CO)_4$	CO	8.77±0.02	PI		2956
$NiC_3O_3^+$	$Ni(CO)_4$	CO	8.89±0.15	EI		2579
$NiC_3O_3^+$	$Ni(CO)_4$	CO	9.22±0.10	EI		2403
$NiC_3O_3^+$	$Ni(CO)_4$	CO	9.34	EI		2500
$NiC_3O_3^+$	$Ni(CO)_4$	CO	9.36±0.15	EI		112
See also – PI:	2886					
$NiC_3O_3^{+2}$						
$NiC_3O_3^{+2}$	$Ni(CO)_4$		25.2±0.5	EI		2579
$Ni(CO)_4^+$		**$\Delta H^\circ_{f0} = 197$ kJ mol^{-1} (47 kcal mol^{-1})**				
$NiC_4O_4^+$	$Ni(CO)_4$		8.28±0.01	PI		2886
$NiC_4O_4^+$	$Ni(CO)_4$		8.28±0.03	PI		1167
$NiC_4O_4^+$	$Ni(CO)_4$		8.32±0.01	PI	197	2956
$NiC_4O_4^+$	$Ni(CO)_4$		8.24±0.14	PE		2886
$NiC_4O_4^+$	$Ni(CO)_4$		8.35±0.15	EI		2579
$NiC_4O_4^+$	$Ni(CO)_4$		8.57±0.10	EI		2403
$NiC_4O_4^+$	$Ni(CO)_4$		8.64±0.15	EI		112
$NiC_4O_4^+$	$Ni(CO)_4$		8.75±0.07	EI		2500
$NiC_4O_4^{+2}$						
$NiC_4O_4^{+2}$	$Ni(CO)_4$		25.1±0.5	EI		2579

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$NiPF_3^+$				
$NiPF_3^+$	$Ni(PF_3)_4$		14.0	EI		2507
		$NiP_2F_6^+$				
$NiP_2F_6^+$	$Ni(PF_3)_4$		11.4	EI		2507
		$NiP_3F_9^+$				
$NiP_3F_9^+$	$Ni(PF_3)_4$		9.7	EI		2507
		$NiP_4F_{12}^+$				
$NiP_4F_{12}^+$	$Ni(PF_3)_4$		9.6 (V)	PE		3070
$NiP_4F_{12}^+$	$Ni(PF_3)_4$		9.69 (V)	PE		3088
$NiP_4F_{12}^+$	$Ni(PF_3)_4$		8.7	EI		2507
		$C_5H_7O_2Ni^+$				
$C_5H_7O_2Ni^+$	$(CH_3COCHCOCH_3)_2Ni$ (Bis(2,4–pentanedionato)nickel)		13.5±0.2	EI		2731
		$C_9H_{11}O_4Ni^+$				
$C_9H_{11}O_4Ni^+$	$(CH_3COCHCOCH_3)_2Ni$ (Bis(2,4–pentanedionato)nickel)		11.6±0.1	EI		2731
		$C_{10}H_{14}O_4Ni^+$				
$C_{10}H_{14}O_4Ni^+$	$(CH_3COCHCOCH_3)_2Ni$ (Bis(2,4–pentanedionato)nickel)		8.23±0.05	EI		2731
		$C_5H_5NONi^+$				
$C_5H_5NONi^+$	C_5H_5NiNO (Cyclopentadienylnickel nitrosyl)		8.50±0.1	EI		2453
		Cu^+ ΔH°_{f0} = 1082.6 kJ mol^{-1} (258.7 kcal mol^{-1})				
Cu^+	Cu		7.726	S	1082.6	2113
See also – EI:	2990					
Cu^+	CuF_2		16.5±0.3	EI		1458

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
			CuF^+			
CuF^+	CuF		8.6±0.3	EI		1458
CuF^+	CuF_2	F	12.4±0.3	EI		1458
			CuF_2^+			
CuF_2^+	CuF_2		11.3±0.3	EI		1458
			$CuCl^+$			
$CuCl^+$	$CuCl$		10.7±0.3	EI		2990
			$C_5H_7O_2Cu^+$			
$C_5H_7O_2Cu^+$	$(CH_3COCHCOCH_3)_2Cu$ (Bis(2,4–pentanedionato)copper)		13.1±0.2	EI		2731, 2959, 3405
			$C_6H_9O_2Cu^+$			
$C_6H_9O_2Cu^+$	$(CH_3COC(CH_3)COCH_3)_2Cu$ (Bis(3–methyl–2,4–pentanedionato)copper)		10.8±0.1	EI		3405
			$C_{10}H_9O_2Cu^+$			
$C_{10}H_9O_2Cu^+$	$(C_6H_5COCHCOCH_3)_2Cu$ (Bis(1–phenyl–1,3–butanedionato)copper)		10.7±0.1	EI		3405
			$C_{15}H_{11}O_2Cu^+$			
$C_{15}H_{11}O_2Cu^+$	$(C_6H_5COCHCOC_6H_5)_2Cu$ (Bis(1,3–diphenyl–1,3–propanedionato)copper)		10.3±0.1	EI		3405
			$C_9H_{11}O_4Cu^+$			
$C_9H_{11}O_4Cu^+$	$(CH_3COCHCOCH_3)_2Cu$ (Bis(2,4–pentanedionato)copper)		10.9±0.1	EI		2731, 2959
			$C_{10}H_{14}O_4Cu^+$			
$C_{10}H_{14}O_4Cu^+$	$(CH_3COCHCOCH_3)_2Cu$ (Bis(2,4–pentanedionato)copper)		7.75±0.05	EI		2992
$C_{10}H_{14}O_4Cu^+$	$(CH_3COCHCOCH_3)_2Cu$ (Bis(2,4–pentanedionato)copper)		8.31±0.05	EI		2731, 2959, 3405

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_{12}H_{18}O_4Cu^+$						
$C_{12}H_{18}O_4Cu^+$	$(CH_3COCHCOC_2H_5)_2Cu$ (Bis(2,4–hexanedionato)copper)		7.68±0.03	EI		2992
$C_{12}H_{18}O_4Cu^+$	$(CH_3COC(CH_3)COCH_3)_2Cu$ (Bis(3–methyl–2,4–pentanedionato)copper)		7.97±0.05	EI		3405
$C_{14}H_{22}O_4Cu^+$						
$C_{14}H_{22}O_4Cu^+$	$(CH_3COCHCOC_3H_7)_2Cu$ (Bis(5–methyl–2,4–hexanedionato)copper)		7.61±0.06	EI		2992
$C_{16}H_{26}O_4Cu^+$						
$C_{16}H_{26}O_4Cu^+$	$(CH_3COCHCOC_4H_9)_2Cu$ (Bis(5,5–dimethyl–2,4–hexanedionato)copper)		7.59±0.05	EI		2992
$C_{20}H_{18}O_4Cu^+$						
$C_{20}H_{18}O_4Cu^+$	$(C_6H_5COCHCOCH_3)_2Cu$ (Bis(1–phenyl–1,3–butanedionato)copper)		8.37±0.05	EI		3405
$C_{22}H_{22}O_4Cu^+$						
$C_{22}H_{22}O_4Cu^+$	$(CH_3COC(C_6H_5)COCH_3)_2Cu$ (Bis(3–phenyl–2,4–pentanedionato)copper)		8.05±0.05	EI		3405
$C_{30}H_{22}O_4Cu^+$						
$C_{30}H_{22}O_4Cu^+$	$(C_6H_5COCHCOC_6H_5)_2Cu$ (Bis(1,3–diphenyl–1,3–propanedionato)copper)		8.28±0.05	EI		3405
$C_5H_4O_2F_3Cu^+$						
$C_5H_4O_2F_3Cu^+$	$(CF_3COCHCOCH_3)_2Cu$ (Bis(1,1,1–trifluoro–2,4–pentanedionato)copper)		13.1±0.1	EI		2959, 3405
$C_9H_8O_4F_3Cu^+$						
$C_9H_8O_4F_3Cu^+$	$(CF_3COCHCOCH_3)_2Cu$ (Bis(1,1,1–trifluoro–2,4–pentanedionato)copper)		11.5±0.1	EI		2959

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_{10}H_8O_4F_6Cu^+$						
$C_{10}H_8O_4F_6Cu^+$	$(CF_3COCHCOCH_3)_2Cu$ (Bis(1,1,1-trifluoro-2,4-pentanedionato)copper)		8.61±0.05	EI		2992
$C_{10}H_8O_4F_6Cu^+$	$(CF_3COCHCOCH_3)_2Cu$ (Bis(1,1,1-trifluoro-2,4-pentanedionato)copper)		9.05±0.1	EI		2959, 3405
$C_{10}H_8O_4F_6Cu^+$	$CH_3COCHCOCH_3CuCF_3COCHCOCF_3$ (1,1,1,5,5,5-Hexafluoro-2,4-pentanedionato(2,4-pentanedionato)copper)		8.65±0.01	EI		2992
$C_{10}H_8O_4F_6Cu^+$	$CH_3COCHCOCH_3CuCF_3COCHCOCF_3$ (1,1,1,5,5,5-Hexafluoro-2,4-pentanedionato(2,4-pentanedionato)copper)		9.03±0.05	EI		3405
$C_{20}H_{12}O_4F_6Cu^+$						
$C_{20}H_{12}O_4F_6Cu^+$	$(C_6H_5COCHCOCF_3)_2Cu$ (Bis(1-phenyl-4,4,4-trifluoro-1,3-butanedionato)copper)		9.06±0.05	EI		3405
$C_{28}H_{16}O_4F_6Cu^+$						
$C_{28}H_{16}O_4F_6Cu^+$	$(C_{10}H_7COCHCOCF_3)_2Cu$ (Bis(1-(2-naphthyl)-4,4,4-trifluoro-1,3-butanedionato)copper)		8.39±0.05	EI		3405
$C_{16}H_8O_6F_6Cu^+$						
$C_{16}H_8O_6F_6Cu^+$	$(C_4H_3OCOCHCOCF_3)_2Cu$ (Bis(1-(2-furyl)-4,4,4-trifluoro-1,3-butanedionato)copper)		8.89±0.05	EI		3405
$C_9H_2O_4F_9Cu^+$						
$C_9H_2O_4F_9Cu^+$	$(CF_3COCHCOCF_3)_2Cu$ (Bis(1,1,1,5,5,5-hexafluoro-2,4-pentanedionato)copper)		11.6±0.1	EI		2959
$C_{10}H_2O_4F_{12}Cu^+$						
$C_{10}H_2O_4F_{12}Cu^+$	$(CF_3COCHCOCF_3)_2Cu$ (Bis(1,1,1,5,5,5-hexafluoro-2,4-pentanedionato)copper)		9.68±0.01	EI		2992
$C_{10}H_2O_4F_{12}Cu^+$	$(CF_3COCHCOCF_3)_2Cu$ (Bis(1,1,1,5,5,5-hexafluoro-2,4-pentanedionato)copper)		9.86±0.05	EI		2959, 3405
$C_{16}H_8O_4F_6S_2Cu^+$						
$C_{16}H_8O_4F_6S_2Cu^+$	$(C_4H_3SCOCHCOCF_3)_2Cu$ (Bis(1-(2-thienyl)-4,4,4-trifluoro-1,3-butanedionato)copper)		8.90±0.05	EI		3405

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
Zn^+	**ΔH°_{f0} = 1036.6 kJ mol^{-1} (247.7 kcal mol^{-1})**					
Zn^+	Zn		9.394	S	1036.6	2113, 2659
See also – EI:	3128					
Zn^+	$ZnCl_2$		14.6±0.3	EI		2506
Zn^+	$(CH_3)_2Zn$	$2CH_3$	13.13±0.02	PI		2983
Zn^+	$(CH_3)_2Zn$	$2CH_3$	13.4±0.3	EI		2556
Zn^+	$ZnBr_2$		14.7±0.3	EI		2506
		ZnH^+				
ZnH^+	$(CH_3)_2Zn$		13.9±0.4	EI		2556
		$ZnCl^+$				
$ZnCl^+$	$ZnCl_2$	Cl	13.7±0.2	EI		2506
		$ZnCl_2^+$				
$ZnCl_2^+$	$ZnCl_2$		11.75±0.23	EI		2506
CH_3Zn^+	**ΔH°_{f298} = 897 kJ mol^{-1} (214 kcal mol^{-1})**					
CH_3Zn^+	$(CH_3)_2Zn$	CH_3	10.22±0.02	PI	897	2983
CH_3Zn^+	$(CH_3)_2Zn$	CH_3	11.2±0.2	EI		2556
$(CH_3)_2Zn^+$	**ΔH°_{f298} = 921 kJ mol^{-1} (220 kcal mol^{-1})**					
$C_2H_6Zn^+$	$(CH_3)_2Zn$ (Threshold value approximately corrected for hot bands)		9.00±0.02	PI	921	2983
$C_2H_6Zn^+$	$(CH_3)_2Zn$		8.86±0.15	EI		2556
See also – PE:	2984					
		$C_5H_7O_2Zn^+$				
$C_5H_7O_2Zn^+$	$(CH_3COCHCOCH_3)_2Zn$ (Bis(2,4–pentanedionato)zinc)		14.1±0.2	EI		2731, 2959
		$C_9H_{11}O_4Zn^+$				
$C_9H_{11}O_4Zn^+$	$(CH_3COCHCOCH_3)_2Zn$ (Bis(2,4–pentanedionato)zinc)		10.9±0.1	EI		2731, 2959

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_{10}H_{14}O_4Zn^+$						
$C_{10}H_{14}O_4Zn^+$	$(CH_3COCHCOCH_3)_2Zn$ (Bis(2,4-pentanedionato)zinc)		8.62±0.05	EI		2731, 2959
$C_5H_4O_2F_3Zn^+$						
$C_5H_4O_2F_3Zn^+$	$(CF_3COCHCOCH_3)_2Zn$ (Bis(1,1,1-trifluoro-2,4-pentanedionato)zinc)		14.6±0.1	EI		2959
$C_9H_8O_4F_3Zn^+$						
$C_9H_8O_4F_3Zn^+$	$(CF_3COCHCOCH_3)_2Zn$ (Bis(1,1,1-trifluoro-2,4-pentanedionato)zinc)		11.3±0.1	EI		2959
$C_5HO_2F_6Zn^+$						
$C_5HO_2F_6Zn^+$	$(CF_3COCHCOCF_3)_2Zn$ (Bis(1,1,1,5,5,5-hexafluoro-2,4-pentanedionato)zinc)		15.3±0.2	EI		2959
$C_9H_5O_4F_6Zn^+$						
$C_9H_5O_4F_6Zn^+$	$(CF_3COCHCOCH_3)_2Zn$ (Bis(1,1,1-trifluoro-2,4-pentanedionato)zinc)		11.7±0.1	EI		2959
$C_{10}H_8O_4F_6Zn^+$						
$C_{10}H_8O_4F_6Zn^+$	$(CF_3COCHCOCH_3)_2Zn$ (Bis(1,1,1-trifluoro-2,4-pentanedionato)zinc)		9.40±0.1	EI		2959
$C_9H_2O_4F_9Zn^+$						
$C_9H_2O_4F_9Zn^+$	$(CF_3COCHCOCF_3)_2Zn$ (Bis(1,1,1,5,5,5-hexafluoro-2,4-pentanedionato)zinc)		11.35±0.1	EI		2959
$C_{10}H_2O_4F_{12}Zn^+$						
$C_{10}H_2O_4F_{12}Zn^+$	$(CF_3COCHCOCF_3)_2Zn$ (Bis(1,1,1,5,5,5-hexafluoro-2,4-pentanedionato)zinc)		10.07±0.05	EI		2959
Ga^+ $\Delta H^\circ_{f0} \sim 855$ kJ mol^{-1} (204 kcal mol^{-1})						
Ga^+	Ga		5.999	S	~855	2113, 3167

See also – S: 3270
EI: 2518, 2523, 2620, 3014, 3244

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
Ga^+	Ga_2S		8.7±0.5	EI		2569
Ga^+	Ga_2Se		8.4±0.5	EI		2569
Ga^+	Ga_2Te		8.2±0.5	EI		2569
		Ga_2^+				
Ga_2^+	Ga_2O	O	16±0.5	EI		3014
Ga_2^+	Ga_2S	S	10.2±0.5	EI		2569
Ga_2^+	Ga_2Se	Se	10.8±0.5	EI		2569
Ga_2^+	Ga_2Te	Te	9.8±0.5	EI		2569
		GaO^+				
GaO^+	GaO		9.4±0.5	EI		2518
GaO^+	Ga_2O	Ga	13.1±0.5	EI		3244
		Ga_2O^+				
Ga_2O^+	Ga_2O		7.4±0.5	EI		2569
Ga_2O^+	Ga_2O		8.0±0.5	EI		3014
Ga_2O^+	Ga_2O		8.4±0.6	EI		2518
Ga_2O^+	Ga_2O		12.1±0.5	EI		3244
		GaF^+				
GaF^+	GaF		9.6±0.5	EI		2523
GaF^+	GaF		10.6±0.4	EI		2620
		GaF_2^+				
GaF_2^+	GaF_2		13.3±0.5	EI		2523
		GaS^+				
GaS^+	Ga_2S	Ga	11.6±0.3	EI		2569
		Ga_2S^+				
Ga_2S^+	Ga_2S		7.5±0.3	EI		2569
		$LiGaO^+$				
$LiGaO^+$	$LiGaO$		7.0±0.3	EI		2565

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$GaOF^+$				
$GaOF^+$	GaOF		9.5±0.5	EI		2523
		Ge^+ **ΔH°_{f0} = 1135.9 kJ mol^{-1} (271.5 kcal mol^{-1})**				
Ge^+	Ge		7.899	S	1135.9	2113
See also – EI:	2502, 2714					
Ge^+	GeH_4	$2H_2$	10.7±0.2	EI		2116
Ge^+	Ge_2H_6		13.3±0.3	EI		2133
Ge^+	Ge_3H_8		16.3±0.3	EI		2133
Ge^+	GeO	O	14.0±1	EI		1255
Ge^+	GeF_2		18.8±0.3	EI		2566
Ge^+	$GeCl_2$		16.8±0.5	EI		2568
Ge^+	$GeCl_4$		21±1	EI		2568
Ge^+	$(CH_3)_4Ge$		18.1	EI		2980
Ge^+	$(CH_3)_4Ge$		19.2±0.5	EI		83
Ge^+	$(C_2H_5)_4Ge$		17.4	EI		2980
Ge^+	$GeBr_2$		15.5±0.5	EI		2568
Ge^+	$GeBr_4$		20±1	EI		2568
Ge^+	GeTe	Te	12.6±0.5	EI		1023
		Ge_2^+				
Ge_2^+	Ge_2		7.9±0.3	EI		2957
Ge_2^+	Ge_2		8.0±0.5	EI		2502
Ge_2^+	Ge_2H_6	$3H_2$	13.1±0.3	EI		2133
Ge_2^+	Ge_3H_8		15.8±0.3	EI		2133
		Ge_3^+				
Ge_3^+	Ge_3		8.0±0.5	EI		2502
Ge_3^+	Ge_3		8.4±0.3	EI		2957
Ge_3^+	Ge_3H_8		14.6±0.3	EI		2133
		Ge_4^+				
Ge_4^+	Ge_4		8.0±0.5	EI		2502
Ge_4^+	Ge_4		8.4±0.3	EI		2957
		GeH^+				
GeH^+	GeH_4	H_2+H	11.3±0.3	EI		2116
GeH^+	$(CH_3)_4Ge$		17.8	EI		2980
GeH^+	$(C_2H_5)_4Ge$		21.6	EI		2980
		GeH_2^+				
GeH_2^+	GeH_4	H_2	11.8±0.2	EI		2116

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
GeH_3^+						
GeH_3^+	GeH_4	H	10.80±0.07	EI		2002, 2116
GeH_3^+	Ge_2H_6		10.26±0.10	EI		2002
GeH_3^+	$(CH_3)_4Ge$		17.1	EI		2980
GeH_3^+	$(C_2H_5)_4Ge$		16.3	EI		2980
GeH_3^+	H_3GeSiH_3		11.32±0.14	EI		2002
GeH_4^+ ΔH°_{f0} = 1171 kJ mol^{-1} (280 kcal mol^{-1})						
GeH_4^+	GeH_4		11.31	PE	1171	3116
Ge_2H^+						
Ge_2H^+	Ge_2H_6	$2H_2$+H	13.0±0.3	EI		2133
$Ge_2H_2^+$						
$Ge_2H_2^+$	Ge_2H_6	$2H_2$	12.9±0.3	EI		2133
$Ge_2H_3^+$						
$Ge_2H_3^+$	Ge_2H_6	H_2+H	12.8±0.3	EI		2133
$Ge_2H_4^+$						
$Ge_2H_4^+$	Ge_2H_6	H_2	12.7±0.3	EI		2133
$Ge_2H_5^+$						
$Ge_2H_5^+$	Ge_2H_6	H	12.6±0.3	EI		2133
$Ge_2H_6^+$						
$Ge_2H_6^+$	Ge_2H_6		12.5±0.3	EI		2133
Ge_3H^+						
Ge_3H^+	Ge_3H_8		11.8±0.3	EI		2133
$Ge_3H_2^+$						
$Ge_3H_2^+$	Ge_3H_8	$3H_2$	10.7±0.3	EI		2133

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of forma-tion (kJ mol^{-1})	Ref.
		$Ge_3H_3^+$				
$Ge_3H_3^+$	Ge_3H_8	$2H_2+H$	10.6±0.3	EI		2133
		$Ge_3H_4^+$				
$Ge_3H_4^+$	Ge_3H_8	$2H_2$	10.4±0.3	EI		2133
		$Ge_3H_5^+$				
$Ge_3H_5^+$	Ge_3H_8	H_2+H	10.1±0.3	EI		2133
		$Ge_3H_6^+$				
$Ge_3H_6^+$	Ge_3H_8	H_2	10.0±0.3	EI		2133
		$Ge_3H_7^+$				
$Ge_3H_7^+$	Ge_3H_8	H	9.9±0.3	EI		2133
		$Ge_3H_8^+$				
$Ge_3H_8^+$	Ge_3H_8		9.6±0.3	EI		2133
		GeC^+				
GeC^+	GeC		10.3±0.3	EI		2957
		GeC_2^+				
GeC_2^+	GeC_2		10.1±0.3	EI		2957
		Ge_2C^+				
Ge_2C^+	Ge_2C		9.3±0.3	EI		2957
		Ge_3C^+				
Ge_3C^+	Ge_3C		8.6±0.3	EI		2957
		GeO^+				
GeO^+	GeO		~11.39	S		2714, 3414
GeO^+	GeO		11.10±0.10	EI		3414
GeO^+	GeO		11.5±0.5	EI		2714
GeO^+	GeO		10.1±0.8	EI		1255

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		Ge_2O^+				
Ge_2O^+	Ge_2O_2	O	14.3±1.0	EI		1255
		$Ge_2O_2^+$				
$Ge_2O_2^+$	Ge_2O_2		8.7±1.0	EI		1255
		$Ge_3O_3^+$				
$Ge_3O_3^+$	Ge_3O_3		8.6±1.0	EI		1255
		GeF^+				
GeF^+	GeF		~7.28	S		2149
GeF^+	GeF		<9.1±0.2	EI		2566
GeF^+	GeF_2	F	14.0±0.3	EI		2566
		GeF_2^+				
GeF_2^+	GeF_2		11.8±0.1	EI		2566
		GeF_4^+				
GeF_4^+	GeF_4		15.69±0.02	PE		3362
See also – PE:	3059					
		$Ge_2F_4^+$				
$Ge_2F_4^+$	Ge_2F_4		10.6±0.3	EI		2566
		$Ge_3F_5^+$				
$Ge_3F_5^+$	Ge_3F_6	F	15.6±0.5	EI		2566
		$GeSi^+$				
$GeSi^+$	GeSi		8.2±0.3	EI		2957
		Ge_2Si^+				
Ge_2Si^+	Ge_2Si		8.4±0.3	EI		2957

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		Ge_3Si^+				
Ge_3Si^+	Ge_3Si		8.6±0.3	EI		2957
		$GeCl^+$				
$GeCl^+$	$GeCl_2$	Cl	11.5±0.5	EI		2568
$GeCl^+$	$GeCl_4$		18±1	EI		2568
		$GeCl_2^+$				
$GeCl_2^+$	$GeCl_2$		10.4±0.3	EI		2568
$GeCl_2^+$	$GeCl_4$		17±1	EI		2568
		$GeCl_3^+$				
$GeCl_3^+$	$GeCl_4$	Cl	12.3±0.3	EI		2568
	$GeCl_4^+$	**$\Delta H_{f0}^\circ = 652$ kJ mol^{-1} (156 kcal mol^{-1})**				
$GeCl_4^+$	$GeCl_4$		11.88±0.02	PE	652	3362
$GeCl_4^+$	$GeCl_4$		11.6±0.3	EI		2568
See also – PE:	3117					
		CH_3Ge^+				
CH_3Ge^+	$(CH_3)_4Ge$		13.8	EI		2980
CH_3Ge^+	$(CH_3)_4Ge$		16.8±0.4	EI		83
		CH_4Ge^+				
CH_4Ge^+	$(CH_3)_4Ge$		13.2	EI		2980
		CH_5Ge^+				
CH_5Ge^+	$(CH_3)_4Ge$		13.4	EI		2980
		$C_2H_5Ge^+$				
$C_2H_5Ge^+$	$(C_2H_5)_4Ge$		16.7	EI		2980

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_2H_6Ge^+$						
$C_2H_6Ge^+$	$(CH_3)_4Ge$		14.1±0.2	EI		83
$C_2H_6Ge^+$	$(CH_3)_4Ge$		14.2	EI		2980
$C_2H_7Ge^+$						
$C_2H_7Ge^+$	$(CH_3)_4Ge$		14.2	EI		2980
$C_2H_7Ge^+$	$(C_2H_5)_4Ge$		13.2	EI		2980
$C_3H_9Ge^+$						
$C_3H_9Ge^+$	$(CH_3)_4Ge$	CH_3	10.05±0.14	EI		2720
$C_3H_9Ge^+$	$(CH_3)_4Ge$	CH_3	10.2±0.1	EI		83
$C_3H_9Ge^+$	$(CH_3)_4Ge$	CH_3	11.4	EI		2980
$C_3H_9Ge^+$	$(CH_3)_3GeGe(CH_3)_3$		11.3±0.2	EI		2700
$C_3H_9Ge^+$	$(CH_3)_3GeGe(C_2H_5)_3$		13.2±0.2	EI		2700
$C_3H_9Ge^+$	$(CH_3)_3SiGe(CH_3)_3$		9.99±0.14	EI		2720
$C_3H_9Ge^+$	$(CH_3)_3GeSn(CH_3)_3$		10.01±0.18	EI		2720
$C_4H_{11}Ge^+$						
$C_4H_{11}Ge^+$	$(C_2H_5)_4Ge$		11.4	EI		2980
$C_4H_{12}Ge^+$						
$C_4H_{12}Ge^+$	$(CH_3)_4Ge$		9.2±0.2	EI		83
$C_4H_{12}Ge^+$	$(CH_3)_4Ge$		9.29±0.14	EI		2720
$C_4H_{12}Ge^+$	$(CH_3)_4Ge$		11.2	EI		2980
$C_6H_{15}Ge^+$						
$C_6H_{15}Ge^+$	$(C_2H_5)_4Ge$		9.6	EI		2980
$C_6H_{15}Ge^+$	$(CH_3)_3GeGe(C_2H_5)_3$		9.1±0.2	EI		2700
$C_6H_{15}Ge^+$	$(C_2H_5)_3GeGe(C_2H_5)_3$		10.9±0.2	EI		2700
$C_8H_{20}Ge^+$						
$C_8H_{20}Ge^+$	$(C_2H_5)_4Ge$		9.8	EI		2980
$C_3H_{11}Ge_2^+$						
$C_3H_{11}Ge_2^+$	$(CH_3)_3GeGe(C_2H_5)_3$		12.7±0.2	EI		2700

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_4H_{13}Ge_2^+$				
$C_4H_{13}Ge_2^+$	$(CH_3)_3GeGe(C_2H_5)_3$		12.8±0.2	EI		2700
$C_4H_{13}Ge_2^+$	$(C_2H_5)_3GeGe(C_2H_5)_3$		14.9±0.2	EI		2700
		$C_5H_{15}Ge_2^+$				
$C_5H_{15}Ge_2^+$	$(CH_3)_3GeGe(CH_3)_3$	CH_3	10.8±0.2	EI		2700
$C_5H_{15}Ge_2^+$	$(CH_3)_3GeGe(C_2H_5)_3$		11.8±0.2	EI		2700
		$C_6H_{17}Ge_2^+$				
$C_6H_{17}Ge_2^+$	$(CH_3)_3GeGe(C_2H_5)_3$		12.1±0.2	EI		2700
$C_6H_{17}Ge_2^+$	$(C_2H_5)_3GeGe(C_2H_5)_3$		12.9±0.2	EI		2700
		$C_6H_{18}Ge_2^+$				
$C_6H_{18}Ge_2^+$	$(CH_3)_3GeGe(CH_3)_3$		7.76±0.01	EI		2900
$C_6H_{18}Ge_2^+$	$(CH_3)_3GeGe(CH_3)_3$		8.5±0.2	EI		2700
		$C_7H_{19}Ge_2^+$				
$C_7H_{19}Ge_2^+$	$(CH_3)_3GeGe(C_2H_5)_3$		10.7±0.2	EI		2700
		$C_8H_{21}Ge_2^+$				
$C_8H_{21}Ge_2^+$	$(CH_3)_3GeGe(C_2H_5)_3$	CH_3	11.2±0.2	EI		2700
$C_8H_{21}Ge_2^+$	$(C_2H_5)_3GeGe(C_2H_5)_3$		11.7±0.2	EI		2700
		$C_9H_{24}Ge_2^+$				
$C_9H_{24}Ge_2^+$	$(CH_3)_3GeGe(C_2H_5)_3$		7.6±0.2	EI		2700
		$C_{10}H_{25}Ge_2^+$				
$C_{10}H_{25}Ge_2^+$	$(C_2H_5)_3GeGe(C_2H_5)_3$		9.6±0.2	EI		2700
		$C_{12}H_{30}Ge_2^+$				
$C_{12}H_{30}Ge_2^+$	$(C_2H_5)_3GeGe(C_2H_5)_3$		7.4±0.2	EI		2700
$C_{12}H_{30}Ge_2^+$	$(C_2H_5)_3GeGe(C_2H_5)_3$		7.48±0.01	EI		2900

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$GeOF_3^+$				
$GeOF_3^+$	$GeOF_4$	F	15.6±0.5	EI		2566
		$GeOF_4^+$				
$GeOF_4^+$	$GeOF_4$		13.6±0.5	EI		2566
		$GeSiH_6^+$				
$GeSiH_6^+$	H_3GeSiH_3		10.20±0.03	EI		2002
		$GeSiC^+$				
$GeSiC^+$	GeSiC		9.6±0.3	EI		2957
		Ge_2SiC^+				
Ge_2SiC^+	Ge_2SiC		8.9±0.3	EI		2957
		$C_6H_{18}SiGe^+$				
$C_6H_{18}SiGe^+$	$(CH_3)_3SiGe(CH_3)_3$		8.31±0.10	EI		2720
	As^+	**ΔH°_{f0} = 1245.9 kJ mol^{-1} (297.8 kcal mol^{-1})**				
As^+	As		9.7883±0.0002	S	1245.9	3430
See also – S:	2113					
As^+	As_2	As	13.9±0.4	EI		3194
As^+	AsH_3	H_2+H	14.8±0.2	EI		2116
As^+	AsH_3	H_2+H	15.0±0.3	EI		2584
As^+	As_2H_4		14.3±0.3	EI		2133
		As_2^+				
As_2^+	As_2		10.4±0.4	EI		3194
As_2^+	As_2H_4	$2H_2$	13.0±0.3	EI		2133
		As_3^+				
As_3^+	As_4	As	13.5±0.4	EI		3194

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		As_4^+				
As_4^+	As_4		9.07±0.07	EI		1047
As_4^+	As_4		10.1±0.4	EI		3194
		AsH^+				
AsH^+	AsH_3	H_2	12.4±0.2	EI		2116
AsH^+	AsH_3	H_2	12.5±0.2	EI		2584
		AsH_2^+				
AsH_2^+	AsH_3	H	13.4±0.2	EI		2584
AsH_2^+	AsH_3	H	14.5±0.2	EI		2116
AsH_2^+	As_2H_4		12.9±0.4	EI		2584
AsH_2^+	H_2AsSiH_3		12.4±0.2	EI		2584
	$AsH_3^+(^2A_1)$	**$\Delta H_{f0}^\circ = 1043$ kJ mol^{-1} (249 kcal mol^{-1})**				
$AsH_3^+(^2A_1)$	AsH_3		10.03	PI	1042	1091
$AsH_3^+(^2A_1)$	AsH_3		10.06±0.03	PE	1045	3085
$AsH_3^+(^2E)$	AsH_3		11.9±0.1	PE		3085
See also – EI:	1007, 2116, 2584					
AsH_3^+	H_2AsSiH_3		13.1±0.6	EI		2584
		As_2H^+				
As_2H^+	As_2H_4	H_2+H	12.7±0.3	EI		2133
		$As_2H_2^+$				
$As_2H_2^+$	As_2H_4	H_2	12.6±0.3	EI		2133
		$As_2H_3^+$				
$As_2H_3^+$	As_2H_4	H	12.5±0.3	EI		2133
		$As_2H_4^+$				
$As_2H_4^+$	As_2H_4		12.2±0.3	EI		2133

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		AsF_3^+				
AsF_3^+	AsF_3		13.00 (V)	PE		3119
		$AsSi^+$				
$AsSi^+$	H_2AsSiH_3	$2H_2+H$	16.8±0.3	EI		2584
	$AsCl_3^+$	**$\Delta H^\circ_{f0} \sim 774$ kJ mol^{-1} (185 kcal mol^{-1})**				
$AsCl_3^+$	$AsCl_3$		10.72±0.07	PE	774	3168
$AsCl_3^+$	$AsCl_3$		11.7±0.1	EI		1007
See also – PE:	3119					
		CH_5As^+				
CH_5As^+	CH_3AsH_2		9.7±0.1	EI		1007
		$C_2H_7As^+$				
$C_2H_7As^+$	$(CH_3)_2AsH$		9.0±0.1	EI		1007
		$C_3H_9As^+$				
$C_3H_9As^+$	$(CH_3)_3As$		8.3±0.1	EI		1007
	$C_{18}H_{15}As^+$ (Triphenylarsine)	**$\Delta H^\circ_{f298} \sim 1117$ kJ mol^{-1} (267 kcal mol^{-1})**				
$C_{18}H_{15}As^+$	$(C_6H_5)_3As$ (Triphenylarsine)		7.34±0.07	PI	1117	1140
		$C_3F_9As^+$				
$C_3F_9As^+$	$(CF_3)_3As$		11.0±0.1	EI		1007
		$AsSiH^+$				
$AsSiH^+$	H_2AsSiH_3	$2H_2$	13.4±0.1	EI		2584
		$AsSiH_2^+$				
$AsSiH_2^+$	H_2AsSiH_3	H_2+H	13.7±0.2	EI		2584

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$AsSiH_3^+$				
$AsSiH_3^+$	H_2AsSiH_3	H_2	9.7±0.1	EI		2584
		$AsSiH_4^+$				
$AsSiH_4^+$	H_2AsSiH_3	H	11.0±0.3	EI		2584
		$AsSiH_5^+$				
$AsSiH_5^+$	H_2AsSiH_3		10.1±0.1	EI		2584
		$C_3H_6F_3As^+$				
$C_3H_6F_3As^+$	$(CH_3)_2AsCF_3$		9.2±0.1	EI		1007
		$C_2HF_6As^+$				
$C_2HF_6As^+$	$(CF_3)_2AsH$		10.9±0.1	EI		1007
		$C_3H_3F_6As^+$				
$C_3H_3F_6As^+$	$(CF_3)_2AsCH_3$		10.5±0.1	EI		1007
		$C_2H_6ClAs^+$				
$C_2H_6ClAs^+$	$(CH_3)_2AsCl$		9.9±0.1	EI		1007
		$CH_3Cl_2As^+$				
$CH_3Cl_2As^+$	CH_3AsCl_2		10.4±0.1	EI		1007
		$C_2F_6ClAs^+$				
$C_2F_6ClAs^+$	$(CF_3)_2AsCl$		11.0±0.1	EI		1007
		$C_7H_8O_2MnAs^+$				
$C_7H_8O_2MnAs^+$	$C_5H_5Mn(CO)_2AsH_3$ (Arsinecyclopentadienylmanganese dicarbonyl)		7.16±0.1	EI		2703

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
	Se^+	**$\Delta H^\circ_{f0} = 1167.3$ kJ mol^{-1} (279.0 kcal mol^{-1})**				
Se^+	Se		9.752	S	1167.3	2113
See also – EI: 2469						
Se^+	Se_2	Se	13.16–13.36	PI		2609
(Threshold value approximately corrected to 0 K)						
Se^+	Se_2	Se	12.6±0.5	EI		2569
Se^+	Se_2	Se	12.0±0.5	EI		2747
Se^+	SeO_2		16.8±0.5	EI		3193
Se^+	SeO_3		18.3±0.5	EI		3193
Se^+	Ga_2Se		15.6±0.5	EI		2569
Se^+	InSe?		14.2±0.5	EI		2469
Se^+	SnSe	Sn	12.7±0.5	EI		2063
Se^+	SbSe?		13.2±0.3	EI		3249
	Se_2^+	**$\Delta H^\circ_{f0} = 1004$ kJ mol^{-1} (240 kcal mol^{-1})**				
Se_2^+	Se_2		~8.84	S		3218
Se_2^+	Se_2		8.88±0.03	PI	1004	2609
(Threshold value approximately corrected to 0 K)						
See also – EI: 2426, 2469, 2569, 3249						
Se_2^+	$C_2H_5SeSeC_2H_5$		11.0±0.3	EI		3285
		Se_5^+				
Se_5^+	Se_5		8.63±0.2	EI		2426
Se_5^+	Se_5		9.2±0.2	EI		2446
Both references report also appearance potentials for the fragment ions Se_3^+ and Se_4^+. Their parentage is not clear.						
		Se_6^+				
Se_6^+	Se_6		8.88±0.2	EI		2426
Se_6^+	Se_6		9.08±0.05	EI		2446
		Se_7^+				
Se_7^+	Se_7		8.38±0.2	EI		2426
Se_7^+	Se_7		8.87±0.05	EI		2446
		Se_8^+				
Se_8^+	Se_8		8.63±0.2	EI		2426
Se_8^+	Se_8		8.97±0.05	EI		2446

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$H_2Se^+(^2B_1)$ $\Delta H^\circ_{f0} = 987$ kJ mol^{-1} (236 kcal mol^{-1})						
$H_2Se^+(^2B_1)$	H_2Se		9.882±0.001	S	987	3317
$H_2Se^+(^2B_1)$	H_2Se		9.93	PE		3170
$H_2Se^+(^2A_1)$	H_2Se		12.17	PE		3170
$H_2Se^+(^2B_2)$	H_2Se		13.61	PE		3170
H_2Se^+	$(C_2H_5)_2Se$		12.8±0.3	EI		3285
HSe_2^+						
HSe_2^+	$C_2H_5SeSeC_2H_5$		14.5±0.3	EI		3285
$H_2Se_2^+$						
$H_2Se_2^+$	$C_2H_5SeSeC_2H_5$		12.2±0.3	EI		3285
BSe^+						
BSe^+	BSe		10.3±1	EI		3206
SeO^+						
SeO^+	SeO_2	O	13.0±0.5	EI		3193
SeO^+	SeO_3		14.8±0.5	EI		3193
SeO_2^+						
SeO_2^+	SeO_2		11.5±0.5	EI		3193
SeO_2^+	SeO_3	O	13.8±0.5	EI		3193
SeO_3^+						
SeO_3^+	SeO_3		11.6±0.5	EI		3193
$AlSe^+$						
$AlSe^+$	AlSe		8.3±0.5	EI		2449
Al_2Se^+						
Al_2Se^+	Al_2Se		6.0±0.5	EI		2449
$Al_2Se_2^+$						
$Al_2Se_2^+$	Al_2Se_2		9.0±0.5	EI		2449

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		S_7Se^+				
S_7Se^+	S_7Se		9.35±0.2	EI		2426
		$ScSe^+$				
$ScSe^+$	$ScSe$		5.62	EI		2721
		$GaSe^+$				
$GaSe^+$	Ga_2Se	Ga	11.2±0.3	EI		2569
		Ga_2Se^+				
Ga_2Se^+	Ga_2Se		7.4±0.3	EI		2569
		$C_2H_4Se^+$				
$C_2H_4Se^+$	$C_2H_5SeSeC_2H_5$		14.2±0.3	EI		3285
		$C_2H_5Se^+$				
$C_2H_5Se^+$	$(C_2H_5)_2Se$		11.9±0.3	EI		3285
$C_2H_5Se^+$	$C_2H_5SeSeC_2H_5$		13.4±0.3	EI		3285
$C_2H_5Se^+$	$CH_3SeCH_2CH_2CH(NH_2)COOH$		12.05±0.14	EI		2587
		$C_2H_6Se^+$				
$C_2H_6Se^+$	$(C_2H_5)_2Se$		10.6±0.3	EI		3285
$C_2H_6Se^+$	$C_2H_5SeSeC_2H_5$		10.0±0.3	EI		3285
		$C_3H_7Se^+$				
$C_3H_7Se^+$	$(C_2H_5)_2Se$	CH_3	10.5±0.3	EI		3285
		$C_4H_4Se^+$				
$C_4H_4Se^+$	C_4H_4Se (Selenophene)		9.01±0.05	EI		3233
		$C_4H_{10}Se^+$				
$C_4H_{10}Se^+$	$(C_2H_5)_2Se$		8.3±0.3	EI		3285

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_2H_5Se_2^+$				
$C_2H_5Se_2^+$	$C_2H_5SeSeC_2H_5$		12.8±0.3	EI		3285
		$C_2H_6Se_2^+$				
$C_2H_6Se_2^+$	$C_2H_5SeSeC_2H_5$		10.2±0.3	EI		3285
		$C_4H_{10}Se_2^+$				
$C_4H_{10}Se_2^+$	$C_2H_5SeSeC_2H_5$		7.4±0.3	EI		3285
		$C_4H_{10}NSe^+$				
$C_4H_{10}NSe^+$	$CH_3SeCH_2CH_2CH(NH_2)COOH$		9.59±0.20	EI		2587
		$C_5H_{11}NO_2Se^+$				
$C_5H_{11}NO_2Se^+$	$CH_3SeCH_2CH_2CH(NH_2)COOH$		8.29±0.15	EI		2587
	Br^+	**$\Delta H^\circ_{f0} = 1257.8$ kJ mol^{-1} (300.6 kcal mol^{-1})**				
Br^+	Br		11.814	S	1257.8	2113
See also – EI:	439					
Br^+	Br_2	Br^-	10.31	PI	(1247)	416
Br^+	Br_2	Br^-	10.48±0.02	PI		213
(Position of peak maximum)						
Br^+	Br_2	Br^-	10.38±0.05	RPD		292
See also – EI:	357					
Br^+	CBr_4		18.1±0.2	EI		1246
Br^+	$MgBr_2$		16±1	EI		178
Br^+	PBr_3		17.1±0.5	EI		2506
Br^+	$ZnBr_2$		17.7±0.3	EI		2506
Br^+	$GeBr_2$		17.5±0.5	EI		2568
Br^+	$GeBr_4$		22±1	EI		2568
Br^+	CH_3Br	CH_3	14.7±0.05	RPD		2154
Br^+	C_2H_5Br		18.6±0.3	EI		356
Br^+	$CH_3C{\equiv}CBr$		16.0±0.5	EI		13
Br^+	BrCN	CN^-	11.9±0.2	EI		73
Br^+	BrCN	CN	15.52±0.02	PI	(1258)	2621
See also – EI:	73					
Br^+	CF_3Br		16.7±0.1	EI		439
See also – EI:	24					
Br^+	$HgBr_2$		16.7±0.2	EI		2506

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
	$Br_2^+(^2\Pi_{3/2g})$	**ΔH°_{f0} = 1060 kJ mol^{-1} (253 kcal mol^{-1})**				
	$Br_2^+(^2\Pi_{1/2g})$	**ΔH°_{f0} = 1094 kJ mol^{-1} (261 kcal mol^{-1})**				
	$Br_2^+(^2\Pi_{3/2u})$	**ΔH°_{f0} = 1243 kJ mol^{-1} (297 kcal mol^{-1})**				
	$Br_2^+(^2\Sigma_g^+)$	**ΔH°_{f0} = 1424 kJ mol^{-1} (340 kcal mol^{-1})**				
$Br_2^+(^2\Pi_{3/2g})$	Br_2		10.559±0.01	S		2671, 3097
$Br_2^+(^2\Pi_{3/2g})$	Br_2		10.52±0.01	PI	1061	3036, 3413
(Threshold value corrected for hot bands)						
$Br_2^+(^2\Pi_{3/2g})$	Br_2		10.51±0.01	PE	1060	3409
$Br_2^+(^2\Pi_{3/2g})$	Br_2		10.51	PE	1060	3275
$Br_2^+(^2\Pi_{3/2g})$	Br_2		10.7±0.1	EDD		3279
The authors of refs. 3036, 3413 conclude that the spectroscopic measurement refers to the first vibrationally excited state of the ion.						
$Br_2^+(^2\Pi_{1/2g})$	Br_2		10.948±0.01	S		2671, 3097
$Br_2^+(^2\Pi_{1/2g})$	Br_2		10.86±0.01	PE	1094	3409
$Br_2^+(^2\Pi_{1/2g})$	Br_2		10.86	PE	1094	3275
$Br_2^+(^2\Pi_{3/2u})$	Br_2		12.41±0.02	PE	1243	3409
$Br_2^+(^2\Pi_{3/2u})$	Br_2		12.5	PE		3275
$Br_2^+(^2\Pi_{1/2u})$	Br_2		~12.75	PE		3409
$Br_2^+(^2\Pi_{1/2u})$	Br_2		~12.8	PE		3275
$Br_2^+(^2\Sigma_g^+)$	Br_2		14.28±0.02	PE	1424	3409
$Br_2^+(^2\Sigma_g^+)$	Br_2		14.3	PE		3275
See also – PI: 182, 213, 416 PE: 2815, 3277 EI: 75, 292, 357						
Br_2^+	CBr_4		13.3±0.1	EDD		3279
Br_2^+	$MgBr_2$	Mg	17±1	EI		178
Br_2^+	$GeBr_4$		19.5±0.5	EI		2568
		Br_2^{+2}				
Br_2^{+2}	Br_2		30.0	EI		75
	$HBr^+(^2\Pi_{3/2})$	**ΔH°_{f0} = 1097 kJ mol^{-1} (262 kcal mol^{-1})**				
	$HBr^+(^2\Pi_{1/2})$	**ΔH°_{f0} = 1131 kJ mol^{-1} (270 kcal mol^{-1})**				
	$HBr^+(^2\Sigma^+)$	**ΔH°_{f0} = 1448 kJ mol^{-1} (346 kcal mol^{-1})**				
$HBr^+(^2\Pi_{3/2})$	HBr		11.677±0.004	D	1098	3278
$HBr^+(^2\Pi_{3/2})$	HBr		11.62±0.01	PI	1093	182, 416
$HBr^+(^2\Pi_{3/2})$	HBr		11.67±0.01	PE	1097	2819
$HBr^+(^2\Pi_{3/2})$	HBr		11.71±0.01	PE	1101	2815
$HBr^+(^2\Pi_{1/2})$	HBr		12.00±0.01	PE	1129	2819
$HBr^+(^2\Pi_{1/2})$	HBr		12.03±0.01	PE	1132	2815

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$HBr^+(^2\Sigma^+)$	HBr		15.29	PE	1447	2819
$HBr^+(^2\Sigma^+)$	HBr		15.31±0.01	PE	1449	2815

DBr^{+2}

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
DBr^{+2}	DBr		33.2±0.3	FD		212

$LiBr^+$

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$LiBr^+$	LiBr		9.4	EI		2179

Li_2Br^+

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
Li_2Br^+	Li_2Br_2	Br	9.9	EI		2179

BBr^+

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
BBr^+	BBr?		10.7±0.2	EI		206
(Probably formed by thermal decomposition of BBr_3)						
BBr^+	BBr_3		15.0±0.2	EI		206

BBr_2^+

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
BBr_2^+	BBr_3	Br	10.7±0.2	EI		206

$BBr_3^+(^2A_2')$ $\Delta H_{f0}^\circ = 831$ kJ mol^{-1} (199 kcal mol^{-1})

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$BBr_3^+(^2A_2')$	BBr_3		10.51±0.02	PE	831	3375
$BBr_3^+(^2E')$	BBr_3		11.13±0.03	PE		3375
$BBr_3^+(^2E'')$	BBr_3		11.71±0.04 (V)	PE		3375
$BBr_3^+(^2A_2'')$	BBr_3		12.89±0.04	PE		3375
$BBr_3^+(^2E')$	BBr_3		13.67±0.03	PE		3375
$BBr_3^+(^2E')$	BBr_3		14.46±0.03 (V)	PE		3375
$BBr_3^+(^2A_1')$	BBr_3		16.63±0.05	PE		3375
BBr_3^{+*}	BBr_3		17.14±0.04 (V)	PE		3375

This last band may be due to an impurity. However, it is also observed in ref. 3119 where it is assigned to the $^2A_1'$ state. There is disagreement on some of the assignments, see ref. 2834. Additional fine structure is resolved in ref. 3119.

