Evaluated Bimolecular Ion-Molecule Gas Phase Kinetics of Positive Ions for Use in Modeling Planetary Atmospheres, Cometary Comae, and Interstellar Clouds

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Recommendations of reaction rate coefficients and product distributions for bimolecular positive ion-molecule reactions of importance in planetary atmospheres, cometary comae, and interstellar clouds are presented. Two publications Anicich and Huntress, Astrophys. J. Suppl. Ser. **62**, 553 (1986) and Anicich, Astrophys. J. Suppl. Ser. **84**, 215 (1993) served as the basis for this evaluation, which covers the literature from 1965 through 1991 with some additional citations missed in the original surveys.

Key words: evaluated results; ion-molecule reactions; positive ions; product distributions; reaction rate coefficients.

Contents

1. Introduction

Anicich and Huntress[1] published a comprehensive survey of bimolecular ion-molecule reaction kinetics in 1987, for use in modeling the chemistry of planetary atmospheres, cometary comae, and interstellar clouds. Then Anicich[2] published a supplement to that original survey of ion-molecule reaction kinetics, which extended the survey's coverage to include published data through 1991.

While these surveys cover a wide range of chemical species, the surveys are not complete. The chemical species reported were limited to those thought to be present as a result of ionic processes taking place in planetary atmospheres, cometary comae, and interstellar clouds. They also were limited to bimolecular positive ion-molecule reactions occurring at thermal energies below 1000 K. Over the years the number of species of interest has expanded. This reflects the increasing complexity of ions and neutrals that models and observations have shown to be present in these environments.

In the original surveys no attempt was made to evaluate the data on each reaction. The surveys included all citations on each reaction of interest. The majority of reactions have been reported only a single time. Thirty two percent of the reactions have been measured on the average of 3.17 times each. The following list of reactions have been measured more than ten times each.

H_3^+/N_2	He^+/N_2	He^+/O_2	N^+/H_2	N^+/O_2	N^+/CO
NH_3^+/H_2	N_2^+/H_2	N_2^+/O_2	O^+/N_2	O^+/O_2	O_2^+/CH_4
Ar^+/H_2	Ar^+/N_2	Ar^+/O_2	Ar^+/CO		

This illustrates the importance of these sixteen reactions in the Earth's atmosphere. Even in heavily studied reactions, there are many disagreements between the various investigations.

2. This Evaluation

The intent of this compilation is to present a ready source of *evaluated* gas phase kinetics data on bimolecular reactions between positive ions and neutrals. It is expected that this will be of interest to those researchers that only want a single set of data, without multiple entries. An example would be a modeler that needs a data base of kinetic data. Another example is a researcher that would like a short listing of the data without having to read over the whole history of the reactions measurements. The Table of Reactions lists the reactants and their products, ordered by reactant ions. It includes the total reaction rate coefficient, product distributions (branching ratios), and references for each reaction. Since the two Surveys[1,2] are the basis for the Table of Reactions, this compilation is therefore restricted to the same limited number of species as the data base used for input. For most reactions a simple average of the existing data gave a mean of the reaction rate coefficients where none of the individual measurements were significantly different from that average value. In these cases the percent error is the statistical value. There were many cases where it was important to consider the following additional information:

(1) accuracy of the measuring technique
(2) thermodynamics of the reaction
(3) characteristics of the ion source
(4) energetics of the ion optics
(5) history of the research field.

A few reactions required special comments, which are presented in "Notes on the Reactions" for all cases where a value is reported that is not a simple average of all of the data. Reactions that have notes in "Notes on the Reactions" have a superscript b ([b]) in the footnotes column.

The Table of Reactions then is a comprehensive source for the reported results of positive ion-molecule bimolecular kinetics. For all reactions that show more than one reference in the Table of Reactions the reported numbers are 'evaluated' results. There are one thousand nine hundred and six reactions listed, of which seventy seven percent had measured rate coefficients and twenty percent had only upper limits to rate coefficients.

For reactions involving more exotic species that are not covered in the present evaluations, the reader is referred to the compilation by Ikezoe *et al.*[3] The Ikezoe listing includes bimolecular and termolecular reaction rate coefficients for both positive and negative ions, but no recommendations were presented where multiple measurements for a single reaction are reported in the literature.

The reader is cautioned that the neutral products reported are not directly observed in these experiments. Neutral products are inferred from atomic balance considerations and the assumption that the reactions are exothermic.

3. Bimolecular Reactions

Since the scope of this compilation is bimolecular reactions, some definitions are required. The word "bimolecular" in this study refers to second-order reactions in the zero pressure limit. This excludes the "pseudo-bimolecular" process which is sometimes observed in flow tube and drift tube experiments that operate at the relatively high pressures between 0.2 and 0.8 Torr. 'Pseudo-bimolecular' processes have the same concentration dependence as bimolecular processes, but are actually saturated termolecular processes (high pressure limit). The termolecular process becomes saturated when the pressure of the neutrals gets so high that the lifetime of the collision complex is longer than the time between collisions. Then the collision complex will always suffer a collision with a third body and be stabilized before dissociation of the collision complex can occur. This has the effect of reducing the order of the reaction from third to second. By comparing low pressure results and high pressure results, several "pseudo-bimolecular" processes were identified and eliminated from the Table of Reactions. Due to the lack of published measurements, there probably still are "pseudo-bimolecular" processes remaining in the Table of Reactions. Moreover, the radiative association reaction, a true bimolecular process, is very similar to the saturated collision-stabilized association reaction. Flow tube measurements cannot distinguish between the former and the latter. Where there are results from other techniques that operate at lower pressures this ambiguity can be resolved. At the present time radiative association reactions have not been clearly detected under the conditions of flow tube experiments. Consequently, where no lower pressure experiments have been performed, flow tube association reactions have been included in the Table of Reactions for completeness. This covers the possibility of the reaction being a fast radiative association reaction which has no competing termolecular process.

4. Termolecular Reactions

There are several environments in the solar system in which termolecular reactions will be competitive with bimolecular reactions. Recent laboratory results[4-6] have shown that termolecular reactions can be important in ion-molecule chemistry, down to a pressure regime of about 10^{-5} Torr, i.e. have reaction rate coefficients as large as 10^{-21} cm^6/s. Therefore, users of the Table of Reactions may need to know which ion-molecule reactions have known termolecular channels. While this evaluation does not cover termolecular processes, the Table of Reactions has been annotated to indicate the existence of known termolecular reactions.

For estimating the importance of termolecular reactions in a given chemical system, it would be interesting to know, how prevalent are termolecular reactions compared to bimolecular reactions? As a preliminary indication we can compare the numbers of reported reaction rate coefficients. In the 1987 survey of Ikezoe *et al.*[3] of both bimolecular and termolecular reactions between positive ions and neutrals, less than one fourth of the reactions reported have reported termolecular channels. Of the reaction set listed in the Table of Reactions that are important to modeling of planetary atmospheres, etc. only one sixth have termolecular channels.

There is a known statistical problem with this comparison. The termolecular reactions listed by Ikezoe *et al.*[3] have reported reaction rate coefficients in the range of 7×10^{-23} to 2×10^{-32} cm^6/s. The major source of these data is flow-tube experiments, which have an upper limit of 10^{-26} cm^6/s for measuring three body processes. This is a result of the pressure regime and the flow time. Termolecular reactions that have reaction rate coefficients faster than 10^{-26} cm^6/s appear to have only bimolecular pressure dependence with the flow-tube technique. These are then the "pseudo-bimolecular" or saturated reactions. The flow tube experimental papers report many "pseudo-bimolecular" rate coefficients. One hundred and six reactions of this type can be found in the 1986 survey[1] and the 1993 supplement,[2] that have adducts as products and were measured using a flow tube technique. The majority of these have been included in the Table of Reactions as termolecular reactions. These one hundred and six reactions represent three body reactions whose rate coefficients are greater than 10^{-26} cm^6/s. When these reactions are included the rate coefficient distribution will be changed, but the increase in number of termolecular channels will only be about thirty three percent. The rough conclusion then is, relatively fast termolecular reactions are less than one twelfth as abundant as the bimolecular reactions.

In summary, three-body processes can be fast enough to be competitive with two-body processes in some plan

etary and cometary environments where pressures of 10^{-5} Torr are reached. Pressures are always too low in interstellar clouds to make three-body processes competitive.

5. Notes on the Tables

The ordering of chemical species used in this work can be seen in the Table of Contents listing of ions in the Table of Reactions. The elements and their hydrides are listed first, in *ascending order of their atomic numbers*. This includes more than three-quarters of the entries. The combinations of the elements are listed next. The lowest atomic number (other than hydrogen) is used for the primary ordering. The next lowest atomic number in the species is taken as the secondary ordering criteria, etc. This ordering form is found to be convenient in dealing with astrophysical problems. In this form the more abundant species are in the front of the listing. Also, in following a progression of chemical reactions it does not require as much flipping around as an alphabetical listing.

Isotopic exchange reactions are noted explicitly in the Table of Reactions when the chemical notation is simple. Other isotopic studies are noted as symmetric reactions, in which, the reactants and products are the same. To distinguish these from the other reactions they have been preceded by an asterisk (*). The referenced works identify the isotopes used in these studies.

The existence of measured termolecular reactions involving reaction pairs of interest to this work are reported in the Table of Reactions. These termolecular reactions are recognized by the reaction arrows that have a capital M written above them, indicating M as the third body. It was thought that it would be of interest to the reader how many of the reactions in the Table of Reactions had measurable three-body reaction rate coefficients. Usually, three-body reactions have measurable rates in the flow tube experiments only when there is not a measurable two-body reaction. The converse is also true, two-body reactions have measurable rates in the flow tube experiments only when there is not a measurable three-body reaction. Since the three-body reaction rate coefficients are very dependent on the third body, no attempt was made to report a value of the rate coefficients of the three-body reactions.

The temperature of all data are referenced to 300 kelvins. A few data are for other temperatures. The temperature of these reactions are noted in the Footnotes column. If the data were reported for a range of temperatures, a superscript a (^{a}) has been placed in the Footnotes column. The references that contain the temperature studies have been underlined for identification. There are other energy studies in the literature besides these temperature studies which are not recognized here. These other studies involve reactant ion translational energies and maybe of interested to some.

The references in the Table of Reactions have been assigned a four digit number. The first two digits of the reference number are the last two digits in the year of its publication. The second two digits are a reference number for the year. For example, 7809 is the ninth reference in the list of publications appearing in the year 1978. The full citation for the reference numbers used in the Table of Reactions are listed in the List of References numerically by the reference number. If a set of measurements are cited in more than one place, the various references have been listed under a single reference code.

Reactions that have notes in "Notes on the Reactions" have a superscript b (^{b}) in the footnotes column.

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7. References

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8. Table of Reactions

Reactions					Prod. Dist.	Rate Const. (cm^3/s)		Ref.			Footnotes
H^+	+ H_2	$\xrightarrow{M}$	No Reaction Adduct			$<1.00\times10^{-12}$		7107 8632			
H^+	+ HD	→	D^+	+ H_2	1.00	1.70×10^{-10}	±20%	8109			a
H^+	+ D_2	→	D^+	+ HD	1.00	3.60×10^{-10}	±20%	8212	8109	7421	a
H^+	+ Na	→	No Reaction			$<1.00\times10^{-10}$		8919			
H^+	+ CH_4	→	CH_3^+	+ H_2	0.82	4.15×10^{-9}	±10%	8421	7401		b
			CH_4^+	+ H	0.18						
H^+	+ C_2H_6	→	$C_2H_3^+$ $C_2H_4^+$ $C_2H_5^+$	+ H_2 + H_2 + H_2 + H + H_2		3.90×10^{-9}	±20%	8117			
H^+	+ NH_3	→	NH_3^+	+ H	>0.95	5.20×10^{-9}	±10%	7401			
H^+	+ O	→	O^+	+ H	1.00	3.75×10^{-10}	±50%	7201			
H^+	+ H_2O	→	H_2O^+	+ H	1.00	8.20×10^{-9}	±10%	7401			
H^+	+ O_2	→	O_2^+	+ H	1.00	1.17×10^{-9}	±10%	7401			
H^+	+ H_2S	→	Products		1.00	7.60×10^{-9}	±15%	7714			
H^+	+ HCl	→	HCl^+	+ H	1.00	1.30×10^{-9}	±20%	8502			a
H^+	+ HCN	→	HCN^+	+ H	1.00	1.10×10^{-8}	±20%	8512	7701		ab
H^+	+ CO_2	→	HCO^+	+ O	1.00	3.80×10^{-9}	±20%	8018	7101		b
H^+	+ NO	→	NO^+	+ H	1.00	1.90×10^{-9}	±30%	7201			
D^+	+ H_2	→	H^+	+ HD	1.00	1.40×10^{-9}	±20%	8212	8109	7421	ab
D^+	+ HD	→	H^+	+ D_2	1.00	9.50×10^{-10}	±20%	8109			a
D^+	+ D_2	$\xrightarrow{M}$	Adduct					8632			
D^+	+ CH_4	→	CH_3^+ CH_2D^+ CH_4^+	+ HD + H_2 + D	0.57 0.21 0.21	3.50×10^{-9}	±10%	8421			
D^+	+ O	→	O^+	+ D	1.00	2.80×10^{-10}	±50%	8008			
D^+	+ CO_2	→	CO_2^+	+ D	1.00	3.50×10^{-9}	±10%	8018			
H_2^+	+ H	→	H^+	+ H_2	1.00	6.40×10^{-10}	±20%	7901			
H_2^+	+ H_2	→	H_3^+	+ H	1.00	2.00×10^{-9}	±10%	9120 7520 7211	8631 7404	8621 7212	a
H_2^+	+ D_2	→	H_2D^+ HD_2^+	+ D + H		3.20×10^{-9}	±20%	7212			
H_2^+	+ He	→	HeH^+	+ H	1.00	1.35×10^{-10}	±10%	9121	7603	7404	
H_2^+	+ CH_4	→	CH_3^+ CH_4^+ CH_5^+	+ H_2 + H + H_2 + H	0.60 0.37 <0.03	3.80×10^{-9}	±10%	7503			

Table of Reactions – Continued

Reactions	Prod. Dist.	Rate Const. (cm^3/s)		Ref.		Footnotes
$H_2^+ + C_2H_2 \rightarrow C_2H_2^+ + H_2$	0.91	5.30×10^{-9}	±10%	7503		
$\quad C_2H_3^+ + H$	0.09					
$H_2^+ + C_2H_4 \rightarrow C_2H_2^+ + H_2 + H_2$	0.18	4.90×10^{-9}	±10%	7503		
$\quad C_2H_3^+ + H_2 + H$	0.37					
$\quad C_2H_4^+ + H_2$	0.45					
$H_2^+ + C_2H_6 \rightarrow C_2H_2^+ + H_2 + H_2 + H_2$	0.04	4.90×10^{-9}	±10%	7503		
$\quad C_2H_3^+ + H_2 + H_2 + H$	0.14					
$\quad C_2H_4^+ + H_2 + H_2$	0.48					
$\quad C_2H_5^+ + H_2 + H$	0.28					
$\quad C_2H_6^+ + H_2$	0.06					
$H_2^+ + NH_3 \rightarrow NH_3^+ + H_2$	1.00	5.70×10^{-9}	±10%	7503		
$H_2^+ + N_2 \rightarrow N_2H^+ + H$	1.00	2.00×10^{-9}	±10%	7503	7423	6907
$H_2^+ + H_2O \rightarrow H_2O^+ + H_2$	0.53	7.30×10^{-9}	±10%	7503		
$\quad H_3O^+ + H$	0.47					
$H_2^+ + O_2 \rightarrow O_2^+ + H_2$	0.29	2.70×10^{-9}	±10%	7503		
$\quad HO_2^+ + H$	0.71					
$H_2^+ + Ne \rightarrow NeH^+ + H$	1.00	2.30×10^{-10}	±10%	7603		
$H_2^+ + Na \rightarrow Na^+ + H_2$	1.00	1.60×10^{-9}	±30%	8919		
$H_2^+ + H_2S \rightarrow S^+ + H_2 + H_2$	0.18	4.30×10^{-9}	±10%	7503		
$\quad HS^+ + H_2 + H$	0.20					
$\quad H_2S^+ + H_2$	0.62					
$H_2^+ + Ar \rightarrow ArH^+ + H$	1.00	2.10×10^{-9}	±10%	9034	7620	6907
$H_2^+ + Kr \rightarrow Kr^+ + H_2$	0.23	3.00×10^{-9}	±10%	7620		
$\quad KrH^+ + H$	0.77					
$H_2^+ + Xe \rightarrow XeH^+ + H$	1.00	2.40×10^{-9}	±10%	7620		
$H_2^+ + CO \rightarrow HCO^+ + H$	0.77	2.90×10^{-9}	±10%	7503	7423	7207
$H_2^+ + CO_2 \rightarrow HCO_2^+ + H$	1.00	2.35×10^{-9}	±10%	7608 7207	7423	7211
$H_2^+ + CS_2 \rightarrow HCS_2^+ + H$	1.00	3.00×10^{-10}	±50%	7414		
$H_2^+ + N_2O \rightarrow N_2H^+ + OH$	0.37	2.10×10^{-9}	±60%	7423	7210	
$\quad HN_2O^+ + H$	0.63					
$D_2^+ + D \rightarrow D^+ + D_2$	1.00	5.00×10^{-10}	±10%	7901		
$D_2^+ + H_2 \rightarrow H_2D^+ + D$		3.00×10^{-9}	±20%	7212		
$\quad HD_2^+ + H$						
$D_2^+ + D_2 \rightarrow D_3^+ + D$	1.00	1.60×10^{-9}	±5%	7212		
$D_2^+ + He \rightarrow HeD^+ + D$	1.00	1.15×10^{-10}	±10%	7603		
$D_2^+ + N_2 \rightarrow N_2D^+ + D$	1.00	1.61×10^{-9}	±10%	6907		
$D_2^+ + Ne \rightarrow NeD^+ + D$	1.00	1.70×10^{-10}	±10%	7603		

Table of Reactions — Continued

Reactions					Prod. Dist.	Rate Const. (cm^3/s)		Ref.			Footnotes
D_2^+	+ SiH_4	→	HD_2^+	+ SiH_3	0.02			7720			
			Si^+	+ D_2 + H_2 + H_2	0.04						
			SiH^+	+ D_2 + H_2 + H	0.04						
			SiH_2^+	+ D_2 + H_2	0.22						
			SiH_3^+	+ D_2 + H	0.68						
D_2^+	+ Ar	→	Ar^+	+ D_2	0.13	1.50×10^{-9}	±20%	7620	7013	6907	b
			ArD^+	+ D	0.87						
D_2^+	+ Kr	→	Products		1.00	2.30×10^{-9}	±10%	7620			
D_2^+	+ Xe	→	XeD^+	+ D	1.00	1.50×10^{-9}	±15%	7620			
H_3^+	+ H_2	M →	Adduct					8632			
H_3^+	+ HD	→	H_2D^+	+ H_2	1.00	1.10×10^{-9}	±20%	8105			a
H_3^+	+ CH_4	→	CH_5^+	+ H_2	1.00	2.40×10^{-9}	±20%	8926 7005	8006	7405	ab
H_3^+	+ C_2H_2	→	$C_2H_3^+$	+ H_2	1.00	3.20×10^{-9}	±25%	7713	7405	7005	b
H_3^+	+ C_2H_4	→	$C_2H_3^+$	+ H_2 + H_2	0.70	2.90×10^{-9}	±20%	8208	7616	7405	b
			$C_2H_5^+$	+ H_2	0.30						
H_3^+	+ C_2H_6	→	$C_2H_5^+$	+ H_2 + H_2	1.00	2.90×10^{-9}	±25%	8117 7005	7405	7316	b
H_3^+	+ N	→	NH^+	+ H_2	~0.40	6.50×10^{-10}	±10%	7714			
			NH_2^+	+ H	~0.60						
H_3^+	+ NH_3	→	NH_4^+	+ H_2	1.00	4.40×10^{-9}	±10%	8926 7405	7516 7005	7415	ab
H_3^+	+ N_2	→	N_2H^+	+ H_2	1.00	1.86×10^{-9}	±10%	8926 8006 7505 7005	8323 7602 7423 6907	8208 7514 7310	ab
H_3^+	+ O	→	OH^+	+ H_2		8.00×10^{-10}	±50%	7604			
			H_2O^+	+ H							
H_3^+	+ H_2O	→	H_3O^+	+ H_2	1.00	5.30×10^{-9}	±25%	7510	7405	7005	b
H_3^+	+ O_2	→	HO_2^+	+ H_2	1.00	6.70×10^{-10}	±10%	8414 7505	8006 7312	7514	ab
		M →	Adduct					8632			
H_3^+	+ Na	→	Na^+	+ H_2 + H	1.00	2.10×10^{-9}	±30%	8919			
H_3^+	+ H_2S	→	H_3S^+	+ H_2	1.00	3.70×10^{-9}	±10%	8926	7507	7405	a
H_3^+	+ HCl	→	H_2Cl^+	+ H_2	1.00	3.60×10^{-9}	±10%	8623	8511	8502	a
H_3^+	+ Ar	→	ArH^+	+ H_2	1.00	3.65×10^{-10}	±10%	7104	6907		b
		M →	Adduct					8632			
H_3^+	+ Kr	→	KrH^+	+ H_2	1.00	1.10×10^{-9}	±10%	8006			
H_3^+	+ HCN	→	$HCNH^+$	+ H_2	1.00	7.50×10^{-9}	±10%	8512 7704	7719 7605	7714	a

Table of Reactions – Continued

Reactions	Prod. Dist.	Rate Const. (cm^3/s)		Ref.			Footnotes
$H_3^+ + CH_3NH_2 \rightarrow CH_3^+ + NH_3 + H_2$	0.01				7316		
$CH_2NH_2^+ + H_2 + H_2$	0.76						
$CH_3NH_2^+ + H_2 + H$	0.07						
$CH_3NH_3^+ + H_2$	0.16						
$H_3^+ + CH_3CN \rightarrow CH_3CNH^+ + H_2$	1.00	8.90×10^{-9}	±25%	7719	7605		
$H_3^+ + HC_3N \rightarrow CHCCNH^+ + H_2$	1.00	9.80×10^{-9}	±30%	8412	7911		
$H_3^+ + C_2N_2 \rightarrow HC_2N_2^+ + H_2$	1.00	2.80×10^{-9}	±25%	8412	7719		
$H_3^+ + CO \rightarrow HCO^+ + H_2$	0.94	1.85×10^{-9}	±25%	8926	8310	8208	ab
$HOC^+ + H_2$	0.06			8105	8006	7505	
				7423	7005		
$H_3^+ + H_2CO \rightarrow CH_2OH^+ + H_2$	>0.99	6.30×10^{-9}	±25%	7906			
$H_3^+ + CH_3OH \rightarrow CH_3^+ + H_2O + H_2$	0.46	2.90×10^{-9}	±20%	7619	7316		b
$CH_2OH^+ + H_2 + H_2$	0.28						
$CH_3OH_2^+ + H_2$	0.26						
$H_3^+ + CO_2 \rightarrow HCO_2^+ + H_2$	1.00	2.50×10^{-9}	±35%	8208	7423	7005	
$H_3^+ + CHOOH \rightarrow H_3O^+ + CO + H_2$	0.30	5.00×10^{-9}	±30%	7821	7818		b
$HCO^+ + H_2O + H_2$	0.70						
$H_3^+ + CH_3COOH \rightarrow CH_3CO^+ + H_2O + H_2$	1.00	6.80×10^{-9}	±30%	7818			
$H_3^+ + CH_3SH \rightarrow CH_2SH^+ + H_2 + H_2$	0.98			7316			
$CH_3SH^+ + H_2 + H$	0.02						
$H_3^+ + CS_2 \rightarrow HCS_2^+ + H_2$	1.00	2.00×10^{-9}	±25%	8208			
$H_3^+ + NO \rightarrow HNO^+ + H_2$	1.00	1.25×10^{-9}	±25%	8208	7005		
$H_3^+ + NO_2 \rightarrow NO^+ + OH + H_2$	0.99	7.00×10^{-10}	±30%	7005			
$NO_2^+ + H_2 + H$	0.01						
$H_3^+ + N_2O \rightarrow HN_2O^+ + H_2$	1.00	2.50×10^{-9}	±40%	8208	7423	7005	
$H_3^+ + SO_2 \rightarrow HSO_2^+ + H_2$	1.00	1.30×10^{-9}	±25%	8926	8208		ab
$H_3^+ + COS \rightarrow HCO^+ + H_2S$	<0.10	1.90×10^{-9}	±25%	8208			
$HCOS^+ + H_2$	>0.90						
$H_2D^+ + H_2 \rightarrow H_3^+ + HD$	1.00	5.60×10^{-10}	±20%	8105			a
$H_2D^+ + HD \rightarrow HD_2^+ + H_2$	1.00	2.60×10^{-10}	±10%	7611			
$H_2D^+ + CO \rightarrow HCO^+ + HD$	1.00	1.60×10^{-9}	±20%	8105			a
$HD_2^+ + HD \rightarrow H_2D^+ + D_2$	1.00	3.50×10^{-10}	±10%	7611			
$D_3^+ + H_2 \rightarrow$ Products	1.00	4.00×10^{-10}	±20%	7615			
$D_3^+ + D_2 \xrightarrow{M}$ Adduct				8632			
$D_3^+ + CH_4 \rightarrow CH_4D^+ + D_2$	>0.98	2.40×10^{-9}	±25%	7501			
$D_3^+ + NH_3 \rightarrow$ Products	1.00	3.60×10^{-9}	±20%	7406	7403		
$D_3^+ + N_2 \rightarrow N_2D^+ + D_2$	1.00	7.49×10^{-10}	±10%	6907			

Table of Reactions — Continued

Reactions	Prod. Dist.	Rate Const. (cm^3/s)		Ref.			Footnotes
$D_3^+ + O_2 \rightarrow DO_2^+ + D_2$	1.00	5.20×10^{-10}	±25%	8414	8006		a
$D_3^+ + SiH_4 \rightarrow SiH_3^+ + D_2 + HD$	1.00			7720			
$D_3^+ + Ar \rightarrow ArD^+ + D_2$	1.00	2.90×10^{-10}	±90%	7612	6907		
$D_3^+ + M_g \rightarrow M_g^+ + D_2 + D$	1.00	1.50×10^{-9}	±20%	7710			T=623
$He^+ + H_2 \rightarrow H^+ + H + He$	0.83	1.00×10^{-13}	±20%	8921	8725	8626	ab
$\rightarrow H_2^+ + He$	0.17			8004	7603	7407	
				7404	7003		
$\xrightarrow{M}$ Products				8632			
$He^+ + HD \rightarrow$ No Reaction		$<2.00\times10^{-14}$		8725			
$He^+ + D_2 \rightarrow D^+ + D + He$		1.10×10^{-14}	±20%	8725	8004	7407	ab
$\rightarrow D_2^+ + He$							
$\rightarrow HeD^+ + D$							
$^*He^+ + He \rightarrow He^+ + He$	1.00	5.00×10^{-10}	±10%	9028	7411		a
$\xrightarrow{M}$ Adduct				8632			
$He^+ + CH_4 \rightarrow H^+ + CH_3 + He$	0.27	1.63×10^{-9}	±11%	8317	7908	7801	b
$\rightarrow CH^+ + H_2 + H + He$	0.15			7702	7602	7402	
$\rightarrow CH_2^+ + H_2 + He$	0.52			7003			
$\rightarrow CH_3^+ + H + He$	0.05						
$\rightarrow CH_4^+ + He$	0.02						
$He^+ + C_2H_2 \rightarrow CH^+ + CH + He$	0.22	3.50×10^{-9}	±10%	7502			
$\rightarrow C_2^+ + H_2 + He$	0.46						
$\rightarrow C_2H^+ + H + He$	0.25						
$\rightarrow C_2H_2^+ + He$	0.07						
$He^+ + C_2H_4 \rightarrow CH_2^+ + CH_2 + He$	0.12	3.40×10^{-9}	±10%	7502			
$\rightarrow C_2H^+ + H_2 + H + He$	0.13						
$\rightarrow C_2H_2^+ + H_2 + He$	0.64						
$\rightarrow C_2H_3^+ + H + He$	0.05						
$\rightarrow C_2H_4^+ + He$	0.07						
$He^+ + C_2H_6 \rightarrow C_2H_2^+ + H_2 + H_2 + He$	0.28	2.90×10^{-9}	±10%	8317	7502		
$\rightarrow C_2H_3^+ + H_2 + H + He$	0.58						
$\rightarrow C_2H_4^+ + H_2 + He$	0.14						
$He^+ + NH_3 \rightarrow NH^+ + H_2 + He$	0.08	2.00×10^{-9}	±10%	8524	7515	7502	ab
$\rightarrow NH_2^+ + H + He$	0.80			7003			
$\rightarrow NH_3^+ + He$	0.12						
$He^+ + N_2 \rightarrow N^+ + N + He$	0.60	1.30×10^{-9}	±15%	8927	8523	8514	a
$\rightarrow N_2^+ + He$	0.40			7908	7702	7602	
				7515	7417	7003	
				7001	6905	6803	
				6801	6601		
$He^+ + H_2O \rightarrow H^+ + OH + He$	0.37	5.00×10^{-10}	±15%	8823	8524	7801	ab
$\rightarrow OH^+ + H + He$	0.52			7502	7202	7006	
$\rightarrow H_2O^+ + He$	0.11						
$He^+ + D_2O \rightarrow D^+ + OD + He$				8823			
$\rightarrow OD^+ + D + He$							
$He^+ + O_2 \rightarrow O^+ + O + He$	0.97	1.00×10^{-9}	±10%	8523	8514	7908	ab
$\rightarrow O_2^+ + He$	0.03			7907	7702	7602	
				7003	7001	6905	
				6601			

Table of Reactions – Continued

Reactions	Prod. Dist.	Rate Const. (cm^3/s)		Ref.			Footnotes
$He^+ + Ne \rightarrow Ne^+ + He + h\nu$	0.83	1.20×10^{-15}	±30%	8306	7815	7317	b
$HeNe^+ + h\nu$	0.17						
$He^+ + SiH_4 \rightarrow Si^+ + He + H_2 + H_2$	0.56	2.35×10^{-9}	±40%	9002			
$SiH^+ + He + H_2 + H$	0.38						
$SiH_2^+ + He + H_2$	0.04						
$SiH_3^+ + He + H$	0.03						
$He^+ + H_2S \rightarrow S^+ + H_2 + He$	0.82	4.40×10^{-9}	±15%	8703	7502		ab
$HS^+ + H + He$	0.11						
$H_2S^+ + He$	0.07						
$He^+ + HCl \rightarrow Cl^+ + H + He$	1.00	3.30×10^{-9}	±15%	8703	7307		ab
$He^+ + Ar \rightarrow$ No Reaction		$<1.00\times10^{-13}$		7317	7003	6601	
$He^+ + HBr \rightarrow Br^+ + H + He$	1.00	3.20×10^{-9}	±15%	7307			
$He^+ + Kr \rightarrow$ No Reaction		$<1.00\times10^{-11}$		7003			
$He^+ + Xe \rightarrow Xe^+ + He$	1.00	7.00×10^{-12}	±20%	8213	7003		a
$He^+ + Hg \rightarrow Hg^+ + He$	1.00	2.10×10^{-9}	±20%	8016	7317		
$He^+ + HCN \rightarrow C^+ + NH + He$	0.25	3.30×10^{-9}	±10%	7704	7701		b
$N^+ + CH + He$	0.07						
$CH^+ + N + He$	0.21						
$CN^+ + H + He$	0.47						
$HCN^+ + He$	<0.01						
$He^+ + HC_3N \rightarrow C_2H^+ + CN + He$	0.28	7.70×10^{-9}	±20%	8518	8509	7911	b
$C_3H^+ + N + He$	0.05						
$C_2N^+ + CH + He$	0.36						
$C_3N^+ + H + He$	0.31						
$He^+ + CO \rightarrow C^+ + O + He$	1.00	1.60×10^{-9}	±10%	8523	8514	7702	a
$O^+ + C + He$	<0.01			7515	7003	6601	
$CO^+ + He$	<0.01						
$He^+ + CO_2 \rightarrow C^+ + O_2 + He$	0.02	1.00×10^{-9}	±25%	8927	8317	7702	a
$O^+ + CO + He$	0.14			7602	7515	7003	
$CO^+ + O + He$	0.78			6601			
$CO_2^+ + He$	0.05						
$He^+ + CHOOH \rightarrow HCO^+ + OH + He$		4.10×10^{-9}	±30%	7821			
$HCO_2^+ + H + He$							
$CHOOH^+ + He$							
$He^+ + NO \rightarrow N^+ + O + He$	0.93	1.15×10^{-9}	±15%	7702	7003	6601	
$O^+ + N + He$	0.07						
$He^+ + N_2O \rightarrow N^+ + NO + He$	0.13	2.30×10^{-9}	±10%	8930	8822	7702	b
$O^+ + N_2 + He$	0.12						
$N_2^+ + O + He$	0.54						
$NO^+ + N + He$	0.21						
$N_2O^+ + He$	<0.01						
$He^+ + SO_2 \rightarrow S^+ + O_2 + He$	0.21	4.30×10^{-9}	±20%	8703	7302		ab
$SO^+ + O + He$	0.69						
$SO_2^+ + He$	0.10						

Table of Reactions – Continued

Reactions				Prod. Dist.	Rate Const. (cm^3/s)		Ref.			Footnotes
HeH^+	+ H	→	H_2^+ + He	1.00	9.10×10^{-10}	±30%	7901			
HeH^+	+ H_2	→	H_3^+ + He	1.00	1.77×10^{-9}	±20%	8006 7008	7407	7404	
HeH^+	+ C_2H_4	→	$C_2H_3^+$ + He + H_2 $C_2H_4^+$ + He + H	0.75 0.25	2.80×10^{-9}	±20%	7610			
HeH^+	+ C_2H_6	→	$C_2H_3^+$ + He + H_2 + H_2 $C_2H_5^+$ + He + H_2		2.10×10^{-9}	±20%	8117			
HeH^+	+ N_2	→	N_2H^+ + He	1.00	1.70×10^{-9}	±20%	7602			
HeH^+	+ O_2	→	HO_2^+ + He	1.00	1.10×10^{-9}	±20%	8006			
HeH^+	+ Ne	→	NeH^+ + He	1.00	1.25×10^{-9}	±50%	9130			
HeH^+	+ Kr	→	KrH^+ + He	1.00	1.20×10^{-9}	±20%	8006			
He_2^+	+ H_2	→	Products	1.00	5.30×10^{-10}	±30%	7008			T=200
		M→	Products				8632			
He_2^+	+ CH_4	M→	Products				8632			
He_2^+	+ C_3H_8	M→	Products				8632			
He_2^+	+ NH_3	M→	Products				8632			
He_2^+	+ N_2	→	N_2^+ + He + He	1.00	1.20×10^{-9}	±30%	7417	6804		ab
		M→	Products				8632			
He_2^+	+ H_2O	M→	Products				8632			
He_2^+	+ O_2	M→	Products				8632			
He_2^+	+ Ne	→ M→	Ne^+ + He + He Products	1.00	1.40×10^{-10}	±30%	6804 8632			
He_2^+	+ HCl	M→	Products				8632			
He_2^+	+ Ar	M→	Products				8632			
He_2^+	+ Kr	M→	Products				8632			
He_2^+	+ Hg	→	Hg^+ + He + He	1.00	4.50×10^{-10}	±20%	8016			
He_2^+	+ CO	M→	Products				8632			
He_2^+	+ CO_2	M→	Products				8632			
He_2^+	+ NO	M→	Products				8632			
He_2^+	+ NO_2	M→	Products				8632			
He_2^+	+ N_2O	M→	Products				8632			
B^+	+ H_2	→	No Reaction		$<2.00\times10^{-14}$		9008			
B^+	+ HD	→	No Reaction		$<2.00\times10^{-14}$		9008			

Table of Reactions — Continued

Reactions					Prod. Dist.	Rate Const. (cm^3/s)		Ref.			Footnotes
C^+	+ H_2	→	CH^+	+ H	1.00	1.20×10^{-16}	±75%	8707	8607	8602	ab
								8307	8014	7905	
								7705			
		M →	Products					8632			
C^+	+ HD	→	CH^+	+ D	0.17	1.20×10^{-16}	±75%	8607			
			CD^+	+ H	0.83						
C^+	+ D_2	→	CD^+	+ D	1.00	2.30×10^{-17}	±75%	8607	8602		b
		M →	Products					8632			
C^+	+ CH_4	→	$C_2H_2^+$	+ H_2	0.28	1.30×10^{-9}	±10%	9029	8207	8012	ab
			$C_2H_3^+$	+ H	0.72			7905	7705	7617	
								7601	7012	7010	
C^+	+ C_2H_2	→	C_3H^+	+ H	1.00	2.63×10^{-9}	±10%	8624	8207	8012	
C^+	+ C_2H_4	→	$C_2H_3^+$	+ CH	0.08	1.50×10^{-9}	±30%	8309	8207	7617	
			$C_2H_4^+$	+ C	0.15						
			C_3H^+	+ H_2 + H	0.05						
			$C_3H_2^+$	+ H_2	0.29						
			$C_3H_3^+$	+ H	0.42						
C^+	+ C_2H_6	→	$C_2H_2^+$	+ CH_4	0.05	1.65×10^{-9}	±30%	8309	8207	7617	
			$C_2H_3^+$	+ CH_3	0.30						
			$C_2H_4^+$	+ CH_2	0.07						
			$C_2H_5^+$	+ CH	0.14						
			$C_3H_2^+$	+ H_2 + H_2	0.01						
			$C_3H_3^+$	+ H_2 + H	0.43						
C^+	+ NH_3	→	NH_3^+	+ C	0.32	2.30×10^{-9}	±10%	8524	8012	7905	ab
			HCN^+	+ H_2	0.05			7707	7704	7601	
			$HCNH^+$	+ H	0.63			7412			
C^+	+ N_2	→	No Reaction			$<2.00\times10^{-14}$		9104	7705		
C^+	+ H_2O	→	H_2O^+	+ C	0.10	2.40×10^{-9}	±15%	8710	8524	7905	ab
			HOC^+	+ H	0.90			7705	7601	7202	
C^+	+ O_2	→	O^+	+ CO	0.60	8.70×10^{-10}	±15%	9029	8814	8811	ab
			CO^+	+ O	0.40			8409	7905	7705	
								7602	7601	6602	
C^+	+ SiH_4	→	Si^+	+ CH_4	0.06	4.40×10^{-9}	±20%	7319			
			SiH^+	+ CH_3	0.08						
			SiH_2^+	+ CH_2	0.14						
			SiH_3^+	+ CH	0.61						
			$HCSi^+$	+ H_2 + H	0.03						
			CH_2Si^+	+ H_2	0.08						
C^+	+ H_2S	→	H_2S^+	+ C	0.27	1.80×10^{-9}	±10%	8703	7803	7601	a
			HCS^+	+ H	0.73			7507			
C^+	+ HCl	→	CCl^+	+ H	1.00	1.00×10^{-9}	±20%	9015	8703	8502	a
								7601			
C^+	+ HCN	→	C_2N^+	+ H	1.00	2.95×10^{-9}	±15%	9015	8624	8512	a
								8012	7704	7601	
C^+	+ CH_3NH_2	→	CH_3^+	+ HCN + H	0.01	3.20×10^{-9}	±45%	7803	7601		
			$HCNH^+$	+ CH_3	0.03						
			$CH_2NH_2^+$	+ CH	0.27						
			$CH_3NH_2^+$	+ C	0.69						
C^+	+ CH_3CN	→	Products		1.00	5.60×10^{-9}	±20%	9015			

Table of Reactions — Continued

Reactions					Prod. Dist.	Rate Const. (cm^3/s)		Ref.			Footnotes
C^+	+ C_2N_2	→	CCN^+	+ CN	0.11	1.90×10^{-9}	±30%	8802	8515		
			CNC^+	+ CN	0.89						
C^+	+ HC_3N	→	C_3^+	+ HCN	0.05	5.50×10^{-9}	±20%	8518	8509	7911	b
			C_3H^+	+ CN	0.70						
			C_2N^+	+ C_2H	0.02						
			C_4N^+	+ H	0.23						
*C^+	+ CO	→	C^+	+ CO	1.00	2.65×10^{-10}	±30%	8005	7601		a
C^+	+ CO	→	No Reaction			$<5.00\times10^{-13}$		7905	7705		
C^+	+ H_2CO	→	CH_2^+	+ CO	0.54	4.20×10^{-9}	±10%	7803	7601		
			HCO^+	+ CH	0.20						
			H_2CO^+	+ C	0.26						
C^+	+ CH_3OH	→	CH_3^+	+ HCO	0.80	3.40×10^{-9}	±30%	7803	7601		b
			CH_2OH^+	+ CH	0.20						
C^+	+ CO_2	→	CO^+	+ CO	0.90	1.10×10^{-9}	±10%	8112	7905	7705	b
			CO_2^+	+ C	0.10			7601	6602		
C^+	+ CHOOH	→	HCO^+	+ HCO	1.00	3.30×10^{-9}	±30%	7821			
C^+	+ NO	→	N^+	+ CO	≤0.08	7.50×10^{-10}	±25%	9029	8811	8409	a
			NO^+	+ C	1.00			8008	7905	7601	
C^+	+ N_2O	→	NO^+	+ CN	1.00	9.10×10^{-10}	±30%	9029	8811	8810	ab
								7009			
C^+	+ SO_2	→	SO^+	+ CO	1.00	2.30×10^{-9}	±30%	8703	7507		ab
C^+	+ COS	→	CS^+	+ CO	0.80	2.00×10^{-9}	±20%	7803			
			COS^+	+ C	0.20						
CH^+	+ H	→	C^+	+ H_2	1.00	7.50×10^{-10}	±30%	8403			
CH^+	+ H_2	→	CH_2^+	+ H	1.00	1.20×10^{-9}	±15%	8403	8103	7705	a
								7506			
CH^+	+ CH_4	→	$C_2H_2^+$	+ H_2 + H	0.11	1.30×10^{-9}	±20%	7705	7402	7012	b
			$C_2H_3^+$	+ H_2	0.84						
			$C_2H_4^+$	+ H	0.05						
CH^+	+ C_2H_2	→	$C_3H_2^+$	+ H	1.00	2.40×10^{-9}	±10%	8624			
CH^+	+ N	→	CN^+	+ H	1.00	1.90×10^{-10}	±50%	8613	8008		
			H^+	+ CN	0.00						
CH^+	+ NH_3	→	NH_3^+	+ CH	0.17	2.70×10^{-9}	±20%	7707			
			NH_4^+	+ C	0.15						
			$HCNH^+$	+ H_2	0.68						
CH^+	+ N_2	$\xrightarrow{M}$	Adduct					8632			
CH^+	+ O	→	H^+	+ CO		3.50×10^{-10}	±50%	8008			
			CO^+	+ H							
CH^+	+ H_2O	→	H_3O^+	+ C	>0.50	2.90×10^{-9}	±20%	7705			
			HCO^+	+ H_2							
			H_2CO^+	+ H							