See also – PE: 2834, 3119
EI: 206, 2512, 2513, 3227

CBr^+

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
CBr^+	CBr		10.43±0.02	EI		129
CBr^+	CBr≡CBr	CBr	16.1±0.1	EDD		3177

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
CBr^+	CBr_4		16.35±0.13	EI		129
CBr^+	CBr_4		17.5±0.2	EI		1246
CBr^+	$CH{\equiv}CBr$	CH	18.1±0.1	EDD		3177
CBr^+	BrCN	N	17.4±0.2	EI		73
CBr^+	$CCl{\equiv}CBr$	CCl	16.0±0.1	EDD		3177
CBr^+	$CBr{\equiv}CI$	CI	16.9±0.1	EDD		3177
		CBr_2^+				
CBr_2^+	CBr_2		10.11±0.09	EI		129
CBr_2^+	CBr_4		12.30±0.08	EI		129
CBr_2^+	CBr_4		14.6±0.3	EI		1246
		$C_2Br_2^+$				
$C_2Br_2^+(^2\Pi_{3/2u})$	$CBr{\equiv}CBr$		9.67	PE		3121
$C_2Br_2^+(^2\Pi_{3/2u})$	$CBr{\equiv}CBr$		9.7±0.1	EDD		3177
$C_2Br_2^+(^2\Pi_{1/2u})$	$CBr{\equiv}CBr$		9.87	PE		3121
$C_2Br_2^+(^2\Pi_{3/2g})$	$CBr{\equiv}CBr$		12.11	PE		3121
$C_2Br_2^+(^2\Pi_{1/2g})$	$CBr{\equiv}CBr$		12.40	PE		3121
$C_2Br_2^+(^2\Pi_{3/2u})$	$CBr{\equiv}CBr$		13.31 (V)	PE		3121
$C_2Br_2^+(^2\Pi_{1/2u})$	$CBr{\equiv}CBr$		13.45 (V)	PE		3121
$C_2Br_2^+(^2\Sigma_g^+)$	$CBr{\equiv}CBr$		15.64 (V)	PE		3121
$C_2Br_2^+(^2\Sigma_u^+)$	$CBr{\equiv}CBr$		16.90 (V)	PE		3121
		$C_2Br_2^{+2}$				
$C_2Br_2^{+2}$	$CBr{\equiv}CBr$		25.8±0.1	EDD		3177
		CBr_3^+				
CBr_3^+	CBr_4	Br	9.95±0.05	EI		129
CBr_3^+	CBr_4	Br	11.3±0.2	EI		1246
		CBr_4^+				
CBr_4^+	CBr_4		10.39 (V)	PE		3119
CBr_4^+	CBr_4		10.40 (V)	PE		3117

Orbital assignments are discussed in R. N. Dixon, J. N. Murrell and B. Narayan, Mol. Phys. **20**, 611 (1971).

See also – EI: 1246

CBr_4^{+2}

CBr_4^{+2}	CBr_4		≤28.6±0.7 (V)	AUG		3424

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		BrF^+				
BrF^+	BrF		11.8±0.2	EI		357
BrF^+	BrF_5		~20	EI		357
		BrF_2^+				
BrF_2^+	BrF_3	F	13.5±0.3	EI		357
BrF_2^+	BrF_5		16.1±0.2	EI		357
		BrF_3^+				
BrF_3^+	BrF_3		12.9±0.3	EI		357
BrF_3^+	BrF_5		15.5±0.2	EI		357
		BrF_4^+				
BrF_4^+	BrF_5	F^-?	14.0±0.3	EI		357
		$MgBr^+$				
$MgBr^+$	$MgBr_2$	Br	12.0±0.4	EI		178
		$MgBr_2^+$				
$MgBr_2^+$	$MgBr_2$		10.65±0.15	EI		178
		$Mg_2Br_3^+$				
$Mg_2Br_3^+$	Mg_2Br_4	Br	10.8±0.3	EI		178
		$AlBr^+$				
$AlBr^+$	$AlBr_3$		17.7±0.5	EI		2897
		$AlBr_2^+$				
$AlBr_2^+$	$AlBr_3$	Br	13.3±0.5	EI		2897
		$AlBr_3^+$				
$AlBr_3^+$	$AlBr_3$		12.2±0.5	EI		2897

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$Al_2Br_5^+$				
$Al_2Br_5^+$	Al_2Br_6	Br	12.3±0.5	EI		2897
		$SiBr_4^+$				
$SiBr_4^+$	$SiBr_4$		10.8	PE		3117
		PBr^+				
PBr^+	PBr_3		15.6±0.3	EI		2506
		PBr_2^+				
PBr_2^+	PBr_3	Br	11.4±0.2	EI		2506
		PBr_3^+				
PBr_3^+	PBr_3		9.85	EI		2597
PBr_3^+	PBr_3		10.0±0.2	EI		2506
		$BrCl^+$				
$BrCl^+$	BrCl		11.1±0.2	EI		357
		$TiBr_4^+$				
$TiBr_4^+$	$TiBr_4$		10.56 (V)	PE		3117
		$MnBr^+$				
$MnBr^+$	$Mn(CO)_5Br$	5CO	12.4	EI		2501
		$FeBr^+$				
$FeBr^+$	$FeBr_2$	Br	12.9±0.5	EI		174
		$FeBr_2^+$				
$FeBr_2^+$	$FeBr_2$		10.7±0.5	EI		174
		$Fe_2Br_3^+$				
$Fe_2Br_3^+$	Fe_2Br_4	Br	13.6±0.5	EI		174

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$Fe_2Br_4^+$				
$Fe_2Br_4^+$	Fe_2Br_4		12.6±0.5	EI		174
		$ZnBr^+$				
$ZnBr^+$	$ZnBr_2$	Br	13.4±0.2	EI		2506
		$ZnBr_2^+$				
$ZnBr_2^+$	$ZnBr_2$		10.39±0.33	EI		2506
		$GeBr^+$				
$GeBr^+$	$GeBr_2$	Br	11.0±0.3	EI		2568
$GeBr^+$	$GeBr_4$		15±1	EI		2568
		$GeBr_2^+$				
$GeBr_2^+$	$GeBr_2$		9.5±0.3	EI		2568
$GeBr_2^+$	$GeBr_4$		15±1	EI		2568
		$GeBr_3^+$				
$GeBr_3^+$	$GeBr_4$	Br	11.0±0.3	EI		2568
		$GeBr_4^+$				
$GeBr_4^+$	$GeBr_4$		10.75	PE		3117
$GeBr_4^+$	$GeBr_4$		10.8±0.3	EI		2568
		$B_5H_8Br^+$				
$B_5H_8Br^+$	1–B_5H_8Br		9.58±0.05	RPD		3228
See also – EI:	1102					
$B_5H_8Br^+$	2–B_5H_8Br		10.48±0.04	RPD		3228
		CH_2Br^+				
CH_2Br^+	CH_2Br		8.34±0.11	EI		131
CH_2Br^+	CH_2Br		9.30	EI		141
CH_2Br^+	CH_3Br	H	12.12±0.09?	RPD		1139
See also – EI:	160, 356, 3017					

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
CH_2Br^+	C_2H_5Br	CH_3	14.1±0.1	EI		356
CH_2Br^+	CH_2Br_2	Br	10.93±0.04	EI		131

$CH_3Br^+(^2E_{3/2})$ ΔH°_{f0} = 997 kJ mol^{-1} (238 kcal mol^{-1})
$CH_3Br^+(^2E_{1/2})$ ΔH°_{f0} = 1028 kJ mol^{-1} (246 kcal mol^{-1})

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$CH_3Br^+(^2E_{3/2})$	CH_3Br		10.541±0.003	S	997	2064
$CH_3Br^+(^2E_{3/2})$	CH_3Br		10.528±0.005	PI		1253
$CH_3Br^+(^2E_{3/2})$	CH_3Br		10.53±0.01	PI		182, 416
$CH_3Br^+(^2E_{3/2})$	CH_3Br		10.53	PI		2637
$CH_3Br^+(^2E_{3/2})$	CH_3Br		10.53	PE		3057
$CH_3Br^+(^2E_{3/2})$	CH_3Br		10.53±0.015	PE		3074
$CH_3Br^+(^2E_{3/2})$	CH_3Br		10.54	PE		3119
$CH_3Br^+(^2E_{3/2})$	CH_3Br		10.53±0.02	RPD		289
$CH_3Br^+(^2E_{1/2})$	CH_3Br		10.856±0.003	S	1028	2064
$CH_3Br^+(^2E_{1/2})$	CH_3Br		10.85	PE		3057
$CH_3Br^+(^2E_{1/2})$	CH_3Br		10.85±0.015	PE		3074
$CH_3Br^+(^2E_{1/2})$	CH_3Br		10.86	PE		3119

Additional higher ionization potentials are given in refs. 3057, 3119.

See also – PI: 190
PEN: 2430, 2466
EI: 2154, 2776

CH_3Br^{+2}

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
CH_3Br^{+2}	CH_3Br		≤29.8±0.7 (V)	AUG		3424

C_2HBr^+

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_2HBr^+(^2\Pi_{3/2})$	$CH{\equiv}CBr$		10.24	PE		3071
$C_2HBr^+(^2\Pi_{3/2})$	$CH{\equiv}CBr$		10.3±0.1	EDD		3177
$C_2HBr^+(^2\Pi_{1/2})$	$CH{\equiv}CBr$		10.38	PE		3071
$C_2HBr^+(^2\Pi_{3/2})$	$CH{\equiv}CBr$		12.93? (V)	PE		3071
$C_2HBr^+(^2\Pi_{1/2})$	$CH{\equiv}CBr$		13.06? (V)	PE		3071
$C_2HBr^+(^2\Sigma^+)$	$CH{\equiv}CBr$		15.99 (V)	PE		3071
$C_2HBr^+(^2\Sigma^+)$	$CH{\equiv}CBr$		17.6 (V)	PE		3071

See also – S: 3052

C_2HBr^{+2}

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
C_2HBr^{+2}	$CH{\equiv}CBr$		28.4±0.1	EDD		3177

$C_2H_2Br^+$

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_2H_2Br^+$	*cis*–CHBr=CHBr	Br	11.44±0.05	EI		114
$C_2H_2Br^+$	*trans*–CHBr=CHBr	Br	11.65±0.05	EI		114

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
	CH_2= $CHBr^+$	**ΔH°_{f0} = 1039 kJ mol^{-1} (248 kcal mol^{-1})**				
$C_2H_3Br^+$	CH_2=$CHBr$		9.80±0.01	PI	1039	182
$C_2H_3Br^+$	CH_2=$CHBr$		9.80	PI	1039	168
$C_2H_3Br^+$	CH_2=$CHBr$		9.82±0.02	PI	1041	268
See also – EI:	268					
	$C_2H_5Br^+(^2E_{3/2})$ **$C_2H_5Br^+(^2E_{1/2})$**	**ΔH°_{f0} = 951 kJ mol^{-1} (227 kcal mol^{-1})** **ΔH°_{f0} = 981 kJ mol^{-1} (234 kcal mol^{-1})**				
$C_2H_5Br^+(^2E_{3/2})$	C_2H_5Br		10.29±0.02	S	950	2065
$C_2H_5Br^+(^2E_{3/2})$	C_2H_5Br		10.29±0.01	PI	950	182, 416
$C_2H_5Br^+(^2E_{3/2})$	C_2H_5Br		10.30±0.015	PE	951	3074
$C_2H_5Br^+(^2E_{3/2})$	C_2H_5Br		10.24±0.03	EDD		3174
$C_2H_5Br^+(^2E_{1/2})$	C_2H_5Br		10.61±0.02	S	981	2065
$C_2H_5Br^+(^2E_{1/2})$	C_2H_5Br		10.61±0.015	PE	981	3074
See also – PI:	190, 297					
EI:	160, 356					
		$C_3H_3Br^+$				
$C_3H_3Br^+$	$CH_3C{\equiv}CBr$		10.1±0.1	EI		13
		$C_3H_5Br^+$				
$C_3H_5Br^+$	CH_3CH=$CHBr$		9.30±0.05?	PI		182
$C_3H_5Br^+$	C_3H_5Br (Bromocyclopropane)		9.53	PE		3074
	n-$C_3H_7Br^+(^2E_{3/2})$ **n-$C_3H_7Br^+(^2E_{1/2})$** ***iso*-$C_3H_7Br^+(^2E_{3/2})$** ***iso*-$C_3H_7Br^+(^2E_{1/2})$**	**ΔH°_{f298} = 894 kJ mol^{-1} (214 kcal mol^{-1})** **ΔH°_{f298} = 924 kJ mol^{-1} (221 kcal mol^{-1})** **ΔH°_{f298} ~ 877 kJ mol^{-1} (210 kcal mol^{-1})** **ΔH°_{f298} = 907 kJ mol^{-1} (217 kcal mol^{-1})**				
$C_3H_7Br^+(^2E_{3/2})$	n-C_3H_7Br		10.18±0.01	PI	894	182
$C_3H_7Br^+(^2E_{3/2})$	n-C_3H_7Br		10.18±0.015	PE	894	3074
$C_3H_7Br^+(^2E_{1/2})$	n-C_3H_7Br		10.49±0.015	PE	924	3074
See also – EI:	160, 2776					
$C_3H_7Br^+(^2E_{3/2})$	*iso*-C_3H_7Br		10.075±0.01	PI	875	182
$C_3H_7Br^+(^2E_{3/2})$	*iso*-C_3H_7Br		10.12±0.015	PE	879	3074
$C_3H_7Br^+(^2E_{1/2})$	*iso*-C_3H_7Br		10.41±0.015	PE	907	3074

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
	n–$C_4H_9Br^+(^2E_{3/2})$	**$\Delta H^\circ_{f298} = 870$ kJ mol^{-1} (208 kcal mol^{-1})**				
	n–$C_4H_9Br^+(^2E_{1/2})$	**$\Delta H^\circ_{f298} = 900$ kJ mol^{-1} (215 kcal mol^{-1})**				
	sec–$C_4H_9Br^+(^2E_{3/2})$	**$\Delta H^\circ_{f298} = 843$ kJ mol^{-1} (201 kcal mol^{-1})**				
	$tert$–$C_4H_9Br^+(^2E_{3/2})$	**$\Delta H^\circ_{f298} \sim 823$ kJ mol^{-1} (197 kcal mol^{-1})**				
	$tert$–$C_4H_9Br^+(^2E_{1/2})$	**$\Delta H^\circ_{f298} = 854$ kJ mol^{-1} (204 kcal mol^{-1})**				
$C_4H_9Br^+(^2E_{3/2})$	n–C_4H_9Br		10.125±0.01	PI	870	182, 416
$C_4H_9Br^+(^2E_{3/2})$	n–C_4H_9Br		10.13±0.015	PE	870	3074
$C_4H_9Br^+(^2E_{1/2})$	n–C_4H_9Br		10.44±0.015	PE	900	3074
$C_4H_9Br^+(^2E_{3/2})$	sec–C_4H_9Br		9.98±0.01	PI	843	182
$C_4H_9Br^+(^2E_{3/2})$	iso–C_4H_9Br		10.09±0.02	PI		182
$C_4H_9Br^+(^2E_{3/2})$	iso–C_4H_9Br		10.10±0.015	PE		3074
$C_4H_9Br^+(^2E_{1/2})$	iso–C_4H_9Br		10.41±0.015	PE		3074
$C_4H_9Br^+(^2E_{3/2})$	$tert$–C_4H_9Br		9.89±0.03	PI	820	182
$C_4H_9Br^+(^2E_{3/2})$	$tert$–C_4H_9Br		9.95±0.015	PE	826	3074
$C_4H_9Br^+(^2E_{1/2})$	$tert$–C_4H_9Br		10.24±0.015	PE	854	3074
		$C_5H_4Br^+$				
$C_5H_4Br^+$	C_5H_4Br (Bromocyclopentadienyl radical)		8.85	EI		126
	n–$C_5H_{11}Br^+(^2E_{3/2})$	**$\Delta H^\circ_{f298} = 845$ kJ mol^{-1} (202 kcal mol^{-1})**				
$C_5H_{11}Br^+(^2E_{3/2})$	n–$C_5H_{11}Br$		10.10±0.02	PI	845	182
$C_5H_{11}Br^+(^2E_{3/2})$	neo–$C_5H_{11}Br$		10.04±0.015	PE		3074
$C_5H_{11}Br^+(^2E_{1/2})$	neo–$C_5H_{11}Br$		10.34±0.015	PE		3074
		$C_6H_4Br^+$				
$C_6H_4Br^+$	C_6H_4BrI (1–Bromo–4–iodobenzene)	I	12.04	EI		3238

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
	$C_6H_5Br^+$ (Bromobenzene)	**$\Delta H^\circ_{f298} \sim 972$ kJ mol^{-1} (232 kcal mol^{-1})**				
$C_6H_5Br^+$	C_6H_5Br (Bromobenzene)		8.950	PI	969	2682
$C_6H_5Br^+$	C_6H_5Br (Bromobenzene)		8.98±0.02	PI	971	182, 416
$C_6H_5Br^+$	C_6H_5Br (Bromobenzene)		9.03±0.01	PI	976	3212
$C_6H_5Br^+$	C_6H_5Br (Bromobenzene)		8.99	PE	972	3212
$C_6H_5Br^+$	C_6H_5Br (Bromobenzene)		8.98±0.03	EDD		3174
See also – S:	3212					
PE:	2806, 3247, 3331					
EI:	301, 1066, 3223, 3230, 3238					
		$C_6H_{11}Br^+$				
$C_6H_{11}Br^+(^2E_{3/2})$	$C_6H_{11}Br$ (Bromocyclohexane)		9.875	PE		3074
$C_6H_{11}Br^+(^2E_{1/2})$	$C_6H_{11}Br$ (Bromocyclohexane)		10.165	PE		3074
		$C_7H_6Br^+$				
$C_7H_6Br^+$	$C_6H_4BrCH_3$ (4–Bromotoluene)	H	12.48	EI		3238
$C_7H_6Br^+$	$C_6H_4BrC_2H_5$ (1–Bromo–4–ethylbenzene)	CH_3	10.75	EI		3238
$C_7H_6Br^+$	$C_6H_5CH_2CH_2C_6H_4Br$ (1–(4–Bromophenyl)–2–phenylethane)		10.4±0.2	EI		3288

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
			$C_7H_7Br^+$			
$C_7H_7Br^+$	$C_6H_5CH_2Br$ (α–Bromotoluene)		9.10±0.05	EI		2025
$C_7H_7Br^+$	$C_6H_5CH_2Br$ (α–Bromotoluene)		9.1±0.1	EI		2973
$C_7H_7Br^+$	$C_6H_5CH_2Br$ (α–Bromotoluene)		8.9	EI		3230
$C_7H_7Br^+$	$C_6H_4BrCH_3$ (2–Bromotoluene)		8.78±0.01	PI		416
See also – PI: EI:	182 3230					
$C_7H_7Br^+$	$C_6H_4BrCH_3$ (3–Bromotoluene)		8.81±0.02	PI		182
See also – EI:	3230					
$C_7H_7Br^+$	$C_6H_4BrCH_3$ (4–Bromotoluene)		8.67±0.02	PI		182, 416
$C_7H_7Br^+$	$C_6H_4BrCH_3$ (4–Bromotoluene)		8.71	PE		2806
See also – EI:	1066, 3230					
			$C_8H_9Br^+$			
$C_8H_9Br^+$	$C_6H_5CH_2CH_2Br$ (1–Bromo–2–phenylethane)		9.0±0.1	EI		2973
			$C_9H_{11}Br^+$			
$C_9H_{11}Br^+$	$C_6H_5(CH_2)_3Br$ (1–Bromo–3–phenylpropane)		8.95±0.1	EI		2973
			$C_{14}H_{13}Br^+$			
$C_{14}H_{13}Br^+$	$C_6H_5CH_2CH_2C_6H_4Br$ (1–(4–Bromophenyl)–2–phenylethane)		8.8±0.1	EI		3288
			$CHBr_2^+$			
$CHBr_2^+$	$CHBr_2$		8.13±0.16	EI		131
$CHBr_2^+$	$CHBr_3$	Br	10.80±0.01	EI		131

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
	$CH_2Br_2^+$ $\Delta H^\circ_{f298} = 1008$ kJ mol^{-1} (241 kcal mol^{-1})					
$CH_2Br_2^+$	CH_2Br_2		10.49±0.02	PI	1008	182
$CH_2Br_2^+$	CH_2Br_2		10.61 (V)	PE		3119
Orbital assignments are discussed in R. N. Dixon, J. N. Murrell and B. Narayan, Mol. Phys. **20**, 611 (1971).						
	$CH_2Br_2^{+2}$					
$CH_2Br_2^{+2}$	CH_2Br_2		≤29.8±0.7 (V)	AUG		3424
	$C_2H_2Br_2^+$					
$C_2H_2Br_2^+$	*cis*–CHBr=CHBr		9.45	PI		168
$C_2H_2Br_2^+$	*cis*–CHBr=CHBr		9.45±0.02	PI		114, 268, 1058, 1190
See also – PI:	182					
EI:	114, 268, 1058, 1190, 3213					
$C_2H_2Br_2^+$	*trans*–CHBr=CHBr		9.47	PI		168
$C_2H_2Br_2^+$	*trans*–CHBr=CHBr		9.46±0.02	PI		114, 268, 1058, 1190
See also – PI:	182					
EI:	114, 268, 1058, 1190, 3213					
	$C_2H_4Br_2^+$					
$C_2H_4Br_2^+$	CH_3CHBr_2		10.19±0.03	PI		182
	$C_3H_6Br_2^+$					
$C_3H_6Br_2^+$	$(CH_2Br)_2CH_2$		10.07±0.02	PI		182
	$C_6H_4Br_2^+$					
$C_6H_4Br_2^+$	$C_6H_4Br_2$ (1,4–Dibromobenzene)		8.97 (V)	PE		2806
$C_6H_4Br_2^+$	$C_6H_4Br_2$ (1,4–Dibromobenzene)		8.9±0.15	CTS		3373
	$CHBr_3^+$ $\Delta H^\circ_{f0} \sim 1055$ kJ mol^{-1} (252 kcal mol^{-1})					
$CHBr_3^+$	$CHBr_3$		10.51±0.02	PI	1057	182
$CHBr_3^+$	$CHBr_3$		10.47 (V)	PE	1053	3119
Orbital assignments are discussed in R. N. Dixon, J. N. Murrell and B. Narayan, Mol. Phys. **20**, 611 (1971).						

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$CHBr_3^{+2}$						
$CHBr_3^{+2}$	$CHBr_3$		≤28.9±0.8 (V)	AUG		3424
$C_2HBr_3^+$						
$C_2HBr_3^+$	$CHBr{=}CBr_2$		9.27±0.01	PI		182
$C_2HBr_3^+$	$CHBr{=}CBr_2$		9.27	PI		168
$BrCN^+(^2\Pi_{3/2})$ $\Delta H^\circ_{f0} \sim 1337$ kJ mol^{-1} (319 kcal mol^{-1})						
$BrCN^+(^2\Pi_{1/2})$ $\Delta H^\circ_{f0} \sim 1355$ kJ mol^{-1} (324 kcal mol^{-1})						
$BrCN^+(^2\Sigma^+)$ $\Delta H^\circ_{f0} \sim 1501$ kJ mol^{-1} (359 kcal mol^{-1})						
$BrCN^+(^2\Pi_{3/2})$ $\Delta H^\circ_{f0} = 1562$ kJ mol^{-1} (373 kcal mol^{-1})						
$BrCN^+(^2\Pi_{1/2})$ $\Delta H^\circ_{f0} = 1576$ kJ mol^{-1} (377 kcal mol^{-1})						
$CNBr^+(^2\Pi_{3/2})$	BrCN		11.84±0.01	PI	1335	2621
$CNBr^+(^2\Pi_{3/2})$	BrCN		11.85±0.02	PE	1336	3091
$CNBr^+(^2\Pi_{3/2})$	BrCN		11.88	PE	1339	3045
$CNBr^+(^2\Pi_{1/2})$	BrCN		12.03±0.02	PE	1353	3091
$CNBr^+(^2\Pi_{1/2})$	BrCN		12.07	PE	1357	3045
$CNBr^+(^2\Sigma^+)$	BrCN		13.54±0.02	PE	1499	3091
$CNBr^+(^2\Sigma^+)$	BrCN		13.58	PE	1503	3045
$CNBr^+(^2\Pi_{3/2})$	BrCN		14.19	PE	1562	3045
$CNBr^+(^2\Pi_{3/2})$	BrCN		14.40±0.02 (V)	PE		3091
$CNBr^+(^2\Pi_{1/2})$	BrCN		14.34	PE	1576	3045
$CNBr^+(^2\Pi_{1/2})$	BrCN		14.49±0.02 (V)	PE		3091
$CNBr^+(^2\Sigma^+)$	BrCN		18.07±0.02 (V)	PE		3091
$CNBr^+(^2\Sigma^+)$	BrCN		18.07 (V)	PE		3045
See also – EI:	73					
BF_2Br^+						
BF_2Br^+	BF_2Br		11.95±0.21	EI		2512, 3227
$BFBr_2^+$						
$BFBr_2^+$	$BFBr_2$		11.11±0.10	EI		2512, 3227
CF_2Br^+						
CF_2Br^+	CF_3Br	F	15.0±0.1	EI		439
CF_2Br^+	CF_3Br	F	15.0±0.7	EI		24

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		CF_3Br^+				
CF_3Br^+	CF_3Br		11.82±0.02	EI		439
CF_3Br^+	CF_3Br		11.89±0.10	EI		1131
CF_3Br^+	CF_3Br		12.3±0.3	EI		24
		$C_6F_5Br^+$				
$C_6F_5Br^+$	C_6F_5Br (Bromopentafluorobenzene)		9.6±0.1	EI		301
		$CF_2Br_2^+$				
$CF_2Br_2^+$	CF_2Br_2		11.07±0.03	PI		182
		$CFBr_3^+$				
$CFBr_3^+$	$CFBr_3$		10.67±0.01	PI		182
		$P_3N_3Br_5^+$				
$P_3N_3Br_5^+$	$(NPBr_2)_3$ (Cyclo–tris(dibromophosphonitrile))	Br	10.29±0.1	EI		2782
		$P_3N_3Br_6^+$				
$P_3N_3Br_6^+$	$(NPBr_2)_3$ (Cyclo–tris(dibromophosphonitrile))		9.56±0.1	EI		2782
		$P_4N_4Br_8^+$				
$P_4N_4Br_8^+$	$(NPBr_2)_4$ (Cyclo–tetrakis(dibromophosphonitrile))		9.21±0.1	EI		2782
		BCl_2Br^+				
BCl_2Br^+	BCl_2Br		11.13±0.18	EI		2512, 2513, 3227
		$BClBr_2^+$				
$BClBr_2^+$	$BClBr_2$		10.79±0.06	EI		2512, 2513, 3227

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
C_2ClBr^+						
$C_2ClBr^+(^2\Pi_{3/2})$	$CCl{\equiv}CBr$		9.98 (V)	PE		3121
$C_2ClBr^+(^2\Pi_{3/2})$	$CCl{\equiv}CBr$		10.0±0.1	EDD		3177
$C_2ClBr^+(^2\Pi_{3/2})$	$CCl{\equiv}CBr$		12.54 (V)	PE		3121
$C_2ClBr^+(^2\Pi_{1/2})$	$CCl{\equiv}CBr$		12.73 (V)	PE		3121
$C_2ClBr^+(^2\Pi_{3/2})$	$CCl{\equiv}CBr$		14.08 (V)	PE		3121
$C_2ClBr^+(^2\Sigma^+)$	$CCl{\equiv}CBr$		16.07 (V)	PE		3121
$C_2ClBr^+(^2\Sigma^+)$	$CCl{\equiv}CBr$		17.47 (V)	PE		3121
C_2ClBr^{+2}						
C_2ClBr^{+2}	$CCl{\equiv}CBr$		26.8±0.1	EDD		3177
$GeClBr_2^+$						
$GeClBr_2^+$	$GeClBr_3$	Br	13.5±1	EI		2568
$C_5H_4NBr^+$						
$C_5H_4NBr^+$	C_5H_4NBr (2–Bromopyridine)		9.65±0.05	EI		217
$C_5H_4NBr^+$	C_5H_4NBr (4–Bromopyridine)		9.94±0.05	EI		217
$C_6H_6NBr^+$						
$C_6H_6NBr^+$	$C_6H_4BrNH_2$ (4–Bromoaniline)		7.74±0.1	CTS		2485
$C_6H_6NBr^+$	$C_6H_4BrNHCOCH_3$ (*N*–(3–Bromophenyl)acetic acid amide)		10.62±0.2	EI		3406
$C_6H_6NBr^+$	$C_6H_4BrNHCOCH_3$ (*N*–(4–Bromophenyl)acetic acid amide)		10.58±0.2	EI		3406
$C_7H_4NBr^+$						
$C_7H_4NBr^+$	C_6H_4BrCN (3–Bromobenzoic acid nitrile)		9.87±0.05	RPD		3223
$C_7H_4NBr^+$	C_6H_4BrCN (4–Bromobenzoic acid nitrile)		9.54 (V)	PE		2806
$C_7H_4NBr^+$	C_6H_4BrCN (4–Bromobenzoic acid nitrile)		9.90±0.05	RPD		3223
$C_8H_9NBr^+$						
$C_8H_9NBr^+$	$C_6H_4BrN(CH_3)_2$ (4–Bromo–*N*,*N*–dimethylaniline)	H	11.15	EI		3238

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
	$C_8H_{10}NBr^+$					
$C_8H_{10}NBr^+$	$C_6H_4BrN(CH_3)_2$ (4–Bromo–*N*,*N*–dimethylaniline)		7.33	CTS		1281
$C_8H_{10}NBr^+$	$C_6H_4(NH_2)CH_2CH_2Br$ (1–(4–Aminophenyl)–2–bromoethane)		7.8	EI		2973
	$C_{10}H_{14}NBr^+$					
$C_{10}H_{14}NBr^+$	$C_6H_4BrN(C_2H_5)_2$ (4–Bromo–*N*,*N*–diethylaniline)		6.96	CTS		1281
	$C_2H_3OBr^+$					
$C_2H_3OBr^+$	CH_3COBr		10.55±0.05?	PI		182
	$C_2H_5OBr^+$					
$C_2H_5OBr^+$	CH_2BrCH_2OH		10.63	PE		3374
	$C_3H_5OBr^+$					
$C_3H_5OBr^+$	C_3H_5OBr (1–Bromo–2,3–epoxypropane)		10.46	PE		3374
	$C_4H_6OBr^+$					
$C_4H_6OBr^+$	$CH_2BrCH_2CH_2COOCH_3$		11.15±0.3	EI		2496
	$C_6H_4OBr^+$					
$C_6H_4OBr^+$	$C_6H_4BrOCH_3$ (1–Bromo–4–methoxybenzene)	CH_3	11.78±0.1	EI		2970
$C_6H_4OBr^+$	$C_6H_4BrOCH_3$ (1–Bromo–4–methoxybenzene)	CH_3	11.80	EI		3238
	$C_6H_5OBr^+$					
$C_6H_5OBr^+$	C_6H_4BrOH (4–Bromophenol)		8.52 (V)	PE		2806

See also – EI: 1066

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
			$C_7H_4OBr^+$			
$C_7H_4OBr^+$	$C_6H_4BrCOCH_3$ (3–Bromoacetophenone)	CH_3	10.51±0.1	EI		2967
$C_7H_4OBr^+$	$C_6H_4BrCOCH_3$ (4–Bromoacetophenone)	CH_3	10.35±0.1	EI		2967
$C_7H_4OBr^+$	$C_6H_4BrCOCH_3$ (4–Bromoacetophenone)	CH_3	10.58	EI		3238
$C_7H_4OBr^+$	$C_6H_4BrCOOCH_3$ (4–Bromobenzoic acid methyl ester)		11.11	EI		3238
			$C_7H_7OBr^+$			
$C_7H_7OBr^+$	$C_6H_4BrOCH_3$ (1–Bromo–2–methoxybenzene)		8.3±0.15	CTS		3373
$C_7H_7OBr^+$	$C_6H_4BrOCH_3$ (1–Bromo–4–methoxybenzene)		8.49 (V)	PE		2806
$C_7H_7OBr^+$	$C_6H_4BrOCH_3$ (1–Bromo–4–methoxybenzene)		8.2±0.15	CTS		3373
			$C_8H_7OBr^+$			
$C_8H_7OBr^+$	$C_6H_4BrCOCH_3$ (3–Bromoacetophenone)		9.60±0.1	EI		2967
$C_8H_7OBr^+$	$C_6H_4BrCOCH_3$ (4–Bromoacetophenone)		9.47±0.1	EI		2967
$C_8H_7OBr^+$	$C_6H_4BrCOCH_3$ (4–Bromoacetophenone)		9.55	EI		3238
			$C_9H_{11}OBr^+$			
$C_9H_{11}OBr^+$	$C_6H_4(OCH_3)CH_2CH_2Br$ (1–Bromo–2–(3–methoxyphenyl)ethane)		8.5	EI		2973
$C_9H_{11}OBr^+$	$C_6H_4(OCH_3)CH_2CH_2Br$ (1–Bromo–2–(4–methoxyphenyl)ethane)		8.2	EI		2973
			$C_{10}H_{11}OBr^+$			
$C_{10}H_{11}OBr^+$	$C_6H_4BrCOC_3H_7$ (1–(4–Bromophenyl)–1–butanone)		8.75±0.2	EI		2534
			$C_3H_5O_2Br^+$			
$C_3H_5O_2Br^+$	$CH_2BrCOOCH_3$		10.37±0.05	EI		2025

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_5H_9O_2Br^+$				
$C_5H_9O_2Br^+$	$CH_2BrCH_2CH_2COOCH_3$		9.85±0.3	EI		2496
		$C_8H_7O_2Br^+$				
$C_8H_7O_2Br^+$	$C_6H_4BrCOOCH_3$ (4–Bromobenzoic acid methyl ester)		9.47	EI		3238
		$C_6H_4FBr^+$				
$C_6H_4FBr^+$	C_6H_4FBr (1–Bromo–4–fluorobenzene)		8.99±0.03	PI		182
		$C_7H_4F_3Br^+$				
$C_7H_4F_3Br^+$	$C_6H_4BrCF_3$ (4–Bromo–α,α,α–trifluorotoluene)		9.55 (V)	PE		2806
		$C_2H_3FBr_2^+$				
$C_2H_3FBr_2^+$	$CH_2BrCHFBr$		10.75±0.02	PI		182
		$C_2H_2F_2Br_2^+$				
$C_2H_2F_2Br_2^+$	CH_2BrCF_2Br		10.83±0.01	PI		182
		$C_2H_6SiBr^+$				
$C_2H_6SiBr^+$	$(CH_3)_3SiBr$	CH_3	10.97±0.02	RPD		1421
$C_2H_6SiBr^+$	$(CH_3)_3SiBr$	CH_3	10.7±0.1	EI		2689
		$C_3H_9SiBr^+$				
$C_3H_9SiBr^+$	$(CH_3)_3SiBr$		10.24±0.02	RPD		1421
$C_3H_9SiBr^+$	$(CH_3)_3SiBr$		9.8±0.1	EI		2689
		$C_{12}H_{10}PBr^+$				
$C_{12}H_{10}PBr^+$	$(C_6H_5)_2PBr$ (Bromodiphenylphosphine)		8.72±0.05	EI		2481

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_4H_3SBr^+$						
$C_4H_3SBr^+$	C_4H_3SBr (2–Bromothiophene)		8.63±0.01	PI		182
$C_4H_3SBr^+$	C_4H_3SBr (2–Bromothiophene)		8.50	PE		3246
See also – EI:	3240					
$C_4H_3SBr^+$	C_4H_3SBr (3–Bromothiophene)		8.90±0.05	PE		3246
$C_7H_7S_3Br^+$						
$C_7H_7S_3Br^+$	$C_7H_7S_3Br$ (3–Bromo–2,5–dimethyl–6a–thiathiophthene)		7.49	EI		3284
CH_2ClBr^+ ΔH°_{f298} = 989 kJ mol^{-1} (236 kcal mol^{-1})						
CH_2ClBr^+	CH_2ClBr		10.77±0.01	PI	989	182
CH_2ClBr^+	CH_2ClBr		10.75±0.05	EI		72
$C_2H_4ClBr^+$						
$C_2H_4ClBr^+$	CH_2ClCH_2Br		10.63±0.03	PI		182
$C_6H_4ClBr^+$						
$C_6H_4ClBr^+$	C_6H_4ClBr (1–Bromo–4–chlorobenzene)		9.04 (V)	PE		2806
$C_8H_8ClBr^+$						
$C_8H_8ClBr^+$	$C_6H_4ClCH_2CH_2Br$ (1–Bromo–2–(3–chlorophenyl)ethane)		9.1	EI		2973
$C_8H_8ClBr^+$	$C_6H_4ClCH_2CH_2Br$ (1–Bromo–2–(4–chlorophenyl)ethane)		8.8	EI		2973
$CHCl_2Br^+$						
$CHCl_2Br^+$	$CHCl_2Br$		10.88±0.05	EI		72
$CHClBr_2^+$ ΔH°_{f298} = 1001 kJ mol^{-1} (239 kcal mol^{-1})						
$CHClBr_2^+$	$CHClBr_2$		10.59±0.01	PI	1001	182

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$BFClBr^+$						
$BFClBr^+$	BFClBr		11.46±0.02	EI		2512, 3227
$P_3N_3Cl_4Br^+$						
$P_3N_3Cl_4Br^+$	$NPCl_2(NPClBr)_2$ (Cyclo–bis(bromochlorophosphonitrile)dichlorophosphonitrile)	Br	10.54±0.1	EI		2782
$P_3N_3Cl_5Br^+$						
$P_3N_3Cl_5Br^+$	$(NPCl_2)_2NPClBr$ (Cyclo–bis(dichlorophosphonitrile)bromochlorophosphonitrile)		9.83±0.1	EI		2782
$P_3N_3Cl_3Br_2^+$						
$P_3N_3Cl_3Br_2^+$	$(NPClBr)_3$ (Cyclo–tris(bromochlorophosphonitrile))	Br	10.32±0.1	EI		2782
$P_3N_3Cl_4Br_2^+$						
$P_3N_3Cl_4Br_2^+$	$NPCl_2(NPClBr)_2$ (Cyclo–bis(bromochlorophosphonitrile)dichlorophosphonitrile)		9.80±0.1	EI		2782
$P_3N_3Cl_2Br_3^+$						
$P_3N_3Cl_2Br_3^+$	$NPBr_2(NPClBr)_2$ (Cyclo–bis(bromochlorophosphonitrile)dibromophosphonitrile)	Br	10.22±0.1	EI		2782
$P_3N_3Cl_3Br_3^+$						
$P_3N_3Cl_3Br_3^+$	$(NPClBr)_3$ (Cyclo–tris(bromochlorophosphonitrile))		9.72±0.1	EI		2782
$P_3N_3ClBr_4^+$						
$P_3N_3ClBr_4^+$	$(NPBr_2)_2NPClBr$ (Cyclo–bis(dibromophosphonitrile)bromochlorophosphonitrile)	Br	10.01±0.1	EI		2782
$P_3N_3Cl_2Br_4^+$						
$P_3N_3Cl_2Br_4^+$	$NPBr_2(NPClBr)_2$ (Cyclo–bis(bromochlorophosphonitrile)dibromophosphonitrile)		9.60±0.1	EI		2782
$P_3N_3ClBr_5^+$						
$P_3N_3ClBr_5^+$	$(NPBr_2)_2NPClBr$ (Cyclo–bis(dibromophosphonitrile)bromochlorophosphonitrile)		9.47±0.1	EI		2782

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$COBrMn^+$						
$COBrMn^+$	$Mn(CO)_5Br$	4CO	11.72	EI		2501
$C_2O_2BrMn^+$						
$C_2O_2BrMn^+$	$Mn(CO)_5Br$	3CO	10.47	EI		2501
$C_3O_3BrMn^+$						
$C_3O_3BrMn^+$	$Mn(CO)_5Br$	2CO	9.55	EI		2501
$C_5O_5BrMn^+$						
$C_5O_5BrMn^+$	$Mn(CO)_5Br$		8.76 (V)	PE		2879
$C_5O_5BrMn^+$	$Mn(CO)_5Br$		8.97±0.03	EI		2501
$C_4H_{12}BN_2Br^+$						
$C_4H_{12}BN_2Br^+$	$((CH_3)_2N)_2BBr$		8.05	EI		3227
$C_2H_6BNBr_2^+$						
$C_2H_6BNBr_2^+$	$(CH_3)_2NBBr_2$		9.50	EI		3227
$C_2H_6BO_2Br^+$						
$C_2H_6BO_2Br^+$	$(CH_3O)_2BBr$		10.62	EI		3227
$CH_3BOBr_2^+$						
$CH_3BOBr_2^+$	CH_3OBBr_2		10.68	EI		3227
$C_8H_8NOBr^+$						
$C_8H_8NOBr^+$	$C_6H_4BrNHCOCH_3$ (*N*–(3–Bromophenyl)acetic acid amide)		8.56±0.2	EI		3406
$C_8H_8NOBr^+$	$C_6H_4BrNHCOCH_3$ (*N*–(4–Bromophenyl)acetic acid amide)		8.42±0.2	EI		3406
$C_8H_8NO_2Br^+$						
$C_8H_8NO_2Br^+$	$C_6H_4(NO_2)CH_2CH_2Br$ (1–Bromo–2–(4–nitrophenyl)ethane)		9.6	EI		2973

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_2H_6BS_2Br^+$				
$C_2H_6BS_2Br^+$	$(CH_3S)_2BBr$		9.55	EI		3227
		$CH_3BSBr_2^+$				
$CH_3BSBr_2^+$	CH_3SBBr_2		10.25	EI		3227
		$C_9H_5O_3BrCr^+$				
$C_9H_5O_3BrCr^+$	$C_6H_5BrCr(CO)_3$ (Bromobenzenechromium tricarbonyl)		7.40	EI		3005
		$C_{10}H_{12}O_4Br_2Cr^+$				
$C_{10}H_{12}O_4Br_2Cr^+$	$(CH_3COCBrCOCH_3)_3Cr$ (Tris(3–bromo–2,4–pentanedionato)chromium)		11.0±0.10	EI		2519
		$C_{15}H_{18}O_6Br_3Cr^+$				
$C_{15}H_{18}O_6Br_3Cr^+$	$(CH_3COCBrCOCH_3)_3Cr$ (Tris(3–bromo–2,4–pentanedionato)chromium)		8.05±0.05	EI		2519
		$C_2H_6BNFBr^+$				
$C_2H_6BNFBr^+$	$(CH_3)_2NBFBr$		9.68	EI		3227
		CH_3BOFBr^+				
CH_3BOFBr^+	CH_3OBFBr		11.68	EI		3227
		$CH_3BOClBr^+$				
$CH_3BOClBr^+$	$CH_3OBClBr$		11.07	EI		3227
		$C_7H_5O_2PBr_3Mn^+$				
$C_7H_5O_2PBr_3Mn^+$	$C_5H_5Mn(CO)_2PBr_3$ (Cyclopentadienyl(tribromophosphine)manganese dicarbonyl)		8.01±0.05	EI		2597
		$C_{12}H_{27}N_2O_2PBrFe^+$				
$C_{12}H_{27}N_2O_2PBrFe^+$	$(n\text{–}C_4H_9)_3PFe(NO)_2Br$		7.85	EI		2799

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
	$C_{18}H_{15}N_2O_2PBrFe^+$					
$C_{18}H_{15}N_2O_2PBrFe^+$	$(C_6H_5)_3PFe(NO)_2Br$ (Triphenylphosphineiron dinitrosyl bromide)		7.7	EI		2799
	$C_9H_{21}N_2O_5PBrFe^+$					
$C_9H_{21}N_2O_5PBrFe^+$	$(iso\text{-}C_3H_7O)_3PFe(NO)_2Br$		8.05	EI		2799
	$C_{12}H_{27}N_2O_2PBrCo^+$					
$C_{12}H_{27}N_2O_2PBrCo^+$	$(n\text{-}C_4H_9)_3PCo(NO)_2Br$		7.9	EI		2799
	$C_{18}H_{15}N_2O_2PBrCo^+$					
$C_{18}H_{15}N_2O_2PBrCo^+$	$(C_6H_5)_3PCo(NO)_2Br$ (Triphenylphosphinecobalt dinitrosyl bromide)		7.7	EI		2799
	$C_9H_{21}N_2O_5PBrCo^+$					
$C_9H_{21}N_2O_5PBrCo^+$	$(iso\text{-}C_3H_7O)_3PCo(NO)_2Br$		7.9	EI		2799
	$Kr^+(^2P_{3/2})$ **$Kr^+(^2P_{1/2})$**	**$\Delta H^\circ_{f0} = 1350.7$ kJ mol^{-1} (322.8 kcal mol^{-1})** **$\Delta H^\circ_{f0} = 1415.0$ kJ mol^{-1} (338.2 kcal mol^{-1})**				
$Kr^+(^2P_{3/2})$	Kr		13.999	S	1350.7	2113
$Kr^+(^2P_{3/2})$	Kr		13.999±0.002	PI		1253
$Kr^+(^2P_{3/2})$	Kr		14.01±0.01	PI		1118
$Kr^+(^2P_{3/2})$	Kr		14.05	PE		248
$Kr^+(^2P_{3/2})$	Kr		14.00±0.05	EDD		2634
$Kr^+(^2P_{1/2})$	Kr		14.665	S	1415.0	2113
$Kr^+(^2P_{1/2})$	Kr		14.69	PE		248
See also – EI:	35, 224, 1012, 1047, 2032, 2776, 2941, 3435					
Kr^+	KrF_2	F_2?	13.21±0.25	EI		2577
	Kr^{+2}	**$\Delta H^\circ_{f0} = 3701.0$ kJ mol^{-1} (884.6 kcal mol^{-1})**				
Kr^{+2}	Kr		38.358	S	3701.0	2113
Kr^{+2}	Kr		38.45±0.1	RPD		198
Kr^{+2}	Kr		38.1±0.1	NRE		211
Kr^{+2}	Kr		38.0±0.5	NRE		201
Kr^{+2}	Kr		38	EI		1240
Kr^{+2}	Kr		38.5	EI		201
Kr^{+2}	Kr		38.5	EI		211

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
Kr^{+2}	Kr^{+}		24.359	S		2113
Kr^{+2}	Kr^{+}		23±2	SEQ		2551

See also – EI: 218

Kr^{+3} ΔH°_{f0} = 7266 kJ mol^{-1} (1737 kcal mol^{-1})

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
Kr^{+3}	Kr		75.31	S	7266	2113
Kr^{+3}	Kr		75.6±0.5	RPD		198
Kr^{+3}	Kr		73.3±0.2	NRE		211
Kr^{+3}	Kr		76	EI		1240
Kr^{+3}	Kr		77	EI		211
Kr^{+3}	Kr^{+2}		36.95	S		2113
Kr^{+3}	Kr^{+2}		34±2	SEQ		2551

Kr^{+4} ΔH°_{f0} ~ 12331 kJ mol^{-1} (2947 kcal mol^{-1})

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
Kr^{+4}	Kr		127.8	S	~12331	2113
Kr^{+4}	Kr		118±1	NRE		211
Kr^{+4}	Kr		117.5±2	NRE		201
Kr^{+4}	Kr		130.0	EI		201
Kr^{+4}	Kr		130	EI		211
Kr^{+4}	Kr		134	EI		1240
Kr^{+4}	Kr		147±2	EI		198
Kr^{+4}	Kr^{+3}		52.5	S		2113
Kr^{+4}	Kr^{+3}		48±2	SEQ		2551

Kr^{+5} ΔH°_{f0} ~ 18574 kJ mol^{-1} (4439 kcal mol^{-1})

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
Kr^{+5}	Kr		192.5	S	~18574	2113
Kr^{+5}	Kr		181±2	NRE		211
Kr^{+5}	Kr		195	EI		211
Kr^{+5}	Kr		204	EI		1240
Kr^{+5}	Kr		218±10	EI		198
Kr^{+5}	Kr^{+4}		64.7	S		2113
Kr^{+5}	Kr^{+4}		62±2	SEQ		2551

Kr^{+6} ΔH°_{f0} ~ 26148 kJ mol^{-1} (6250 kcal mol^{-1})

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
Kr^{+6}	Kr		271.0	S	~26148	2113
Kr^{+6}	Kr		275±10	NRE		211
Kr^{+6}	Kr		302	EI		1240
Kr^{+6}	Kr		310	EI		211
Kr^{+6}	Kr		350±10	EI		198
Kr^{+6}	Kr^{+5}		78.5	S		2113
Kr^{+6}	Kr^{+5}		77±2	SEQ		2551

4.3. The Positive Ion Table—Continued

Kr^{+7} $\Delta H^\circ_{f0} \sim 36858$ kJ mol^{-1} (8809 kcal mol^{-1})

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
Kr^{+7}	Kr		382.0	S	~36858	2113
Kr^{+7}	Kr		470	EI		1240
Kr^{+7}	Kr^{+6}		111.0	S		2113
Kr^{+7}	Kr^{+6}		107±2	SEQ		2551

Kr^{+8}

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
Kr^{+8}	Kr		508	S	(~49015)	2113
Kr^{+8}	Kr		670	EI		1240
Kr^{+8}	Kr^{+7}		126	S		2113

Kr_2^+

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
Kr_2^+	Kr+Kr*		12.87	PI	(≤1242)	2650
Kr_2^+	Kr+Kr*		13.004±0.007	PI	(≤1255)	2763

The results of these two similar studies cannot be reconciled. For earlier work see references in ref. 2763.