Table of Reactions — Continued

Reactions					Prod. Dist.	Rate Const. (cm^3/s)		Ref.			Footnotes
CH^+	+ O_2	→	O^+	+ HCO	>0.90	9.70×10^{-10}	±20%	7705			
			CO^+	+ OH							
			HCO^+	+ O							
CH^+	+ SiH_4	→	Si^+	+ CH_4 + H	0.05	4.60×10^{-9}	±20%	7319			
			SiH^+	+ CH_4	0.10						
			SiH_2^+	+ CH_3	0.09						
			SiH_3^+	+ CH_2	0.43						
			CH_2Si^+	+ H_2 + H	0.19						
			CH_3Si^+	+ H_2	0.14						
CH^+	+ H_2S	→	H_3S^+	+ C	0.30	2.10×10^{-9}	±20%	7803	7305		b
			HCS^+	+ H_2	0.70						
CH^+	+ HCN	→	$HCNH^+$	+ C	0.75	2.80×10^{-9}	±15%	8624	7819	7406	b
			C_2N^+	+ H_2	0.15						
			$CHCN^+$	+ H	0.10						
CH^+	+ CH_3NH_2	→	$CH_2NH_2^+$	+ CH_2	0.50	2.30×10^{-9}	±20%	7803			
			$CH_3NH_2^+$	+ CH	0.10						
			$CH_3NH_3^+$	+ C	0.40						
CH^+	+ CO	→	HCO^+	+ C	1.00	$\sim7.00\times10^{-12}$	±50%	7705			
CH^+	+ H_2CO	→	CH_3^+	+ CO	0.30	3.20×10^{-9}	±20%	7803			
			HCO^+	+ CH_2	0.30						
			CH_2OH^+	+ C	0.30						
			CH_2CO^+	+ H	0.10						
CH^+	+ CH_3OH	→	CH_3^+	+ H_2CO	0.50	2.90×10^{-9}	±30%	7803			
			CH_2OH^+	+ CH_2	0.10						
			$CH_3OH_2^+$	+ C	0.40						
CH^+	+ CO_2	→	HCO^+	+ CO	1.00	1.60×10^{-9}	±20%	7705			
CH^+	+ NO	→	NO^+	+ CH	1.00	7.60×10^{-10}	±50%	8008			
CH^+	+ COS	→	HCS^+	+ CO	0.55	1.90×10^{-9}	±20%	7803			
			$HCOS^+$	+ C	0.45						
CH_2^+	+ H_2	→	CH_3^+	+ H	1.00	1.16×10^{-9}	±54%	7705	7506		
CH_2^+	+ CH_4	→	$C_2H_4^+$	+ H_2	0.70	1.30×10^{-9}	±15%	7705	7402	7012	b
			$C_2H_5^+$	+ H	0.30						
CH_2^+	+ C_2H_2	→	$C_3H_3^+$	+ H	1.00	2.50×10^{-9}	±10%	8624			
CH_2^+	+ N	→	CN^+	+ H_2		2.20×10^{-10}	±50%	8008			
			HCN^+	+ H							
CH_2^+	+ NH_3	→	NH_4^+	+ CH	0.33	2.66×10^{-9}	±10%	8001	7707	7305	b
			$CH_2NH_2^+$	+ H	0.67						
CH_2^+	+ N_2	$\xrightarrow{M}$	Adduct					8632			
CH_2^+	+ H_2O	→	CH_2OH^+	+ H	1.00	2.05×10^{-9}	±60%	8001 7305	7802	7705	b
CH_2^+	+ O_2	→	HCO^+	+ OH	>0.50	9.10×10^{-10}	±20%	7705			
			H_2CO^+	+ O	<0.50						

Table of Reactions — Continued

Reactions				Prod. Dist.	Rate Const. (cm^3/s)		Ref.			Footnotes
CH_2^+	+ SiH_4 →	Si^+	+ CH_4 + H_2	0.03	3.50×10^{-9}	±20%	7319			
		SiH^+	+ CH_4 + H	0.09						
		SiH_2^+	+ CH_4	0.03						
		SiH_3^+	+ CH_3	0.62						
		CH_2Si^+	+ H_2 + H_2	0.03						
		CH_3Si^+	+ H_2 + H	0.20						
CH_2^+	+ H_2S →	HCS^+	+ H_2 + H	0.37	2.50×10^{-9}	±10%	8401	7803	7305	b
		CH_2SH^+	+ H	0.63						
CH_2^+	+ HCl →	CH_3^+	+ Cl	0.15	1.50×10^{-9}	±30%	9125			
		$CHCl^+$	+ H_2	0.42						
		CH_2Cl^+	+ H	0.42						
CH_2^+	+ HCN →	CH_2CN^+	+ H	1.00	1.80×10^{-9}	±10%	8624			
CH_2^+	+ CH_3NH_2 →	$CH_2NH_2^+$	+ CH_3	0.55	2.10×10^{-9}	±20%	7803			
		$CH_3NH_2^+$	+ CH_2	0.35						
		$CH_3NH_3^+$	+ CH	0.10						
CH_2^+	+ HC_3N →	$CHCCNH^+$	+ CH	1.00	4.10×10^{-9}	±30%	7911			
CH_2^+	+ CO →	No Reaction			$<5.00\times10^{-12}$		7705			
	M →	Adduct					8632			
CH_2^+	+ H_2CO →	HCO^+	+ CH_3	0.85	3.30×10^{-9}	±20%	7803			
		CH_2CO^+	+ H_2	0.05						
		CH_3CO^+	+ H	0.10						
CH_2^+	+ CH_3OH →	CH_2OH^+	+ CH_3	0.50	2.60×10^{-9}	±30%	7803			
		$CH_3COH_2^+$	+ CH	0.50						
CH_2^+	+ CO_2 →	H_2CO^+	+ CO	1.00	1.60×10^{-9}	±20%	7705			
CH_2^+	+ NO →	NO^+	+ CH_2	1.00	4.20×10^{-10}	±50%	8008			
CH_2^+	+ COS →	HCS^+	+ HCO	0.60	1.80×10^{-9}	±20%	7803			
		CH_2S^+	+ CO	0.40						
CH_3^+	+ H →	No Reaction			$<1.00\times10^{-11}$		7901			
CH_3^+	+ H_2 →	CH_5^+	+ $h\nu$	1.00	$<5.00\times10^{-13}$	±30%	8410	7506		a
	M →	Adduct					8632			
CH_3^+	+ HD →	Products		1.00	8.10×10^{-10}	±20%	8202			a
CH_3^+	+ D_2 →	Products		1.00	6.80×10^{-10}	±20%	8202			a
CH_3^+	+ CH_4 →	$C_2H_5^+$	+ H_2	1.00	1.10×10^{-9}	±15%	7803	7705	7424	
							7402	7304	7013	
							7012			
CH_3^+	+ C_2H_2 →	$C_3H_3^+$	+ H_2	1.00	1.15×10^{-9}	±10%	8624	8012	7803	
							7712			
CH_3^+	+ C_2H_4 →	$C_2H_3^+$	+ CH_4	0.46	1.06×10^{-9}	±10%	7712	7703		
		$C_3H_3^+$	+ H_2 + H_2	0.04						
		$C_3H_5^+$	+ H_2	0.51						
CH_3^+	+ C_2H_6 →	$C_2H_5^+$	+ CH_4	0.85	1.74×10^{-9}	±10%	7712			
		$C_3H_5^+$	+ H_2 + H_2	0.09						
		$C_3H_7^+$	+ H_2	0.06						

Table of Reactions – Continued

Reactions				Prod. Dist.	Rate Const. (cm^3/s)		Ref.			Footnotes
CH_3^+ + N	→	HCN^+	+ H_2		6.70×10^{-11}	±20%	8613	7604		
		$HCNH^+$	+ H							
CH_3^+ + NH_3	→	NH_4^+	+ CH_2	0.15	1.75×10^{-9}	±10%	8706	8001	7803	b
		$CH_2NH_2^+$	+ H_2	0.85			7707	7305		
	M →	Adduct					8632	7707		
CH_3^+ + N_2	M →	Adduct					8632			
CH_3^+ + O	→	H_3^+	+ CO	1.00	4.40×10^{-10}	±20%	8809	7604		
		H_2CO^+	+ H							
		HCO^+	+ H_2							
CH_3^+ + H_2O	→	No Reaction			$<1.00\times10^{-11}$		7305			
	M →	Adduct					8632			
CH_3^+ + O_2	→	HCO^+	+ H_2O	1.00	4.30×10^{-11}	±10%	7701			
	M →	Adduct					8632			
CH_3^+ + SiH_4	→	SiH_3^+	+ CH_4	0.94	2.40×10^{-9}	±20%	7319			
		CH_3Si^+	+ H_2 + H_2	0.03						
		$CH_3SiH_2^+$	+ H_2 + H	0.03						
CH_3^+ + PH_3	→	CH_2P^+	+ H_2 + H_2	0.63	1.11×10^{-9}	±20%	7011			
		CH_3PH^+	+ H_2	0.37						
CH_3^+ + H_2S	→	CH_2SH^+	+ H_2	1.00	9.90×10^{-10}	±45%	8401	7803	7305	b
CH_3^+ + HCl	→	CH_2Cl^+	+ H_2	1.00	1.20×10^{-10}	±60%	8623	8511	8502	a
CH_3^+ + HCN	→	CH_3CNH^+	+ $h\nu$	1.00	2.00×10^{-10}	±10%	8623	8516	8510	b
							8624	8120	8003	
							7701			
	M →	Adduct					8632	8510		
CH_3^- + CH_3NH_2	→	$CH_2NH_2^-$	+ CH_4	0.45	3.20×10^{-9}	±20%	7803	7609		
		$CH_3NH_2^+$	+ CH_3	0.55						
	M →	Adduct					8632			
CH_3^- + CH_3CN	→	$C_2H_5^-$	+ HCN	0.37	1.80×10^{-9}	±20%	8929			b
		$HCNH^+$	+ C_2H_4	0.58						
		$C_2H_5CNH^+$	+ $h\nu$	0.05						
	M →	Adduct					8510			
CH_3^+ + CH_3NC	→	CH_3CNH^+	+ CH_2	1.00	1.10×10^{-9}	±30%	8510			
CH_3^+ + HC_3N	→	$C_3H_3^+$	+ HCN	0.49	4.30×10^{-9}	±20%	8518	8509	7911	b
		$H_4C_4N^+$		0.51						
	M →	Adduct					8518	8509		
CH_3^+ + CO	→	No Reaction			$<1.00\times10^{-11}$		7701			
	M →	Adduct					8632			
CH_3^+ + H_2CO	→	HCO^+	+ CH_4	1.00	1.30×10^{-9}	±20%	7803	7701		
	M →	Adduct					8632			
CH_3^+ + CH_3OH	→	CH_2OH^+	+ CH_4	0.91	2.30×10^{-9}	±30%	7804	7803	7701	b
		CH_3OH^+	+ CH_3	0.01						
		$CH_3OH_2^+$	+ CH_2	0.08						
	M →	Adduct					8632			
CH_3^+ + CO_2	→	No Reaction			$<1.00\times10^{-11}$		7701			
	M →	Adduct					8632			
CH_3^+ + CHOOH	→	CH_5^+	+ CO_2	1.00	2.10×10^{-9}	±30%	7821			

Table of Reactions — Continued

Reactions	Prod. Dist.	Rate Const. (cm^3/s)		Ref.		Footnotes
$CH_3^+ + c\text{-}(CH_2)_2O \rightarrow c\text{-}C_2H_3O^+ + CH_4$	1.00	1.40×10^{-9}	±10%	7609		
$CH_3^+ + CH_3CHO \rightarrow C_2H_5^+ + H_2CO$		4.00×10^{-9}	±50%	9014	7609	b
$CH_2OH^+ + C_2H_4$						
$CH_3CO^+ + CH_4$						
Adduct						
$CH_3^+ + C_2H_5OH \rightarrow C_2H_5^+ + CH_3OH$	0.53	3.40×10^{-9}	±10%	7804	7609	b
$C_2H_6^+ + CH_3O$	0.03					
$C_2H_8^+ + HCO$	0.23					
$C_2H_5O^+ + CH_4$	0.20					
$CH_3^+ + (CH_3)_2O \rightarrow CH_3OCH_2^+ + CH_4$	1.00	3.00×10^{-9}	±10%	7609		
$CH_3^+ + CS_2 \rightarrow$ No Reaction		$<1.00\times10^{-10}$		7414		
$CH_3^+ + NO \rightarrow NO^+ + CH_3$	1.00	9.70×10^{-10}	±10%	8008	7701	
$CH_3^+ + N_2O \rightarrow$ No Reaction		$<4.00\times10^{-11}$		7424		
$CH_3^+ + COS \rightarrow CH_2SH^+ + CO$	1.00	1.30×10^{-9}	±20%	7803		
$CH_2D^+ + H_2 \xrightarrow{M}$ Adduct				8632		
$CH_2D^+ + O \rightarrow HCO^+ + HD$	0.60	4.40×10^{-10}	±20%	8809		
$DCO^+ + H_2$	0.40					
$CHD_2^+ + H_2 \xrightarrow{M}$ Adduct				8632		
$CHD_2^+ + O \rightarrow HCO^+ + D_2$	0.30	4.40×10^{-10}	±20%	8809		
$DCO^+ + HD$	0.70					
$CD_3^+ + H_2 \rightarrow$ Products	1.00	5.10×10^{-10}	±10%	8202	7506	a
$\xrightarrow{M}$ Adduct				8632		
$CD_3^+ + HD \rightarrow$ Products	1.00	4.00×10^{-10}	±25%	8202		a
$CD_3^+ + O \rightarrow DCO^+ + D_2$	1.00	4.40×10^{-10}	±20%	8809		
$CD_3^+ + O_2 \xrightarrow{M}$ Adduct				8632		
$CD_3^+ + HCN \xrightarrow{M}$ Adduct				8632		
$CD_3^+ + CO \xrightarrow{M}$ Adduct				8632		
$CH_4^+ + H \rightarrow$ No Reaction		$<1.00\times10^{-11}$		7901		
$CH_4^+ + H_2 \rightarrow CH_5^+ + H$	1.00	3.50×10^{-11}	±15%	8521	7705	7506
$CH_4^+ + CH_4 \rightarrow CH_5^+ + CH_3$	1.00	1.14×10^{-9}	±15%	7705	7425	7424
				7402	7304	7211
				7203	7013	6906
$CH_4^+ + CD_4 \rightarrow CH_4D^+ + CD_3$	0.10	1.30×10^{-9}	±20%	8913		a
$CH_3D_2^+ + CHD_2$	0.22					
$CH_2D_3^+ + CH_2D$	0.43					
$CHD_4^+ + CH_3$	0.25					
$CH_4^+ + C_2H_2 \rightarrow C_2H_2^+ + CH_4$	0.53	2.72×10^{-9}	±10%	7712	7203	
$C_2H_3^+ + CH_3$	0.41					
$C_3H_3^+ + H_2 + H$	0.06					

Table of Reactions – Continued

Reactions				Prod. Dist.	Rate Const. (cm^3/s)		Ref.			Footnotes
CH_4^+ + C_2H_4	→	$C_2H_4^+$	+ CH_4	0.85	2.00×10^{-9}	±30%	7712	7203		
		$C_2H_5^+$	+ CH_3	0.13						
		$C_3H_5^+$	+ H_2 + H	0.03						
CH_4^+ + C_2H_6	→	$C_2H_4^+$	+ CH_4 + H_2	1.00	1.91×10^{-9}	±10%	7712			
CH_4^+ + NH_3	→	CH_5^+	+ NH_2	0.02	3.00×10^{-9}	±10%	8001	7707	7305	b
		NH_4^+	+ CH_3	0.45						
		NH_3^+	+ CH_4	0.53						
CH_4^+ + N_2	→	No Reaction			$<5.00\times10^{-13}$		7705			
CH_4^+ + H_2O	→	H_3O^+	+ CH_3	1.00	2.50×10^{-9}	±10%	8001 7305	7802	7705	b
CH_4^+ + O_2	→	O_2^+	+ CH_4	1.00	3.90×10^{-10}	±20%	8018	7705		
CH_4^+ + SiH_4	→	SiH_2^+	+ CH_4 + H_2	0.23	2.00×10^{-9}	±20%	7319			
		SiH_3^+	+ CH_4 + H	0.72						
		CH_3SiH^+	+ H_2 + H_2	0.02						
		$CH_3SiH_2^+$	+ H_2 + H	0.03						
CH_4^+ + H_2S	→	H_2S^+	+ CH_4	0.55	2.30×10^{-9}	±10%	8401	7803	7305	b
		H_3S^+	+ CH_3	0.45						
CH_4^+ + HCN	→	$HCNH^+$	+ CH_3	0.98	3.30×10^{-9}	±10%	8624	8101		b
		CH_3CNH^+	+ H	0.02						
CH_4^+ + CH_3NH_2	→	$CH_2NH_2^+$	+ CH_4 + H	0.40	2.20×10^{-9}	±20%	7803			
		$CH_3NH_2^+$	+ CH_4	0.60						
CH_4^+ + HC_3N	→	$CHCCNH^+$	+ CH_3	1.00	2.50×10^{-9}	±30%	7911			
CH_4^+ + CO	→	HCO^+	+ CH_3	0.96	1.08×10^{-9}	±40%	8001	7705		
		CH_3CO^+	+ H	0.04						
CH_4^+ + H_2CO	→	H_2CO^+	+ CH_4	0.45	3.60×10^{-9}	±20%	7803			
		CH_2OH^+	+ CH_3	0.55						
CH_4^+ + CH_3OH	→	CH_3OH^+	+ CH_4	0.60	3.00×10^{-9}	±30%	7803			
		$CH_3OH_2^+$	+ CH_3	0.40						
CH_4^+ + CO_2	→	HCO_2^+	+ CH_3	0.99	1.00×10^{-9}	±20%	8001	7705	7424	b
		CH_3CO^+	+ OH	0.01						
CH_4^+ + CS_2	→	HCS_2^+	+ CH_3	1.00	3.40×10^{-10}	±50%	7414			
CH_4^+ + N_2O	→	HNO^+	+ H_3CN	0.03	1.27×10^{-9}	±20%	7424	7210		b
		HN_2O^+	+ CH_3	0.97						
CH_4^+ + COS	→	COS^+	+ CH_4	0.30	1.40×10^{-9}	±20%	7803			
		$HCOS^+$	+ CH_3	0.70						
CD_4^+ + H_2	→	No Reaction			$<1.00\times10^{-12}$		7506			
CD_4^+ + CH_4	→	CH_4D^+	+ CD_3	0.28	1.20×10^{-9}	±20%	8913			a
		$CH_3D_2^+$	+ CHD_2	0.36						
		$CH_2D_3^+$	+ CH_2D	0.24						
		CHD_4^+	+ CH_3	0.12						

Table of Reactions — Continued

Reactions					Prod. Dist.	Rate Const. (cm^3/s)		Ref.			Footnotes
CH_5^+	+ H	→	CH_4^+	+ H_2	1.00	1.50×10^{-10}	±50%	8521	8308	7901	b
$^*CH_5^+$	+ CH_4	→	Products		1.00	3.00×10^{-11}	±30%			7611	
		M →	Adduct					8632			
CH_5^+	+ CD_4	→	Products		1.00	2.90×10^{-10}	±25%			8206	a
CH_5^+	+ C_2H_2	→	$C_2H_3^+$	+ CH_4	1.00	1.48×10^{-9}	±20%	7713	7426		
CH_5^+	+ C_2H_4	→	$C_2H_5^+$	+ CH_4	1.00	1.50×10^{-9}	±20%	7426			
CH_5^+	+ C_2H_6	→	$C_2H_5^+$	+ CH_4 + H_2	0.15	1.35×10^{-9}	±15%	8305	8117		
			$C_2H_7^+$	+ CH_4	0.85						
CH_5^+	+ N	→	No Reaction			$<1.00\times10^{-11}$		8613	8008		
CH_5^+	+ NH_3	→	NH_4^+	+ CH_4	1.00	2.40×10^{-9}	±15%	7516	7415	7315	
CH_5^+	+ O	→	H_3O^+	+ CH_2	~0.98	2.40×10^{-10}	±30%	8008	8006		
			CH_2OH^+	+ H_2	~0.02						
CH_5^+	+ H_2O	→	H_3O^+	+ CH_4	1.00	3.70×10^{-9}	±25%	7510			
CH_5^+	+ Mg	→	Mg^+	+ CH_4 + H	0.65	1.40×10^{-9}	±20%	7710			T=623
			MgH^+	+ CH_4	0.35						
CH_5^+	+ SiH_4	→	SiH_3^+	+ CH_4 + H_2	1.00	2.00×10^{-9}	±20%	7319			
CH_5^+	+ CH_3NH_2	→	Products		1.00	2.25×10^{-9}	±15%	7315			
CH_5^+	+ HC_3N	→	$CHCCNH^+$	+ CH_4	1.00	4.50×10^{-9}	±30%	7911			
CH_5^+	+ CO	→	HCO^+	+ CH_4	1.00	9.90×10^{-10}	±20%	8006			
CH_5^+	+ H_2CO	→	CH_2OH^+	+ CH_4	1.00	4.50×10^{-9}	±25%	7906			
CH_5^+	+ CO_2	→	HCO_2^+	+ CH_4	1.00	3.25×10^{-11}	±30%	7424	7313	7310	b
CH_5^+	+ CHOOH	→	$CH(OH)_2^+$	+ CH_4	1.00	2.95×10^{-9}	±30%	7820	7818		
CH_5^+	+ NO	→	No Reaction			$<3.00\times10^{-12}$		8008	7104		
CH_5^+	+ N_2O	→	HN_2O^+	+ CH_4	1.00	9.00×10^{-10}	±10%	9031	8006	7424	
								7415			
CD_5^+	+ H_2	→	No Reaction			$<5.00\times10^{-13}$		7506			
CD_3^+	+ CH_4	→	Products		1.00	2.00×10^{-10}	±25%	8206			a
C_2^+	+ H_2	→	C_2H^+	+ H	1.00	1.24×10^{-9}	±15%	9021	7705	7506	
C_2^+	+ CH_4	→	C_2H^+	+ CH_3	0.17	1.40×10^{-9}	±20%	7705			
			$C_2H_2^+$	+ CH_2	0.13						
			C_3H^+	+ H_2 + H	0.14						
			$C_3H_2^+$	+ H_2	0.41						
			$C_3H_3^+$	+ H	0.15						
C_2^+	+ C_2H_2	→	C_4H^+	+ H	1.00	1.85×10^{-9}	±40%	8709	8624	7012	
C_2^+	+ C_2H_4	→	Products		1.00	$\sim1.90\times10^{-9}$		7012			T=373
C_2^+	+ N	→	No Reaction			$<4.00\times10^{-11}$		8008			

Table of Reactions – Continued

Reactions					Prod. Dist.	Rate Const. (cm^3/s)		Ref.			Footnotes
C_2^+	+ O	→	C^+	+ CO		3.10×10^{-10}	±50%	8008			
			CO^+	+ C							
C_2^+	+ HCN	→	C_2H^+	+ CN	0.10	2.60×10^{-9}	±10%	8624	8012	8011	b
			C_3H^+	+ N	0.30						
			C_3N^+	+ H	0.60						
C_2^+	+ C_2N_2	→	C_2N^+	+ C_2N	0.50	1.50×10^{-9}	±30%	8515			
			C_3N^+	+ CN	0.30						
			C_4^+	+ N_2	0.20						
C_2^+	+ HC_3N	→	C_3H^+	+ C_2N	0.07	4.00×10^{-9}	±25%	8518	8509		b
			$CHCCN^+$	+ C_2	0.06						
			C_4^+	+ HCN	0.17						
			C_4H^+	+ CN	0.39						
			C_5N^+	+ H	0.31						
C_2^+	+ NO	→	NO^+	+ C_2	1.00	3.40×10^{-10}	±50%	8008			
C_2H^+	+ H_2	→	$C_2H_2^+$	+ H	1.00	1.24×10^{-9}	±50%	7705	7506		
C_2H^+	+ CH_4	→	$C_2H_2^+$	+ CH_3	0.34	1.10×10^{-9}	±20%	7705			
			$C_3H_3^+$	+ H_2	0.34						
			$C_3H_4^+$	+ H	0.12						
			$C_3H_5^+$		0.20						
C_2H^+	+ C_2H_2	→	$C_4H_2^+$	+ H	1.00	1.85×10^{-9}	±30%	8709	8624	7422	b
								7105	7012		
C_2H^+	+ C_2H_4	→	Products		1.00	1.71×10^{-9}	±10%	7012			T=373
C_2H^+	+ N	→	CH^+	+ CN	1.00	9.50×10^{-11}	±20%	8613	8008		
C_2H^+	+ O	→	C^+	+ HCO		3.30×10^{-10}	±50%	8008			
			CH^+	+ CO							
			CO^+	+ CH							
			HCO^+	+ C							
C_2H^+	+ HCN	→	$C_2H_2^+$	+ CN	0.20	2.70×10^{-9}	±10%	8624	8012	8011	b
			$HCNH^+$	+ C_2	0.35						
			$CHCCN^+$	+ H	0.45						
C_2H^+	+ HC_3N	→	C_4H^+	+ HCN	0.20	3.80×10^{-9}	±25%	8518	8509		b
			$C_4H_2^+$	+ CN	0.12						
			$CHCCNH^+$	+ C_2	0.37						
			HC_5N^+	+ H	0.31						
C_2H^+	+ NO	→	NO^+	+ C_2H	1.00	1.20×10^{-10}	±50%	8008			
C_2D^+	+ D_2	→	$C_2D_2^+$	+ D	0.80	1.10×10^{-9}	±20%	9021			
			$C_2D_3^+$		0.20						
$C_2H_2^+$	+ D	→	C_2HD^+	+ H	1.00	2.00×10^{-10}	±20%	8916			
$C_2H_2^+$	+ H_2	→	$C_2H_3^+$	+ H	1.00	1.00×10^{-11}	±30%	9029	8916	7705	ab
								7409			
		M →	Adduct					8632			
$C_2H_2^+$	+ HD	→	C_2HD^+	+ H_2	1.00	9.00×10^{-11}	±20%	8713			a
$C_2H_2^+$	+ D_2	→	$C_2H_2D^+$	+ D	~0.30	1.40×10^{-10}	±20%	8916			
			C_2HD^+	+ HD	~0.70						

Table of Reactions — Continued

Reactions				Prod. Dist.	Rate Const. (cm^3/s)		Ref.			Footnotes
$C_2H_2^+$	+ CH_4	→	$C_3H_4^+$ + H_2	0.21	8.90×10^{-10}	±10%	9029	8012	7712	ab
			$C_3H_5^+$ + H	0.79			7705	7203		
$C_2H_2^+$	+ CD_4	→	$C_3H_2D_2^+$ + D_2	0.07			8931			
			$C_3HD_3^+$ + HD	0.12						
			$C_3H_2D_3^+$ + D	0.40						
			$C_3HD_4^+$ + H	0.41						
			Adduct	0.02						
$C_2H_2^+$	+ C_2H_2	→	$C_4H_2^+$ + H_2	0.32	1.40×10^{-9}	±15%	7712	7422	7409	
			$C_4H_3^+$ + H	0.68			7203	7105	7012	
							6906			
		M →	Adduct				8709	8632		
$C_2H_2^+$	+ C_2H_4	→	$C_2H_4^+$ + C_2H_2	0.30	1.38×10^{-9}	±15%	9029	8321	7712	ab
			$C_3H_3^+$ + CH_3	0.48			7203	7012		
			$C_4H_5^+$ + H	0.23						
$C_2H_2^+$	+ C_2H_6	→	$C_2H_4^+$ + C_2H_4	0.18	1.38×10^{-9}	±10%	7712	7208		
			$C_2H_5^+$ + C_2H_3	0.09						
			$C_3H_3^+$ + CH_3 + H_2	0.06						
			$C_3H_4^+$ + CH_4	0.01						
			$C_3H_5^+$ + CH_3	0.54						
			$C_4H_5^+$ + H_2 + H	0.05						
			$C_4H_7^+$ + H	0.09						
$C_2H_2^+$	+ N	→	CH^+ + HCN	~0.10	2.50×10^{-10}	±20%	8613	8008		
			C_2N^+ + H_2	~0.30						
			$CHCN^+$ + H	~0.60						
$C_2H_2^+$	+ NH_3	→	NH_3^+ + C_2H_2	0.69	3.10×10^{-9}	±10%	9026	7714		
			NH_4^+ + C_2H	0.31						
$C_2H_2^+$	+ O	→	HCO^+ + CH	~0.50	1.70×10^{-10}	±25%	8008			
			HC_2O^+ + H	~0.50						
$C_2H_2^+$	+ H_2O	→	H_3O^+ + C_2H	1.00	2.20×10^{-10}	±10%	7714			
$C_2H_2^+$	+ O_2	→	No Reaction		$<1.00\times10^{-11}$		7714			
$C_2H_2^+$	+ SiH_4	→	Si^+ + C_2H_4 + H_2	0.06	1.45×10^{-9}	±20%	7428	7427		
			SiH^+ + C_2H_5	0.04						
			SiH_2^+ + C_2H_4	0.19						
			SiH_3^+ + C_2H_3	0.61						
			CH_3Si^+ + CH_3	0.02						
			$CHCSi^+$ + H_2 + H_2 + H	0.01						
			CH_3CSi^+ + H_2 + H	0.02						
			CH_3CHSi^+ + H_2	0.01						
			$C_2H_5Si^+$ + H	0.03						
$C_2H_2^+$	+ H_2S	→	H_2S^+ + C_2H_2	0.96	2.30×10^{-9}	±10%	7714			
			H_3S^+ + C_2H	0.02						
			$C_2H_3^+$ + SH	0.02						
$C_2H_2^+$	+ HCN	→	$HCNH^+$ + C_2H	0.66	3.90×10^{-10}	±25%	8002			
			$CHCCNH^+$ + H	0.34						
		M →	Adduct				9026			
$C_2H_2^+$	+ CH_3NH_2	→	$CH_2NH_2^+$ + C_2H_3	0.24	2.70×10^{-9}	±25%	9026			
			$CH_3NH_2^+$ + C_2H_2	0.28						
			$CH_3NH_3^+$ + C_2H	0.48						
$C_2H_2^+$	+ CH_3CN	→	CH_3CNH^+ + C_2H	0.22	3.80×10^{-9}	±25%	9026			
			$C_3H_4^+$ + HCN	0.28						
			$C_3H_5^+$ + CN	0.28						
			Adduct	0.23						

Table of Reactions – Continued

Reactions	Prod. Dist.	Rate Const. (cm^3/s)		Ref.			Footnotes
$C_2H_2^+ + HC_3N \rightarrow C_4H_2^+ + HCN$	0.45	3.45×10^{-9}	±20%	8518	8509	7911	b
$\rightarrow H_3C_5N^+$	0.55						
$C_2H_2^+ + CH_3OH \rightarrow CH_2OH^+ + C_2H_3$	0.85	2.29×10^{-9}	±25%	9026			
$\rightarrow CH_3OH_2^+ + C_2H$	0.15						
$C_2H_2^+ + CO_2 \rightarrow$ No Reaction		$<1.00\times10^{-11}$		7714			
$\xrightarrow{M}$ Adduct				8632			
$C_2H_2^+ + CH_3CHO \rightarrow CH_2CO^+ + C_2H_4$	0.22	3.20×10^{-9}	±25%	9026			
$\rightarrow CH_3CO^+ + C_2H_3$	0.24						
$\rightarrow CH_3CHO^+ + C_2H_2$	0.36						
$\rightarrow CH_3COH_2^+ + C_2H$	0.18						
$C_2H_2^+ + (CH_3)_2CO \rightarrow CH_3CO^+ + C_3H_5$	0.09	3.00×10^{-9}	±25%	9026			
$\rightarrow (CH_3)_2CO^+ + C_2H_2$	0.55						
$\rightarrow (CH_3)_2COH^+ + C_2H$	0.36						
$C_2H_2^+ + NO \rightarrow NO^+ + C_2H_2$	1.00	1.20×10^{-10}	±25%	9029	8008		ab
$C_2H_2^+ + COS \rightarrow CH_2CS^+ + CO$	0.46	4.20×10^{-10}	±30%	9027			
$\rightarrow COS^+ + C_2H_2$	0.54						
$C_2HD^+ + H_2 \rightarrow C_2H_2^+ + HD$	1.00	2.00×10^{-11}	±20%	8713			a
$C_2D_2^+ + D_2 \rightarrow C_2D_3^+ + D$	1.00	4.00×10^{-11}	±25%	9029			T=15
$C_2H_3^+ + H \rightarrow C_2H_2^+ + H_2$	1.00	1.00×10^{-10}	±20%	8916	7901		b
$C_2H_3^+ + H_2 \rightarrow$ No Reaction		$<1.00\times10^{-12}$		8309	7409		a
$\xrightarrow{M}$ Adduct				8632			
$C_2H_3^+ + CH_4 \rightarrow C_3H_5^+ + H_2$	1.00	1.90×10^{-10}	±20%	8012	7712	7705	
$^*C_2H_3^+ + C_2H_2 \rightarrow C_2H_3^+ + {}^*C_2H_2$	~0.70	7.20×10^{-10}	±10%	8624			
$\rightarrow C_4H_3^+ + H_2$	~0.30						
$C_2H_3^+ + C_2H_2 \rightarrow C_4H_3^+ + H_2$	1.00	2.40×10^{-10}	±30%	8012	7712	7422	b
				7409	7208	7005	
$\xrightarrow{M}$ Adduct				8632			
$C_2H_3^+ + C_2H_4 \rightarrow C_2H_5^+ + C_2H_2$	1.00	8.90×10^{-10}	±10%	7712	7012		
$C_2H_3^+ + C_2H_6 \rightarrow C_2H_5^+ + C_2H_4$	0.47	6.20×10^{-10}	±10%	7712	7208		b
$\rightarrow C_3H_5^+ + CH_4$	0.40						
$\rightarrow C_4H_7^+ + H_2$	0.13						
$C_2H_3^+ + N \rightarrow CHCN^+ + H_2$	1.00	2.20×10^{-10}	±20%	8613			
$C_2H_3^+ + NH_3 \rightarrow NH_4^+ + C_2H_2$	1.00	2.48×10^{-9}	±10%	7714			
$C_2H_3^+ + H_2O \rightarrow H_3O^+ + C_2H_2$	1.00	1.11×10^{-9}	±10%	7714			
$C_2H_3^+ + SiH_4 \rightarrow SiH_3^+ + C_2H_4$	0.89	2.80×10^{-10}	±20%	7428			
$\rightarrow SiH_5^+ + C_2H_2$	0.11						
$C_2H_3^+ + H_2S \rightarrow H_3S^+ + C_2H_2$	1.00	8.40×10^{-10}	±10%	7714			
$C_2H_3^+ + HCN \rightarrow HCNH^+ + C_2H_2$	1.00	2.30×10^{-9}	±40%	8624	8011		
$C_2H_3^+ + HC_3N \rightarrow CHCCNH^+ + C_2H_2$	1.00	3.80×10^{-9}	±20%	8518	8412	7911	b

Table of Reactions – Continued

Reactions					Prod. Dist.	Rate Const. (cm^3/s)		Ref.			Footnotes
$C_2H_3^+$	+ C_2N_2	→	$HC_2N_2^+$	+ C_2H_2	1.00	5.50×10^{-10}	±40%	8702	8412		b
		M →	Adduct					8412			
$C_2H_4^+$	+ H	→	$C_2H_3^+$	+ H_2	1.00	3.00×10^{-10}	±20%	8916	7901		b
$C_2H_4^+$	+ H_2	→	No Reaction			$<4.00\times10^{-14}$		8616	8309	7711	a
								7705			
		M →	Adduct					8632			
$C_2H_4^+$	+ CH_4	→	No Reaction			$<1.00\times10^{-13}$		7712	7705	7203	
$C_2H_4^+$	+ C_2H_2	→	$C_3H_3^+$	+ CH_3	0.77	8.40×10^{-10}	±10%	8321	7712	7208	
			$C_4H_5^+$	+ H	0.23						
		M →	Adduct					8632			
$C_2H_4^+$	+ C_2H_4	→	$C_3H_5^+$	+ CH_3	0.91	7.90×10^{-10}	±10%	7712	7203	7014	b
			$C_4H_7^+$	+ H	0.09				7012		
$C_2H_4^+$	+ C_2H_6	→	$C_3H_6^+$	+ CH_4	0.07	5.15×10^{-12}	±10%	7712	7208		
			$C_3H_7^+$	+ CH_3	0.93						
$C_2H_4^+$	+ NH_3	→	NH_3^+	+ C_2H_4	0.06	2.06×10^{-9}	±10%	7714			
			NH_4^+	+ C_2H_3	0.94						
$C_2H_4^+$	+ H_2O	→	No Reaction			$<1.00\times10^{-12}$		7714			
$C_2H_4^+$	+ SiH_4	→	$C_2H_5^+$	+ SiH_3	0.36	1.40×10^{-9}	±20%	7428			
			SiH_2^+	+ C_2H_6	0.14						
			SiH_3^+	+ C_2H_5	0.44						
			CH_3CHSi^+	+ H_2 + H_2	0.01						
			$C_2H_5Si^+$	+ H_2 + H	0.01						
			$C_2H_6Si^+$	+ H_2	0.02						
			$C_2H_7Si^+$	+ H	0.02						
$C_2H_4^+$	+ H_2S	→	H_2S^+	+ C_2H_4	0.62	1.06×10^{-9}	±10%	7714			
			CH_2S^+	+ CH_4	0.07						
			CH_2SH^+	+ CH_3	0.31						
$C_2H_4^+$	+ HCN	→	No Reaction			$<2.00\times10^{-11}$		8624			b
		M →	Adduct					8011			
$C_2H_4^+$	+ HC_3N	→	$CHCCNH^+$	+ C_2H_3	1.00	1.10×10^{-9}	±30%	7911			
$C_2H_5^+$	+ H	→	$C_2H_4^+$	+ H_2	1.00	$\sim1.00\times10^{-11}$	±30%	8916	7901		b
$C_2H_5^+$	+ H_2	→	No Reaction			$<4.00\times10^{-14}$		8309	7711	7701	a
		M →	Adduct					8632			
$C_2H_5^+$	+ CH_4	→	$C_3H_7^+$	+ H_2	1.00	9.00×10^{-14}	±15%	8305	7712	7509	a
		M →	Adduct					8632			
*$C_2H_5^+$	+ C_2H_2	→	$C_2H_5^+$	+ C_2H_2	0.79	9.00×10^{-10}	±20%	7712	7703	7208	b
			$C_3H_3^+$	+ CH_4	0.08						
			$C_4H_5^+$	+ H_2	0.13						
		M →	Adduct					8632	7005		
$C_2H_5^+$	+ C_2H_4	→	$C_3H_5^+$	+ CH_4	1.00	3.55×10^{-10}	±15%	7712	7012	7005	b
		M →	Adduct					7005			
$C_2H_5^+$	+ C_2H_6	→	$C_3H_7^+$	+ CH_4	0.14	3.90×10^{-11}	±10%	8305	7712	7005	b
			$C_4H_9^+$	+ H_2	0.86						

Table of Reactions – Continued

Reactions	Prod. Dist.	Rate Const. (cm^3/s)		Ref.			Footnotes
$C_2H_5^+ + NH_3 \rightarrow NH_4^+ + C_2H_4$	1.00	2.09×10^{-9}	±10%	7701	7415	7315	
$C_2H_5^+ + H_2O \rightarrow H_3O^+ + C_2H_4$	1.00	1.86×10^{-9}	±65%	8807 7701	8208	8115	a
$C_2H_5^+ + H_2S \rightarrow H_3S^+ + C_2H_4$	1.00	6.70×10^{-10}	±10%	7701			
$C_2H_5^+ + HCN \rightarrow HCNH^+ + C_2H_4$	1.00	2.70×10^{-9}	±20%	8011			
$C_2H_5^+ + CH_3NH_2 \rightarrow$ Products	1.00	1.87×10^{-9}	±15%	7315			
$C_2H_5^+ + CH_3CN \rightarrow CH_3CNH^+ + C_2H_4$	1.00	3.80×10^{-9}	±20%	8929			
$C_2H_5^+ + C_2N_2 \xrightarrow{M} HC_2N_2^+ + C_2H_4$ Adduct	1.00	8.00×10^{-11}	±50%	8932 8932	8702		b
$C_2H_5^+ + HC_3N \rightarrow CHCCNH^+ + C_2H_4$	1.00	3.55×10^{-9}	±20%	8518	7911		
$C_2H_5^+ + H_2CO \rightarrow CH_2OH^+ + C_2H_4$	1.00	3.10×10^{-9}	±25%	7906			
$C_2H_5^+ + CHOOH \rightarrow CH(OH)_2^+ + C_2H_4$	1.00	1.50×10^{-9}	±30%	7821			
$C_2H_5^+ + CS_2 \rightarrow HCS_2^+ + C_2H_4$	1.00	7.20×10^{-10}	±20%	8807			a
$C_2H_6^+ + H \rightarrow C_2H_5^+ + H_2$	1.00	1.00×10^{-10}	±20%	8916	7901		b
$C_2H_6^+ + H_2 \rightarrow$ No Reaction		$<1.00\times10^{-11}$		7701			
$C_2H_6^+ + CH_4 \rightarrow$ No Reaction		$<1.00\times10^{-12}$		7712			
$C_2H_6^+ + C_2H_2 \rightarrow C_2H_5^+ + C_2H_3$ $C_3H_5^+ + CH_3$ $C_4H_7^+ + H$	0.19 0.70 0.11	1.30×10^{-9}	±10%	7712	7208		
$C_2H_6^+ + C_2H_4 \rightarrow C_2H_4^+ + C_2H_6$	1.00	1.15×10^{-9}	±10%	7712			
$C_2H_6^+ + C_2H_6 \rightarrow C_3H_8^+ + CH_4$ $C_3H_6^+ + CH_3$	0.42 0.58	1.90×10^{-11}	±10%	7712	7208		
$C_2H_6^+ + NH_3 \rightarrow NH_3^+ + C_2H_6$ $NH_4^+ + C_2H_5$	0.28 0.72	2.23×10^{-9}	±10%	7701			
$C_2H_6^+ + H_2O \rightarrow H_3O^+ + C_2H_5$	1.00	2.95×10^{-9}	±10%	7701			
$C_2H_6^+ + H_2S \rightarrow H_2S^+ + C_2H_6$ $H_3S^+ + C_2H_5$	0.69 0.31	2.87×10^{-9}	±10%	7701			
$C_3^+ + H_2 \rightarrow C_3H^+ + H$	1.00	2.40×10^{-10}	±25%	9021	8916	8309	
$C_3^+ + D_2 \xrightarrow{M} C_3D^+ + D$ Adduct	1.00	1.50×10^{-10}	±20%	9021 9021	8916	8726	b
$C_3^+ + CH_4 \rightarrow C_3H^+ + CH_3$ $C_4H_2^+ + H_2$ $C_4H_3^+ + H$	0.25 0.38 0.37	9.50×10^{-10}	±30%	8805			
$C_3^+ + C_2H_2 \rightarrow C_5H^+ + H$	1.00	1.70×10^{-9}	±30%	8805	8624		
$C_3^+ + C_2H_4 \rightarrow C_2H_4^+ + C_3$ $C_3H_2^+ + C_2H_2$ $C_5H_2^+ + H_2$ $C_5H_3^+ + H$	0.44 0.15 0.26 0.15	9.00×10^{-10}	±30%	8805			
$C_3^+ + O_2 \rightarrow C_3O^+ + O$	1.00	1.75×10^{-10}	±20%	8726			

Table of Reactions — Continued

Reactions					Prod. Dist.	Rate Const. (cm^3/s)		Ref.			Footnotes
C_3^+	+ HCN	→	C_3H^+	+ CN	0.20	1.30×10^{-9}	±30%	8924	8624		
			C_4N^+	+ H	0.80						
C_3^+	+ HC_3N	→	C_5H^+	+ CN	1.00	3.20×10^{-9}	±20%	8518			
C_3H^+	+ H_2	→	*c*-$C_3H_2^+$	+ H	~0.04	2.60×10^{-11}	±30%	8712	8309		a
			l-$C_3H_2^+$	+ H	~0.16						
			c-$C_3H_3^+$		~0.52						
			l-$C_3H_3^+$		~0.28						
		M →	Adduct					8712	8632	8309	a
C_3H^+	+ CH_4	→	$C_2H_3^+$	+ C_2H_2	0.70	5.50×10^{-10}	±30%	8304			
			$C_3H_3^+$	+ CH_2	0.20						
			$C_4H_3^+$	+ H_2	0.10						
C_3H^+	+ C_2H_2	→	$C_5H_2^+$	+ H	1.00	8.40×10^{-10}	±50%	8805	8624	8012	
C_3H^+	+ C_2H_4	→	$C_3H_3^+$	+ C_2H_2	0.95	9.50×10^{-10}	±30%	8304			
			$C_5H_3^+$	+ H_2	0.05						
C_3H^+	+ CH_2CCH_2	→	$C_4H_3^+$	+ C_2H_2	1.00	1.40×10^{-9}	±20%	8429			
C_3H^+	+ CH_3CCH	→	$C_4H_3^+$	+ C_2H_2	1.00	1.40×10^{-9}	±20%	8429			
C_3H^+	+ NH_3	→	NH_3^+	+ C_3H	0.20	1.65×10^{-9}	±30%	8311	8304		
			NH_4^+	+ C_3	0.45						
			$HCNH^+$	+ C_2H_2	0.25						
			CH_2CHCN^+	+ H	0.10						
C_3H^+	+ N_2	→	No Reaction			$<1.00\times10^{-13}$		8304			
C_3H^+	+ H_2O	→	$C_2H_3^+$	+ CO	0.40	4.50×10^{-10}	±30%	8304			
			HCO^+	+ C_2H_2	0.55						
			$CHCCO^+$	+ H_2	0.05						
C_3H^+	+ O_2	→	HCO^+	+ C_2O	0.60	2.50×10^{-11}	±30%	8304			
			HC_2O^+	+ CO	0.10						
			$CHCCO^+$	+ O	0.30						
C_3H^+	+ H_2S	→	$C_2H_3^+$	+ CS	0.30	1.20×10^{-9}	±30%	8304			
			HCS^+	+ C_2H_2	0.63						
			$CHCCS^+$	+ H_2	0.07						
C_3H^+	+ HCN	→	$HCNH^+$	+ C_3	0.09	4.00×10^{-11}	±30%	8924	8624		b
			$H_2C_4N^+$	+ $h\nu$	0.91						
		M →	Adduct					8311			
C_3H^+	+ CH_3CN	→	$C_2H_3^+$	+ HC_3N	0.20	3.00×10^{-9}	±30%	8311	8304		b
			CH_3CNH^+	+ C_3	0.15						
			$CHCCNH^+$	+ C_2H_2	0.33						
			$H_4C_5N^+$		0.30						
C_3H^+	+ C_2N_2	→	$HC_5N_2^+$		1.00	$>4.40\times10^{-10}$	±30%	8304			
C_3H^+	+ HC_3N	→	$H_2C_6N^+$		1.00	1.25×10^{-9}	±20%	8518	8509		
C_3H^+	+ CO	M →	Adduct					8632			
C_3H^+	+ CH_3OH	→	CH_3^+	+ H_2C_3O	0.10	2.20×10^{-9}	±30%	8311	8304		b
			CH_2OH^+	+ C_3H_2	0.10						
			$CHCCO^+$	+ CH_4	0.80						
C_3H^+	+ CO_2	→	$CHCCO^+$	+ CO	1.00	2.00×10^{-12}	±30%	8304			

Table of Reactions – Continued

Reactions				Prod. Dist.	Rate Const. (cm^3/s)		Ref.		Footnotes
C_3H^+ + NO	→	NO^+	+ C_3H	0.25	5.50×10^{-10}	±30%	8304		
		$CHCN^+$	+ CO	0.75					
C_3H^+ + N_2O	→	HCN^+	+ C_2NO	0.05			8304		
		NO^+	+ HC_3N	0.55					
		$CHCCO^+$	+ N_2	0.40					
C_3H^+ + COS	→	CS^+	+ HC_3O	0.70	6.10×10^{-10}	±30%	8304		
		$CHCCO^+$	+ CS	0.20					
		$CHCCS^+$	+ CO	0.10					
l-C_3H^+ + D	→	l-C_3D^+	+ H	1.00	5.00×10^{-10}	±20%	8916		
l-C_3H^+ + H_2	→	c-$C_3H_2^+$	+ H	1.00	6.00×10^{-12}	±30%	8916		
l-C_3H^+ + D_2	→	c-C_3HD^+	+ D	0.50	6.00×10^{-12}	±30%	8916		
		c-$C_3D_2^+$	+ H	0.50					
C_3D^+ + D_2	→	$C_3D_2^+$	+ D	1.00	2.70×10^{-11}	±20%	8726		
$C_3H_2^+$ + H_2	→	No Reaction			$<5.00\times10^{-14}$		8415	8309	a
	M →	No Reaction					8632		
$C_3H_2^+$ + CH_2CCH_2	→	$C_4H_2^+$	+ C_2H_4	0.04	1.40×10^{-9}	±20%	8429		
		$C_4H_3^+$	+ C_2H_3	0.14					
		$C_4H_4^+$	+ C_2H_2	0.50					
		$C_5H_3^+$	+ CH_3	0.09					
		$C_6H_5^+$	+ H	0.21					
$C_3H_2^+$ + CH_3CCH	→	$C_4H_2^+$	+ C_2H_4	0.09	1.30×10^{-9}	±20%	8429		
		$C_4H_3^+$	+ C_2H_3	0.12					
		$C_4H_4^+$	+ C_2H_2	0.41					
		$C_5H_3^+$	+ CH_3	0.18					
		$C_6H_5^+$	+ H	0.20					
$C_3H_2^+$ + HCN	→	Products		1.00	1.60×10^{-10}	±10%	8624		
c-$C_3H_2^+$ + H	→	No Reaction			$<7.00\times10^{-12}$		8916		
c-$C_3H_2^+$ + D	→	c-C_3HD^+	+ H	1.00	1.00×10^{-10}	±20%	8916		
c-$C_3H_2^+$ + D_2	→	No Reaction			$<1.00\times10^{-12}$		8916		
c-$C_3H_2^+$ + C_2H_2	→	$C_5H_3^+$	+ H	1.00	9.00×10^{-10}	±20%	8712		
l-$C_3H_2^+$ + H	→	l-C_3H^+	+ H_2	1.00	6.00×10^{-11}	±20%	8916		
l-$C_3H_2^+$ + D	→	c-C_3HD^+	+ H	0.50	1.00×10^{-9}	±20%	8916		
		l-C_3HD^+	+ H	0.50					
l-$C_3H_2^+$ + D_2	→	No Reaction			$<1.00\times10^{-12}$		8916		
l-$C_3H_2^+$ + C_2H_2	→	$C_5H_3^+$	+ H	1.00	1.10×10^{-9}	±20%	8712	8624	b
$C_3H_3^+$ + H_2	→	No Reaction			$<1.00\times10^{-13}$		8309		T=80
	M →	No Reaction					8632		
$C_3H_3^+$ + C_2H_2	→	No Reaction			$<1.00\times10^{-11}$		8624		

Table of Reactions — Continued

Reactions	Prod. Dist.	Rate Const. (cm^3/s)	Ref.			Footnotes
$C_3H_3^+ + CH_2CCH_2 \rightarrow$ No Reaction		$< 1.00 \times 10^{-11}$	8429			
$C_3H_3^+ + CH_3CCH \rightarrow$ No Reaction		$< 1.00 \times 10^{-11}$	8429			
$C_3H_3^+ + N \rightarrow CHCCNH^+ + H$	1.00	1.30×10^{-10} ±20%	8613			
$C_3H_3^+ + HCN \rightarrow$ No Reaction		$< 2.00 \times 10^{-11}$	8624			
$c\text{-}C_3H_3^+ + C_2H_2 \rightarrow$ No Reaction		$< 8.00 \times 10^{-13}$	8712	8624	8209	
$c\text{-}C_3H_3^+ + C_2H_4 \rightarrow$ No Reaction		$< 1.00 \times 10^{-11}$	8209			
$c\text{-}C_3H_3^+ + c\text{-}C_6H_6 \rightarrow$ No Reaction		$< 1.00 \times 10^{-11}$	8209			
$c\text{-}C_3H_3^+ + HCN \rightarrow$ No Reaction		$< 2.00 \times 10^{-11}$	8624			
$c\text{-}C_3H_3^+ + CH_3OH \rightarrow$ No Reaction		$< 1.00 \times 10^{-11}$	8630			
$c\text{-}C_3H_3^+ + C_2H_5OH \rightarrow$ No Reaction		$< 1.00 \times 10^{-11}$	8630			
$l\text{-}C_3H_3^+ + C_2H_2 \xrightarrow{M}$ Adduct			9041	8712	8708	b
$l\text{-}C_3H_3^+ + C_2D_2 \rightarrow$ $l\text{-}C_3H_3^+ + C_2D_2$	0.08	9.10×10^{-10} ±15%	9041	8708		T=373
$l\text{-}C_3H_2D^+ + C_2HD$	0.46					
$l\text{-}C_3HD_2^+ + C_2H_2$	0.23					
$c\text{-}C_3H_3^+ + C_2D_2$	0.02					
$c\text{-}C_3H_2D^+ + C_2HD$	0.14					
$c\text{-}C_3HD_2 + C_2H_2$	0.07					
$l\text{-}C_3H_3^+ + C_2H_4 \rightarrow C_5H_5^+ + H_2$		1.10×10^{-9} ±50%	8209			
$C_5H_7^+$						
$l\text{-}C_3H_3^+ + C_4H_2 \rightarrow$ $c\text{-}C_3H_3^+ + C_4H_2$	0.24	1.40×10^{-9} ±50%	9041	8708		T=363
$C_5H_3^+ + C_2H_2$	0.76					
$l\text{-}C_3H_3^+ + c\text{-}C_6H_6 \rightarrow C_7H_7^+ + C_2H_2$		1.40×10^{-9} ±20%	8209			
$C_9H_7^+ + H_2$						
$l\text{-}C_3H_3^+ + CH_3OH \rightarrow CH_2OH^+ + C_3H_4$		3.00×10^{-10} ±20%	8630			
$CH_3OH_2^+ + C_3H_2$						
$l\text{-}C_3H_3^+ + C_2H_5OH \rightarrow C_2H_5^+ + C_3H_4O$		6.00×10^{-10} ±20%	8630			
$C_2H_5O^+ + C_3H_4$						
$C_2H_5OH_2^+ + C_3H_2$						
$C_3H_5O^+ + C_2H_4$						
$C_3H_4^+ + H_2 \rightarrow$ No Reaction		$< 1.00 \times 10^{-13}$	8309			T=80
$\xrightarrow{M}$ No Reaction			8632			
$C_3H_4^+ + C_2H_2 \rightarrow C_5H_5^+ + H$	1.00	4.90×10^{-10} ±10%	8624			
$C_3H_4^+ + HCN \rightarrow$ No Reaction		$< 1.00 \times 10^{-11}$	8624			
$CH_2CCH_2^+ + CH_2CCH_2 \rightarrow$ $C_4H_4^+ + C_2H_4$	0.05	1.10×10^{-9} ±20%	8527	8429		
$C_4H_6^+ + C_2H_2$	0.01					
$C_5H_5^+ + CH_3$	0.01					
$C_6H_5^+ + H_2 + H$	0.07					
$c\text{-}C_6H_7^+ + H$	0.61					
$ac\text{-}C_6H_7^+ + H$	0.26					

Table of Reactions – Continued

Reactions				Prod. Dist.	Rate Const. (cm^3/s)		Ref.			Footnotes
$CH_3CCH^+ + CH_3CCH \rightarrow$	$C_3H_5^+$	+ C_3H_3		0.18	1.10×10^{-9}	±20%	8527	8429		
	$C_4H_4^+$	+ C_2H_4		0.02						
	$C_4H_6^+$	+ C_2H_2		0.02						
	$C_5H_5^+$	+ CH_3		0.02						
	$C_6H_5^+$	+ H_2	+ H	0.08						
	c-$C_6H_7^+$	+ H		0.30						
	ac-$C_6H_7^+$	+ H		0.38						
$C_3H_5^+ + H_2 \xrightarrow{M}$	No Reaction						8632			
$C_3H_5^+ + C_2H_4 \xrightarrow{M}$	Adduct						8632			
$C_3H_5^+ + C_2H_6 \xrightarrow{M}$	Adduct						8632			
$C_3H_5^+ + N \rightarrow$	$C_2H_4^+$	+ HCN		0.88	1.25×10^{-10}	±20%	8613			
	CH_2CHCN^+	+ H_2		0.12						
$C_3H_7^+ + H_2 \xrightarrow{M}$	No Reaction						8632			
$C_3H_7^+ + N \rightarrow$	No Reaction				$<1.00\times10^{-11}$	±20%	8613			
$C_4^+ + H_2 \rightarrow$	C_4H^+	+ H		1.00	1.30×10^{-10}	±20%	9021	8914	8309	a
$C_4^+ + D_2 \rightarrow$	C_4D^+	+ D		1.00	3.20×10^{-10}	±20%	8726			
$C_4^+ + CH_4 \rightarrow$	$C_3H_2^+$	+ C_2H_2		0.20	7.80×10^{-10}	±30%	8805			
	C_4H^+	+ CH_3		0.18						
	$C_5H_2^+$	+ H_2		0.48						
	$C_5H_3^+$	+ H		0.14						
$C_4^+ + C_2H_2 \rightarrow$	$C_3H_2^+$	+ C_3		0.12	1.60×10^{-9}	±20%	8805	8709	8624	
	C_6H^+	+ H		0.88						
$C_4^+ + C_2H_4 \rightarrow$	$C_2H_4^+$	+ C_4		0.27	1.40×10^{-9}	±30%	8805			
	$C_3H_3^+$	+ C_3H		0.08						
	$C_4H_2^+$	+ C_2H_2		0.17						
	C_5H^+	+ CH_3		0.09						
	$C_6H_2^+$	+ H_2		0.39						
$C_4^+ + C_4H_2 \rightarrow$	C_8H^+	+ H		1.00	1.70×10^{-9}	±20%	8429			
$C_4^+ + C_4H_4 \rightarrow$	Products			1.00	1.50×10^{-9}	±20%	8429			
$C_4^+ + O_2 \rightarrow$	C_3^+	+ CO_2		0.50	2.50×10^{-10}	±20%	8726			
	C_4O^+	+ O		0.50						
$C_4^+ + HCN \rightarrow$	C_4H^+	+ CN		0.28	1.95×10^{-9}	±60%	8924	8624		
	C_5N^+	+ H		0.57						
	HC_5N^+	+ $h\nu$		0.16						
$C_4^+ + CO \rightarrow$	Adduct			1.00	4.50×10^{-10}	±20%	8914			a
$C_4H^+ + H_2 \rightarrow$	$C_4H_2^+$	+ H		1.00	1.65×10^{-10}	±20%	9021	8914	8309	a
$\xrightarrow{M}$	No Reaction						8632			
$C_4H^+ + C_2H_2 \rightarrow$	$C_6H_2^+$	+ H		1.00	1.22×10^{-9}	±35%	8805	8709	8624	
$C_4H^+ + C_4H_2 \rightarrow$	$C_8H_2^+$	+ H		1.00	1.60×10^{-9}	±20%	8429			

Table of Reactions – Continued

Reactions				Prod. Dist.	Rate Const. (cm^3/s)		Ref.			Footnotes
C_4H^+ + C_4H_4	→	$C_4H_4^+$	+ C_4H	0.55	2.20×10^{-9}	±20%	8429			
		$C_6H_3^+$	+ C_2H_2	0.37						
		$C_8H_4^+$	+ H	0.08						
C_4H^+ + HCN	→	$C_4H_2^+$	+ CN	0.07	1.35×10^{-9}	±30%	8924	8624		b
		HC_5N^+	+ H	0.91						
		$H_2C_5N^+$	+ $h\nu$	0.03						
C_4H^+ + CO	→	Adduct		1.00	4.70×10^{-10}	±20%	8914			a
C_4D^+ + D_2	→	$C_4D_2^+$	+ D	1.00	1.10×10^{-10}	±20%	8726			
$C_4H_2^+$ + C_2H_2	→	$C_6H_3^+$	+ H	0.05	2.80×10^{-10}	±65%	8624	8121	7422	b
		$C_6H_4^+$	+ $h\nu$	0.95			7105			
	M →	Adduct					8709	8632		
$C_4H_2^+$ + C_2D_2	→	C_4HD^+	+ C_2HD	0.52	5.90×10^{-10}	±20%	9033			
		Adduct	+ $h\nu$	0.48						
$C_4H_2^+$ + CH_3CCH	→	$C_5H_4^+$	+ C_2H_2	0.10			8429			
		$C_7H_5^+$	+ H	0.90						
$C_4H_2^+$ + C_4H_2	→	$C_6H_2^+$	+ C_2H_2	0.83	1.40×10^{-9}	±20%	8429			
		$C_8H_2^+$	+ H_2	0.17						
		$C_8H_3^+$	+ H	0.01						
$C_4H_2^+$ + C_4H_4	→	$C_4H_4^+$	+ C_4H_2	0.13	1.40×10^{-9}	±20%	8429			
		$C_6H_4^+$	+ C_2H_2	0.80						
		$C_8H_4^+$	+ H_2	0.06						
		$C_8H_6^+$	+ $h\nu$	<0.01						
$C_4H_2^+$ + HCN	→	No Reaction			$<2.00\times10^{-11}$		8624			
$C_4H_2^+$ + HC_3N	→	$H_3C_7N^+$		1.00	1.70×10^{-9}	±20%	8518			
$C_4H_2^+$ + CO	→	Adduct		1.00	3.20×10^{-11}	±20%	8914			a
$C_4H_3^+$ + C_2H_2	→	$C_6H_5^+$	+ $h\nu$	1.00	2.20×10^{-10}	±10%	9033	8624	8121	b
							7422	7105		
	M →	Adduct					8709	8632		
$C_4H_3^+$ + C_2D_2	→	$C_4H_2D^+$	+ C_2HD	0.30	3.00×10^{-10}	±20%	9033			
		Adduct	+ $h\nu$	0.70						
$C_4H_3^+$ + CH_3CCH	→	$C_5H_5^+$	+ C_2H_2	>0.96			8429			
		$C_6H_5^+$	+ CH_2	<0.04						
$C_4H_3^+$ + C_4H_2	→	$C_6H_3^+$	+ C_2H_2	1.00	7.40×10^{-10}	±20%	8429			
$C_4H_3^+$ + C_4H_4	→	$C_4H_5^+$	+ C_4H_2	0.25	1.10×10^{-9}	±20%	8429			
		$C_6H_3^+$	+ C_2H_2	0.65						
		$C_8H_6^+$	+ H	0.10						
$C_4H_3^+$ + c-C_6H_6	→	$C_6H_7^+$	+ C_4H_2	1.00			8702			
$C_4H_3^+$ + HCN	→	No Reaction			$<5.00\times10^{-11}$		8624			
$C_4H_3^+$ + CO	→	Adduct		1.00	1.30×10^{-12}	±20%	8914			a
$C_4H_3^+$ + CH_3OH	→	$CH_3OH_2^+$	+ C_4H_2	1.00	$\sim3.00\times10^{-10}$	±50%	8702			

Table of Reactions — Continued

Reactions				Prod. Dist.	Rate Const. (cm^3/s)		Ref.			Footnotes
$C_4H_4^+$ + C_2H_2	→	$C_6H_4^+$	+ H_2	0.10	1.20×10^{-10}	±20%	8709	8624		b
		$C_6H_5^+$	+ H	0.75						
		$C_6H_6^+$	+ $h\nu$	0.15						
	M →	Adduct					8632			
$C_4H_4^+$ + CH_3CCH	→	$C_5H_6^+$	+ C_2H_2	0.05			8429			
		$C_7H_7^+$	+ H	0.95						
$C_4H_4^+$ + C_4H_2	→	$C_6H_4^+$	+ C_2H_2	0.87	8.00×10^{-10}	±20%	8429			
		$C_8H_6^+$	+ $h\nu$	0.13						
	M →	Adduct					8709			
$C_4H_4^+$ + C_4H_4	→	$C_6H_6^+$	+ C_2H_2	0.38	1.00×10^{-9}	±20%	8429			
		$C_8H_7^+$	+ H	0.62						
$C_4H_4^+$ + HCN	→	No Reaction			$<3.00\times10^{-11}$		8624			
l-$C_4H_4^+$ + C_2H_2	→	$C_3H_3^+$	+ C_3H_3	0.04	2.86×10^{-10}	±30%	8624	8407	8316	
		c-$C_4H_4^+$	+ C_2H_2	0.37						
		$C_6H_4^+$	+ H_2	0.08						
		$C_6H_5^+$	+ H	0.44						
		$C_6H_6^+$	+ $h\nu$	0.06						
l-$C_4H_4^+$ + HCN	→	No Reaction			$<3.00\times10^{-11}$		8624			
c-$C_4H_4^+$ + C_2H_2	→	No Reaction			$<1.00\times10^{-11}$		8407			
$C_4H_5^+$ + CH_3CCH	→	$C_6H_5^+$	+ CH_4	0.40			8429			
		$C_7H_7^+$	+ H_2	0.60						
$C_4H_5^+$ + C_4H_2	→	$C_6H_5^+$	+ C_2H_2	1.00			8429			
$C_4H_5^+$ + C_4H_4	→	$C_6H_7^+$	+ C_2H_2	1.00			8429			
$C_4H_6^+$ + CH_3CCH	→	$C_6H_7^+$	+ CH_3	0.85			8429			
		$C_7H_9^+$	+ H	0.15						
$C_4H_7^+$ + N	→	No Reaction			$<1.00\times10^{-11}$	±20%	8613			
$C_4H_9^+$ + N	→	No Reaction			$<1.00\times10^{-11}$	±20%	8613			
C_5^+ + H_2	→	C_5H^+	+ H	1.00	6.20×10^{-10}	±20%	8914			a
C_5^+ + D_2	→	C_5D^+	+ D	1.00	4.70×10^{-10}	±20%	9021	8726		
C_5^+ + CH_4	→	$C_4H_2^+$	+ C_2H_2	0.30	8.80×10^{-10}	±30%	8805			
		C_5H^+	+ CH_3	0.41						
		$C_6H_2^+$	+ H_2	0.11						
		$C_6H_3^+$	+ H	0.18						
C_5^+ + C_2H_2	→	C_7H^+	+ H	1.00	1.80×10^{-9}	±30%	8805			
C_5^+ + C_2H_4	→	$C_2H_4^+$	+ C_5	0.18	1.70×10^{-9}	±30%	8805			
		$C_3H_2^+$	+ C_4H_2	0.04						
		$C_3H_3^+$	+ C_4H	0.05						
		$C_5H_2^+$	+ C_2H_2	0.30						
		$C_7H_2^+$	+ H_2	0.16						
		$C_7H_3^+$	+ H	0.27						

Table of Reactions – Continued

Reactions				Prod. Dist.	Rate Const. (cm^3/s)		Ref.	Footnotes
C_5^+	+ H_2O $\xrightarrow{M}$	Adduct					8632	
C_5^+	+ O_2 →	C_3^+	+ CO + CO	0.13	1.90×10^{-10}	±20%	8726	
		C_4^+	+ CO_2	0.11				
		C_5O^+	+ O	0.76				
C_5^+	+ HCN →	C_5H^+	+ CN	0.30	1.10×10^{-9}	±30%	8924	
		C_6N^+	+ H	0.70				
C_5^+	+ CO →	Adduct		1.00	6.40×10^{-10}	±20%	8914	a
C_5H^+	+ D_2 →	No Reaction			$<2.00\times10^{-12}$		9021	
C_5H^+	+ C_2H_2 →	$C_7H_2^+$	+ H	0.30	5.00×10^{-10}	±30%	8805	
		$C_7H_3^+$	+ $h\nu$	0.70				
C_5H^+	+ HCN →	$H_2C_6N^+$	+ $h\nu$	1.00	9.10×10^{-11}	±30%	8924	
C_5H^+	+ CO →	Adduct		1.00	2.30×10^{-10}	±20%	8914	a
C_5D^+	+ D_2 →	No Reaction			$<2.00\times10^{-13}$		8726	
$C_5H_2^+$	+ C_2H_2 →	No Reaction			$<1.00\times10^{-12}$		8805	
$C_5H_2^+$	+ CO →	No Reaction			$<5.00\times10^{-13}$		8914	a
$C_5H_3^+$	+ CH_3CCH →	$C_6H_5^+$	+ C_2H_2	0.81			8429	
		$C_8H_6^+$	+ H	0.19				
$C_5H_3^+$	+ C_4H_2 →	$C_7H_3^+$	+ C_2H_2	0.43	5.60×10^{-10}	±20%	8708	T=373
		$C_9H_5^+$	+ $h\nu$	0.57				
$C_5H_3^+$	+ c-C_6H_6 →	c-$C_6H_5^+$	+ C_5H_4				8708	T=373
		c-$C_6H_6^+$	+ C_5H_3					
		$C_7H_7^+$	+ C_4H_2					
		$C_9H_7^+$	+ C_2H_2					
		Adduct						
$C_5H_4^+$	+ CH_3CCH →	$C_6H_6^+$	+ C_2H_2	0.57			8429	
		$C_8H_7^+$	+ H	0.43				
$C_5H_5^+$	+ C_2H_2 →	$C_7H_7^+$	+ $h\nu$	1.00	3.10×10^{-11}	±40%	8708	T=373
$C_5H_5^+$	+ CH_3CCH →	$C_6H_7^+$	+ C_2H_2	0.56			8429	
		$C_8H_7^+$	+ H_2	0.44				
$C_5H_5^+$	+ C_4H_2 →	$C_7H_5^+$	+ C_2H_2		2.20×10^{-10}	±40%	8708	T=373
		$C_7H_7^+$	+ C_2					
		$C_9H_7^+$	+ $h\nu$					
C_6^+	+ H_2 →	C_6H^+	+ H	~0.20	2.70×10^{-10}	±20%	8914	a
		$C_6H_2^+$		~0.80				
C_6^+	+ CH_4 →	$C_5H_2^+$	+ C_2H_2	0.40	5.80×10^{-10}	±30%	8805	
		$C_7H_2^+$	+ H_2	0.21				
		$C_7H_3^+$	+ H	0.39				

Table of Reactions – Continued

Reactions				Prod. Dist.	Rate Const. (cm^3/s)		Ref.		Footnotes
C_6^+ + C_2H_2	→	$C_5H_2^+$	+ C_3	0.38	1.40×10^{-9}	±30%	8805		
		C_8H^+	+ H	0.62					
C_6^+ + C_2H_4	→	$C_4H_2^+$	+ C_4H_2	0.09	1.30×10^{-9}	±30%	8805		
		C_5H^+	+ C_3H_3	0.04					
		$C_6H_2^+$	+ C_2H_2	0.40					
		C_7H^+	+ CH_3	0.16					
		$C_8H_2^+$	+ H_2	0.24					
		$C_8H_3^+$	+ H	0.07					
C_6^+ + HCN	→	C_6H^+	+ CN	0.06	8.50×10^{-10}	±30%	8924		
		C_7N^+	+ H	0.19					
		HC_7N^+	+ $h\nu$	0.75					
C_6^+ + CO	→	Adduct		1.00	7.40×10^{-10}	±20%	8914		a
C_6H^+ + H_2	→	$C_6H_2^+$	+ H	1.00	1.30×10^{-12}	±20%	8914		a
C_6H^+ + C_2H_2	→	$C_8H_2^+$	+ H	1.00	5.80×10^{-10}	±30%	8805	8709	b
C_6H^+ + CO	→	Adduct		1.00	2.80×10^{-10}	±20%	8914		a
C_6H^+ + HCN	→	$C_6H_2^+$	+ CN	0.04	5.10×10^{-10}	±30%	8924		
		HC_7N^+	+ H	0.53					
		$H_2C_7N^+$	+ $h\nu$	0.43					
$C_6H_2^+$ + C_2H_2	→	$C_8H_3^+$	+ H	0.69	1.40×10^{-10}	±30%	8805		b
		$C_8H_4^+$	+ $h\nu$	0.31					
	M →	Adduct					8709		
$C_6H_2^+$ + C_4H_2	→	$C_8H_2^+$	+ C_2H_2	1.00			8429		
$C_6H_2^+$ + C_4H_4	→	$C_8H_4^+$	+ C_2H_2	1.00			8429		
$C_6H_3^+$ + C_2H_2	→	$C_8H_5^+$		>0.98	2.50×10^{-10}	±20%	8709		
		$C_8H_4^+$	+ H	<0.02					
$C_6H_3^+$ + C_4H_2	→	$C_8H_3^+$	+ C_2H_2	1.00			8429		
$C_6H_3^+$ + C_4H_4	→	$C_8H_5^+$	+ C_2H_2	1.00			8429		
$C_6H_4^+$ + C_2H_2	→	$C_8H_6^+$		>0.98	7.00×10^{-11}	±20%	8709		
		$C_8H_5^+$	+ H	<0.02					
$C_6H_4^+$ + C_4H_2	→	$C_8H_4^+$	+ C_2H_2	1.00			8429		
$C_6H_4^+$ + C_4H_4	→	$C_8H_6^+$	+ C_2H_2	1.00			8429		
$C_6H_5^+$ + C_2H_2	→	$C_8H_7^+$		>0.98	4.00×10^{-10}	±20%	8709		
		$C_8H_6^+$	+ H	<0.02					
$C_6H_5^+$ + C_4H_2	→	$C_8H_5^+$	+ C_2H_2	1.00			8429		
$C_6H_5^+$ + C_4H_4	→	$C_8H_7^+$	+ C_2H_2	1.00			8429		
ac-$C_6H_5^+$ + H_2	→	$C_6H_7^+$	+ $h\nu$	1.00	5.00×10^{-11}	±20%	8920	8914	ab
ac-$C_6H_5^+$ + CO	→	Adduct		1.00	2.00×10^{-10}	±20%	8914		a

Table of Reactions – Continued

Reactions	Prod. Dist.	Rate Const. (cm^3/s)		Ref.		Footnotes
$c\text{-}C_6H_5^+ + H_2 \rightarrow$ No Reaction		$< 5.00 \times 10^{-13}$		8920	8914	ab
$c\text{-}C_6H_5^+ + CH_4 \rightarrow C_7H_7^+ + H_2$	1.00	7.50×10^{-11}	±30%	8920		
$c\text{-}C_6H_5^+ + C_2H_2 \rightarrow C_8H_6^+ + H$	0.60	1.30×10^{-10}	±30%	8920		
$C_8H_7^+ + h\nu$	0.40					
$c\text{-}C_6H_5^+ + C_2H_4 \rightarrow C_6H_7^+ + C_2H_2$	0.50	1.70×10^{-10}	±30%	8920		
$C_8H_7^+ + H_2$	0.50					
$c\text{-}C_6H_5^+ + C_2H_6 \rightarrow C_6H_7^+ + C_2H_4$	0.97	1.30×10^{-10}	±30%	8920		
$C_7H_7^+ + CH_4$	0.03					
$c\text{-}C_6H_5^+ + CH_2CCH_2 \rightarrow C_7H_7^+ + C_2H_2$	0.30	5.20×10^{-10}	±30%	8920		
$C_9H_7^+ + H_2$	0.70					
$c\text{-}C_6H_5^+ + CH_3CCH \rightarrow C_7H_7^+ + C_2H_2$	0.18	2.30×10^{-10}	±30%	8920	8429	
$C_9H_7^+ + H_2$	0.78					
$C_9H_8^+ + H$	0.05					
$c\text{-}C_6H_5^+ + CH_3CHCH_2 \rightarrow C_7H_7^+ + C_2H_4$	1.00	3.40×10^{-10}	±30%	8920		
$c\text{-}C_6H_5^+ + C_4H_6 \rightarrow C_7H_7^+ + C_3H_4$	0.35	3.30×10^{-10}	±30%	8920		
$C_9H_7^+ + CH_4$	0.10					
$C_9H_8^+ + CH_3$	0.20					
$C_{10}H_8^+ + H_2 + H$	0.20					
$C_{10}H_9^+ + H_2$	0.10					
$c\text{-}C_6H_5^+ + CO \rightarrow$ No Reaction		$< 5.00 \times 10^{-13}$		8914		
$c\text{-}C_6H_5^+ + CH_3OH \rightarrow C_6H_6O^+ + CH_3$	1.00	4.00×10^{-11}	±30%	8920		
$c\text{-}C_6H_5^+ + CH_3CHO \rightarrow C_7H_5^+ + CH_3OH$	0.09	2.30×10^{-10}	±30%	8920		
$C_7H_7^+ + H_2CO$	0.47					
$C_8H_7^+ + H_2O$	0.16					
$C_6H_5O^+ + C_2H_4$	0.28					
$c\text{-}C_6H_5^+ + (CH_3)_2CO \rightarrow C_7H_7O^+ + C_2H_4$	1.00	2.90×10^{-10}	±30%	8920		
$c\text{-}C_6H_6^+ + D_2 \rightarrow$ No Reaction		$< 2.00 \times 10^{-13}$		9131		
$c\text{-}C_6H_6^+ + C_2H_2 \rightarrow$ No Reaction		$< 1.00 \times 10^{-13}$		9131	8709	
$c\text{-}C_6H_6^+ + C_4H_2 \rightarrow$ Adduct	1.00	5.00×10^{-10}	±30%	9131		
$c\text{-}C_6H_6^+ + c\text{-}C_6H_6 \rightarrow$ Adduct	1.00	$> 5.00 \times 10^{-11}$		9131		
$\xrightarrow{M}$ Adduct				8632		
$c\text{-}C_6H_6^+ + C_8H_8 \rightarrow C_8H_8^+ + c\text{-}C_6H_6$	1.00	7.80×10^{-10}	±30%	9131		
$C_6H_7^+ + C_2H_2 \rightarrow$ No Reaction		$< 1.00 \times 10^{-13}$		8709		
$C_6H_7^+ + CH_3CCH \rightarrow C_7H_7^+ + C_2H_4$	1.00			8429		
$C_6H_7^+ + C_4H_2 \rightarrow$ No Reaction		$< 2.00 \times 10^{-11}$		8702		
$c\text{-}C_6H_7^+ + CH_3OH \rightarrow CH_3OH_2^+ + c\text{-}C_6H_6$	1.00	2.00×10^{-10}	±25%	8527		
$c\text{-}C_6H_7^+ + CH_3CHO \rightarrow C_2H_5O^+ + c\text{-}C_6H_6$	1.00	1.30×10^{-9}	±25%	8527		

Table of Reactions – Continued

Reactions				Prod. Dist.	Rate Const. (cm^3/s)		Ref.			Footnotes
$C_7H_3^+$ + C_4H_2	→	$C_{11}H_5^+$	+ $h\nu$	1.00			8708			T=373
$C_7H_7^+$ + C_2H_2	→	$C_9H_9^+$	+ $h\nu$	1.00			8708			T=373
$C_7H_7^+$ + C_4H_2	→	$C_{11}H_9^+$	+ $h\nu$	1.00			8708			T=373
c-$C_7H_7^+$ + CH_3CCH	→	$C_9H_8^+$	+ CH_3	0.10			8429			
		$C_{10}H_9^+$	+ H_2	0.42						
		$C_{10}H_{11}^+$	+ $h\nu$	0.48						
$CH_3C_6H_5^+$ + CH_3CCH	→	$C_8H_9^+$	+ C_2H_2	0.18			8429			
		$C_9H_7^+$	+ CH_4	0.18						
		$C_9H_8^+$	+ CH_3	0.13						
		$C_{10}H_9^+$	+ H_2	0.20						
		$C_{10}H_{11}^+$	+ $h\nu$	0.31						
$C_9H_7^+$ + CH_3CCH	→	$C_{12}H_9^+$	+ H_2				8429			
		$C_{12}H_{11}^+$	+ $h\nu$							
$C_{10}H_8^+$ + D_2	→	No Reaction			$<4.00\times10^{-13}$		9131			
$C_{10}H_8^+$ + C_2H_2	→	No Reaction			$<1.00\times10^{-12}$		9131			
$C_{10}H_8^+$ + C_4H_2	→	Adduct		1.00	1.00×10^{-12}		9131			
$C_{10}H_8^+$ + C_8H_8	→	No Reaction			$<1.00\times10^{-12}$		9131			
$C_{10}H_8^+$ + $(CH_3)_3N$	→	$(CH_3)_3N^+$	+ $C_{10}H_8$	0.75	1.10×10^{-9}	±30%	9131			
		$(CH_3)_3NH^+$	+ $C_{10}H_7$	0.25						
$C_{10}H_8^+$ + NO	→	No Reaction			$<2.00\times10^{-13}$		9131			
N^+ + H_2	→	NH^+	+ H	1.00	5.00×10^{-10}	±20%	8927	8821	8720	ab
							8523	8513	8307	
							8010	7905	7602	
							7506	6702		
N^+ + p-H_2	→	NH^+	+ H	1.00	3.00×10^{-10}	±30%	8821			aT=163
N^+ + HD	→	NH^+	+ D	0.25	3.10×10^{-10}	±20%	8821	8720	8513	a
		ND^+	+ H	0.75						
N^+ + D_2	→	ND^+	+ D	1.00	1.50×10^{-10}	±20%	8821	8720	8513	a
N^+ + CH_4	→	CH_3^+	+ NH	0.50	1.15×10^{-9}	±15%	8523	8514	8421	ab
		CH_4^+	+ N	0.05			8010	7905	7708	
		$HCNH^+$	+ H_2	0.36						
		HCN$^+$	+ H_2 + H	0.10						
N^+ + C_2H_4	→	$C_2H_2^+$	+ NH_2	0.10	1.60×10^{-9}	±20%	8007			
		$C_2H_3^+$	+ NH	0.30						
		$C_2H_4^+$	+ N	0.25						
		HCN^+	+ CH_3	0.15						
		$HCNH^+$	+ CH_2	0.10						
		CH_2CN^+	+ H_2	0.10						
N^+ + NH_3	→	NH_2^+	+ NH	0.20	2.35×10^{-9}	±20%	8524	8010	7905	a
		NH_3^+	+ N	0.71						
		N_2H^+	+ H_2	0.09						