KrF^+

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
KrF^+	KrF_2	F	13.71±0.20	EI		2577

Rb^+

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
Rb^+	Rb		4.177	S		2113

See also – EI: 2487

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
Rb^+	RbCl	Cl	8.9±0.5	EI		2406
Rb^+	RbCl	Cl	9.2±0.5	EI		2711

The possible existence of an ion–pair process in RbCl is discussed in J. Berkowitz and W. A. Chupka, J. Chem. Phys. **29**, 653 (1958).

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
Rb^+	RbI	I	8.1±0.3	EI		2001

Rb^{+2}

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
Rb^{+2}	Rb		31.46	S		2113
Rb^{+2}	Rb^+		27.28	S		2113, 3271

Rb_2O^+

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
Rb_2O^+	Rb_2SO_4		11.9±0.5	EI		2487

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$Rb_2SO_4^+$				
$Rb_2SO_4^+$	Rb_2SO_4		8.6±0.5	EI		2487
	Sr^+	**ΔH°_{f298} = 714 kJ mol^{-1} (171 kcal mol^{-1})**				
Sr^+	Sr		5.695	S	714	2113
See also – S:	3270					
EI:	2178, 2432, 2990					
Sr^+	$SrCl_2$		15.36±0.10	EI		2991
	Sr^{+2}	**ΔH°_{f298} = 1778 kJ mol^{-1} (425 kcal mol^{-1})**				
Sr^{+2}	Sr		16.725	S	1778	2113
Sr^{+2}	Sr*?		11.5±0.2	EI		2178
Sr^{+2}	Sr^+		11.030	S		2113
		SrO^+				
SrO^+	SrO		6.1	EI		1244, 2123
See also – EI:	2178					
		Sr_2O^+				
Sr_2O^+	Sr_2O		4.8	EI		1244, 2123
		SrF^+				
SrF^+	SrF		4.9±0.3	EI		1105
SrF^+	SrF		5.0±0.3	EI		2432
SrF^+	SrF		5.2±0.3	EI		1104
SrF^+	SrF_2	F	13.0±1.0	EI		2432
See also – EI:	1105					
		$SrCl^+$				
$SrCl^+$	SrCl		5.59±0.10	EI		2991
$SrCl^+$	SrCl		5.3±0.5	EI		2990
$SrCl^+$	$SrCl_2$	Cl	10.48±0.10	EI		2991
$SrCl^+$	$SrCl_2$	Cl	10.7±0.3	EI		2990

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$SrCl_2^+$				
$SrCl_2^+$	$SrCl_2$		9.70±0.10	EI		2991
$SrCl_2^+$	$SrCl_2$		10.5±1.0	EI		2990
		$SrOH^+$				
$SrOH^+$	SrOH		5.55±0.1	D		3242, 3419
	Y^+	**$\Delta H_{f0}^\circ = 1036$ kJ mol^{-1} (248 kcal mol^{-1})**				
Y^+	Y		6.38	S	1036	2113
See also – EI:	2151, 2167, 2600					
Y^+	YO	O	12	EI		2167
Y^+	YF_3		28.0±0.7	EI		2009, 2600
Y^+	YCl_3		22.1±0.5	EI		2132
See also – EI:	2594					
	Y^{+2}	**$\Delta H_{f0}^\circ = 2217$ kJ mol^{-1} (530 kcal mol^{-1})**				
Y^{+2}	Y		18.62	S	2217	2113
Y^{+2}	Y^+		12.24	S		2113
	Y^{+3}	**$\Delta H_{f0}^\circ = 4197$ kJ mol^{-1} (1003 kcal mol^{-1})**				
Y^{+3}	Y		39.14	S	4197	2113, 3165
Y^{+3}	Y		39.03	BH		3273
Y^{+3}	Y^{+2}		20.5235±0.0002	S		3165
See also – S:	2113					
		YC^+				
YC^+	YC_2	C	13.4±0.5	EI		2151
YC^+	YC_2	C	14±1	EI		2996
		YC_2^+				
YC_2^+	YC_2		6.7±0.3	EI		2996
YC_2^+	YC_2		6.8±0.3	EI		2151
		YC_4^+				
YC_4^+	YC_4		7.0±0.3	EI		2996

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		YO^+				
YO^+	YO		5.5	EI		2167
YO^+	YO		6.1±1	EI		3206
		YF^+				
YF^+	YF		6.3±0.3	EI		2600
YF^+	YF		7.5	EI		2594
YF^+	YF_3		21.5±0.7	EI		2009, 2600
		YF_2^+				
YF_2^+	YF_2		7.0±0.3	EI		2594, 2600
YF_2^+	YF_3	F	13.5±0.7	EI		2009, 2600
YF_2^+	YF_3	F	14.0	EI		2594
		YS^+				
YS^+	YS		6.0±1	EI		3206
		YCl^+				
YCl^+	YCl_3		17.3±0.5	EI		2132
		YCl_2^+				
YCl_2^+	YCl_3	Cl	14.5±0.5	EI		2132
		YCl_3^+				
YCl_3^+	YCl_3		12.8±0.5	EI		2132
		$Y_2Cl_5^+$				
$Y_2Cl_5^+$	Y_2Cl_6	Cl	13.7±0.5	EI		2132
		YSe^+				
YSe^+	YSe		6.1±1	EI		3206
	Zr^+	**$\Delta H^\circ_{f0} = 1267$ kJ mol^{-1} (303 kcal mol^{-1})**				
Zr^+	Zr		6.84	S	1267	2113
Zr^+	ZrF_4		29.5±0.5	EI		2532

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		ZrN^+				
ZrN^+	ZrN		7.9±0.4	EI		2490
		ZrO^+				
ZrO^+	ZrO		~5.5	EI		2783
ZrO^+	ZrO		6.6±0.3	EI		2490
		ZrO_2^+				
ZrO_2^+	ZrO_2		8±0.5	EI		2783
		ZrF^+				
ZrF^+	ZrF_4		29.4±0.5	EI		2532
		ZrF_2^+				
ZrF_2^+	ZrF_2		12.0±0.5	EI		2532
ZrF_2^+	ZrF_4		23.4±0.5	EI		2532
		ZrF_3^+				
ZrF_3^+	ZrF_3		7.5±0.3	EI		2532
ZrF_3^+	ZrF_4	F	14.5±0.5	EI		2532
		$ZrCl^+$				
$ZrCl^+$	$(C_5H_5)_2ZrCl_2$ (Bis(cyclopentadienyl)zirconium dichloride)		24.3±0.5	EI		2479
		$ZrCl_2^+$				
$ZrCl_2^+$	$(C_5H_5)_2ZrCl_2$ (Bis(cyclopentadienyl)zirconium dichloride)		20.9±0.5	EI		2479
		$C_{33}H_{57}O_6Zr^+$				
$C_{33}H_{57}O_6Zr^+$	$((CH_3)_3CCOCHCOC(CH_3)_3)_4Zr$ (Tetrakis(2,2,6,6–tetramethyl–3,5–heptanedionato)zirconium)		10.5±0.5	EI		2524

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_3H_3ClZr^+$						
$C_3H_3ClZr^+$	$(C_5H_5)_2ZrCl_2$ (Bis(cyclopentadienyl)zirconium dichloride)		~19.9	EI		2479
$C_5H_5ClZr^+$						
$C_5H_5ClZr^+$	$(C_5H_5)_2ZrCl_2$ (Bis(cyclopentadienyl)zirconium dichloride)		19.8±0.4	EI		2479
$C_{10}H_{10}ClZr^+$						
$C_{10}H_{10}ClZr^+$	$(C_5H_5)_2ZrCl_2$ (Bis(cyclopentadienyl)zirconium dichloride)	Cl	12.3±0.2	EI		2479
$C_5H_5Cl_2Zr^+$						
$C_5H_5Cl_2Zr^+$	$(C_5H_5)_2ZrCl_2$ (Bis(cyclopentadienyl)zirconium dichloride)		12.5±0.2	EI		2479
$C_{10}H_{10}Cl_2Zr^+$						
$C_{10}H_{10}Cl_2Zr^+$	$(C_5H_5)_2ZrCl_2$ (Bis(cyclopentadienyl)zirconium dichloride)		9.37±0.25	EI		2479
Nb^+	**$\Delta H^\circ_{f0} = 1387$ kJ mol^{-1} (331 kcal mol^{-1})**					
Nb^+	Nb		6.88	S	1387	2113
Nb^+	$NbCl_5$		28.0±0.7	EI		2506
$NbCl^+$						
$NbCl^+$	$NbCl_5$		22.8±0.5	EI		2506
$NbCl_2^+$						
$NbCl_2^+$	$NbCl_5$		18.8±0.3	EI		2506
$NbCl_2^+$	$NbCl_5$		20±1	EI		2861
$NbCl_3^+$						
$NbCl_3^+$	$NbCl_5$		14.9±0.8	EI		2861

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$NbCl_4^+$				
$NbCl_4^+$	$NbCl_5$	Cl	11.34±0.22	EI		2506
$NbCl_4^+$	$NbCl_5$	Cl	11.6±0.8	EI		2861
	Mo^+	**ΔH°_{f0} = 1341.5 kJ mol^{-1} (320.6 kcal mol^{-1})**				
Mo^+	Mo		7.099	S	1341.5	2113
Mo^+	$Mo(CO)_6$	6CO	18.3±0.3	EI		2023
Mo^+	$Mo(CO)_6$	6CO	18.6±0.2	EI		2403
Mo^+	$Mo(CO)_6$	6CO	19.63	EI		2500
Mo^+	$Mo(CO)_6$	6CO	20.7±0.5	EI		1107
		MoC^+				
MoC^+	$Mo(CO)_6$		24.3±1	EI		2403
MoC^+	$Mo(CO)_6$		27.2±0.4	EI		1107
		MoO^+				
MoO^+	MoO		8.0±0.6	EI		2126
MoO^+	$Mo(CO)_6$		24.3±1	EI		2403
		MoO_2^+				
MoO_2^+	MoO_2		9.2	EI		1244, 2123
MoO_2^+	MoO_2		9.4±0.6	EI		2126, 2129
MoO_2^+	MoO_2		9.7±0.5	EI		3257
		MoO_3^+				
MoO_3^+	MoO_3		11.8±0.5	EI		3257
MoO_3^+	MoO_3		11.8	EI		1244, 2123
MoO_3^+	MoO_3		12.0±0.6	EI		2126, 2129
MoO_3^+	MoO_3		12.2±0.5	EI		3256
		$Mo_2O_5^+$				
$Mo_2O_5^+$	Mo_2O_5		10	EI		2129
$Mo_2O_5^+$	Mo_2O_6	O	14.5	EI		2129
		$Mo_2O_6^+$				
$Mo_2O_6^+$	Mo_2O_6		12.1±0.6	EI		2129

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$Mo_3O_8^+$				
$Mo_3O_8^+$	Mo_3O_8		12.2	EI		2129
$Mo_3O_8^+$	Mo_3O_9	O	14.5	EI		2129
		$Mo_3O_9^+$				
$Mo_3O_9^+$	Mo_3O_9		12.0±1.0	EI		2129
		$Li_2MoO_4^+$				
$Li_2MoO_4^+$	Li_2MoO_4		9.7±0.5	EI		3257
		$MoCO^+$				
$MoCO^+$	$Mo(CO)_6$	5CO	15.61	EI		2500
$MoCO^+$	$Mo(CO)_6$	5CO	15.7±0.2	EI		2403
$MoCO^+$	$Mo(CO)_6$	5CO	15.8±0.06	EI		2023
$MoCO^+$	$Mo(CO)_6$	5CO	18.1±0.3	EI		1107
		$MoCO^{+2}$				
$MoCO^{+2}$	$Mo(CO)_6$		34.5±0.5	EI		1107
$MoCO^{+2}$	$Mo(CO)_6$		35.7±1	EI		2403
		$MoC_2O_2^+$				
$MoC_2O_2^+$	$Mo(CO)_6$	4CO	13.90±0.3	EI		2023
$MoC_2O_2^+$	$Mo(CO)_6$	4CO	14.5±0.1	EI		2403
$MoC_2O_2^+$	$Mo(CO)_6$	4CO	14.76	EI		2500
$MoC_2O_2^+$	$Mo(CO)_6$	4CO	15.6±0.3	EI		1107
		$MoC_2O_2^{+2}$				
$MoC_2O_2^{+2}$	$Mo(CO)_6$		30.8±0.5	EI		1107
$MoC_2O_2^{+2}$	$Mo(CO)_6$		31.6±1	EI		2403
		$MoC_3O_3^+$				
$MoC_3O_3^+$	$Mo(CO)_6$	3CO	12.36±0.12	EI		2023
$MoC_3O_3^+$	$Mo(CO)_6$	3CO	12.82±0.1	EI		2403
$MoC_3O_3^+$	$Mo(CO)_6$	3CO	13.18	EI		2500
$MoC_3O_3^+$	$Mo(CO)_6$	3CO	13.7±0.3	EI		1107

4.3. The Positive Ion Table—Continued

$MoC_3O_3^{+2}$

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$MoC_3O_3^{+2}$	$Mo(CO)_6$		29.1±1.2	EI		1107

$MoC_4O_4^+$

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$MoC_4O_4^+$	$Mo(CO)_6$	2CO	10.63±0.15	EI		2403
$MoC_4O_4^+$	$Mo(CO)_6$	2CO	~10.72	EI		2500
$MoC_4O_4^+$	$Mo(CO)_6$	2CO	11.28±0.14	EI		2023
$MoC_4O_4^+$	$Mo(CO)_6$	2CO	11.9±0.2	EI		1107

$MoC_5O_5^+$

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$MoC_5O_5^+$	$Mo(CO)_6$	CO	~9.14	EI		2500
$MoC_5O_5^+$	$Mo(CO)_6$	CO	9.43±0.1	EI		2403
$MoC_5O_5^+$	$Mo(CO)_6$	CO	9.64±0.05	EI		2023
$MoC_5O_5^+$	$Mo(CO)_6$	CO	9.80±0.15	EI		1107

See also – PI: 2886

$Mo(CO)_6^+$ $\Delta H^\circ_{f0} = -121$ kJ mol^{-1} (−29 kcal mol^{-1})

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$MoC_6O_6^+$	$Mo(CO)_6$		8.227±0.011	PI	−121	2886
(Threshold value approximately corrected for hot bands)						
$MoC_6O_6^+$	$Mo(CO)_6$		8.12±0.03	PI		1167
$MoC_6O_6^+$	$Mo(CO)_6$		8.23±0.12	EI		1107
$MoC_6O_6^+$	$Mo(CO)_6$		8.30±0.03	EI		2023
$MoC_6O_6^+$	$Mo(CO)_6$		8.43±0.05	EI		2500
$MoC_6O_6^+$	$Mo(CO)_6$		8.46±0.08	EI		2403

$MoOF^+$

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$MoOF^+$	MoO_2F_2		23.0±0.5	EI		2859

MoO_2F^+

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
MoO_2F^+	MoO_2F_2	F	15.0±0.5	EI		2859

$MoO_2F_2^+$

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$MoO_2F_2^+$	MoO_2F_2		13.0±0.3	EI		2859

$SrMoO_2^+$

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$SrMoO_2^+$	$SrMoO_4$		11.0	EI		1244

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$SrMoO_3^+$				
$SrMoO_3^+$	$SrMoO_3$		6.2	EI		1244
		$SrMoO_4^+$				
$SrMoO_4^+$	$SrMoO_4$		9.2	EI		1244
		$C_7H_5NO_3Mo^+$				
$C_7H_5NO_3Mo^+$	$C_5H_5Mo(CO)_2NO$ (Cyclopentadienylmolybdenum dicarbonyl nitrosyl)		8.1±0.2	EI		2963
		$C_{10}H_9NO_5Mo^+$				
$C_{10}H_9NO_5Mo^+$	n–$C_4H_9NCMo(CO)_5$		7.65±0.05	EI		2481
		$C_{12}H_5NO_5Mo^+$				
$C_{12}H_5NO_5Mo^+$	$C_6H_5NCMo(CO)_5$ (Isocyanobenzenemolybdenum pentacarbonyl)		7.88	EI		2544
		$C_{12}H_{11}NO_5Mo^+$				
$C_{12}H_{11}NO_5Mo^+$	$C_6H_{11}NCMo(CO)_5$ (Isocyanocyclohexanemolybdenum pentacarbonyl)		7.72	EI		2544
		$C_{13}H_7NO_5Mo^+$				
$C_{13}H_7NO_5Mo^+$	$C_6H_4(CH_3)NCMo(CO)_5$ (Isocyanotoluenemolybdenum pentacarbonyl)		7.73±0.05	EI		2481
		$C_{11}H_{15}O_5PMo^+$				
$C_{11}H_{15}O_5PMo^+$	$(C_2H_5)_3PMo(CO)_5$		7.73±0.05	EI		2481
		$C_{17}H_{27}O_5PMo^+$				
$C_{17}H_{27}O_5PMo^+$	$(n$–$C_4H_9)_3PMo(CO)_5$		7.51±0.05	EI		2481
		$C_8H_9O_8PMo^+$				
$C_8H_9O_8PMo^+$	$(CH_3O)_3PMo(CO)_5$		7.89	EI		2544

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_{11}H_{15}O_8PMo^+$				
$C_{11}H_{15}O_8PMo^+$	$(C_2H_5O)_3PMo(CO)_5$		7.72	EI		2544
		$C_{17}H_{27}O_8PMo^+$				
$C_{17}H_{27}O_8PMo^+$	$(n\text{-}C_4H_9O)_3PMo(CO)_5$		7.71±0.05	EI		2481
		$C_{10}H_{18}O_{10}P_2Mo^+$				
$C_{10}H_{18}O_{10}P_2Mo^+$	$((CH_3O)_3P)_2Mo(CO)_4$		7.54	EI		2716
		$C_{16}H_{30}O_{10}P_2Mo^+$				
$C_{16}H_{30}O_{10}P_2Mo^+$	$((C_2H_5O)_3P)_2Mo(CO)_4$		7.23	EI		2716
		$C_5O_5PCl_3Mo^+$				
$C_5O_5PCl_3Mo^+$	$PCl_3Mo(CO)_5$		8.25	EI		2544
		$C_{11}H_5O_5PCl_2Mo^+$				
$C_{11}H_5O_5PCl_2Mo^+$	$C_6H_5PCl_2Mo(CO)_5$ (Dichloro(phenyl)phosphinemolybdenum pentacarbonyl)		8.03±0.05	EI		2481
		Tc^+ $\Delta H^\circ_{f298} = 1380$ kJ mol^{-1} (330 kcal mol^{-1})				
Tc^+	Tc		7.28	S	1380	2113
		$C_{10}H_{10}Tc^+$				
$C_{10}H_{10}Tc^+$	$(C_5H_5)_2TcH$ (Bis(cyclopentadienyl)technetium hydride)	H	7.86±0.1	EI		2683
		$C_{10}H_{11}Tc^+$				
$C_{10}H_{11}Tc^+$	$(C_5H_5)_2TcH$ (Bis(cyclopentadienyl)technetium hydride)		7.13±0.05	EI		2683
		$TcC_5O_5^+$				
$TcC_5O_5^+$	$Tc_2(CO)_{10}$		10.13	EI		3234

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$Tc_2C_{10}O_{10}^+$						
$Tc_2C_{10}O_{10}^+$	$Tc_2(CO)_{10}$		8.30±0.03	EI		3234
Ru^+ $\Delta H^\circ_{f0} = 1352$ kJ mol^{-1} (323 kcal mol^{-1})						
Ru^+	Ru		7.37	S	1352	2113
See also – EI:	2537					
Ru^+	RuO_2		13.0	EI		2537
Ru^+	RuO_4		22.3±0.3	EI		1284
Ru^+	$(C_5H_5)_2Ru$ (Bis(cyclopentadienyl)ruthenium)		16.1±0.5	EI		2683
RuO^+						
RuO^+	RuO		8.7	EI		2537
RuO^+	RuO_2	O	12.8	EI		2537
RuO^+	RuO_4		18.1±0.3	EI		1284
RuO_2^+						
RuO_2^+	RuO_2		10.6	EI		2537
RuO_2^+	RuO_4		14.2±0.2	EI		1284
RuO_3^+						
RuO_3^+	RuO_3		11.2	EI		2537
RuO_3^+	RuO_4	O	15.7±0.3	EI		1284
RuO_4^+						
RuO_4^+	RuO_4		12.33±0.23	EI		1284
RuO_4^+	RuO_4		12.8	EI		2537
$C_5H_5Ru^+$						
$C_5H_5Ru^+$	$(C_5H_5)_2Ru$ (Bis(cyclopentadienyl)ruthenium)		14.3±0.2	EI		2683
$C_8H_8Ru^+$						
$C_8H_8Ru^+$	$(C_5H_5)_2Ru$ (Bis(cyclopentadienyl)ruthenium)		13.7±0.2	EI		2683

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
			$C_{10}H_{10}Ru^+$			
$C_{10}H_{10}Ru^+$	$(C_5H_5)_2Ru$ (Bis(cyclopentadienyl)ruthenium)		7.82±0.1	EI		2683
		Rh^+ ΔH°_{f0} = 1275 kJ mol^{-1} (305 kcal mol^{-1})				
Rh^+	Rh		7.46	S	1275	2113
See also – EI:	1020					
			RhO^+			
RhO^+	RhO		9.3	EI		1020
			RhO_2^+			
RhO_2^+	RhO_2		10.0	EI		1020
			$C_{16}H_{24}Cl_2Rh_2^+$			
$C_{16}H_{24}Cl_2Rh_2^+$	$(C_8H_{12}RhCl)_2$ (Bis(1,5–cyclooctadienerhodium chloride))		7.1±0.1	EI		2698
			$C_{16}H_{24}Br_2Rh_2^+$			
$C_{16}H_{24}Br_2Rh_2^+$	$(C_8H_{12}RhBr)_2$ (Bis(1,5–cyclooctadienerhodium bromide))		7.2±0.1	EI		2698
			$C_{15}H_3O_6F_{18}Rh^+$			
$C_{15}H_3O_6F_{18}Rh^+$	$(CF_3COCHCOCF_3)_3Rh$ (Tris(1,1,1,5,5,5–hexafluoro–2,4–pentanedionato)rhodium)		10.15±0.12	EI		2580
		Pd^+ ΔH°_{f0} = 1182 kJ mol^{-1} (283 kcal mol^{-1})				
Pd^+	Pd		8.34	S	1182	2113
See also – EI:	1020					
			Pd_2^+			
Pd_2^+	Pd_2		7.7±0.3	EI		2441

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
PdO^+						
PdO^+	PdO		9.1	EI		1020
$PdSi^+$						
$PdSi^+$	$PdSi$		8.4±0.5	EI		2943
Ag^+	**ΔH°_{f0} = 1015.1 kJ mol^{-1} (242.6 kcal mol^{-1})**					
Ag^+	Ag		7.576	S	1015.1	2113
Ag^+	Ag		7.53	RPD		2994
See also – EI:	2990					
Ag^+	AgF	F	11.5±0.3	EI		2596
Ag^+	$AgCl$	Cl	11.0±0.4	EI		3205
Ag_2^+						
Ag_2^+	Ag_3Cl_2		15.7±1.3	EI		3205
AgF^+						
AgF^+	AgF		11.4±0.3	EI		2596
$AgCl^+$						
$AgCl^+$	$AgCl$		10.3±0.4	EI		3205
$AgCl^+$	$AgCl$		10.5±0.3	EI		2990
Ag_2Cl^+						
Ag_2Cl^+	Ag_3Cl_2		11.6±0.6	EI		3205
$Ag_3Cl_2^+$						
$Ag_3Cl_2^+$	Ag_3Cl_2		10.7±0.2	EI		3205
$Ag_3Cl_3^+$						
$Ag_3Cl_3^+$	Ag_3Cl_3		10.3±0.4	EI		3205

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol⁻¹)	Ref.
Cd^+ $\Delta H^\circ_{f0} = 979.8$ kJ mol^{-1} (234.2 kcal mol^{-1})						
Cd^+	Cd		8.993	S	979.8	2113
See also – EI:	1047, 2056					
Cd^+	$(CH_3)_2Cd$	$2CH_3$	12.10±0.02	PI		2983
$CdCl^+$						
$CdCl^+$	$CdCl_2$	Cl	11.8±0.2	EI		2056
$CdCl_2^+$						
$CdCl_2^+$	$CdCl_2$		11.2±0.2	EI		2056
CH_3Cd^+ $\Delta H^\circ_{f298} = 894$ kJ mol^{-1} (214 kcal mol^{-1})						
CH_3Cd^+	$(CH_3)_2Cd$	CH_3	9.69±0.02	PI	894	2983
(Threshold value approximately corrected for hot bands)						
$(CH_3)_2Cd^+$ $\Delta H^\circ_{f298} = 927$ kJ mol^{-1} (222 kcal mol^{-1})						
$C_2H_6Cd^+$	$(CH_3)_2Cd$		8.56±0.02	PI	927	2983
(Threshold value approximately corrected for hot bands)						
In^+ $\Delta H^\circ_{f0} = 802.0$ kJ mol^{-1} (191.7 kcal mol^{-1})						
In^+	In		5.786	S	802.0	2113, 3167
See also – S:	3270					
EI:	1065, 2138, 2469, 2518, 2565, 2620, 3014, 3244					
In^+	In_2S		8.7±1.0	EI		2469
In^+	In_2Se		9.8±0.5	EI		2469
In^+	In_2Te?		9.3±1.0	EI		2469
In_2^+						
In_2^+	In_2		5.8±0.3	EI		2138
In_2^+	In_2O	O	15±0.5	EI		3014
In_2^+	In_2S	S	10.8±0.5	EI		2469
In_2^+	In_2Se	Se	11.6±0.5	EI		2469

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
In_2O^+						
In_2O^+	In_2O		7.8±0.5	EI		1065
In_2O^+	In_2O		8.0±0.5	EI		2518
In_2O^+	In_2O		9±0.5	EI		3014
In_2O^+	In_2O		10.3±0.5	EI		3244
InF^+						
InF^+	InF		9.6±0.5	EI		2620
InS^+						
InS^+	InS		7.0±0.5	EI		2469
InS^+	In_2S	In	11.7±1.0	EI		2469
In_2S^+						
In_2S^+	In_2S		7.6±0.5	EI		2469
$In_2S_2^+$						
$In_2S_2^+$	In_2S_2		6.4±0.5	EI		2469
$InSe^+$						
$InSe^+$	InSe		7.1±0.5	EI		2469
$InSe^+$	In_2Se	In	11.9±0.5	EI		2469
In_2Se^+						
In_2Se^+	In_2Se		7.5±0.5	EI		2469
$LiInO^+$						
$LiInO^+$	LiInO		6.6±0.5	EI		2565
Sn^+ $\Delta H^\circ_{f0} = 1010.6$ kJ mol^{-1} (241.5 kcal mol^{-1})						
Sn^+	Sn		7.344	S	1010.6	2113
See also – EI:	2595					
Sn^+	SnH_4	$2H_2$	9.0±0.3	EI		2116
Sn^+	SnH_4	$2H_2$	11.4±0.2	EI		2137
Sn^+	Sn_2H_6		10.8±0.3	EI		2133
Sn^+	SnO	O	13.0±1	EI		1243

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
Sn^+	SnF	F	15.5±0.3	EI		2436
Sn^+	SnF_2		18.5±0.5	EI		2436, 2595
Sn^+	SnS	S	12.5±0.5	EI		2139
Sn^+	$SnCl_2$		12.8±1.0	EI		2871
Sn^+	$SnCl_4$		22.2±1.0	EI		2871
Sn^+	SnSe	Se	12.8±0.5	EI		2063
Sn^+	$SnBr_2$		12.8±1.0	EI		3185
Sn^+	$SnBr_4$		18.5±1.0	EI		3185
Sn^+	$(CH_3)_4Sn$		16.7	EI		2980
Sn^+	$(CH_3)_4Sn$		17.5±0.5	EI		2725
Sn^+	$(CH_3)_4Sn$		18.1±0.3	EI		82
Sn^+	$(C_2H_5)_4Sn$		17.1	EI		2980
Sn^+	$(C_6H_5)_4Sn$ (Tetraphenyltin)		9.4±0.2	EI		2725
		Sn_2^+				
Sn_2^+	Sn_2H_6	$3H_2$	10.7±0.3	EI		2133
Sn_2^+	Sn_2S_2		16.5±1.0	EI		2139
		SnH^+				
SnH^+	SnH_4	H_2+H	10.7±0.3	EI		2116
SnH^+	SnH_4	H_2+H	13.3±0.2	EI		2137
SnH^+	$(CH_3)_4Sn$		16.8	EI		2980
SnH^+	$(C_2H_5)_4Sn$		16.7	EI		2980
		SnH_2^+				
SnH_2^+	SnH_4	H_2	9.5±0.3	EI		2116
SnH_2^+	SnH_4	H_2	12.1±0.2	EI		2137
		SnH_3^+				
SnH_3^+	SnH_4	H	11.31±0.01	RPD		2553
SnH_3^+	SnH_4	H	9.4±0.3	EI		2116
SnH_3^+	SnH_4	H	11.9±0.2	EI		2137
SnH_3^+	$(CH_3)_4Sn$		14.0	EI		2980
		Sn_2H^+				
Sn_2H^+	Sn_2H_6	$2H_2$+H	10.6±0.3	EI		2133
		$Sn_2H_2^+$				
$Sn_2H_2^+$	Sn_2H_6	$2H_2$	10.5±0.3	EI		2133

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$Sn_2H_3^+$						
$Sn_2H_3^+$	Sn_2H_6	H_2+H	10.4±0.3	EI		2133
$Sn_2H_4^+$						
$Sn_2H_4^+$	Sn_2H_6	H_2	10.3±0.3	EI		2133
$Sn_2H_5^+$						
$Sn_2H_5^+$	Sn_2H_6	H	10.0±0.3	EI		2133
$Sn_2H_6^+$						
$Sn_2H_6^+$	Sn_2H_6		9.0±0.3	EI		2133
SnO^+						
SnO^+	SnO		10.5±0.5	EI		1243, 1244
Sn_2O^+						
Sn_2O^+	Sn_2O_2	O	13.8±0.5	EI		1243
Sn_2O^+	Sn_2O_2	O	14.0	EI		1244
$Sn_2O_2^+$						
$Sn_2O_2^+$	Sn_2O_2		9.8±0.5	EI		1243, 1244
$Sn_3O_3^+$						
$Sn_3O_3^+$	Sn_3O_3		9.8±0.5	EI		1243, 1244
$Sn_4O_4^+$						
$Sn_4O_4^+$	Sn_4O_4		9.2±0.5	EI		1243, 1244
SnF^+						
SnF^+	SnF		~7.04	S		2149
SnF^+	SnF		7.8±0.3	EI		2595
SnF^+	SnF		8.5±0.3	EI		2595
SnF^+	SnF		9.0±0.5	EI		2436
SnF^+	SnF_2	F	12.0±0.3	EI		2595
SnF^+	SnF_2	F	12.5	EI		2436

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
SnF_2^+						
SnF_2^+	SnF_2		10.5±0.3	EI		2436
SnF_2^+	SnF_2		11.5±0.2	EI		2595
$Sn_2F_3^+$						
$Sn_2F_3^+$	Sn_2F_4	F	11.0±0.5	EI		2595
$Sn_2F_4^+$						
$Sn_2F_4^+$	Sn_2F_4		10.5±0.5	EI		2595
$Sn_3F_5^+$						
$Sn_3F_5^+$	Sn_3F_6	F	10.0±0.5	EI		2595
$Sn_3F_6^+$						
$Sn_3F_6^+$	Sn_3F_6		10.0±0.5	EI		2595
SnS^+						
SnS^+	SnS		9.7±0.5	EI		2139
Sn_2S^+						
Sn_2S^+	Sn_2S_2	S	12.4±1.0	EI		2139
$Sn_2S_2^+$						
$Sn_2S_2^+$	Sn_2S_2		9.4±0.5	EI		2139
$SnCl^+$						
$SnCl^+$	$SnCl_2$	Cl	11.3±0.4	EI		2871
$SnCl^+$	$SnCl_4$		12.5±1.0	EI		2871
$SnCl_2^+$						
$SnCl_2^+$	$SnCl_2$		10.1±0.4	EI		2871
$SnCl_2^+$	$SnCl_4$		13.6±1.0	EI		2871

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$SnCl_3^+$						
$SnCl_3^+$	$SnCl_4$	Cl	12.2±0.4	EI		2871
$SnCl_4^+$ **$\Delta H_{f0}^\circ = 677$ kJ mol^{-1} (162 kcal mol^{-1})**						
$SnCl_4^+$	$SnCl_4$		11.88±0.05	PE	677	3362
$SnCl_4^+$	$SnCl_4$		11.5±0.4	EI		2871
See also – PE: 3117						
$SnSe^+$						
$SnSe^+$	SnSe		9.7±0.5	EI		2063
$Sn_2Se_2^+$						
$Sn_2Se_2^+$	Sn_2Se_2		9.8±0.5	EI		2063
$SnBr^+$						
$SnBr^+$	$SnBr_2$	Br	11.0±0.4	EI		3185
$SnBr^+$	$SnBr_4$		13.7±1.0	EI		3185
$SnBr_2^+$						
$SnBr_2^+$	$SnBr_2$		10.0±0.4	EI		3185
$SnBr_2^+$	$SnBr_4$		12.0±1.0	EI		3185
$SnBr_3^+$						
$SnBr_3^+$	$SnBr_4$	Br	11.3±0.4	EI		3185
$SnBr_4^+$						
$SnBr_4^+$	$SnBr_4$		11.0 (V)	PE		3117
$SnBr_4^+$	$SnBr_4$		10.6±0.4	EI		3185
CH_3Sn^+						
CH_3Sn^+	CH_3Sn		6.85±0.1	EI		2719
CH_3Sn^+	$(CH_3)_4Sn$		14.2	EI		2980
CH_3Sn^+	$(CH_3)_4Sn$		15.7±0.4	EI		82

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_2H_5Sn^+$				
$C_2H_5Sn^+$	$(C_2H_5)_4Sn$		14.4	EI		2980
		$C_2H_6Sn^+$				
$C_2H_6Sn^+$	$(CH_3)_2Sn$		7.95±0.05	EI		2719
$C_2H_6Sn^+$	$(CH_3)_4Sn$		13.0±0.2	EI		2725
$C_2H_6Sn^+$	$(CH_3)_4Sn$		13.1±0.2	EI		82
$C_2H_6Sn^+$	$(CH_3)_4Sn$		13.6	EI		2980
		$C_2H_7Sn^+$				
$C_2H_7Sn^+$	$(CH_3)_4Sn$		13.9	EI		2980
$C_2H_7Sn^+$	$(C_2H_5)_4Sn$		13.0	EI		2980
		$C_3H_9Sn^+$				
$C_3H_9Sn^+$	$(CH_3)_3Sn$		7.10±0.05	EI		2719
$C_3H_9Sn^+$	$(CH_3)_4Sn$	CH_3	9.65	EM		2553
$C_3H_9Sn^+$	$(CH_3)_4Sn$	CH_3	9.72±0.06	RPD		1424, 2553
$C_3H_9Sn^+$	$(CH_3)_4Sn$	CH_3	9.58±0.19	EI		2720
See also – EI:	82, 2725, 2980					
$C_3H_9Sn^+$	$(CH_3)_3SnCH{=}CH_2$		10.44±0.11	RPD		2553
$C_3H_9Sn^+$	$(CH_3)_3SnC_2H_5$		9.50	EM		2553
$C_3H_9Sn^+$	$(CH_3)_3SnC_2H_5$		9.49±0.07	RPD		2553
See also – EI:	1424					
$C_3H_9Sn^+$	$(CH_3)_3SnC_3H_5$		8.68±0.02	RPD		2553
$C_3H_9Sn^+$	*n*–$C_3H_7Sn(CH_3)_3$		9.50±0.06	RPD		1424, 2553
$C_3H_9Sn^+$	*iso*–$C_3H_7Sn(CH_3)_3$		9.17±0.14	RPD		2553
$C_3H_9Sn^+$	*n*–$C_4H_9Sn(CH_3)_3$		9.80±0.04	RPD		2553
$C_3H_9Sn^+$	*sec*–$C_4H_9Sn(CH_3)_3$		9.20±0.05	RPD		2553
$C_3H_9Sn^+$	*iso*–$C_4H_9Sn(CH_3)_3$		9.79±0.12	RPD		2553
$C_3H_9Sn^+$	*tert*–$C_4H_9Sn(CH_3)_3$		9.50±0.10	RPD		2553
$C_3H_9Sn^+$	*tert*–$C_4H_9Sn(CH_3)_3$		9.32±0.16	EI		2720
$C_3H_9Sn^+$	$(CH_3)_3SnSn(CH_3)_3$		9.65	EM		2553
$C_3H_9Sn^+$	$(CH_3)_3SnSn(CH_3)_3$		9.82±0.15	RPD		2553
See also – EI:	1424					
$C_3H_9Sn^+$	$(CH_3)_3SiSn(CH_3)_3$		9.80±0.24	EI		2720
$C_3H_9Sn^+$	$(CH_3)_3GeSn(CH_3)_3$		9.85±0.22	EI		2720
		$C_4H_9Sn^+$				
$C_4H_9Sn^+$	$(CH_3)_3SnCH{=}CH_2$	CH_3	9.56±0.08	RPD		2553

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_4H_{11}Sn^+$						
$C_4H_{11}Sn^+$	$(CH_3)_3SnC_2H_5$	CH_3	9.88±0.02	RPD		2553
$C_4H_{11}Sn^+$	$(C_2H_5)_4Sn$		12.1	EI		2980
$C_4H_{12}Sn^+$						
$C_4H_{12}Sn^+$	$(CH_3)_4Sn$		8.25±0.15	EI		82
$C_4H_{12}Sn^+$	$(CH_3)_4Sn$		8.76±0.02	EI		2553
$C_4H_{12}Sn^+$	$(CH_3)_4Sn$		8.76±0.12	EI		2720
See also – EI:	218, 2980					
$C_5H_{11}Sn^+$						
$C_5H_{11}Sn^+$	$(CH_3)_3SnC_3H_5$	CH_3	9.43±0.20	RPD		2553
$C_5H_{13}Sn^+$						
$C_5H_{13}Sn^+$	*n*-$C_3H_7Sn(CH_3)_3$	CH_3	9.59±0.07	RPD		2553
$C_5H_{13}Sn^+$	*iso*-$C_3H_7Sn(CH_3)_3$	CH_3	10.03±0.04	RPD		2553
$C_6H_5Sn^+$						
$C_6H_5Sn^+$	$(C_6H_5)_4Sn$ (Tetraphenyltin)		16.1±0.5	EI		2725
$C_6H_{15}Sn^+$						
$C_6H_{15}Sn^+$	*n*-$C_4H_9Sn(CH_3)_3$	CH_3	9.67±0.09	RPD		2553
$C_6H_{15}Sn^+$	*sec*-$C_4H_9Sn(CH_3)_3$	CH_3	9.76±0.19	RPD		2553
$C_6H_{15}Sn^+$	*iso*-$C_4H_9Sn(CH_3)_3$	CH_3	9.62±0.02	RPD		2553
$C_6H_{15}Sn^+$	*tert*-$C_4H_9Sn(CH_3)_3$	CH_3	10.95±0.19	RPD		2553
$C_6H_{15}Sn^+$	$(C_2H_5)_4Sn$		8.70±0.09	EI		3248
$C_6H_{15}Sn^+$	$(C_2H_5)_4Sn$		10.9	EI		2980
$C_6H_{15}Sn^+$	$(n$-$C_3H_7)_4Sn$		10.6±0.2	EI		2725
$C_6H_{16}Sn^+$						
$C_6H_{16}Sn^+$	*n*-$C_3H_7Sn(CH_3)_3$		8.54±0.01	EI		2553
$C_6H_{16}Sn^+$	*iso*-$C_3H_7Sn(CH_3)_3$		8.28±0.01	EI		2553
$C_7H_{18}Sn^+$						
$C_7H_{18}Sn^+$	*sec*-$C_4H_9Sn(CH_3)_3$		8.27±0.01	EI		2553
$C_7H_{18}Sn^+$	*iso*-$C_4H_9Sn(CH_3)_3$		8.34±0.02	EI		2553
$C_7H_{18}Sn^+$	*tert*-$C_4H_9Sn(CH_3)_3$		8.34±0.11	EI		2720

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_8H_{20}Sn^+$				
$C_8H_{20}Sn^+$	$(C_2H_5)_4Sn$		10.3	EI		2980
		$C_9H_{21}Sn^+$				
$C_9H_{21}Sn^+$	$(n-C_3H_7)_4Sn$		8.8±0.2	EI		2725
		$C_{12}H_{10}Sn^+$				
$C_{12}H_{10}Sn^+$	$(C_6H_5)_4Sn$ (Tetraphenyltin)		9.1±0.2	EI		2725
		$C_{18}H_{15}Sn^+$				
$C_{18}H_{15}Sn^+$	$(C_6H_5)_3SnCH_3$ (Methyltriphenyltin)	CH_3	8.7±0.2	EI		3248
$C_{18}H_{15}Sn^+$	$(C_6H_5)_3SnC_2H_5$ (Ethyltriphenyltin)		8.6±0.2	EI		3248
$C_{18}H_{15}Sn^+$	$(C_6H_5)_4Sn$ (Tetraphenyltin)		9.6±0.2	EI		3248
$C_{18}H_{15}Sn^+$	$(C_6H_5)_4Sn$ (Tetraphenyltin)		10.1±0.2	EI		2725
$C_{18}H_{15}Sn^+$	$(C_6H_5)_3SnSn(CH_3)_3$ (1,1,1–Trimethyl–2,2,2–triphenylditin)		8.9±0.2	EI		3248
$C_{18}H_{15}Sn^+$	$(C_6H_5)_3SnSn(C_6H_5)_3$ (Hexaphenylditin)		8.7±0.2	EI		3248
$C_{18}H_{15}Sn^+$	$(C_6H_5)_3SnSC_6H_5$ (Phenylthiotriphenyltin)		9.0±0.2	EI		3248
$C_{18}H_{15}Sn^+$	$(C_6H_5)_3SnGe(CH_3)_3$ (Trimethylgermanyltriphenyltin)		9.1±0.2	EI		3248
$C_{18}H_{15}Sn^+$	$(C_6H_5)_3SnI$ (Triphenyltin iodide)	I	8.6±0.2	EI		3248
		$C_5H_{15}Sn_2^+$				
$C_5H_{15}Sn_2^+$	$(CH_3)_3SnSn(CH_3)_3$	CH_3	8.17±0.03	RPD		2553
		$C_6H_{18}Sn_2^+$				
$C_6H_{18}Sn_2^+$	$(CH_3)_3SnSn(CH_3)_3$		7.42±0.02	EI		2900
$C_6H_{18}Sn_2^+$	$(CH_3)_3SnSn(CH_3)_3$		8.08±0.02	EI		2553
		$C_{12}H_{30}Sn_2^+$				
$C_{12}H_{30}Sn_2^+$	$(C_2H_5)_3SnSn(C_2H_5)_3$		6.60±0.02	EI		2900

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$NaSnF^+$				
$NaSnF^+$	$NaSnF_3$		13.0±1.0	EI		2436
		$NaSnF_2^+$				
$NaSnF_2^+$	$NaSnF_3$	F	9.0±0.3	EI		2436
		$NaSnF_3^+$				
$NaSnF_3^+$	$NaSnF_3$		8.8±0.3	EI		2436
		$Na_2SnF_3^+$				
$Na_2SnF_3^+$	Na_2SnF_4	F	9.5±0.3	EI		2436
		$Na_2SnF_4^+$				
$Na_2SnF_4^+$	Na_2SnF_4		9.0±0.4	EI		2436
		$C_6H_{18}SiSn^+$				
$C_6H_{18}SiSn^+$	$(CH_3)_3SiSn(CH_3)_3$		8.18±0.14	EI		2720
		$C_6H_{18}GeSn^+$				
$C_6H_{18}GeSn^+$	$(CH_3)_3GeSn(CH_3)_3$		8.20±0.10	EI		2720
	Sb^+	**$\Delta H_{f0}^\circ = 1095.8$ kJ mol^{-1} (261.9 kcal mol^{-1})**				
Sb^+	Sb		8.641	S	1095.8	2113
See also – EI:	2138					
Sb^+	Sb_2	Sb	11.5±0.3	EI		2138
Sb^+	Sb_2?		9.3±0.3	EI		2508
Sb^+	Sb_4		15±0.5	EI		2138
Sb^+	SbH_3	H_2+H	12.1±0.2	EI		2116
Sb^+	Sb_2H_4		11.5±0.3	EI		2133
Sb^+	SbF_3		20	EI		2696
Sb^+	SbS?		16.4±0.3	EI		3249
Sb^+	SbSe?		12.8±0.3	EI		3249
Sb^+	$(CH_3)_3Sb$		14.8±0.4	EI		2556
Sb^+	$(C_2H_5)_3Sb$		19.2±0.3	EI		3285
Sb^+	$(C_2H_5)_2SbSb(C_2H_5)_2$		18.5±0.3	EI		3285

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
Sb_2^+						
Sb_2^+	Sb_2		8.4±0.3	EI		2138
Sb_2^+	Sb_2		8.7±0.3	EI		2508
Sb_2^+	Sb_4		11.4±0.3	EI		2138
Sb_2^+	Sb_2H_4	$2H_2$	11.2±0.3	EI		2133
Sb_2^+	Sb_2S_2?		11.8±0.3	EI		3249
Sb_2^+	Sb_2Se_2?		12.8±0.3	EI		3249
Sb_2^+	$(C_2H_5)_2SbSb(C_2H_5)_2$		18.2±0.3	EI		3285
Sb_3^+						
Sb_3^+	Sb_4	Sb	10.8±0.3	EI		2138
Sb_3^+	Sb_4?		10.4±0.3	EI		2508
Sb_3^+	Sb_3S_2?		13.3±0.3	EI		3249
Sb_3^+	Sb_3Se_2?		13.2±0.3	EI		3249
Sb_4^+						
Sb_4^+	Sb_4		7.7±0.3	EI		2138
Sb_4^+	Sb_4		8.3±0.3	EI		2508
SbH^+						
SbH^+	SbH_3	H_2	9.9±0.2	EI		2116
SbH^+	$(CH_3)_3Sb$		14.5±0.5	EI		2556
SbH^+	$(C_2H_5)_3Sb$		18.3±0.3	EI		3285
SbH^+	$(C_2H_5)_2SbSb(C_2H_5)_2$		16.2±0.3	EI		3285
SbH_2^+						
SbH_2^+	SbH_3	H	11.8±0.3	EI		2116
SbH_2^+	$(CH_3)_3Sb$		13.7±0.2	EI		2556
SbH_2^+	$(C_2H_5)_3Sb$		17.2±0.3	EI		3285
SbH_2^+	$(C_2H_5)_2SbSb(C_2H_5)_2$		15.2±0.3	EI		3285
SbH_3^+	**$\Delta H_{f0}^\circ = 1078$ kJ mol^{-1} (258 kcal mol^{-1})**					
SbH_3^+	SbH_3		9.58	PI	1078	1091
SbH_3^+	SbH_3		9.9±0.3	EI		2116
Sb_2H^+						
Sb_2H^+	Sb_2H_4	H_2+H	10.9±0.3	EI		2133
Sb_2H^+	$(C_2H_5)_2SbSb(C_2H_5)_2$		18.9±0.3	EI		3285