Table of Reactions – Continued

Reactions					Prod. Dist.	Rate Const. (cm^3/s)		Ref.			Footnotes
N^+	+ N_2	→	N^+	+ N_2	1.00	2.55×10^{-10}	±40%	7708	7421		
		M →	Adduct					8632			
N^+	+ H_2O	→	H_2O^+	+ N	1.00	2.70×10^{-9}	±20%	8524	8010	7905	ab
								7202	7006		
N^+	+ O_2	→	O^+	+ NO	0.08	5.80×10^{-10}	±10%	8619	8615	8523	ab
			NO^+	+ O	0.40			8514	8017	8010	
			O_2^+	+ N	0.53			7905	7708	7602	
								7417	7311	7007	
								7001	6801	6603	
N^+	+ HCl	→	HCl^+	+ N		9.00×10^{-10}	±20%	9015			
			NCl^+	+ H							
N^+	+ H_2S	→	NH^+	+ SH	0.03	1.90×10^{-9}	±20%	8010			
			S^+	+ NH_2	0.12						
			HS^+	+ NH	0.29						
			H_2S^+	+ N	0.56						
N^+	+ Hg	→	No Reaction			$<1.00\times10^{-12}$		8015			
N^+	+ HCN	→	HCN^+	+ N	1.00	3.70×10^{-9}	±20%	9015			
N^+	+ CH_3NH_2	→	CH_3^+	+ C_2N_2	0.06	2.00×10^{-9}	±20%	8010			
			$HCNH^+$	+ NH_3	0.10						
			$CHNH_2^+$	+ NH_2	0.07						
			$CH_2NH_2^+$	+ NH	0.70						
			$CH_3NH_2^+$	+ N	0.07						
N^+	+ C_2N_2	→	C_2N^+	+ N_2	0.70	1.40×10^{-9}	±30%	8515			
			$C_2N_2^+$	+ N	0.30						
N^+	+ HC_3N	→	C_3H^+	+ N_2	0.50	4.20×10^{-9}	±20%	8518			
			CHCCN$^+$	+ N	0.50						
N^+	+ CO	→	C^+	+ NO	0.01	5.60×10^{-10}	±25%	8701	8523	8514	ab
			CO^+	+ N	0.88			8426	8409	8408	
			NO^+	+ C	0.11			8010	7905	7708	
								6701			
N^+	+ H_2CO	→	HCO^+	+ NH	0.25	2.90×10^{-9}	±20%	8010			
			H_2CO^+	+ N	~0.65						
			NO^+	+ CH_2	~0.10						
N^+	+ CH_3OH	→	CH_3^+	+ HNO	0.04	3.10×10^{-9}	±20%	8010			
			H_2CO^+	+ NH_2	~0.30						
			CH_2OH^+	+ NH	0.16						
			CH_3OH^+	+ N	0.40						
			NO^+	+ CH_4	~0.10						
N^+	+ CO_2	→	CO^+	+ NO	0.18	1.12×10^{-9}	±10%	8010	7905	7708	b
			CO_2^+	+ N	0.82			6701			
N^+	+ CHOOH	→	HCO^+	+ HNO	1.00	6.20×10^{-9}	±30%	7821			
N^+	+ NO	→	NO^+	+ N	0.85	5.55×10^{-10}	±10%	8106	8010	7905	b
			N_2^+	+ O	0.15			7708	6603		
N^+	+ N_2O	→	NO^+	+ N_2	1.00	$\sim5.50\times10^{-10}$		6401			
N^+	+ COS	→	S^+	+ NCO	0.22	1.40×10^{-9}	±20%	8010			
			CS^+	+ NO	0.05						
			COS^+	+ N	0.73						

Table of Reactions – Continued

Reactions					Prod. Dist.	Rate Const. (cm^3/s)		Ref.			Footnotes
NH^+	+ H_2	→	H_3^+	+ N	0.15	1.23×10^{-9}	±30%	8010	7506	6702	
			NH_2^+	+ H	0.85						
NH^+	+ CH_4	→	CH_5^+	+ N	0.10	9.60×10^{-10}	±20%	8010			
			NH_2^+	+ CH_3	0.20						
			$HCNH^+$	+ H_2 + H	0.70						
NH^+	+ C_2H_4	→	$C_2H_2^+$	+ NH_3	0.10	1.50×10^{-9}	±20%	8007			
			$C_2H_3^+$	+ NH_2	0.25						
			$C_2H_4^+$	+ NH	0.25						
			$HCNH^+$	+ CH_3	0.20						
			$CHNH_2^+$	+ CH_2	0.10						
			CH_2CNH^+	+ H_2	0.10						
NH^+	+ NH_3	→	NH_3^+	+ NH	0.75	2.40×10^{-9}	±20%	8010			
			NH_4^+	+ N	0.25						
NH^+	+ N_2	→	N_2H^+	+ N	1.00	6.50×10^{-10}	±20%	8010	6702		
NH^+	+ H_2O	→	NH_2^+	+ OH	0.25	3.50×10^{-9}	±20%	8010			
			NH_3^+	+ O	0.05						
			H_2O^+	+ NH	0.30						
			H_3O^+	+ N	0.30						
			HNO^+	+ H_2	0.10						
NH^+	+ O_2	→	O_2^+	+ NH	0.55	8.20×10^{-10}	±20%	8010			
			HO_2^+	+ N	0.20						
			NO^+	+ OH	0.25						
NH^+	+ H_2S	→	HS^+	+ NH_2	0.15	1.70×10^{-9}	±20%	8010			
			H_2S^+	+ NH	0.55						
			NHS^+	+ H_2	0.15						
			$NHSH^+$	+ H	0.15						
NH^+	+ CH_3NH_2	→	$HCNH^+$	+ NH_3 + H	0.20	2.10×10^{-9}	±20%	8010			
			$CHNH_2^+$	+ NH_3	0.05						
			$CH_2NH_2^+$	+ NH_2	0.45						
			$CH_3NH_2^+$	+ NH	0.20						
			$CH_3NH_3^+$	+ N	0.20						
NH^+	+ CO	→	HCO^+	+ N	0.45	9.80×10^{-10}	±20%	8010			
			NCO^+	+ H	0.55						
NH^+	+ H_2CO	→	HCO^+	+ NH_2	0.55	3.30×10^{-9}	±20%	8010			
			H_2CO^+	+ NH	0.30						
			CH_2OH^+	+ N	0.15						
NH^+	+ CH_3OH	→	HCO^+	+ NH_3 + H	0.15	3.00×10^{-9}	±20%	8010			
			H_2CO^+	+ NH_3	0.15						
			CH_2OH^+	+ NH_2	0.70						
			$CH_3OH_2^+$	+ N	0.10						
		M →	Adduct					8632			
NH^+	+ CO_2	→	HCO_2^+	+ N	0.35	1.10×10^{-9}	±20%	8010			
			NO^+	+ HCO	0.30						
			HNO^+	+ CO	0.35						
NH^+	+ NO	→	NO^+	+ NH	0.80	8.90×10^{-10}	±20%	8010			
			N_2H^+	+ O	0.20						
NH^+	+ COS	→	HS^+	+ NCO	0.05	1.80×10^{-9}	±20%	8010			
			NS^+	+ HCO	0.05						
			COS^+	+ NH	0.85						
			$HCOS^+$	+ N	0.05						

Table of Reactions – Continued

Reactions					Prod. Dist.	Rate Const. (cm^3/s)		Ref.			Footnotes
NH_2^+	+ H_2	→	NH_3^+	+ H	1.00	1.95×10^{-10}	±50%	8010	7506	6702	b
NH_2^+	+ CH_4	→	NH_3^+	+ CH_3	1.00	9.20×10^{-10}	±20%	8010	7305		
NH_2^+	+ C_2H_4	→	$C_2H_4^+$	+ NH_2	0.30	1.50×10^{-9}	±20%	8007			
			$C_2H_5^+$	+ NH	0.20						
			$CH_2NH_2^+$	+ CH_2	0.30						
			$CH_2CHNH_2^+$	+ H	0.20						
NH_2^+	+ NH_3	→	NH_3^+	+ NH_2	0.50	2.30×10^{-9}	±10%	8010	7304	7106	b
			NH_4^+	+ NH	0.50						
NH_2^+	+ N_2	→	No Reaction			$<5.00\times10^{-13}$		8018	8010		
NH_2^+	+ H_2O	→	NH_3^+	+ OH	0.03	2.90×10^{-9}	±20%	8617	8010	7709	b
			NH_4^+	+ O	0.04						
			H_3O^+	+ NH	0.94						
NH_2^+	+ O_2	→	HNO^+	+ OH	0.15	1.40×10^{-10}	±20%	8010			
			H_2NO^+	+ O	0.85						
NH_2^+	+ H_2S	→	HS^+	+ NH_3	0.10	1.80×10^{-9}	±20%	8010	7410		b
			H_2S^+	+ NH_2	0.40						
			H_3S^+	+ NH	0.15						
			NH_3^+	+ SH	0.25						
			NH_4^+	+ S	0.10						
NH_2^+	+ CH_3NH_2	→	NH_4^+	+ H_3CN	0.08	1.90×10^{-9}	±20%	8322	8010		
			$CH_2NH_2^+$	+ NH_3	0.20						
			$CH_3NH_2^+$	+ NH_2	0.53						
			$CH_3NH_3^+$	+ NH	0.20						
NH_2^+	+ CO	→	No Reaction			$<1.00\times10^{-11}$		8018			
NH_2^+	+ H_2CO	→	NH_3^+	+ HCO	0.20	2.80×10^{-9}	±20%	8010			
			CH_2OH^+	+ NH	0.80						
NH_2^+	+ CH_3OH	→	NH_3^+	+ CH_3O	0.14	3.05×10^{-9}	±20%	8122	8010		
			$CH_3OH_2^+$	+ NH	0.86						
NH_2^+	+ CO_2	→	No Reaction			$<1.00\times10^{-12}$		8018	8010		
NH_2^+	+ CHOOH	→	Products		1.00	2.70×10^{-9}	±30%	7821			
NH_2^+	+ CH_3CHO	→	HCO^+	+ CH_3NH_2	0.15	8.00×10^{-9}	±25%	8617			
			CH_3CO^+	+ NH_3	0.11						
			CH_3CHO^+	+ NH_2	0.19						
			$C_2H_5O^+$	+ NH	0.55						
NH_2^+	+ NO	→	NO^+	+ NH_2	1.00	7.00×10^{-10}	±20%	8010			
NH_2^+	+ COS	→	$NHSH^+$	+ CO	0.80	1.50×10^{-9}	±20%	8010			
			H_2NCO^+	+ S	0.15						
			$HCOS^+$	+ NH	0.05						
NH_3^+	+ H_2	→	NH_4^+	+ H	1.00	4.40×10^{-13}	±20%	9029 8416 8010 7412	8704 8307 7508	8523 8103 7506	a
		M →	No Reaction					8632			
NH_3^+	+ D_2	→	No Reaction			$<2.00\times10^{-12}$		8704	7506		a
NH_3^+	+ CH_4	→	NH_4^+	+ CH_3	1.00	3.90×10^{-10}	±25%	8010	8001	7305	

Table of Reactions — Continued

Reactions					Prod. Dist.	Rate Const. (cm^3/s)		Ref.			Footnotes
NH_3^+	+ C_2H_4	→	NH_4^+	+ C_2H_3	1.00	1.40×10^{-9}	±20%	8007			
NH_3^+	+ NH_3	→	NH_4^+	+ NH_2	1.00	2.10×10^{-9}	±12%	9029 7516 7304	8010 7415 7106	7711 7308	a
NH_3^+	+ N_2	→	No Reaction			$<5.00\times10^{-14}$		8010			
NH_3^+	+ H_2O	→	NH_4^+	+ OH	1.00	$\sim2.50\times10^{-10}$	±30%	8313	8010	7709	b
NH_3^+	+ O_2	→ M⇒	No Reaction Adduct			$<5.00\times10^{-13}$		8010 8632			
NH_3^+	+ H_2S	→	NH_4^+	+ SH	1.00	9.50×10^{-10}	±50%	8405	8010	7410	b
NH_3^+	+ HCN	→	No Reaction			$<1.00\times10^{-11}$		7709			
NH_3^+	+ CH_3NH_2	→	NH_4^+ $CH_3NH_2^+$ $CH_3NH_3^+$	+ CH_2NH_2 + NH_3 + NH_2	0.15 0.50 0.35	1.80×10^{-9}	±20%	8010			
NH_3^+	+ CO	→	No Reaction			$<5.00\times10^{-13}$		8010			
NH_3^+	+ H_2CO	→	NH_4^+	+ HCO	1.00	8.00×10^{-10}	±50%	8010	7709		
NH_3^+	+ CH_3OH	→	NH_4^+	+ CH_3O	1.00	2.20×10^{-9}	±20%	8122	8010		
NH_3^+	+ CO_2	→ M⇒	No Reaction Adduct			$<1.00\times10^{-13}$		8010 8632			
NH_3^+	+ CHOOH	→	Products		1.00	9.00×10^{-10}	±30%	7821			
NH_3^+	+ NO	→	NO^+	+ NH_3	1.00	7.20×10^{-10}	±20%	8010			
NH_3^+	+ COS	→	Products		1.00	$\sim2.00\times10^{-12}$	±20%	8010			
ND_3^+	+ H_2	→	NHD_3^+	+ H	1.00	6.20×10^{-13}	±50%	8704			a T=16
ND_3^+	+ D_2	→	ND_4^+	+ D	1.00	1.00×10^{-13}	±50%	8704			T=12
NH_4^+	+ H_2	→	No Reaction			$<4.00\times10^{-14}$		7711			
NH_4^+	+ D_2	→	No Reaction			$<1.00\times10^{-13}$		7506			
NH_4^+	+ C_2H_4	→	No Reaction			$<5.00\times10^{-13}$		8007			
$^*NH_4^+$	+ NH_3	→ M⇒	NH_4^+ Adduct	+ $^*NH_3$	1.00	6.00×10^{-10}	±10%	7611 8632			
NH_4^+	+ ND_3	→	Products		1.00	1.90×10^{-9}	±25%	8206			a
NH_4^+	+ H_2O	M⇒	Adduct					8632			
NH_4^+	+ Mg	→	MgH^+	+ NH_3	1.00	8.00×10^{-11}	±20%	7710			T=623
NH_4^+	+ CH_3NH_2	→	$CH_3NH_3^+$	+ NH_3	1.00	2.00×10^{-9}	±30%	8322			
NH_4^+	+ CH_3NC	→	CH_3CNH^+	+ NH_3	1.00	1.60×10^{-10}	±30%	8510			
NH_4^+	+ HC_3N	→	No Reaction			$<1.00\times10^{-14}$		7911			
NH_4^+	+ CO_2	M⇒	Adduct					8632			

Table of Reactions – Continued

Reactions	Prod. Dist.	Rate Const. (cm^3/s)		Ref.			Footnotes
$NH_3D^+ + D_2 \rightarrow NH_2D_2^+ + HD$ $NHD_3^+ + H_2$		$<3.00\times10^{-13}$		8704			[a] T=12
$NHD_3^+ + H_2 \rightarrow NH_3D^+ + D_2$ $NH_2D_2^+ + HD$		$<8.00\times10^{-14}$		8704			[a] T=12
$ND_4^+ + NH_3 \rightarrow$ Products	1.00	1.50×10^{-9}	±25%	8206			[a]
$N_2^+ + H \rightarrow$ Products		$<1.00\times10^{-11}$		9102			
$N_2^+ + D \rightarrow$ Products		$<1.00\times10^{-11}$		9102	7901		[b]
$N_2^+ + H_2 \rightarrow N_2H^+ + H$	1.00	2.00×10^{-9}	±15%	9114 8010 7506 6907	9102 7905 7423 6702	8428 7602 7209	[ab]
$N_2^+ + D_2 \rightarrow N_2D^+ + D$	1.00	1.25×10^{-9}	±20%	9102	7901	6907	
$N_2^+ + CH_4 \rightarrow CH_2^+ + N_2 + H_2$ $CH_3^+ + N_2 + H$	0.09 0.91	1.14×10^{-9}	±15%	9114 8001	8927 7905	8010 7209	[a]
$N_2^+ + C_2H_2 \rightarrow C_2H_2^+ + N_2$	1.00	4.30×10^{-10}		7209			
$N_2^+ + N \rightarrow N^+ + N_2$	1.00	$<1.00\times10^{-11}$		6804			
$N_2^+ + NH_3 \rightarrow NH_3^+ + N_2$	1.00	1.95×10^{-9}	±10%	8318 7905	8010	8001	
$^*N_2^+ + N_2 \xrightarrow{M} N_2^+ + {}^*N_2$ Adduct	1.00	5.80×10^{-10}	±25%	8108 8632	7611		[a]
$N_2^+ + O \rightarrow O^+ + N_2$ $NO^+ + N$	0.07 0.93	1.40×10^{-10}	±50%	7418	7004	6501	[b]
$N_2^+ + H_2O \rightarrow H_2O^+ + N_2$	0.79	2.40×10^{-9}	±20%	8010	8001	7905	
$N_2H^+ + OH$	0.21			7802	7202	7006	
$N_2^+ + O_2 \rightarrow O_2^+ + N_2$	1.00	5.00×10^{-11}	±15%	9129 8523 7905 7311 7001 6603	9114 8118 7602 7209 6902	8611 8010 7417 7007 6801	[ab]
$N_2^+ + Cl_2 \rightarrow$ Products	1.00	6.00×10^{-10}	±20%	8119			
$N_2^+ + Na \rightarrow Na^+ + N_2$	1.00	1.30×10^{-9}	±75%	8919	6901		
$N_2^+ + H_2S \rightarrow S^+ + N_2 + H_2$ $HS^+ + N_2 + H$ $H_2S^+ + N_2$ $N_2H^+ + SH$	0.16 0.73 0.11 0.01	1.65×10^{-9}	±10%	8401	8010		
$N_2^+ + Ar \rightarrow Ar^+ + N_2$	1.00	2.00×10^{-13}	±20%	9107	8116	8114	[ab]
$N_2^+ + Kr \rightarrow Kr^+ + N_2$	1.00	1.00×10^{-12}	±30%	8119			
$N_2^+ + Xe \rightarrow$ No Reaction		$<1.00\times10^{-13}$		8119			
$N_2^+ + Hg \rightarrow Hg^+ + N_2$	1.00	1.20×10^{-11}	±20%	8015			

Table of Reactions – Continued

Reactions	Prod. Dist.	Rate Const. (cm^3/s)		Ref.			Footnotes
$N_2^+ + HCN \rightarrow HCN^+ + N_2$	1.00	3.90×10^{-10}	±10%	8101			
$N_2^+ + CH_3NH_2 \rightarrow CH_3^+ + N_2 + NH_2$	0.21	1.20×10^{-9}	±30%	8010			
$CH_2NH_2^+ + N_2 + H$	0.73						
$CH_3NH_2^+ + N_2$	0.06						
$N_2^+ + CH_3CN \rightarrow CHCN^+ + N_2 + H_2$	0.20	2.10×10^{-9}	±30%	8804			
$CH_2CN^+ + N_2 + H$	0.65						
$CH_2CNH^+ + N_2$	0.15						
$N_2^+ + C_2N_2 \rightarrow C_2N_2^+ + N_2$	>0.95	8.60×10^{-10}	±30%	8515			
$N_2^+ + HC_3N \rightarrow CHCCN^+ + N_2$	1.00	3.50×10^{-9}	±25%	8518	8509		
$N_2^+ + CO \rightarrow CO^+ + N_2$	1.00	7.30×10^{-11}	±20%	8010	8001	6701	
$N_2^+ + H_2CO \rightarrow HCO^+ + N_2H$	0.87	2.90×10^{-9}	±30%	8010			
$H_2CO^+ + N_2$	0.13						
$N_2^+ + CH_3OH \rightarrow CH_3^+ + N_2 + OH$	0.79	1.40×10^{-9}	±30%	8010			
$CH_2OH^+ + N_2 + H$	0.12						
$CH_3OH^+ + N_2$	0.09						
$N_2^+ + CO_2 \rightarrow CO_2^+ + N_2$	1.00	8.00×10^{-10}	± 20%	8927	8010	8001	a
				7905	7209	6701	
$N_2^+ + CHOOH \rightarrow HCO^+ + N_2 + OH$	1.00	4.60×10^{-9}	± 30%	7821			
$N_2^+ + CS_2 \rightarrow S^+ + N_2 + CS$	0.60	1.20×10^{-9}	± 20%	9020			
$CS_2^+ + N_2$	0.40						
$N_2^+ + NO \rightarrow$ Products	1.00	4.10×10^{-10}	±20%	8119	7905	7209	
				7004	6603		
$N_2^+ + N_2O \rightarrow N_2O^+ + N_2$	1.00	6.00×10^{-10}	± 20%	8822	7209	7009	
				6804			
$N_2^+ + SO_2 \rightarrow SO_2^+ + N_2$	1.00	5.20×10^{-10}	±30%	7606	7209		
$N_2^+ + COS \rightarrow S^+ + N_2 + CO$	0.80	1.36×10^{-9}	±20%	8010	7209		
$COS^+ + N_2$	0.20						
$N_2H^+ + D \rightarrow N_2D^+ + H$	1.00	8.00×10^{-11}	±20%	8503			a
$N_2H^+ + H_2 \xrightarrow{M} H_3^+ + N_2$	1.00	5.10×10^{-18}	±80%	7714	7310		
Adduct				8632			
$N_2H^+ + CH_4 \rightarrow CH_5^+ + N_2$	1.00	8.90×10^{-10}	±30%	7005			
$N_2H^+ + C_2H_2 \rightarrow C_2H_3^+ + N_2$	1.00	1.41×10^{-9}	±25%	7713			
$N_2H^+ + C_2H_6 \rightarrow C_2H_5^+ + N_2 + H_2$	0.87	1.30×10^{-9}	±35%	8117			
$C_2H_7^+ + N_2$	0.13						
$N_2H^+ + NH_3 \rightarrow NH_4^+ + N_2$	1.00	2.30×10^{-9}	±20%	7415			
$^*N_2H^+ + N_2 \rightarrow N_2H^+ + {}^*N_2$	1.00	4.10×10^{-9}	±20%	8108			a
$\xrightarrow{M}$ Adduct				8632			
$N_2H^+ + O \rightarrow OH^+ + N_2$	1.00	1.40×10^{-10}	±20%	8006			
$N_2H^+ + H_2O \rightarrow H_3O^+ + N_2$	1.00	2.60×10^{-9}	±10%	8208	7510	7420	
				7309	7005		

Table of Reactions – Continued

Reactions	Prod. Dist.	Rate Const. (cm^3/s)		Ref.			Footnotes
$N_2H^+ + O_2 \rightarrow$ No Reaction		$<8.00\times10^{-13}$		7406			
$N_2H^+ + Kr \rightarrow$ No Reaction		$<4.00\times10^{-13}$		8418			
$N_2H^+ + Xe \rightarrow XeH^+ + N_2$	1.00	6.60×10^{-10}	±30%	8006	7607		
$N_2H^+ + HCN \rightarrow HCNH^+ + N_2$	1.00	3.20×10^{-9}	±20%	7605			
$N_2H^+ + CH_3CN \rightarrow CH_3CNH^+ + N_2$	1.00	4.10×10^{-9}	±25%	7605			
$N_2H^+ + C_2N_2 \rightarrow HC_2N_2^+ + N_2$	1.00	1.20×10^{-9}	±30%	8412			
$N_2H^+ + HC_3N \rightarrow CHCCNH^+ + N_2$	1.00	4.20×10^{-9}	±20%	8518	8412	7911	
$N_2H^+ + CO \rightarrow HCO^+ + N_2$	1.00	8.80×10^{-10}	±25%	8006			
$N_2H^+ + H_2CO \rightarrow CH_2OH^+ + N_2$	1.00	3.30×10^{-9}	±25%	7906			
$N_2H^+ + CH_3OH \rightarrow CH_3^+ + N_2 + H_2O$	0.11	1.70×10^{-9}	±20%	7706			
$CH_2OH^+ + N_2 + H_2$	0.07						
$CH_3OH_2^+ + N_2$	0.82						
$N_2H^+ + CO_2 \rightarrow HCO_2^+ + N_2$	1.00	1.07×10^{-9}	±20%	8208 7005	8006	7607	
$N_2H^+ + ClOOH \rightarrow ClH(OH)_2^+ + N_2$	1.00	1.70×10^{-9}	±30%	7820			
$N_2H^+ + CS_2 \rightarrow HCS_2^+ + N_2$	1.00	6.00×10^{-10}	±40%	8208			
$N_2H^+ + NO \rightarrow HNO^+ + N_2$	1.00	3.40×10^{-10}	±40%	8208	7104		
$N_2H^+ + N_2O \rightarrow HN_2O^+ + N_2$	1.00	1.25×10^{-9}	±50%	8208	7005		
$N_2H^+ + SO_2 \rightarrow HSO_2^+ + N_2$	1.00	1.70×10^{-9}	±40%	8208			
$N_2D^+ + H \rightarrow N_2H^+ + D$	1.00	2.50×10^{-11}	±20%	8503			a
$O^+ + H \rightarrow H^+ + O$	1.00	6.40×10^{-10}	±30%	8403	7205		
$O^+ + H_2 \rightarrow OH^+ + H$	1.00	1.62×10^{-9}	±20%	9122 8010	8724 7506	8403 6702	
$O^+ + HD \rightarrow OH^+ + D$	0.54	1.22×10^{-9}	±40%	9128	9006	8724	a
$OD^+ + H$	0.46						
$O^+ + D_2 \rightarrow OD^+ + D$	1.00	1.04×10^{-9}	±20%	8724			
$O^+ + CH_4 \rightarrow CH_3^+ + OH$	0.11	1.00×10^{-9}	±20%	8010			
$CH_4^+ + O$	0.89						
$O^+ + C_2H_6 \rightarrow C_2H_4^+ + H_2O$	0.70	1.90×10^{-9}	±20%	8117			
$C_2H_5^+ + OH$	0.30						
$O^+ + NH_3 \rightarrow NH_3^+ + O$	1.00	1.20×10^{-9}	±20%	8010			
$O^+ + N_2 \rightarrow NO^+ + N$	1.00	1.20×10^{-12}	±10%	9036 7816 7417 6902	8718 7808 7311 6803	8010 7718 7306 6801	a,b
$\xrightarrow{M}$ Product				8632			
$O^+ + H_2O \rightarrow H_2O^+ + O$	1.00	2.60×10^{-9}	±15%	8925 7006	8010	7202	

Table of Reactions — Continued

Reactions	Prod. Dist.	Rate Const. (cm^3/s)		Ref.			Footnotes
$O^+ + O_2 \rightarrow O_2^+ + O$	1.00	2.10×10^{-11}	±10%	8523 8808 7417 6902	8010 7718 7311 6801	7816 7602 7306	a
$^*O^+ + O_2 \rightarrow O^+ + {}^*O_2$		$<1.00\times10^{-12}$		7421			
$O^+ + H_2S \rightarrow S^+ + H_2O$	0.11	1.90×10^{-9}	±20%	8010	7507		b
$HS^+ + OH$	0.21						
$H_2S^+ + O$	0.68						
$O^+ + HCN \rightarrow CO^+ + NH$	~0.33	3.50×10^{-9}	±20%	8512			a
$HCO^+ + N$	~0.33						
$NO^+ + CH$	~0.33						
$O^+ + CH_3NH_2 \rightarrow CHNH_2^+ + H_2O$	0.15	2.10×10^{-9}	±20%	8010			
$CH_2NH_2^+ + OH$	0.79						
$CH_3NH_2^+ + O$	0.06						
$O^+ + CO \rightarrow$ No Reaction		$<5.00\times10^{-13}$		8010			
$^*O^+ + CO \rightarrow O^+ + {}^*CO$	1.00	4.40×10^{-10}	±30%	7421			
$O^+ + H_2CO \rightarrow HCO^+ + OH$	0.40	3.50×10^{-9}	±30%	8010			
$H_2CO^+ + O$	0.60						
$O^+ + CH_3OH \rightarrow H_2CO^+ + H_2O$	0.05	1.90×10^{-9}	±30%	8010			
$CH_2OH^+ + OH$	0.70						
$CH_3OH^+ + O$	0.25						
$O^+ + CO_2 \rightarrow O_2^+ + CO$	1.00	1.10×10^{-9}	±20%	9022 7417 6801	8010 7211 6604	7602 7007	a
$O^+ + CHOOH \rightarrow HO_2^+ + HCO$		5.00×10^{-9}	±30%	7821			
$HCO^+ + HO_2$							
$O^+ + NO \rightarrow NO^+ + O$	1.00	8.00×10^{-13}	±15%	7808 7419	7718 7102	7519 6603	
$^*O^+ + NO \rightarrow O^+ + {}^*NO$		$<5.00\times10^{-12}$		7421			
$O^+ + NO_2 \rightarrow NO_2^+ + O$	1.00	1.60×10^{-9}	±30%	7102			T=393
$O^+ + N_2O \rightarrow N_2O^+ + O$	1.00	6.30×10^{-10}	±30%	7102			T=393
$O^+ + SO_2 \rightarrow O_2^+ + SO$	1.00	$\sim8.00\times10^{-10}$	±50%	8401			
$O^+ + COS \rightarrow S^+ + CO_2$	0.03	6.70×10^{-10}	±20%	8010			
$COS^+ + O$	0.97						
$OH^+ + H_2 \rightarrow H_2O^+ + H$	1.00	9.70×10^{-10}	±20%	8818 6702	8104	7506	b
$OH^+ + CH_4 \rightarrow CH_5^+ + O$	0.13	1.45×10^{-9}	±10%	8006	8001	7806	b
$H_3O^+ + CH_2$	0.87			7305			
$OH^+ + C_2H_6 \rightarrow H_3O^+ + C_2H_4$	0.10	1.60×10^{-9}	±20%	8117			
$C_2H_4^+ + H_2O + H$	0.65						
$C_2H_5^+ + H_2O$	0.20						
$C_2H_6^+ + OH$	0.03						
$C_2H_7^+ + O$	0.02						

Table of Reactions — Continued

Reactions				Prod. Dist.	Rate Const. (cm^3/s)		Ref.			Footnotes
OH^+	+ NH_3 →	NH_3^+	+ OH	0.50	1.84×10^{-9}	±30%	8818	7709		
		NH_4^+	+ O	0.50						
OH^+	+ N_2 →	N_2H^+	+ O	1.00	2.40×10^{-10}	±30%	8818	8104	8006	
							8001	7806	7716	
OH^+	+ H_2O →	H_2O^+	+ OH	0.55	2.89×10^{-9}	±10%	7304			
		H_3O^+	+ O	0.45						
OH^+	+ O_2 →	O_2^+	+ OH	1.00	3.80×10^{-10}	±50%	8818	8104	7806	
							6702			
OH^+	+ H_2S →	H_2S^+	+ OH	0.60	2.00×10^{-9}	±30%	8818	8714	8104	b
		H_3S^+	+ O	0.40			7806	7410		
OH^+	+ Xe →	Xe^+	+ OH	0.80	9.20×10^{-10}	±20%	8104			
		XeH^+	+ O	0.20						
OH^+	+ CO →	HCO^+	+ O	1.00	8.40×10^{-10}	±20%	8818	8104	8006	
							8001	7806	7716	
OH^+	+ H_2CO →	H_2CO^+	+ OH	0.40	1.86×10^{-9}	±10%	7806			
		CH_2OH^+	+ O	0.60						
OH^+	+ CO_2 →	HCO_2^+	+ O	1.00	1.35×10^{-9}	±15%	8818	8104	8001	
							7806	7716	7715	
OH^+	+ CH_3SH →	Products		1.00	1.10×10^{-9}	±10%	8714			
OH^+	+ CS_2 →	CS_2^+	+ OH		1.50×10^{-9}	±30%	8818			
		HC_2S^+	+ O							
OH^+	+ C_2H_5SH →	Products		1.00	3.50×10^{-9}	±10%	8714			
OH^+	+ $(CH_3)_2S$ →	Products		1.00	2.30×10^{-9}	±10%	8714			
OH^+	+ NO →	NO^+	+ OH	1.00	8.15×10^{-10}	±15%	8818	8104	8018	b
							8008	7806		
OH^+	+ NO_2 →	NO^+	+ HO_2		1.30×10^{-9}	±30%	8818			
		NO_2^+	+ OH							
OH^+	+ N_2O →	NO^+	+ HNO	0.11	1.33×10^{-9}	±20%	8818	8104	7806	
		N_2O^+	+ OH	0.16						
		HN_2O^+	+ O	0.72						
OH^+	+ SO_2 →	SO_2^+	+ OH		2.10×10^{-9}	±30%	8818			
		HSO_2^+	+ O							
OD^+	+ SiH_4 →	Si^+	+ HDO + H_2 + H	0.03	6.60×10^{-10}	±20%	7320			
		SiH^+	+ HDO + H_2	0.09						
		SiH_2^+	+ HDO + H	0.21						
		SiH_3^+	+ HDO	0.27						
		$SiOD^+$	+ H_2 + H_2	0.26						
		$SiOH_2D^+$	+ H_2	0.13						
H_2O^+	+ H_2 →	H_3O^+	+ H	1.00	7.60×10^{-10}	±15%	8104	8009	7506	
							6702			
H_2O^+	+ CH_4 →	H_3O^+	+ CH_3	1.00	1.12×10^{-9}	±10%	8818	8009	8001	b
							7806	7305		
H_2O^+	+ C_2H_4 →	$C_2H_4^+$	+ H_2O		1.60×10^{-9}	±30%	8009			
		$C_2H_5^+$	+ OH							

Table of Reactions – Continued

Reactions					Prod. Dist.	Rate Const. (cm^3/s)		Ref.			Footnotes
H_2O^+	+ C_2H_6	→	H_3O^+	+ C_2H_5	0.83	1.60×10^{-9}	±20%	8117			
			$C_2H_4^+$	+ H_2O + H_2	0.12						
			$C_2H_5^+$	+ H_2O + H	0.01						
			$C_2H_6^+$	+ H_2O	0.04						
H_2O^+	+ N	→	NO^+	+ H_2		1.90×10^{-10}	±50%	8008			
			HNO^+	+ H							
H_2O^+	+ NH_3	→	NH_3^+	+ H_2O	0.70	3.15×10^{-9}	±10%	7709			
			NH_4^+	+ OH	0.30						
H_2O^+	+ N_2	→	No Reaction			$<1.00\times10^{-11}$		7806			
		M →	Adduct					8632			
H_2O^+	+ O	→	No Reaction			$<4.00\times10^{-11}$		8008			
H_2O^+	+ H_2O	→	H_3O^+	+ OH	1.00	1.85×10^{-9}	±15%	7304	7202		
H_2O^+	+ O_2	→	O_2^+	+ H_2O	1.00	3.30×10^{-10}	±45%	8818	8104	8018	b
								8009	7806	6702	
H_2O^+	+ Na	→	Na^+	+ H_2O	1.00	6.20×10^{-9}	±30%	8919			
H_2O^+	+ H_2S	→	H_3O^+	+ SH	0.24	2.00×10^{-9}	±25%	8818	8714	8104	
			H_2S^+	+ H_2O	0.42			7806	7410		
			H_3S^+	+ OH	0.34						
H_2O^+	+ Xe	→	Xe^+	+ H_2O	1.00	8.00×10^{-10}	±20%	8104			
H_2O^+	+ HCN	→	H_3O^+	+ CN	<0.50	2.10×10^{-9}	±10%	8101			
			$HCNH^+$	+ OH	>0.50						
H_2O^+	+ C_2N_2	→	$HC_2N_2^+$	+ OH	1.00	1.00×10^{-9}	±30%	8412			
H_2O^+	+ CO	→	HCO^+	+ OH	1.00	4.25×10^{-10}	±20%	8818	8104	8009	b
								8006	8001	7806	
H_2O^+	+ H_2CO	→	H_2CO^+	+ H_2O	0.68	2.07×10^{-9}	±10%	7806			
			CH_2OH^+	+ OH	0.32						
H_2O^+	+ CO_2	→	No Reaction			$<1.00\times10^{-11}$		7806			
		M →	Adduct					8632			
H_2O^+	+ CH_3SH	→	Products		1.00	1.10×10^{-9}	±10%	8714			
H_2O^+	+ C_2H_5SH	→	Products		1.00	3.30×10^{-9}	±10%	8714			
H_2O^+	+ $(CH_3)_2S$	→	Products		1.00	2.10×10^{-9}	±10%	8714			
H_2O^+	+ NO	→	NO^+	+ H_2O	1.00	4.60×10^{-10}	±20%	8818	8314	8104	b
								8009	8008	7806	
H_2O^+	+ NO_2	→	NO_2^+	+ H_2O	1.00	1.20×10^{-9}	±30%	8818	8009		
H_2O^+	+ N_2O	→	Products		1.00	4.80×10^{-12}	±30%	8818	7806		
		M →	Adduct					8632			
H_2O^+	+ SO_2	→	SO_2^+	+ H_2O		2.00×10^{-9}	±30%	8818			
			HSO_2^+	+ OH							

Table of Reactions – Continued

Reactions	Prod. Dist.	Rate Const. (cm^3/s)		Ref.			Footnotes
$D_2O^+ + SiH_4 \rightarrow HD_2O^+ + SiH_3$	0.15	5.30×10^{-10}	±20%	7320			
$SiH_2^+ + D_2O + H_2$	0.36						
$SiH_3^+ + D_2O + H$	0.39						
$SiOD^+ + HD + H_2 + H$	0.02						
$SiOHD^+ + H_2 + HD$	0.01						
$SiOH_2D^+ + HD + H$	0.06						
$SiOH_2D_2^+ + H_2$	0.01						
$H_3O^+ + H_2 \rightarrow$ No Reaction		$<5.00\times10^{-15}$		7711			
$H_3O^+ + D_2 \rightarrow$ No Reaction		$<1.00\times10^{-12}$		7506			
$H_3O^+ + C_2H_4 \rightarrow C_2H_5^+ + H_2O$	1.00	5.15×10^{-11}	±30%	8807	8115		a
$H_3O^+ + NH_3 \rightarrow NH_4^+ + H_2O$	1.00	2.23×10^{-9}	±10%	8818 7711 7308	8019 7709	7904 7415	
$H_3O^+ + H_2O \xrightarrow{M}$ Adduct				8632			
$H_3O^+ + D_2O \rightarrow$ Products	1.00	2.20×10^{-9}	±20%	8019			
$H_3O^+ + H_2S \rightarrow H_3S^+ + H_2O$	1.00	1.65×10^{-9}	±15%	8818 7809	8714	7904	
$H_3O^+ + HCN \rightarrow HCNH^+ + H_2O$	1.00	3.80×10^{-9}	±15%	7819	7809	7605	
$H_3O^+ + CH_3CN \rightarrow CH_3CNH^+ + H_2O$	1.00	4.50×10^{-9}	±15%	9112	8618	7605	
$H_3O^+ + HC_3N \rightarrow CHCCNH^+ + H_2O$	1.00	3.90×10^{-9}	±30%	8412	7911		
$H_3O^+ + H_2CO \rightarrow CH_2OH^+ + H_2O$	1.00	3.00×10^{-9}	±25%	7906	7904	7812	
$H_3O^+ + CH_3OH \rightarrow CH_3OH_2^+ + H_2O$	1.00	2.50×10^{-9}	±25%	7904	7812		
$H_3O^+ + CHOOH \rightarrow CH(OH)_2^+ + H_2O$	1.00	2.50×10^{-9}	±15%	7820	7904	7818	
$H_3O^+ + CH_2CO \rightarrow CH_3CO^+ + H_2O$	1.00	2.00×10^{-9}	±25%	7904			
$H_3O^+ + CH_3CHO \rightarrow C_2H_5O^+ + H_2O$	1.00	3.55×10^{-9}	±25%	8617	7904		
$H_3O^+ + C_2H_5OH \rightarrow C_2H_5OH_2^+ + H_2O$	1.00	2.80×10^{-9}	±25%	7904			
$H_3O^+ + (CH_3)_2O \rightarrow (CH_3)_2OH^+ + H_2O$	1.00	2.70×10^{-9}	±25%	7904			
$H_3O^+ + CH_3COOH \rightarrow CH_3CO^+ + H_2O + H_2O$	0.05	3.00×10^{-9}	±30%	7818			
$CH_3C(OH)_2^+ + H_2O$	0.95						
$H_3O^+ + (CH_3)_2CO \rightarrow$ Products	1.00	3.80×10^{-9}	±30%	9112			
$H_3O^+ + CH_3COOCH_3 \rightarrow$ Products	1.00	2.60×10^{-9}	±30%	9112			
$H_3O^+ + CH_3SH \rightarrow$ Products	1.00	1.00×10^{-9}	±10%	8714			
$H_3O^+ + CS_2 \rightarrow HC_2S^+ + H_2O$	1.00	3.05×10^{-10}	±30%	8818	8807		a
$H_3O^+ + C_2H_5SH \rightarrow$ Products	1.00	3.00×10^{-9}	±10%	8714			
$H_3O^+ + (CH_3)_2S \rightarrow$ Products	1.00	2.10×10^{-9}	±10%	8714			
$H_3O^+ + N_2O \xrightarrow{M}$ Adduct				8632			
$H_3O^+ + SO_2 \xrightarrow{M}$ Adduct				8632			

Table of Reactions – Continued

Reactions					Prod. Dist.	Rate Const. (cm^3/s)		Ref.			Footnotes
D_3O^+	+ NH_3	→	Products		1.00	2.20×10^{-9}	±20%	8019			
D_3O^+	+ H_2O	→	Products		1.00	2.00×10^{-9}	±20%	8019			
D_3O^+	+ SiH_4	→	SiH_3^+	+ D_2O + HD	~0.80	$>1.40\times10^{-10}$	±20%	7320			
			SiH_4D^+	+ D_2O	~0.20						
O_2^+	+ H_2	→	No Reaction			$<1.00\times10^{-13}$		7408	6702		
		M →	Adduct					8632			
O_2^+	+ CH_4	→	$CH(OH)_2^+$	+ H	1.00	6.00×10^{-12}	±15%	9106	9005	8927	ab
								8612	8508	8419	
								8406	8123	8010	
								7912	7810	7314	
		M →	Adduct					8632			
O_2^+	+ CH_3D	→	$CH(OH)_2^+$	+ D	0.24	4.60×10^{-12}	±30%	8612			
			$CH_2DO_2^+$	+ H	0.76						
O_2^+	+ CH_2D_2	→	$CH_2DO_2^+$	+ D	0.48	3.80×10^{-12}	±30%	8612			
			$CHD_2O_2^+$	+ H	0.52						
O_2^+	+ CHD_3	→	$CHD_2O_2^+$	+ D	0.79	2.50×10^{-12}	±30%	8612			
			$CD(OD)_2^+$	+ H	0.21						
O_2^+	+ CD_4	→	$CD(OD)_2^+$	+ D	1.00	1.70×10^{-12}	±30%	8612			a
O_2^+	+ N	→	NO^+	+ O	1.00	1.50×10^{-10}	±50%	7717	6603		
O_2^+	+ NH_3	→	NH_3^+	+ O_2	1.00	2.10×10^{-9}	±20%	8318	8010	7308	
O_2^+	+ N_2	→	NO^+	+ NO	1.00	$<1.00\times10^{-15}$		6502			
		M →	Adduct					8632			
O_2^+	+ H_2O	→	No Reaction			$<1.00\times10^{-12}$		8419	8018		
		M →	Adduct					8632			
$^*O_2^+$	+ O_2	→	O_2^+	+ $^*O_2$	1.00	3.90×10^{-10}	±10%	8506	8021		
		M →	Adduct					8632			
O_2^+	+ H_2O_2	→	$H_2O_2^+$	+ O_2	1.00	1.50×10^{-9}	±30%	7513			
O_2^+	+ O_3	M →	Adduct					8632			
O_2^+	+ Na	→	Na^+	+ O_2	>0.90	1.20×10^{-9}	±60%	8919	6901		
			NaO^+	+ O	<0.10						
O_2^+	+ H_2S	→	H_2S^+	+ O_2	1.00	1.40×10^{-9}	±20%	8010	7507		
O_2^+	+ Kr	M →	Adduct					8632			
O_2^+	+ Xe	→	Xe^+	+ O_2	1.00	5.50×10^{-11}	±25%	9022	8413		a
O_2^+	+ HCN	→	No Reaction			$<1.00\times10^{-11}$		8101			
O_2^+	+ CH_3NH_2	→	$CH_3NH_2^+$	+ HO_2	0.35	$\sim1.00\times10^{-9}$	±50%	8010			
			$CH_3NH_2^+$	+ O_2	0.65						
O_2^+	+ CO	→	No Reaction			$<1.00\times10^{-11}$		8018			
O_2^+	+ H_2CO	→	H_2CO^+	+ O_2	0.90	2.30×10^{-9}	±20%	8010			
			HCO^+		0.10						

Table of Reactions – Continued

Reactions	Prod. Dist.	Rate Const. (cm^3/s)		Ref.			Footnotes
$O_2^+ + CH_3OH \rightarrow CH_2OH^+ + HO_2$ $CH_3OH^+ + O_2$	~0.50 ~0.50	$\sim 1.00\times10^{-9}$	±50%	8010			
$O_2^+ + CO_2 \rightarrow$ No Reaction		$<1.00\times10^{-11}$		8018			
$\xrightarrow{M}$ Adduct				8632			
$O_2^+ + CHOOH \rightarrow HCO_2^+ + HO_2$ $CHOOH^+ + O_2$		1.80×10^{-9}	±30%	7821			
$O_2^+ + NO \rightarrow NO^+ + O_2$	1.00	4.60×10^{-10}	±30%	7808 7007	7517 7004	7417 6603	ab
$O_2^+ + NO_2 \rightarrow NO_2^+ + O_2$	1.00	6.60×10^{-10}	±30%	7303			
$O_2^+ + N_2O \rightarrow$ No Reaction		$<1.00\times10^{-11}$		8018			
$\xrightarrow{M}$ Adduct				8632			
$O_2^+ + SO_2 \rightarrow$ No Reaction		$<1.00\times10^{-12}$		8419	8401		
$\xrightarrow{M}$ Adduct				8632			
$O_2^+ + COS \rightarrow COS^+ + O_2$	1.00	1.00×10^{-9}	±20%	8010			
$HO_2^+ + H_2 \rightarrow H_3^+ + O_2$	1.00	3.30×10^{-10}	±10%	8414 7505	8006 7312	7514	a
$HO_2^+ + CH_4 \rightarrow CH_3^+ + O_2 + H_2$ $CH_5^+ + O_2$	0.08 0.92	1.00×10^{-9}	±30%	7613			
$HO_2^+ + C_2H_4 \rightarrow C_2H_3^+ + O_2 + H_2$ $C_2H_5^+ + O_2$	0.77 0.23	1.10×10^{-9}	±30%	7613			
$HO_2^+ + C_2H_6 \rightarrow C_2H_3^+ + O_2 + H_2 + H_2$ $C_2H_5^+ + O_2 + H_2$	0.02 0.98	1.40×10^{-9}	±20%	7613			
$HO_2^+ + NH_3 \rightarrow NH_3^+ + HO_2$ $NH_4^+ + O_2$	0.04 0.96	1.90×10^{-9}	±20%	7613	7516		
$HO_2^+ + N_2 \rightarrow N_2H^+ + O_2$	1.00	8.00×10^{-10}	±30%	7516			
$HO_2^+ + Ar \rightarrow ArH^+ + O_2$	1.00	$<5.00\times10^{-12}$		7512			
$HO_2^+ + Kr \rightarrow KrH^+ + O_2$	1.00	4.30×10^{-10}	±20%	8006			
$HO_2^+ + CO_2 \rightarrow HCO_2^+ + O_2$	1.00	1.10×10^{-9}	±30%	7516			
$HO_2^+ + NO \rightarrow$ Products	1.00	7.00×10^{-10}	±30%	7517			
$DO_2^+ + D_2 \rightarrow D_3^+ + O_2$	1.00	2.80×10^{-10}	±25%	8414	8006		a
$H_2O_2^+ + NH_3 \rightarrow NH_4^+ + HO_2$	1.00	1.80×10^{-9}	±30%	7513			
$H_2O_2^+ + H_2O \rightarrow H_3O^+ + HO_2$	1.00	1.70×10^{-9}	±30%	7513			
$H_2O_2^+ + H_2O_2 \rightarrow H_3O_2^+ + HO_2$	1.00	$\sim 6.00\times10^{-10}$	±50%	7513			
$H_2O_2^+ + CO \rightarrow$ No Reaction		$<1.00\times10^{-11}$		7513			
$H_2O_2^+ + NO \rightarrow NO^+ + H_2O_2$	1.00	5.00×10^{-10}	±30%	7513			

Table of Reactions – Continued

Reactions					Prod. Dist.	Rate Const. (cm^3/s)		Ref.		Footnotes
F^+	+ H_2	→	H^+	+ HF	0.03	1.04×10^{-9}	±20%	9013	8601	
			H_2^+	+ F	0.60					
			HF^+	+ H	0.37					
F^+	+ D_2	→	D^+	+ DF	0.05	7.00×10^{-10}	±20%	9013		
			D_2^+	+ F	0.60					
			DF^+	+ D	0.35					
F^+	+ CH_4	→	CH_2^+	+ HF + H	0.15	1.70×10^{-9}	±20%	9013	8601	
			CH_3^+	+ HF	0.83					
			CH_4^+	+ F	0.02					
F^+	+ C_2H_2	→	C_2H^+	+ HF	0.14	1.40×10^{-9}	±20%	9013		
			$C_2H_2^+$	+ F	0.86					
F^+	+ C_2H_4	→	$C_2H_2^+$	+ HF + H	0.27	1.40×10^{-9}	±20%	9013		
			$C_2H_3^+$	+ HF	0.66					
			$C_2H_4^+$	+ F	0.06					
F^+	+ c-C_6H_6	→	$C_3H_3^+$	+ C_3H_3F	0.16	2.00×10^{-9}	±20%	9013		
			$C_4H_4^+$	+ C_2H_2F	0.55					
			$C_5H_3^+$	+ CH_3F	0.06					
			c-$C_6H_6^+$	+ F	0.23					
F^+	+ NH_3	→	NH^+	+ HF + H	0.05	2.05×10^{-9}	±20%	9013	8601	
			NH_2^+	+ HF	0.79					
			NH_3^+	+ F	0.12					
			HF^+	+ NH_2	0.04					
F^+	+ N_2	→	N_2^+	+ F	1.00	9.70×10^{-10}	±20%	9013	8620	8601
F^+	+ H_2O	→	O^+	+ HF + H	0.17	3.10×10^{-9}	±20%	9013		
			OH^+	+ HF	0.06					
			H_2O^+	+ F	0.66					
			HF^+	+ OH	0.11					
F^+	+ O_2	→	O^+	+ FO	0.07	8.65×10^{-10}	±20%	9013	8620	8601
			O_2^+	+ F	0.81					
			FO^+	+ O	0.12					
F^+	+ H_2S	→	S^+	+ HF + H	0.16	7.60×10^{-10}	±20%	9013	8601	
			HS+	+ HF	0.84					
F^+	+ Ar	→	Ar^+	+ F	1.00	$\sim1.00\times10^{-11}$	±60%	8620		
F^+	+ CO	→	CO^+	+ F	0.96	9.80×10^{-10}	±20%	9013	8601	
			CF^+	+ O	0.04					
F^+	+ CO_2	→	CO_2^+	+ F	1.00	1.15×10^{-9}	±20%	9013	8601	
F^+	+ NO	→	NO^+	+ F	0.90	9.40×10^{-10}	±20%	9013	8601	
			FN^+	+ O	0.10					
F^+	+ N_2O	→	O^+	+ FN_2	0.10	8.00×10^{-10}	±20%	8601		
			NO^+	+ FN	0.90					
F^+	+ SO_2	→	SO^+	+ FO	1.00	2.20×10^{-9}	±20%	8601		
F^+	+ COS	→	S^+	+ FCO	0.95	1.45×10^{-9}	±20%	9013	8601	
			COS^+	+ F	0.05					

Table of Reactions — Continued

Reactions					Prod. Dist.	Rate Const. (cm^3/s)		Ref.			Footnotes
Ne^+	+ H_2	→	No Reaction			$<2.00\times10^{-14}$		8725 7603	8126 7010	7714	
Ne^+	+ HD	→	No Reaction			$<2.00\times10^{-14}$		8725			
Ne^+	+ D_2	→	No Reaction			$<2.00\times10^{-14}$		8725			
Ne^+	+ He	$\xrightarrow{M}$	Adduct					8632			
Ne^+	+ CH_4	→	CH^+	+ H_2 + H + Ne	0.04	2.10×10^{-11}	±20%	8126	7702	7010	
			CH_2^+	+ H_2 + Ne	0.20						
			CH_3^+	+ H + Ne	0.24						
			CH_4^+	+ Ne	0.52						
Ne^+	+ C_2H_4	→	$C_2H_3^+$	+ H + Ne	0.82	1.20×10^{-9}	±20%	8126			
			$C_2H_4^+$	+ Ne	0.18						
Ne^+	+ C_2H_6	→	Products		1.00	6.00×10^{-10}	±20%	7010			
Ne^+	+ NH_3	→	NH^+	+ H_2 + Ne	0.02	2.25×10^{-10}	±20%	8126	7010		
			NH_2^+	+ H + Ne	0.86						
			NH_3^+	+ Ne	0.12						
Ne^+	+ N_2	→	N_2^+	+ Ne	1.00	1.10×10^{-13}	±40%	8315 7204	8126 7010	7702	
Ne^+	+ H_2O	→	H_2O^+	+ Ne	1.00	8.00×10^{-10}	±10%	8126 7006	7801	7202	b
Ne^+	+ O_2	→	O^+	+ O + Ne	1.00	6.00×10^{-11}	±10%	8315 7204	8126 7010	7702 7003	
$^*Ne^+$	+ Ne	→	Ne^+	+ *Ne	1.00	3.40×10^{-10}	±25%	9023			a
		$\xrightarrow{M}$	Adduct					8632			
Ne^+	+ SiH_4	→	Si^+	+ Ne + H_2 + H_2	0.37	5.30×10^{-10}	±30%	9002			
			SiH^+	+ Ne + H_2 + H	0.54						
			SiH_2^+	+ Ne + H_2	0.08						
Ne^+	+ H_2S	→	S^+	+ H_2 + Ne	0.45	5.00×10^{-10}	±20%	8126			
			$HS+$	+ H + Ne	0.45						
			H_2S^+	+ Ne	0.10						
Ne^+	+ Ar	→	Ar^+	+ Ne	1.00	$\sim6.00\times10^{-15}$	±50%	7815			
Ne^+	+ Kr	→	No Reaction			$<1.00\times10^{-14}$		7817			
Ne^+	+ Hg	→	No Reaction			$<5.00\times10^{-13}$		8016	7317		
Ne^+	+ CO	→	No Reaction			$<1.00\times10^{-13}$		8315 7010	8126	7702	
Ne^+	+ CO_2	→	CO^+	+ O + Ne	1.00	6.00×10^{-11}	±30%	8126	7702	7010	
Ne^+	+ NO	→	N^+	+ O + Ne	0.91	1.45×10^{-10}	±20%	8126	7702	7010	
			O^+	+ N + Ne	0.09						
Ne^+	+ N_2O	→	N^+	+ NO + Ne	0.18	3.70×10^{-10}	±10%	8126	7702		
			O^+	+ N_2 + Ne	0.06						
			N_2^+	+ O + Ne	0.23						
			NO^+	+ N + Ne	0.52						
			N_2O^+	+ Ne	0.01						
Ne^+	+ SO_2	→	SO^+	+ O + Ne	1.00	2.20×10^{-9}	±20%	8126			

Table of Reactions – Continued

Reactions					Prod. Dist.	Rate Const. (cm^3/s)		Ref.			Footnotes
Ne^+	+ COS	→	S^+	+ CO + Ne	0.47	1.40×10^{-9}	±20%	8126			
			CO^+	+ S + Ne	0.47						
			CS^+	+ O + Ne	0.06						
NeH^+	+ H_2	→	H_3^+	+ Ne	1.00	2.00×10^{-11}	±50%	7008			T=200
NeH^+	+ He	→	HeH^+	+ Ne	1.00	3.80×10^{-14}	±50%	9130			
NeH^+	+ C_2H_4	→	$C_2H_3^+$	+ H_2 + Ne	0.77	1.80×10^{-9}	±20%	7610			
			$C_2H_4^+$	+ H + Ne	0.23						
Na^+	+ H_2	→	No Reaction			$<1.00\times10^{-13}$		8320			T=80
		M→	Adduct					8632			
Na^+	+ CH_4	→	No Reaction			$<1.00\times10^{-13}$		8320			T=80
		M→	Adduct					8632			
Na^+	+ N_2	→	No Reaction			$<1.00\times10^{-13}$		8320			T=80
		M→	Adduct					8632			
Na^+	+ H_2O	→	No Reaction			$<1.00\times10^{-13}$		8320			
		M→	Adduct					8632			
Na^+	+ O_2	→	No Reaction			$<1.00\times10^{-13}$		7103			
		M→	Adduct					8632			
Na^+	+ O_3	→	No Reaction			$<1.00\times10^{-11}$		6802			
Na^+	+ CO	→	No Reaction			$<1.00\times10^{-13}$		8320			T=80
		M→	Adduct					8632			
Na^+	+ CO_2	M→	Adduct					8632			
Na^+	+ NO	→	No Reaction			$<1.00\times10^{-13}$		7103			
Na^+	+ SO_2	M→	Adduct					8632			
Mg^+	+ O_2	M→	Adduct					8632			
Mg^+	+ H_2O_2	→	$MgOH^+$	+ OH	1.00	1.30×10^{-9}	±50%	8113			
Mg^+	+ O_3	→	MgO^+	+ O_2	1.00	7.00×10^{-10}	±50%	8113	6802		b
Mg^+	+ Cl_2	→	$MgCl^+$	+ Cl	1.00	4.40×10^{-10}	±50%	8113			
Mg^+	+ Br_2	→	$MgBr^+$	+ Br	1.00	2.50×10^{-10}	±50%	8113			
Mg^+	+ N_2O	→	No Reaction			$<5.00\times10^{-13}$		8113			
Al^+	+ HD	→	No Reaction			$<2.00\times10^{-14}$		9009			
Al^+	+ D_2	→	No Reaction			$<2.00\times10^{-14}$		9009			
Al^+	+ O_2	→	No Reaction			$<1.00\times10^{-16}$		9113	8604	8214	
Si^+	+ H_2	→	No Reaction			$<1.00\times10^{-13}$		8705 7609	8425	8111	
Si^+	+ D_2	→	No Reaction			$<2.00\times10^{-13}$		8705			

Table of Reactions – Continued

Reactions				Prod. Dist.	Rate Const. (cm^3/s)		Ref.			Footnotes
Si^+	+ CH_4 →	CH_3Si^+	+ H	1.00	7.70×10^{-11}	±20%	7319			
	M →	Adduct					9110			
Si^+	+ C_2H_2 →	$CHCSi^+$	+ H	1.00	1.80×10^{-10}	±20%	9110	7427		
	M →	Adduct					9110			
Si^+	+ C_2H_4 →	CH_3CSi^+	+ H	1.00	7.40×10^{-11}	±20%	9110	7428		b
	M →	Adduct					9110			
Si^+	+ C_2H_6 →	CH_2Si^+	+ CH_4	0.15	8.00×10^{-10}	±30%	9110			
		CH_3Si^+	+ CH_3	0.80						
		CH_3CHSi^+	+ H_2	0.03						
		Adduct		0.02						
Si^+	+ CH_2CCH_2 →	CH_2Si^+	+ C_2H_2	0.10	1.20×10^{-9}	±30%	9110			
		$CHCSi^+$	+ CH_3	0.20						
		$C_3H_3Si^+$	+ H	0.70						
Si^+	+ CH_3CCH →	CH_2Si^+	+ C_2H_2	0.15	1.20×10^{-9}	±30%	9110			
		$CHCSi^+$	+ CH_3	0.25						
		$C_3H_3Si^+$	+ H	0.60						
Si^+	+ C_4H_2 →	C_4H^+	+ SiH	1.00	1.60×10^{-9}	±30%	9110			
Si^+	+ c-C_6H_6 →	c-$C_6H_6^+$	+ Si	0.30	4.20×10^{-10}	±20%	9111	7715		b
		$C_6H_5Si^+$	+ H	0.20						
		Adduct		0.50						
	M →	Adduct					9111			
Si^+	+ $C_{10}H_8$ →	$C_{10}H_8^+$	+ Si	1.00			9111			
Si^+	+ NH_3 →	$SiNH_2^+$	+ H	1.00	6.40×10^{-10}	±30%	8820			
Si^+	+ H_2O →	$SiOH^+$	+ H	1.00	2.30×10^{-10}	±30%	8705	8111		
Si^+	+ O_2 →	No Reaction			$<1.00\times10^{-13}$		8918	8111	6903	
	M →	Adduct					8632			
Si^+	+ SiH_4 →	$Si_2H_2^+$	+ H_2	0.96	1.10×10^{-9}	±20%	8723	7214	7213	b
		$Si_2H_3^+$	+ H	0.04						
$^*Si^+$	+ SiD_4 →	Si^+	+ $^*SiD_4$	0.08	8.05×10^{-10}	±30%	8803	8723		
		$Si_2D_2^+$	+ D_2	0.92						
Si^+	+ H_2S →	$SiSH^+$	+ H	1.00			8933			
Si^+	+ HCN →	$CNSi^+$	+ H	0.20	7.00×10^{-12}	±30%	8917			
		Adduct		0.80						
Si^+	+ CH_3NH_2 →	$CH_2NH_2^+$	+ SiH	0.35	1.20×10^{-9}	±30%	8820			
		$SiNH_2^+$	+ CH_3	0.55						
		$SiNHCH_3^+$	+ H	0.10						
Si^+	+ CH_3CN →	CH_2Si^+	+ HCN	0.50	2.40×10^{-9}	±30%	8917			
		Adduct		0.50						
Si^+	+ $(CH_3)_2NH$ →	m/e = 44	+ m = 29	0.60	1.20×10^{-9}	±30%	8820			
		$SiNHCH_3^+$	+ CH_3	0.35						
		$SiN(CH_3)_2^+$	+ H	0.05						
Si^+	+ C_2N_2 →	$CNSi^+$	+ CN	0.55	1.50×10^{-10}	±30%	8917			
		Adduct		0.45						

Table of Reactions – Continued

Reactions				Prod. Dist.	Rate Const. (cm^3/s)		Ref.		Footnotes
Si^+ + HC_3N	→	$CHCSi^+$	+ CN	0.70	1.40×10^{-9}	±30%	8917		
		Adduct		0.30					
Si^+ + $(CH_3)_3N$	→	m/e=42	+ m=45	0.04	9.80×10^{-10}	±30%	8820		
		m/e=44	+ m=43	0.09					
		$(CH_3)_2NCH_2^+$	+ SiH	0.80					
		$SiN(CH_3)_2^+$	+ CH_3	0.07					
Si^+ + CO	→	No Reaction			$<2.00\times10^{-14}$		8918	8705	
Si^+ + CH_3OH	→	$SiOH^+$	+ CH_3	0.75	2.20×10^{-9}	±30%	8705		
		$SiOCH_3^+$	+ H	0.25					
Si^+ + C_2H_5OH	→	$SiOH^+$	+ C_2H_5	1.00	2.50×10^{-9}	±30%	8705		
Si^+ + CO_2	→	No Reaction			$<1.70\times10^{-13}$		8918		
Si^+ + CHOOH	→	$SiOH^+$	+ HCO	1.00	2.30×10^{-9}	±30%	8705		
Si^+ + CH_3COOH	→	CH_3CO^+	+ SiOH	0.30	3.00×10^{-9}	±30%	8705		
		$SiOH^+$	+ CH_3CO	0.70					
Si^+ + CS_2	→	Adduct		1.00	6.60×10^{-11}	±30%	8918		
Si^+ + NO	→	No Reaction			$<1.00\times10^{-11}$		8918	8111	
Si^+ + NO_2	→	NO^+	+ SiO	0.30	8.60×10^{-10}	±30%	8918		
		SiO^+	+ NO	0.68					
		Adduct		0.02					
Si^+ + N_2O	→	SiO^+	+ N_2	1.00	4.00×10^{-10}	±30%	8918		
Si^+ + SO_2	→	SO^+	+ SiO	1.00	8.10×10^{-10}	±30%	8918		
Si^+ + COS	→	SiS^+	+ CO	1.00	9.00×10^{-10}	±30%	8918		
SiH^+ + H_2	→	No Reaction			$<2.00\times10^{-14}$		8722	7609	[b]
SiH^+ + D_2	→	SiD^+	+ HD	1.00	3.00×10^{-11}	±20%	8722	7720	
SiH^+ + CH_4	→	CH_3Si^+	+ H_2	0.37	5.60×10^{-10}	±20%	7319		
		CH_3SiH^+	+ H	0.63					
SiH^+ + C_2H_2	→	$CHCSi^+$	+ H_2	0.47	3.20×10^{-10}	±20%	7427		
		CH_2CSi^+	+ H	0.53					
SiH^+ + C_2H_4	→	CH_3CSi^+	+ H_2	1.00	2.80×10^{-10}	±20%	7428		
SiH^+ + c-C_6H_6	→	c-$C_6H_6^+$	+ SiH	0.55	8.90×10^{-10}	±30%	7715		
		$C_4H_5Si^+$	+ C_2H_2	~0.02					
		$C_6H_5Si^+$	+ H_2	0.30					
		$C_6H_6Si^+$	+ H	~0.02					
		Adduct		0.09					
SiH^+ + D_2O	→	$SiOD_2^+$	+ H	1.00	1.20×10^{-11}	±20%	7320		
SiH^+ + SiH_4	→	Si_2H^+	+ H_2 + H_2	0.23	3.50×10^{-10}	±20%	7214	7213	[b]
		$Si_2H_3^+$	+ H_2	0.77					
SiD^+ + H_2	→	SiH^+	+ HD	1.00	3.00×10^{-11}	±20%	8722		
SiD^+ + SiD_4	→	$Si_2D_3^+$	+ D_2	1.00	5.20×10^{-10}	±30%	8803		

Table of Reactions – Continued

Reactions				Prod. Dist.	Rate Const. (cm^3/s)		Ref.		Footnotes
SiH_2^+	+ H_2 →	No Reaction			$<5.00\times10^{-12}$		7609		
$^*SiH_2^+$	+ H_2 →	SiH_2^+	+ $^*H_2$	1.00			7720		
SiH_2^+	+ CH_4 →	CH_3SiH^+	+ H_2	0.62	2.10×10^{-10}	±20%	7319		
		$CH_3SiH_2^+$	+ H	0.38					
SiH_2^+	+ C_2H_2 →	$CHCSi^+$	+ H_2 + H	0.10	4.30×10^{-10}	±20%	7427		
		CH_2CSi^+	+ H_2	0.15					
		CH_3CSi^+	+ H	0.75					
SiH_2^+	+ C_2H_4 →	CH_3Si^+	+ CH_3	0.44	1.10×10^{-9}	±20%	7428		
		CH_3CSi^+	+ H_2 + H	0.24					
		CH_3CHSi^+	+ H_2	0.22					
		$C_2H_5Si^+$	+ H	0.09					
SiH_2^+	+ O_2 →	$SiOH^+$	+ OH	1.00	2.36×10^{-11}	±10%	7609		
SiH_2^+	+ SiH_4 →	SiH_3^+	+ SiH_3	0.71	1.40×10^{-9}	±20%	7214	7213	
		$Si_2H_2^+$	+ H_2 + H_2	0.06					
		$Si_2H_4^+$	+ H_2	0.23					
		$Si_2H_5^+$	+ H	0.01					
SiH_2^+	+ D_2O →	$SiOD_2^+$	+ H_2	1.00	5.30×10^{-12}	±20%	7320		
$^*SiH_3^+$	+ H_2 →	SiH_3^+	+ $^*H_2$	1.00			7720		
SiH_3^+	+ H_2 →	No Reaction			$<2.00\times10^{-12}$		7609		
SiH_3^+	+ CH_4 →	$CH_3SiH_2^+$	+ H_2	1.00	5.00×10^{-12}	±20%	7319		
SiH_3^+	+ C_2H_2 →	$CHCSi^+$	+ H_2 + H_2	0.28	3.60×10^{-11}	±20%	7427		
		CH_3CSi^+	+ H_2	0.72					
SiH_3^+	+ C_2H_4 →	$C_2H_5Si^+$	+ H_2	0.46	1.50×10^{-10}	±20%	7428		
		Adduct		0.54					
SiH_3^+	+ NH_3 →	NH_4^+	+ SiH_2	0.74	6.00×10^{-10}	±20%	8629		
		$NH_2SiH_2^+$	+ H_2	0.26					
$^*SiH_3^+$	+ H_2O →	SiH_2OH^+	+ H_2	1.00	2.10×10^{-10}	±20%	8629		
SiH_3^+	+ H_2O →	SiH_2OH^+	+ H_2	1.00	5.80×10^{-12}	±20%	7320		
SiH_3^+	+ O_2 →	SiH_2OH^+	+ O	1.00	2.90×10^{-12}	±20%	7609		
$^*SiH_3^+$	+ SiH_4 →	SiH_3^+	+ $^*SiH_4$	1.00	1.25×10^{-9}	±20%	9018	7214	
SiH_3^+	+ SiH_4 →	$Si_2H_3^+$	+ H_2 + H_2	0.08	2.20×10^{-11}	±60%	9018	7214	7213
		$Si_2H_5^+$	+ H_2	0.92					
SiH_3^+	+ CH_3CN →	CH_3CNSiH^+	+ H_2	1.00	1.55×10^{-9}	±20%	8629		
$^*SiH_3^+$	+ CH_3OH →	CH_2OH^+	+ SiH_4	0.38	6.40×10^{-10}	±20%	8629		
		SiH_2OH^+	+ CH_4	0.18					
		$SiOCH_5^+$	+ H_2	0.44					
SiH_3^+	+ CH_3CHO →	SiH_2OH^+	+ C_2H_4	1.00	9.90×10^{-10}	±20%	8629		
SiH_3^+	+ $(CH_3)_2O$ →	$CH_3OCH_2^+$	+ SiH_4	1.00	5.40×10^{-10}	±20%	8629		

Table of Reactions — Continued

Reactions					Prod. Dist.	Rate Const. (cm^3/s)		Ref.			Footnotes
$*SiD_3^+$	+ SiD_4	→	SiD_3^+	+ $*SiD_4$	1.00	8.50×10^{-10}	±20%	9018			
SiD_3^+	+ SiD_4	→	$Si_2D_5^+$	+ D_2	0.99	6.00×10^{-11}	±20%	9018			
			$Si_3D_7^+$		<0.01						
Si_2^+	+ SiD_4	→	$Si_3D_2^+$	+ D_2	1.00	2.50×10^{-10}	±30%	8923			
Si_2^+	+ NO_2	→	Si^+	+ SiO + NO	1.00	3.40×10^{-10}	±25%	8729			
$*Si_2D_2^+$	+ SiD_4	→	$Si_2D_2^+$	+ $*SiD_4$	0.12	3.60×10^{-11}	±30%	8803			
			$Si_3D_4^+$	+ D_2	0.88						
$*Si_2H_5^+$	+ SiH_4	→	$Si_2H_5^+$	+ $*SiH_4$	1.00	2.40×10^{-10}	±20%	9018			
$Si_2H_5^+$	+ SiH_4	→	$Si_3H_7^+$	+ H_2	0.94	2.20×10^{-11}	±20%	9018			
			$Si_3H_9^+$		0.06						
$Si_2D_5^+$	+ SiD_4	→	$Si_3D_7^+$	+ D_2	0.57	2.80×10^{-11}	±20%	9018			
			$Si_3D_9^+$		0.43						
$Si_3H_7^+$	+ SiH_4	→	$Si_4H_9^+$	+ H_2	<0.35	1.20×10^{-13}	±20%	9018			
			$Si_4H_{11}^+$		>0.65						
$Si_3D_7^+$	+ SiD_4	→	$Si_4D_9^+$	+ D_2	<0.04	2.30×10^{-13}	±20%	9018			
			$Si_4D_{11}^+$		>0.96						
P^+	+ H_2	→	PH_2^+		1.00	1.30×10^{-13}	±20%	8912	8302		
P^+	+ D_2	→	No Reaction			$<2.00\times10^{-14}$		9011			
P^+	+ CH_4	→	CH_2P^+	+ H_2	1.00	9.50×10^{-10}	±20%	8912	8302	7011	
P^+	+ C_2H_2	→	$CHCP^+$	+ H	0.95	1.30×10^{-9}	±20%	8912			
			CH_2CP^+		0.05						
P^+	+ C_2H_4	→	CH_2CP^+	+ H_2	1.00	1.20×10^{-9}	±20%	8912			
P^+	+ CH_3CCH	→	$C_2H_3^+$	+ CHP	0.42	1.70×10^{-9}	±20%	8912			
			CH_2P^+	+ C_2H_2	0.52						
			$C_3H_2P^+$	+ H_2	0.06						
P^+	+ NH_3	→	NH_3^+	+ P	0.52	2.00×10^{-9}	±10%	8912	8302		b
			NHP$^+$	+ H_2	0.01						
			NHPH$^+$	+ H	0.48						
P^+	+ N_2	→	No Reaction			$<1.00\times10^{-11}$		8302			
P^+	+ H_2O	→	PO$^+$	+ H_2	0.09	5.50×10^{-10}	±10%	8912	8302		
			POH$^+$	+ H	0.91						
P^+	+ O_2	→	PO$^+$	+ O	1.00	5.30×10^{-10}	±10%	8912	8302		
P^+	+ PH_3	→	PH_3^+	+ P	0.16	1.25×10^{-9}	±15%	8912	8302	7011	b
			P_2H^+	+ H_2	0.74						
			$P_2H_2^+$	+ H	0.11						
P^+	+ H_2S	→	H_2S^+	+ P	0.31	1.40×10^{-9}	±20%	8912			
			PS$^+$	+ H_2	0.12						
			HPS$^+$	+ H	0.57						

Table of Reactions – Continued

Reactions				Prod. Dist.	Rate Const. (cm^3/s)		Ref.			Footnotes
P^+ + HCN	→	No Reaction			$<1.00\times10^{-11}$		8302			b
	$\underset{\rightarrow}{M}$	Adduct					8912			
P^+ + CH_3NH_2	→	$CH_2NH_2^+$	+ PH	0.68	1.30×10^{-9}	±20%	8912			
		$NHPH^+$	+ CH_3	0.32						
P^+ + CO	→	Adduct		1.00	3.50×10^{-13}	±20%	8912	8302		
P^+ + CH_3OH	→	POH^+	+ CH_3	1.00	1.40×10^{-9}	±20%	8912			
P^+ + CO_2	→	PO^+	+ CO	1.00	4.85×10^{-10}	±20%	8912	8302		
P^+ + COS	→	PO^+	+ CS	0.38	1.10×10^{-9}	±20%	8912			
		PS^+	+ CO	0.62						
PH^+ + H_2	→	Adduct		1.00	4.30×10^{-13}	±20%	8912	8302		
PH^+ + D_2	→	PD^+	+ HD	1.00	3.10×10^{-10}	±25%	8302			
PH^+ + CH_4	→	CH_3P^+	+ H_2	0.87	9.40×10^{-10}	±15%	8912	8302	7011	
		CH_3PH^+	+ H	0.13						
PH^+ + C_2H_2	→	CH_2CP^+	+ H	1.00	1.30×10^{-9}	±20%	8912			
PH^+ + C_2H_4	→	CH_2P^+	+ CH_3	0.30	1.20×10^{-9}	±20%	8912			
		CH_3CP^+	+ H_2	0.70						
PH^+ + CH_3CCH	→	$C_2H_4^+$	+ CHP	0.19	1.70×10^{-9}	±20%	8912			
		$C_3H_3^+$	+ PH_2	0.17						
		CH_2CP^+	+ CH_3	0.64						
PH^+ + NH_3	→	NH_4^+	+ P	0.06	1.80×10^{-9}	±30%	8912	8302	7011	b
		$NHPH^+$	+ H_2	0.38						
		NH_2PH^+	+ H	0.56						
PH^+ + N_2	→	No Reaction			$<1.00\times10^{-11}$		8302			
PH^+ + H_2O	→	H_3O^+	+ P	0.07	9.90×10^{-10}	±30%	8912	8302	7011	b
		POH^+	+ H_2	0.66						
		H_2PO^+	+ H	0.27						
PH^+ + O_2	→	PO^+	+ OH	1.00	5.30×10^{-10}	±10%	8912	8302		
PH^+ + PH_3	→	PH_3^+	+ PH	0.17	1.30×10^{-9}	±15%	8912	8302	7011	b
		PH_4^+	+ P	0.05						
		P_2^+	+ H_2 + H_2	0.24						
		P_2H^+	+ H_2 + H	0.04						
		$P_2H_2^+$	+ H_2	0.41						
		$P_2H_3^+$	+ H	0.11						
PH^+ + H_2S	→	H_3S^+	+ P	0.09	1.50×10^{-9}	±20%	8912			
		HPS^+	+ H_2	0.64						
		H_2PS^+	+ H	0.27						
PH^+ + HCN	→	$HCNH^+$	+ P	0.65	4.70×10^{-10}	±10%	8912	8302		b
		$PNCH^+$	+ H	0.35						
PH^+ + CH_3NH_2	→	$CH_2NH_2^+$	+ PH_2	0.38	1.80×10^{-9}	±20%	8912			
		$NHPH^+$	+ CH_4	0.16						
		NH_2PH^+	+ CH_3	0.46						
	$\underset{\rightarrow}{M}$	Adduct					8912			
PH^+ + CO	→	Adduct		1.00	1.00×10^{-12}	±20%	8912	8302		

Table of Reactions – Continued

Reactions				Prod. Dist.	Rate Const. (cm^3/s)		Ref.		Footnotes
PH^+ + CH_3OH	→	H_2PO^+	+ CH_3	1.00	1.90×10^{-9}	±20%	8912		
PH^+ + CO_2	→	Adduct		1.00	8.60×10^{-12}	±20%	8912	8302	
PH^+ + COS	→	HPS^+	+ CO	1.00	1.30×10^{-9}	±20%	8912		
PH_2^+ + H_2	→	Adduct		1.00	1.10×10^{-12}	±20%	8912	8302	
PH_2^+ + D_2	→	No Reaction			$<1.00\times10^{-11}$		8302		
PH_2^+ + NH_3	→	NH_4^+	+ PH	0.28	1.70×10^{-9}	±10%	8302		
		NH_2PH^+	+ H_2	0.72					
PH_2^+ + CH_4	→	CH_3PH^+	+ H_2	1.00	8.40×10^{-10}	±45%	8912	8302	7011
PH_2^+ + C_2H_2	→	CH_2CP^+	+ H_2	1.00	1.40×10^{-9}	±20%	8912		
PH_2^+ + C_2H_4	→	CH_2P^+	+ CH_4	0.12	1.20×10^{-9}	±20%	8912		
		CH_3CHP^+	+ H_2	0.88					
PH_2^+ + CH_3CCH	→	$C_2H_5^+$	+ CHP	0.43	1.60×10^{-9}	±20%	8912		
		CH_2P^+	+ C_2H_4	0.44					
		CH_3PH^+	+ C_2H_2	0.07					
		$C_3H_4P^+$	+ H_2	0.06					
PH_2^+ + NH_3	→	NH_4^+	+ PH	0.19	2.00×10^{-9}	±20%	8912		
		NH_2PH^+	+ H_2	0.81					
PH_2^+ + H_2O	→	H_3O^+	+ PH	0.33	4.90×10^{-10}	±20%	8912		
		H_2PO^+	+ H_2	0.67					
PH_2^+ + O_2	→	PO^+	+ H_2O	1.00	7.80×10^{-11}	±20%	8912		
PH_2^+ + PH_3	→	PH_4^+	+ PH	0.02	9.50×10^{-10}	±15%	8912	8302	7011
		P_2H^+	+ H_2 + H_2	0.54					
		$P_2H_3^+$	+ H_2	0.52					
PH_2^+ + H_2S	→	H_2PS^+	+ H_2	1.00	1.50×10^{-9}	±20%	8912		
PH_2^+ + HCN	→	$HCNH^+$	+ PH	0.72	1.40×10^{-9}	±20%	8912		
		Adduct		0.28					
PH_2^+ + CH_3NH_2	→	$CH_2NH_2^+$	+ PH_3	0.62	1.70×10^{-9}	±20%	8912		
		$CH_3NH_3^+$	+ PH	0.38					
PH_2^+ + CO	→	Adduct		1.00	2.90×10^{-12}	±20%	8912		
PH_2^+ + CH_3OH	→	CH_2OH^+	+ PH_3	0.65	2.00×10^{-9}	±20%	8912		
		CH_3PH^+	+ H_2O	0.08					
		H_2PO^+	+ CH_4	0.27					
PH_2^+ + CO_2	→	Adduct		1.00	7.50×10^{-12}	±20%	8912		
PH_2^+ + COS	→	H_2PS^+	+ CO	1.00	9.90×10^{-10}	±20%	8912		
PH_3^+ + H_2	→	No Reaction			$<1.00\times10^{-13}$		8912	8302	
PH_3^+ + D_2	→	No Reaction			$<4.00\times10^{-11}$		8302		
PH_3^+ + CH_4	→	No Reaction			$<1.00\times10^{-13}$		8912	8302	
PH_3^+ + C_2H_2	→	CH_3CP^+	+ H_2	1.00	5.80×10^{-10}	±20%	8912		
PH_3^+ + C_2H_4	→	Adduct		1.00	4.70×10^{-10}	±20%	8912		

Table of Reactions – Continued

Reactions	Prod. Dist.	Rate Const. (cm^3/s)		Ref.			Footnotes
$PH_3^+ + CH_3CCH \rightarrow C_3H_5^+ + PH_2$	0.91	1.60×10^{-9}	±20%	8912			
$CH_3PH_2^+ + C_2H_2$	0.09						
$PH_3^+ + NH_3 \rightarrow NH_4^+ + PH_2$	0.99	2.10×10^{-9}	±20%	8912	8302		
$NH_3PH_2^+ + H$	0.01						
$PH_3^+ + H_2O \rightarrow$ No Reaction		$<1.00\times10^{-13}$		8912			
$PH_3^+ + O_2 \rightarrow$ No Reaction		$<2.00\times10^{-13}$		8912			
$PH_3^+ + PH_3 \rightarrow PH_4^+ + PH_2$	0.97	1.00×10^{-9}	±20%	8912	8302	7011	
$P_2H_4^+ + H_2$	0.03						
$P_2H_5^+ + H$	<0.01						
$PH_3^+ + H_2S \rightarrow H_3S^+ + PH_2$	1.00	1.00×10^{-9}	±20%	8912			
$PH_3^+ + HCN \rightarrow HCNH^+ + PH_2$	1.00	2.60×10^{-9}	±20%	8912			
$PH_3^+ + CH_3NH_2 \rightarrow CH_3NH_3^+ + PH_2$	1.00	1.90×10^{-9}	±20%	8912			
$PH_3^+ + CO \rightarrow$ No Reaction		$<1.00\times10^{-13}$		8912			
$PH_3^+ + CH_3OH \rightarrow CH_3OH_2^+ + PH_2$	1.00	1.90×10^{-9}	±20%	8912			
$PH_3^+ + CO_2 \rightarrow$ No Reaction		$<1.00\times10^{-13}$		8912			
$PH_3^+ + COS \rightarrow H_3PS^+ + CO$	1.00	4.60×10^{-11}	±20%	8912			
$PH_4^+ + H_2 \rightarrow$ No Reaction		$<1.00\times10^{-11}$		8302			
$PH_4^+ + CH_4 \rightarrow$ No Reaction		$<2.00\times10^{-11}$		8302			
$PH_4^+ + NH_3 \rightarrow NH_4^+ + PH_3$	1.00	2.10×10^{-9}	±10%	8302	7011		
$PH_4^+ + PH_3 \rightarrow$ No Reaction		$<1.00\times10^{-11}$		8302			
$S^+ + H_2 \rightarrow$ No Reaction		$<2.00\times10^{-14}$		9003	8603	8110	
				7905	7506		
$\xrightarrow{M}$ No Reaction				8632			
$S^+ + HD \rightarrow$ No Reaction		$<2.00\times10^{-14}$		9003			
$S^+ + D_2 \rightarrow$ No Reaction		$<2.00\times10^{-14}$		9003			
$S^+ + CH_4 \rightarrow HCS^+ + H_2 + H$	0.05	3.20×10^{-10}	±30%	8401	8110	7905	b
$CH_2SH^+ + H$	0.95			7305			
$S^+ + C_2H_2 \rightarrow HC_2S^+ + H$	1.00	9.70×10^{-10}	±20%	8808	8401		
$S^+ + C_2H_4 \rightarrow HCS^+ + CH_3$	0.70	9.80×10^{-10}	±30%	8808			
$CH_3CS^+ + H$	0.30						
$S^+ + C_2H_6 \rightarrow C_2H_5^+ + SH$	0.70	9.90×10^{-10}	±30%	8808			
$CH_2SH^+ + CH_3$	0.25						
$CH_3CHSH^+ + H$	0.05						
$S^+ + CH_3CCH \rightarrow C_3H_3^+ + SH$	0.20	1.70×10^{-9}	±30%	8808			
$C_3H_4^+ + S$	0.05						
$HCS^+ + C_2H_3$	0.15						
$CH_2CHCS^+ + H$	0.60						