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$Sb_2H_2^+$				
$Sb_2H_2^+$	Sb_2H_4	H_2	10.7±0.3	EI		2133
$Sb_2H_2^+$	$(C_2H_5)_2SbSb(C_2H_5)_2$		15.4±0.3	EI		3285
		$Sb_2H_3^+$				
$Sb_2H_3^+$	Sb_2H_4	H	10.5±0.3	EI		2133
$Sb_2H_3^+$	$(C_2H_5)_2SbSb(C_2H_5)_2$		17.5±0.3	EI		3285
		$Sb_2H_4^+$				
$Sb_2H_4^+$	Sb_2H_4		10.2±0.3	EI		2133
		SbF^+				
SbF^+	SbF_3		21	EI		2696
		SbF_2^+				
SbF_2^+	SbF_3	F	15	EI		2696
		SbF_3^+				
SbF_3^+	SbF_3		13	EI		2696
		SbS^+				
SbS^+	SbS		8.4±0.3	EI		3249
		SbS_2^+				
SbS_2^+	Sb_2S_2?		10.6±0.3	EI		3249
		Sb_2S^+				
Sb_2S^+	Sb_2S_2?		10.7±0.3	EI		3249
		$Sb_2S_2^+$				
$Sb_2S_2^+$	Sb_2S_2		8.8±0.3	EI		3249

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$Sb_2S_3^+$				
$Sb_2S_3^+$	Sb_2S_3		8.8±0.3	EI		3249
		$Sb_2S_4^+$				
$Sb_2S_4^+$	Sb_2S_4		8.6±0.3	EI		3249
		Sb_3S^+				
Sb_3S^+	Sb_3S_2?		11.3±0.3	EI		3249
		$Sb_3S_2^+$				
$Sb_3S_2^+$	Sb_3S_2		9.6±0.3	EI		3249
		$Sb_3S_3^+$				
$Sb_3S_3^+$	Sb_3S_3		9.5±0.3	EI		3249
		$Sb_3S_4^+$				
$Sb_3S_4^+$	Sb_3S_4		9.3±0.3	EI		3249
		$Sb_4S_3^+$				
$Sb_4S_3^+$	Sb_4S_3		8.5±0.3	EI		3249
		$Sb_4S_4^+$				
$Sb_4S_4^+$	Sb_4S_4		8.5±0.3	EI		3249
		$Sb_4S_5^+$				
$Sb_4S_5^+$	Sb_4S_5		8.5±0.3	EI		3249
		$SbSe^+$				
$SbSe^+$	SbSe		8.0±0.3	EI		3249
		$SbSe_2^+$				
$SbSe_2^+$	Sb_2Se_2?		11.0±0.3	EI		3249

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		Sb_2Se^+				
Sb_2Se^+	Sb_2Se_2?		10.8±0.3	EI		3249
		$Sb_2Se_2^+$				
$Sb_2Se_2^+$	Sb_2Se_2		8.6±0.3	EI		3249
		$Sb_2Se_3^+$				
$Sb_2Se_3^+$	Sb_2Se_3		8.6±0.3	EI		3249
		$Sb_2Se_4^+$				
$Sb_2Se_4^+$	Sb_2Se_4		8.6±0.3	EI		3249
		Sb_3Se^+				
Sb_3Se^+	Sb_3Se		9.6±0.3	EI		3249
		$Sb_3Se_2^+$				
$Sb_3Se_2^+$	Sb_3Se_2		9.8±0.3	EI		3249
		$Sb_3Se_3^+$				
$Sb_3Se_3^+$	Sb_3Se_3		9.2±0.3	EI		3249
		$Sb_3Se_4^+$				
$Sb_3Se_4^+$	Sb_3Se_4		9.2±0.3	EI		3249
		$Sb_4Se_3^+$				
$Sb_4Se_3^+$	Sb_4Se_3		8.4±0.3	EI		3249
		$Sb_4Se_4^+$				
$Sb_4Se_4^+$	Sb_4Se_4		8.4±0.3	EI		3249
		$InSb^+$				
$InSb^+$	InSb		6.6±0.4	EI		2138

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$InSb_2^+$				
$InSb_2^+$	$InSb_2$		6.6±0.4	EI		2138
		$CHSb^+$				
$CHSb^+$	$(CH_3)_3Sb$		13.7±0.4	EI		2556
		CH_2Sb^+				
CH_2Sb^+	$(CH_3)_3Sb$		15.1±0.2	EI		2556
		CH_3Sb^+				
CH_3Sb^+	$(CH_3)_3Sb$		14.3±0.2	EI		2556
CH_3Sb^+	$(C_2H_5)_3Sb$		16.5±0.3	EI		3285
		CH_4Sb^+				
CH_4Sb^+	$(CH_3)_3Sb$		13.4±0.3	EI		2556
CH_4Sb^+	$(C_2H_5)_3Sb$		17.4±0.3	EI		3285
		$C_2H_2Sb^+$				
$C_2H_2Sb^+$	$(C_2H_5)_3Sb$		13.0±0.3	EI		3285
		$C_2H_4Sb^+$				
$C_2H_4Sb^+$	$(CH_3)_3Sb$		12.6±0.3	EI		2556
$C_2H_4Sb^+$	$(C_2H_5)_3Sb$		14.8±0.3	EI		3285
		$C_2H_5Sb^+$				
$C_2H_5Sb^+$	$(C_2H_5)_3Sb$		12.4±0.3	EI		3285
$C_2H_5Sb^+$	$(C_2H_5)_2SbSb(C_2H_5)_2$		10.7±0.3	EI		3285
		$C_2H_6Sb^+$				
$C_2H_6Sb^+$	$(CH_3)_3Sb$	CH_3	10.5±0.2	EI		2556
$C_2H_6Sb^+$	$(C_2H_5)_3Sb$		12.6±0.3	EI		3285
		$C_2H_7Sb^+$				
$C_2H_7Sb^+$	$(C_2H_5)_3Sb$		12.6±0.3	EI		3285

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_3H_9Sb^+$				
$C_3H_9Sb^+$	$(CH_3)_3Sb$		8.04±0.16	EI		2556
		$C_4H_{10}Sb^+$				
$C_4H_{10}Sb^+$	$(C_2H_5)_3Sb$		10.7±0.3	EI		3285
		$C_4H_{11}Sb^+$				
$C_4H_{11}Sb^+$	$(C_2H_5)_3Sb$		10.0±0.3	EI		3285
$C_4H_{11}Sb^+$	$(C_2H_5)_2SbSb(C_2H_5)_2$		9.0±0.3	EI		3285
		$C_6H_{15}Sb^+$				
$C_6H_{15}Sb^+$	$(C_2H_5)_3Sb$		9.2±0.3	EI		3285
	$C_{18}H_{15}Sb^+$ (Triphenylantimony)		**ΔH°_{f298} ~ 1140 kJ mol^{-1} (272 kcal mol^{-1})**			
$C_{18}H_{15}Sb^+$	$(C_6H_5)_3Sb$ (Triphenylantimony)		7.3±0.1	PI	~1140	1140
		$C_2H_5Sb_2^+$				
$C_2H_5Sb_2^+$	$(C_2H_5)_2SbSb(C_2H_5)_2$		14.4±0.3	EI		3285
		$C_2H_6Sb_2^+$				
$C_2H_6Sb_2^+$	$(C_2H_5)_2SbSb(C_2H_5)_2$		13.5±0.3	EI		3285
		$C_4H_{11}Sb_2^+$				
$C_4H_{11}Sb_2^+$	$(C_2H_5)_2SbSb(C_2H_5)_2$		11.5±0.3	EI		3285
		$C_6H_{15}Sb_2^+$				
$C_6H_{15}Sb_2^+$	$(C_2H_5)_2SbSb(C_2H_5)_2$		9.6±0.3	EI		3285
		$C_8H_{20}Sb_2^+$				
$C_8H_{20}Sb_2^+$	$(C_2H_5)_2SbSb(C_2H_5)_2$		8.3±0.3	EI		3285

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
Te^+ ΔH°_{f0} ~ 1066 kJ mol^{-1} (255 kcal mol^{-1})						
Te^+	Te		9.009	S	~1066	2113
See also – EI: 2063, 2469, 2787						
Te^+	Te_2	Te	11.71±0.01	PI	(~1104)	2609
(Threshold value approximately corrected to 0 K)						
Te^+	Te_2	Te	10.8±0.5	EI		2747
Te^+	Te_2	Te	11.2±0.3	EI		2569
Te^+	Te_2	Te	11.6	EI		3016
Te^+	Te_2?		11.0±1.0	EI		2469
Te^+	GeTe	Ge	13.3±0.5	EI		1023
Te^+	SnTe	Sn	12.1±1.0	EI		2063
Te^+	$(C_2H_5)_2Te$		12.8±0.3	EI		3285
Te^+	$C_2H_5TeTeC_2H_5$		14.4±0.3	EI		3285
Te_2^+ ΔH°_{f0} = 970 kJ mol^{-1} (232 kcal mol^{-1})						
Te_2^+	Te_2		8.29±0.03	PI	970	2609
(Threshold value approximately corrected to 0 K)						
See also – EI: 1023, 2457; 2469, 2569, 3016						
Te_2^+	$C_2H_5TeTeC_2H_5$		13.0±0.3	EI		3285
TeH^+						
TeH^+	$(C_2H_5)_2Te$		15.2±0.3	EI		3285
TeH^+	$C_2H_5TeTeC_2H_5$		15.0±0.3	EI		3285
H_2Te^+ ΔH°_{f298} = 981 kJ mol^{-1} (235 kcal mol^{-1})						
TeH_2^+	H_2Te		9.138±0.005	S	981	3317
TeH_2^+	$(C_2H_5)_2Te$		13.2±0.3	EI		3285
TeH_2^+	$C_2H_5TeTeC_2H_5$		12.8±0.3	EI		3285
Te_2H^+						
Te_2H^+	$C_2H_5TeTeC_2H_5$		12.8±0.3	EI		3285
$Te_2H_2^+$						
$Te_2H_2^+$	$C_2H_5TeTeC_2H_5$		12.0±0.3	EI		3285
TeO^+						
TeO^+	TeO		9.4±0.5	EI		2787

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		TeO_2^+				
TeO_2^+	TeO_2		11.3±0.5	EI		2787
		$AlTe^+$				
$AlTe^+$	AlTe		9.0±0.5	EI		2449
		Al_2Te^+				
Al_2Te^+	Al_2Te		10.0±0.5	EI		2449
		$AlTe_2^+$				
$AlTe_2^+$	$AlTe_2$		6.5±0.5	EI		2449
		$Al_2Te_2^+$				
$Al_2Te_2^+$	Al_2Te_2		10.0±0.5	EI		2449
		$SiTe^+$				
$SiTe^+$	SiTe		9.2±0.5	EI		2457
		$GaTe^+$				
$GaTe^+$	GaTe		8.4±0.3	EI		2569
		Ga_2Te^+				
Ga_2Te^+	Ga_2Te		7.6±0.3	EI		2569
		$GaTe_2^+$				
$GaTe_2^+$	$GaTe_2$		8.3±0.5	EI		2569
		$Ga_2Te_2^+$				
$Ga_2Te_2^+$	Ga_2Te_2		8.1±0.5	EI		2569
		$GeTe^+$				
$GeTe^+$	GeTe		10.1±0.5	EI		1023

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$GeTe_2^+$				
$GeTe_2^+$	$GeTe_2$		10.8±0.5	EI		1023
		YTe^+				
YTe^+	YTe		6.0±1	EI		3206
		$InTe^+$				
$InTe^+$	InTe		7.6±0.5	EI		2469
		In_2Te^+				
In_2Te^+	In_2Te		7.1±0.5	EI		2469
		$InTe_2^+$				
$InTe_2^+$	$InTe_2$		8.9±0.5	EI		2469
		$In_2Te_2^+$				
$In_2Te_2^+$	In_2Te_2		7.2±0.5	EI		2469
		$SnTe^+$				
$SnTe^+$	SnTe		9.1±0.5	EI		2063
		CH_3Te^+				
CH_3Te^+	$(C_2H_5)_2Te$		14.5±0.3	EI		3285
		$C_2H_5Te^+$				
$C_2H_5Te^+$	$(C_2H_5)_2Te$		13.4±0.3	EI		3285
$C_2H_5Te^+$	$C_2H_5TeTeC_2H_5$		13.0±0.3	EI		3285
		$C_2H_6Te^+$				
$C_2H_6Te^+$	$(C_2H_5)_2Te$		10.9±0.3	EI		3285
$C_2H_6Te^+$	$C_2H_5TeTeC_2H_5$		10.3±0.3	EI		3285

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_4H_{10}Te^+$				
$C_4H_{10}Te^+$	$(C_2H_5)_2Te$		9.2±0.3	EI		3285
		$C_2H_5Te_2^+$				
$C_2H_5Te_2^+$	$C_2H_5TeTeC_2H_5$		10.9±0.3	EI		3285
		$C_2H_6Te_2^+$				
$C_2H_6Te_2^+$	$C_2H_5TeTeC_2H_5$		10.4±0.3	EI		3285
		$C_4H_{10}Te_2^+$				
$C_4H_{10}Te_2^+$	$C_2H_5TeTeC_2H_5$		9.0±0.3	EI		3285
		$GaOTe^+$				
$GaOTe^+$	GaOTe		7.7±0.5	EI		2569

I^+ $\Delta H^\circ_{f0} = 1115.6$ kJ mol^{-1} (266.6 kcal mol^{-1})

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
I^+	I		10.451	S	1115.6	2113, 3003

See also – S: 2656, 3089
EI: 439, 2554

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
I^+	I_2	I^-	8.922±0.013	PI	(1114)	3102

This appearance potential is corrected for an assumed 0←3 hot band transition, amounting to 0.079 eV. The actual onset is 8.843 eV. From the appearance potential the authors deduce the electron affinity of I atoms.

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
I^+	I_2	I^-	8.83±0.02	PI		416
I^+	I_2	I^-	8.95±0.02	PI		213

(Position of peak maximum)

See also – EI: 288, 292, 357

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
I^+	LiI	Li	14.4±0.3	EI		2001
I^+	NaI	Na	14.4±0.3	EI		2001
I^+	KI	K	14.6±0.3	EI		2001
I^+	RbI	Rb	14.4±0.3	EI		2001
I^+	CH_3I	CH_3	12.9±0.05	RPD		2154
I^+	C_2H_5I		14.8±0.2	EI		356
I^+	n-C_4H_9I		12.45±0.05	RPD		2776

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
I^+	ICN	CN^-	9.8±0.1	EI		73
I^+	ICN	CN	13.62±0.02	PI	(1108)	2621

From this result the authors deduce $\Delta H^\circ_{f0}(CN) \leq 425$ kJ mol^{-1}.

See also – EI: 73

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
I^+	CF_3I		13.4±0.1	SD		1111

This fragmentation occurs with little kinetic energy, see refs. 24, 1111.

See also – EI: 24, 439

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
I^+	CsI	Cs	14.1±0.3	EI		2001
I^+	HgI_2		15.5±0.4	EI		2506
I^+	TlI	Tl	13.4±0.1	RPD		2159

$I_2^+(^2\Pi_{3/2g})$ ΔH°_{f0} = 971 kJ mol^{-1} (232 kcal mol^{-1})

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$I_2^+(^2\Pi_{3/2g})$	I_2		9.3995±0.0012	S	972	2906
$I_2^+(^2\Pi_{3/2g})$	I_2		9.331	PI		3102
(Threshold value corrected for hot bands)						
$I_2^+(^2\Pi_{3/2g})$	I_2		~9.37	PI	~970	3413
$I_2^+(^2\Pi_{3/2g})$	I_2		9.22±0.01	PE		3409
$I_2^+(^2\Pi_{3/2g})$	I_2		9.34 (V)	PE		3275

The disagreement among these values is partly in the varying corrections for hot bands. The adiabatic ionization potential is most likely either 9.37 or 9.3995 eV.

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$I_2^+(^2\Pi_{1/2g})$	I_2		10.029±0.006	S		2906
$I_2^+(^2\Pi_{1/2g})$	I_2		9.87±0.01	PE		3409
$I_2^+(^2\Pi_{1/2g})$	I_2		9.97 (V)	PE		3275
$I_2^+(^2\Pi_{3/2u})$	I_2		10.74±0.02	PE		3409
$I_2^+(^2\Pi_{3/2u})$	I_2		10.8	PE		3275
$I_2^+(^2\Pi_{1/2u})$	I_2		11.54±0.02	PE		3409
$I_2^+(^2\Pi_{1/2u})$	I_2		11.6	PE		3275
$I_2^+(^2\Sigma_g^+)$	I_2		12.66±0.02	PE		3409
$I_2^+(^2\Sigma_g^+)$	I_2		12.7	PE		3275

See also – PI: 182, 213, 416
PE: 2815, 3277
EI: 288, 292, 2554, 3279

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
I_2^+	CI_4		11.3±0.1	EDD		3279
I_2^+	CHI_3		12.0±0.1	EDD		3279

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
	HI^+ ($^2\Pi_{3/2}$)	**ΔH°_{f0} = 1031 kJ mol^{-1} (247 kcal mol^{-1})**				
	HI^+ ($^2\Pi_{1/2}$)	**ΔH°_{f0} = 1095 kJ mol^{-1} (262 kcal mol^{-1})**				
$HI^+(^2\Pi_{3/2})$	HI		~10.39	S	~1031	3150
$HI^+(^2\Pi_{3/2})$	HI		10.38±0.02	PI	1030	182, 416
$HI^+(^2\Pi_{3/2})$	HI		10.38±0.01	PE	1030	2819
$HI^+(^2\Pi_{3/2})$	HI		10.42±0.01	PE	1034	2815
$HI^+(^2\Pi_{1/2})$	HI		11.050±0.005	S	1095	3150
$HI^+(^2\Pi_{1/2})$	HI		11.05±0.01	PE		2819
$HI^+(^2\Pi_{1/2})$	HI		11.08±0.01	PE		2815
$HI^+(^2\Sigma^+)$	HI		13.85	PE		2819
$HI^+(^2\Sigma^+)$	HI		14.03±0.01	PE		2815
See also – PI:	213					
EI:	463, 2001					
HI^+	C_2H_5I		11.7±0.1	EI		356
		HI^{+2}				
HI^{+2}	HI		30.0±0.5	FD		212
		LiI^+				
LiI^+	LiI		8.6±0.3	EI		2001
		Li_2I^+				
Li_2I^+	Li_2I_2	I	9.2±0.3	EI		2001
		$Li_3I_2^+$				
$Li_3I_2^+$	Li_3I_3	I	9.2±0.3	EI		2001
		BI^+				
BI^+	BI_3		14.4±0.2	EI		206
		BI_2^+				
BI_2^+	BI_3	I	9.7±0.2	EI		206

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$BI_3^+(^2A_2')$		**ΔH°_{f0} = 968 kJ mol^{-1} (231 kcal mol^{-1})**				
$BI_3^+(^2A_2')$	BI_3		9.25±0.03	PE	968	3375
$BI_3^+(^2E')$	BI_3		9.85±0.02	PE		3375
$BI_3^+(^2E')$	BI_3		10.03±0.02	PE		3375
$BI_3^+(^2E'')$	BI_3		10.28±0.02	PE		3375
$BI_3^+(^2E'')$	BI_3		10.44±0.02	PE		3375
$BI_3^+(^2A_2'')$	BI_3		11.56±0.02	PE		3375
$BI_3^+(^2E')$	BI_3		12.28±0.03	PE		3375
$BI_3^+(^2E')$	BI_3		12.83±0.03	PE		3375
$BI_3^+(^2A_1')$	BI_3		15.10±0.02	PE		3375
See also – PE:	3119					
EI:	206, 2512, 3227					
		CI^+				
CI^+	$CI{\equiv}CI$	CI	16.8±0.1	EDD		3177
CI^+	$CH{\equiv}CI$	CH	18.1±0.1	EDD		3177
CI^+	ICN	N	17.6±0.3	EI		73
CI^+	$CCl{\equiv}CI$	CCl	16.4±0.1	EDD		3177
CI^+	$CBr{\equiv}CI$	CBr	16.9±0.1	EDD		3177
		$C_2I_2^+$				
$C_2I_2^+(^2\Pi_{3/2u})$	$CI{\equiv}CI$		9.03	PE		3121
$C_2I_2^+(^2\Pi_{3/2u})$	$CI{\equiv}CI$		9.2±0.1	EDD		3177
$C_2I_2^+(^2\Pi_{1/2u})$	$CI{\equiv}CI$		9.47	PE		3121
$C_2I_2^+(^2\Pi_{3/2g})$	$CI{\equiv}CI$		10.63	PE		3121
$C_2I_2^+(^2\Pi_{1/2g})$	$CI{\equiv}CI$		11.23	PE		3121
$C_2I_2^+(^2\Pi_{3/2u})$	$CI{\equiv}CI$		12.17 (V)	PE		3121
$C_2I_2^+(^2\Pi_{1/2u})$	$CI{\equiv}CI$		12.38 (V)	PE		3121
$C_2I_2^+(^2\Sigma_g^+)$	$CI{\equiv}CI$		14.22 (V)	PE		3121
$C_2I_2^+(^2\Sigma_u^+)$	$CI{\equiv}CI$		15.48 (V)	PE		3121
		$C_2I_2^{+2}$				
$C_2I_2^{+2}$	$CI{\equiv}CI$		23.7±0.1	EDD		3177
		IF^+				
IF^+	IF		10.5±0.3	EI		357
IF^+	IF_5		~24	EI		357
		IF_2^+				
IF_2^+	IF_5		15.1±0.3	EI		357

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
IF_3^+						
IF_3^+	IF_5		11.5±0.3	EI		357
IF_4^+						
IF_4^+	IF_5	F^-?	13.6±0.3	EI		357
IF_5^+						
IF_5^+	IF_5		13.5±0.2	EI		357
NaI^+						
NaI^+	NaI		7.64	PI		2610
(Threshold value corrected for hot bands)						
NaI^+	NaI		8.0±0.3	EI		2610
NaI^+	NaI		8.7±0.3	EI		2001
Na_2I^+						
Na_2I^+	Na_2I_2	I	~7.80±0.05	PI		2610
(Threshold value corrected for hot bands)						
Na_2I^+	Na_2I_2	I	9.1±0.3	EI		2001
$Na_2I_2^+$						
$Na_2I_2^+$	Na_2I_2		7.64	PI		2610
$Na_3I_2^+$						
$Na_3I_2^+$	Na_3I_3	I	8.6±0.3	EI		2001
MgI^+						
MgI^+	MgI_2	I	~10.12±0.12	PI		2610
MgI^+	MgI_2	I	11.5±0.5	EI		178
MgI_2^+ ΔH°_{f298} ~ 752 kJ mol^{-1} (180 kcal mol^{-1})						
MgI_2^+	MgI_2		9.57	PI	~752	2610
MgI_2^+	MgI_2		10.0±0.4	EI		178

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$Mg_2I_3^+$				
$Mg_2I_3^+$	Mg_2I_4	I	10.0±0.4	EI		178
	ICl^+	**$\Delta H_{f0}^\circ = 991$ kJ mol^{-1} (237 kcal mol^{-1})**				
ICl^+	ICl		10.07±0.01	PI	991	3413
(Threshold value corrected for hot bands)						
See also – PE:	3277, 3409					
EI:	292, 357					
		KI^+				
KI^+	KI		8.2±0.3	EI		2001
		K_2I^+				
K_2I^+	K_2I_2	I	8.2±0.3	EI		2001
		MnI^+				
MnI^+	$Mn(CO)_5I$	5CO	14.0	EI		2501
	IBr^+	**$\Delta H_{f0}^\circ = 994$ kJ mol^{-1} (238 kcal mol^{-1})**				
IBr^+	IBr		9.79±0.01	PI	994	3413
(Threshold value corrected for hot bands)						
See also – PE:	3277, 3409					
EI:	292, 357					
		RbI^+				
RbI^+	RbI		8.0±0.3	EI		2001
		Rb_2I^+				
Rb_2I^+	Rb_2I_2	I	8.2±0.3	EI		2001

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$B_5H_8I^+$						
$B_5H_8I^+$	$1\text{-}B_5H_8I$		8.49±0.05	RPD		3228
See also – EI:	103, 1102					
$B_5H_8I^+$	$2\text{-}B_5H_8I$		8.82±0.02	RPD		3228
CH_2I^+						
CH_2I^+	CH_3I	H	12.08±0.09	RPD		1139
See also – EI:	160, 356, 3017					
CH_2I^+	C_2H_5I	CH_3	13.7±0.3	EI		356
$CH_3I^+(^2E_{3/2})$ ΔH°_{f0} = 943 kJ mol^{-1} (225 kcal mol^{-1})						
$CH_3I^+(^2E_{1/2})$ ΔH°_{f0} = 1003 kJ mol^{-1} (240 kcal mol^{-1})						
$CH_3I^+(^2E_{3/2})$	CH_3I		9.538±0.003	S	943	2064
$CH_3I^+(^2E_{3/2})$	CH_3I		9.534±0.005	RPI	942	2866
$CH_3I^+(^2E_{3/2})$	CH_3I		9.54	PE		3119
$CH_3I^+(^2E_{3/2})$	CH_3I		9.50	PE		3057
$CH_3I^+(^2E_{1/2})$	CH_3I		10.165±0.003	S	1003	2064
$CH_3I^+(^2E_{1/2})$	CH_3I		10.151±0.015	RPI	1002	2866
$CH_3I^+(^2E_{1/2})$	CH_3I		10.16	PE		3119
$CH_3I^+(^2E_{1/2})$	CH_3I		10.13	PE		3057
Additional higher ionization potentials are given in refs. 3057, 3119.						
See also – PI:	158, 182, 190, 213, 297, 416, 1253					
PEN:	2430, 2466					
EI:	289, 2154, 2776, 3201					
C_2HI^+						
$C_2HI^+(^2\Pi_{3/2})$	CH≡CI		9.73	PE		3071
$C_2HI^+(^2\Pi_{3/2})$	CH≡CI		9.9±0.1	EDD		3177
$C_2HI^+(^2\Pi_{1/2})$	CH≡CI		10.14	PE		3071
$C_2HI^+(^2\Pi_{3/2})$	CH≡CI		11.96 (V)	PE		3071
$C_2HI^+(^2\Pi_{1/2})$	CH≡CI		12.19 (V)	PE		3071
$C_2HI^+(^2\Sigma^+)$	CH≡CI		14.86 (V)	PE		3071
$C_2HI^+(^2\Sigma^+)$	CH≡CI		17.4 (V)	PE		3071
C_2HI^{+2}						
C_2HI^{+2}	CH≡CI		26.9±0.1	EDD		3177

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
	$C_2H_5I^+(^2E_{3/2})$	**$\Delta H^\circ_{f0} = 910$ kJ mol^{-1} (217 kcal mol^{-1})**				
	$C_2H_5I^+(^2E_{1/2})$	**$\Delta H^\circ_{f0} = 966$ kJ mol^{-1} (231 kcal mol^{-1})**				
$C_2H_5I^+(^2E_{3/2})$	C_2H_5I		9.346±0.005	S	910	2065
$C_2H_5I^+(^2E_{3/2})$	C_2H_5I		9.33±0.01	PI		182, 416
$C_2H_5I^+(^2E_{3/2})$	C_2H_5I		9.37	PE		3374
$C_2H_5I^+(^2E_{3/2})$	C_2H_5I		9.35±0.02	RPD		224
$C_2H_5I^+(^2E_{1/2})$	C_2H_5I		9.928±0.005	S	966	2065
$C_2H_5I^+(^2E_{1/2})$	C_2H_5I		9.93	PE		3374

Additional higher ionization potentials are given in ref. 3374.

See also – PI: 190
EI: 160, 356

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
	n-$C_3H_7I^+(^2E_{3/2})$	**$\Delta H^\circ_{f298} = 863$ kJ mol^{-1} (206 kcal mol^{-1})**				
	n-$C_3H_7I^+(^2E_{1/2})$	**$\Delta H^\circ_{f298} = 919$ kJ mol^{-1} (220 kcal mol^{-1})**				
	iso-$C_3H_7I^+(^2E_{3/2})$	**$\Delta H^\circ_{f298} = 844$ kJ mol^{-1} (202 kcal mol^{-1})**				
	iso-$C_3H_7I^+(^2E_{1/2})$	**$\Delta H^\circ_{f298} \sim 896$ kJ mol^{-1} (214 kcal mol^{-1})**				
$C_3H_7I^+(^2E_{3/2})$	n-C_3H_7I		9.26±0.01	PI	863	182
$C_3H_7I^+(^2E_{3/2})$	n-C_3H_7I		9.26±0.005	PE	863	3289
$C_3H_7I^+(^2E_{3/2})$	n-C_3H_7I		9.27	PE	864	3374
$C_3H_7I^+(^2E_{1/2})$	n-C_3H_7I		9.84±0.005	PE	919	3289
$C_3H_7I^+(^2E_{1/2})$	n-C_3H_7I		9.84	PE	919	3374

Additional higher ionization potentials are given in ref. 3374.

See also – EI: 160

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_3H_7I^+(^2E_{3/2})$	iso-C_3H_7I		9.17±0.02	PI	843	182
$C_3H_7I^+(^2E_{3/2})$	iso-C_3H_7I		9.18±0.005	PE	844	3289
$C_3H_7I^+(^2E_{3/2})$	iso-C_3H_7I		9.19	PE	845	3374
$C_3H_7I^+(^2E_{1/2})$	iso-C_3H_7I		9.69±0.005	PE	893	3289
$C_3H_7I^+(^2E_{1/2})$	iso-C_3H_7I		9.74	PE	898	3374

Additional higher ionization potentials are given in ref. 3374.

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
	tert-$C_4H_9I^+(^2E_{3/2})$	**ΔH°_{f298} = 797 kJ mol^{-1} (190 kcal mol^{-1})**				
	tert-$C_4H_9I^+(^2E_{1/2})$	**ΔH°_{f298} = 845 kJ mol^{-1} (202 kcal mol^{-1})**				
$C_4H_9I^+(^2E_{3/2})$	n-C_4H_9I		9.21±0.01	PI		182
$C_4H_9I^+(^2E_{3/2})$	n-C_4H_9I		9.23±0.005	PE		3289
$C_4H_9I^+(^2E_{1/2})$	n-C_4H_9I		9.78±0.005	PE		3289
$C_4H_9I^+(^2E_{3/2})$	sec-C_4H_9I		9.09±0.02	PI		182
$C_4H_9I^+(^2E_{3/2})$	iso-C_4H_9I		9.18±0.02	PI		182
$C_4H_9I^+(^2E_{3/2})$	iso-C_4H_9I		9.18±0.005	PE		3289
$C_4H_9I^+(^2E_{1/2})$	iso-C_4H_9I		9.73±0.005	PE		3289
$C_4H_9I^+(^2E_{3/2})$	tert-C_4H_9I		9.02±0.03	PI	797	182
$C_4H_9I^+(^2E_{3/2})$	tert-C_4H_9I		9.02±0.01	PE	797	3289
$C_4H_9I^+(^2E_{1/2})$	tert-C_4H_9I		9.52±0.01	PE	845	3289
		$C_5H_{11}I^+$				
$C_5H_{11}I^+(^2E_{3/2})$	n-$C_5H_{11}I$		9.19±0.01	PI		182, 416
$C_5H_{11}I^+(^2E_{3/2})$	n-$C_5H_{11}I$		9.18±0.01	PE		3289
$C_5H_{11}I^+(^2E_{3/2})$	n-$C_5H_{11}I$		9.21	PE		3374
$C_5H_{11}I^+(^2E_{1/2})$	n-$C_5H_{11}I$		9.72±0.01	PE		3289
$C_5H_{11}I^+(^2E_{1/2})$	n-$C_5H_{11}I$		9.77	PE		3374
Additional higher ionization potentials are given in ref. 3374.						
$C_5H_{11}I^+(^2E_{3/2})$	iso-$C_5H_{11}I$		9.17±0.01	PE		3289
$C_5H_{11}I^+(^2E_{1/2})$	iso-$C_5H_{11}I$		9.72±0.01	PE		3289
$C_5H_{11}I^+(^2E_{3/2})$	$(CH_3)_2CIC_2H_5$		8.93±0.01	PE		3289
$C_5H_{11}I^+(^2E_{1/2})$	$(CH_3)_2CIC_2H_5$		9.50±0.01	PE		3289
	$C_6H_5I^+$ (Iodobenzene)	**ΔH°_{f298} ~ 1003 kJ mol^{-1} (240 kcal mol^{-1})**				
$C_6H_5I^+$	C_6H_5I (Iodobenzene)		8.685	PI	1001	2682
$C_6H_5I^+$	C_6H_5I (Iodobenzene)		8.73±0.01	PI	1005	3212
$C_6H_5I^+$	C_6H_5I (Iodobenzene)		8.73±0.03	PI	1005	182, 416

The information on higher ionization potentials is quite confused, see refs. 2682, 2806, 3212, 3247, 3331.

See also – PE: 2806, 3212, 3247, 3331
EI: 3230, 3238

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_7H_6I^+$				
$C_7H_6I^+$	$C_6H_5CH_2CH_2C_6H_4I$ (1–(4–Iodophenyl)–2–phenylethane)		10.3±0.2	EI		3288
	$C_7H_7I^+$ (2–Iodotoluene)	**ΔH°_{f298} = 964 kJ mol^{-1} (230 kcal mol^{-1})**				
	$C_7H_7I^+$ (3–Iodotoluene)	**ΔH°_{f298} = 964 kJ mol^{-1} (230 kcal mol^{-1})**				
	$C_7H_7I^+$ (4–Iodotoluene)	**ΔH°_{f298} = 942 kJ mol^{-1} (225 kcal mol^{-1})**				
$C_7H_7I^+$	$C_6H_5CH_2I$ (α–Iodotoluene)		8.8	EI		3230
$C_7H_7I^+$	$C_6H_4ICH_3$ (2–Iodotoluene)		8.62±0.01	PI	964	182
$C_7H_7I^+$	$C_6H_4ICH_3$ (3–Iodotoluene)		8.61±0.03	PI	964	182
$C_7H_7I^+$	$C_6H_4ICH_3$ (4–Iodotoluene)		8.50±0.01	PI	942	182
		$C_{14}H_{13}I^+$				
$C_{14}H_{13}I^+$	$C_6H_5CH_2CH_2C_6H_4I$ (1–(4–Iodophenyl)–2–phenylethane)		8.7±0.1	EI		3288
		$CH_2I_2^+$				
$CH_2I_2^+$	CH_2I_2		9.46 (V)	PE		3119
	$ICN^+(^2\Pi_{3/2})$	**ΔH°_{f0} = 1277 kJ mol^{-1} (305 kcal mol^{-1})**				
	$ICN^+(^2\Pi_{1/2})$	**ΔH°_{f0} = 1330 kJ mol^{-1} (318 kcal mol^{-1})**				
	$ICN^+(^2\Sigma^+)$	**ΔH°_{f0} = 1496 kJ mol^{-1} (358 kcal mol^{-1})**				
	$ICN^+(^2\Pi_{3/2})$	**ΔH°_{f0} = 1514 kJ mol^{-1} (362 kcal mol^{-1})**				
$CNI^+(^2\Pi_{3/2})$	ICN		10.870±0.001	S	1275	2887
$CNI^+(^2\Pi_{3/2})$	ICN		10.87±0.02	PI	1275	2621
$CNI^+(^2\Pi_{3/2})$	ICN		10.91±0.02	PE	1279	3091
$CNI^+(^2\Pi_{3/2})$	ICN		10.91	PE	1279	3045
$CNI^+(^2\Pi_{1/2})$	ICN		11.44±0.02	PE	1330	3091
$CNI^+(^2\Pi_{1/2})$	ICN		11.45	PE	1331	3045
$CNI^+(^2\Sigma^+)$	ICN		13.15±0.02	PE	1495	3091
$CNI^+(^2\Sigma^+)$	ICN		13.17	PE	1497	3045
$CNI^+(^2\Pi_{3/2})$	ICN		13.35	PE	1514	3045
$CNI^+(^2\Pi_{3/2})$	ICN		13.41±0.02 (V)	PE		3091
$CNI^+(^2\Pi_{1/2})$	ICN		13.56±0.02 (V)	PE		3091

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$CNI^+(^2\Sigma^+)$	ICN		16.69±0.02 (V)	PE		3091
$CNI^+(^2\Sigma^+)$	ICN		16.71 (V)	PE		3045

See also – S: 2660
EI: 73

BF_2I^+

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
BF_2I^+	BF_2I		10.42±0.08	EI		2512, 3227

BFI_2^+

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
BFI_2^+	BFI_2		9.69±0.06	EI		2512, 3227

CF_2I^+

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
CF_2I^+	CF_3I	F	14.58±0.06	EI		439
CF_2I^+	CF_3I	F	15.3±0.3	EI		24

CF_3I^+ $\Delta H^\circ_{f0} = 404$ kJ mol^{-1} (97 kcal mol^{-1})

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
CF_3I^+	CF_3I		10.23	PI	404	2643
CF_3I^+	CF_3I		10.5±0.1	SD		1111
CF_3I^+	CF_3I		10.0±0.3	EI		24
CF_3I^+	CF_3I		10.64±0.02	EI		439

$C_6F_5I^+$

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_6F_5I^+$	C_6F_5I (Iodopentafluorobenzene)		9.5±0.1	EI		301

$C_3F_7I^+$

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_3F_7I^+$	n-C_3F_7I		10.36±0.01	PI		182

$LiNaI^+$

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$LiNaI^+$	$LiNaI_2$	I	9.0±0.3	EI		2001

BCl_2I^+

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
BCl_2I^+	BCl_2I		9.93±0.10	EI		2512, 3227

$BClI_2^+$

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$BClI_2^+$	$BClI_2$		9.49±0.14	EI		2512, 3227

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
C_2ClI^+						
$C_2ClI^+(^2\Pi_{3/2})$	$CCl\equiv CI$		9.44	PE		3121
$C_2ClI^+(^2\Pi_{3/2})$	$CCl\equiv CI$		9.7±0.1	EDD		3177
$C_2ClI^+(^2\Pi_{1/2})$	$CCl\equiv CI$		9.75	PE		3121
$C_2ClI^+(^2\Pi_{3/2})$	$CCl\equiv CI$		11.48 (V)	PE		3121
$C_2ClI^+(^2\Pi_{1/2})$	$CCl\equiv CI$		11.84 (V)	PE		3121
$C_2ClI^+(^2\Pi_{3/2})$	$CCl\equiv CI$		13.85 (V)	PE		3121
$C_2ClI^+(^2\Sigma^+)$	$CCl\equiv CI$		14.88 (V)	PE		3121
$C_2ClI^+(^2\Sigma^+)$	$CCl\equiv CI$		17.21 (V)	PE		3121
C_2ClI^{+2}						
C_2ClI^{+2}	$CCl\equiv CI$		25.5±0.1	EDD		3177
$LiKI^+$						
$LiKI^+$	$LiKI_2$	I	9.0±0.3	EI		2001
BBr_2I^+						
BBr_2I^+	BBr_2I		9.74±0.11	EI		2512, 3227
$BBrI_2^+$						
$BBrI_2^+$	$BBrI_2$		9.40±0.11	EI		2512, 3227
C_2BrI^+						
$C_2BrI^+(^2\Pi_{3/2})$	$CBr\equiv CI$		9.34	PE		3121
$C_2BrI^+(^2\Pi_{3/2})$	$CBr\equiv CI$		9.4±0.1	EDD		3177
$C_2BrI^+(^2\Pi_{1/2})$	$CBr\equiv CI$		9.68	PE		3121
$C_2BrI^+(^2\Pi_{3/2})$	$CBr\equiv CI$		11.24	PE		3121
$C_2BrI^+(^2\Pi_{1/2})$	$CBr\equiv CI$		11.67	PE		3121
$C_2BrI^+(^2\Pi_{3/2})$	$CBr\equiv CI$		13.03 (V)	PE		3121
$C_2BrI^+(^2\Sigma^+)$	$CBr\equiv CI$		14.71 (V)	PE		3121
$C_2BrI^+(^2\Sigma^+)$	$CBr\equiv CI$		16.35 (V)	PE		3121
C_2BrI^{+2}						
C_2BrI^{+2}	$CBr\equiv CI$		24.7±0.1	EDD		3177

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol⁻¹)	Ref.
		$LiRbI^+$				
$LiRbI^+$	$LiRbI_2$	I	8.4±0.3	EI		2001
		$C_6H_6NI^+$				
$C_6H_6NI^+$	$C_6H_4INH_2$ (4–Iodoaniline)		7.66±0.1	CTS		2485
		$C_8H_{10}NI^+$				
$C_8H_{10}NI^+$	$C_6H_4IN(CH_3)_2$ (*N*,*N*–Dimethyl–4–iodoaniline)		7.29	CTS		1281
		$C_2H_5OI^+$				
$C_2H_5OI^+$	CH_2ICH_2OH		9.62	PE		3374
		$C_7H_4OI^+$				
$C_7H_4OI^+$	$C_6H_4ICOOCH_3$ (4–Iodobenzoic acid methyl ester)		11.08	EI		3238
		$C_8H_7O_2I^+$				
$C_8H_7O_2I^+$	$C_6H_4ICOOCH_3$ (4–Iodobenzoic acid methyl ester)		9.10	EI		3238
		$C_2H_2F_3I^+$				
$C_2H_2F_3I^+$	CF_3CH_2I		10.00±0.01	PI		182
		$C_4H_2F_7I^+$				
$C_4H_2F_7I^+$	*n*–$C_3F_7CH_2I$		9.96±0.02	PI		182
		$C_2H_6SiI^+$				
$C_2H_6SiI^+$	$(CH_3)_3SiI$	CH_3	10.3±0.1	EI		2689

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_3H_9SiI^+$				
$C_3H_9SiI^+$	$(CH_3)_3SiI$		8.9±0.1	EI		2689
		$C_4H_3SI^+$				
$C_4H_3SI^+$	C_4H_3SI (2–Iodothiophene)		8.55±0.05	PE		3246
		$C_6H_4ClI^+$				
$C_6H_4ClI^+$	C_6H_4ClI (1–Chloro–2–iodobenzene)		8.35±0.1?	PI		416
		$BFClI^+$				
$BFClI^+$	BFClI		10.18±0.09	EI		2512, 3227
		$COIMn^+$				
$COIMn^+$	$Mn(CO)_5I$	4CO	12.37	EI		2501
		$C_2O_2IMn^+$				
$C_2O_2IMn^+$	$Mn(CO)_5I$	3CO	10.46	EI		2501
		$C_3O_3IMn^+$				
$C_3O_3IMn^+$	$Mn(CO)_5I$	2CO	9.49	EI		2501
		$C_5O_5IMn^+$				
$C_5O_5IMn^+$	$Mn(CO)_5I$		8.35 (V)	PE		2879
$C_5O_5IMn^+$	$Mn(CO)_5I$		8.55±0.02	EI		2501
		$BFBrI^+$				
$BFBrI^+$	BFBrI		10.11±0.08	EI		2512, 3227
		$BClBrI^+$				
$BClBrI^+$	BClBrI		9.81±0.02	EI		2512, 3227

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_4H_{12}BN_2I^+$						
$C_4H_{12}BN_2I^+$	$((CH_3)_2N)_2BI$		7.97	EI		3227
$C_2H_6BNI_2^+$						
$C_2H_6BNI_2^+$	$(CH_3)_2NBI_2$		8.99	EI		3227
$C_2H_6BO_2I^+$						
$C_2H_6BO_2I^+$	$(CH_3O)_2BI$		9.63	EI		3227
$CH_3BOI_2^+$						
$CH_3BOI_2^+$	CH_3OBI_2		9.21	EI		3227
$C_2H_6BS_2I^+$						
$C_2H_6BS_2I^+$	$(CH_3S)_2BI$		8.90	EI		3227
$CH_3BSI_2^+$						
$CH_3BSI_2^+$	CH_3SBI_2		9.26	EI		3227
$C_9H_5O_3ICr^+$						
$C_9H_5O_3ICr^+$	$C_6H_5ICr(CO)_3$ (Iodobenzenechromium tricarbonyl)		7.36	EI		3005
$C_{10}H_{12}O_4I_2Cr^+$						
$C_{10}H_{12}O_4I_2Cr^+$	$(CH_3COCICOCH_3)_3Cr$ (Tris(3–iodo–2,4–pentanedionato)chromium)		10.8±0.10	EI		2519
$C_{15}H_{18}O_6I_3Cr^+$						
$C_{15}H_{18}O_6I_3Cr^+$	$(CH_3COCICOCH_3)_3Cr$ (Tris(3–iodo–2,4–pentanedionato)chromium)		8.03±0.05	EI		2519
$C_2H_6BNFI^+$						
$C_2H_6BNFI^+$	$(CH_3)_2NBFI$		9.61	EI		3227

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		CH_3BOFI^+				
CH_3BOFI^+	CH_3OBFI		9.96	EI		3227
		$C_{18}H_{15}N_2O_2PIFe^+$				
$C_{18}H_{15}N_2O_2PIFe^+$	$(C_6H_5)_3PFe(NO)_2I$ (Triphenylphosphineiron dinitrosyl iodide)		7.5	EI		2799
		$C_{12}H_{27}N_2O_2PICo^+$				
$C_{12}H_{27}N_2O_2PICo^+$	$(n\text{-}C_4H_9)_3PCo(NO)_2I$		7.7	EI		2799
		$C_{18}H_{15}N_2O_2PICo^+$				
$C_{18}H_{15}N_2O_2PICo^+$	$(C_6H_5)_3PCo(NO)_2I$ (Triphenylphosphinecobalt dinitrosyl iodide)		7.6	EI		2799
		$C_9H_{21}N_2O_5PICo^+$				
$C_9H_{21}N_2O_5PICo^+$	$(iso\text{-}C_3H_7O)_3PCo(NO)_2I$		7.95	EI		2799
	$Xe^+(^2P_{3/2})$ **$Xe^+(^2P_{1/2})$**	**ΔH°_{f0} = 1170.4 kJ mol^{-1} (279.7 kcal mol^{-1})** **ΔH°_{f0} = 1296.4 kJ mol^{-1} (309.8 kcal mol^{-1})**				
$Xe^+(^2P_{3/2})$	Xe		12.130	S	1170.4	2113
$Xe^+(^2P_{3/2})$	Xe		12.129±0.002	PI		1032, 1253
$Xe^+(^2P_{3/2})$	Xe		12.12±0.01	PI		1118
$Xe^+(^2P_{3/2})$	Xe		12.17	PE		248
$Xe^+(^2P_{3/2})$	Xe		12.15±0.03	EDD		2557
$Xe^+(^2P_{3/2})$	Xe		12.09±0.03	EDD		3174
$Xe^+(^2P_{1/2})$	Xe		13.436	S	1296.4	2113
$Xe^+(^2P_{1/2})$	Xe		13.49	PE		248
See also – EI: 35, 52, 2032, 2053, 3201						
Xe^+ (Threshold value corrected to 0 K)	XeF_2	$F+F^-$	11.481	PI		3276
The measurement was made upon the F^- ion. From this result the authors deduce $\Delta H^\circ_{f0}(XeF_2)$ = −117.2 kJ mol^{-1} (−28.0 kcal mol^{-1}).						
Xe^+	XeF_2	$F+F^-$?	12.0±0.1	EI		2053
See also – PI: 3217						
Xe^+	XeF_2	2F	~15.3	PI		3276
Xe^+	XeF_4	F_2+F+F^-?	12.4±0.1	EI		2053

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
Xe^{+2} $\Delta H^\circ_{f0} = 3217$ kJ mol^{-1} (769 kcal mol^{-1})						
Xe^{+2}	Xe		33.34	S	3217	2113
Xe^{+2}	Xe		33.3±0.1	RPD		3137
Xe^{+2}	Xe		33.4±0.2	EDD		2634
Xe^{+2}	Xe		33.5±0.2	NRE		25, 211
Xe^{+2}	Xe		33.3±0.5	NRE		201
Xe^{+2}	Xe		33	EI		1240
Xe^{+2}	Xe		33.3	EI		211
Xe^{+2}	Xe		33.5	EI		201
Xe^{+2}	Xe^{+}		21.21	S		2113
Xe^{+2}	Xe^{+}		20±2	SEQ		2551
Xe^{+3} $\Delta H^\circ_{f0} \sim 6310$ kJ mol^{-1} (1508 kcal mol^{-1})						
Xe^{+3}	Xe		65.4	S	~6310	2113
Xe^{+3}	Xe		66.2±0.3	RPD		3137
Xe^{+3}	Xe		64.8±0.5	NRE		25, 211
Xe^{+3}	Xe		64.3±1	NRE		201
Xe^{+3}	Xe		65	EI		1240
Xe^{+3}	Xe		65.4	EI		211
Xe^{+3}	Xe		66.5	EI		201
Xe^{+3}	Xe^{+2}		32.1	S		2113
Xe^{+3}	Xe^{+2}		29±2	SEQ		2551
Xe^{+4}						
Xe^{+4}	Xe		110±1	RPD		3137
Xe^{+4}	Xe		107±1	NRE		25, 211
Xe^{+4}	Xe		103±2	NRE		201
Xe^{+4}	Xe		107	EI		201
Xe^{+4}	Xe		110	EI		1240
Xe^{+4}	Xe		111	EI		211
Xe^{+4}	Xe^{+3}		40±2	SEQ		2551
Xe^{+5}						
Xe^{+5}	Xe		170±2	RPD		3137
Xe^{+5}	Xe		160±1	NRE		25, 211
Xe^{+5}	Xe		157±3	NRE		201
Xe^{+5}	Xe		170	EI		201
Xe^{+5}	Xe		171	EI		211
Xe^{+5}	Xe		172	EI		1240
Xe^{+5}	Xe^{+4}		51±2	SEQ		2551

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
Xe^{+6}						
Xe^{+6}	Xe		218±1	NRE		25, 211
Xe^{+6}	Xe		246	EI		211
Xe^{+6}	Xe		248	EI		1240
Xe^{+6}	Xe		255±3	EI		3137
Xe^{+6}	Xe^{+5}		64±2	SEQ		2551
Xe^{+7}						
Xe^{+7}	Xe		362	EI		1240
Xe^{+7}	Xe		390±10	EI		3137
Xe^{+7}	Xe^{+6}		92±2	SEQ		2551
Xe^{+8}						
Xe^{+8}	Xe		535	EI		1240
Xe^{+8}	Xe^{+7}		105±2	SEQ		2551
Xe^{+9}						
Xe^{+9}	Xe		820	EI		1240
Xe^{+9}	Xe^{+8}		183±2	SEQ		2551
Xe^{+10}						
Xe^{+10}	Xe^{+9}		203±2	SEQ		2551
Xe_2^+	**$\Delta H_{f0}^{\circ} = 1075$ kJ mol^{-1} (257 kcal mol^{-1})**					
Xe_2^+	Xe_2?		11.14±0.02	PI	1075	2650
Xe_2^+	Xe+Xe*		11.162	PI	(≤1077)	2650
Xe_2^+	Xe+Xe*		11.162±0.005	PI	(≤1077)	2763
XeF^+	**$\Delta H_{f0}^{\circ} \sim 1050$ kJ mol^{-1} (251 kcal mol^{-1})**					
XeF^+	XeF_2	F	12.90	PI	1051	3276
(Threshold value corrected to 0 K)						
XeF^+	XeF_2	F	12.86	PI	1047	2639
See also – EI: 2053						
XeF^+	XeF_4	3F	15.81	PI	1054	3276
(Threshold value corrected to 0 K)						
See also – EI: 2053						

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
	$XeF_2^+(^2\Pi_{3/2u})$	**ΔH°_{f0} = 1074 kJ mol^{-1} (257 kcal mol^{-1})**				
$XeF_2^+(^2\Pi_{3/2u})$	XeF_2		12.35±0.01	PI	1074	3217, 3276
(Threshold value corrected to 0 K)						
$XeF_2^+(^2\Pi_{3/2u})$	XeF_2		12.28	PI		2639
$XeF_2^+(^2\Pi_{3/2u})$	XeF_2		12.35±0.01	PE		2912
$XeF_2^+(^2\Pi_{3/2u})$	XeF_2		12.33±0.02	PE		3062
$XeF_2^+(^2\Pi_{1/2u})$	XeF_2		12.89±0.01	PE		2912
$XeF_2^+(^2\Pi_{1/2u})$	XeF_2		12.83±0.02	PE		3062
$XeF_2^+(^2\Sigma_g^+)$	XeF_2		~13.5	PE		2912
$XeF_2^+(^2\Sigma_g^+)$	XeF_2		13.58±0.05	PE		3062
$XeF_2^+(^2\Pi_g)$	XeF_2		14.00±0.05	PE		2912
$XeF_2^+(^2\Pi_g)$	XeF_2		14.06±0.05	PE		3062
$XeF_2^+(^2\Pi_u)$	XeF_2		15.25±0.05	PE		2912
$XeF_2^+(^2\Pi_u)$	XeF_2		15.40±0.05	PE		3062
$XeF_2^+(^2\Sigma_u^+)$	XeF_2		16.80±0.05	PE		2912
$XeF_2^+(^2\Sigma_u^+)$	XeF_2		17.10±0.1	PE		3062
$XeF_2^+(^2\Sigma_g)$	XeF_2		20.05±0.1	PE		3062
$XeF_2^+(^2\Sigma_g)$	XeF_2		~22.5 (V)	PE		2912
See also – S:	2181					
EI:	2053					
XeF_2^+	XeF_4	2F	≤15.22	PI		3276
(Threshold value corrected to 0 K)						

From this result the authors deduce $\Delta H^\circ_{f0}(XeF_4)$ = −241.0 kJ mol^{-1} (−57.6 kcal mol^{-1}).

See also – EI: 2053

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
	XeF_3^+	**ΔH°_{f0} = 946 kJ mol^{-1} (226 kcal mol^{-1})**				
XeF_3^+	XeF_4	F	13.10	PI	946	3276
(Threshold value corrected to 0 K)						
XeF_3^+	XeF_4	F	13.1±0.1	EI		2053
XeF_3^+	XeF_6	3F	15.9–16.1	PI		3276

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
	XeF_4^+	**ΔH°_{f0} = 980 kJ mol^{-1} (234 kcal mol^{-1})**				
XeF_4^+	XeF_4		12.65±0.1	PI	980	3276
XeF_4^+	XeF_4		$\leq$12.72	PE		3364
XeF_4^+	XeF_4		12.9±0.1	EI		2053
XeF_4^+	XeF_6	2F	15.67±0.05	PI		3276
(Threshold value corrected to 0 K)						
		XeF_5^+				
XeF_5^+	XeF_6	F	12.56	PI		3276
(Threshold value corrected to 0 K)						
		XeF_6^+				
XeF_6^+	XeF_6		12.19±0.02	PI		3276
(Threshold value corrected to 0 K)						
XeF_6^+	XeF_6		$\geq$11.96	PE		3364
	Cs^+	**ΔH°_{f0} = 453.9 kJ mol^{-1} (108.5 kcal mol^{-1})**				
Cs^+	Cs		3.894	S	453.9	2113
See also – S:	3160					
EI:	2487, 3221					
Cs^+	CsF	F	8.75±0.1	PI	(413)	2611
(Threshold value corrected for hot bands)						
See also – EI:	2406					
Cs^+	CsCl	Cl	8.47±0.07	PI	(459)	2611
(Threshold value corrected for hot bands)						
See also – EI:	2056, 2406					
Cs^+	CsBr	Br	8.06±0.05	PI		2611
(Threshold value corrected for hot bands)						
Cs^+	CsI	I	7.46±0.05	PI		2611
(Threshold value corrected for hot bands)						
See also – EI:	1239, 2001					
Cs^+	CsOH	OH	7.46±0.14	RPD		2985
Cs^+	CsOH	OH	7.60±0.15	EI		3189
		Cs_2^+				
Cs_2^+	Cs_2		3.80±0.1	PI		2633
Cs_2^+	Cs_2CO_3		11.4	EI		3243

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
Cs_3^+						
Cs_3^+	Cs_3		3.2±0.1	PI		2633
Cs_4^+						
Cs_4^+	Cs_4		3.2±0.1	PI		2633
Cs_2O^+						
Cs_2O^+	Cs_2O		4.45±0.06	EI		2985
Cs_2O^+	Cs_2O		4.5	EI		3243
Cs_2O^+	$Cs_2(OH)_2$		7.52±0.14	EI		2985
Cs_2O^+	Cs_2SO_4		10.6±0.5	EI		2487
Cs_2F^+						
Cs_2F^+	Cs_2F_2	F	9.64±0.05	PI		2611
(Threshold value corrected for hot bands)						
$CsCl^+$						
$CsCl^+$	CsCl		8.3±0.3	EI		2406
Cs_2Cl^+						
Cs_2Cl^+	Cs_2Cl_2	Cl	8.48±0.05	PI		2611
(Threshold value corrected for hot bands)						
$CsBr^+$						
$CsBr^+$	CsBr		7.72±0.05	PI		2611
(Threshold value corrected for hot bands)						
Cs_2Br^+						
Cs_2Br^+	Cs_2Br_2	Br	8.14±0.06	PI		2611
(Threshold value corrected for hot bands)						
CsI^+						
CsI^+	CsI		7.25±0.05	PI		2611
(Threshold value corrected for hot bands)						

See also – EI: 1239, 2001

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
Cs_2I^+						
Cs_2I^+	Cs_2I_2	I	8.1±0.3	EI		2001
Cs_2I^+	Cs_2I_2	I	10.7±1	EI		1239
$CsOH^+$						
$CsOH^+$	CsOH		7.21±0.14	EI		2985
$CsOH^+$	CsOH		7.40±0.15	EI		3189
Cs_2OH^+						
Cs_2OH^+	$Cs_2(OH)_2$	OH	7.10±0.12	RPD		2985
$Cs_2CO_3^+$						
$Cs_2CO_3^+$	Cs_2CO_3		5.5	EI		3243
$Cs_2SO_4^+$						
$Cs_2SO_4^+$	Cs_2SO_4		8.9±0.5	EI		2487
$CsCdCl^+$						
$CsCdCl^+$	$CsCdCl_3$		10.5±0.2	EI		2056
$LiCsI^+$						
$LiCsI^+$	$LiCsI_2$	I	8.6±0.3	EI		2001
Ba^+ ΔH°_{f0} = 684 kJ mol^{-1} (163 kcal mol^{-1})						
Ba^+	Ba		5.212	S	684	2113
See also – S:	3270					
EI:	2178, 2432, 2527, 2589, 2990, 3204					
Ba^+	BaO	O	13.2±0.2	EI		2178
Ba^+	BaO	O	13.7±0.5	EI		2527
Ba^+	$BaCl_2$		15.43±0.10	EI		2991
Ba^+	BaI_2		12.8±1	EI		1239
Ba^{+2} ΔH°_{f0} = 1649 kJ mol^{-1} (394 kcal mol^{-1})						
Ba^{+2}	Ba		15.216	S	1649	2113
Ba^{+2}	Ba*?		11.5±0.3	EI		2178
Ba^{+2}	Ba^+		10.004	S		2113
Ba^{+2}	BaO?		20.6±0.5	EI		2178

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
Ba^{+3}						
Ba^{+3}	Ba		57.5	EI		2178
BaO^+						
BaO^+	BaO		6.5±0.3	EI		2178
BaO^+	BaO		6.8±0.5	EI		3256
See also – EI:	2052, 2527					
BaO^+	$BaMoO_4$		12.6±0.5	EI		3256
BaO^+	$BaWO_4$		12.6±0.5	EI		3256
BaF^+						
BaF^+	BaF		4.8±0.3	EI		2432
BaF^+	BaF		4.8±0.3	EI		2589
BaF^+	BaF		4.9±0.3	EI		1104
BaF^+	BaF_2	F	13.5±1.0	EI		2432
$BaCl^+$						
$BaCl^+$	BaCl		5.01±0.10	EI		2991
$BaCl^+$	BaCl		5.0±0.5	EI		2990
$BaCl^+$	BaCl		5.5±0.5	EI		3204
$BaCl^+$	$BaCl_2$	Cl	10.03±0.10	EI		2991
$BaCl^+$	$BaCl_2$	Cl	10.3±0.3	EI		2990
$BaCl_2^+$						
$BaCl_2^+$	$BaCl_2$		9.18±0.10	EI		2991
$BaCl_2^+$	$BaCl_2$		10.0±1.0	EI		2990
$BaCl_2^+$	$BaCl_2$		11.0±1	EI		3204
BaI^+						
BaI^+	BaI_2	I	9.6±1	EI		1239
BaI_2^+						
BaI_2^+	BaI_2		8.1±1	EI		1239
$BaOH^+$						
$BaOH^+$	BaOH		4.5±1	EI		2052
$BaOH^+$	BaOH		5.25±0.1	D		3242, 3419

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$BaMoO_3^+$				
$BaMoO_3^+$	$BaMoO_3$		8.5±0.5	EI		3256
$BaMoO_3^+$	$BaMoO_4$	O	14.2±0.5	EI		3256
		$BaMoO_4^+$				
$BaMoO_4^+$	$BaMoO_4$		9.6±0.5	EI		3256
	La^+	**$\Delta H^\circ_{f0} = 969.4$ kJ mol^{-1} (231.7 kcal mol^{-1})**				
La^+	La		5.577	S	969.4	2113
La^+	La		5.55±0.05	SI		2495
See also – EI:	2600, 2779, 3195					
La^+	LaF_3		26.5±0.7	EI		2009, 2600
La^+	LaS?		~12	EI		3198
La^+	$LaCl_3$		23±1	EI		2435
La^+	$(C_5H_5)_3La$ (Tris(cyclopentadienyl)lanthanum)		24.4±0.4	EI		3298
	La^{+2}	**$\Delta H^\circ_{f0} \sim 2037$ kJ mol^{-1} (487 kcal mol^{-1})**				
La^{+2}	La		16.64±0.08	S	2037	2113
La^{+2}	La^+		11.06±0.08	S		2113, 3265
	La^{+3}	**$\Delta H^\circ_{f0} \sim 3887$ kJ mol^{-1} (929 kcal mol^{-1})**				
La^{+3}	La		35.81±0.08	S	3887	2113
La^{+3}	La^{+2}		19.175	S		2113, 3262
See also – S:	3263					
		LaO^+				
LaO^+	LaO		4.8±0.5	EI		3195
LaO^+	LaO		~5	EI		3198
		LaF^+				
LaF^+	LaF		6.3±0.3	EI		2600
LaF^+	LaF_3		18.5±0.7	EI		2009, 2600
		LaF_2^+				
LaF_2^+	LaF_2		6.8±0.3	EI		2600
LaF_2^+	LaF_3	F	12.0±0.7	EI		2009, 2600

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
LaS^+						
LaS^+	LaS		~5	EI		3198
$LaCl^+$						
$LaCl^+$	$LaCl_3$		17.5±1	EI		2435
$LaCl_2^+$						
$LaCl_2^+$	$LaCl_3$	Cl	13.6±0.5	EI		2435
$LaCl_3^+$						
$LaCl_3^+$	$LaCl_3$		13.8±1	EI		2435
$La_2Cl_5^+$						
$La_2Cl_5^+$	La_2Cl_6	Cl	15±1	EI		2435
$C_5H_5La^+$						
$C_5H_5La^+$	$(C_5H_5)_3La$ (Tris(cyclopentadienyl)lanthanum)		17.3±0.3	EI		3298
$C_{10}H_{10}La^+$						
$C_{10}H_{10}La^+$	$(C_5H_5)_3La$ (Tris(cyclopentadienyl)lanthanum)		10.2±0.3	EI		3298
$C_{15}H_{15}La^+$						
$C_{15}H_{15}La^+$	$(C_5H_5)_3La$ (Tris(cyclopentadienyl)lanthanum)		7.9±0.3	EI		3298
$C_{22}H_{38}O_4La^+$						
$C_{22}H_{38}O_4La^+$	$((CH_3)_3CCOCHCOC(CH_3)_3)_3La$ (Tris(2,2,6,6–tetramethyl–3,5–heptanedionato)lanthanum)		14.9±0.5	EI		2524
$C_{29}H_{48}O_6La^+$						
$C_{29}H_{48}O_6La^+$	$((CH_3)_3CCOCHCOC(CH_3)_3)_3La$ (Tris(2,2,6,6–tetramethyl–3,5–heptanedionato)lanthanum)		11.1±0.5	EI		2524

4.3. The Positive Ion Table—Continued

$C_{33}H_{57}O_6La^+$

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_{33}H_{57}O_6La^+$	$((CH_3)_3CCOCHCOC(CH_3)_3)_3La$ (Tris(2,2,6,6-tetramethyl-3,5-heptanedionato)lanthanum)		8.0±0.5	EI		2524

Ce^+ $\Delta H^\circ_{f0} = 951$ kJ mol^{-1} (227 kcal mol^{-1})

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
Ce^+	Ce		5.47±0.02	S	951	2113, 3051
Ce^+	Ce		5.54±0.06	SI		2495
Ce^+	Ce		5.60±0.05	SI		2882

See also – S: 2667
EI: 2517, 2600, 2690, 2734, 2779

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
Ce^+	CeF_3		28.0±0.7	EI		2600

Ce^{+2} $\Delta H^\circ_{f0} \sim 1998$ kJ mol^{-1} (478 kcal mol^{-1})

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
Ce^{+2}	Ce		16.32±0.10	S	1998	2113
Ce^{+2}	Ce^+		10.85±0.08	S		2113, 3265

Ce^{+3} $\Delta H^\circ_{f0} \sim 3947$ kJ mol^{-1} (943 kcal mol^{-1})

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
Ce^{+3}	Ce		36.52±0.11	S	3947	2113
Ce^{+3}	Ce		36.4	BH		3259
Ce^{+3}	Ce		36.56	BH		3273
Ce^{+3}	Ce^{+2}		20.20±0.01	S		2113

See also – S: 3264

Ce_2^+

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
Ce_2^+	Ce_2		5.2±0.5	EI		2690

CeC^+

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
CeC^+	CeC		7.5±1.0	EI		2491
CeC^+	CeC_2	C	~14	EI		2491

CeC_2^+

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
CeC_2^+	CeC_2		5.6±0.5	EI		2517

CeC_4^+

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
CeC_4^+	CeC_4		6.2±0.5	EI		2517

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
			CeO^+			
CeO^+	CeO		5.2±0.5	EI		2734
CeO^+	CeO_2	O	11.6±0.5	EI		2734
			CeO_2^+			
CeO_2^+	CeO_2		9.5±0.5	EI		2734
			CeF^+			
CeF^+	CeF		6.5±0.3	EI		2600
CeF^+	CeF_3		20.5±0.7	EI		2600
			CeF_2^+			
CeF_2^+	CeF_2		6.0±0.3	EI		2600
CeF_2^+	CeF_3	F	13.0±0.7	EI		2600
		Pr^+	**$\Delta H^\circ_{f0} = 880$ kJ mol^{-1} (210 kcal mol^{-1})**			
Pr^+	Pr		5.42±0.02	S	880	2113, 2667
Pr^+	Pr		5.40±0.05	SI		2495
Pr^+	Pr		5.48±0.01	SI		2881
Pr^+	Pr		5.61±0.12	SI		2478, 2982
Pr^+	Pr		5.6±0.2	SI		3024
See also – EI:	2600, 2779					
Pr^+	PrO_2?		12.9±0.5	EI		2734
Pr^+	PrF_3		27.5±0.7	EI		2600
Pr^+	$(C_5H_5)_3Pr$ (Tris(cyclopentadienyl)praseodymium)		24.1±0.4	EI		3298
		Pr^{+2}	**$\Delta H^\circ_{f0} \sim 1898$ kJ mol^{-1} (454 kcal mol^{-1})**			
Pr^{+2}	Pr		15.97±0.10	S	1898	2113
Pr^{+2}	Pr^+		10.55±0.08	S		2113, 3265
		Pr^{+3}	**$\Delta H^\circ_{f0} \sim 3984$ kJ mol^{-1} (952 kcal mol^{-1})**			
Pr^{+3}	Pr		37.59±0.12	S	3984	2113
Pr^{+3}	Pr		37.55	BH		3259
Pr^{+3}	Pr		37.62	BH		3273
Pr^{+3}	Pr^{+2}		21.62±0.02	S		2113, 3282
See also – S:	3260, 3267					

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
	Pr^{+4}	**$\Delta H^\circ_{f0} \sim 7742$ kJ mol^{-1} (1850 kcal mol^{-1})**				
Pr^{+4}	Pr		76.54±0.14	S	7742	2113
Pr^{+4}	Pr^{+3}		38.95±0.02	S		2113, 3268
		PrO^+				
PrO^+	PrO		4.9±0.5	EI		2734
PrO^+	PrO_2	O	10.9±0.5	EI		2734
		PrO_2^+				
PrO_2^+	PrO_2		9.6±0.5	EI		2734
		PrF^+				
PrF^+	PrF_3		19.0±0.7	EI		2600
		PrF_2^+				
PrF_2^+	PrF_3	F	12.5±0.7	EI		2600
		$C_5H_5Pr^+$				
$C_5H_5Pr^+$	$(C_5H_5)_3Pr$ (Tris(cyclopentadienyl)praseodymium)		17.0±0.4	EI		2640
$C_5H_5Pr^+$	$(C_5H_5)_3Pr$ (Tris(cyclopentadienyl)praseodymium)		17±0.4	EI		3298
		$C_{10}H_{10}Pr^+$				
$C_{10}H_{10}Pr^+$	$(C_5H_5)_3Pr$ (Tris(cyclopentadienyl)praseodymium)		8.48±0.2	EI		2640
$C_{10}H_{10}Pr^+$	$(C_5H_5)_3Pr$ (Tris(cyclopentadienyl)praseodymium)		10±0.2	EI		3298
		$C_{15}H_{15}Pr^+$				
$C_{15}H_{15}Pr^+$	$(C_5H_5)_3Pr$ (Tris(cyclopentadienyl)praseodymium)		7.68±0.1	EI		2640
$C_{15}H_{15}Pr^+$	$(C_5H_5)_3Pr$ (Tris(cyclopentadienyl)praseodymium)		8.2±0.2	EI		3298

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
Nd^+ ΔH°_{f0} = 858 kJ mol^{-1} (205 kcal mol^{-1})						
Nd^+	Nd		5.49±0.02	S	858	2113, 2667
Nd^+	Nd		5.49±0.05	SI		2495
Nd^+	Nd		5.51±0.02	SI		2881
Nd^+	Nd		5.5±0.1	SI		3024
See also – S:	2177					
EI:	2459, 2589, 2600, 2779, 3210					
Nd^+	NdO_2?		11.8±0.5	EI		2734
Nd^+	NdF_3		25.5±0.3	EI		2589, 2600
Nd^+	$(C_5H_5)_3Nd$ (Tris(cyclopentadienyl)neodymium)		23.2±0.4	EI		3269
Nd^+	$(C_5H_5)_3Nd$ (Tris(cyclopentadienyl)neodymium)		23.6±0.4	EI		3298
Nd^{+2} ΔH°_{f0} ~ 1894 kJ mol^{-1} (453 kcal mol^{-1})						
Nd^{+2}	Nd		16.22±0.10	S	1894	2113
Nd^{+2}	Nd^+		10.73±0.08	S		2113, 3265
Nd^{+3}						
Nd^{+3}	Nd		38.27	BH		3273
Nd^{+3}	Nd		38.3	BH		3261
Nd^{+3}	Nd		38.4	BH		3259
NdC_2^+						
NdC_2^+	NdC_2		6.5±0.3	EI		3210
NdC_2^+	NdC_2		6.6±0.3	EI		2459
NdC_4^+						
NdC_4^+	NdC_4		7.6±0.7	EI		2459
NdO^+						
NdO^+	NdO		5.0±0.5	EI		2734
NdO_2^+						
NdO_2^+	NdO_2		9.5±0.5	EI		2734

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
NdF^+						
NdF^+	NdF		5.0±0.3	EI		2589, 2600
NdF^+	NdF_2	F	~12.5±0.5	EI		2600
NdF^+	NdF_3		19.8±0.3	EI		2589, 2600
NdF_2^+						
NdF_2^+	NdF_2		5.6±0.3	EI		2589, 2600
NdF_2^+	NdF_3	F	12.9±0.3	EI		2589, 2600
$C_5H_5Nd^+$						
$C_5H_5Nd^+$	$(C_5H_5)_3Nd$ (Tris(cyclopentadienyl)neodymium)		16.8±0.2	EI		3298
$C_5H_5Nd^+$	$(C_5H_5)_3Nd$ (Tris(cyclopentadienyl)neodymium)		17.8±0.3	EI		3269
$C_{10}H_{10}Nd^+$						
$C_{10}H_{10}Nd^+$	$(C_5H_5)_3Nd$ (Tris(cyclopentadienyl)neodymium)		9.8±0.2	EI		3298
$C_{10}H_{10}Nd^+$	$(C_5H_5)_3Nd$ (Tris(cyclopentadienyl)neodymium)		10.0±0.2	EI		3269
$C_{15}H_{15}Nd^+$						
$C_{15}H_{15}Nd^+$	$(C_5H_5)_3Nd$ (Tris(cyclopentadienyl)neodymium)		8.0±0.2	EI		3298
$C_{15}H_{15}Nd^+$	$(C_5H_5)_3Nd$ (Tris(cyclopentadienyl)neodymium)		8.3±0.1	EI		3269
Pm^+						
Pm^+	Pm		5.55±0.02	S		2113, 2667
Pm^{+2}						
Pm^{+2}	Pm		16.45±0.10	S		2113
Pm^{+2}	Pm^+		10.90±0.08	S		2113, 3265

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
Sm^+	**$\Delta H^\circ_{f0} = 749$ kJ mol^{-1} (179 kcal mol^{-1})**					
Sm^+	Sm		5.63±0.02	S	749	2113, 2667
Sm^+	Sm		5.56±0.10	EI		2588
Sm^+	Sm		5.61±0.05	SI		2495
Sm^+	Sm		5.70±0.02	SI		1165
Sm^+	Sm		6.15±0.05	SI		3024
See also – EI:	2593, 2600					
Sm^+	$\mathrm{SmF_3}$		26.0±0.7	EI		2600
Sm^+	$\mathrm{(C_5H_5)_3Sm}$ (Tris(cyclopentadienyl)samarium)		22.2±0.4	EI		3269
Sm^{+2}	**$\Delta H^\circ_{f0} \sim 1817$ kJ mol^{-1} (434 kcal mol^{-1})**					
Sm^{+2}	Sm		16.70±0.10	S	1817	2113
Sm^{+2}	Sm^+		11.07±0.08	S		2113, 3265
Sm^{+3}						
Sm^{+3}	Sm		40.38	BH		3273
Sm^{+3}	Sm		40.4	BH		3259
Sm^{+3}	Sm		40.4	BH		3261
SmF^+						
SmF^+	SmF		5.7±0.3	EI		2593, 2600
SmF^+	$\mathrm{SmF_3}$		19.0±0.7	EI		2600
$\mathrm{SmF_2^+}$						
$\mathrm{SmF_2^+}$	$\mathrm{SmF_3}$	F	13.0±0.7	EI		2600
$\mathrm{C_5H_5Sm^+}$						
$\mathrm{C_5H_5Sm^+}$	$\mathrm{(C_5H_5)_3Sm}$ (Tris(cyclopentadienyl)samarium)		14.4±0.3	EI		3269
$\mathrm{C_{10}H_{10}Sm^+}$						
$\mathrm{C_{10}H_{10}Sm^+}$	$\mathrm{(C_5H_5)_3Sm}$ (Tris(cyclopentadienyl)samarium)		10.0±0.2	EI		3269

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
			$C_{15}H_{15}Sm^+$			
$C_{15}H_{15}Sm^+$	$(C_5H_5)_3Sm$ (Tris(cyclopentadienyl)samarium)		8.0±0.1	EI		3269
	Eu^+		**$\Delta H^\circ_{f0} = 724$ kJ mol^{-1} (173 kcal mol^{-1})**			
Eu^+	Eu		5.67±0.01	S	724	2113
Eu^+	Eu		5.68±0.02	S	725	2667
Eu^+	Eu		5.664±0.008	PI	723	3258
Eu^+	Eu		5.61±0.10	EI		2588
Eu^+	Eu		5.64±0.05	SI		2495
Eu^+	Eu		5.68±0.03	SI		1165
See also – EI:	2593, 2600, 2710, 3190					
Eu^+	EuF_3		27.0±0.7	EI		2600
Eu^+	$EuCl_2$		15.0±0.5	EI		2435
	Eu^{+2}		**$\Delta H^\circ_{f0} \sim 1809$ kJ mol^{-1} (432 kcal mol^{-1})**			
Eu^{+2}	Eu		16.92±0.09	S	1809	2113
Eu^{+2}	Eu^+		11.25±0.08	S		2113, 3265
Eu^{+2}	$EuCl_2$		26.0±0.5	EI		2435
			Eu^{+3}			
Eu^{+3}	Eu		41.8	BH		3259
Eu^{+3}	Eu		41.8	BH		3261
Eu^{+3}	Eu		42.05	BH		3273
			EuF^+			
EuF^+	EuF		5.9±0.3	EI		2593, 2600
EuF^+	EuF_3		19.5±0.7	EI		2600
			EuF_2^+			
EuF_2^+	EuF_3	F	13.5±0.7	EI		2600
			$EuCl^+$			
$EuCl^+$	$EuCl_2$	Cl	10.3±0.5	EI		2435
			$EuCl_2^+$			
$EuCl_2^+$	$EuCl_2$		10.5±0.5	EI		2435

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$EuCl_3^+$				
$EuCl_3^+$	$EuCl_3$		13±1	EI		2435
		$EuBr^+$				
$EuBr^+$	$EuBr_2$	Br	10.4	EI		2903, 3188
		$C_{11}H_{19}O_2Eu^+$				
$C_{11}H_{19}O_2Eu^+$	$((CH_3)_3CCOCHCOC(CH_3)_3)_3Eu$ (Tris(2,2,6,6–tetramethyl–3,5–heptanedionato)europium)		24.0±0.5	EI		2524
		$C_{22}H_{38}O_4Eu^+$				
$C_{22}H_{38}O_4Eu^+$	$((CH_3)_3CCOCHCOC(CH_3)_3)_3Eu$ (Tris(2,2,6,6–tetramethyl–3,5–heptanedionato)europium)		16.5±0.5	EI		2524
		$C_{29}H_{48}O_6Eu^+$				
$C_{29}H_{48}O_6Eu^+$	$((CH_3)_3CCOCHCOC(CH_3)_3)_3Eu$ (Tris(2,2,6,6–tetramethyl–3,5–heptanedionato)europium)		12.7±0.5	EI		2524
		$C_{33}H_{57}O_6Eu^+$				
$C_{33}H_{57}O_6Eu^+$	$((CH_3)_3CCOCHCOC(CH_3)_3)_3Eu$ (Tris(2,2,6,6–tetramethyl–3,5–heptanedionato)europium)		9.8±0.5	EI		2524
		Gd^+ $\Delta H_{f0}^\circ = 991$ kJ mol^{-1} (237 kcal mol^{-1})				
Gd^+	Gd		6.14±0.02	S	991	2113, 3051
Gd^+	Gd		5.98±0.10	EI		2588
Gd^+	Gd		6.16±0.05	SI		2495
Gd^+	Gd		6.73±0.09	SI		2781
Gd^+	Gd		6.73±0.09	SI		2477, 2982
See also – EI:	2593, 2600					
Gd^+	GdF_3		26.5±0.7	EI		2600
		Gd^{+2}				
Gd^{+2}	Gd		18.2±0.4	S		2113
Gd^{+2}	Gd^+		12.1±0.4	S		2113, 3265

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
Gd^{+3}						
Gd^{+3}	Gd		38.8	BH		3259
Gd^{+3}	Gd		39.03	BH		3273
Gd^{+3}	Gd		39.1	BH		3261
GdF^+						
GdF^+	GdF		6.2±0.3	EI		2593, 2600
GdF^+	GdF_3		20.0±0.7	EI		2600
GdF_2^+						
GdF_2^+	GdF_2		6.5±0.3	EI		2593, 2600
GdF_2^+	GdF_3	F	12.2±0.5	EI		2593
GdF_2^+	GdF_3	F	14.5±0.7	EI		2600
Tb^+	**ΔH°_{f0} = 955 kJ mol^{-1} (228 kcal mol^{-1})**					
Tb^+	Tb		5.85±0.02	S	955	2113, 2667
Tb^+	Tb		5.89±0.04	SI		2495
Tb^+	Tb		5.98±0.02	SI		2882
See also – EI:	2600					
Tb^+	TbF_3		27.0±0.7	EI		2600
Tb^{+2}	**ΔH°_{f0} ~ 2067 kJ mol^{-1} (494 kcal mol^{-1})**					
Tb^{+2}	Tb		17.37±0.10	S	2067	2113
Tb^{+2}	Tb^+		11.52±0.08	S		2113, 3265
Tb^{+3}						
Tb^{+3}	Tb		39.1	BH		3261
Tb^{+3}	Tb		39.3	BH		3259
Tb^{+3}	Tb		39.41	BH		3273
TbF^+						
TbF^+	TbF_3		19.5±0.7	EI		2600
TbF_2^+						
TbF_2^+	TbF_3	F	13.0±0.7	EI		2600

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
Dy^+ ΔH°_{f0} = 865 kJ mol^{-1} (207 kcal mol^{-1})						
Dy^+	Dy		5.93±0.02	S	865	2113, 2667
Dy^+	Dy		5.78±0.10	EI		2588
Dy^+	Dy		5.72±0.10	SI		2478, 2982
Dy^+	Dy		5.80±0.02	SI		1165
Dy^+	Dy		5.82±0.03	SI		2495
See also – EI:	2590, 2600, 2755					
Dy^+	DyF_3		25.0±0.3	EI		2402
Dy^+	DyF_3		27.4±0.7	EI		2600
Dy^{+2} ΔH°_{f0} ~ 1991 kJ mol^{-1} (476 kcal mol^{-1})						
Dy^{+2}	Dy		17.60±0.10	S	1991	2113
Dy^{+2}	Dy^+		11.67±0.08	S		2113, 3265
Dy^{+3}						
Dy^{+3}	Dy		40.4	BH		3259
Dy^{+3}	Dy		40.5	BH		3261
Dy^{+3}	Dy		40.66	BH		3273
DyC_2^+						
DyC_2^+	DyC_2		8.3±0.5	EI		2755
DyC_4^+						
DyC_4^+	DyC_4		8.8±0.5	EI		2755
DyF^+						
DyF^+	DyF		6.0±0.3	EI		2590, 2600
DyF^+	DyF_3		19.5±0.3	EI		2402
DyF^+	DyF_3		20.0±0.7	EI		2600
DyF_2^+						
DyF_2^+	DyF_2		6.7±0.3	EI		2600
DyF_2^+	DyF_3	F	13.5±0.7	EI		2600

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
Ho$^+$ ΔH°_{f0} = **883 kJ mol^{-1} (211 kcal mol^{-1})**						
Ho$^+$	Ho		6.02±0.02	S	883	2113, 2667
Ho$^+$	Ho		5.85±0.10	EI		2588
Ho$^+$	Ho		5.89±0.03	SI		2495
Ho$^+$	Ho		6.08±0.09	SI		2477, 2982
Ho$^+$	Ho		6.19±0.02	SI		1165
See also – EI:	2590, 2593, 2600, 2755					
Ho$^+$	HoF$_3$		27.5±0.5	EI		2402
Ho$^+$	HoF$_3$		28.0±0.7	EI		2600
Ho^{+2} ΔH°_{f0} **~ 2022 kJ mol^{-1} (483 kcal mol^{-1})**						
Ho^{+2}	Ho		17.82±0.10	S	2022	2113
Ho^{+2}	Ho$^+$		11.80±0.08	S		2113, 3265
Ho^{+3}						
Ho^{+3}	Ho		40.6±0.7	S		2113, 3261
Ho^{+3}	Ho		40.77	BH		3273
Ho^{+3}	Ho		40.8	BH		3259
Ho^{+3}	Ho^{+2}		22.8±0.6	S		3261
HoC$_2^+$						
HoC$_2^+$	HoC$_2$		7.3±0.5	EI		2755
HoC$_4^+$						
HoC$_4^+$	HoC$_4$		7.7±0.5	EI		2755
HoF$^+$						
HoF$^+$	HoF		6.0±0.5	EI		2755
HoF$^+$	HoF		6.1±0.3	EI		2590, 2593, 2600
HoF$^+$	HoF$_3$		21.0±0.5	EI		2402, 2600
HoF$_2^+$						
HoF$_2^+$	HoF$_2$		6.9±0.3	EI		2590, 2593, 2600
HoF$_2^+$	HoF$_3$	F	12.5±0.5	EI		2590
HoF$_2^+$	HoF$_3$	F	13.3±0.5	EI		2593
HoF$_2^+$	HoF$_3$	F	14.5±0.5	EI		2402, 2600

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_{10}H_{10}Ho^+$				
$C_{10}H_{10}Ho^+$	$(C_5H_5)_3Ho$ (Tris(cyclopentadienyl)holmium)		8.92±0.3	EI		2640
		$C_{15}H_{15}Ho^+$				
$C_{15}H_{15}Ho^+$	$(C_5H_5)_3Ho$ (Tris(cyclopentadienyl)holmium)		7.46±0.1	EI		2640
	Er^+	**$\Delta H^\circ_{f0} = 907$ kJ mol^{-1} (217 kcal mol^{-1})**				
Er^+	Er		6.10±0.02	S	907	2113, 2667
Er^+	Er		6.11±0.10	EI		2588
Er^+	Er		5.95±0.03	SI		2495
Er^+	Er		6.08±0.03	SI		2882
Er^+	Er		6.23±0.09	SI		2781
Er^+	Er		6.36±0.10	SI		2982
See also – S:	1286					
EI:	2590, 2600, 2754, 3384					
Er^+	ErF_3		26.5±0.3	EI		2402
Er^+	ErF_3		27.5±0.7	EI		2600
	Er^{+2}	**$\Delta H^\circ_{f0} \sim 2058$ kJ mol^{-1} (492 kcal mol^{-1})**				
Er^{+2}	Er		18.03±0.10	S	2058	2113
Er^{+2}	Er^+		11.93±0.08	S		2113, 3265
		Er^{+3}				
Er^{+3}	Er		40.4	BH		3261
Er^{+3}	Er		40.5	BH		3259
Er^{+3}	Er		40.83	BH		3273
		ErC_2^+				
ErC_2^+	ErC_2		7.0±0.5	EI		2754
		ErF^+				
ErF^+	ErF		6.3±0.3	EI		2590, 2600
ErF^+	ErF_3		20.0±0.7	EI		2600
ErF^+	ErF_3		20.5±0.3	EI		2402

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		ErF_2^+				
ErF_2^+	ErF_2		7.0±0.3	EI		2590, 2600
ErF_2^+	ErF_3	F	12.5±0.5	EI		2590
ErF_2^+	ErF_3	F	13.8±0.3	EI		2402
ErF_2^+	ErF_3	F	14.0±0.7	EI		2600
	Tm^+	**$\Delta H^\circ_{f0} = 831$ kJ mol^{-1} (199 kcal mol^{-1})**				
Tm^+	Tm		6.18±0.02	S	830	2113, 2667
Tm^+	Tm		6.22±0.02	S	834	1448
Tm^+	Tm		6.180±0.008	PI	830	3258
Tm^+	Tm		5.87±0.10	EI		2588
Tm^+	Tm		6.03±0.04	SI		2495
Tm^+	Tm		6.15±0.02	SI		1165
See also – S:	1286, 2186					
EI:	2600					
Tm^+	TmF_3		26.5±0.5	EI		2598
Tm^+	TmF_3		27.0±0.7	EI		2600
	Tm^{+2}	**$\Delta H^\circ_{f0} \sim 1992$ kJ mol^{-1} (476 kcal mol^{-1})**				
Tm^{+2}	Tm		18.23±0.10	S	1992	2113
Tm^{+2}	Tm^+		12.05±0.08	S		2113, 3265
	Tm^{+3}	**$\Delta H^\circ_{f0} \sim 4280$ kJ mol^{-1} (1023 kcal mol^{-1})**				
Tm^{+3}	Tm		41.94±0.16	S	4280	2113
Tm^{+3}	Tm		41.7	BH		3261
Tm^{+3}	Tm		41.85	BH		3259
Tm^{+3}	Tm		42.04	BH		3273
Tm^{+3}	Tm^{+2}		23.71±0.06	S		2113, 3283
		TmF^+				
TmF^+	TmF_3		20.0±0.5	EI		2598
TmF^+	TmF_3		20.8±0.7	EI		2600
		TmF_2^+				
TmF_2^+	TmF_3	F	13.0±0.5	EI		2598
TmF_2^+	TmF_3	F	13.5±0.7	EI		2600
		$C_{15}H_{15}Tm^+$				
$C_{15}H_{15}Tm^+$	$(C_5H_5)_3Tm$ (Tris(cyclopentadienyl)thulium)		7.43±0.1	EI		2640

4.3. The Positive Ion Table—Continued

Yb^+ $\Delta H^\circ_{f0} = 756.1$ kJ mol^{-1} (180.7 kcal mol^{-1})

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
Yb^+	Yb		6.254	S	756.1	2113, 2953
Yb^+	Yb		6.25±0.01	S		2645
Yb^+	Yb		6.25±0.02	S		2667
Yb^+	Yb		5.90±0.10	EI		2588
Yb^+	Yb		6.04±0.04	SI		2495
Yb^+	Yb		6.69±0.08	SI		2781

See also – EI: 2600

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
Yb^+	YbF_3		26.0±0.5	EI		2598
Yb^+	YbF_3		27.0±0.7	EI		2600
Yb^+	$(C_5H_5)_2Yb$ (Bis(cyclopentadienyl)ytterbium)		15.6±0.3	EI		3269
Yb^+	$(C_5H_5)_3Yb$ (Tris(cyclopentadienyl)ytterbium)		17.8±0.4	EI		3269
Yb^+	$(C_5H_5)_3Yb$ (Tris(cyclopentadienyl)ytterbium)		19.0±0.5	EI		2640

(Misprint corrected, see ref. 3269)

Yb^{+2} $\Delta H^\circ_{f0} \sim 1927$ kJ mol^{-1} (460 kcal mol^{-1})

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
Yb^{+2}	Yb		18.42±0.08	S	1930	2113
Yb^{+2}	Yb		18.35±0.10	PI	1923	2958
Yb^{+2}	Yb^+		12.17±0.08	S		2113, 3265

Yb^{+3}

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
Yb^{+3}	Yb		43.6	S		2113
Yb^{+3}	Yb		43.39	BH		3273
Yb^{+3}	Yb		43.5	BH		3259
Yb^{+3}	Yb^{+2}		25.2	S		2113
Yb^{+3}	Yb^{+2}		25.0±0.7	S		3261

See also – S: 3266

YbF^+

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
YbF^+	YbF_3		20.0±0.5	EI		2598
YbF^+	YbF_3		20.5±0.7	EI		2600

YbF_2^+

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
YbF_2^+	YbF_3	F	13.5±0.5	EI		2598
YbF_2^+	YbF_3	F	14.0±0.7	EI		2600

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_5H_5Yb^+$				
$C_5H_5Yb^+$	$(C_5H_5)_2Yb$ (Bis(cyclopentadienyl)ytterbium)		10.4±0.2	EI		3269
$C_5H_5Yb^+$	$(C_5H_5)_3Yb$ (Tris(cyclopentadienyl)ytterbium)		12.0±0.4	EI		2640
$C_5H_5Yb^+$	$(C_5H_5)_3Yb$ (Tris(cyclopentadienyl)ytterbium)		12.2±0.2	EI		3269
		$C_{10}H_{10}Yb^+$				
$C_{10}H_{10}Yb^+$	$(C_5H_5)_2Yb$ (Bis(cyclopentadienyl)ytterbium)		7.62±0.09	EI		3269
$C_{10}H_{10}Yb^+$	$(C_5H_5)_3Yb$ (Tris(cyclopentadienyl)ytterbium)		8.94±0.2	EI		2640
$C_{10}H_{10}Yb^+$	$(C_5H_5)_3Yb$ (Tris(cyclopentadienyl)ytterbium)		10.1±0.2	EI		3269
		$C_{15}H_{15}Yb^+$				
$C_{15}H_{15}Yb^+$	$(C_5H_5)_3Yb$ (Tris(cyclopentadienyl)ytterbium)		7.30±0.1	EI		2640
$C_{15}H_{15}Yb^+$	$(C_5H_5)_3Yb$ (Tris(cyclopentadienyl)ytterbium)		7.72±0.09	EI		3269
		$C_{20}H_{24}N_2Yb_2^+$				
$C_{20}H_{24}N_2Yb_2^+$	$((C_5H_5)_2YbNH_2)_2$ (Bis(bis(cyclopentadienyl)ytterbium amide))		7.87±0.1	EI		2640
		$C_{10}H_{10}ClYb^+$				
$C_{10}H_{10}ClYb^+$	$(C_5H_5)_2YbCl$ (Bis(cyclopentadienyl)ytterbium chloride)		8.65±0.1	EI		2640
	Lu^+	**$\Delta H^\circ_{f0} = 951.3$ kJ mol^{-1} (227.4 kcal mol^{-1})**				
Lu^+	Lu		5.426	S	951.3	2113
Lu^+	Lu		5.32±0.05	SI		2495
Lu^+	Lu		5.41±0.02	SI		1165
See also – EI:	2600					
Lu^+	LuF_3		27.0±0.5	EI		2598
Lu^+	LuF_3		28.0±0.7	EI		2600
Lu^+	$LuCl_3$		20.5±0.5	EI		2435

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
Lu^{+2}						
Lu^{+2}	Lu		19.3±0.4	S		2113
Lu^{+2}	Lu^{+}		13.9±0.4	S		2113, 3265
Lu^{+3}						
Lu^{+3}	Lu		40.4	BH		3259
Lu^{+3}	Lu		40.51	BH		3273
LuF^{+}						
LuF^{+}	LuF_3		20.5±0.5	EI		2598
LuF^{+}	LuF_3		21.0±0.7	EI		2600
LuF_2^{+}						
LuF_2^{+}	LuF_3	F	14.0±0.5	EI		2598
LuF_2^{+}	LuF_3	F	14.3±0.7	EI		2600
$LuCl^{+}$						
$LuCl^{+}$	$LuCl_3$		16.0±0.5	EI		2435
$LuCl_2^{+}$						
$LuCl_2^{+}$	$LuCl_3$	Cl	12.5±0.3	EI		2435
$LuCl_3^{+}$						
$LuCl_3^{+}$	$LuCl_3$		11.5±0.5	EI		2435
$Lu_2Cl_5^{+}$						
$Lu_2Cl_5^{+}$	Lu_2Cl_6	Cl	12.5±0.5	EI		2435
$C_5H_5Lu^{+}$						
$C_5H_5Lu^{+}$	$(C_5H_5)_3Lu$ (Tris(cyclopentadienyl)lutetium)		18.3±0.2	EI		2640
$C_{10}H_{10}Lu^{+}$						
$C_{10}H_{10}Lu^{+}$	$(C_5H_5)_3Lu$ (Tris(cyclopentadienyl)lutetium)		8.94±0.2	EI		2640

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_{15}H_{15}Lu^+$				
$C_{15}H_{15}Lu^+$	$(C_5H_5)_3Lu$ (Tris(cyclopentadienyl)lutetium)		7.36±0.1	EI		2640
	Ta^+	**$\Delta H^\circ_{f0} = 1543$ kJ mol^{-1} (369 kcal mol^{-1})**				
Ta^+	Ta		7.89	S	1543	2113
Ta^+	TaF_5		39.5±1.0	EI		3023
Ta^+	$TaCl_5$		29.5±0.4	EI		2506
		TaO^+				
TaO^+	TaO		6±0.5	EI		2050
		TaO_2^+				
TaO_2^+	TaO_2		9±0.5	EI		2050
		TaF^+				
TaF^+	TaF_5		36.5±1.0	EI		3023
		TaF_2^+				
TaF_2^+	TaF_5		27.3±0.8	EI		3023
See also – EI:	2859					
		TaF_3^+				
TaF_3^+	TaF_5		22.5±0.5	EI		3023
See also – EI:	2859					
		TaF_4^+				
TaF_4^+	TaF_5	F	14.8±0.3	EI		3023
TaF_4^+	TaF_5	F	15.0±0.3	EI		2859
		$TaCl^+$				
$TaCl^+$	$TaCl_5$		25.0±0.5	EI		2506
		$TaCl_2^+$				
$TaCl_2^+$	$TaCl_5$		19.6±0.6	EI		2506