Table of Reactions – Continued

Reactions					Prod. Dist.	Rate Const. (cm^3/s)		Ref.			Footnotes
S^+	+ C_3H_6	→	$C_3H_5^+$	+ SH	0.40	1.20×10^{-9}	±30%	8808			
			$C_3H_6^+$	+ S	0.30						
			HCS^+	+ C_2H_5	0.10						
			CH_2S^+	+ C_2H_4	0.10						
			CH_3CS^+	+ CH_3	0.05						
			$C_2H_5CS^+$	+ H	0.05						
S^+	+ NH_3	→	NH_3^+	+ S	0.92	1.50×10^{-9}	±15%	8110	7905	7507	
			$NHSH^+$	+ H	0.08			7410			
S^+	+ N_2	→	No Reaction			$<5.00\times10^{-13}$		8110			
S^+	+ H_2O	→	No Reaction			$<1.00\times10^{-12}$		8110	7905	7410	
S^+	+ O_2	→	SO^+	+ O	1.00	1.80×10^{-11}	±20%	8401	8110	7905	
								7903	7302		
S^+	+ H_2S	→	S_2^+	+ H_2	0.70	8.20×10^{-10}	±15%	8401	8110	7507	b
			S_2H^+	+ H	0.23			7304			
			$S_2H_2^+$	+ $h\nu$	0.06						
S^+	+ HCN	→	No Reaction			$<1.00\times10^{-11}$		8401			
S^+	+ CH_3NH_2	→	$CH_2NH_2^+$	+ SH	0.45	2.20×10^{-9}	±20%	8110			
			$CH_3NH_2^+$	+ S	0.55						
S^+	+ CO	→	No Reaction			$<5.00\times10^{-13}$		8401	8110		
S^+	+ H_2CO	→	H_2S^+	+ CO	0.50	6.70×10^{-10}	±10%	8401			
			HCO^+	+ SH	0.50						
S^+	+ CO_2	→	No Reaction			$<5.00\times10^{-13}$		8401	8110	7905	
								7302			
S^+	+ NO	→	NO^+	+ S	1.00	3.40×10^{-10}	±15%	8401	8110	7905	
								7903	7302		
S^+	+ SO_2	→	No Reaction			$<1.00\times10^{-11}$		8401			
S^+	+ COS	→	S_2^+	+ CO	1.00	9.10×10^{-10}	±20%	8110			
HS^+	+ H	→	S^+	+ H_2	1.00	1.10×10^{-10}	±20%	8603			
HS^+	+ H_2	$\xrightarrow{M}$	No Reaction			$<5.00\times10^{-13}$		8603	8110	7506	
			Adduct					8632			
HS^+	+ CH_4	→	CH_3^+	+ H_2S	0.05	3.80×10^{-10}	±60%	8401	8110	7305	
			CH_2SH^+	+ H_2	0.95						
HS^+	+ C_2H_2	→	CH_2CS^+	+ H	0.96	1.05×10^{-9}	±10%	8401			
			CH_3CS^+	+ $h\nu$	0.04						
HS^+	+ NH_3	→	NH_3^+	+ SH	0.43	1.57×10^{-9}	±20%	8110	7410		
			NH_4^+	+ S	0.55						
			$NHSH^+$	+ H_2	0.01						
			NH_2SH^+	+ H	0.01						
HS^+	+ N_2	→	No Reaction			$<5.00\times10^{-13}$		8110			
HS^+	+ H_2O	→	H_3O^+	+ S	1.00	7.10×10^{-10}	±15%	8110	7802	7410	b
HS^+	+ O_2	→	No Reaction			$<5.00\times10^{-13}$		8401	8110		

Table of Reactions – Continued

Reactions				Prod. Dist.	Rate Const. (cm^3/s)		Ref.			Footnotes
HS^+	+ H_2S →	H_3S^+	+ S	0.38	1.00×10^{-9}	±20%	8401	8110	7304	b
		S_2H^+	+ H_2	0.48						
		$S_2H_2^+$	+ H	0.15						
HS^+	+ HCN →	$HCNH^+$	+ S	1.00	8.60×10^{-10}	±10%	8401			
HS^+	+ CH_3NH_2 →	$CH_2NH_2^+$	+ H_2S	0.35	2.20×10^{-9}	±20%	8110			
		$CH_3NH_2^+$	+ SH	0.50						
		$CH_3NH_3^+$	+ S	0.15						
HS^+	+ CO →	No Reaction			$<5.00\times10^{-13}$		8401	8110		
HS^+	+ CO_2 →	No Reaction			$<5.00\times10^{-13}$		8401	8110		
HS^+	+ NO →	NO^+	+ SH	1.00	3.70×10^{-10}	±15%	8401	8110		
HS^+	+ SO_2 →	No Reaction			$<3.00\times10^{-11}$		8401			
HS^+	+ COS →	S_2H^+	+ CO	1.00	9.70×10^{-10}	±20%	8110			
H_2S^+	+ H →	HS^+	+ H_2	1.00	2.00×10^{-10}	±20%	8603			
H_2S^+	+ H_2 →	H_3S^+	+ H	1.00	-5.00×10^{-12}	±40%	8603	8110	7506	
H_2S^+	+ D_2 →	No Reaction			$<5.00\times10^{-13}$		7506			
H_2S^+	+ CH_4 →	No Reaction			$<5.00\times10^{-13}$		8110	7305		
H_2S^+	+ NH_3 →	NH_3^+	+ H_2S	0.25	1.77×10^{-9}	±20%	8110	7410		
		NH_4^+	+ SH	0.75						
H_2S^+	+ N_2 →	No Reaction			$<5.00\times10^{-13}$		8110			
H_2S^+	+ H_2O →	H_3O^+	+ SH	1.00	7.60×10^{-10}	±10%	8110	7802	7410	
H_2S^+	+ O_2 →	No Reaction			$<5.00\times10^{-13}$		8110			
H_2S^+	+ H_2S →	H_3S^+	+ SH	0.99	7.60×10^{-10}	±30%	8110	7507	7304	
		$S_2H_2^+$	+ H_2	0.01						
H_2S^+	+ CH_3NH_2 →	$CH_2NH_2^+$	+ H_2S + H	0.20	1.90×10^{-9}	±20%	8110			
		$CH_3NH_2^+$	+ H_2S	0.40						
		$CH_3NH_3^+$	+ SH	0.40						
H_2S^+	+ CO →	No Reaction			$<5.00\times10^{-13}$		8110			
H_2S^+	+ CO_2 →	No Reaction			$<5.00\times10^{-13}$		8110			
H_2S^+	+ NO →	NO^+	+ H_2S	1.00	3.70×10^{-10}	±20%	8110			
H_2S^+	+ COS →	No Reaction			$<5.00\times10^{-13}$		8110			
H_3S^+	+ H →	H_2S^+	+ H_2	1.00	6.00×10^{-11}	±20%	8603			
H_3S^+	+ H_2 →	No Reaction			$<5.00\times10^{-13}$		8110	7506		
H_3S^+	+ D_2 →	No Reaction			$<1.00\times10^{-12}$		7506			
H_3S^+	+ CH_4 →	No Reaction			$<5.00\times10^{-13}$		8110			
H_3S^+	+ NH_3 →	NH_4^+	+ H_2S	1.00	1.90×10^{-9}	±20%	8110			
H_3S^+	+ N_2 →	No Reaction			$<5.00\times10^{-13}$		8110			

Table of Reactions – Continued

Reactions					Prod. Dist.	Rate Const. (cm^3/s)		Ref.			Footnotes
H_3S^+	+ H_2O	→	H_3O^+	+ H_2S	1.00	3.30×10^{-12}	±40%	8110	7809		b
H_3S^+	+ O_2	→	No Reaction			$<5.00\times10^{-13}$		8110			
$^*H_3S^+$	+ H_2S	→	H_3S^+	+ $^*H_2S$	1.00	5.90×10^{-10}	±20%	8110			
		M →	Adduct					8632			
H_3S^+	+ HCN	→	$HCNH^+$	+ H_2S	1.00	1.70×10^{-9}	±30%	7813	7809		
H_3S^+	+ CH_3NH_2	→	$CH_3NH_3^+$	+ H_2S	1.00	1.60×10^{-9}	±20%	8110			
H_3S^+	+ CO	→	No Reaction			$<5.00\times10^{-13}$		8110			
H_3S^+	+ H_2CO	→	CH_2OH^+	+ H_2S	1.00	2.60×10^{-9}	±25%	7906	7814	7809	
H_3S^+	+ CO_2	→	No Reaction			$<5.00\times10^{-13}$		8110			
H_3S^+	+ CHOOH	→	$CH(OH)_2^+$	+ H_2S	1.00	2.00×10^{-9}	±30%	7820			
H_3S^+	+ NO	→	No Reaction			$<5.00\times10^{-13}$		8110			
H_3S^+	+ COS	→	No Reaction			$<5.00\times10^{-13}$		8110			
S_2^+	+ H_2	→	No Reaction			$<5.00\times10^{-13}$		7701			
S_2^+	+ H_2O	→	No Reaction			$<5.00\times10^{-11}$		7410			
S_2H^+	+ H_2	→	No Reaction			$<1.00\times10^{-12}$		7701			
S_2H^+	+ H_2O	→	H_3O^+	+ S_2	1.00			7410			
S_2H^+	+ H_2S	→	H_3S^+	+ S_2	1.00	2.90×10^{-10}	±10%	7304			
$S_2H_2^+$	+ H_2O	→	No Reaction			$<5.00\times10^{-11}$		7410			
Cl^+	+ H_2	→	HCl^+	+ H	1.00	7.20×10^{-10}	±20%	9013	8312	8103	a
								8102	7413		
Cl^+	+ HD	→	Products		1.00	6.00×10^{-10}	±15%	8312			
Cl^+	+ D_2	→	DCl^+	+ D	1.00	4.80×10^{-10}	±15%	9013	9010	8312	
Cl^+	+ CH_4	→	CH_3^+	+ HCl	0.40	1.20×10^{-9}	±20%	9013			
			CH_4^+	+ Cl	0.20						
			H_2Cl^+	+ CH_2	0.25						
			CH_2Cl^+	+ H_2	0.15						
Cl^+	+ C_2H_2	→	No Reaction			$<2.60\times10^{-11}$		9013			
Cl^+	+ C_2H_4	→	$C_2H_3^+$	+ HCl	0.17	1.20×10^{-9}	±20%	9013			
			$C_2H_4^+$	+ Cl	0.83						
Cl^+	+ c-C_6H_6	→	$C_6H_5^+$	+ HCl	0.06	1.90×10^{-9}	±20%	9013			
			c-$C_6H_6^+$	+ Cl	0.94						
Cl^+	+ NH_3	→	NH_2^+	+ HCl	0.04	7.80×10^{-10}	±20%	9013			
			NH_3^+	+ Cl	0.96						
Cl^+	+ H_2O	→	H_2O^+	+ Cl	1.00	5.00×10^{-10}	±20%	9013			

Table of Reactions — Continued

Reactions	Prod. Dist.	Rate Const. (cm^3/s)	Ref.			Footnotes
$Cl^+ + O_2 \rightarrow O_2^+ + Cl$	1.00	4.75×10^{-10} ±20%	9013	7602		
$Cl^+ + NO \rightarrow NO^+ + Cl$	1.00	1.40×10^{-10} ±20%	9013			
$Cl^+ + H_2S \rightarrow H_2S^+ + Cl$	0.63	1.60×10^{-9} ±20%	9013			
$HS+ + HCl$	0.28					
$HCl^+ + SH$	0.09					
$Cl^+ + COS \rightarrow COS^+ + Cl$	1.00	9.00×10^{-10} ±20%	9013			
$HCl^+ + H_2 \rightarrow H_2Cl^+ + H$	1.00	8.20×10^{-10} ±40%	8312	8201	8103	a
			8102	7413		
$HCl^+ + CH_4 \rightarrow CH_4^+ + HCl$	0.30	1.22×10^{-9} ±20%	8201			
$CH_5^+ + Cl$	0.70					
$HCl^+ + NH_3 \rightarrow NH_3^+ + HCl$	0.35	2.04×10^{-9} ±20%	8201			
$NH_4^+ + Cl$	0.65					
$HCl^+ + O_2 \rightarrow O_2^+ + HCl$	1.00	6.90×10^{-10} ±20%	8201			
$HCl^+ + H_2S \rightarrow H_2S^+ + HCl$	0.75	1.32×10^{-9} ±20%	8201			
$H_3S^+ + Cl$	0.25					
$HCl^+ + Xe \rightarrow Xe^+ + HCl$	0.80	6.30×10^{-10} ±20%	8201			
$XeH^+ + Cl$	0.20					
$HCl^+ + CO \rightarrow HCO^+ + Cl$	1.00	7.10×10^{-10} ±20%	8201			
$HCl^+ + CO_2 \rightarrow HCO_2^+ + Cl$	1.00	9.30×10^{-10} ±20%	8201			
$HCl^+ + NO \rightarrow NO^+ + HCl$	0.63	6.40×10^{-10} ±20%	8201			
$HNO^+ + Cl$	0.37					
$HCl^+ + N_2O \rightarrow HN_2O + Cl$	1.00	1.01×10^{-9} ±20%	8201			
$HCl^+ + SO_2 \rightarrow SO_2^+ + HCl$	0.40	1.90×10^{-9} ±20%	8201			
$HSO_2^+ + Cl$	0.60					
$HCl^+ + COS \rightarrow COS^+ + HCl$	0.72	1.36×10^{-9} ±20%	8201			
$HCOS^+ + Cl$	0.28					
$H_2Cl^+ + H_2O \rightarrow H_3O^+ + HCl$	1.00	1.35×10^{-9} ±60%	8623	8511		
$H_2Cl^+ + CO \rightarrow HCO^+ + HCl$	1.00	5.90×10^{-10} ±25%	8623	8511	8502	a
$Ar^+ + H_2 \rightarrow H_2^+ + Ar$	0.02	8.90×10^{-10} ±20%	9035	9016	8927	ab
$ArH^+ + H$	0.98		8715	8526	8504	
			8420	8319	8210	
			8020	7620	7002	
			6907	6702	6605	
$Ar^+ + HD \rightarrow HD^+ + Ar$	0.06	8.00×10^{-10} ±20%	9016	8526		a
$ArH^+ + D$	0.46					
$ArD^+ + H$	0.48					
$Ar^+ + D_2 \rightarrow D_2^+ + Ar$	0.02	7.45×10^{-10} ±15%	9016	8526	8504	a
$ArD^+ + D$	0.98		7620	7013	6907	
$Ar^+ + CH_4 \rightarrow CH_2^+ + Ar + H_2$	0.12	9.80×10^{-10} ±10%	8716	8319	8317	a
$CH_3^+ + Ar + H$	0.85		7909	7702		
$CH_4^+ + Ar$	0.03		7003			

Table of Reactions – Continued

Reactions					Prod. Dist.	Rate Const. (cm^3/s)		Ref.			Footnotes
Ar^+	+ C_2H_6	→	Products		1.00	1.15×10^{-9}	±15%	8317			T=700
Ar^+	+ NH_3	→	NH_3^+	+ Ar	1.00	1.60×10^{-9}	±20%	8716	8318	7003	
Ar^+	+ N_2	→	N_2^+	+ Ar	1.00	1.10×10^{-11}	±20%	9038	9025	8927	ab
								8715	8701	8622	
								8411	8210	8116	
								8114	8020	7702	
								7204	6605		
Ar^+	+ H_2O	→	H_2O^+	+ Ar	0.80	1.62×10^{-9}	±20%	8716	7910	7802	
			ArH^+	+ OH	0.20			7801	7202	7006	
Ar^+	+ O_2	→	O_2^+	+ Ar	1.00	4.60×10^{-11}	±20%	9037	8928	8927	ab
								8819	8716	8318	
								8210	8127	8020	
								7702	7602	7002	
								6605			
Ar^+	+ SiH_4	→	Si^+	+ Ar + H_2 + H_2	0.02	3.90×10^{-11}	±30%	9002			
			SiH^+	+ Ar + H_2 + H	0.08						
			SiH_2^+	+ Ar + H_2	0.12						
			SiH_3^+	+ Ar + H	0.78						
Ar^+	+ H_2S	→	H_2S^+	+ Ar	1.00	1.30×10^{-9}	±30%	8716	8714		
Ar^+	+ HCl	→	HCl^+	+ Ar	1.00	2.40×10^{-10}	±25%	9024			a
$*Ar^+$	+ Ar	$\xrightarrow{M}$	Adduct					8632			
Ar^+	+ Kr	→	No Reaction			$<1.00\times10^{-14}$		8715	7817		
Ar^+	+ Hg	→	No Reaction			$<5.00\times10^{-13}$		8016	7317		b
Ar^+	+ Xe	→	Xe^+	+ Ar	1.00	4.30×10^{-13}	±30%	8715			
Ar^+	+ CO	→	CO^+	+ Ar	1.00	4.40×10^{-11}	±20%	9126	8927	8801	ab
								8716	8701	8318	
								8210	8020	7702	
								6605			
Ar^+	+ CO_2	→	CO_2^+	+ Ar	1.00	4.80×10^{-10}	±15%	8716	8319	8318	b
								8210	8020	7702	
								6605			
Ar^+	+ CH_3SH	→	Products		1.00	1.70×10^{-9}	±10%	8714			
Ar^+	+ CS_2	→	S^+	+ CS + Ar	0.88	2.60×10^{-10}	±30%	8716	8614		b
			CS_2^+	+ Ar	0.12						
Ar^+	+ C_2H_5SH	→	Products		1.00	2.10×10^{-9}	±10%	8714			
Ar^+	+ $(CH_3)_2S$	→	Products		1.00	1.60×10^{-9}	±10%	8714			
Ar^+	+ NO	→	NO^+	+ Ar	1.00	3.10×10^{-10}	±35%	8716	8319	8318	b
								8020	7909	7702	
Ar^+	+ NO_2	→	NO^+	+ O + Ar	0.94	4.60×10^{-10}	±30%	8716			
			NO_2^+	+ Ar	0.06						
Ar^+	+ N_2O	→	O^+	+ N_2 + Ar	0.01	3.00×10^{-10}	±10%	8716	8319	8318	
			N_2^+	+ O + Ar	0.01			8210	8020	7702	
			NO^+	+ N + Ar	0.01						
			N_2O^+	+ Ar	0.97						

Table of Reactions — Continued

Reactions	Prod. Dist.	Rate Const. (cm^3/s)		Ref.			Footnotes
$Ar^+ + SO_2 \rightarrow SO_2^+ + Ar$	1.00	5.20×10^{-10}	±30%	8716	7606		
$Ar^+ + COS \rightarrow$ Products	1.00	1.30×10^{-9}	±20%	8210			
$ArH^+ + H_2 \rightarrow H_3^+ + Ar$	1.00	6.30×10^{-10}	±40%	9016 7104	8211 7008	7612 6702	ab
$ArH^+ + HD \rightarrow H_2D^+ + Ar$	1.00	8.60×10^{-10}	±20%	9016			a
$ArH^+ + D_2 \rightarrow HD_2^+ + Ar$	1.00	7.15×10^{-10}	±20%	9016	8211		a
$ArH^+ + CH_4 \rightarrow CH_5^+ + Ar$	1.00	1.02×10^{-9}	±30%	8211	7614		b
$ArH^+ + C_2H_4 \rightarrow C_2H_3^+ + H_2 + Ar$ $C_2H_5^+ + Ar$	0.73 0.27	1.17×10^{-9}	±15%	7614	7610		
$ArH^+ + C_2H_6 \rightarrow C_2H_3^+ + H_2 + H + Ar$ $C_2H_5^+ + H_2 + Ar$	0.04 0.96	1.40×10^{-9}	±15%	7614			
$ArH^+ + NH_3 \rightarrow NH_3^+ + H + Ar$ $NH_4^+ + Ar$	<0.25 >0.75	2.14×10^{-9}	±15%	7618			
$ArH^+ + N_2 \rightarrow N_2H^+ + Ar$	1.00	8.00×10^{-10}	±30%	8211			
$ArH^+ + O_2 \rightarrow HO_2^+ + Ar$	1.00	5.05×10^{-10}	±30%	8211	7512	7104	
$ArH^+ + CO \rightarrow HCO^+ + Ar$	1.00	1.25×10^{-9}	±30%	8211			
$ArH^+ + CO_2 \rightarrow HCO_2^+ + Ar$	1.00	1.10×10^{-9}	±30%	8211			
$ArH^+ + N_2O \rightarrow N_2H^+ + O + Ar$ $OH^+ + N_2 + Ar$ $HN_2O^+ + Ar$	~0.05 ~0.10 >0.85			7618			
$ArD^+ + H_2 \rightarrow H_2D^+ + Ar$	1.00	8.80×10^{-10}	±20%	9016	7612		ab
$ArD^+ + HD \rightarrow HD_2^+ + Ar$	1.00	8.10×10^{-10}	±20%	9016			a
$ArD^+ + D_2 \rightarrow D_3^+ + Ar$	1.00	4.65×10^{-10}	±65%	9016	7612		a
$ArD^+ + N_2 \rightarrow N_2D^+ + Ar$	1.00	4.20×10^{-10}	±15%	7618			
$ArD^+ + O_2 \rightarrow DO_2^+ + Ar$	1.00	5.00×10^{-10}	±15%	7618			
$ArD^+ + Ne \rightarrow$ No Reaction		$<1.00\times10^{-13}$		7618			
$ArD^+ + Kr \rightarrow KrD^+ + Ar$	1.00	5.00×10^{-10}	±15%	7618			
$ArD^+ + CO \rightarrow DCO^+ + Ar$	1.00	7.80×10^{-10}	±15%	7618			
$ArD^+ + CO_2 \rightarrow DCO_2^+ + Ar$	1.00	8.90×10^{-10}	±15%	7618			
$ArD^+ + COS \rightarrow DS^+ + CO + Ar$ $DCOS^+ + Ar$	<0.17 >0.83			7618			
$ArH_2^+ + H_2 \rightarrow ArH_3^+ + H$	1.00	1.19×10^{-9}	±20%	9016			a
$ArHD^+ + HD \rightarrow ArH_2D^+ + D + Ar$ $ArHD_2^+ + H$		6.50×10^{-10}	±20%	9016			a

Table of Reactions – Continued

Reactions					Prod. Dist.	Rate Const. (cm^3/s)		Ref.	Footnotes
ArD_2^+	+ D_2	→	ArD_3^+	+ D	1.00	7.70×10^{-10}	±20%	9016	a
ArH_3^+	+ H_2	→	H_5^+	+ Ar	1.00	5.00×10^{-12}	±20%	9016	T=80
Ar_2^+	+ H_2	→	ArH^+	+ H + Ar	0.70	5.00×10^{-10}	±20%	9016	a
			ArH_2^+	+ Ar	0.30				
Ar_2^+	+ HD	→	ArH^+	+ D + Ar	0.40	4.30×10^{-10}	±20%	9016	a
			ArD^+	+ H + Ar	0.40				
			$ArHD^+$	+ Ar	0.20				
Ar_2^+	+ D_2	→	ArD^+	+ D + Ar	0.74	3.60×10^{-10}	±20%	9016	a
			ArD_2^+	+ Ar	0.26				
Ar_2^+	+ CS_2	→	CS_2^+	+ Ar + Ar	1.00	7.00×10^{-10}	±20%	8614	
K^+	+ H_2O	$\xrightarrow{M}$	Adduct					8632	
K^+	+ O_2	→	No Reaction			$<1.00\times10^{-13}$		7103	
		$\xrightarrow{M}$	Adduct					8632	
K^+	+ O_3	→	No Reaction			$<1.00\times10^{-11}$		6802	
K^+	+ CO_2	$\xrightarrow{M}$	Adduct					8632	
K^+	+ NO	→	No Reaction			$<1.00\times10^{-13}$		7103	
Ca^+	+ H_2	→	No Reaction			$<2.00\times10^{-14}$		8813	
Ca^+	+ HD	→	No Reaction			$<2.00\times10^{-14}$		8813	
Ca^+	+ D_2	→	No Reaction			$<2.00\times10^{-14}$		8813	
Ca^+	+ O_2	→	No Reaction			$<2.00\times10^{-14}$		9001	
		$\xrightarrow{M}$	Adduct					8632	
Ca^+	+ O_3	→	CaO^+	+ O_2	1.00	1.60×10^{-10}	±50%	6802	
Ca^+	+ CO	$\xrightarrow{M}$	Adduct					8632	
Ca^+	+ N_2O	→	CaO^+	+ N_2	1.00	$\sim5.00\times10^{-11}$		7206	
Sc^+	+ H_2	→	No Reaction			$<2.00\times10^{-14}$		8717	
Sc^+	+ HD	→	No Reaction			$<2.00\times10^{-14}$		8717	
Sc^+	+ D_2	→	No Reaction			$<2.00\times10^{-14}$		8717	
Sc^+	+ CH_4	→	No Reaction			$<2.00\times10^{-14}$		8907	
Sc^+	+ C_2H_6	→	$ScC_2H_4^+$	+ H_2	1.00	2.40×10^{-11}	±20%	8907	
Sc^+	+ O_2	→	ScO^+	+ O	1.00	4.00×10^{-10}	±30%	9001	
Sc^+	+ CO	→	No Reaction			$<2.00\times10^{-14}$		9127	

Table of Reactions – Continued

Reactions	Prod. Dist.	Rate Const. (cm^3/s)		Ref.	Footnotes
$Ti^+ + H_2 \rightarrow$ No Reaction		$<2.00\times10^{-14}$		8717	
$Ti^+ + HD \rightarrow$ No Reaction		$<2.00\times10^{-14}$		8815	
$Ti^+ + D_2 \rightarrow$ No Reaction		$<5.00\times10^{-14}$		8717	
$Ti^+ + CH_4 \rightarrow TiCH_2^+ + H_2$	1.00	2.40×10^{-14}	±20%	8816	
$Ti^+ + C_2H_6 \rightarrow TiC_2H_4^+ + H_2$	0.96	1.30×10^{-10}	±20%	8901	
$\rightarrow TiC_2H_2^+ + H_2 + H_2$	0.04				
$Ti^+ + C_3H_8 \rightarrow TiC_3H_2^+ + H_2 + H_2 + H_2$	0.03	2.00×10^{-10}	±20%	8901	
$\rightarrow TiC_3H_4^+ + H_2 + H_2$	0.03				
$\rightarrow TiC_3H_6^+ + H_2$	0.94				
$Ti^+ + O_2 \rightarrow TiO^+ + O$	1.00	4.00×10^{-10}	±30%	9001	
$Ti^+ + CO \rightarrow$ No Reaction		$<2.00\times10^{-14}$		9127	
$V^+ + H_2 \rightarrow$ No Reaction		$<1.00\times10^{-13}$		8519	
$V^+ + HD \rightarrow$ No Reaction		$<1.00\times10^{-13}$		8519	
$V^+ + D_2 \rightarrow$ No Reaction		$<1.00\times10^{-13}$		8519	
$V^+ + CH_4 \rightarrow$ No Reaction		$<2.00\times10^{-14}$		8721	
$V^+ + C_2H_2 \rightarrow$ No Reaction		$<1.00\times10^{-14}$		8627	
$V^+ + C_2H_4 \rightarrow VC_2H_2^+ + H_2$	1.00	2.20×10^{-12}	±20%	8627	
$V^+ + C_2H_6 \rightarrow VC_2H_4^+ + H_2$	1.00	2.20×10^{-12}	±20%	8627	
$V^+ + NH_3 \rightarrow VNH^+ + H_2$	1.00	2.20×10^{-12}	±20%	9007	
$V^+ + O_2 \rightarrow VO^+ + O$	1.00	2.70×10^{-10}	±30%	9001	
$V^+ + CO \rightarrow$ No Reaction		$<2.00\times10^{-14}$		9127	
$Cr^+ + H_2 \rightarrow$ No Reaction		$<2.00\times10^{-14}$		8719	8124
$Cr^+ + HD \rightarrow$ No Reaction		$<2.00\times10^{-14}$		8719	
$Cr^+ + D_2 \rightarrow$ No Reaction		$<2.00\times10^{-14}$		8719	
$Cr^+ + CH_4 \rightarrow$ No Reaction		$<2.00\times10^{-14}$		8812	
$Cr^+ + C_2H_4 \rightarrow$ No Reaction		$<2.00\times10^{-14}$		8905	
$Cr^+ + C_2H_6 \rightarrow$ No Reaction		$<2.00\times10^{-14}$		8905	
$Cr^+ + c\text{-}C_3H_6 \rightarrow$ No Reaction		$<2.00\times10^{-14}$		8905	
$Cr^+ + O_2 \rightarrow$ No Reaction		$<2.00\times10^{-14}$		9001	8214
$Cr^+ + N_2O \rightarrow$ No Reaction		$<2.00\times10^{-12}$		8214	
$Mn^+ + H_2 \rightarrow$ No Reaction		$<2.00\times10^{-14}$		8606	
$Mn^+ + HD \rightarrow$ No Reaction		$<2.00\times10^{-14}$		8606	

Table of Reactions – Continued

Reactions					Prod. Dist.	Rate Const. (cm^3/s)		Ref.		Footnotes
Mn^+	+ D_2	→	No Reaction			$<2.00\times10^{-14}$		8606		
Mn^+	+ C_2H_4	→	No Reaction			$<2.00\times10^{-14}$		8906		
Mn^+	+ c-C_3H_6	→	$MnCH_2^+$	+ C_2H_4	1.00	6.00×10^{-12}	±30%	9012		
Mn^+	+ O_2	→	No Reaction			$<2.00\times10^{-14}$		9001	8214	
Mn^+	+ c-CH_2CH_2O	→	$MnCH_2^+$	+ H_2CO	0.20	2.00×10^{-11}	±30%	9012		
			MnO^+	+ C_2H_4	0.80					
Mn^+	+ $(CH_3)_2CO$	→	Products		1.00	4.00×10^{-12}	±30%	9012		
Mn^+	+ N_2O	→	No Reaction			$<6.00\times10^{-12}$		8214		
Fe^+	+ H_2	→	No Reaction			$<2.00\times10^{-14}$		8609	8423	
Fe^+	+ HD	→	No Reaction			$<2.00\times10^{-14}$		8609		
Fe^+	+ D_2	→	No Reaction			$<2.00\times10^{-14}$		8609		
Fe^+	+ CH_4	→	No Reaction			$<2.00\times10^{-14}$		8817	8427	
Fe^+	+ C_2H_6	→	$FeC_2H_4^+$	+ H_2	1.00	2.00×10^{-12}	±20%	8817	8427	
Fe^+	+ c-C_3H_6	→	No Reaction			$<2.00\times10^{-14}$		9109	8427	
Fe^+	+ C_3H_8	→	$FeC_2H_4^+$	+ CH_4	0.76	3.00×10^{-10}	±20%	8728	8427	
			$FeC_3H_6^+$	+ H_2	0.24					
Fe^+	+ O_2	→	No Reaction			$<2.00\times10^{-14}$		9001	8903	8214
		M →	Adduct					8632		
Fe^+	+ O_3	→	FeO^+	+ O_2	1.00	1.50×10^{-10}	±50%	6802		
Fe^+	+ CH_3CHO	→	$FeCO^+$	+ CH_4	1.00			8422		
Fe^+	+ N_2O	→	FeO^+	+ N_2	1.00	$\sim1.00\times10^{-10}$	±50%	8214		
FeH^+	+ CH_3OH	→	$CH_3OH_2^+$	+ Fe	0.19			8423		
			$FeOCH_3^+$	+ H_2	0.81					
Fe_2^+	+ O_2	→	Fe^+	+ FeO_2	1.00	1.50×10^{-10}	±20%	8904		
Fe_3^+	+ O_2	→	Fe^+	+ Fe_2O_2	0.12	3.00×10^{-10}	±20%	8904		
			Fe_2O^+	+ FeO	0.37					
			$Fe_2O_2^+$	+ Fe	0.51					
Co^+	+ H_2	→	No Reaction			$<5.00\times10^{-14}$		8608		
Co^+	+ HD	→	No Reaction			$<5.00\times10^{-14}$		8608		
Co^+	+ D_2	→	No Reaction			$<5.00\times10^{-14}$		8608	8107	
Co^+	+ C_2H_4	→	No Reaction			$<2.00\times10^{-11}$		8125		
Co^+	+ C_2H_6	→	No Reaction			$<2.00\times10^{-14}$		8910		
Co^+	+ c-C_3H_6	→	No Reaction			$<2.00\times10^{-12}$		9004		

Table of Reactions – Continued

Reactions				Prod. Dist.	Rate Const. (cm^3/s)		Ref.	Footnotes
Co^+ + C_3H_8 →	$CoC_2H_4^+$	+ CH_4		0.33	1.40×10^{-10}	±20%	8910	
	$CoC_3H_6^+$	+ H_2		0.67				
Co^+ + NH_3 →	No Reaction				$<2.00\times10^{-14}$		9108	8909
Co^+ + O_2 →	No Reaction				$<2.00\times10^{-14}$		9001	8214
Co^+ + H_2CO →	$CoCO^+$	+ H_2		1.00			8422	
Co^+ + CH_3CHO →	$CoCO^+$	+ CH_4		1.00			8422	
Co^+ + c-CH_2CH_2O →	Products			1.00	4.00×10^{-10}	±20%	9004	
Co^+ + N_2O →	CoO^+	+ N_2		1.00	$\sim1.00\times10^{-11}$	±50%	8214	
Ni^+ + H_2 →	No Reaction				$<5.00\times10^{-14}$		8608	8022
Ni^+ + HD →	No Reaction				$<5.00\times10^{-14}$		8608	
Ni^+ + D_2 →	No Reaction				$<5.00\times10^{-14}$		8608	
Ni^+ + C_2H_6 →	No Reaction				$<2.00\times10^{-14}$		8910	
Ni^+ + c-C_3H_6 →	No Reaction				$<2.00\times10^{-13}$		9004	
Ni^+ + C_3H_8 →	$NiC_2H_4^+$	+ CH_4		1.00	2.80×10^{-10}	±20%	8910	
Ni^+ + NH_3 →	No Reaction				$<2.00\times10^{-14}$		9108	
Ni^+ + O_2 →	No Reaction				$<2.00\times10^{-14}$		9001	8214
Ni^+ + c-CH_2CH_2O →	Products			1.00	4.50×10^{-10}	±20%	9004	
Ni^+ + N_2O →	No Reaction				$<4.00\times10^{-12}$		8214	
Cu^+ + H_2 →	No Reaction				$<5.00\times10^{-14}$		8608	
Cu^+ + HD →	No Reaction				$<5.00\times10^{-14}$		8608	
Cu^+ + D_2 →	No Reaction				$<5.00\times10^{-14}$		8608	
Cu^+ + C_2H_6 →	No Reaction				$<2.00\times10^{-14}$		8910	
Cu^+ + c-C_3H_6 →	No Reaction				$<2.00\times10^{-13}$		9004	
Cu^+ + C_3H_8 →	No Reaction				$<2.00\times10^{-14}$		8910	
Cu^+ + NH_3 →	No Reaction				$<2.00\times10^{-14}$		9108	
Cu^+ + O_2 →	No Reaction				$<2.00\times10^{-14}$		9001	
Cu^+ + CH_3NH_2 →	$CH_2NH_2^+$	+ CuH		1.00	2.10×10^{-9}	±10%	8911	
Cu^+ + $(CH_3)_2NH$ →	$(CH_3)_2N^+$	+ CuH		1.00	1.70×10^{-9}	±10%	8911	
Cu^+ + $(CH_3)_3N$ →	$(CH_3)_2NCH_2^+$	+ CuH		1.00	1.50×10^{-9}	±10%	8911	
Cu^+ + c-CH_2CH_2O →	CH_3CO^+	+ CuH		1.00	1.90×10^{-10}	±20%	9004	
Zn^+ + H_2 →	No Reaction				$<2.00\times10^{-14}$		8813	
Zn^+ + HD →	No Reaction				$<2.00\times10^{-14}$		8813	

Table of Reactions – Continued

Reactions					Prod. Dist.	Rate Const. (cm^3/s)		Ref.		Footnotes
Zn^+	+ D_2	→	No Reaction			$<2.00\times10^{-14}$		8813		
Zn^+	+ C_2H_6	→	No Reaction			$<2.00\times10^{-14}$		8610		
Zn^+	+ C_3H_8	→	No Reaction			$<2.00\times10^{-14}$		8610		
Zn^+	+ O_2	→	No Reaction			$<2.00\times10^{-14}$		9001		
Zn^+	+ NO_2	→	No Reaction			$<2.00\times10^{-14}$		9001		
Br^+	+ CH_4	→	CH_3^+	+ HBr	0.80	8.40×10^{-10}	±20%	9013		
			CH_2Br^+	+ H_2	0.20					
Br^+	+ C_2H_2	→	$C_2H_2^+$	+ Br	1.00	8.90×10^{-10}	±20%	9013		
Br^+	+ C_2H_4	→	$C_2H_3^+$	+ HBr	0.25	1.10×10^{-9}	±20%	9013		
			$C_2H_4^+$	+ Br	0.75					
Br^+	+ c-C_6H_6	→	c-$C_6H_6^+$	+ Br	1.00	1.40×10^{-9}	±20%	9013		
Br^+	+ NH_3	→	NH_3^+	+ Br	1.00	2.10×10^{-9}	±20%	9013		
Br^+	+ O_2	→	O_2^+	+ Br	1.00	7.10×10^{-10}	±20%	9013		
Br^+	+ H_2S	→	HS +	+ HBr	0.12	9.70×10^{-10}	±20%	9013		
			H_2S^+	+ Br	0.88					
Br^+	+ NO	→	NO^+	+ Br	1.00	4.40×10^{-11}	±20%	9013		
Br^+	+ COS	→	BrS^+	+ CO	0.16	1.10×10^{-9}	±20%	9013		
			COS^+	+ Br	0.84					
HBr^+	+ CH_4	→	CH_5^+	+ Br	1.00	8.30×10^{-11}	±25%	9030		
HBr^+	+ H_2S	→	H_2S^+	+ HBr	0.65	1.56×10^{-9}	±25%	9030		
			H_3S^+	+ Br	0.35					
HBr^+	+ CO_2	→	HCO_2^+	+ Br	1.00	3.00×10^{-12}	±25%	9030		
HBr^+	+ NO	→	NO^+	+ HBr	1.00	3.00×10^{-10}	±25%	9030		
HBr^+	+ N_2O	→	HN_2O^+	+ Br	1.00	9.60×10^{-10}	±25%	9030		
HBr^+	+ SO_2	→	HSO_2^+	+ Br	1.00	1.60×10^{-9}	±25%	9030		
HBr^+	+ COS	→	COS^+	+ HBr	0.75	1.20×10^{-9}	±25%	9030		
			$HCOS^+$	+ Br	0.25					
Kr^+	+ H_2	→	KrH^+	+ H	1.00	2.14×10^{-10}	±30%	8605 7504	8013 7416	7620
Kr^+	+ HD	→	KrH^+	+ D	0.45	5.80×10^{-10}	±35%	8605	8013	
			KrD^+	+ H	0.55					
Kr^+	+ D_2	→	KrD^+	+ D	1.00	1.50×10^{-10}	±15%	8605	7620	
Kr^+	+ CH_4	→	CH_4^+	+ Kr	1.00	1.02×10^{-9}	±15%	8319 7702	8318	8013
Kr^+	+ C_2H_2	→	No Reaction			$<1.00\times10^{-12}$		8915		

Table of Reactions – Continued

Reactions	Prod. Dist.	Rate Const. (cm^3/s)		Ref.			Footnotes
$Kr^+ + C_2H_4 \rightarrow C_2H_2^+ + H_2 + Kr$	0.45	7.40×10^{-10}	±20%	8915			
$C_2H_3^+ + H + Kr$	0.45						
$C_2H_4^+ + Kr$	0.10						
$Kr^+ + C_2H_6 \rightarrow C_2H_4^+ + H_2 + Kr$	0.65	9.80×10^{-10}	±20%	8915			
$C_2H_5^+ + H + Kr$	0.35						
$Kr^+ + C_3H_8 \rightarrow C_2H_3^+ + CH_4 + H + Kr$	0.05	9.80×10^{-10}	±20%	8915			
$C_2H_4^+ + CH_4 + Kr$	0.15						
$C_2H_5^+ + CH_3 + Kr$	0.60						
$C_3H_5^+ + H_2 + H + Kr$	0.10						
$C_3H_6^+ + H_2 + Kr$	0.10						
$Kr^+ + NH_3 \rightarrow NH_3^+ + Kr$	1.00	7.50×10^{-10}	±20%	8318	8013		
$Kr^+ + H_2O \rightarrow H_2O^+ + Kr$	1.00	1.20×10^{-9}	±20%	8318	7006		
$Kr^+ + O_2 \rightarrow O_2^+ + Kr$	1.00	4.00×10^{-11}	±30%	8318 7204	8013	7702	
$Kr^+ + SiH_4 \rightarrow Si^+ + H_2 + H_2 + Kr$	0.05	7.70×10^{-10}	±20%	9002			
$SiH^+ + H_2 + H + Kr$	0.03						
$SiH_2^+ + H_2 + Kr$	0.17						
$SiH_3^+ + H + Kr$	0.75						
$Kr^+ + H_2S \rightarrow S^+ + H_2 + Kr$	0.30	1.00×10^{-9}	±20%	8013			
$H_2S^+ + Kr$	0.35						
$KrH^+ + SH$	0.35						
$Kr^+ + HCl \rightarrow HCl^+ + Kr$	1.00	4.05×10^{-11}	±25%	9024	8915		a
$Kr^+ + DCl \rightarrow DCl^+ + Kr$	1.00	2.70×10^{-11}	±25%	9024			a
$*Kr^+ + Kr \rightarrow Kr^+ + *Kr$	1.00	8.30×10^{-10}	±20%	7318			T=373
$\xrightarrow{M}$ Adduct				8632			
$Kr^+ + Hg \rightarrow$ No Reaction		$<1.00\times10^{-12}$		8016	7317		b
$Kr^+ + CO \rightarrow CO^+ + Kr$	1.00	1.50×10^{-10}	±50%	8013	7702	7318	b
$Kr^+ + CO_2 \rightarrow CO_2^+ + Kr$	1.00	6.15×10^{-10}	±20%	8013	7702		
$Kr^+ + NO \rightarrow$ No Reaction		$<1.00\times10^{-12}$		7702			
$Kr^+ + N_2O \rightarrow N_2O^+ + Kr$	1.00	4.00×10^{-10}	±20%	8013	7702		b
$Kr^+ + COS \rightarrow COS^+ + Kr$	1.00	4.30×10^{-10}	±20%	8013			
$KrH^+ + H_2 \rightarrow H_3^+ + Kr$	1.00	3.80×10^{-11}	±20%	8006			
$KrH^+ + CH_4 \rightarrow CH_5^+ + Kr$	1.00	9.20×10^{-10}	±20%	7613			
$KrH^+ + C_2H_4 \rightarrow C_2H_3^+ + H_2 + Kr$	0.72	1.10×10^{-9}	±20%	7613	7610		
$C_2H_5^+ + Kr$	0.28						
$KrH^+ + C_2H_6 \rightarrow C_2H_5^+ + H_2 + Kr$	1.00	1.20×10^{-9}	±20%	7613			
$KrH^+ + NH_3 \rightarrow NH_4^+ + Kr$	1.00	1.50×10^{-9}	±20%	7613			
$KrH^+ + N_2 \rightarrow N_2H^+ + Kr$	1.00	5.80×10^{-10}	±20%	8006	7415		
$KrH^+ + O_2 \rightarrow HO_2^+ + Kr$	1.00	3.70×10^{-11}	±20%	8006			
$KrH^+ + Ar \rightarrow$ No Reaction		$<3.00\times10^{-12}$		7618			

Table of Reactions – Continued

Reactions	Prod. Dist.	Rate Const. (cm^3/s)	Ref.	Footnotes
$Zr^+ + O_2 \rightarrow ZrO^+ + O$	1.00	5.50×10^{-10} ±10%	8528	
$Zr^+ + CO_2 \rightarrow ZrO^+ + CO$	1.00	4.00×10^{-10} ±10%	8528	
$Zr^+ + NO \rightarrow ZrO^+ + N$	1.00	4.80×10^{-10} ±10%	8528	
$Ag^+ + NH_3 \xrightarrow{M}$ Adduct			8632	
$Ag^+ + (CH_3)_2NH \rightarrow (CH_3)_2N^+ + AgH$	1.00	1.60×10^{-9} ±10%	8911	
$Ag^+ + (CH_3)_3N \rightarrow (CH_3)_2NCH_2^+ + AgH$	1.00	1.40×10^{-9} ±10%	8911	
$Xe^+ + H_2 \rightarrow$ No Reaction		$<2.00\times10^{-14}$	8908	
$Xe^+ + HD \rightarrow$ No Reaction		$<2.00\times10^{-14}$	8908	
$Xe^+ + D_2 \rightarrow$ No Reaction		$<2.00\times10^{-14}$	8908	
$Xe^+ + CH_4 \rightarrow$ No Reaction		$<2.00\times10^{-13}$	8013	
$Xe^+ + C_2H_2 \rightarrow C_2H_2^+ + Xe$	1.00	5.00×10^{-10} ±20%	8915	
$Xe^+ + C_2H_4 \rightarrow C_2H_2^+ + H_2 + Xe$	0.25	8.50×10^{-10} ±20%	8915	
$C_2H_4^+ + Xe$	0.75			
$Xe^+ + C_2H_6 \rightarrow C_2H_4^+ + H_2 + Xe$	0.55	9.20×10^{-10} ±20%	8915	
$C_2H_5^+ + H + Xe$	0.10			
$C_2H_6^+ + Xe$	0.35			
$Xe^+ + C_3H_8 \rightarrow C_3H_6^+ + H_2 + Xe$	0.30	8.80×10^{-10} ±20%	8915	
$C_3H_7^+ + H + Xe$	0.65			
$C_3H_8^+ + Xe$	0.05			
$Xe^+ + NH_3 \rightarrow NH_3^+ + Xe$	1.00	8.30×10^{-10} ±20%	8013	
$Xe^+ + O_2 \rightarrow O_2^+ + Xe$	1.00	1.10×10^{-10} ±20%	8013	
$Xe^+ + SiH_4 \rightarrow SiH_2^+ + H_2 + Xe$	0.56	9.40×10^{-10} ±20%	9002	
$SiH_3^+ + H + Xe$	0.44			
$Xe^+ + H_2S \rightarrow H_2S^+ + Xe$	1.00	9.90×10^{-10} ±20%	8013	
$Xe^+ + HCl \rightarrow$ No Reaction		$<1.00\times10^{-12}$	8915	
$Xe^+ + Ar \xrightarrow{M}$ Adduct			8632	
$Xe^+ + Xe \xrightarrow{M}$ Adduct			8632	
$Xe^+ + C_2N_2 \xrightarrow{M}$ Adduct			8632	
$Xe^+ + CO \rightarrow$ No Reaction		$<1.00\times10^{-12}$	8915	
$Xe^+ + CO_2 \rightarrow$ No Reaction		$<1.00\times10^{-12}$	8915	
$Xe^+ + N_2O \rightarrow$ No Reaction		$<2.00\times10^{-13}$	8013	
$Xe^+ + COS \rightarrow COS^+ + Xe$	1.00	8.70×10^{-10} ±20%	8013	
$Ba^+ + D_2 \rightarrow$ No Reaction		$<1.00\times10^{-12}$	8023	T=400
$Ba^+ + O_2 \rightarrow$ No Reaction		$<1.00\times10^{-13}$	7103	

Table of Reactions – Continued

Reactions	Prod. Dist.	Rate Const. (cm^3/s)	Ref.	Footnotes
$Ba^+ + CO_2 \rightarrow BaO^+ + CO$	1.00		7206	
$Ba^+ + CO_2 \xrightarrow{M}$ Adduct			8632	
$Ba^+ + NO \rightarrow$ No Reaction		$<1.00\times10^{-13}$	7103	
$Ba^+ + N_2O \rightarrow BaO^+ + N_2$	1.00		7206	
$CN^+ + H_2 \rightarrow HCN^+ + H$	0.50	1.10×10^{-9} ±30%	9116 8404 7701	
$HNC^+ + H$	0.50			
$CN^+ + D_2 \rightarrow DCN^+ + D$	1.00	9.10×10^{-10} ±20%	8404 8301	
$CN^+ + CH_4 \rightarrow CH_3^+ + HCN$	0.50	1.00×10^{-9} ±15%	8404 8301 8012	b
$CH_4^+ + CN$	0.15			
$HCN^+ + CH_3$	0.15			
$HCNH^+ + CH_2$	0.10			
$CH_2CN^+ + H_2$	0.10			
$CN^+ + C_2H_2 \rightarrow C_2H_2^+ + CN$	0.90	$\sim1.50\times10^{-9}$ ±20%	8301	
$CHCCN^+ + H$	0.10			
$CN^+ + C_2D_2 \rightarrow C_2D_2^+ + CN$	0.70	5.40×10^{-10} ±30%	8404	
$CDCCN^+ + D$	0.30			
$CN^+ + C_2H_4 \rightarrow C_2H_4^+ + CN$	0.70	1.30×10^{-9} ±30%	8404 8301	b
$HCN^+ + C_2H_3$	0.25			
$CHCCNH^+ + H_2$	0.05			
$CN^+ + C_2H_6 \rightarrow C_2H_3^+ + HCN + H_2$	0.15	1.90×10^{-9} ±20%	8301	
$C_2H_4^+ + HCN + H$	0.65			
$C_2H_5^+ + HCN$	0.20			
$CN^+ + NH_3 \rightarrow NH_2^+ + HCN$	0.05	2.00×10^{-9} ±20%	8301	
$NH_3^+ + CN$	0.60			
$HCN^+ + NH_2$	0.20			
$HCNH^+ + NH$	0.15			
$CN^+ + ND_3 \rightarrow ND_3^+ + CN$	>0.80	1.30×10^{-9} ±30%	8404	
$DCN^+ + ND_2$	0.10			
$DCND^+ + ND$	0.10			
$CN^+ + N_2 \rightarrow$ No Reaction		$<4.30\times10^{-12}$ ±30%	8404 8301	
$CN^+ + H_2O \rightarrow H_2O^+ + CN$	0.10	3.20×10^{-9} ±20%	8301	
$HCN^+ + OH$	0.50			
$HCNH^+ + O$	0.15			
$HCO^+ + NH$	0.05			
$HNCO^+ + H$	0.20			
$CN^+ + D_2O \rightarrow D_2O^+ + CN$	0.40	2.10×10^{-9} ±30%	8404	
$DCN^+ + OD$	0.40			
$DCND^+ + O$	0.10			
$DNCO^+ + D$	0.10			
$CN^+ + O_2 \rightarrow O_2^+ + CN$	0.60	4.30×10^{-10} ±30%	8404	
$NO^+ + CO$	0.20			
$NCO^+ + O$	0.20			
$CN^+ + H_2S \rightarrow S^+ + CN + H_2$	0.30	1.30×10^{-9} ±30%	8404	
$HS^+ + HCN$	0.30			
$H_2S^+ + CN$	0.40			
$CN^+ + Xe \rightarrow Xe^+ + CN$	1.00	1.60×10^{-10} ±30%	8404	

Table of Reactions — Continued

Reactions				Prod. Dist.	Rate Const. (cm^3/s)		Ref.			Footnotes
CN^+ + HCN →	HCN^+	+	CN	0.83	2.70×10^{-9}	±20%	8404	8301	7819	
	$C_2N_2^+$	+	H	0.17						
CN^+ + CD_3CN →	CD_3^+	+	C_2N_2	0.20	3.40×10^{-9}	±30%	8404			
	$C_2D_3^+$	+	CN_2	0.10						
	CD_2CN^+	+	DCN	0.20						
	CD_2CND^+	+	CN	0.50						
CN^+ + C_2N_2 →	C_2N^+	+	CN_2	0.03	1.75×10^{-9}	±30%	8515	8404	8301	
	$C_2N_2^+$	+	CN	0.93						
	C_3N^+	+	N_2	0.05						
CN^+ + HC_3N →	C_3N^+	+	HCN	0.20	4.60×10^{-9}	±20%	8509	7911		b
	$CHCCN^+$	+	CN	0.80						
CN^+ + CO →	CO^+	+	CN	1.00	4.40×10^{-10}	±60%	8404	8301		b
$\xrightarrow{M}$	Adduct						8404			
CN^+ + CH_3OH →	CH_3OH^+	+	CN	0.30	2.60×10^{-9}	±30%	8404			
	CH_2OH^+	+	HCN	0.60						
	$HCNH^+$	+	H_2CO	0.10						
CN^+ + CO_2 →	CO_2^+	+	CN	0.40	1.10×10^{-9}	±50%	8404	8301		
	C_2O^+	+	NO	0.30						
	NCO^+	+	CO	0.30						
CN^+ + CHOOH →	HCO^+	+	HNCO	1.00	5.30×10^{-9}	±30%	7821			
CN^+ + NO →	NO^+	+	CN	0.75	7.60×10^{-10}	±30%	8404			
	NCO^+	+	N	0.25						
CN^+ + N_2O →	NO^+	+	CN_2	0.20	7.60×10^{-10}	±30%	8404			
	N_2O^+	+	CN	0.60						
	NCO^+	+	N_2	0.20						
CN^+ + COS →	COS^+	+	CN	0.80	1.50×10^{-9}	±30%	8404			
	CSN^+	+	CO	0.15						
	C_2SN^+	+	O	0.05						
HCN^+ + D →	D^+	+	HCN	1.00	3.70×10^{-11}	±50%	7901			
HCN^+ + H_2 →	$HCNH^+$	+	H	1.00	8.80×10^{-10}	±20%	9116	7704	7701	
HCN^+ + CH_4 →	$C_2H_3^+$	+	NH_2	0.10	1.27×10^{-9}	±15%	9116	8101	8012	
	$HCNH^+$	+	CH_3	0.90						
HCN^+ + C_2H_2 →	$C_2H_2^+$	+	HCN	>0.85	1.35×10^{-9}	±45%	9116	8012	8002	b
	$C_2H_3^+$	+	CN	<0.15						
	$CHCCNH^+$	+	H	<0.10						
HCN^+ + NH_3 →	NH_3^+	+	HCN	~0.60	2.80×10^{-9}	±10%	8101			
	NH_4^+	+	CN	<0.05						
	$HCNH^+$	+	NH_2	~0.30						
HCN^+ + N_2 →	No Reaction				$<1.00\times10^{-11}$		8101			
HCN^+ + H_2O →	H_2O^+	+	HCN	~0.50	3.60×10^{-9}	±10%	8101			
	H_3O^+	+	CN	~0.50						
	$HCNH^+$	+	OH	<0.05						
HCN^+ + O_2 →	O_2^+	+	HCN	1.00	4.10×10^{-10}	±30%	9039	8101		
HCN^+ + HCN →	$HCNH^+$	+	CN	1.00	1.45×10^{-9}	±45%	8101	7819		

Table of Reactions — Continued

Reactions	Prod. Dist.	Rate Const. (cm^3/s)		Ref.			Footnotes
$HCN^+ + HC_3N \rightarrow CHCCN^+ + HCN$	0.52	4.60×10^{-9}	±20%	8518	7911		b
$\quad\quad\quad\quad\quad\quad\quad\quad CHCCNH^+ + CN$	0.48						
$HCN^+ + CO \rightarrow HCO^+ + CN$	0.30	4.60×10^{-10}	±20%	9116	9039	8101	b
$\quad\quad\quad\quad\quad\quad\quad\quad HNC^+ + CO$	0.70						
$HCN^+ + CO_2 \rightarrow HCO_2^+ + CN$	0.42	5.00×10^{-10}	±25%	9116	9039	8101	b
$\quad\quad\quad\quad\quad\quad\quad\quad HNC^+ + CO_2$	0.58						
$HCN^+ + CHOOH \rightarrow HCO^+ + H_2NCO$	1.00	2.50×10^{-9}	±30%	7821			
$HCN^+ + N_2O \rightarrow N_2O^+ + HCN$	>0.90	1.20×10^{-9}	±25%	9039			
$\quad\quad\quad\quad\quad\quad\quad\quad HNCO^+ + N_2$	<0.10						
$HNC^+ + H_2 \rightarrow HCNH^+ + H$	1.00	7.00×10^{-10}	±30%	9116			
$HNC^+ + CH_4 \rightarrow HCNH^+ + CH_3$	1.00	1.10×10^{-9}	±30%	9116			
$HNC^+ + C_2H_2 \rightarrow C_2H_2^+ + HCN$	~0.40	1.50×10^{-9}	±30%	9116			
$\quad\quad\quad\quad\quad\quad\quad\quad CHCCNH^+ + H$	~0.60						
$HNC^+ + O_2 \rightarrow NO^+ + HCO$	0.25	3.60×10^{-10}	±25%	9039			
$\quad\quad\quad\quad\quad\quad\quad\quad HNCO^+ + O$	0.75						
$HNC^+ + CO \rightarrow$ No Reaction		$<1.00\times10^{-12}$		9039			
$HNC^+ + CO_2 \rightarrow$ Products	1.00	1.20×10^{-12}	±25%	9039			
$HNC^+ + N_2O \rightarrow NO^+ + HCN_2$	0.45	1.10×10^{-9}	±25%	9039			
$\quad\quad\quad\quad\quad\quad\quad\quad HNCO^+ + N_2$	0.55						
$HCNH^+ + H_2 \rightarrow$ No Reaction		$<4.00\times10^{-13}$		7711			
$HCNH^+ + D_2 \rightarrow$ No Reaction		$<2.50\times10^{-12}$		7701			
$HCNH^+ + C_4H_2 \rightarrow C_4H_3^+ + HCN$	1.00	1.80×10^{-9}	±30%	9118			
$HCNH^+ + NH_3 \rightarrow NH_4^+ + HCN$	1.00	2.30×10^{-9}	±30%	7704	7701	7412	
$HCNH^+ + H_2O \rightarrow H_3O^+ + HCN$	1.00	8.80×10^{-13}	±40%	7809			
$HCNH^+ + H_2S \rightarrow H_3S^+ + HCN$	1.00	3.20×10^{-10}	±30%	7813	7809		
$HCNH^+ + CH_3NH_2 \rightarrow CH_2NH_2^+ + HCN + H_2$	0.11	2.10×10^{-9}	±20%	9124			
$\quad\quad\quad\quad\quad\quad\quad\quad CH_3NH_3^+ + HCN$	0.89						
$HCNH^+ + CH_3CN \rightarrow CH_3CNH^+ + HCN$	1.00	3.80×10^{-9}	±20%	8929			
$HCNH^+ + HC_3N \rightarrow CHCCNH^+ + HCN$	1.00	3.40×10^{-9}	±30%	7911			
$HCNH^+ + H_2CO \rightarrow CH_2OH^+ + HCN$	1.00	2.10×10^{-9}	±30%	7906	7814	7809	
$HCNH^+ + CHOOH \rightarrow CH(OH)_2^+ + HCN$	1.00	1.40×10^{-9}	±30%	7820			
$CH_2NH_2^+ + H_2 \rightarrow$ No Reaction		$<4.00\times10^{-14}$		7711			
$CH_2NH_2^+ + CH_3NH_2 \rightarrow CH_3NH_3^+ + HCN + H_2$	1.00	1.80×10^{-9}	±20%	9124	8322		
$CH_2NH_2^+ + (CH_3)_2NH \rightarrow (CH_3)_3NH_2^+ + HCN + H_2$	1.00	1.60×10^{-9}	±20%	9124			

Table of Reactions – Continued

Reactions	Prod. Dist.	Rate Const. (cm^3/s)		Ref.			Footnotes
$CH_3NH_2^+ + CH_3NH_2 \rightarrow CH_3NH_3^+ + CH_2NH_2$	1.00	1.90×10^{-9}	±20%	9124			
$CH_3NH_2^+ + (CH_3)_2NH \rightarrow (CH_3)_2NH^+ + CH_3NH_2$	0.55	1.70×10^{-9}	±20%	9124			
$\rightarrow (CH_3)_2NH_2^+ + CH_2NH_2$	0.45						
$CH_3NH_2^+ + (CH_3)_3N \rightarrow (CH_3)_3N^+ + CH_3NH_2$	0.92	1.60×10^{-9}	±20%	9124			
$\rightarrow (CH_3)_3NH^+ + CH_2NH_2$	0.08						
$CH_3NH_3^+ + CH_3NH_2 \xrightarrow{M} \text{Adduct}$				8632			
$CH_3NH_3^+ + (CH_3)_2NH \rightarrow (CH_3)_2NH_2^+ + CH_3NH_2$	1.00	1.60×10^{-9}	±20%	9124			
$CH_3NH_3^+ + (CH_3)_3N \rightarrow (CH_3)_3NH^+ + CH_3NH_2$	1.00	9.30×10^{-10}	±20%	9124			
$CNC^+ + H_2 \rightarrow$ No Reaction		$<1.00\times10^{-13}$		8802	8012		
$CNC^+ + CH_4 \rightarrow C_2H_3^+ + HCN$		4.20×10^{-12}	±20%	8802	8301	8012	
$\rightarrow CHCCNH^+ + H_2$							
$CNC^+ + C_2H_2 \rightarrow C_3H^+ + HCN$	0.92	8.00×10^{-10}	±40%	8802	8301	8012	b
$\rightarrow HCNH^+ + C_3$	0.08						
$\rightarrow HC_4N^+ + H$	?						
$CNC^+ + C_2H_4 \rightarrow C_2H_4^+ + C_2N$	0.10	1.30×10^{-9}	±20%	8301			
$\rightarrow C_3H_3^+ + HCN$	0.30						
$\rightarrow CH_2CN^+ + C_2H_2$	0.50						
$\rightarrow H_2C_4N^+ + H_2$	0.10						
$CNC^+ + C_2H_6 \rightarrow C_2H_3^+ + CH_3CN$	0.10	1.20×10^{-9}	±20%	8301			
$\rightarrow C_2H_5^+ + HC_2N$	0.25						
$\rightarrow C_3H_3^+ + HCN + H_2$	0.30						
$\rightarrow C_3H_5^+ + HCN$	0.10						
$\rightarrow CH_2CN^+ + C_2H_4$	0.25						
$CNC^+ + NH_3 \rightarrow HCNH^+ + HCN$	0.95	1.85×10^{-9}	±10%	8802	8301	8012	
$\rightarrow N_2H^+ + C_2H_2$	0.05						
$CNC^+ + N_2 \rightarrow$ No Reaction		$<1.00\times10^{-13}$		8802	8301		
$CNC^+ + H_2O \rightarrow CHCN^+ + OH$	0.25	7.00×10^{-11}	±40%	8802	8301	8012	
$\rightarrow HCO^+ + HCN$	0.75						
$CNC^+ + O_2 \rightarrow$ No Reaction		$<1.00\times10^{-13}$		8802			
$CNC^+ + H_2S \rightarrow HCS^+ + HCN$	1.00	1.20×10^{-9}	±20%	8012			
$CNC^+ + HCN \rightarrow$ No Reaction		$<3.00\times10^{-11}$		8301	7819		b
$\xrightarrow{M}$ Adduct				8802			
$CNC^+ + CH_3CN \rightarrow C_2H_3^+ + C_2N_2$	1.00	4.10×10^{-9}	±20%	8012			
$CNC^+ + C_2N_2 \rightarrow$ No Reaction		$<1.00\times10^{-11}$		8301			
$CNC^+ + HC_3N \rightarrow C_3H^+ + C_2N_2$	1.00	3.30×10^{-9}	±20%	8518	8509		
$CNC^+ + CO \rightarrow$ No Reaction		$<1.00\times10^{-11}$		8301			
$CNC^+ + CO_2 \rightarrow$ No Reaction		$<1.00\times10^{-13}$		8802	8301		
$CNC^+ + N_2O \rightarrow$ Products	1.00	4.00×10^{-10}	±40%	8802			

Table of Reactions – Continued

Reactions	Prod. Dist.	Rate Const. (cm^3/s)		Ref.	Footnotes
$CCN^+ + H_2 \rightarrow HCNH^+ + H$	0.90	9.00×10^{-10}	±40%	8802	
$\rightarrow CH_2CN^+$	0.10				
$CCN^+ + CH_4 \rightarrow C_2H_3^+ + HCN$	0.60	7.00×10^{-10}	±40%	8802	
$\rightarrow HCNH^+ + C_2H_2$	0.10				
$\rightarrow CHCCNH^+ + H_2$	0.30				
$CCN^+ + C_2H_2 \rightarrow C_3H^+ + HCN$	0.92	1.60×10^{-9}	±40%	8802	
$\rightarrow HCNH^+ + C_3$	0.08				
$CCN^+ + NH_3 \rightarrow HCNH^+ + HCN$	1.00	1.90×10^{-9}	±40%	8802	
$CCN^+ + N_2 \rightarrow$ No Reaction		$<1.00\times10^{-13}$		8802	
$CCN^+ + H_2O \rightarrow HCNH^+ + CO$	0.08	1.63×10^{-9}	±40%	8802	
$\rightarrow HCO^+ + HCN$	0.92				
$CCN^+ + O_2 \rightarrow O_2^+ + C_2N$	<0.03	$\sim4.00\times10^{-10}$	±40%	8802	
$\rightarrow C_2NO^+ + O$	>0.97				
$CCN^+ + HCN \rightarrow$ Adduct	1.00	4.20×10^{-10}	±40%	8802	
$CCN^+ + CO_2 \rightarrow C_2NO^+ + CO$	1.00	1.10×10^{-9}	±40%	8802	
$CCN^+ + N_2O \rightarrow NO^+ + C_2N_2$	0.22	1.00×10^{-9}	±40%	8802	
$\rightarrow N_2O^+ + C_2N$	0.05				
$\rightarrow$ m/e = 54 + m = 28	0.73				
$CH_2CNH^+ + CO \rightarrow$ Adduct	0.40	2.10×10^{-13}	±30%	8804	
$\rightarrow CH_3CO^+ + CN$	0.60				
$CH_2CNH^+ + CO_2 \rightarrow$ No Reaction		$<1.50\times10^{-13}$		8804	
$CH_3CNH^+ + CH_3CN \rightarrow$ Adduct + $h\nu$	1.00	8.00×10^{-13}	±20%	9032	
$(CH_3)_2NH^+ + (CH_3)_2NH \rightarrow (CH_3)_2NH_2^+ + CH_3NH(CH_2)$	1.00	1.30×10^{-9}	±20%	9124	
$(CH_3)_2NH_2^+ + (CH_3)_2NH \xrightarrow{M}$ Adduct				8632	
$C_2N_2^+ + H_2 \rightarrow HC_2N_2^+ + H$	1.00	9.60×10^{-10}	±20%	8932	
$C_2N_2^+ + C_2H_2 \rightarrow C_2H_2^+ + C_2N_2$	1.00	5.80×10^{-10}	±20%	8932	
$C_2N_2^+ + C_2H_4 \rightarrow C_2H_4^+ + C_2N_2$	1.00	1.30×10^{-9}	±20%	8932	
$C_2N_2^+ + H_2O \rightarrow H_2O^+ + C_2N_2$	0.09	2.60×10^{-9}	±20%	8932	
$\rightarrow HC_2N_2^+ + OH$	0.91				
$C_2N_2^+ + HCN \rightarrow HNC^+ + C_2N_2$	0.20	2.70×10^{-9}	±25%	9039	
$\rightarrow HC_2N_2^+ + CN$	0.75				
$\rightarrow$ Adduct	0.05				
$C_2N_2^+ + C_2N_2 \xrightarrow{M} C_4N_4^+$	1.00			8507	8515
$C_2N_2^+ + HC_3N \rightarrow CHCCN^+ + C_2N_2$	1.00	1.60×10^{-9}	±30%	8509	
$C_2N_2^+ + CO \rightarrow$ Adduct	1.00	1.10×10^{-10}	±20%	8932	
$C_2N_2^+ + CO_2 \rightarrow C_2N_2O^+ + CO$	0.58	4.10×10^{-12}	±20%	8932	
$\rightarrow$ Adduct	0.42				

Table of Reactions – Continued

Reactions				Prod. Dist.	Rate Const. (cm^3/s)		Ref.			Footnotes
$HC_2N_2^+ + C_2H_4$	→	$C_2H_5^+$	$+ C_2N_2$	1.00	8.00×10^{-10}	±20%	8932	8702	8412	b
	$\xrightarrow{M}$	Adduct					8932			
$HC_2N_2^+ + H_2O$	→	H_3O^+	$+ C_2N_2$	1.00	5.10×10^{-10}	±30%	8412			
$HC_2N_2^+ + CH_3OH$	→	$CH_3OH_2^+$	$+ C_2N_2$	1.00	1.50×10^{-9}	±30%	8412			
$C_3N^+ + H_2$	→	$CHCCN^+$	$+ H$	0.90	9.10×10^{-10}	±20%	8518			
		$CHCCNH^+$		0.10						
$CHCCN^+ + H_2$	→	$C_2H_2^+$	$+ HCN$	0.37	4.45×10^{-12}	±80%	8616	8518		
		$CHCCNH^+$	$+ H$	0.63						
$CHCCN^+ + CH_4$	→	$C_3H_4^+$	$+ HCN$	0.10	5.90×10^{-10}	±30%	8616			
		CH_2CNH^+	$+ C_2H_2$	0.50						
		$CHCCNH^+$	$+ CH_3$	0.30						
$CHCCN^+ + C_2H_2$	→	$C_2H_2^+$	$+ HC_3N$	0.20	6.40×10^{-10}	±30%	8616			
		$C_4H_2^+$	$+ HCN$	0.80						
$CHCCN^+ + C_2H_4$	→	$C_2H_4^+$	$+ HC_3N$	0.80	6.70×10^{-10}	±30%	8616			
		$CHCCNH^+$	$+ C_2H_3$	0.20						
$CHCCN^+ + C_4H_2$	→	$C_4H_2^+$	$+ HC_3N$	1.00	8.90×10^{-10}	±30%	8616			
$CHCCN^+ + H_2O$	→	$CHCCNH^+$	$+ OH$	1.00	6.70×10^{-10}	±30%	8616			
$CHCCN^+ + O_2$	→	HCO^+	$+ C_2NO$	0.40	2.50×10^{-12}	±30%	8616			
		Adduct		0.60						
$CHCCN^+ + HCN$	→	Adduct		1.00	8.90×10^{-10}	±30%	8616			
$CHCCN^+ + HC_3N$	→	HC_5N^+	$+ HCN$	0.90	1.30×10^{-9}	±20%	9115			b
		$HC_6N_2^+$	$+ H$	0.05						
		$H_3C_6N_2^+$	$+ h\nu$	0.05						
	$\xrightarrow{M}$	Adduct					8616			
$CHCCN^+ + CO$	→	Adduct		1.00	3.40×10^{-11}	±30%	8616			
$CHCCN^+ + COS$	→	COS^+	$+ HC_3N$	0.80	7.20×10^{-10}	±30%	8616			
		HC_3SN^+	$+ CO$	0.20						
$CHCCNH^+ + H_2$	→	No Reaction			$<1.00\times10^{-13}$		8616			
$CHCCNH^+ + C_4H_2$	→	Adduct		1.00	8.70×10^{-10}	±30%	8616			
$CHCCNH^+ + CH_3CN$	→	CH_3CNH^+	$+ HC_3N$	1.00	3.60×10^{-9}	±30%	8412			
$CHCCNH^+ + CO$	→	No Reaction			$<1.00\times10^{-12}$		8616			
$CHCCNH^+ + CH_3OH$	→	$CH_3OH_2^+$	$+ HC_3N$	1.00	1.90×10^{-9}	±20%	8518			
$CHCCNH^+ + CH_3CHO$	→	$CH_3COH_2^+$	$+ HC_3N$	1.00	2.40×10^{-9}	±20%	8518			
$CHCCNH^+ + (CH_3)_2CO$	→	$(CH_3)_2COH^+$	$+ HC_3N$	1.00	1.30×10^{-9}	±30%	8412			

Table of Reactions – Continued

Reactions	Prod. Dist.	Rate Const. (cm^3/s)	Ref.	Footnotes
$CH_2CHCN^+ + H_2 \rightarrow CH_2CHCNH^+ + H$	1.00	1.20×10^{-12} ±30%	9117	
$CH_2CHCN^+ + CH_4 \rightarrow CH_2CNH^+ + C_2H_4$	0.70	2.60×10^{-11} ±30%	9117	
$CH_2CHCNH^+ + CH_3$	0.25			
$H_6C_4N^+ + H$	0.05			
$CH_2CHCN^+ + C_2H_2 \rightarrow C_3H_3^+ + CH_2CN$	0.08	9.30×10^{-10} ±30%	9117	
m/e = 52 + m = 27	0.55			
$H_2C_5N^+ + H_2 + H$	0.21			
$H_4C_5N^+ + H$	0.16			
$CH_2CHCN^+ + NH_3 \rightarrow NH_3^+ + CH_2CHCN$	0.66	1.90×10^{-9} ±30%	9117	
$NH_4^+ + H_2C_3N$	0.34			
$CH_2CHCN^+ + N_2 \rightarrow$ No Reaction		$<5.00\times10^{-13}$	9117	
$CH_2CHCN^+ + H_2O \rightarrow CH_3COH^+ + HCN$	0.68	2.10×10^{-10} ±30%	9117	
$C_3H_4NO^+ + H$	0.31			
Adduct	0.01			
$CH_2CHCN^+ + HCN \rightarrow HC_4N_2^+ + H_2 + H$	0.09	1.90×10^{-10} ±30%	9117	
$H_2C_4N_2^+ + H_2$	0.38			
$H_3C_4N_2^+ + H$	0.20			
Adduct	0.33			
$CH_2CHCN^+ + CH_2CHCN \rightarrow$ Adduct	1.00	2.00×10^{-9} ±30%	9117	
$CH_2CHCN^+ + CO \rightarrow CO^+ + CH_2CHCN$	1.00	7.00×10^{-12} ±30%	9117	
$(CH_3)_3N^+ + (CH_3)_3N \rightarrow (CH_3)_3NH^+ + (CH_3)_2NCH_2$	1.00	1.10×10^{-9} ±20%	9124	
$C_4N^+ + H_2 \rightarrow C_3H^+ + HCN$	1.00	2.20×10^{-11} ±30%	8727	
$C_4N^+ + CH_4 \rightarrow H_3^+ + HC_5N$	0.05	6.35×10^{-10} ±20%	8922	8727
$C_2H_3^+ + HC_3N$	0.22			
$C_4H_2^+ + H_2CN$	0.01			
$C_4H_3^+ + HCN$	0.32			
$HCNH^+ + C_4H_2$	0.08			
$CHCCNH^+ + C_2H_2$	0.26			
$H_2C_5N^+ + H_2$	0.06			
$C_4N^+ + C_2H_2 \rightarrow C_5H^+ + HCN$	>0.70	8.00×10^{-10} ±30%	8727	
Adduct	<0.30			
$C_4N^+ + C_4H_2 \rightarrow C_7H^+ + HCN$	0.40	1.60×10^{-9} ±30%	8727	
Adduct	0.60			
$C_4N^+ + ND_3 \rightarrow ND_3^+ + C_4N$	0.65	1.20×10^{-9} ±30%	8727	
$DCND^+ + DC_3N$	0.15			
$CDCCND^+ + DCN$	0.20			
$C_4N^+ + H_2O \rightarrow HCO^+ + HC_3N$	0.40	1.50×10^{-9} ±30%	8727	
$CHCCNH^+ + CO$	0.50			
Adduct	0.10			
$C_4N^+ + H_2S \rightarrow HCS^+ + HC_3N$	0.60	8.90×10^{-10} ±30%	8727	
$CHCCS^+ + HCN$	0.10			
$C_2SN^+ + C_2H_2$	0.25			
Adduct	0.15			
$C_4N^+ + HCN \rightarrow HC_5N_2^+ + h\nu$	1.00	3.80×10^{-10} ±30%	8924	b
$\xrightarrow{M}$ Adduct			8727	

Table of Reactions – Continued

Reactions	Prod. Dist.	Rate Const. (cm^3/s)		Ref.			Footnotes
$C_4N^+ + CH_3CN \rightarrow C_2H_3^+ + C_4N_2$	0.60	3.10×10^{-9}	±30%	8727			
$HC_4N_2^+ + C_2H_2$	0.40						
$C_4N^+ + HC_3N \rightarrow$ Adduct	1.00	1.00×10^{-9}	±30%	8727			
$C_4N^+ + CO \rightarrow$ Adduct	1.00	9.60×10^{-11}	±30%	8727			
$C_5N^+ + CH_4 \rightarrow CH_3^+ + HC_5N$	0.23	7.50×10^{-10}	±30%	8922			
$C_2H_3^+ + HC_4N$	0.07						
$C_3H_3^+ + HC_3N$	0.07						
$C_5H_3^+ + HCN$	0.05						
$HCNH^+ + C_5H_2$	0.08						
$H_2C_4N^+ + C_2H_2$	0.09						
$HC_5N^+ + CH_3$	0.37						
$H_2C_6N^+ + H_2$	0.04						
$C_5N^+ + HCN \rightarrow HC_5N^+ + CN$	0.27	9.40×10^{-10}	±30%	8924			
$C_6N_2^+ + H$	0.57						
$HC_6N_2^+ + h\nu$	0.16						
$HC_5N^+ + HCN \rightarrow$ No Reaction		$<3.20\times10^{-13}$		8924			
$HC_5N^+ + HC_3N \rightarrow H_2C_8N_2^+ + h\nu$	1.00	5.00×10^{-10}	±20%	9115			
$C_6N^+ + HCN \rightarrow HC_7N_2^+ + h\nu$	1.00	3.80×10^{-10}	±30%	8924			
$HC_6N_2^+ + HC_3N \rightarrow CHCCNH^+ + C_6N_2$	1.00			9115			
$H_2C_6N_2^+ + H_2 \rightarrow$ No Reaction		$<1.00\times10^{-13}$		8616			
$H_2C_6N_2^+ + CO \rightarrow$ No Reaction		$<1.00\times10^{-12}$		8616			
$CO^+ + H \rightarrow H^+ + CO$	1.00	7.50×10^{-10}	±30%	8403			
$CO^+ + D \rightarrow D^+ + CO$	1.00	9.00×10^{-11}	±20%	7901			
$CO^+ + H_2 \rightarrow HCO^+ + H$	0.52	1.40×10^{-9}	±15%	8711	8403	7805	b
$HOC^+ + H$	0.48			7506	7423	7209	
				7207	6702		
$CO^+ + D_2 \rightarrow DCO^+ + D$	1.00	9.60×10^{-10}	±10%	7901			
$CO^+ + CH_4 \rightarrow CH_4^+ + CO$	0.67	1.34×10^{-9}	±10%	8001	7805	7209	
$HCO^+ + CH_3$	0.28						
$CH_3CO^+ + H$	0.05						
$CO^+ + C_2H_2 \rightarrow C_2H_2^+ + CO$	1.00	4.10×10^{-10}		7209			
$CO^+ + N \rightarrow$ No Reaction		$<2.00\times10^{-11}$		7201			
$CO^+ + NH_3 \rightarrow NH_3^+ + CO$	1.00	1.85×10^{-9}	±15%	8318	8001	7805	
				7711			
$CO^+ + N_2 \xrightarrow{M}$ Adduct				8632			
$CO^+ + O \rightarrow O^+ + CO$	1.00	1.40×10^{-10}	±50%	7201			
$CO^+ + H_2O \rightarrow H_2O^+ + CO$	0.65	2.40×10^{-9}	±10%	8001	7805	7802	b
$HCO^+ + OH$	0.35			7202			

Table of Reactions – Continued

Reactions	Prod. Dist.	Rate Const. (cm^3/s)		Ref.			Footnotes
$CO^+ + O_2 \rightarrow O_2^+ + CO$	1.00	1.50×10^{-10}	±30%	8409 7010	7805 6602	7209	a
$CO^+ + H_2S \rightarrow H_2S^+ + CO$	0.94	2.10×10^{-9}	±20%	8401	7507		b
$\rightarrow HCO^+ + SH$	0.06						
$CO^+ + Kr \rightarrow Kr^+ + CO$	1.00	2.20×10^{-9}	±20%	7318			T=373
$CO^+ + HCN \rightarrow HCO^+ + CN$	<0.10	3.40×10^{-9}	±10%	8101			
$\rightarrow HCN^+ + CO$	>0.90						
$CO^+ + CH_3CN \rightarrow CH_2CN^+ + H + CO$	0.25	3.00×10^{-9}	±30%	8804			
$\rightarrow CH_2CNH^+ + CO$	0.75						
$CO^+ + HC_3N \rightarrow CHCCN^+ + CO$	1.00	3.10×10^{-9}	±25%	8518	8509	7911	
$*CO^+ + CO \rightarrow CO^+ + *CO$	1.00	6.30×10^{-10}	±50%	7611	7318		
$\xrightarrow{M}$ Adduct				8632			
$CO^+ + H_2CO \rightarrow HCO^+ + HCO$	0.55	3.00×10^{-9}	±20%	7805			
$\rightarrow H_2CO^+ + CO$	0.45						
$CO^+ + CH_3OH \rightarrow CH_2OH^+ + HCO$	1.00	2.40×10^{-9}	±20%	7805			
$CO^+ + CO_2 \rightarrow CO_2^+ + CO$	1.00	1.10×10^{-9}	±10%	8001 7209	7805 6602	7602	
$CO^+ + CHOOH \rightarrow HCO^+ + HCO_2$	1.00	4.10×10^{-9}	±30%	7821			
$CO^+ + NO \rightarrow NO^+ + CO$	1.00	4.20×10^{-10}	±30%	7209	7201		
$CO^+ + N_2O \rightarrow$ Products	1.00	1.15×10^{-9}		7209			
$CO^+ + SO_2 \rightarrow SO^+ + CO_2$	>0.90	2.40×10^{-9}	±40%	7507	7209		
$\rightarrow SO_2^+ + CO$	>0.10						
$CO^+ + COS \rightarrow S^+ + CO + CO$	0.10	1.41×10^{-9}	±20%	7805	7209		
$\rightarrow COS^+ + CO$	0.90						
$HCO^+ + D \rightarrow DCO^+ + H$	1.00	4.25×10^{-11}	±20%	8522	8503		a
$HCO^+ + H_2 \rightarrow$ No Reaction		$<2.00\times10^{-14}$		8505 7711	8307	7805	a
$\xrightarrow{M}$ Adduct				8632			
$HCO^+ + D_2 \rightarrow DCO^+ + HD$	1.00	1.80×10^{-11}	±50%	7701			
$HCO^+ + CH_4 \rightarrow$ No Reaction		$<1.00\times10^{-13}$		7805	7104		
$HCO^+ + C_2H_2 \rightarrow C_2H_3^+ + CO$	1.00	1.36×10^{-9}	±25%	7713			
$HCO^+ + C_2H_6 \rightarrow C_2H_7^+ + CO$	1.00	1.20×10^{-10}	±20%	8117			
$HCO^+ + NH_3 \rightarrow NH_4^+ + CO$	1.00	2.25×10^{-9}	±15%	7805 7516	7711 7415	7701	
$HCO^+ + N_2 \rightarrow$ No Reaction		$<4.00\times10^{-14}$		7805			
$HCO^+ + H_2O \rightarrow H_3O^+ + CO$	1.00	2.60×10^{-9}	±30%	8208 7510	7805	7802	
$HCO^+ + O_2 \rightarrow$ No Reaction		$<2.00\times10^{-13}$		8505	7805		
$HCO^+ + H_2S \rightarrow H_3S^+ + CO$	1.00	1.60×10^{-9}	±30%	7507			