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$TaCl_3^+$				
$TaCl_3^+$	$TaCl_5$		15.0±0.4	EI		2506
		$TaCl_4^+$				
$TaCl_4^+$	$TaCl_5$	Cl	12.0±0.28	EI		2506
		$TaOF^+$				
$TaOF^+$	$TaOF_3$		20.5±0.5	EI		3023
$TaOF^+$	$TaOF_3$		21±1	EI		2859
		$TaOF_2^+$				
$TaOF_2^+$	$TaOF_3$	F	14.8±0.3	EI		3023
$TaOF_2^+$	$TaOF_3$	F	15.0±0.5	EI		2859
		$TaOF_3^+$				
$TaOF_3^+$	$TaOF_3$		12.5±0.5	EI		2859
$TaOF_3^+$	$TaOF_3$		12.7±0.3	EI		3023
	W^+	**ΔH°_{f0} = 1618 kJ mol^{-1} (387 kcal mol^{-1})**				
W^+	W		7.98	S	1618	2113
W^+	$W(CO)_6$	6CO	20.6±0.2	EI		2023
W^+	$W(CO)_6$	6CO	21.7±0.3	EI		2403
W^+	$W(CO)_6$	6CO	22.25	EI		2500
W^+	$W(CO)_6$	6CO	22.9±0.6	EI		1107
W^+	WO_2F_2?		37.4±1.0	EI		2859
		WC^+				
WC^+	$W(CO)_6$		28.8±0.5	EI		1107
		WO^+				
WO^+	WO		9.1±1	EI		2126

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
WO_2^+						
WO_2^+	WO_2		9.8	EI		1244, 2123
WO_2^+	WO_2		9.9±0.6	EI		2126
WO_2^+	WO_2		9.9±1.0	EI		3257
WO_2^+	WO_3?		14.2	EI		2131
WO_2^+	WO_2F_2		21.0±0.5	EI		2859
WO_3^+						
WO_3^+	WO_3		11.7±0.6	EI		2126
WO_3^+	WO_3		11.9±0.5	EI		3257
WO_3^+	WO_3		11.9	EI		1244, 2123
WO_3^+	WO_3		12.0±0.5	EI		3256
WO_3^+	WO_3		12.1	EI		2131
$W_2O_5^+$						
$W_2O_5^+$	W_2O_6?		15.8	EI		2131
$W_2O_6^+$						
$W_2O_6^+$	W_2O_6		13.4	EI		2131
$W_3O_8^+$						
$W_3O_8^+$	W_3O_9	O	15.5	EI		2131
$W_3O_9^+$						
$W_3O_9^+$	W_3O_9		13.3	EI		2131
WF^+						
WF^+	WO_2F_2?		32.1±0.8	EI		2859
WF_2^+						
WF_2^+	WO_2F_2?		27.6±0.5	EI		2859
WF_3^+						
WF_3^+	WOF_4		22.8±1.0	EI		2859

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
WCl_3^+						
WCl_3^+	WCl_4?		11.8	EI		2552
WCl_4^+						
WCl_4^+	WCl_4		8.0	EI		2552
WCl_5^+						
WCl_5^+	WCl_5		9.1	EI		2552
$W_2Cl_5^+$						
$W_2Cl_5^+$	W_2Cl_6?		11.9	EI		2552
$W_2Cl_6^+$						
$W_2Cl_6^+$	W_2Cl_6		9.5	EI		2552
$W_3Cl_9^+$						
$W_3Cl_9^+$	W_3Cl_9		9.3	EI		2552
$C_{10}H_{12}W^+$						
$C_{10}H_{12}W^+$	$(C_5H_5)_2WH_2$ (Bis(cyclopentadienyl)tungsten dihydride)		6.49±0.1	EI		2683
$Li_2WO_4^+$						
$Li_2WO_4^+$	Li_2WO_4		9.2±0.5	EI		3257
COW^+						
COW^+	$W(CO)_6$	5CO	18.5±0.16	EI		2023
COW^+	$W(CO)_6$	5CO	18.51	EI		2500
COW^+	$W(CO)_6$	5CO	18.7±0.3	EI		2403
COW^+	$W(CO)_6$	5CO	20.2±0.3	EI		1107
COW^{+2}						
COW^{+2}	$W(CO)_6$		31.7±1	EI		2403

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		C_2OW^+				
C_2OW^+	$W(CO)_6$		25.9±0.6	EI		1107
		$C_2O_2W^+$				
$C_2O_2W^+$	$W(CO)_6$	4CO	15.8±0.3	EI		2403
$C_2O_2W^+$	$W(CO)_6$	4CO	16.07±0.04	EI		2023
$C_2O_2W^+$	$W(CO)_6$	4CO	16.08	EI		2500
$C_2O_2W^+$	$W(CO)_6$	4CO	17.6±0.2	EI		1107
		$C_2O_2W^{+2}$				
$C_2O_2W^{+2}$	$W(CO)_6$		35.0±1	EI		2403
		$C_3O_3W^+$				
$C_3O_3W^+$	$W(CO)_6$	3CO	13.60±0.02	EI		2023
$C_3O_3W^+$	$W(CO)_6$	3CO	13.70±0.15	EI		2403
$C_3O_3W^+$	$W(CO)_6$	3CO	13.87	EI		2500
$C_3O_3W^+$	$W(CO)_6$	3CO	14.9±0.2	EI		1107
		$C_4O_4W^+$				
$C_4O_4W^+$	$W(CO)_6$	2CO	11.82±0.02	EI		2023
$C_4O_4W^+$	$W(CO)_6$	2CO	11.93±0.15	EI		2403
$C_4O_4W^+$	$W(CO)_6$	2CO	12.05	EI		2500
$C_4O_4W^+$	$W(CO)_6$	2CO	12.7±0.2	EI		1107
		$C_5O_5W^+$				
$C_5O_5W^+$	$W(CO)_6$	CO	~9.21	EI		2500
$C_5O_5W^+$	$W(CO)_6$	CO	9.80±0.17	EI		1107
$C_5O_5W^+$	$W(CO)_6$	CO	9.86±0.1	EI		2403
$C_5O_5W^+$	$W(CO)_6$	CO	9.97±0.04	EI		2023
See also – PI:	2886					
	$W(CO)_6^+$	**$\Delta H^\circ_{f298} = -76$ kJ mol^{-1} (-18 kcal mol^{-1})**				
$C_6O_6W^+$	$W(CO)_6$		8.242±0.006	PI	−76	2886
(Threshold value approximately corrected for hot bands)						
$C_6O_6W^+$	$W(CO)_6$		8.18±0.03	PI		1167
$C_6O_6W^+$	$W(CO)_6$		8.46±0.02	EI		2023
$C_6O_6W^+$	$W(CO)_6$		8.47±0.1	EI		2403
$C_6O_6W^+$	$W(CO)_6$		8.48±0.05	EI		2500
$C_6O_6W^+$	$W(CO)_6$		8.56±0.13	EI		1107

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
WOF^+						
WOF^+	WO_2F_2?		23.6±0.5	EI		2859
WO_2F^+						
WO_2F^+	WO_2F_2	F	16.3±0.5	EI		2859
WOF_2^+						
WOF_2^+	WO_2F_2?		18.4±0.5	EI		2859
$WO_2F_2^+$						
$WO_2F_2^+$	WO_2F_2		13.0±0.3	EI		2859
WOF_3^+						
WOF_3^+	WOF_4	F	14.6±0.5	EI		2859
$CaWO_3^+$						
$CaWO_3^+$	$CaWO_3$		6.7	EI		1244
$CaWO_4^+$						
$CaWO_4^+$	$CaWO_4$		9.8	EI		1244
$SrWO_3^+$						
$SrWO_3^+$	$SrWO_3$		6.4	EI		1244
$SrWO_4^+$						
$SrWO_4^+$	$SrWO_4$		9.4	EI		1244
$SnWO_4^+$						
$SnWO_4^+$	$SnWO_4$		10.8	EI		1244
$Sn_2WO_5^+$						
$Sn_2WO_5^+$	Sn_2WO_5		8.4	EI		1244

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		WO_2I^+				
WO_2I^+	WO_2I_2	I	14.4	EI		2554
		$WO_2I_2^+$				
$WO_2I_2^+$	WO_2I_2		13.4	EI		2554
		$BaWO_3^+$				
$BaWO_3^+$	$BaWO_3$		8.5±0.5	EI		3256
$BaWO_3^+$	$BaWO_4$	O	14.0±0.5	EI		3256
		$BaWO_4^+$				
$BaWO_4^+$	$BaWO_4$		9.8±0.5	EI		3256
		$C_{10}H_5NO_5W^+$				
$C_{10}H_5NO_5W^+$	$C_5H_5NW(CO)_5$ (Pyridinetungsten pentacarbonyl)		7.6±0.2	EI		2481
		$C_{10}H_9NO_5W^+$				
$C_{10}H_9NO_5W^+$	n-$C_4H_9NCW(CO)_5$		7.60±0.05	EI		2481
		$C_{12}H_5NO_5W^+$				
$C_{12}H_5NO_5W^+$	$C_6H_5NCW(CO)_5$ (Isocyanobenzenetungsten pentacarbonyl)		8.03	EI		2544
		$C_{12}H_{11}NO_5W^+$				
$C_{12}H_{11}NO_5W^+$	$C_6H_{11}NCW(CO)_5$ (Isocyanocyclohexanetungsten pentacarbonyl)		7.75	EI		2544
		$C_{11}H_{15}O_5PW^+$				
$C_{11}H_{15}O_5PW^+$	$(C_2H_5)_3PW(CO)_5$		7.82±0.05	EI		2481
		$C_{17}H_{27}O_5PW^+$				
$C_{17}H_{27}O_5PW^+$	$(n$-$C_4H_9)_3PW(CO)_5$		7.63±0.05	EI		2481

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_8H_9O_8PW^+$						
$C_8H_9O_8PW^+$	$(CH_3O)_3PW(CO)_5$		7.96	EI		2544
$C_{11}H_{15}O_8PW^+$						
$C_{11}H_{15}O_8PW^+$	$(C_2H_5O)_3PW(CO)_5$		7.8	EI		2544
$C_{17}H_{27}O_8PW^+$						
$C_{17}H_{27}O_8PW^+$	$(n\text{-}C_4H_9O)_3PW(CO)_5$		7.85±0.05	EI		2481
$C_5O_5PCl_3W^+$						
$C_5O_5PCl_3W^+$	$PCl_3W(CO)_5$		8.50±0.05	EI		2481
$C_{11}H_5O_5PCl_2W^+$						
$C_{11}H_5O_5PCl_2W^+$	$C_6H_5PCl_2W(CO)_5$ (Dichloro(phenyl)phosphinetungsten pentacarbonyl)		8.20±0.05	EI		2481
Re^+ $\Delta H^\circ_{f0} = 1529$ kJ mol^{-1} (366 kcal mol^{-1})						
Re^+	Re		7.88	S	1529	2113
Re^+	$Re_2(CO)_{10}$		37.55	EI		2563
Re^+	$Re(CO)_5Cl$		23.1	EI		2501
Re^+	$ReMn(CO)_{10}$		30.93	EI		2563
Re^+	$Re(CO)_5Br$		>23	EI		2501
Re^+	$Re(CO)_5I$		>23	EI		2501
Re_2^+						
Re_2^+	$Re_2(CO)_{10}$	10CO	28.96	EI		2563
ReO_2^+						
ReO_2^+	Re_2O_7?		~20	EI		2461
ReO_3^+						
ReO_3^+	Re_2O_7?		15.9±0.5	EI		2461
$Re_2O_5^+$						
$Re_2O_5^+$	Re_2O_7		~19	EI		2461

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$Re_2O_6^+$				
$Re_2O_6^+$	Re_2O_7	O	17.2±0.5	EI		2461
		$Re_2O_7^+$				
$Re_2O_7^+$	Re_2O_7		13.0±0.5	EI		2461
		$ReCl^+$				
$ReCl^+$	$Re(CO)_5Cl$	5CO	19.27	EI		2501
		$ReCl_3^+$				
$ReCl_3^+$	Re_3Cl_9		16±0.5	EI		2140
		$ReCl_4^+$				
$ReCl_4^+$	Re_3Cl_9		16±0.5	EI		2140
		$Re_2Cl_5^+$				
$Re_2Cl_5^+$	Re_3Cl_9		13.5±0.5	EI		2140
		$Re_2Cl_6^+$				
$Re_2Cl_6^+$	Re_3Cl_9		13.5±0.5	EI		2140
		$Re_3Cl_8^+$				
$Re_3Cl_8^+$	Re_3Cl_9	Cl	13±0.5	EI		2140
		$Re_3Cl_9^+$				
$Re_3Cl_9^+$	Re_3Cl_9		10.5±0.5	EI		2140
		$ReMn^+$				
$ReMn^+$	$ReMn(CO)_{10}$	10CO	25.98	EI		2563
		$ReBr^+$				
$ReBr^+$	$Re(CO)_5Br$	5CO	19.51	EI		2501

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$Re_3Br_8^+$				
$Re_3Br_8^+$	Re_3Br_9	Br	12.5±1	EI		3159
$Re_3Br_8^+$	Re_3Br_9	Br	12.5	EI		2140
		$Re_3Br_9^+$				
$Re_3Br_9^+$	Re_3Br_9		10	EI		2140
$Re_3Br_9^+$	Re_3Br_9		11.0±1	EI		3159
		ReI^+				
ReI^+	$Re(CO)_5I$	5CO	19.20	EI		2501
		$C_{10}H_{10}Re^+$				
$C_{10}H_{10}Re^+$	$(C_5H_5)_2ReH$ (Bis(cyclopentadienyl)rhenium hydride)	H	7.85±0.1	EI		2683
		$C_{10}H_{11}Re^+$				
$C_{10}H_{11}Re^+$	$(C_5H_5)_2ReH$ (Bis(cyclopentadienyl)rhenium hydride)		6.76±0.05	EI		2683
		$C_3O_3Re^+$				
$C_3O_3Re^+$	$Re(CO)_5Br$		15.51	EI		2501
$C_3O_3Re^+$	$Re(CO)_5I$		14.71	EI		2501
		$C_4O_4Re^+$				
$C_4O_4Re^+$	$Re_2(CO)_{10}$		13.30	EI		2563
		$C_5O_5Re^+$				
$C_5O_5Re^+$	$Re_2(CO)_{10}$		10.34	EI		3234
See also – EI:	2563					
$C_5O_5Re^+$	$ReMn(CO)_{10}$		10.80	EI		2563, 3234
		$C_6O_6Re^+$				
$C_6O_6Re^+$	$ReMn(CO)_{10}$		9.36	EI		2563

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$CORe_2^+$						
$CORe_2^+$	$Re_2(CO)_{10}$	9CO	26.26	EI		2563
$C_2O_2Re_2^+$						
$C_2O_2Re_2^+$	$Re_2(CO)_{10}$	8CO	23.55	EI		2563
$C_3O_3Re_2^+$						
$C_3O_3Re_2^+$	$Re_2(CO)_{10}$	7CO	21.46	EI		2563
$C_4O_4Re_2^+$						
$C_4O_4Re_2^+$	$Re_2(CO)_{10}$	6CO	19.31	EI		2563
$C_5O_5Re_2^+$						
$C_5O_5Re_2^+$	$Re_2(CO)_{10}$	5CO	16.71	EI		2563
$C_6O_6Re_2^+$						
$C_6O_6Re_2^+$	$Re_2(CO)_{10}$	4CO	15.01	EI		2563
$C_7O_7Re_2^+$						
$C_7O_7Re_2^+$	$Re_2(CO)_{10}$	3CO	13.55	EI		2563
$C_8O_8Re_2^+$						
$C_8O_8Re_2^+$	$Re_2(CO)_{10}$	2CO	10.89	EI		2563
$C_9O_9Re_2^+$						
$C_9O_9Re_2^+$	$Re_2(CO)_{10}$	CO	9.57	EI		2563
$C_{10}O_{10}Re_2^+$						
$C_{10}O_{10}Re_2^+$	$Re_2(CO)_{10}$		8.36±0.03	EI		3234
See also – EI:	2563					

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$NaReO_4^+$				
$NaReO_4^+$	$NaReO_4$		~9.5	EI		2573
		$Na_2ReO_4^+$				
$Na_2ReO_4^+$	$(NaReO_4)_2$		~10.5	EI		2573
		$KReO_4^+$				
$KReO_4^+$	$KReO_4$		~9.5	EI		2573
		$K_2ReO_4^+$				
$K_2ReO_4^+$	$(KReO_4)_2$		~10.5	EI		2573
		$COClRe^+$				
$COClRe^+$	$Re(CO)_5Cl$	4CO	16.84	EI		2501
		$C_2O_2ClRe^+$				
$C_2O_2ClRe^+$	$Re(CO)_5Cl$	3CO	14.85	EI		2501
		$C_3O_3ClRe^+$				
$C_3O_3ClRe^+$	$Re(CO)_5Cl$	2CO	11.92	EI		2501
		$C_4O_4ClRe^+$				
$C_4O_4ClRe^+$	$Re(CO)_5Cl$	CO	10.45	EI		2501
		$C_5O_5ClRe^+$				
$C_5O_5ClRe^+$	$Re(CO)_5Cl$		9.18±0.03	EI		2501
		$COMnRe^+$				
$COMnRe^+$	$ReMn(CO)_{10}$	9CO	23.00	EI		2563
		$C_2O_2MnRe^+$				
$C_2O_2MnRe^+$	$ReMn(CO)_{10}$	8CO	19.75	EI		2563

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_3O_3MnRe^+$				
$C_3O_3MnRe^+$	$ReMn(CO)_{10}$	7CO	16.94	EI		2563
		$C_4O_4MnRe^+$				
$C_4O_4MnRe^+$	$ReMn(CO)_{10}$	6CO	14.65	EI		2563
		$C_5O_5MnRe^+$				
$C_5O_5MnRe^+$	$ReMn(CO)_{10}$	5CO	12.12	EI		2563
		$C_{10}O_{10}MnRe^+$				
$C_{10}O_{10}MnRe^+$	$ReMn(CO)_{10}$		8.14±0.01	EI		3234
See also – EI:	2563					
		$COBrRe^+$				
$COBrRe^+$	$Re(CO)_5Br$	4CO	16.94	EI		2501
		$C_2O_2BrRe^+$				
$C_2O_2BrRe^+$	$Re(CO)_5Br$	3CO	15.02	EI		2501
		$C_3O_3BrRe^+$				
$C_3O_3BrRe^+$	$Re(CO)_5Br$	2CO	11.97	EI		2501
		$C_4O_4BrRe^+$				
$C_4O_4BrRe^+$	$Re(CO)_5Br$	CO	10.50	EI		2501
		$C_5O_5BrRe^+$				
$C_5O_5BrRe^+$	$Re(CO)_5Br$		9.07±0.02	EI		2501
		$COIRe^+$				
$COIRe^+$	$Re(CO)_5I$	4CO	16.69	EI		2501

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$C_2O_2IRe^+$						
$C_2O_2IRe^+$	$Re(CO)_5I$	3CO	14.65	EI		2501
$C_3O_3IRe^+$						
$C_3O_3IRe^+$	$Re(CO)_5I$	2CO	12.04	EI		2501
$C_4O_4IRe^+$						
$C_4O_4IRe^+$	$Re(CO)_5I$	CO	10.29	EI		2501
$C_5O_5IRe^+$						
$C_5O_5IRe^+$	$Re(CO)_5I$		8.64±0.03	EI		2501
Os^+						
Os^+	Os		8.7	S	$\sim$1630*	2113
Os^+	OsO_4		26.8±0.5	EI		1284
*ΔH°_{f298}						
OsO^+						
OsO^+	OsO_4		21.2±0.2	EI		1284
OsO_2^+						
OsO_2^+	OsO_4		17.1±0.2	EI		1284
OsO_3^+						
OsO_3^+	OsO_3		12.3±1	EI		2127
OsO_3^+	OsO_4	O	17.00±0.10	EI		1284
OsO_4^+						
OsO_4^+	OsO_4		12.97±0.12	EI		1284
OsO_4^+	OsO_4		12.6±1	EI		2127
$C_{10}H_{10}Os^+$						
$C_{10}H_{10}Os^+$	$(C_5H_5)_2Os$ (Bis(cyclopentadienyl)osmium)		7.59±0.1	EI		2683

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		Ir^+				
Ir^+	Ir		9.1±0.1	S	~1542	2113
See also – EI:	1124, 2526					
Ir^+	IrO_2		13.1	EI		1124
		IrC^+				
IrC^+	IrC		9.5±1	EI		2526
		IrO^+				
IrO^+	IrO		10.1	EI		1124
IrO^+	IrO_2	O	15.1	EI		1124
		IrO_2^+				
IrO_2^+	IrO_2		10.9	EI		1124
		IrO_3^+				
IrO_3^+	IrO_3		11.9	EI		1124
		Pt^+				
Pt^+	Pt		9.0	S	~1433	2113
See also – EI:	2526, 2536					
		PtB^+				
PtB^+	PtB		10.0±1	EI		2526
		PtO^+				
PtO^+	PtO		10.1±0.3	EI		2536
PtO^+	PtO_2	O	14.8±0.3	EI		2536
		PtO_2^+				
PtO_2^+	PtO_2		11.2±0.3	EI		2536

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$PtSi^+$						
$PtSi^+$	$PtSi$		7.9±0.5	EI		2943
$PtF_{12}P_4^+$						
$PtF_{12}P_4^+$	$Pt(PF_3)_4$		9.83 (V)	PE		3088
$PtF_{12}P_4^+$	$Pt(PF_3)_4$		9.8 (V)	PE		3070
Au^+ **ΔH°_{f0} = 1256.0 kJ mol^{-1} (300.2 kcal mol^{-1})**						
Au^+	Au		9.225	S	1256.0	2113
Au_2^+						
Au_2^+	Au_2		9.2±0.4	EI		2707
Au_2^+	Au_2		9.7±0.3	EI		2779
$AuSi^+$						
$AuSi^+$	$AuSi$		7.7±0.4	EI		2707
$AuSi^+$	$AuSi$		8.9±0.5	EI		2943
$AuLa^+$						
$AuLa^+$	$AuLa$		5.9±0.5	EI		2779
$AuCe^+$						
$AuCe^+$	$AuCe$		6.0±0.3	EI		2779
$AuPr^+$						
$AuPr^+$	$AuPr$		5.4±0.8	EI		2779
$AuNd^+$						
$AuNd^+$	$AuNd$		5.8±0.8	EI		2779

4.3. The Positive Ion Table—Continued

$Hg^+(^2S_{1/2})$ ΔH°_{f0} = 1071.5 kJ mol^{-1} (256.1 kcal mol^{-1})
$Hg^+(^2D_{5/2})$ ΔH°_{f0} = 1496.3 kJ mol^{-1} (357.6 kcal mol^{-1})
$Hg^+(^2D_{3/2})$ ΔH°_{f0} = 1676.2 kJ mol^{-1} (400.6 kcal mol^{-1})

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$Hg^+(^2S_{1/2})$	Hg		10.437	S	1071.5	2113
$Hg^+(^2S_{1/2})$	Hg		10.443±0.009	PE		2814, 2853, 3109
$Hg^+(^2D_{5/2})$	Hg		14.8396±0.0004	S	1496.3	3377
$Hg^+(^2D_{3/2})$	Hg		16.7043±0.0004	S	1676.2	3377
$Hg^+(^2D_{3/2})$	Hg		16.715±0.004	PE		2814, 2853, 3109

The $^2D_{5/2}$ level was also observed in the PE study, but used for calibration. A fourth ionization potential at 20.725 eV is given in refs. 2814, 2853, 3109 but is spurious, see P. Mitchell and M. Wilson, Chem. Phys. Letters **3**, 389 (1969) and V. Fuchs and H. Hotop, Chem. Phys. Letters **4**, 71 (1969).

See also – PEN: 2468

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
Hg^+	$(CH_3)_2Hg$	$2CH_3$	13.05±0.02	PI		2983

Hg^{+2} ΔH°_{f0} = 2881.2 kJ mol^{-1} (688.6 kcal mol^{-1})

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
Hg^{+2}	Hg		29.193	S	2881.2	2113
Hg^{+2}	Hg		29.0±0.2	NRE		211
Hg^{+2}	Hg		29.8	EI		211
Hg^{+2}	Hg^+		18.756	S		2113

Hg^{+3}

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
Hg^{+3}	Hg		63.4	S	~6182	2113
Hg^{+3}	Hg		63.5±0.5	NRE		211
Hg^{+3}	Hg		68.5	EI		211
Hg^{+3}	Hg^{+2}		34.2	S		2113

Hg^{+4}

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
Hg^{+4}	Hg		113±1	NRE		211
Hg^{+4}	Hg		122.5	EI		211
Hg^{+4}	Hg^{+3}		46.0±0.2	SEQ		2730

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		Hg^{+5}				
Hg^{+5}	Hg		158±2	NRE		211
Hg^{+5}	Hg		175	EI		211
Hg^{+5}	Hg^{+4}		61.2±0.2	SEQ		2730
		Hg^{+6}				
Hg^{+6}	Hg		225±10	NRE		211
Hg^{+6}	Hg		300	EI		211
Hg^{+6}	Hg^{+5}		76.6±0.5	SEQ		2730
		Hg^{+7}				
Hg^{+7}	Hg^{+6}		93±2	SEQ		2730
		Hg^{+8}				
Hg^{+8}	Hg^{+7}		122±2	SEQ		2730
		Hg^{+9}				
Hg^{+9}	Hg^{+8}		141±2	SEQ		2730
		Hg_2^+				
Hg_2^+	Hg_2		9.52±0.15	EI		3297
		Hg_3^+				
Hg_3^+	Hg_3		9.32±0.20	EI		3297
		$HgCl^+$				
$HgCl^+$	$HgCl_2$	Cl	12.06±0.26	EI		2506
		$HgCl^{+2}$				
$HgCl^{+2}$	$HgCl_2$	Cl	32.0±0.5	EI		2506

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
	$HgCl_2^+(^2\Pi_{3/2g})$ **$HgCl_2^+(^2\Pi_{1/2g})$**	**ΔH°_{f298} = 951 kJ mol^{-1} (227 kcal mol^{-1})** **ΔH°_{f298} = 963 kJ mol^{-1} (230 kcal mol^{-1})**				
$HgCl_2^+(^2\Pi_{3/2g})$	$HgCl_2$		11.37	PE	951	2984
$HgCl_2^+(^2\Pi_{1/2g})$	$HgCl_2$		11.50	PE	963	2984
$HgCl_2^+(^2\Pi_u)$	$HgCl_2$		12.13 (V)	PE		2984
$HgCl_2^+(^2\Sigma_u)$	$HgCl_2$		12.74 (V)	PE		2984
$HgCl_2^+(^2\Sigma_g)$	$HgCl_2$		13.74 (V)	PE		2984

Additional higher ionization potentials are given in ref. 2984.

See also – EI: 2506

$HgCl_2^{+2}$

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$HgCl_2^{+2}$	$HgCl_2$		28.3±0.5	EI		2506

$HgBr^+$

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$HgBr^+$	$HgBr_2$	Br	12.09±0.17	EI		2506

$HgBr^{+2}$

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$HgBr^{+2}$	$HgBr_2$	Br	31.1±0.7	EI		2506

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
	$HgBr_2^+(^2\Pi_{3/2g})$ **$HgBr_2^+(^2\Pi_{1/2g})$**	**ΔH°_{f298} = 939 kJ mol^{-1} (224 kcal mol^{-1})** **ΔH°_{f298} = 972 kJ mol^{-1} (232 kcal mol^{-1})**				
$HgBr_2^+(^2\Pi_{3/2g})$	$HgBr_2$		10.62	PE	939	2984
$HgBr_2^+(^2\Pi_{1/2g})$	$HgBr_2$		10.96	PE	972	2984
$HgBr_2^+(^2\Pi_{3/2u})$	$HgBr_2$		11.20 (V)	PE		2984
$HgBr_2^+(^2\Pi_{1/2u})$	$HgBr_2$		11.54 (V)	PE		2984
$HgBr_2^+(^2\Sigma_u)$	$HgBr_2$		12.09 (V)	PE		2984
$HgBr_2^+(^2\Sigma_g)$	$HgBr_2$		13.39 (V)	PE		2984

Additional higher ionization potentials are given in ref. 2984.

See also – EI: 2506

$HgBr_2^{+2}$

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
$HgBr_2^{+2}$	$HgBr_2$		25.7±0.3	EI		2506

HgI^+

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
HgI^+	HgI_2	I	11.3±0.4	EI		2506

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
	$HgI_2^+(^2\Pi_{3/2g})$	**ΔH°_{f0} = 906 kJ mol^{-1} (216 kcal mol^{-1})**				
	$HgI_2^+(^2\Pi_{1/2g})$	**ΔH°_{f0} = 969 kJ mol^{-1} (232 kcal mol^{-1})**				
$HgI_2^+(^2\Pi_{3/2g})$	HgI_2		9.50	PE	906	2984
$HgI_2^+(^2\Pi_{1/2g})$	HgI_2		10.16	PE	969	2984
$HgI_2^+(^2\Pi_{3/2u})$	HgI_2		10.00 (V)	PE		2984
$HgI_2^+(^2\Pi_{1/2u})$	HgI_2		10.40 (V)	PE		2984
$HgI_2^+(^2\Sigma_u)$	HgI_2		11.29 (V)	PE		2984
$HgI_2^+(^2\Sigma_g)$	HgI_2		12.85 (V)	PE		2984
Additional higher ionization potentials are given in ref. 2984.						
See also – EI:	2506					
		HgI_2^{+2}				
HgI_2^{+2}	HgI_2		21.4±0.5	EI		2506
	CH_3Hg^+	**ΔH°_{f298} = 927 kJ mol^{-1} (221 kcal mol^{-1})**				
CH_3Hg^+	$(CH_3)_2Hg$	CH_3	10.10±0.02	PI	927	2983
See also – EI:	83, 306					
CH_3Hg^+	CH_3HgCl	Cl	12.35±0.2	EI		306
		$C_2H_5Hg^+$				
$C_2H_5Hg^+$	$(C_2H_5)_2Hg$	C_2H_5	9.65±0.1	EI		306
	$(CH_3)_2Hg^+$	**ΔH°_{f298} = 972 kJ mol^{-1} (232 kcal mol^{-1})**				
$C_2H_6Hg^+$	$(CH_3)_2Hg$		9.10±0.05	PI	972	2983
(Threshold value approximately corrected for hot bands)						
See also – PE:	2984					
EI:	83, 306					
		$C_3H_7Hg^+$				
$C_3H_7Hg^+$	(*iso*-$C_3H_7)_2Hg$	C_3H_7	9.1±0.1	EI		306

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_4H_{10}Hg^+$				
$C_4H_{10}Hg^+$	$(C_2H_5)_2Hg$		8.5±0.1	EI		306
See also – PE: 2984						
		$C_6H_{14}Hg^+$				
$C_6H_{14}Hg^+$	$(iso\text{-}C_3H_7)_2Hg$		7.6±0.1	EI		306
		CH_3HgCl^+				
$CH_3HgCl^+(^2E,^2A_1)$	CH_3HgCl		10.88 (V)	PE		2984
$CH_3HgCl^+(^2A_1)$	CH_3HgCl		12.70 (V)	PE		2984
$CH_3HgCl^+(^2E)$	CH_3HgCl		14.1 (V)	PE		2984
Additional higher ionization potentials are given in ref. 2984.						
See also – EI: 306						
		CH_3HgBr^+				
$CH_3HgBr^+(^2E_{3/2})$	CH_3HgBr		10.16 (V)	PE		2984
$CH_3HgBr^+(^2E_{1/2})$	CH_3HgBr		10.43 (V)	PE		2984
$CH_3HgBr^+(^2A_1)$	CH_3HgBr		10.66 (V)	PE		2984
$CH_3HgBr^+(^2A_1)$	CH_3HgBr		12.52 (V)	PE		2984
$CH_3HgBr^+(^2E)$	CH_3HgBr		13.9 (V)	PE		2984
Additional higher ionization potentials are given in ref. 2984.						
		CH_3HgI^+				
$CH_3HgI^+(^2E_{3/2})$	CH_3HgI		9.25 (V)	PE		2984
$CH_3HgI^+(^2E_{1/2})$	CH_3HgI		9.68 (V)	PE		2984
$CH_3HgI^+(^2A_1)$	CH_3HgI		10.29 (V)	PE		2984
$CH_3HgI^+(^2A_1)$	CH_3HgI		12.21 (V)	PE		2984
$CH_3HgI^+(^2E)$	CH_3HgI		13.6 (V)	PE		2984
Additional higher ionization potentials are given in ref. 2984.						

4.3. The Positive Ion Table—Continued

Tl^+ ΔH°_{f0} = 772.2 kJ mol^{-1} (184.6 kcal mol^{-1})

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
Tl^+	Tl		6.108	S	772.2	2113

See also – S: 3270
EI: 2620, 3244

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
Tl^+	Tl_2O		12±1	EI		2955
Tl^+	TlF	F^-	7.59	PI		2604

This is the energy of the maximum ion–pair formation cross section, and is about 0.3 eV above the thermochemical threshold. The measurement was made upon the F^- ion.

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
Tl^+ (Threshold value corrected for hot bands)	TlF	F	10.68	PI		2604
Tl^+	TlCl	Cl^-	7.01	PI		2604

This is the energy of the maximum ion–pair formation cross section, and is about 0.7 eV above the thermochemical threshold. The measurement was made upon the Cl^- ion.

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
Tl^+ (Threshold value corrected for hot bands)	TlCl	Cl	9.925±0.02	PI		2604

See also – EI: 2159

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
Tl^+	TlBr	Br^-	6.3	PI		2604

This is the energy of the maximum ion–pair formation cross section, and is about 0.1 eV above the thermochemical threshold. The measurement was made upon the Br^- ion.

See also – EI: 2159

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
Tl^+ (Threshold value corrected for hot bands)	TlBr	Br	9.53±0.02	PI		2604
Tl^+ (Threshold value corrected for hot bands)	TlI	I^-	5.799±0.005	PI		2610

See also – EI: 2159

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
Tl^+ (Threshold value corrected for hot bands)	TlI	I	8.875	PI		2610

Tl_2^+

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
Tl_2^+	Tl_2O	O	9.7±0.5	EI		3244

See also – EI: 2955

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
Tl_2^+	Tl_2F_2		~18	EI		2920

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
Tl_2O^+						
Tl_2O^+	Tl_2O		7.5±0.3	EI		2955
Tl_2O^+	Tl_2O		8.8±0.5	EI		3244
TlF^+						
TlF^+	TlF		11.2±0.5	EI		2620
Tl_2F^+						
Tl_2F^+	Tl_2F_2	F	9.97±0.02	PI		2604
(Threshold value corrected for hot bands)						
$Tl_2F_2^+$						
$Tl_2F_2^+$	Tl_2F_2		9.71±0.02	PI		2604
(Threshold value corrected for hot bands)						
$TlCl^+$ ΔH°_{f298} = 868 kJ mol^{-1} (207 kcal mol^{-1})						
$TlCl^+$	TlCl		9.70±0.03	PI	868	2604
(Threshold value corrected for hot bands)						
$TlBr^+$ ΔH°_{f298} = 844 kJ mol^{-1} (202 kcal mol^{-1})						
$TlBr^+$	TlBr		9.14±0.02	PI	844	2604
(Threshold value corrected for hot bands)						
TlI^+ ΔH°_{f298} = 824 kJ mol^{-1} (197 kcal mol^{-1})						
TlI^+	TlI		8.469	PI	824	2610
(Threshold value corrected for hot bands)						
Pb^+ ΔH°_{f0} = 911.2 kJ mol^{-1} (217.8 kcal mol^{-1})						
Pb^+	Pb		7.416	S	911.2	2113, 3113
See also – EI:	1245, 2139, 2595, 2747					
Pb^+	PbH_4		11.2	EI		2116
Pb^+	PbO?		11±1	EI		2747
See also – EI:	1245					
Pb^+	PbS	S	11.6±0.5	EI		2139
See also – EI:	2747					

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
Pb^+	$PbCl_2$		12.0±0.2	EI		2056
See also – EI:	2434, 2462					
Pb^+	PbSe	Se	11±1	EI		2747
Pb^+	$(CH_3)_4Pb$		14.4	EI		2980
See also – EI:	82					
Pb^+	$(C_2H_5)_4Pb$		11.6	EI		2980
		PbH^+				
PbH^+	PbH_4		11.1	EI		2116
PbH^+	$(CH_3)_4Pb$		15.3	EI		2980
PbH^+	$(C_2H_5)_4Pb$		14.4	EI		2980
		PbH_2^+				
PbH_2^+	PbH_4		10.1	EI		2116
		PbH_3^+				
PbH_3^+	PbH_4	H	9.6	EI		2116
		PbO^+				
PbO^+	PbO		9.0±0.5	EI		1245
PbO^+	PbO		9.1±0.5	EI		2747
		Pb_2O^+				
Pb_2O^+	Pb_2O_2?		11.9±1.0	EI		1245
		$Pb_2O_2^+$				
$Pb_2O_2^+$	Pb_2O_2		8.8±0.5	EI		1245
$Pb_2O_2^+$	Pb_2O_2		9.1±0.5	EI		2747
		$Pb_3O_2^+$				
$Pb_3O_2^+$	Pb_3O_3?		14.6±1.0	EI		1245

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$Pb_3O_3^+$				
$Pb_3O_3^+$	Pb_3O_3		9.7±1.0	EI		1245
		$Pb_4O_4^+$				
$Pb_4O_4^+$	Pb_4O_4		8.5±1.0	EI		1245
		PbF^+				
PbF^+	PbF		7.5±0.3	EI		2595
PbF^+	PbF_2?		12.1±0.3	EI		2595
		PbF_2^+				
PbF_2^+	PbF_2		11.6±0.3	EI		2595
		PbF_4^+				
PbF_4^+	PbF_4		10.4±0.3	EI		2595
		PbS^+				
PbS^+	PbS		8.4±0.5	EI		2747
PbS^+	PbS		8.6±0.5	EI		2139
		$Pb_2S_2^+$				
$Pb_2S_2^+$	Pb_2S_2		9.2±0.5	EI		2139
		$PbCl^+$				
$PbCl^+$	$PbCl_2$	Cl^-	~7.1	EI		2434, 2462
$PbCl^+$	$PbCl_2$	Cl	10.7±0.1	EI		2434, 2462
$PbCl^+$	$PbCl_2$	Cl	11.7±0.2	EI		2056
		$PbCl_2^+$				
$PbCl_2^+$	$PbCl_2$		10.3±0.1	EI		2434, 2462
$PbCl_2^+$	$PbCl_2$		11.2±0.2	EI		2056
		$PbSe^+$				
$PbSe^+$	PbSe		8.4±0.5	EI		2747

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$PbBr^+$				
$PbBr^+$	$PbBr_2$	Br	10.5±0.2	EI		2434
		$PbBr_2^+$				
$PbBr_2^+$	$PbBr_2$		10.2±0.2	EI		2434
		$PbTe^+$				
$PbTe^+$	PbTe		8.3±0.5	EI		2747
		CH_3Pb^+				
CH_3Pb^+	$(CH_3)_4Pb$		12.4±0.2	EI		82
CH_3Pb^+	$(CH_3)_4Pb$		13.1	EI		2980
		$C_2H_5Pb^+$				
$C_2H_5Pb^+$	$(C_2H_5)_4Pb$		12.2	EI		2980
		$C_2H_6Pb^+$				
$C_2H_6Pb^+$	$(CH_3)_4Pb$		11.6±0.2	EI		82
$C_2H_6Pb^+$	$(CH_3)_4Pb$		12.7	EI		2980
		$C_3H_9Pb^+$				
$C_3H_9Pb^+$	$(CH_3)_4Pb$	CH_3	8.9±0.1	EI		82
$C_3H_9Pb^+$	$(CH_3)_4Pb$	CH_3	10.1	EI		2980
		$C_4H_{10}Pb^+$				
$C_4H_{10}Pb^+$	$(C_2H_5)_4Pb$		12.2	EI		2980
		$C_4H_{12}Pb^+$				
$C_4H_{12}Pb^+$	$(CH_3)_4Pb$		8.0±0.4	EI		82
$C_4H_{12}Pb^+$	$(CH_3)_4Pb$		9.3	EI		2980
		$C_6H_{15}Pb^+$				
$C_6H_{15}Pb^+$	$(C_2H_5)_4Pb$	C_2H_5	10.8	EI		2980

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_8H_{20}Pb^+$				
$C_8H_{20}Pb^+$	$(C_2H_5)_4Pb$		11.1	EI		2980
		$NaPbCl_2^+$				
$NaPbCl_2^+$	$NaPbCl_3$	Cl	9.8±0.2	EI		2462
		$KPbCl_2^+$				
$KPbCl_2^+$	$KPbCl_3$	Cl	9.6±0.2	EI		2462
		$KPbCl_3^+$				
$KPbCl_3^+$	$KPbCl_3$		9.3±0.2	EI		2462
		$PbClBr^+$				
$PbClBr^+$	PbClBr		10.4±0.2	EI		2434
		$RbPbCl^+$				
$RbPbCl^+$	$RbPbCl_3$		~13.3±0.4	EI		2462
		$RbPbCl_2^+$				
$RbPbCl_2^+$	$RbPbCl_3$	Cl^-	~5.7	EI		2462
$RbPbCl_2^+$	$RbPbCl_3$	Cl	9.3±0.2	EI		2462
$RbPbCl_2^+$	$RbPbCl_3$	Cl	11.6±0.2	EI		2056
		$RbPbCl_3^+$				
$RbPbCl_3^+$	$RbPbCl_3$		9.2±0.2	EI		2462
		$CsPbCl^+$				
$CsPbCl^+$	$CsPbCl_3$		11.5±0.2	EI		2056
$CsPbCl^+$	$CsPbCl_3$		13.3±0.2	EI		2462
		$CsPbCl_2^+$				
$CsPbCl_2^+$	$CsPbCl_3$	Cl	9.4±0.2	EI		2462

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
Bi^+	**$\Delta H^\circ_{f0} = 910.7$ kJ mol^{-1} (217.7 kcal mol^{-1})**					
Bi^+	Bi		7.289	S	910.7	2113
See also – EI:	2049, 2747					
Bi^+	Bi_2	Bi	9.7±0.1	RPD		2509
Bi^+	BiH_3		13.4	EI		2116
Bi^+	BiO?		10±1	EI		2747
		Bi_2^+				
Bi_2^+	Bi_2		7.4±0.1	RPD		2509
Bi_2^+	Bi_2		7.1±0.3	EI		2509
Bi_2^+	Bi_2		7.2±0.5	EI		2747
See also – EI:	2049, 2508					
		Bi_3^+				
Bi_3^+	Bi_4?		7.7±0.5	EI		2509
		Bi_4^+				
Bi_4^+	Bi_4		7.6±0.3	EI		2508, 2509
		BiH^+				
BiH^+	BiH_3		12.2	EI		2116
		BiH_2^+				
BiH_2^+	BiH_3	H	12.4	EI		2116
		BiH_3^+				
BiH_3^+	BiH_3		10.1	EI		2116
		BiO^+				
BiO^+	BiO		9.0±0.5	EI		2747

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
BiS^+						
BiS^+	BiS		8.7±0.5	EI		2747
See also – EI:	2049					
Bi_2S^+						
Bi_2S^+	Bi_2S_2	S	14	EI		2049
$BiSb^+$						
$BiSb^+$	BiSb		8.0±0.3	EI		2508
$BiSb_2^+$						
$BiSb_2^+$	Bi_2Sb_2?		10.5±0.3	EI		2508
$BiSb_3^+$						
$BiSb_3^+$	$BiSb_3$		7.8±0.3	EI		2508
Bi_2Sb^+						
Bi_2Sb^+	Bi_2Sb_2?		10.6±0.3	EI		2508
$Bi_2Sb_2^+$						
$Bi_2Sb_2^+$	Bi_2Sb_2		7.7±0.3	EI		2508
Bi_3Sb^+						
Bi_3Sb^+	Bi_3Sb		7.2±0.3	EI		2508
$BiTe^+$						
$BiTe^+$	BiTe		8.4±0.5	EI		2747
$C_{18}H_{15}Bi^+$ (Triphenylbismuth)			**$\Delta H^\circ_{f298} \sim 1284$ kJ mol^{-1} (307 kcal mol^{-1})**			
$C_{18}H_{15}Bi^+$	$(C_6H_5)_3Bi$ (Triphenylbismuth)		7.3±0.1	PI	~1284	1140

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
Po^+						
Po^+	Po		8.42	S		2113
Po^+	Po		8.2±0.4	S		3378
H_2Po^+						
H_2Po^+	H_2Po		8.6	D		3317
At^+						
At^+	At		9.2±0.4	S		3378
At_2^+						
At_2^+	At_2		8.3	D		104
Fr^+						
Fr^+	Fr		3.98±0.10	S		3378
Ac^+						
Ac^+	Ac		6.89±0.6	S		2113, 3378
Th^+						
Th^+	Th		6.95±0.06	SI		2882
Th^+	Th		7.5±0.3	SI		2756
Th^+	ThF_4		39±1.0	EI		3203
ThO^+						
ThO^+	ThO		8.1±0.1	RPD		2994
ThO_2^+						
ThO_2^+	ThO_2		10.9	RPD		2994
ThF^+						
ThF^+	ThF_4		30±1.0	EI		3203

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		ThF_2^+				
ThF_2^+	ThF_2?		13.1±0.6	EI		3203
ThF_2^+	ThF_4		23.2±0.6	EI		3203
		ThF_3^+				
ThF_3^+	ThF_3		7.8±0.5	EI		3203
ThF_3^+	ThF_4	F	14.5±0.5	EI		3203
		$C_{15}H_{15}Th^+$				
$C_{15}H_{15}Th^+$	$(C_5H_5)_4Th$ (Tetrakis(cyclopentadienyl)thorium)		7.73±0.1	EI		2640
		$C_{20}H_{20}Th^+$				
$C_{20}H_{20}Th^+$	$(C_5H_5)_4Th$ (Tetrakis(cyclopentadienyl)thorium)		7.41±0.1	EI		2640
		$C_{10}H_{10}FTh^+$				
$C_{10}H_{10}FTh^+$	$(C_5H_5)_3ThF$ (Tris(cyclopentadienyl)thorium fluoride)		9.18±0.2	EI		2640
		$C_{15}H_{15}FTh^+$				
$C_{15}H_{15}FTh^+$	$(C_5H_5)_3ThF$ (Tris(cyclopentadienyl)thorium fluoride)		8.06±0.1	EI		2640
		U^+				
U^+	U		6.11±0.05	RPD		16
U^+	U		6.08±0.08	SI		317
U^+	U		6.19±0.06	SI		2494, 2756
See also – EI:	2054, 2126, 3196					
U^+	UO	O	13.4	EI		2054
		UC^+				
UC^+	UC		6.1±0.5	EI		2491

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		UC_2^+				
UC_2^+	UC_2		5.7±0.5	EI		2491
		UO^+				
UO^+	UO		5.72±0.06	RPD		16
UO^+	UO		4.7±0.6	EI		2126
See also – EI:	2054					
		UO_2^+				
UO_2^+	UO_2		5.5±0.1	RPD		16
UO_2^+	UO_2		4.3±0.6	EI		2126
See also – EI:	2054					
		UO_3^+				
UO_3^+	UO_3		10.4±0.6	EI		2126
		UF_6^+				
UF_6^+	UF_6		14.14 (V)	PE		3119
		UP^+				
UP^+	UP		7.3±0.4	EI		2440
		US^+				
US^+	US		6.3	EI		3196
		$C_{10}H_{10}U^+$				
$C_{10}H_{10}U^+$	$(C_5H_5)_4U$ (Tetrakis(cyclopentadienyl)uranium)		15.1±0.5	EI		2640
		$C_{15}H_{15}U^+$				
$C_{15}H_{15}U^+$	$(C_5H_5)_4U$ (Tetrakis(cyclopentadienyl)uranium)		7.29±0.1	EI		2640

4.3. The Positive Ion Table—Continued

Ion	Reactant	Other products	Ionization or appearance potential (eV)	Method	Heat of formation (kJ mol^{-1})	Ref.
		$C_{20}H_{20}U^+$				
$C_{20}H_{20}U^+$	$(C_5H_5)_4U$ (Tetrakis(cyclopentadienyl)uranium)		6.50±0.1	EI		2640
		HUO_3^+				
HUO_3^+	HUO_3		<3.89	D		3419
		$C_{10}H_{10}FU^+$				
$C_{10}H_{10}FU^+$	$(C_5H_5)_3UF$ (Tris(cyclopentadienyl)uranium fluoride)		10.18±0.2	EI		2640
		$C_{15}H_{15}FU^+$				
$C_{15}H_{15}FU^+$	$(C_5H_5)_3UF$ (Tris(cyclopentadienyl)uranium fluoride)		7.53±0.2	EI		2640
		Np^+				
Np^+	Np		6.16±0.06	SI		2756
		Pu^+				
Pu^+	Pu		5.8	S		2113
Pu^+	Pu		5.71±0.06	SI		2756
See also – EI:	2503, 2944					
SI:	1149					
Pu^+	PuF_3		25.0±1.0	EI		2503
		PuF^+				
PuF^+	PuF		5.9±0.5	EI		2503
PuF^+	PuF_3		17.8±0.5	EI		2503
		PuF_2^+				
PuF_2^+	PuF_2		6.4±0.5	EI		2503
PuF_2^+	PuF_3	F	12.6±0.5	EI		2503
		Am^+				
Am^+	Am		6.0	S		341, 2113
		Cm^+				
Cm^+	Cm		6.18±0.09	SI		3272

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5. Energetics of Gaseous Negative Ions

The electron affinity of an atom or molecule is the difference in energy between the unexcited negative ion and a reference state of the neutral species, usually the ground state. Where the neutral reference is not the ground state, the state in question is identified. The electron affinities of both atomic and molecular species evaluated before the end of 1973 are included in the Negative Ion Table (section 6). The relatively weak binding of negative ions, however, leads to a status for their study different from that for positive ions. Several of these differences are reflected in the table.

In the first place, the difficulty of experimental work has long encouraged the wide use of approximate methods, whose results differ greatly from those of recent, more sophisticated techniques. The coverage of the Negative Ion Table is therefore not exhaustive. Early values never intended as precise estimates and more recent values by relatively imprecise techniques have not been included, since they would add little useful information.

Moreover, because no reliable experimental values are yet available for many species, theoretical calculations and empirical extrapolations are more crucial to the selection of the best electron affinities than are the corresponding techniques in the evaluation of ionization potentials. The most reliable of these calculated affinities are thus included in the table, both where no experimental data exist and in some other instances, as well. In this way an estimate of the reliability of the calculated values can be made by the user.

The Negative Ion Table contains all values, consistent with the preceding criteria, from previous reviews. The most recent of these are by Compton [1] and Steiner [2]. Another review by Hotop and Lineberger [3] covers more recent literature, but deals only with atomic negative ions.

5.1. Experimental Techniques

Values obtained by nearly two dozen experimental techniques are included in the Negative Ion Table. The accuracy of the results from a given experiment will be a function of three sets of conditions. The first set is associated with experimental imprecision and with systematic deviations from an ideal thought experiment. Some of these factors are inherent in the given technique, while others are associated with the care exercised by the individual experimenter. A second set of conditions is associated with the energy level structure of the negative ion and/or neutral molecule. The primary considerations here have been described in section 3.2. Transitions close in energy to the one to be determined will complicate the analysis of negative ion spectra and, typically, reduce its accuracy. A third set of conditions affecting accuracy is associated with the presence of interfering species that have transitions similar in energy to the one to be measured.

The accuracy of a given experiment may be dominated by any of these three sources of uncertainty. Since only the first source, and only part of that source, is associated generally with a given technique, a general assessment of the relative experimental accuracy of each of the approaches cannot be precise. Nevertheless, the following techniques are described roughly in order of decreasing accuracy for transitions where molecular dynamics do not dominate. Laser photodetachment can have an accuracy less than one millielectron volt. Other techniques using photons can have an accuracy of a few millielectron volts. The remaining experimental techniques considered here attain at best an accuracy of several tenths of an electron volt.

a. Dye Laser Photodetachment (LP)

The precision of crossed negative ion photon beam electron detachment experiments

$$X^- + h\nu \rightarrow X + e^-,$$

has been greatly increased with the incorporation of a tunable dye laser. The formation of either the electrons or the neutralized ions is followed as a function of wavelength [4–6]. Dye lasers have also been applied to experiments utilizing ion-cyclotron-resonance-concentrated negative ions [7]. The primary problem in dye laser photodetachment experiments is the determination of the states between which transitions are being observed. (Compare section c.) The accuracy can exceed one millielectron volt.

b. Spectroscopy (S)

An initial, extremely difficult problem preventing the direct spectroscopic observation of negative ions was the achievement of an ion density sufficient to absorb a measurable fraction of a photon beam. Berry and co-workers pioneered in the solution of this problem with shock wave techniques [8]. Both absorption [9] and emission [10] in shock waves have now been observed. Popp has extended these techniques to other plasmas [11, 12]. Care must be exercised that unexpected species do not confuse the experimenter with misleading thresholds, since the plasmas contain many species. Accuracies of 2 millielectron volts have been achieved.

c. Incoherent Photon Detachment (P)

The classical ion photon crossed beam photodetachment experiment

$$X^- + h\nu \rightarrow X + e^-,$$

as developed first by Branscomb and colleagues [13] has been described in detail [2]. A mass analyzed ion beam traverses spectrally resolved radiation from an arc, now typically a xenon arc. The energy of the detached electrons is measured as a function of photon wavelength. The identification of the transitions is substantially less precise, greater than 2 millielectron volts, than for similar experiments employing a dye laser. The applicability of threshold behavior theory is thus more questionable.

d. Photoelectron Spectroscopy (PE)

Crossed beam photodetachment with a fixed frequency laser has also been performed. The energy of the detached electrons is measured with an electron spectrometer [14–16]. Energy resolution of the detached electrons can be achieved sufficient to resolve transitions between various vibrational levels of the ion and neutral molecule to a precision of several millielectron volts. This technique is thus particularly useful for polyatomic negative ions. Molecules with much smaller affinities can be studied than can those using a threshold technique. The energy determined for the electrons can be influenced by the surface chemistry of the detachment region, however.

e. Photoionization (PI)

Dissociative pair production from a molecule

$$XY + h\nu \rightarrow X^+ + Y^-,$$

occurs at a lower energy than simple dissociative ionization

$$XY + h\nu \rightarrow X^+ + Y + e^-,$$

by an amount equal to the electron affinity where the degree of internal excitation is the same. The difference in the thresholds for these two processes leading to unexcited species is the electron affinity. Although the initial application of the technique [17] was not sufficiently precise (>0.1 eV) to distinguish errors in prevailing values, more recent applications approaching a precision of 1 millielectron volt have been extremely useful in choosing among conflicting values for electron affinities [18]. Unless the kinetic energy of the products at each threshold is measured, however, the result represents only an upper bound on the electron affinity.

f. Electrostatic Field Detachment (FD)

The ions of atoms with very small electron affinities (several millielectron volts) may be detached in a strong electric field [19]. From the threshold strength of this field and a detailed knowledge of the ionic structure, the electron affinity may be calculated. The reliability, estimated to approach 2 millielectron volts, will thus depend strongly on the theoretical analysis on which it is based.

g. Heavy Particle Collisions (HPC)

Atomic collisions have been used to determine negative ion bond dissociation energies from reaction thresholds. These may be combined with molecular dissociation energies and appropriate atomic electron affinities to determine polyatomic electron affinities [20, 21]. The accuracy is thought to be several tenths of an electron volt.

h. Charge Exchange (CE)

Observation of the cross section for the interaction

$$X + Y^- \rightarrow X^- + Y,$$

as a function of Y^- energy can be used to determine a difference between two electron affinities if the interaction is endothermic at threshold and to bracket the affinity for exothermic reactions [22–24]. Internal and kinetic energies severely complicate the interpretation. The energy resolution, several tenths of an electron volt, is limited partially by the energy spread of the electron beam used to generate the initial negative ion.

i. Dissociative Electron Attachment (ATT)

The threshold energy for the interaction

$$XY + e^- \rightarrow X + Y^-,$$

has been used to determine electron affinities where the relevant dissociation energy is known [25]. Appreciable internal energies can severely complicate the analysis [26–28]. Energy resolution, several tenths of an electron volt, is limited here also by the energy spread of the electron beam.

j. Thermochemistry (T)

The temperature dependence of the concentration of negative ions in equilibrium with neutral species, combined with the laws of thermodynamics, leads to ion heats of formation from those of the neutral species. A number of techniques for generating a quasi-equilibrium population are used, a notable one of which is plasmas [29–31]. The identity of the species being observed is sometimes uncertain. The achievement of equilibrium is also difficult to ascertain. An uncertainty of several tenths of an electron volt is achieved.

k. Surface Ionization (SI)

Surface ionization has been employed for negative ion study by a number of workers, particularly successfully by Scheer and Fine [32]. A number of parameters must be carefully evaluated, especially the work function of the surface under the particular conditions. If mass analysis is not provided, the identity of the ions observed is in doubt. Accuracies are thought to approach several tenths of an electron volt.

l. Exploding Wire (EW)

Ya'akobi has interpreted the power balance in exploding wires and the observation of an anomaly as due to evaporating negative ions. From the temperature for onset of the anomaly, he evaluates the electron affinity associated with the negative ion to several tenths of an electron volt [33]. Evidence for the validity of the supporting assumptions is indirect.

m. Electron Scattering (ES)

The energies of temporary (excited) negative ion states can be explored by changes in the differential elastic electron scattering cross section [34–37]. For molecular ions with small affinities, features of the elastic [38] and total [39] electron scattering cross sections may be extrapolated to the lowest vibrational level of the bound ion. Since the threshold is not observed directly, the analysis is crucial to the success of this technique. The accuracy is of the order of a tenth of an electron volt.

n. Electron Impact with Analytic Deconvolution (DEC)

Dissociative ionization under electron impact

$$XY + e^- \rightarrow X^+ + Y + 2e^-,$$

can be observed as a function of incident electron energy to identify the threshold for the process. When a negative ion as well as a positive ion is formed,

$$XY + e^- \rightarrow X^+ + Y^- + e^-,$$

the electron affinity is obtained from the difference in positive ion thresholds for the two types of process. In addition to internal and kinetic energy changes in the molecular particles, the energy spread of the electron beam obscures the threshold identification. Various analytical techniques have been used to reduce this latter source of imprecision [40–43] to achieve a resolution of several tenths of an electron volt. Because of the necessity for a mathematical model, unexpected transitions cannot be allowed for in such an analysis.

o. Electron Impact with Retarding Potential Difference (RPD)

The threshold behavior for negative ion formation on electron impact can be clarified by varying the electron energy slightly and observing the correlated modification in the generation of negative ions. The technique developed by Fox for positive ions has been applied to negative ions only recently by other workers [44, 45]. The primary goal of this negative ion work is the survey of ions not previously studied by other techniques. The sensitivity of this approach is limited by the presence of noise from the entire electron beam. Moreover, Fox's successors have not always applied his care in the utilization of this technique. Accuracies of several tenths of an electron volt are possible in favorable cases.

p. Electron Impact (EI)

Simple electron impact leading to ion-pair production has generally been superseded by more sophisticated handling of the electron beam energy spread, either by analytic deconvolution (see section n) or by the retarding potential difference method (see section o). Occasionally, however [46], no other data are available. Accuracies of about one half an electron volt can then be achieved where a fortuitous reference ion is available.

q. Born-Haber Cycle Calculations (BH)

The earliest measure of electron affinities came from application of the Born-Haber thermodynamic analysis to ionic crystals. One must know the energy of formation of the salt with respect to the elements, the lattice energy, the ionization energy of the alkali, the sublimation energy of the alkali, and the dissociation energy of the molecular electronegative component [47, 48]. The uncertainty in one or more of these quantities is typically of a size that is a substantial fraction of the electron affinity to be determined. An accuracy greater than one half an electron volt seems unlikely.

r. Dipole Moment Extrapolation (DME)

From uv absorption spectra, Sklar has observed changes in the dipole moment of a given molecular bond as a function of the electron affinity of various electronegative atoms. This is extrapolated to zero moment to obtain the affinity of the radical on which the substitution was observed [49]. Since the method is indirect, it is difficult to evaluate quantitatively. Its accuracy is certainly not better than one half an electron volt.

s. Dissociation Energy (DE and AA)

Mulliken's thesis that the dissociation energy of a molecular negative ion should be about half that of the corresponding neutral species has been applied by Geiger [50] to the determination of electron affinities (DE). He has estimated homoatomic molecular halogen affinities from the corresponding atomic halogen affinities.

Gaines and Page [51], on the other hand, have estimated certain molecular electron affinities by assuming that the dissociation energies of both negative ion and corresponding neutral species are identical (AA). The molecular affinity can then be calculated where appropriate molecular and atomic negative ion heats of formation are known. The basic assumption here clearly conflicts with that of Geiger. The uncertainty in both cases is certainly no better than one half an electron volt.

t. Lyotropic Series Analysis (L)

The sum of the heat of hydration of a negative ion and its electron affinity has been postulated to be a constant. The heat of hydration is determined from a plot of the relative efficiencies of salts in precipitating gelatine from a solution [52]. In this manner, comparisons of electron affinities are made. The validity of the assumptions is difficult to assess. The accuracy is probably less than one half an electron volt.

u. Observation in Mass Spectrum (OBS)

Ions observed in a negative ion mass spectrum have a lifetime of at least a microsecond. When no other evidence is available, the affinity of such species is taken to be positive. Autodetachment can in principle occur, however.

5.2. Theoretical Techniques

Calculations employing ab initio techniques are proving increasingly accurate. Theoretical techniques which first utilized empirical correlation terms, now are being made entirely ab initio. Accuracy better than a millielectron volt has been attained for the variational calculation of H^-, which is a special case. Hartree-Fock and configuration interaction calculations now agree with experiments to better than a tenth of an electron volt upon occasion. The other approaches can be as good as several tenths of an electron volt.

a. Variational Calculations (VAR)

For sufficiently small atoms and ions, it is feasible to vary the parameters of an energy calculation in order to produce an energy minimum, which, following Ritz, is always greater than the true value. Pekeris has employed this technique in a definitive fashion to calculate the electron affinity for H, probably the most precisely known affinity [53]. It approaches a microelectron volt in accuracy. More recently, Nesbet has performed Bethe-Goldstone variational calculations on more complex atomic species [54].

b. Hartree-Fock Calculations (HF)

The Hartree-Fock self-consistent field ab initio calculations previously performed widely for neutral atoms and positive ions have now been used to calculate negative ion energies as well. However, since the electron correlation energy is of the order of the electron affinity, the procedure used to estimate this correction is crucial to the reliability of the technique when applied to negative ions. Clementi and colleagues have employed isoelectronic ionization potential extrapolations [55–57] to estimate the correlation energy. Weiss has employed an ab initio superposition of configuration technique [58, 59]. Cade has extended this method to molecular ions [60, 61].

c. Configuration Interaction Calculations (CI)

Various configuration interaction calculations have been used for molecular and atomic species [62–69]. This theoretical approach has been limited to systems with few electrons. Even for these, the reliability is uncertain, probably several tenths of an electron volt.

d. Many Electron Theory (MET)

Öksüz and Sinanoğlu have developed an ab initio theory incorporating electron correlation [70]. Although the results are initially less accurate than those of some experiments and some empirical extrapolation approaches, the method is promising because of its ab initio character for relatively heavy negative ions. An accuracy of several tenths of an electron volt is achieved.

e. Rydberg-Klein-Rees Calculations (RKR)

Rydberg-Klein-Rees calculations have been used to generate molecular negative ion potential energy curves (dissociation energies) as well as those for neutral molecules. The electron affinity can then be derived indirectly where the separated atom affinities are known [71]. The uncertainty is of the order of one half an electron volt.

5.3. Empirical Extrapolation Techniques

The use of regularities in ionization energies or other periodic parameters for atoms in the periodic table to predict atomic electron affinities has become more reliable as the experimental values on which the techniques are based have improved. The approach most widely used recently, the estimation of affinities from the location in a row of the periodic table, is probably reliable to several tenths of an electron volt. The others may be somewhat less reliable.

a. Horizontal Analysis of the Periodic Table (HA)

Probably the most generally applicable and reliable empirical extrapolation technique involves analysis of regular changes in electron affinities of atoms along rows of the periodic table. The analysis depends on the prior knowledge of at least one affinity in each row. Such analyses have been performed by Ginsberg and Miller [72], Edie and Rohrlich [73], Crossley [74], Zollweg [75], and most recently by Hotop, Bennett, and Lineberger [76]. As noted an accuracy of several tenths of an electron volt may be achieved.

b. Extrapolation of Ionization Potentials (IE)

One of the earliest approaches to electron affinity determinations was an empirical extrapolation developed by Glockler [77]. The ionization energies of isoelectronic ions of differing charge are fit to the equation

$$E = a + bZ + cZ^2,$$

where Z is the nuclear charge. The parabola so determined is extrapolated to find the ionization energy of the isoelectronic singly-charged negative ion, i.e. the electron affinity of the corresponding neutral atom. This technique has been extended by Charkin and Dyatkina [78], Geltman [79], Johnson and Rohrlich [80], Edlén [81], and Kaufman [82]. An accuracy of several tenths of an electron volt may be obtained.

c. Vertical Analysis of the Periodic Table (VA)

A logarithmic plot of the difference between the first ionization potential and the electron affinity of an atom against the atomic radius has been observed to form a straight line [83]. Politzer has used this line to estimate the electron affinity for atoms in the lower part of the periodic table from those in the first rows. An accuracy of better than one half an electron volt may be achieved.

d. Isoelectronic Model (IM)

Gilmore [34] has referred to isoelectronic molecules in order to estimate the bond energies of molecular negative ions. These values are then combined with the neutral molecular bond energies and atomic electron affinities to estimate molecular electron affinities to within perhaps one half an electron volt.

5.4. Order of Tabular Listing

In the Negative Ion Table the various species are listed, as are the positive ions, in order of increasing atomic number of the highest-atomic-number constituent. Polyatomic ions are arranged after the atomic ions in order of increasing atomic numbers of other constituents.

Where an electron affinity is thought to be known to better than 0.1 eV, a heat of formation has been calculated from the first listed affinity and presented in the ion heading.

For a given negative ion, the various determinations of the electron affinity are listed in order of estimated decreasing reliability. The abbreviations for the techniques used are listed alphabetically in table 1 and explained in the preceding text.

TABLE 1. Techniques for negative ion energetics

Abbreviation	Technique
AA	Constituent atom electron affinity (dissociation energy)
ATT	Dissociative electron attachment
BH	Born-Haber cycle calculation
CE	Charge exchange
CI	Configuration interaction calculation
DE	Dissociation energy
DEC	Electron impact with analytic deconvolution
DME	Dipole moment extrapolation
EI	Electron impact
ES	Electron scattering
EW	Exploding wire
FD	Electrostatic field detachment
HA	Horizontal analysis of the periodic table
HF	Hartree-Fock calculation
HPC	Heavy particle collisions
IE	Extrapolation of ionization potentials
IM	Isoelectronic model
L	Lyotropic series analysis
LP	Dye laser photodetachment
MET	Many electron theory
OBS	Observation in mass spectrum
P	Incoherent photon detachment
PE	Photoelectron spectroscopy with fixed frequency laser
PI	Photoionization
RKR	Rydberg-Klein-Rees calculation
RPD	Electron impact with retarding potential difference
S	Spectroscopy
SI	Surface ionization
T	Thermochemistry
VA	Vertical analysis of the periodic table
VAR	Variational calculation

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6.2. The Negative Ion Table

Ion	State	Electron affinity (eV)	Method	Ref.
	$H^-(^1S_0)$ $\Delta H^\circ_{f0} = 143.2$ kJ mol^{-1} (34.2 kcal mol^{-1})			
H^-	$1s^2\ ^1S_0$	0.7542	VAR	1
		0.756±0.013	S	2
		0.776±0.020	P	3
	$2p^2\ ^3P$ (→$2p\ ^2P^\circ$)	>0.0095	VAR	4
	H_2^-			
H_2^-	$^2\Sigma_u^+$	−2.5	RKR−CI	5
		−2.85	VAR	169
		<0	CI	6
		<0	CI	7
		<0	CI	8
		<0	CI	9
		>0	OBS	10
		>0	OBS	11
	He^-			
He^-	$1s\ 2s\ 2p\ ^4P$ (→$1s\ 2s\ ^3S_1$)	0.080±0.008	PE	12
		0.060±0.005	FD	13
		≥0.033	VAR	14
	$Li^-(^1S_0)$ $\Delta H^\circ_{f0} \sim 99$ kJ mol^{-1} (24 kcal mol^{-1})			
Li^-	$2s^2\ ^1S_0$	0.62±0.10	HF	15
		0.58±0.05	HF	16
		0.591	CI	17
		0.62	CI	18
		0.593±0.021	CI	19
		0.85±0.20	SI	20
		0.59	HA	21
		0.64	IE	22
		0.82	IE	23
		0.6	EW	24
	Be^-			
Be^-	$2s^2\ 3s\ ^2S_{1/2}$	<0	HF	15
		0.38±0.20	HA	25
		>0	OBS	26
	$2s\ 2p^2\ ^4P$ (→$2s\ 2p\ ^3P^\circ$)	0.24±0.10	HF	15
	$2s^2\ 2p\ ^2P^\circ_{1/2}$	−0.65	HA	25
		−0.68	HA	21
		−0.38	HA	27
		−0.19	IE	23

6.2. The Negative Ion Table—Continued

Ion	State	Electron affinity (eV)	Method	Ref.
BeH^-		1.00	AA	28
		BeH_3^-		
BeH_3^-		3.8	HF	29
		B^-		
B^-	$2p^2\ {}^3P_0$	0.223	HF–VAR	30
		0.187±0.100	HF	31
		0.30±0.05	HF	16
		0.18±0.20	HA	25
		0.16	HA	21
		0.33	HA	27
		0.33	IE	23
		>0	OBS	32
		BH^-		
BH^-		0.09	AA	28
		BH_2^-		
BH_2^-		1.39	AA	28
	$C^-({}^4S^\circ_{3/2})$	**ΔH°_{f0} = 588.7 kJ mol^{-1} (140.7 kcal mol^{-1})**		
C^-	$2p^3\ {}^4S^\circ_{3/2}$	1.270±0.010	PE	33
		1.25±0.03	P	34
		1.29	HF–VAR	30
		1.24±0.10	HF	31
		1.17±0.06	HF	16
		1.17±>0.10	MET	35
		1.29±0.20	HA	25
		1.33	HA	21
		1.38	HA	27
		1.24	IE	23
		1.2	SI	36
	$2p^3\ {}^2D^\circ$	0.050±0.025	PE	37
		0.062	PE	33
		>0	P	34
		<0.5	P	3
		−0.105±0.100	HF	31
		−0.08±0.05	HF	16
		−0.13±>0.10	MET	35

6.2. The Negative Ion Table—Continued

Ion	State	Electron affinity (eV)	Method	Ref.
$C_2^-(^2\Sigma_g^+)$ $\Delta H^\circ_{f0} \geq 488$ kJ mol^{-1} (117 kcal mol^{-1})				
C_2^-	$^2\Sigma_g^+$	$\leq 3.54 \pm 0.05$	P	3
		4.0	SI	36
		3.3 ± 0.2	EI	38
		$> 2.9 \pm 0.5$	DEC	39
C_3^-				
C_3^-		2.5	SI	36
$CH^-(^3\Sigma^-)$ $\Delta H^\circ_{f0} = 521$ kJ mol^{-1} (125 kcal mol^{-1})				
CH^-	$^3\Sigma^-$	0.74 ± 0.05	P	3
		1.61 ± 0.20	HF	40
		2.6 ± 0.3	EI	38
		$\geq 4.1 \pm 0.4$	DEC	39
CH_3^-				
CH_3^-		1.8	DME	41
C_2H^- $\Delta H^\circ_{f0} \geq 114$ kJ mol^{-1} (27 kcal mol^{-1})				
C_2H^-		$\leq 3.73 \pm 0.05$	P	3
		2.1 ± 0.3	EI	38
		$\geq 2.3 \pm 0.7$	DEC	39
$C_5H_5^-$				
$C_5H_5^-$ (Cyclopentadienyl)		$\leq 2.2 \pm 0.3$	DEC	42
N^-				
N^-	$2p^4\ ^3P_2$	−0.12	HF–VAR	30
		−0.213	HF	31
		0.05	IE	23
		> 0	CE	43
N_2^-				
N_2^-	$^2\Pi_g$	-1.6 ± 1.0	ES	44
	$^2\Sigma_g^+$	−11.345	ES	45

6.2. The Negative Ion Table—Continued

Ion	State	Electron affinity (eV)	Method	Ref.
N_3^-				
N_3^-	$^1\Sigma_g^+$	1.8	HF	46
		3.5±0.2	S	47
		2.3	L	48
NH^-				
NH^-	$^2\Pi_i$	0.22±0.20	HF	40
NH_2^- $\Delta H^\circ_{f298} \sim 100$ kJ mol^{-1} (24 kcal mol^{-1})				
NH_2^-		0.744±0.022	P	49
		0.74	P	50
		0.76±0.04	P	51
		0.6	ATT	52
		1.21	SI	53
$CN^-(^1\Sigma^+)$ $\Delta H^\circ_{f0} = 63$ kJ mol^{-1} (15 kcal mol^{-1})				
CN^-	$^1\Sigma^+$	3.82±0.02	PI	54
		3.6±0.3	ATT	54
		3.17±0.04	SI	55
		2.797±0.022	SI	170
$O^-(^2P^\circ_{3/2})$ $\Delta H^\circ_{f0} = 105.4$ kJ mol^{-1} (25.2 kcal mol^{-1})				
O^-	$2p^5\ ^2P^\circ_{3/2}$	1.465±0.005	P	56
		1.478±0.002	S	57
		1.461±0.024	PI	58
		1.5±0.1	ATT	59
		1.43	HF–VAR	30
		1.46±0.10	HF	31
		1.31±0.15	ATT	60
		1.22±0.14	HF	16
		1.24±>0.10	MET	35
		1.39	HA	21
		1.47	IE	23
		−10.112±0.010	HPC	61
		−12.115±0.010	HPC	61

6.2. The Negative Ion Table—Continued

Ion	State	Electron affinity (eV)	Method	Ref.
$O_2^-(^2\Pi_{3/2g})$ $\Delta H^\circ_{f0} = -42.5$ kJ mol^{-1} (-10.1 kcal mol^{-1})				
O_2^-	$^2\Pi_{3/2g}$	0.440±0.008	PE	62
		0.43±0.02	T	63
		0.45±0.10	CE	64
		0.5±0.1	CE	65
		⩾0.48	CE	66
		0.42	DE	67
		0.15±0.05	P	68
		⩾0.21	PI	69
O_3^-				
O_3^-		1.92±0.13	S	70
		1.91±0.43	BH	71
		>1.5	S	130
		⩾1.96	CE	66
O_4^-				
O_4^-		>0	OBS	72
$OH^-(^1\Sigma^+)$ $\Delta H^\circ_{f0} = -137.4$ kJ mol^{-1} (-32.8 kcal mol^{-1})				
OH^-	$^1\Sigma^+$	1.825±0.002	LP	171
		1.826±0.002	LP	73
		1.83±0.04	P	74
		1.91±0.10	HF	75
$OD^-(^1\Sigma^+)$ $\Delta H^\circ_{f0} = -139.4$ kJ mol^{-1} (-33.3 kcal mol^{-1})				
OD^-	$^1\Sigma^+$	1.823±0.002	LP	73
H_2O^-				
H_2O^-		0.9	S	47
HO_2^-				
HO_2^-		4.6	BH	76
$H_2O_2^-$				
$H_2O_2^-$		>0	OBS	77

6.2. The Negative Ion Table—Continued

Ion	State	Electron affinity (eV)	Method	Ref.
$H_3O_2^-$				
$H_3O_2^-$		$\leq 2.95 \pm 0.15$	P	78
		3.35 ± 0.15	HPC	79
$H_2O_3^-$				
$H_2O_3^-$		>0	OBS	77
BO^-				
BO^-		3.12 ± 0.09	SI	80
		>2.5	T	81
		2.12	AA	28
BO_2^-				
BO_2^-		3.57 ± 0.13	SI	80
		4.07 ± 0.21	T	178
CO^-				
CO^-		$<-1.8 \pm 0.1$	ES	82
CO_2^-				
CO_2^-		>-0.9	ES	83
CO_3^-				
CO_3^-		>2.6	T	172
		1.8 ± 0.2	P	173
		>0	OBS	77
CO_4^-				
CO_4^-		1.22 ± 0.07	T	84
		>0	OBS	77

6.2. The Negative Ion Table—Continued

Ion	State	Electron affinity (eV)	Method	Ref.
$NO^-(^3\Sigma_g^-)$ ΔH°_{f0} = 87.4 kJ mol^{-1} (20.9 kcal mol^{-1})				
NO^-	$^3\Sigma_g^-$	$0.024^{+0.010}_{-0.005}$	PE	85
		≥ 0.09	CE	66
		≤ 0.440	CE	86
		0.15	IM	44
		0.89±0.11	SI	87
		0.85; 0.86	RPD	88
N_2O^-				
N_2O^-		0.27±0.17	ATT	89
		<1.5	CE	90
		>0.5	ATT	91
		>0	CE	92
		~0	ATT	93
		~0	CE	94
		~0	ATT	83
NO_2^- ΔH°_{f0} = −263 kJ mol^{-1} (−63 kcal mol^{-1})				
NO_2^-		3.10±0.05	P	95
		2.38±0.06	CE	96
		2.5±0.1	CE	65
		≥ 2.04	CE	66
		≤ 2.6	CE	97
		>3.6	CE	98
		3.99±0.16	SI	87
NO_3^-				
NO_3^-		3.9±0.2	CE	97
		3.7±>0.2	CE	99
		≥ 2.48	CE	66
		4.22±0.22	BH	100
$C_2H_5O^-$				
$C_2H_5O^-$		1.68	RPD	88
$C_3H_7O^-$				
n–$C_3H_7O^-$		1.87	RPD	88
iso–$C_3H_7O^-$		1.73	RPD	88

6.2. The Negative Ion Table—Continued

Ion	State	Electron affinity (eV)	Method	Ref.
$C_4H_9O^-$				
n-$C_4H_9O^-$		1.90	RPD	88
$C_4H_6O_2^-$				
$(CH_3CO)_2^-$		1.1	ATT	174
$CH_2O_4^-$				
$CO_3(H_2O)^-$		>3.1	T	172
		2.1±0.2	P	173
$C_6H_5NO_2^-$				
$C_6H_5NO_2^-$ (Nitrobenzene)		0.4	ATT	174
$F^-(^1S_0)$	**$\Delta H^\circ_{f0} = -251.2$ kJ mol^{-1} (-60.0 kcal mol^{-1})**			
F^-	$2p^6\ ^1S_0$	3.400±0.002	S	101, 102
		3.398±0.002	S	103
		3.39±0.02	PI	104
		3.47±0.03	PI	105
		3.37	HF–VAR	30
		3.47	HF	106
		3.45±0.10	HF	31
		3.37±0.08	HF	16
		3.23±>0.10	MET	35
		3.50±0.20	HA	25
		3.47	HA	27
		3.50	IE	23
F_2^-				
F_2^-		3.08±0.10	CE	107
HF^-				
HF^-	$^2\Sigma^+$	<0	HF	108
HF_2^-				
HF_2^-		3	HF	109

6.2. The Negative Ion Table—Continued

Ion	State	Electron affinity (eV)	Method	Ref.
		CF^-		
CF^-	$^3\Sigma$	1.06±0.20	HF	110
		$\geqslant$3.3±1.1	DEC	111
		C_2F^-		
C_2F^-		$\geqslant$3.4±0.8	DEC	39
		CF_2^-		
CF_2^-		$\geqslant$0.2	DEC	111
		CF_3^-		
CF_3^-		2.1±0.3	DEC	111
		$C_2F_3^-$		
$C_2F_3^-$		2.0±0.2	DEC	111
		$C_2F_5^-$		
$C_2F_5^-$		2.1	DEC	112
		$C_3F_5^-$		
$C_3F_5^-$		2.7	DEC	112
		$C_3F_7^-$		
$C_3F_7^-$		2.3	DEC	112
		$C_5F_9^-$		
$C_5F_9^-$		3.1	RPD	113
		$C_6F_{11}^-$		
$C_6F_{11}^-$		3.5	RPD	113
		$C_7F_{13}^-$		
$C_7F_{13}^-$		3.9	RPD	113

6.2. The Negative Ion Table—Continued

Ion	State	Electron affinity (eV)	Method	Ref.
		NF^-		
NF^-	$^2\Pi$	0.6±0.5	HF	114
		OF^-		
OF^-	$^1\Sigma$	<1.4	HF	175
	$Na^-(^1S_0)$	**ΔH°_{f0} = 55.6 kJ mol^{-1} (13.3 kcal mol^{-1})**		
Na^-	$3s^2\ ^1S_0$	0.543±0.010	LP	171
		0.542±0.100	LP	115
		0.54±0.10	HF	15
		0.541±0.004	CI	116
		0.54	CI	18
		0.78±0.06	HF	118
		$0.41^{+0.06}_{-0.02}$	CE	119
		0.22	HA	21
		0.47	IE	23
		NaO^-		
NaO^-		1.1±0.5	HF	117
		Mg^-		
Mg^-	$3s^2\ 4s\ ^2S_{1/2}$	<0	HF	15
		−0.22	HA	25
	$3s\ 3p^2\ ^4P$ (→$3s\ 3p\ ^3P^\circ$)	0.32±0.10	HF	15
		>0	OBS	26
	$3s^2\ 3p\ ^2P^\circ_{1/2}$	−0.52	HA	25
		−0.69	HA	21
		−0.61	HA	27
		−0.32	IE	23
		MgH^-		
MgH^-		1.08	AA	28

6.2. The Negative Ion Table—Continued

Ion	State	Electron affinity (eV)	Method	Ref.
Al^-				
Al^-	$3p^2\ ^3P_0$	0.52	HF	118
		0.20±0.20	HA	25
		0.27	HA	21
		0.28	HA	27
		0.52	IE	23
		>0	OBS	120
		>0	OBS	32
	$3p^2\ ^1D_2$	0.23	HF	118
AlH^-				
AlH^-		0.04	AA	28
AlH_2^-				
AlH_2^-		2.12	AA	28
AlO^-				
AlO^-		3.68±0.13	SI	121
		2.60	AA	28
AlO_2^-				
AlO_2^-		4.11±0.13	SI	121
Si^-				
Si^-	$3p^3\ ^4S^\circ_{3/2}$	1.39	HF	118
		1.36±0.20	HA	25
		1.40	HA	21
		1.36	HA	27
		1.46	IE	23
		>0	OBS	122
	$3p^3\ ^2D^\circ$	0.56±0.04	P	51
		0.58	HF	118
	$3p^3\ ^2P^\circ$	0.08	HF	118

6.2. The Negative Ion Table—Continued

Ion	State	Electron affinity (eV)	Method	Ref.
SiH^-				
SiH^-	$^3\Sigma^-$	1.46±0.20	HF	40
SiH_2^-				
SiH_2^-		3.47	AA	28
SiH_3^-				
SiH_3^-		2.73	AA	28
Si_2H^-				
Si_2H^-		4.08	AA	28
$Si_2H_3^-$				
$Si_2H_3^-$		3.17	AA	28
SiF^-				
SiF^-	$^3\Sigma$	1.0±0.2	HF	110
P^-				
P^-	$3p^4\ ^3P_2$	0.78	HF	118
		0.71±0.20	HA	25
		0.62	HA	21
		0.72	HA	27
		0.77	IE	23
		>0	OBS	32
	$3p^4\ ^1D_2$	0.01	HF	118
PH^-				
PH^-	$^2\Pi_i$	0.93±0.20	HF	40
PH_2^- $\Delta H^\circ_{f0} = 7$ kJ mol^{-1} (2 kcal mol^{-1})				
PH_2^-		1.25±0.03	P	123
		1.26±0.03	LP	50
		>0	OBS	124
		1.60	AA	28

6.2. The Negative Ion Table—Continued

Ion	State	Electron affinity (eV)	Method	Ref.
PO^-				
PO^-	$^3\Sigma^-$	<1.13	HF	125
PF^-				
PF^-	$^2\Pi$	≤1.4±0.3	HF	114
$S^-(^2P^\circ_{3/2})$ $\Delta H^\circ_{f0} = 76$ kJ mol^{-1} (18 kcal mol^{-1})				
S^-	$3p^5\ ^2P^\circ_{3/2}$	2.0772±0.0005	LP	126
		2.095±0.015	P	127
		2.07±0.07	P	32
		2.090±0.065	SI	128
		2.12	HF	118
		2.04±0.20	HA	25
		2.03	HA	21
		2.08	HA	27
		2.15	IE	23
S_2^-				
S_2^-	$^2\Pi_g$	>2.0	ATT	129
$HS^-(^1\Sigma^+)$ $\Delta H^\circ_{f0} \sim -81$ kJ mol^{-1} (−19 kcal mol^{-1})				
HS^-	$^1\Sigma^+$	2.319±0.010	P	131
		2.28±0.15	P	132
		2.25±0.10	HF	75
		2.30±0.04	T	128
H_2S^-				
H_2S^-		1.11±0.09	SI	128
$SO^-(^2\Pi)$ $\Delta H^\circ_{f0} = -102.4$ kJ mol^{-1} (−24.5 kcal mol^{-1})				
SO^-	$^2\Pi$	1.126±0.013	PE	171
		≤1.09±0.05	P	3
		>1.0; <1.27	CE	176
SO_2^-				
SO_2^-		<1.0±0.1	P	3
		>1.0; <1.27	CE	176

6.2. The Negative Ion Table—Continued

Ion	State	Electron affinity (eV)	Method	Ref.
SF^-				
SF^-	$^1\Sigma$	$\leq 2.5 \pm 0.5$	HF	133
SF_3^-				
SF_3^-		2.95 ± 0.05	DEC	134
SF_5^-				
SF_5^-		3.66 ± 0.04	SI	135
SF_6^-				
SF_6^-		$>0.432; <1.470$	CE	127
		1.49 ± 0.22	SI	135
		1.1	ATT	174
CNS^-				
CNS^-		2.164 ± 0.022	SI	170
		1.99	SI	53
$Cl^-(^1S_0)$ $\Delta H^\circ_{f0} = -228.6$ kJ mol^{-1} (-54.6 kcal mol^{-1})				
Cl^-	$3p^6\ ^1S_0$	3.613 ± 0.003	S	136
		3.616 ± 0.003	S	137
		3.628 ± 0.005	S	138
		3.56	HF	118
		3.70	IE	23
Cl_2^-				
Cl_2^-		2.38 ± 0.10	CE	107
		2.45 ± 0.15	CE	65
		2.46 ± 0.14	CE	96
		<1.7	ATT	139
		2.54	DE	140
CCl_3^-				
CCl_3^-		$>2.10 \pm 0.35$	ATT	141
		1.6 ± 0.2	ATT	142
		1.44 ± 0.05	SI	143

6.2. The Negative Ion Table—Continued

Ion	State	Electron affinity (eV)	Method	Ref.
		CCl_4^-		
CCl_4^-		2.12±0.10	SI	143
		ClO^-		
ClO^-	$^1\Sigma$	≤2.2±0.5	HF	144
		$SiCl_2^-$		
$SiCl_2^-$		≥2.6	ATT	145
		$CHCl_3^-$		
$CHCl_3^-$		1.76±0.05	SI	143
	$K^-(^1S_0)$	**ΔH°_{f0} = 41.7 kJ mol^{-1} (10.0 kcal mol^{-1})**		
K^-	$4s^2\ ^1S_0$	0.5012±0.0005	LP	171
		0.47±0.10	HF	15
		0.90±0.05	HF	146
		0.40±0.20	HA	25
		$0.22^{+0.08}_{-0.06}$	CE	119
		0.5	IE	147
		0.51	CI	18
		Ca^-		
Ca^-	$3d\ 4s^2\ ^2D_{3/2}$	−1.62±0.10	HA	148
		−1.88±0.20	HA	25
		1.6	IE	147
		Sc^-		
Sc^-	$3d^2\ 4s^2\ ^3F_2$	−0.14±0.10	HF	146
		−0.80±0.10	HA	148
		−0.70±0.20	HA	25
		−0.4	IE	147
		Ti^-		
Ti^-	$3d^3\ 4s^2\ ^4F_{3/2}$	0.39±0.20	HF	146
		−0.11±0.10	HA	148
		−0.03±0.20	HA	25
		0.15	IE	147

6.2. The Negative Ion Table—Continued

Ion	State	Electron affinity (eV)	Method	Ref.
V^-				
V^-	$3d^4\ 4s^2\ {}^5D_0$	0.94±0.25	HF	146
		0.51±0.10	HA	148
		0.56±0.20	HA	25
		0.65	IE	147
Cr^-				
Cr^-	$3d^5\ 4s^2\ {}^6S_{5/2}$	0.98±0.35	HF	146
		0.85±0.10	HA	148
		0.85±0.20	HA	25
		0.85	IE	147
Mn^-				
Mn^-	$3d^6\ 4s^2\ {}^5D_4$	−1.07±0.20	HF	146
		−1.19±0.10	HA	148
		−1.07±0.20	HA	25
		−1.2	IE	147
Fe^-				
Fe^-	$3d^7\ 4s^2\ {}^4F_{9/2}$	0.58±0.20	HF	146
		0.14±0.10	HA	148
		0.40±0.20	HA	25
		0.1	IE	147
Co^-				
Co^-	$3d^8\ 4s^2\ {}^3F_4$	0.94±0.15	HF	146
		0.65±0.10	HA	148
		1.03±0.20	HA	25
		0.7	IE	147
Ni^-				
Ni^-	$3d^9\ 4s^2\ {}^2D_{5/2}$	1.28±0.20	HF	146
		1.13±0.10	HA	148
		1.62±0.20	HA	25
		1.1	IE	147

6.2. The Negative Ion Table—Continued

Ion	State	Electron affinity (eV)	Method	Ref.
	$Cu^-({}^1S_0)$ ΔH°_{f0} = 218.9 kJ mol^{-1} (52.3 kcal mol^{-1})			
Cu^-	$3d^{10}\ 4s^2\ {}^1S_0$	1.226±0.010	PE	148
		1.80±0.10	HF	146
		0.7	CI	18
		1.80±0.20	HA	25
		1.5±0.5	T	149
		1.4	IE	147
	Zn^-			
Zn^-	$5s\ {}^2S_{1/2}$	0.09±0.20	HA	25
	$4p\ {}^2P^\circ_{1/2}$	−0.67±0.20	HA	25
	Ga^-			
Ga^-	$4p^2\ {}^3P_0$	0.37±0.20	HA	25
		0.50	VA	150
		>0	OBS	120
	Ge^-			
Ge^-	$4p^3\ {}^4S^\circ_{3/2}$	1.44±0.20	HA	25
		1.37	VA	150
		>0	OBS	122
	As^-			
As^-	$4p^4\ {}^3P_2$	1.07±0.20	HA	25
		0.74	VA	150
	AsH_2^-			
AsH_2^-		1.27±0.03	P	49
	$Se^-({}^2P^\circ_{3/2})$ ΔH°_{f0} = 31.4 kJ mol^{-1} (7.5 kcal mol^{-1})			
Se^-	$4p^5\ {}^2P^\circ_{3/2}$	2.0206±0.0004	LP	171
		2.0204±0.0004	LP	151
		2.12±0.20	HA	25
		2.11	VA	150
		5.4±2.0	ATT	152

6.2. The Negative Ion Table—Continued

Ion	State	Electron affinity (eV)	Method	Ref.
Se_2^-				
Se_2^-		>0	OBS	153
Se_3^-				
Se_3^-		>0	OBS	153
Se_4^-				
Se_4^-		>0	OBS	153
SeH^-				
SeH^-	$^1\Sigma^+$	2.21±0.03	P	154
		>0	OBS	124
		2.0	BH	152
SeF^-				
SeF^-	$^1\Sigma$	≤2.8±0.5	HF	133
$Br^-(^1S_0)$ $\Delta H^\circ_{f0} = -206.8$ kJ mol^{-1} (-49.4 kcal mol^{-1})				
Br^-	$4p^6\ ^1S_0$	3.366±0.003	S	155
		3.363±0.003	S	136
		3.378±0.005	S	138
		3.53±0.12	PI	156
Br_2^-				
Br_2^-		2.51±0.10	CE	107
		2.55±0.10	CE	65
		>0	OBS	157
		~2.62	DE	140
Rb^-				
Rb^-	$5s^2\ ^1S_0$	0.48	CI	18
		0.40±0.20	HA	25
		0.16±0.06	CE	119
		>0.20	PI	158
		0.6	IE	147

6.2. The Negative Ion Table—Continued

Ion	State	Electron affinity (eV)	Method	Ref.
Sr$^-$				
Sr$^-$	4d 5s^2 $^2D_{3/2}$	−1.74±0.10	HA	148
		−1.33±0.20	HA	25
		−0.5	IE	147
Y$^-$				
Y$^-$	4d^2 5s^2 $^3F_2$	−0.76±0.10	HA	148
		−0.15±0.20	HA	25
		0.3	IE	147
Zr$^-$				
Zr$^-$	4d^3 5s^2 $^4F_{3/2}$	0.08±0.10	HA	148
		0.62±0.20	HA	25
		1.0	IE	147
Nb$^-$				
Nb$^-$	4d^4 5s^2 $^5D_0$	0.77±0.10	HA	148
		1.23±0.20	HA	25
		1.3	IE	147
Mo$^-$				
Mo$^-$	4d^5 5s^2 $^6S_{5/2}$	0.86±0.10	HA	148
		1.0±0.2	SI	159, 160
		1.15±0.20	HA	25
		1.3	IE	147
Tc$^-$				
Tc$^-$	4d^6 5s^2 $^5D_4$	0.63±0.10	HA	148
		0.94±0.20	HA	25
		1.0	IE	147
Ru$^-$				
Ru$^-$	4d^7 5s^2 $^4F_{9/2}$	1.04±0.10	HA	148
		1.49±0.20	HA	25
		1.45	IE	147

6.2. The Negative Ion Table—Continued

Ion	State	Electron affinity (eV)	Method	Ref.
Rh^-				
Rh^-	$4d^8\ 5s^2\ {}^3F_4$	1.12 ± 0.10	HA	148
		1.68 ± 0.20	HA	25
		1.35	IE	147
Pd^-				
Pd^-	$4d^9\ 5s^2\ {}^2D_{5/2}$	0.40 ± 0.10	HA	148
		1.01 ± 0.20	HA	25
		1.4	IE	147
$Ag^-({}^1S_0)$ $\Delta H^\circ_{f0} = 158.4$ kJ mol^{-1} (37.9 kcal mol^{-1})				
Ag^-	$4d^{10}\ 5s^2\ {}^1S_0$	$1.303^{+0.007}_{-0.011}$	PE	148
		<1.78	LP	161
		2.0 ± 0.2	SI	149
		2.00 ± 0.20	HA	25
		1.5	IE	147
Cd^-				
Cd^-	$6s\ {}^2S_{1/2}$	-0.27 ± 0.20	HA	25
	$5p\ {}^2P^\circ_{1/2}$	-0.78 ± 0.20	HA	25
In^-				
In^-	$5p^2\ {}^3P_0$	0.20 ± 0.20	HA	25
		0.72	VA	150
		>0	OBS	120
Sn^-				
Sn^-	$5p^3\ {}^4S^\circ_{3/2}$	1.03 ± 0.20	HA	25
		1.47	VA	150
		>0	OBS	122
Sb^-				
Sb^-	$5p^4\ {}^3P_2$	0.94 ± 0.20	HA	25
		0.61	VA	150
		>0	OBS	153
Sb_2^-				
Sb_2^-		>0	OBS	153

6.2. The Negative Ion Table—Continued

Ion	State	Electron affinity (eV)	Method	Ref.
		Sb_3^-		
Sb_3^-		>0	OBS	153
		Te^-		
Te^-	$5p^5\ ^2P^\circ_{3/2}$	1.96±0.20	HA	25
		2.21	VA	150
		>0	OBS	153
		Te_2^-		
Te_2^-		>0	OBS	153
	$I^-(^1S_0)$	**$\Delta H^\circ_{f0} = -187.9$ kJ mol^{-1} (-44.9 kcal mol^{-1})**		
I^-	$5p^6\ ^1S_0$	3.059±0.002	P	162
		3.063±0.003	S	136
		3.078±0.005	S	138
		≤3.076±0.005	P	163
		3.073±0.014	PI	179
		3.13±0.12	PI	156
		I_2^-		
I_2^-		2.58±0.10	CE	107
		2.55±0.05	CE	65
		>0	OBS	164
		2.42	DE	140
		I_3^-		
I_3^-		>0	OBS	164
		IBr^-		
IBr^-		2.7±0.2	CE	107
		2.55±0.10	CE	65
	$Cs^-(^1S_0)$	**$\Delta H^\circ_{f0} = 32.8$ kJ mol^{-1} (7.8 kcal mol^{-1})**		
Cs^-	$6s^2\ ^1S_0$	0.4705±0.0015	LP	171
		0.40±0.30	HA	25
		$0.13^{+0.07}_{-0.06}$	CE	119
		>0.19	PI	158

6.2. The Negative Ion Table—Continued

Ion	State	Electron affinity (eV)	Method	Ref.
Ba^-				
Ba^-	$5d\ 6s^2\ {}^2D_{3/2}$	−0.54±0.10	HA	148
		−0.48±0.30	HA	25
La^-				
La^-	$5d^2\ 6s^2\ {}^3F_2$	0.44±0.10	HA	148
		0.55±0.30	HA	25
Hf^-				
Hf^-	$5d^3\ 6s^2\ {}^4F_{3/2}$	−0.78±0.10	HA	148
		−0.63±0.30	HA	25
Ta^-				
Ta^-	$5d^4\ 6s^2\ {}^5D_0$	0.8±0.3	SI	159
		−0.05±0.10	HA	148
		0.15±0.30	HA	25
W^-				
W^-	$5d^5\ 6s^2\ {}^6S_{5/2}$	0.5±0.3	SI	159, 165, 166
		0.98±0.10	HA	148
		1.23±0.30	HA	25
WO_3^-				
WO_3^-		3.6	T	167
HWO_4^-				
HWO_4^-		4.4	T	167
Re^-				
Re^-	$5d^6\ 6s^2\ {}^5D_4$	0.15±0.10	SI	159, 165
		0.09±0.10	HA	148
		0.38±0.30	HA	25
Os^-				
Os^-	$5d^7\ 6s^2\ {}^4F_{9/2}$	1.10±0.10	HA	148
		1.44±0.30	HA	25

6.2. The Negative Ion Table—Continued

Ion	State	Electron affinity (eV)	Method	Ref.
	Ir^-			
Ir^-	$5d^8\ 6s^2\ ^3F_4$	1.58±0.10	HA	148
		1.97±0.30	HA	25
	$Pt^-(^2D_{5/2})$ ΔH°_{f0} = 359.1 kJ mol^{-1} (85.8 kcal mol^{-1})			
Pt^-	$5d^9\ 6s^2\ ^2D_{5/2}$	2.128±0.002	LP	161
		2.12±0.10	HA	148
		2.56±0.30	HA	25
	PtN^-			
PtN^-		>0	OBS	161
	$Au^-(^1S_0)$ ΔH°_{f0} = 143.2 kJ mol^{-1} (34.2 kcal mol^{-1})			
Au^-	$5d^{10}\ 6s^2\ ^1S_0$	2.3086±0.0007	LP	161
		2.8±0.1	SI	149
		2.80±0.30	HA	25
	Hg^-			
Hg^-	$7s\ ^2S_{1/2}$	−0.19±0.30	HA	25
	$6p\ ^2P^\circ_{1/2}$	−0.67±0.30	HA	25
	Tl^-			
Tl^-	$6p^2\ ^3P_0$	0.5±0.1	ATT	168
		0.32±0.30	HA	25
		1.21	VA	150
		>0	OBS	120
	Pb^-			
Pb^-	$6p^3\ ^4S^\circ_{3/2}$	1.03±0.30	HA	25
		1.79	VA	150
		>0	OBS	122
	Bi^-			
Bi^-	$6p^4\ ^3P_2$	0.95±0.30	HA	25
		−0.34	VA	150
		>0	OBS	153

6.2. The Negative Ion Table—Continued

Ion	State	Electron affinity (eV)	Method	Ref.
		Bi_2^-		
Bi_2^-		>0	OBS	153
		Bi_3^-		
Bi_3^-		>0	OBS	153
		Po^-		
Po^-	$6p^5\ ^2P^\circ_{3/2}$	1.32±0.30	HA	25
		1.97	VA	150

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7. Auxiliary Thermochemistry

7.1. Introduction

In this section are given the auxiliary heats of formation of the species on which the ionic heats of formation are based. In contrast to the previous edition (NSRDS-NBS 26) we list only values based on analysis of experimental thermochemical information and no longer include estimated heats of formation based on empirical correlation schemes. As noted in section 3.3 we have striven wherever possible to calculate ΔH°_{f0} rather than ΔH°_{f298} in the belief that the ionization experiments are more easily relatable to the former quantity, even if only approximately. However, where only ΔH°_{f298} is available it has been used to arrive at room temperature heats of formation. For the convenience of the reader both absolute zero and room temperature heats of formation have been tabulated, and are given both in kJ mol^{-1} and kcal mol^{-1}. Further, no attempt has been made to further modify or refine the evaluations embodied in the source material used here. We are aware of occasional significant differences among the three sources of heats of formation for organic molecules. We have arbitrarily chosen the values given in order of decreasing preference in NBS Technical Note 270-3 [1], the compilation of Stull, Westrum, and Sinke [2] and the compilation of Cox and Pilcher [3]. As for heats of formation of radicals we have emphasized the use of heats of formation obtained by non-mass spectrometric methods in order to minimize circular reasoning.

The compounds are listed in order of increasing complexity and increasing atomic number, as in the ion tables.

References for Section 7.1

[1] Wagman, D. D., Evans, W. H., Parker, V. B., Halow, I., Bailey, S. M., and Schumm, R. H., Selected Values of Chemical Thermodynamic Properties. Tables for the First Thirty-Four Elements in the Standard Order of Arrangement, NBS Tech. Note 270–3 (U.S. Government Printing Office, Washington, D.C., 1968).

[2] Stull, D. R., Westrum, E. F., Jr., and Sinke, G. C., The Chemical Thermodynamics of Organic Compounds (John Wiley and Sons, New York, 1969).

[3] Cox, J. D., and Pilcher, G., Thermochemistry of Organic and Organometallic Compounds (Academic Press, New York, 1970).

7.2. Table of Auxiliary Heats of Formation

Empirical formula	Description	$\Delta H f^\circ_0$(g) (kJ mol^{-1})	$\Delta H f^\circ_{298}$(g) (kJ mol^{-1})	$\Delta H f^\circ_0$(g) (kcal mol^{-1})	$\Delta H f^\circ_{298}$(g) (kcal mol^{-1})	Ref.
H	H	216.003	217.965	51.626	52.095	1
D	D	219.760	221.673	52.524	52.981	1
H^-	H^-	143.22		34.23		6
Li	Li	159.134	160.71	38.034	38.41	11
Be	Be	320.03	324.3	76.49	77.5	4
B	B	557.64	562.7	133.28	134.5	1
BH	BH	446.4	449.61	106.7	107.46	1
B_2H_6	B_2H_6	51.42	35.6	12.29	8.5	1
C	C	711.20	716.682	169.98	171.291	1
C^-	C^-	588.65		140.69		6
C_2	C_2	829.3	837.6	198.2	200.2	11
C_3	C_3	812	820	194	196	11
CH	CH	592.5	595.8	141.6	142.4	1
CH_2	CH_2	392.9	392.0	93.9	93.7	1
CH_3	CH_3	145.6	142.3	34.8	34.0	12
CH_4	CH_4	−66.818	−74.81	−15.970	−17.88	1
C_2H	C_2H	474.0	477	113.3	114	11
C_2H_2	C_2H_2	227.292	226.73	54.324	54.19	1
C_2H_4	C_2H_4	60.731	52.26	14.515	12.49	1
C_2H_5	C_2H_5		107.5		25.7	9
C_2H_6	C_2H_6	−69.132	−84.68	−16.523	−20.24	1
C_3H_3	$CH_2C{\equiv}CH$		337.6		80.7	14
C_3H_4	$CH_2{=}C{=}CH_2$		192.13		45.92	7
C_3H_4	$CH_3C{\equiv}CH$		185.43		44.32	7
C_3H_4	Cyclopropene		276.1		66.0	7
C_3H_5	$CH_2{=}CHCH_2$		169.9		40.6	9
C_3H_6	$CH_3CH{=}CH_2$		20.42		4.88	7
C_3H_6	Cyclopropane		53.30		12.74	7
C_3H_7	*n*–C_3H_7		86.6		20.7	9
C_3H_7	*iso*–C_3H_7		73.6		17.6	9
C_3H_8	C_3H_8		−103.85		−24.82	7
C_4H_2	$CH{\equiv}CC{\equiv}CH$		472.79		113.00	7
C_4H_6	$CH_3CH{=}C{=}CH_2$		162.21		38.77	7
C_4H_6	$CH_2{=}CHCH{=}CH_2$		110.16		26.33	7
C_4H_6	$C_2H_5C{\equiv}CH$		165.18		39.48	7
C_4H_6	$CH_3C{\equiv}CCH_3$		146.31		34.97	7
C_4H_6	Cyclobutene		129.70		31.00	7
C_4H_7	$CH_3CHCH{=}CH_2$		127.6		30.5	9
C_4H_8	1–C_4H_8		−0.13		−0.03	7
C_4H_8	*cis*–2–C_4H_8		−6.99		−1.67	7
C_4H_8	*trans*–2–C_4H_8		−11.17		−2.67	7
C_4H_8	*iso*–C_4H_8		−16.90		−4.04	7
C_4H_8	Cyclobutane		26.65		6.37	7
C_4H_9	*n*–C_4H_9		65.7		15.7	9
C_4H_9	*sec*–C_4H_9		52.7		12.6	9
C_4H_9	*iso*–C_4H_9		57.3		13.7	9
C_4H_9	*tert*–C_4H_9		28.5		6.8	9
C_4H_{10}	*n*–C_4H_{10}		−126.15		−30.15	7
C_4H_{10}	*iso*–C_4H_{10}		−134.52		−32.15	7
C_5H_6	Cyclopentadiene		133.89		32.00	7
C_5H_8	*cis*–$CH_2{=}CHCH{=}CHCH_3$		78.24		18.70	7
C_5H_8	*trans*–$CH_2{=}CHCH{=}CHCH_3$		77.82		18.60	7
C_5H_8	$CH_2{=}C(CH_3)CH{=}CH_2$		75.73		18.10	7
C_5H_8	Cyclopentene		32.93		7.87	7
C_5H_8	Spiropentane		185.23		44.27	7
C_5H_{10}	$CH_3CH_2CH_2CH{=}CH_2$		−20.92		−5.00	7
C_5H_{10}	*trans*–$C_2H_5CH{=}CHCH_3$		−31.76		−7.59	7
C_5H_{10}	$(CH_3)_2CHCH{=}CH_2$		−28.95		−6.92	7
C_5H_{10}	$C_2H_5C(CH_3){=}CH_2$		−36.32		−8.68	7

7.2. Table of Auxiliary Heats of Formation—Continued

Empirical formula	Description	ΔH_{f0}°(g) (kJ mol^{-1})	ΔH_{f298}°(g) (kJ mol^{-1})	ΔH_{f0}°(g) (kcal mol^{-1})	ΔH_{f298}°(g) (kcal mol^{-1})	Ref.
C_5H_{10}	$(CH_3)_2C{=}CHCH_3$		−42.55		−10.17	7
C_5H_{10}	Cyclopentane		−77.24		−18.46	7
C_5H_{12}	*n*−C_5H_{12}		−146.44		−35.00	7
C_5H_{12}	*iso*−C_5H_{12}		−154.47		−36.92	7
C_5H_{12}	*neo*−C_5H_{12}		−165.98		−39.67	7
C_6H_6	Benzene		82.93		19.82	7
C_6H_8	1,3−Cyclohexadiene		108.4		25.9	7
C_6H_{10}	$CH_2{=}C(CH_3)C(CH_3){=}CH_2$		47.7		11.4	7
C_6H_{10}	1−Methylcyclopentene		−5.4		−1.3	7
C_6H_{10}	Cyclohexene		−5.36		−1.28	7
C_6H_{12}	1−C_6H_{12}		−41.67		−9.96	7
C_6H_{12}	*trans*−3−C_6H_{12}		−54.43		−13.01	7
C_6H_{12}	$(CH_3)_3CCH{=}CH_2$		−43.14		−10.31	7
C_6H_{12}	$(CH_3)_2C{=}C(CH_3)_2$		−59.20		−14.15	7
C_6H_{12}	Cyclohexane		−123.14		−29.43	7
C_6H_{14}	*n*−C_6H_{14}		−167.19		−39.96	7
C_6H_{14}	*iso*−C_6H_{14}		−174.31		−41.66	7
C_6H_{14}	$(C_2H_5)_2CHCH_3$		−171.63		−41.02	7
C_6H_{14}	$C_2H_5C(CH_3)_3$		−185.56		−44.35	7
C_6H_{14}	$(CH_3)_2CHCH(CH_3)_2$		−177.78		−42.49	7
C_7H_8	Toluene		50.00		11.95	7
C_7H_8	Cycloheptatriene		181.88		43.47	7
C_7H_{12}	Cycloheptene		−9.33		−2.23	7
C_7H_{14}	Methylcyclohexane		−154.77		−36.99	7
C_7H_{16}	*n*−C_7H_{16}		−187.78		−44.88	7
C_8H_6	Ethynylbenzene		327.27		78.22	7
C_8H_8	Ethenylbenzene		147.36		35.22	7
C_8H_8	Cyclooctatetraene		298.02		71.23	7
C_8H_{10}	Ethylbenzene		29.79		7.12	7
C_8H_{10}	1,2−Dimethylbenzene		19.00		4.54	7
C_8H_{10}	1,3−Dimethylbenzene		17.24		4.12	7
C_8H_{10}	1,4−Dimethylbenzene		17.95		4.29	7
C_8H_{16}	1−C_8H_{16}		−82.93		−19.82	7
C_8H_{18}	*n*−C_8H_{18}		−208.45		−49.82	7
C_8H_{18}	$(CH_3)_2CHCH_2C(CH_3)_3$		−224.14		−53.57	7
C_9H_8	Indene		163.34		39.04	8
C_9H_{10}	Isopropenylbenzene		112.97		27.00	7
C_9H_{12}	Propylbenzene		7.82		1.87	7
C_9H_{12}	Isopropylbenzene		3.93		0.94	7
C_9H_{12}	1,2,3−Trimethylbenzene		−9.58		−2.29	7
C_9H_{12}	1,2,4−Trimethylbenzene		−13.93		−3.33	7
C_9H_{12}	1,3,5−Trimethylbenzene		−16.07		−3.84	7
C_9H_{20}	*n*−C_9H_{20}		−229.03		−54.74	7
$C_{10}H_8$	Naphthalene		150.96		36.08	7
$C_{10}H_8$	Azulene		279.91		66.90	7
$C_{10}H_{14}$	Butylbenzene		−13.81		−3.30	7
$C_{10}H_{14}$	*sec*−Butylbenzene		−17.45		−4.17	7
$C_{10}H_{14}$	Isobutylbenzene		−21.55		−5.15	7
$C_{10}H_{14}$	*tert*−Butylbenzene		−22.68		−5.42	7
$C_{10}H_{14}$	1,2,4,5−Tetramethylbenzene		−45.27		−10.82	7
$C_{10}H_{18}$	*cis*−Decalin		−168.95		−40.38	7
$C_{10}H_{18}$	*trans*−Decalin		−182.30		−43.57	7
$C_{11}H_{10}$	1−Methylnaphthalene		116.86		27.93	7
$C_{11}H_{10}$	2−Methylnaphthalene		116.11		27.75	7
$C_{11}H_{16}$	Pentamethylbenzene		−74.48		−17.80	7
$C_{12}H_8$	Biphenylene		482.0		115.2	7
$C_{12}H_8$	Acenaphthylene		258.2		61.7	7
$C_{12}H_{10}$	Biphenyl		182.09		43.52	7
$C_{12}H_{10}$	Acenaphthene		156.5		37.4	7

7.2. Table of Auxiliary Heats of Formation—Continued

Empirical formula	Description	ΔH°_{f0}(g) (kJ mol^{-1})	ΔH°_{f298}(g) (kJ mol^{-1})	ΔH°_{f0}(g) (kcal mol^{-1})	ΔH°_{f298}(g) (kcal mol^{-1})	Ref.
$C_{12}H_{12}$	1,4–Dimethylnaphthalene		82.51		19.72	7
$C_{12}H_{12}$	2,3–Dimethylnaphthalene		83.55		19.97	7
$C_{12}H_{18}$	Hexamethylbenzene		−105.69		−25.26	7
$C_{14}H_{10}$	Anthracene		230.83		55.17	7
$C_{14}H_{10}$	Phenanthrene		206.94		49.46	7
$C_{16}H_{10}$	Fluoranthene		294.6		70.4	7
N	N	470.842	472.704	112.534	112.979	1
NH	NH	331	331	79	79	1
NH_2	NH_2		172		41	1
NH_3	NH_3	−39.08	−46.11	−9.34	−11.02	1
N_3H	HN_3	300.49	294.1	71.82	70.3	1
CN	CN	431.8	435.1	103.2	104.0	11
C_2N_2	C_2N_2	307.047	308.95	73.386	73.84	1
CHN	HCN	135.52	135.1	32.39	32.3	1
CH_5N	CH_3NH_2		−22.97		−5.49	1
C_2H_2N	CH_2CN		213.8		51.1	9
C_2H_3N	CH_3CN	94.47	87.4	22.58	20.9	1
C_2H_3N	CH_3NC	155.44	149.0	37.15	35.6	1
C_2H_5N	Ethylenimine		126.4		30.2	1
C_2H_7N	$C_2H_5NH_2$		−47.15		−11.27	1
C_2H_7N	$(CH_3)_2NH$		−18.45		−4.41	1
C_3H_3N	$CH_2{=}CHCN$		184.93		44.20	7
C_3H_5N	C_2H_5CN		50.63		12.10	7
C_3H_9N	*n*–$C_3H_7NH_2$		−70.17		−16.77	8
C_3H_9N	*iso*–$C_3H_7NH_2$		−83.76		−20.02	8
C_3H_9N	$(CH_3)_3N$		−23.85		−5.70	7
C_4H_5N	Pyrrole		108.28		25.88	8
C_4H_7N	*n*–C_3H_7CN		34.06		8.14	7
$C_4H_{11}N$	*n*–$C_4H_9NH_2$		−92.05		−22.00	7
$C_4H_{11}N$	*sec*–$C_4H_9NH_2$		−104.18		−24.90	7
$C_4H_{11}N$	*tert*–$C_4H_9NH_2$		−119.87		−28.65	7
$C_4H_{11}N$	$(C_2H_5)_2NH$		−72.38		−17.30	7
C_5H_5N	Pyridine		140.16		33.50	7
C_6H_7N	Aniline		86.86		20.76	7
C_6H_7N	2–Methylpyridine		98.95		23.65	7
C_6H_7N	3–Methylpyridine		106.15		25.37	7
C_6H_7N	4–Methylpyridine		102.22		24.43	7
$C_6H_{15}N$	$(C_2H_5)_3N$		−99.58		−23.80	7
C_7H_5N	Benzoic acid nitrile		218.82		52.30	7
C_8H_7N	Indole		186.6		44.6	8
$C_{12}H_{11}N$	Diphenylamine		201.67		48.20	7
CH_2N_2	Diazomethane		192.5		46.0	7
$C_2H_8N_2$	$(CH_3)_2NNH_2$		84.43		20.18	1
$C_2H_8N_2$	$CH_3NHNHCH_3$		94.98		22.70	1
$C_3H_4N_2$	Pyrazole		181.2		43.3	7
$C_4H_4N_2$	1,2–Diazine		278.36		66.53	7
$C_4H_4N_2$	1,3–Diazine		196.61		46.99	7
$C_4H_4N_2$	1,4–Diazine		196.06		46.86	7
$C_6H_8N_2$	Phenylhydrazine		203.84		48.72	8
O	O	246.785	249.170	58.983	59.553	1
O^-	O^-	105.44		25.20		6
O_3	O_3	145.35	142.7	34.74	34.1	1
OH	OH	38.70	38.95	9.25	9.31	1
OD	OD	36.48	36.86	8.72	8.81	1
H_2O	H_2O	−238.915	−241.818	−57.102	−57.796	1
D_2O	D_2O	−246.249	−249.199	−58.855	−59.560	1
CO	CO	−113.801	−110.525	−27.199	−26.416	1
CO_2	CO_2	−393.141	−393.509	−93.963	−94.051	1
C_3O_2	C_3O_2	−96.82	−93.64	−23.14	−22.38	11

7.2. Table of Auxiliary Heats of Formation—Continued

Empirical formula	Description	$\Delta H f^\circ_0(g)$ (kJ mol^{-1})	$\Delta H f^\circ_{298}(g)$ (kJ mol^{-1})	$\Delta H f^\circ_0(g)$ (kcal mol^{-1})	$\Delta H f^\circ_{298}(g)$ (kcal mol^{-1})	Ref.
NO	NO	89.75	90.25	21.45	21.57	1
N_2O	N_2O	85.500	82.05	20.435	19.61	1
NO_2	NO_2	35.98	33.18	8.60	7.93	1
CH_2O	HCHO	−113.4	−117	−27.1	−28	1
CH_4O	CH_3OH	−189.765	−200.66	−45.355	−47.96	1
C_2H_2O	$CH_2{=}CO$	−57.99	−61.1	−13.86	−14.6	1
C_2H_3O	CH_3CO		−22.6		−5.4	9
C_2H_4O	CH_3CHO	−155.39	−166.19	−37.14	−39.72	1
C_2H_4O	1,2–Epoxyethane	−40.120	−52.63	−9.589	−12.58	1
C_2H_6O	C_2H_5OH	−217.438	−235.10	−51.969	−56.19	1
C_2H_6O	$(CH_3)_2O$	−166.293	−184.05	−39.745	−43.99	1
C_3H_6O	C_2H_5CHO		−192.05		−45.90	7
C_3H_6O	$(CH_3)_2CO$		−217.57		−52.00	7
C_3H_6O	1,2–Epoxypropane		−92.76		−22.17	7
C_3H_6O	1,3–Epoxypropane		−80.54		−19.25	7
C_3H_8O	*n*–C_3H_7OH	−233.09	−257.53	−55.71	−61.55	7, 10
C_3H_8O	*iso*–C_3H_7OH	−248.24	−272.59	−59.33	−65.15	7, 10
C_4H_4O	Furan		−34.69		−8.29	7
C_4H_6O	$CH_3CH{=}CHCHO$		−100.54		−24.03	8
C_4H_8O	*n*–C_3H_7CHO		−205.02		−49.00	7
C_4H_8O	*iso*–C_3H_7CHO		−218.61		−52.25	8
C_4H_8O	$C_2H_5COCH_3$		−238.36		−56.97	7
C_4H_8O	1,4–Epoxybutane		−184.22		−44.03	7
$C_4H_{10}O$	*n*–C_4H_9OH	−246.02	−274.43	−58.80	−65.59	7, 10
$C_4H_{10}O$	*iso*–C_4H_9OH		−283.84		−67.84	8
$C_4H_{10}O$	*tert*–C_4H_9OH	−282.13	−325.81	−67.43	−77.87	7, 10
$C_4H_{10}O$	$(C_2H_5)_2O$		−252.21		−60.28	7
C_5H_8O	Cyclopentanone		−192.59		−46.03	8
C_5H_8O	Dihydropyran		−125.1		−29.9	8
$C_5H_{10}O$	*n*–C_4H_9CHO		−227.82		−54.45	7
$C_5H_{10}O$	*n*–$C_3H_7COCH_3$		−258.65		−61.82	7
$C_5H_{10}O$	*iso*–$C_3H_7COCH_3$		−262.59		−62.76	8
$C_5H_{10}O$	$(C_2H_5)_2CO$		−258.65		−61.82	7
$C_5H_{10}O$	1,5–Epoxypentane		−223.84		−53.50	7
C_6H_6O	Phenol		−96.36		−23.03	7
$C_6H_{10}O$	Cyclohexanone		−230.12		−55.00	7
$C_6H_{12}O$	*n*–$C_4H_9COCH_3$		−279.78		−66.87	8
$C_6H_{12}O$	*tert*–$C_4H_9COCH_3$		−289.87		−69.28	8
$C_6H_{14}O$	(*n*–$C_3H_7)_2O$		−292.88		−70.00	7
$C_6H_{14}O$	(*iso*–$C_3H_7)_2O$		−318.82		−76.20	7
C_7H_8O	Methoxybenzene		−72.26		−17.27	8
$C_7H_{12}O$	Cycloheptanone		−247.3		−59.1	8
$C_7H_{14}O$	(*iso*–$C_3H_7)_2CO$		−311.29		−74.40	8
C_8H_8O	Acetophenone		−86.86		−20.76	7
$C_8H_{10}O$	Ethoxybenzene		−110.0		−26.3	8
$C_8H_{18}O$	(*tert*–$C_4H_9)_2O$		−364.84		−87.20	7
$C_9H_{18}O$	(*tert*–$C_4H_9)_2CO$		−345.77		−82.64	8
$C_{12}H_8O$	Dibenzofuran		83.3		19.9	8
CH_2O_2	HCOOH		−378.57		−90.48	1
$C_2H_4O_2$	CH_3COOH	−418.283	−432.25	−99.972	−103.31	1
$C_2H_4O_2$	$HCOOCH_3$		−350.2		−83.7	1
$C_3H_4O_2$	3–Hydroxypropanoic acid lactone		−282.88		−67.61	7
$C_3H_6O_2$	C_2H_5COOH		−453.5		−108.4	8
$C_3H_6O_2$	$HCOOC_2H_5$		−371.29		−88.74	7
$C_3H_6O_2$	CH_3COOCH_3		−409.6		−97.9	7
$C_3H_8O_2$	$(CH_3O)_2CH_2$		−348.40		−83.27	8
$C_4H_6O_2$	$CH_3COCOCH_3$		−327.19		−78.20	8
$C_4H_6O_2$	$CH_3COOCH{=}CH_2$		−315.72		−75.46	8

7.2. Table of Auxiliary Heats of Formation—Continued

Empirical formula	Description	ΔHf°_0(g) (kJ mol^{-1})	ΔHf°_{298}(g) (kJ mol^{-1})	ΔHf°_0(g) (kcal mol^{-1})	ΔHf°_{298}(g) (kcal mol^{-1})	Ref.
$C_4H_8O_2$	n–C_3H_7COOH		–470.3		–112.4	8
$C_4H_8O_2$	$CH_3COOC_2H_5$		–442.92		–105.86	7
$C_4H_8O_2$	1,4–Dioxane		–315.06		–75.30	7
$C_4H_{10}O_2$	$(CH_3O)_2CHCH_3$		–390.20		–93.26	8
$C_5H_4O_2$	Furfural		–151.0		–36.1	8
$C_5H_8O_2$	$CH_3COCH_2COCH_3$		–378.53		–90.47	8
$C_5H_{10}O_2$	$CH_3COOCH(CH_3)_2$		–481.66		–115.12	8
$C_5H_{10}O_2$	$C_2H_5COOC_2H_5$		–425.5		–101.7	8
$C_6H_4O_2$	1,4–Benzoquinone		–118.4		–28.3	7
$C_6H_{12}O_2$	$CH_3COO(CH_2)_3CH_3$		–485.76		–116.10	8
$C_4H_6O_3$	$CH_3COOCOCH_3$		–575.72		–137.60	7
CH_3NO	$HCONH_2$		–186.2		–44.5	7
C_3H_7NO	$HCON(CH_3)_2$		–191.6		–45.8	8
$C_6H_{11}NO$	6–Aminohexanoic acid lactam		–246.0		–58.8	8
CH_3NO_2	CH_3NO_2	–60.860	–74.73	–14.546	–17.86	1
$C_2H_5NO_2$	$C_2H_5NO_2$		–98.58		–23.56	1
$C_2H_5NO_2$	C_2H_5ONO		–104.2		–24.9	1
$C_3H_7NO_2$	n–$C_3H_7NO_2$		–124.68		–29.80	7
$C_3H_7NO_2$	iso–$C_3H_7NO_2$		–140.16		–33.50	7
$C_4H_9NO_2$	n–$C_4H_9NO_2$		–143.93		–34.40	7
$C_4H_9NO_2$	sec–$C_4H_9NO_2$		–163.59		–39.10	7
CH_3NO_3	CH_3ONO_2		–124.7		–29.8	1
$C_3H_7NO_3$	n–$C_3H_7ONO_2$		–174.05		–41.60	7
F	F	76.90	78.99	18.38	18.88	1
F^-	F^-	–251.17		–60.03		6
HF	HF	–271.077	–271.1	–64.789	–64.8	1
BF	BF	–125.23	–122.2	–29.93	–29.2	1
BF_3	BF_3	–1134.207	–1137.00	–271.082	–271.75	1
B_2F_4	B_2F_4	–1437.12	–1440.1	–343.48	–344.2	1
CF	CF	251.5	255	60.1	61	11
CF_2	CF_2	–182.4	–182.0	–43.6	–43.5	11
CF_3	CF_3	–467.4	–470.3	–111.7	–112.4	11
CF_4	CF_4	–927.22	–933.20	–221.61	–223.04	11
C_2F_4	C_2F_4	–655.2	–658.6	–156.6	–157.4	11
C_2F_6	C_2F_6	–1335.5	–1343.9	–319.2	–321.2	11
C_6F_6	Hexafluorobenzene		–956.63		–228.64	7
C_3F_8	C_3F_8		–1748.5		–417.9	7
C_4F_{10}	n–C_4F_{10}		–2158.9		–516.0	7
NF_2	NF_2	45.69	43.1	10.92	10.3	1
NF_3	NF_3	–118.95	–124.7	–28.43	–29.8	1
N_2F_4	N_2F_4	3.68	–7.1	0.88	–1.7	1
OF_2	OF_2	–19.7	–21.8	–4.7	–5.2	1
CH_3F	CH_3F		–233.89		–55.90	7
C_6H_5F	Fluorobenzene		–116.57		–27.86	7
C_7H_7F	4–Fluorotoluene		–148.03		–35.38	7
CH_2F_2	CH_2F_2	–439.19	–446.9	–104.97	–106.8	1
$C_2H_2F_2$	$CH_2{=}CF_2$	–321.96	–328.9	–76.95	–78.6	1
$C_6H_4F_2$	1,2–Difluorobenzene		–294.51		–70.39	7
$C_6H_4F_2$	1,4–Difluorobenzene		–307.23		–73.43	7
CHF_3	CHF_3	–681.32	–688.3	–162.84	–164.5	1
C_2HF_3	C_2HF_3		–495.80		–118.50	7
$C_7H_5F_3$	α,α,α–Trifluorotoluene		–600.07		–143.42	7
C_6HF_5	Pentafluorobenzene		–806.05		–192.65	8
CNF	FCN	23.4		5.6		16
Na	Na	108.010	107.759	25.815	25.755	11
Na_2	Na_2	140.026	137.53	33.467	32.87	11
Mg	Mg	146.499	147.70	35.014	35.30	4
Al	Al	324.01	326.4	77.44	78.0	1
Si	Si	451.29	455.6	107.86	108.9	1

7.2. Table of Auxiliary Heats of Formation—Continued

Empirical formula	Description	$\Delta H f^{\circ}_{0}(g)$ (kJ mol^{-1})	$\Delta H f^{\circ}_{298}(g)$ (kJ mol^{-1})	$\Delta H f^{\circ}_{0}(g)$ (kcal mol^{-1})	$\Delta H f^{\circ}_{298}(g)$ (kcal mol^{-1})	Ref.
SiH_4	SiH_4	43.10	34.3	10.30	8.2	1
SiO	SiO	−100.75	−99.6	−24.08	−23.8	1
SiF	SiF	4	7.1	1	1.7	1
SiF_4	SiF_4	−1609.42	−1614.94	−384.66	−385.98	1
$C_4H_{12}Si$	$(CH_3)_4Si$		−239.111		−57.149	1
P	P	314	314.64	75	75.20	1
P_4	P_4	66.23	58.91	15.83	14.08	1
PH_2	PH_2	128.0	125.9	30.6	30.1	11
PH_3	PH_3	13.39	5.4	3.20	1.3	1
PF_3	PF_3	−913.16	−918.8	−218.25	−219.6	1
$C_{18}H_{15}P$	Triphenylphosphine		328.4		78.5	8
POF_3	POF_3	−1202.44	−1211.3	−287.39	−289.5	1
S	S	276.6	278.805	66.1	66.636	1
S_2	S_2	128.227	128.37	30.647	30.68	1
S_3	S_3		132.6		31.7	1
S_4	S_4		136.8		32.7	1
S_5	S_5		123.8		29.6	1
S_6	S_6		102.5		24.5	1
S_7	S_7		113.4		27.1	1
S_8	S_8	106.06	102.30	25.35	24.45	1
HS	HS	142	142.67	34	34.10	1
H_2S	H_2S	−17.707	−20.63	−4.232	−4.93	1
CS	CS	269.4		64.4		15
CS_2	CS_2	116.57	117.36	27.86	28.05	1
SO	SO	6.3	6.259	1.5	1.496	1
SO_2	SO_2	−294.286	−296.830	−70.336	−70.944	1
SF_4	SF_4	−767.3	−774.9	−183.4	−185.2	1
SF_6	SF_6	−1195.4	−1209	−285.7	−289	1
CH_4S	CH_3SH	−12.071	−22.34	−2.885	−5.34	1
C_2H_6S	C_2H_5SH	−29.037	−45.81	−6.940	−10.95	1
C_2H_6S	$(CH_3)_2S$	−21.058	−37.24	−5.033	−8.90	1
C_3H_6S	Trimethylene sulfide		61.13		14.61	7
C_3H_8S	$n\text{–}C_3H_7SH$		−67.86		−16.22	7
C_3H_8S	$C_2H_5SCH_3$		−59.62		−14.25	7
C_4H_4S	Thiophene		115.73		27.66	7
$C_4H_{10}S$	$n\text{–}C_4H_9SH$		−88.07		−21.05	7
$C_4H_{10}S$	$(C_2H_5)_2S$		−83.47		−19.95	7
C_5H_6S	2–Methylthiophene		83.68		20.00	7
C_5H_6S	3–Methylthiophene		82.80		19.79	7
C_6H_6S	Mercaptobenzene		111.55		26.66	7
$C_6H_{14}S$	$(n\text{–}C_3H_7)_2S$		−125.35		−29.96	7
COS	COS	−142.218	−142.09	−33.991	−33.96	1
CHNS	HNCS		127.6		30.5	1
C_2H_3NS	CH_3SCN		160.2		38.3	1
C_2H_3NS	CH_3NCS	140.00	131.0	33.46	31.3	1
C_2H_4OS	CH_3COSH		−181.96		−43.49	7
Cl	Cl	120.00	121.679	28.68	29.082	1
Cl^-	Cl^-	−228.61		−54.64		6
HCl	HCl	−92.132	−92.307	−22.020	−22.062	1
BCl_3	BCl_3	−402.84	−403.76	−96.28	−96.50	1
B_2Cl_4	B_2Cl_4	−489.90	−490.4	−117.09	−117.2	1
CCl_4	CCl_4	−100.75	−102.9	−24.08	−24.6	1
C_2Cl_4	C_2Cl_4	−11.30	−12.1	−2.70	−2.9	1
Cl_2O	Cl_2O	82.47	80.3	19.71	19.2	1
ClF	ClF	−54.4	−54.48	−13.0	−13.02	1
NaCl	NaCl	−180.00	−181.42	−43.02	−43.36	11
$SiCl_4$	$SiCl_4$	−654.829	−657.01	−156.508	−157.03	1
CH_3Cl	CH_3Cl	−72.910	−80.83	−17.426	−19.32	1
C_2H_3Cl	C_2H_3Cl	43.14	35.6	10.31	8.5	1

7.2. Table of Auxiliary Heats of Formation—Continued

Empirical formula	Description	$\Delta H f^{\circ}_{0}$(g) (kJ mol^{-1})	$\Delta H f^{\circ}_{298}$(g) (kJ mol^{-1})	$\Delta H f^{\circ}_{0}$(g) (kcal mol^{-1})	$\Delta H f^{\circ}_{298}$(g) (kcal mol^{-1})	Ref.
C_2H_5Cl	C_2H_5Cl	−97.617	−112.17	−23.331	−26.81	1
C_3H_7Cl	*n*−C_3H_7Cl		−130.12		−31.10	7
C_3H_7Cl	*iso*−C_3H_7Cl		−146.44		−35.00	7
C_4H_9Cl	*n*−C_4H_9Cl		−147.28		−35.20	7
C_4H_9Cl	*sec*−C_4H_9Cl		−161.50		−38.60	7
C_4H_9Cl	*iso*−C_4H_9Cl		−159.41		−38.10	7
C_4H_9Cl	*tert*−C_4H_9Cl		−183.26		−43.80	7
C_6H_5Cl	Chlorobenzene		51.84		12.39	7
C_7H_7Cl	α−Chlorotoluene		18.8		4.5	8
CH_2Cl_2	CH_2Cl_2	−85.613	−92.47	−20.462	−22.10	1
$C_2H_2Cl_2$	$CH_2{=}CCl_2$	8.401	2.43	2.008	0.58	1
$C_2H_2Cl_2$	*cis*−CHCl=CHCl	9.749	3.77	2.330	0.90	1
$C_2H_2Cl_2$	*trans*−CHCl=CHCl	11.556	6.15	2.762	1.47	1
$C_2H_4Cl_2$	CH_2ClCH_2Cl	−118.646	−129.79	−28.357	−31.02	1
$C_6H_4Cl_2$	1,2−Dichlorobenzene		29.96		7.16	7
$C_6H_4Cl_2$	1,3−Dichlorobenzene		26.44		6.32	7
$C_6H_4Cl_2$	1,4−Dichlorobenzene		23.01		5.50	7
$CHCl_3$	$CHCl_3$	−98.265	−103.14	−23.486	−24.65	1
C_2HCl_3	C_2HCl_3	−4.318	−7.78	−1.032	−1.86	1
CNCl	ClCN	137.252	137.95	32.804	32.97	1
CF_3Cl	CF_3Cl	−689.5	−695	−164.8	−166	1
C_2F_3Cl	C_2F_3Cl	−552.46	−555.2	−132.04	−132.7	1
CF_2Cl_2	CF_2Cl_2	−472.8	−477	−113.0	−114	1
$C_2F_2Cl_2$	$CF_2{=}CCl_2$		−319.2		−76.3	1
$CFCl_3$	$CFCl_3$	−272.8	−276	−65.2	−66	1
$C_2F_3Cl_3$	$CFCl_2CF_2Cl$		−759.4		−181.5	1
C_2H_3OCl	CH_3COCl	−234.530	−243.51	−56.054	−58.20	1
C_3H_5OCl	1−Chloro−2,3−epoxypropane		−107.9		−25.8	8
CHF_2Cl	CHF_2Cl	−475.3	−481.6	−113.6	−115.1	11
C_2HF_2Cl	$CF_2{=}CHCl$	−310.66	−315.5	−74.25	−75.4	1
K	K	90.048	89.16	21.522	21.31	11
Ca	Ca	177.74	178.2	42.48	42.6	4
Sc	Sc	376.02	377.8	89.87	90.3	3
Ti	Ti	467.14	469.9	111.65	112.3	3
V	V	510.95	514.21	122.12	122.90	3
Cr	Cr	394.51	396.6	94.29	94.8	2
CrC_6O_6	$Cr(CO)_6$		−1005.8		−240.4	2
Mn	Mn	279.37	280.7	66.77	67.1	2
Fe	Fe	413.96	416.3	98.94	99.5	2
FeC_5O_5	$Fe(CO)_5$		−733.9		−175.4	2
Co	Co	423.082	424.7	101.119	101.5	2
Ni	Ni	427.659	429.7	102.213	102.7	2
NiC_4O_4	$Ni(CO)_4$	−606.165	−602.91	−144.877	−144.10	2
Cu	Cu	337.15	338.32	80.58	80.86	2
Zn	Zn	130.181	130.729	31.114	31.245	1
C_2H_6Zn	$(CH_3)_2Zn$		53.01		12.67	1
Ga	Ga	276	277.0	66	66.2	1
Ge	Ge	373.80	376.6	89.34	90.0	1
GeH_4	GeH_4	79.96	90.8	19.11	21.7	1
GeO	GeO	−46	−46.19	−11	−11.04	1
$GeCl_4$	$GeCl_4$	−493.96	−495.8	−118.06	−118.5	1
As	As	301.42	302.5	72.04	72.3	1
AsH_3	AsH_3	74.06	66.44	17.70	15.88	1
$AsCl_3$	$AsCl_3$	−259.91	−261.5	−62.12	−62.5	1
$C_{18}H_{15}As$	Triphenylarsine		408.4		97.6	8
Se	Se	226.40	227.07	54.11	54.27	1
Se_2	Se_2	147.53	146.0	35.26	34.9	1
H_2Se	H_2Se	33.68	29.7	8.05	7.1	1
Br	Br	117.943	111.884	28.189	26.741	1

7.2. Table of Auxiliary Heats of Formation—Continued

Empirical formula	Description	$\Delta H_{f0}^{\circ}(g)$ (kJ mol^{-1})	$\Delta H_{f298}^{\circ}(g)$ (kJ mol^{-1})	$\Delta H_{f0}^{\circ}(g)$ (kcal mol^{-1})	$\Delta H_{f298}^{\circ}(g)$ (kcal mol^{-1})	Ref.
Br^-	Br^-	-206.82		-49.43		6
Br_2	Br_2	45.702	30.907	10.923	7.387	1
HBr	HBr	-28.560	-36.40	-6.826	-8.70	1
BBr_3	BBr_3	-183.38	-205.64	-43.83	-49.15	1
CH_3Br	CH_3Br	-19.75	-35.1	-4.72	-8.4	1
C_2H_3Br	$CH_2=CHBr$	93.14	78.2	22.26	18.7	1
C_2H_5Br	C_2H_5Br	-42.627	-64.52	-10.188	-15.42	1
C_3H_7Br	*n*-C_3H_7Br		-87.86		-21.00	7
C_3H_7Br	*iso*-C_3H_7Br		-97.07		-23.20	7
C_4H_9Br	*n*-C_4H_9Br		-107.32		-25.65	7
C_4H_9Br	*sec*-C_4H_9Br		-120.08		-28.70	7
C_4H_9Br	*tert*-C_4H_9Br		-133.89		-32.00	7
$C_5H_{11}Br$	*n*-$C_5H_{11}Br$		-129.16		-30.87	7
C_6H_5Br	Bromobenzene		105.02		25.10	7
CH_2Br_2	CH_2Br_2		-4.2		-1.0	7
$CHBr_3$	$CHBr_3$	42.84	17	10.24	4	1
CNBr	BrCN	192.76	186.2	46.07	44.5	1
CF_3Br	CF_3Br	-630.61	-642.7	-150.72	-153.6	1
CH_2ClBr	CH_2ClBr		-50.2		-12.0	7
$CHClBr_2$	$CHClBr_2$		-20.9		-5.0	7
Sr	Sr		164.4		39.3	4
Y	Y	420.45	421.3	100.49	100.7	3
Zr	Zr	607.47	608.8	145.19	145.5	3
Nb	Nb	722.819	725.9	172.758	173.5	3
Mo	Mo	656.55	658.1	156.92	157.3	2
MoC_6O_6	$Mo(CO)_6$	-914.6	-912.1	-218.6	-218.0	2
Tc	Tc		678		162	2
Ru	Ru	641.031	642.7	153.210	153.6	2
Rh	Rh	555.59	556.9	132.79	133.1	2
Pd	Pd	377.4	378.2	90.2	90.4	2
Ag	Ag	284.09	284.55	67.90	68.01	2
Cd	Cd	112.05	112.01	26.78	26.77	1
C_2H_6Cd	$(CH_3)_2Cd$		101.55		24.27	1
In	In	243.72	243.30	58.25	58.15	1
Sn	Sn	302.00	302.1	72.18	72.2	1
$SnCl_4$	$SnCl_4$	-469.28	-471.5	-112.16	-112.7	1
Sb	Sb	262.04	262.3	62.63	62.7	1
SbH_3	SbH_3	153.239	145.105	36.625	34.681	1
$C_{18}H_{15}Sb$	Triphenylantimony		435.6		104.1	8
Te	Te	197	196.73	47	47.02	1
Te_2	Te_2	170.50	168.2	40.75	40.2	1
TeH_2	H_2Te		99.6		23.8	1
I	I	107.240	106.838	25.631	25.535	1
I^-	I^-	-187.90		-44.91		6
I_2	I_2	65.517	62.438	15.659	14.923	1
HI	HI	28.660	26.48	6.850	6.33	1
BI_3	BI_3	75	71.13	18	17.00	1
MgI_2	MgI_2		-172		-41	4
ICl	ICl	19.41	17.78	4.64	4.25	1
IBr	IBr	49.79	40.84	11.90	9.76	1
CH_3I	CH_3I	22.51	13.0	5.38	3.1	1
C_2H_5I	C_2H_5I	8.16	-7.70	1.95	-1.84	1
C_3H_7I	*n*-C_3H_7I		-30.54		-7.30	7
C_3H_7I	*iso*-C_3H_7I		-41.84		-10.00	7
C_4H_9I	*tert*-C_4H_9I		-73.64		-17.60	7
C_6H_5I	Iodobenzene		162.55		38.85	7
C_7H_7I	2-Iodotoluene		132.6		31.7	8
C_7H_7I	3-Iodotoluene		133.5		31.9	8
C_7H_7I	4-Iodotoluene		121.8		29.1	8

7.2. Table of Auxiliary Heats of Formation—Continued

Empirical formula	Description	ΔH°_{f0}(g) (kJ mol^{-1})	ΔH°_{f298}(g) (kJ mol^{-1})	ΔH°_{f0}(g) (kcal mol^{-1})	ΔH°_{f298}(g) (kcal mol^{-1})	Ref.
CNI	ICN	226.10	225.5	54.04	53.9	1
CF_3I	CF_3I	−583.2	−589.1	−139.4	−140.8	11
XeF_2	XeF_2	−117.2		−28.0		13
XeF_4	XeF_4	−241.0		−57.6		13
Cs	Cs	78.16	76.65	18.68	18.32	11
CsF	CsF	−354.0	−356.5	−84.6	−85.2	11
CsCl	CsCl	−238.1	−240.2	−56.9	−57.4	11
Ba	Ba	180.7	180	43.2	43	4
La	La	431.303		103.084		5
Ce	Ce	423.4		101.2		5
Pr	Pr	356.69		85.25		5
Nd	Nd	328.57		78.53		5
Sm	Sm	206.10		49.26		5
Eu	Eu	176.699		42.232		5
Gd	Gd	398.957		95.353		5
Tb	Tb	390.62		93.36		5
Dy	Dy	293.05		70.04		5
Ho	Ho	302.63		72.33		5
Er	Er	318.32		76.08		5
Tm	Tm	233.409		55.786		5
Yb	Yb	152.628		36.479		5
Lu	Lu	427.781		102.242		5
Ta	Ta	781.425	782.0	186.765	186.9	3
W	W	848.10	849.4	202.70	203.0	2
C_6O_6W	$W(CO)_6$		−871.5		−208.3	2
Re	Re	769.0	769.9	183.8	184.0	2
Os	Os		791		189	2
Ir	Ir	664.34	665.3	158.78	159.0	2
Pt	Pt	564.42	565.3	134.90	135.1	2
Au	Au	365.93	366.1	87.46	87.5	2
Hg	Hg	64.463	61.317	15.407	14.655	2
$HgCl_2$	$HgCl_2$		−146.294		−34.965	11
$HgBr_2$	$HgBr_2$		−85.454		−20.424	11
HgI_2	HgI_2	−10.88	−17.2	−2.60	−4.1	2
C_2H_6Hg	$(CH_3)_2Hg$		94.39		22.56	2
Tl	Tl	182.845	182.21	43.701	43.55	1
TlF	TlF		−182.4		−43.6	1
TlCl	TlCl		−67.8		−16.2	1
TlBr	TlBr		−37.7		−9.0	1
TlI	TlI		7.1		1.7	1
Pb	Pb	195.64	195.0	46.76	46.6	1
Bi	Bi	207.36	207.1	49.56	49.5	1
$C_{18}H_{15}Bi$	Triphenylbismuth		579.9		138.6	8

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Energetics of gaseous ions

H. M. Rosenstock, K. Draxl, B. W. Steiner, and J. T. Herron

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