Table of Reactions – Continued

Reactions	Prod. Dist.	Rate Const. (cm^3/s)		Ref.			Footnotes
$HCO^+ + HCl \rightarrow H_2Cl^+ + CO$	1.00	4.00×10^{-12}	±20%	8511	8502		ab
$HCO^+ + Ar \rightarrow$ No Reaction		$<1.00\times10^{-11}$		8505			
$HCO^+ + HCN \rightarrow HCNH^+ + CO$	1.00	3.50×10^{-9}	±15%	8512 7605	7819	7704	a
$HCO^+ + CH_3CN \rightarrow CH_3CNH^+ + CO$	1.00	4.10×10^{-9}	±25%	7605			
$HCO^+ + HC_3N \rightarrow CHCCNH^+ + CO$	1.00	3.80×10^{-9}	±20%	8518	8412	7911	
$^*HCO^+ + CO \rightarrow HCO^+ + {}^*CO$	1.00	2.60×10^{-10}	±20%	8005			a
$HCO^+ + CO \xrightarrow{M}$ No Reaction		$<4.00\times10^{-14}$		7805			
$\xrightarrow{M}$ Adduct				8632			
$HCO^+ + H_2CO \rightarrow CH_2OH^+ + CO$	1.00	3.30×10^{-9}	±15%	7906	7902	7805	
$HCO^+ + CH_3OH \rightarrow CH_3OH_2^+ + CO$	1.00	2.60×10^{-9}	±15%	7902	7805		
$HCO^+ + CO_2 \rightarrow$ No Reaction		$<2.00\times10^{-13}$		7805			
$HCO^+ + CHOOH \rightarrow CH(OH)_2^+ + CO$	1.00	1.80×10^{-9}	±15%	7902	7820	7818	
$HCO^+ + CH_2CO \rightarrow CH_3CO^+ + CO$	1.00	1.80×10^{-9}	±15%	7902			
$HCO^+ + CH_3CHO \rightarrow C_2H_5O^+ + CO$	1.00	3.30×10^{-9}	±15%	8617	7902		
$HCO^+ + C_2H_5OH \rightarrow H_3O^+ + C_2H_4 + CO$	0.45	2.20×10^{-9}	±15%	7902			
$C_2H_5OH_2^+ + CO$	0.55						
$HCO^+ + (CH_3)_2O \rightarrow (CH_3)_2OH^+ + CO$	1.00	2.10×10^{-9}	±15%	7902			
$HCO^+ + CH_3COOH \rightarrow CH_3CO^+ + H_2O + CO$	0.20	2.50×10^{-9}	±30%	7818			
$CH_3C(OH)_2^+ + CO$	0.80						
$HCO^+ + CS_2 \rightarrow HCS_2^+ + CO$	1.00	2.00×10^{-9}	±20%	8204			
$HCO^+ + N_2O \rightarrow HN_2O^+ + CO$	1.00	3.30×10^{-12}	±15%	8710	7512	7313	
$HCO^+ + COS \rightarrow HCOS^+ + CO$	1.00	1.10×10^{-9}	±20%	7805			
$DCO^+ + H \rightarrow HCO^+ + D$	1.00	1.50×10^{-11}	±30%	8521	8503		a
$HOC^+ + H_2 \rightarrow H_3^+ + CO$	0.57	4.70×10^{-10}	±20%	8711	8505		b
$HCO^+ + H_2$	0.43						
$HOC^+ + CH_4 \rightarrow CH_5^+ + CO$	1.00	1.10×10^{-9}	±20%	8711			
$HOC^+ + N_2 \rightarrow N_2H^+ + CO$	1.00	6.70×10^{-10}	±20%	8505			
$HOC^+ + O_2 \rightarrow HO_2^+ + CO$	1.00	1.90×10^{-10}	±20%	8711			
$HOC^+ + Ar \rightarrow$ No Reaction		$<1.00\times10^{-12}$		8711			
$HOC^+ + Kr \rightarrow KrH^+ + CO$	1.00	4.00×10^{-10}	±20%	8711			
$HOC^+ + Xe \rightarrow XeH^+ + CO$	1.00	$\sim1.00\times10^{-9}$	±40%	8711			
$HOC^+ + CO \rightarrow HCO^+ + CO$	1.00	6.00×10^{-10}	±20%	8711			
$HOC^+ + CO_2 \rightarrow HCO_2^+ + CO$	1.00	9.45×10^{-10}	±20%	8711	8505		

Table of Reactions – Continued

Reactions				Prod. Dist.	Rate Const. (cm^3/s)		Ref.			Footnotes
HOC^+ + NO	→	HNO^+	+ CO	1.00	7.10×10^{-10}	±20%	8711			
HOC^+ + N_2O	→	HN_2O^+	+ CO	1.00	1.17×10^{-9}	±20%	*8710*	*8505*		
DOC^+ + H_2	→	H_2D^+	+ CO	0.57	6.20×10^{-10}	±20%	8711			
		HCO^+	+ HD	0.43						
H_2CO^+ + H_2	→	No Reaction			$<4.00\times10^{-14}$		7805	7711		
H_2CO^+ + D_2	→	No Reaction			$<5.00\times10^{-12}$		7701			
H_2CO^+ + CH_4	→	CH_2OH^+	+ CH_3	0.85	1.10×10^{-10}	±20%	7805			
		$C_2H_5O^+$	+ H	0.15						
H_2CO^+ + NH_3	→	NH_3^+	+ H_2CO	0.37	2.00×10^{-9}	±15%	7805	7711	7701	
		NH_4^+	+ HCO	0.63						
H_2CO^+ + N_2	→	No Reaction			$<4.00\times10^{-14}$		7805			
H_2CO^+ + H_2O	→	H_3O^+	+ HCO	1.00	2.10×10^{-9}	±20%	7805	7802		
H_2CO^+ + O_2	→	$H_2O_2^+$	+ CO	0.30	1.10×10^{-10}	±20%	7805			
		HCO^+	+ HO_2	0.70						
H_2CO^+ + HCN	→	$HCNH^+$	+ HCO	1.00	1.40×10^{-9}	±10%	7701			
H_2CO^+ + CO	→	No Reaction			$<4.00\times10^{-14}$		7805			
H_2CO^+ + H_2CO	→	CH_2OH^+	+ HCO	1.00	3.20×10^{-9}	±30%	7805			
H_2CO^+ + CH_3OH	→	CH_2OH^+	+ CH_3O	0.10	2.40×10^{-9}	±30%	7805			
		$CH_3OH_2^+$	+ HCO	0.90						
H_2CO^+ + CO_2	→	No Reaction			$<4.00\times10^{-14}$		7805			
H_2CO^+ + COS	→	H_2S^+	+ CO + CO	0.56	1.00×10^{-9}	±20%	7805			
		$HCOS^+$	+ HCO	0.41						
		H_2COS^+	+ CO	0.03						
CH_2OH^+ + H_2	→	No Reaction			$<2.00\times10^{-14}$		7805	7711		
CH_2OH^+ + CH_4	→	No Reaction			$<4.00\times10^{-14}$		7805			
CH_2OH^+ + C_4H_2	→	$C_4H_3^+$	+ H_2CO	1.00	9.30×10^{-10}	±20%	8702			
CH_2OH^+ + NH_3	→	NH_4^+	+ H_2CO	1.00	2.05×10^{-9}	±15%	7906 7701	7805	7711	
CH_2OH^+ + N_2	→	No Reaction			$<4.00\times10^{-14}$		7805			
CH_2OH^+ + H_2O	→	H_3O^+	+ H_2CO	1.00	2.30×10^{-10}	±10%	7805	7802		b
CH_2OH^+ + O_2	→	No Reaction			$<4.00\times10^{-14}$		7805			
CH_2OH^+ + H_2S	→	H_3S^+	+ H_2CO	1.00	4.00×10^{-10}	±40%	7814	7809	7701	b
CH_2OH^+ + HCN	→	$HCNH^+$	+ H_2CO	1.00	1.30×10^{-9}	±30%	7814	7809		b
CH_2OH^+ + CO	→	No Reaction			$<4.00\times10^{-14}$		7711			
CH_2OH^+ + H_2CO	$\xrightarrow{M}$	Adduct					8632			

Table of Reactions – Continued

Reactions	Prod. Dist.	Rate Const. (cm^3/s)		Ref.			Footnotes
$CH_2OH^+ + CH_3OH \rightarrow CH_3OH_2^+ + H_2CO$	1.00	1.90×10^{-9}	±30%	7805			
$CH_2OH^+ + CO_2 \rightarrow$ No Reaction		$<4.00\times10^{-14}$		7805			
$CH_2OH^+ + CHOOH \rightarrow CH(OH)_2^+ + H_2CO$	1.00	2.00×10^{-9}	±30%	7820			
$CH_2OH^+ + COS \rightarrow$ No Reaction		$<4.00\times10^{-13}$		7805			
$CH_3OH_2^+ + C_4H_2 \xrightarrow{M}$ No Reaction Adduct		$<2.00\times10^{-11}$		8702 9118			b
$CH_3OH_2^+ + CH_3OH \xrightarrow{M} (CH_3)_2OH^+ + H_2O$ Adduct	1.00	7.60×10^{-11}	±30%	9119 8632			a
$CH_3CHO^+ + CH_3CHO \rightarrow C_2H_5O^+ + CH_3CO$	1.00	3.00×10^{-9}	±30%	8617			
$CH_3CHOH^+ + CH_3CHO \xrightarrow{M}$ Adduct				8632			
$(CH_3)_2OH^+ + (CH_3)_2O \rightarrow$ Adduct $+ h\nu$	1.00	2.00×10^{-12}	±20%	9032			
$(CH_3)_2COH^+ + (CH_3)_2CO \xrightarrow{M}$ Adduct $+ h\nu$ Adduct	1.00	9.20×10^{-12}	±20%	9032 8632	8806		
$CO_2^+ + H \rightarrow H^+ + CO_2$ $HCO^+ + O$	~0.17 ~0.83	3.25×10^{-10}	±60%	8417 7101	8308	7901	b
$CO_2^+ + D \rightarrow D^+ + CO_2$ $DCO^+ + O$	<0.24 >0.76	8.40×10^{-11}	±25%	7901			
$CO_2^+ + H_2 \rightarrow HCO_2^+ + H$	1.00	6.20×10^{-10}	±35%	8401 7901 7211	8308 7608 7207	8203 7423 6702	b
$CO_2^+ + D_2 \rightarrow DCO_2^+ + D$	1.00	5.00×10^{-10}	±20%	7912	7901		
$CO_2^+ + CH_4 \rightarrow CH_4^+ + CO_2$ $HCO_2^+ + CH_3$	0.25 0.27	1.05×10^{-9}	±10%	8314 7424	8203	8001	
$CO_2^+ + N \rightarrow$ No Reaction		$<1.00\times10^{-11}$		7004			
$CO_2^+ + NH_3 \rightarrow NH_3^+ + CO_2$	1.00	1.90×10^{-9}	±10%	8318	8203	8001	
$CO_2^+ + O \rightarrow O^+ + CO_2$ $O_2^+ + CO$	~0.37 ~0.63	2.60×10^{-10}	±50%	7004			
$CO_2^+ + H_2O \rightarrow H_2O^+ + CO_2$ $HCO_2^+ + OH$	0.75 0.25	2.40×10^{-9}	±15%	8001	7802	7716	
$CO_2^+ + O_2 \rightarrow O_2^+ + CO_2$	1.00	5.50×10^{-11}	±15%	8506 8203 7417	8409 7912 7004	8314 7512 6804	ab
$CO_2^+ + H_2S \rightarrow H_2S^+ + CO_2$	1.00	1.55×10^{-9}	±20%	8401	8203		b
$CO_2^+ + Xe \rightarrow Xe^+ + CO_2$	1.00	6.00×10^{-10}	±30%	8314			
$CO_2^+ + HCN \rightarrow HCN^+ + CO_2$ $HCO_2^+ + CN$	~0.90 ~0.10	9.00×10^{-10}	±10%	8101			
$CO_2^+ + CH_3CN \rightarrow CH_2CNH^+ + CO_2$	1.00	2.50×10^{-9}	±30%	8804			
$^*CO_2^+ + CO_2 \xrightarrow{M} CO_2^+ + {}^*CO_2$ Adduct	1.00	3.70×10^{-10}	±10%	7611 8632			

Table of Reactions – Continued

Reactions	Prod. Dist.	Rate Const. (cm^3/s)		Ref.			Footnotes
$CO_2^+ + NO \rightarrow NO^+ + CO_2$	1.00	1.23×10^{-10}	±20%	8314 7004	8203	8123	
$CO_2^+ + SO_2 \rightarrow SO_2^+ + CO_2$	1.00	1.50×10^{-9}	±20%	8203			
$CO_2^+ + COS \rightarrow COS^+ + CO_2$	1.00	9.60×10^{-10}	±20%	8203			
$HCO_2^+ + CH_4 \rightarrow CH_5^+ + CO_2$	1.00	7.20×10^{-10}	±15%	8006 7310	7424	7313	
$HCO_2^+ + C_2H_2 \rightarrow C_2H_3^+ + CO_2$	1.00	1.37×10^{-9}	±25%	7713			
$HCO_2^+ + N_2 \rightarrow N_2H^+ + CO_2$	1.00	$<2.00\times10^{-15}$		7607			
$HCO_2^+ + H_2O \rightarrow H_3O^+ + CO_2$	1.00	2.65×10^{-9}	±20%	8208	7510		
$HCO_2^+ + CH_3CN \rightarrow CH_3CNH^+ + CO_2$	1.00	4.10×10^{-9}	±25%	7605			
$HCO_2^+ + NO \rightarrow HNO^+ + CO_2$	1.00	$<1.00\times10^{-10}$		7104			
$CH(OH)_2^+ + C_2H_4 \rightarrow C_2H_5^+ + CHOOH$; $C_2H_5O^+ + H_2CO$		6.20×10^{-10}	±25%	8612			
$CH(OH)_2^+ + C_2H_6 \rightarrow$ No Reaction		$<1.00\times10^{-12}$		8612			
$CH(OH)_2^+ + C_4H_2 \rightarrow C_4H_3^+ + CHOOH$	1.00	6.20×10^{-10}	±20%	9118	8702		b
$\xrightarrow{M}$ Adduct				9118			
$CH(OH)_2^+ + NH_3 \rightarrow NH_4^+ + CHOOH$; $NH_3OH^+ + H_2CO$		1.20×10^{-9}	±25%	8612			
$CH(OH)_2^+ + ND_3 \rightarrow NHD_3^+ + CHOOH$; $ND_3OH^+ + H_2CO$		1.40×10^{-9}	±25%	8612			
$^*CH(OH)_2^+ + H_2O \rightarrow H_3O^+ + CHOOH$	1.00	2.10×10^{-11}	±25%	8612			
$CH(OH)_2^+ + D_2O \rightarrow HD_2O^+ + CHOOH$	1.00	2.60×10^{-11}	±25%	8612			
$CH(OH)_2^+ + H_2S \rightarrow H_3S^+ + CHOOH$; $CH_2OH^+ + H_2SO$; $HSO^+ + CH_3OH$; $H_3SO^+ + H_2CO$		7.40×10^{-10}	±25%	8612			
$CH(OH)_2^+ + CO_2 \rightarrow$ No Reaction		$<1.00\times10^{-12}$		8612			
$CH(OH)_2^+ + COS \rightarrow H_3SO^+ + CO + CO$; $HCO_2S^+ + H_2CO$		8.60×10^{-10}	±25%	8612			
$CS^+ + H_2 \rightarrow HCS^+ + H$	1.00	4.30×10^{-10}	±15%	8401	8303	7414	b
$CS^+ + CH_4 \rightarrow HCS^+ + CH_3$	1.00	7.30×10^{-10}	±45%	8303	7414		
$CS^+ + O_2 \rightarrow COS^+ + O$	1.00	1.02×10^{-10}	±20%	8401	8303		b
$HCS^+ + H_2 \rightarrow$ No Reaction		$<5.00\times10^{-13}$		8517	8401	8303	
$HCS^+ + CH_4 \rightarrow$ No Reaction		$<1.00\times10^{-12}$		8525	8517		
$HCS^+ + NH_3 \rightarrow NH_4^+ + CS$	1.00	2.00×10^{-9}	±20%	8525	8517		
$HCS^+ + N_2 \rightarrow$ No Reaction		$<1.00\times10^{-12}$		8525	8517		

Table of Reactions – Continued

Reactions				Prod. Dist.	Rate Const. (cm^3/s)		Ref.		Footnotes
$HCS^+ + H_2O \rightarrow$	No Reaction				$<1.00\times10^{-12}$		8525	8517	
$HCS^+ + O_2 \rightarrow$	No Reaction				$<1.00\times10^{-12}$		8525	8517	
$HCS^+ + H_2S \rightarrow$	No Reaction				$<1.00\times10^{-12}$		8525	8517	
$HCS^+ + HCN \rightarrow$	No Reaction				$<1.00\times10^{-12}$		8525	8517	
$HCS^+ + CO \rightarrow$	No Reaction				$<1.00\times10^{-12}$		8525	8517	
$HCS^+ + H_2CO \rightarrow$	No Reaction				$<1.00\times10^{-12}$		8525	8517	
$HCS^+ + CO_2 \rightarrow$	No Reaction				$<1.00\times10^{-12}$		8525	8517	
$HCS^+ + C_2H_5OH \rightarrow$	$C_2H_5OH_2^+$	+ CS		1.00	8.20×10^{-10}	±20%	8525		
$HCS^+ + (CH_3)_2CO \rightarrow$	$(CH_3)_2COH^+$	+ CS		1.00	2.40×10^{-9}	±20%	8525		
$HCS^+ + CH_3SH \rightarrow$	$CH_3SH_2^+$	+ CS		1.00	4.50×10^{-10}	±20%	8525	8517	
$CS_2^+ + Xe \rightarrow$	No Reaction				$<5.00\times10^{-14}$		9105		
$CS_2^+ + CS_2 \xrightarrow{M}$	Adduct						8632		
$HCS_2^+ + C_2H_4 \rightarrow$	$C_2H_5^+$	+ CS_2		1.00	4.50×10^{-11}	±10%	8807		[a]
$HCS_2^+ + H_2O \rightarrow$	H_3O^+	+ CS_2		1.00	2.05×10^{-9}	±70%	8807	8208	[a]
$CCl^+ + H_2 \rightarrow$	No Reaction				$<1.00\times10^{-12}$		8511	8502	
$CCl^+ + CH_4 \rightarrow$	No Reaction				$<1.00\times10^{-12}$		8511	8502	
$CCl^+ + NH_3 \rightarrow$	$HCNH^+$	+ HCl		0.99	1.30×10^{-9}	±20%	8623	8511	8502
	$CHNH_2^+$	+ Cl		0.01					
$CCl^+ + N_2 \rightarrow$	No Reaction				$<1.00\times10^{-12}$		8511	8502	
$CCl^+ + H_2O \rightarrow$	No Reaction				$<3.00\times10^{-11}$		8511		
$CCl^+ + O_2 \rightarrow$	No Reaction				$<1.00\times10^{-12}$		8511	8502	
$CCl^+ + HCN \rightarrow$	No Reaction				$<1.00\times10^{-12}$		8511	8502	
$CCl^+ + CO \rightarrow$	No Reaction				$<1.00\times10^{-12}$		8511	8502	
$CCl^+ + H_2CO \rightarrow$	CH_2Cl^+	+ CO		1.00	5.30×10^{-10}	±20%	8623	8511	
$CCl^+ + CO_2 \rightarrow$	No Reaction				$<1.00\times10^{-12}$		8511	8502	
$HCCl^+ + H_2 \rightarrow$	CH_2Cl^+	+ H		1.00	6.00×10^{-12}	±20%	8502		
$HCCl^+ + CH_4 \rightarrow$	No Reaction				$<1.00\times10^{-12}$		8502		
$HCCl^+ + NH_3 \rightarrow$	NH_4^+	+ CCl		1.00	$\sim2.50\times10^{-9}$	±50%	8502		
$HCCl^+ + N_2 \rightarrow$	No Reaction				$<1.00\times10^{-12}$		8502		
$HCCl^+ + O_2 \rightarrow$	No Reaction				$<1.00\times10^{-12}$		8502		
$HCCl^+ + HCN \rightarrow$	No Reaction				$<1.00\times10^{-12}$		8502		

Table of Reactions — Continued

Reactions	Prod. Dist.	Rate Const. (cm^3/s)		Ref.	Footnotes
$HCCl^+ + CO \rightarrow$ No Reaction		$<1.00\times10^{-12}$		8502	
$HCCl^+ + CO_2 \rightarrow$ No Reaction		$<1.00\times10^{-12}$		8502	
$CH_2Cl^+ + H_2 \rightarrow$ No Reaction		$<1.00\times10^{-12}$		8511	8502
$CH_2Cl^+ + CH_4 \rightarrow$ No Reaction		$<1.00\times10^{-12}$		8502	
$CH_2Cl^+ + NH_3 \rightarrow NH_4^+ + HCCl$	0.50	$\sim1.50\times10^{-9}$	±50%	8502	
$CH_3NH_3^+ + HCl$	0.50				
$CH_2Cl^+ + N_2 \rightarrow$ No Reaction		$<1.00\times10^{-12}$		8502	
$CH_2Cl^+ + H_2O \rightarrow CH_2OH^+ + HCl$	1.00	1.20×10^{-10}	±10%	7802	
$CH_2Cl^+ + O_2 \rightarrow$ No Reaction		$<1.00\times10^{-12}$		8502	
$CH_2Cl^+ + HCN \rightarrow$ No Reaction		$<1.00\times10^{-12}$		8502	
$CH_2Cl^+ + CO \rightarrow$ No Reaction		$<1.00\times10^{-12}$		8511	8502
$CH_2Cl^+ + CO_2 \rightarrow$ No Reaction		$<1.00\times10^{-12}$		8502	
$NO^+ + H_2 \rightarrow$ No Reaction		$<1.00\times10^{-13}$		8010	7701
$NO^+ + CH_4 \rightarrow$ No Reaction		$<1.00\times10^{-11}$		8018	
$\xrightarrow{M}$ Adduct				8632	
$NO^+ + i\text{-}C_4H_8 \rightarrow i\text{-}C_4H_8^+ + NO$	1.00	1.27×10^{-9}	±20%	9040	
$NO^+ + c\text{-}C_6H_6 \rightarrow c\text{-}C_6H_6^+ + NO$	1.00	1.43×10^{-9}	±20%	9040	
$NO^+ + NH_3 \xrightarrow{M}$ Adduct				8632	
$NO^+ + N_2 \xrightarrow{M}$ Adduct				8632	
$NO^+ + H_2O \xrightarrow{M}$ Adduct				8632	
$NO^+ + O_2 \rightarrow$ No Reaction		$<1.00\times10^{-11}$		8018	
$\xrightarrow{M}$ Adduct				8632	
$NO^+ + O_3 \rightarrow$ No Reaction		$<1.00\times10^{-14}$		7303	
$\xrightarrow{M}$ Adduct				8632	
$NO^+ + Na \rightarrow Na^+ + NO$	1.00	7.70×10^{-11}	±30%	6901	
$NO^+ + H_2S \xrightarrow{M}$ Adduct				8632	
$NO^+ + Kr \xrightarrow{M}$ Adduct				8632	
$NO^+ + CH_3NH_2 \rightarrow CH_3NH_2^+ + NO$	1.00	8.20×10^{-10}	±20%	8010	
$NO^+ + CO \xrightarrow{M}$ Adduct				8632	
$NO^+ + H_2CO \xrightarrow{M}$ Adduct				8632	
$NO^+ + CH_3OH \xrightarrow{M}$ Adduct				8632	
$NO^+ + CO_2 \rightarrow$ No Reaction		$<1.00\times10^{-11}$		8018	
$\xrightarrow{M}$ Adduct				8632	
$NO^+ + CH_3CHO \rightarrow CH_3CO^+ + HNO$	1.00	3.50×10^{-10}	±20%	9040	

Table of Reactions – Continued

Reactions					Prod. Dist.	Rate Const. (cm^3/s)		Ref.		Footnotes
NO^+	+ NO	$\xrightarrow{M}$	Adduct					8632		
NO^+	+ NO_2	→	No Reaction			$<3.00\times10^{-12}$		8018		
NO^+	+ N_2O	→	No Reaction			$<1.00\times10^{-11}$		8018		
		$\xrightarrow{M}$	Adduct					8632		
NO^+	+ COS	$\xrightarrow{M}$	Adduct					8632		
HNO^+	+ CH_4	→	CH_5^+	+ NO	1.00	$>1.00\times10^{-10}$		7104		
HNO^+	+ N_2	→	N_2H^+	+ NO	1.00	$<1.00\times10^{-10}$		7104		
HNO^+	+ H_2O	→	H_3O^+	+ NO	1.00	2.30×10^{-9}	±25%	8208		
HNO^+	+ CO	→	HCO^+	+ NO	1.00	$>1.00\times10^{-10}$		7104		
HNO^+	+ CO_2	→	HCO_2^+	+ NO	1.00	$>1.00\times10^{-10}$		7104		
HNO^+	+ NO	→	NO^+	+ HNO	1.00	7.00×10^{-10}	±30%	7005		
NO_2^+	+ N	→	No Reaction			$<8.00\times10^{-12}$		7717		
NO_2^+	+ O	→	No Reaction			$<8.00\times10^{-12}$		7717		
NO_2^+	+ H_2O	$\xrightarrow{M}$	Adduct					8632		
NO_2^+	+ NO	→	NO^+	+ NO_2	1.00	2.75×10^{-10}	±30%	8314	6904	
N_2O^+	+ H_2	→	N_2H^+	+ OH	0.29	3.60×10^{-10}	±40%	7423	7210	6702
			HN_2O^+	+ H	0.71					
N_2O^+	+ CH_4	→	HNO^+	+ HCN + H_2	0.03	1.00×10^{-9}	±10%	7424	7210	
			HN_2O^+	+ CH_3	0.97					
N_2O^+	+ N_2	→	No Reaction			$<1.00\times10^{-12}$		8402		
N_2O^+	+ O_2	→	O_2^+	+ N_2O	0.83	2.70×10^{-10}	±20%	8402		
			NO^+	+ NO_2	0.17					
N_2O^+	+ CO	→	CO_2^+	+ N_2	0.37	3.00×10^{-10}	±20%	8402		
			NO^+	+ NCO	0.63					
N_2O^+	+ CO_2	$\xrightarrow{M}$	Adduct					8632		
N_2O^+	+ NO	→	NO^+	+ N_2O	1.00	2.30×10^{-10}	±40%	8402	8314	
N_2O^+	+ NO_2	→	NO^+	+ N_2 + O_2	0.66	6.50×10^{-10}	±50%	8402		
			NO_2^+	+ N_2O	0.34					
N_2O^+	+ N_2O	→	NO^+	+ N_2 + NO	1.00	$\sim1.20\times10^{-11}$		8402		
		$\xrightarrow{M}$	Adduct					8632		
HN_2O^+	+ C_2H_2	→	$C_2H_3^+$	+ N_2O	1.00	1.21×10^{-9}	±25%	7713		
HN_2O^+	+ C_2H_6	→	$C_2H_5^+$	+ N_2O + H_2	0.05	1.08×10^{-9}	±20%	8117	7415	
			$C_2H_7^+$	+ N_2O	0.95					
HN_2O^+	+ NH_3	→	NH_4^+	+ N_2O	1.00	2.10×10^{-9}	±20%	7415		
HN_2O^+	+ H_2O	→	H_3O^+	+ N_2O	1.00	2.83×10^{-9}	±25%	8208	7510	

Table of Reactions — Continued

Reactions	Prod. Dist.	Rate Const. (cm^3/s)		Ref.		Footnotes
$HN_2O^+ + CH_3CN \rightarrow CH_3CNH^+ + N_2O$	1.00	3.80×10^{-9}	±25%	7605		
$HN_2O^+ + CO \rightarrow HCO^+ + N_2O$	1.00	5.30×10^{-10}	±20%	8006	7512	7313
$HNNO^+ + CH_4 \rightarrow CH_5^+ + N_2O$	1.00	1.00×10^{-11}	±25%	9031		
$NNOH^+ + CH_4 \rightarrow$ No Reaction		$<1.00\times10^{-12}$		9031	7104	
$MgO^+ + N_2 \rightarrow$ No Reaction		$<1.00\times10^{-12}$		8113		
$MgO^+ + O \rightarrow Mg^+ + O_2$	1.00	$\sim1.00\times10^{-10}$		6802		
$MgO^+ + D_2O \rightarrow MgOD^+ + OD$	1.00	1.30×10^{-9}	±30%	8113		
$MgO^+ + O_3 \rightarrow Mg^+ + O_2 + O_2$	1.00	8.00×10^{-10}	±50%	8113		
$MgO^+ + CO \rightarrow Mg^+ + CO_2$	1.00	3.20×10^{-10}	±30%	8113		
$MgO^+ + NO \rightarrow Mg^+ + NO_2$	1.00	4.30×10^{-10}	±30%	8113		
$MgOH^+ + H_2O_2 \rightarrow Mg(OH)_2^+ + OH$	1.00	$\sim1.00\times10^{-9}$	±50%	8113		
$SiNH_2^+ + NH_3 \rightarrow NH_4^+ + SiNH$	1.00	9.00×10^{-10}	±30%	8824		
$SiNH_2^+ + (CH_3)_2CO \rightarrow SiNHCH_3^+ + CH_3CHO$	0.85	2.40×10^{-9}	±30%	8824		
Adduct	0.15					
$SiNH_2^+ + (CH_3)_2S \rightarrow CH_3SCH_2^+ + SiNH_3$	0.70	1.50×10^{-9}	±30%	8824		
$SiNHCH_3^+ + CH_3SH$	0.05					
Adduct	0.25					
$SiO^+ + H_2 \rightarrow SiOH^+ + H$	1.00	3.20×10^{-10}	±30%	8111		
$SiO^+ + D_2 \rightarrow SiOD^+ + D$	1.00	2.00×10^{-10}	±30%	8111		
$SiO^+ + N \rightarrow Si^+ + NO$	~0.70	$\sim3.00\times10^{-10}$	±50%	6903		
$NO^+ + Si$	~0.30					
$SiO^+ + O \rightarrow Si^+ + O_2$	1.00	$\sim2.00\times10^{-10}$	±50%	6903		
$SiO^+ + O_2 \rightarrow$ No Reaction		$<2.00\times10^{-13}$		8918		
$SiO^+ + NO_2 \rightarrow NO^+ + SiO_2$	0.63	1.50×10^{-9}	±30%	8918		
$NO_2^+ + SiO$	0.35					
$SiO_2^+ + NO$	0.02					
$SiO^+ + N_2O \rightarrow SiO_2^+ + N_2$	1.00	4.80×10^{-10}	±30%	8918		
$SiOH^+ + H_2 \rightarrow$ No Reaction		$<2.00\times10^{-13}$		8705		
$SiOH^+ + CH_2CCH_2 \rightarrow C_3H_5^+ + SiO$	0.20	3.10×10^{-11}	±30%	8933		
Adduct	0.80					
$SiOH^+ + NH_3 \rightarrow NH_4^+ + SiO$	1.00	2.25×10^{-9}	±30%	8933	8111	
$SiOH^+ + H_2O \rightarrow$ Adduct	1.00	1.00×10^{-11}	±30%	8705		
$SiOH^+ + CH_3CN \rightarrow CH_3CNH^+ + SiO$	0.45	4.80×10^{-10}	±30%	8933		
Adduct	0.55					

Table of Reactions — Continued

Reactions	Prod. Dist.	Rate Const. (cm^3/s)		Ref.	Footnotes
$SiOH^+ + H_2S \rightarrow$ No Reaction		$<1.00\times10^{-12}$		8933	
$SiOH^+ + CO \rightarrow$ No Reaction		$<3.00\times10^{-13}$		8705	
$SiOH^+ + CH_3OH \rightarrow SiOCH_3^+ + H_2O$	0.90	1.15×10^{-9}	±30%	8705	
Adduct	0.10				
$SiOH^+ + CHOOH \rightarrow SiO_2H_3^+ + CO$	≥0.90	1.00×10^{-9}	±30%	8705	
Adduct	≤0.10				
$SiOH^+ + C_2H_5OH \rightarrow SiH_2OH^+ + CH_3CHO$	0.03	2.40×10^{-9}	±30%	8705	
$SiO_2H_3^+ + C_2H_4$	0.60				
$SiOC_2H_5^+ + H_2O$	0.30				
$C_2H_5OH_2^+ + SiO$	0.07				
$SiOH^+ + (CH_3)_2O \rightarrow (CH_3)_2OH^+ + SiO$	0.20	9.50×10^{-10}	±30%	8933	
Adduct	0.80				
$SiOH^+ + CH_3COOH \rightarrow CH_3CO^+ + SiO_2H_2$	0.90	2.30×10^{-9}	±30%	8705	
$CH_3C(OH)_2^+ + SiO$	0.10				
$SiO_2^+ + O_2 \rightarrow$ No Reaction		$<1.00\times10^{-13}$		8111	
$SiO_2H_3^+ + H_2O \rightarrow$ Adduct	1.00			8705	
$SiO_2H_3^+ + HCOOH \rightarrow SiO_3H_5^+ + CO$	0.10			8705	
$SiO_3CH_3^+ + H_2O$	0.90				
$SiO_2H_3^+ + C_2H_5OH \rightarrow SiO_3H_5^+ + C_2H_4$				8705	
$SiO_2C_2H_7^+ + H_2O$					
Adduct					
$SO^+ + H_2 \rightarrow$ No Reaction		$<6.00\times10^{-12}$		8401	
$SO^+ + N \rightarrow NS^+ + O$	1.00	5.00×10^{-11}	±50%	7302	
$SO^+ + NH_3 \rightarrow NH_3^+ + SO$	1.00	1.30×10^{-9}	±30%	7507	
$SO^+ + O_2 \rightarrow$ No Reaction		$<2.20\times10^{-11}$		8401	
$SO^+ + H_2S \rightarrow S_2^+ + H_2O$	1.00	1.10×10^{-9}	±30%	7507	
$SO^+ + CO \rightarrow$ No Reaction		$<1.00\times10^{-12}$		7302	
$SO^+ + SO_2 \rightarrow$ No Reaction		$<1.00\times10^{-11}$		8401	
$SO_2^+ + H_2 \rightarrow HSO_2^+ + H$	1.00	1.70×10^{-11}	±40%	8401	
$SO_2^+ + O_2 \rightarrow O_2^+ + SO_2$	1.00	2.65×10^{-10}	±20%	8401	7302
$SO_2^+ + CO \rightarrow SO^+ + CO_2$	1.00	3.00×10^{-10}	±20%	7302	
$SO_2^+ + CO_2 \xrightarrow{M}$ Adduct				8632	
$SO_2^+ + NO \rightarrow NO^+ + SO_2$	1.00	7.00×10^{-11}	±30%	8314	
$SO_2^+ + SO_2 \rightarrow$ No Reaction		$<1.00\times10^{-11}$		8401	
$\xrightarrow{M}$ Adduct				8632	

Table of Reactions – Continued

Reactions					Prod. Dist.	Rate Const. (cm^3/s)		Ref.	Footnotes
HSO_2^+	+ H_2O	→	H_3O^+	+ SO_2	1.00	2.13×10^{-9}	±25%	8208	
HSO_2^+	+ C_2N_2	→	$HC_2N_2^+$	+ SO_2	1.00	8.20×10^{-10}	±30%	8412	
CrO^+	+ H_2	→	No Reaction			$<4.00\times10^{-12}$		8628	
CrO^+	+ CH_4	→	No Reaction			$<4.00\times10^{-12}$		8628	
CrO^+	+ C_2H_6	→	Cr^+	+ C_2H_5OH	1.00	$\sim1.00\times10^{-10}$	±50%	8628	
FeO^+	+ CH_4	→	No Reaction			$<1.00\times10^{-11}$		8427	
FeO^+	+ C_2H_6	→	Fe^+	+ H_2O + C_2H_4	0.10			8427	
			$FeC_2H_4^+$	+ H_2O	0.70				
			FeH_2O^+	+ C_2H_4	0.20				
FeO^+	+ c-C_3H_6	→	No Reaction			$<1.00\times10^{-11}$		8427	
FeO^+	+ C_3H_8	→	Fe^+	+ H_2O + C_3H_6	0.20			8427	
			$FeC_3H_6^+$	+ H_2O	0.50				
			FeH_2O^+	+ C_3H_6	0.10				
			$HOFeC_2H_4^+$	+ CH_3	0.20				
ZrO^+	+ O_2	→	ZrO_2^+	+ O	1.00	5.00×10^{-12}	±75%	8528	
ZrO^+	+ CO_2	→	ZrO_2^+	+ CO	1.00	1.00×10^{-12}	±75%	8528	
ZrO^+	+ NO	→	ZrO_2^+	+ N	1.00	2.50×10^{-12}	±75%	8528	
SiS^+	+ H_2	→	No Reaction			$<2.00\times10^{-14}$		8918	
SiS^+	+ O_2	→	SO^+	+ SiO	0.70	8.90×10^{-11}	±30%	8918	
			SiO^+	+ SO	0.30				
SiS^+	+ CO	→	No Reaction			$<4.00\times10^{-14}$		8918	
SiS^+	+ COS	→	SiS_2^+	+ CO	1.00	1.40×10^{-9}	±30%	8918	
$SiSH^+$	+ C_2H_4	→	Adduct		1.00	1.80×10^{-11}	±30%	8933	
$SiSH^+$	+ NH_3	→	NH_4^+	+ SiS	1.00	9.70×10^{-10}	±30%	8933	
$SiSH^+$	+ H_2O	→	$SiOH^+$	+ H_2S	1.00	1.10×10^{-9}	±30%	8933	
$SiSH^+$	+ H_2S	→	H_3S^+	+ SiS	1.00	2.90×10^{-10}	±30%	8933	
$SiSH^+$	+ HCN	→	$HCNH^+$	+ SiS	1.00	6.10×10^{-10}	±30%	8933	
COS^+	+ H_2	→	No Reaction			$<5.00\times10^{-13}$		8401	8110
COS^+	+ CH_4	→	No Reaction			$<5.00\times10^{-13}$		8110	
COS^+	+ C_2H_2	→	$C_2H_2^+$	+ COS	0.02	4.80×10^{-10}	±30%	9123	
			CH_2CS^+	+ CO	0.98				
COS^+	+ NH_3	→	NH_3^+	+ COS	1.00	2.30×10^{-9}	±20%	8110	
COS^+	+ N_2	→	No Reaction			$<5.00\times10^{-13}$		8110	

Table of Reactions — Continued

Reactions					Prod. Dist.	Rate Const. (cm^3/s)		Ref.	Footnotes
COS^+	+ H_2O	→	No Reaction			$<1.00\times10^{-12}$		8110	
COS^+	+ O_2	→	No Reaction			$<5.00\times10^{-13}$		8110	
		$\xrightarrow{M}$	Adduct					8632	
COS^+	+ H_2S	→	H_2S^+	+ COS	1.00	1.40×10^{-9}	±20%	8110	
COS^+	+ CH_3NH_2	→	$CH_2NH_2^+$	+ HCOS	0.60	1.60×10^{-9}	±20%	8110	
			$CH_3NH_2^+$	+ COS	0.40				
COS^+	+ CO	→	No Reaction			$<5.00\times10^{-13}$		8110	
		$\xrightarrow{M}$	Adduct					8632	
COS^+	+ CO_2	→	No Reaction			$<5.00\times10^{-13}$		8110	
COS^+	+ NO	→	NO^+	+ COS	1.00	7.00×10^{-11}	±20%	8110	
*COS^+	+ COS	→	COS^+	+ *COS	1.00	7.20×10^{-10}	±20%	8110	
		$\xrightarrow{M}$	Adduct					8632	
$HCOS^+$	+ H_2O	→	H_3O^+	+ COS	1.00	3.40×10^{-9}	±25%	8208	
$HCOS^+$	+ C_2N_2	→	$HC_2N_2^+$	+ COS	1.00			8702	

[a] Temperature dependent study made.
[b] See "Notes on Reactions."

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10. Notes on Reactions

H^+/CH_4	Averaged rate con. Disregarded the 7401 prod. distribution, discussion in 8421 shows that it has the more thermal value.
H^+/HCN	Disregarded 7701, as it is an unpublished reference.
H^+/CO_2	Used weighted average using known error limits.
D^+/H_2	Averaged 8212 and 8109.
H_2^+/N_2	Disregarded 7423.
H_2^+/Ar	Used 7620 for rate con. and 6907 for the prod. distribution.
H_2^+/CO	Averaged the rate con. of 7503 and 7423. Used the prod. distribution of 7503, disregarding 7207.
H_2^+/CO_2	Assumed 7608 was the most reliable, since it is a rework of 7207. The rate con. of 7423 and 7211 were not used since they are faster than the collision rate of 2.9E−9. There is a possibility of a CO_2^+ reaction channel, but it was not observed in 7608 using similar equipment.
D_2^+/Ar	Used 7620 only.
H_3^+/CH_4	Disregarded 7005.
H_3^+/C_2H_2	Disregarded 7005.
H_3^+/C_2H_4	Disregarded 7005. Did not average 7405 in the prod. distribution.
H_3^+/C_2H_6	Disregarded 7005. There is a possible 1 or 2% channel leading to $C_2H_7^+$.
H_3^+/NH_3	Disregarded 7005.
H_3^+/N_2	Disregarded 7005 and 6907.
H_3^+/H_2O	Disregarded 7005.
H_3^+/O_2	Disregarded 7312
H_3^+/Ar	Disregarded 7104, because it reported a lower limit and also agreed with the rate constant reported in 6907.
H_3^+/CO	Disregarded 7005. Used 8310 for isotopic ratio.
H_3^+/CH_3OH	Disregarded the 7316 prod. distribution. H_3^+ has been shown to be energetic from the tandem source.
$H_3^+/CHOOH$	Decided that the 7818 prod. distribution would be consistent with the 7821 report.
H_3^+/SO_2	Disregarded 8926, because it was only at 30K.
He^+/H_2	Used 8004 and 7407.
He^+/D_2	Assumed that 8004 updated the 7407 rate con.
He^+/CH_4	Averaged the prod. distributions, assuming 7402 missed the H^+ channel. Averaged the rate con. of 8317, 7908, 7801, and 7602.
He^+/NH_3	Used a weighted averaged of 7515 and 7502 using known error limits.
He^+/H_2O	Assumed 7502 missed the H^+ channel.
He^+/O_2	Disregarded 6905 and 6601. Assumed the prod. distribution of 7602 was correct.
He^+/Ne	Assumed that latest values were correct.
He^+/H_2S	Disregarded 8703, because the experiments did not get above 67K.
He^+/HCl	Disregarded 8703, because the experiments did not get above 67K.
He^+/HCN	Used a weighted average using known error limits.
He^+/HC_3N	Disregarded the 7911 prod. distribution.
He^+/N_2O	8822 was only interested in the charge transfer process.
He^+/SO_2	Disregarded 8703, because the experiments did not get above 67K.
He_2^+/N_2	Assumed that 7417 superseded 6804.
C^+/H_2	Used 8607, because the others were only upper limits and they were consistent with 8607.
C^+/D_2	Used 8607, because the other was only an upper limit and it was consistent with 8607.
C^+/CH_4	Disregarded the prod. distribution of 7905, because the C^+ was made by electron impact ionization.
C^+/NH_3	Averaged the prod. distributions from 7905, 7707, and 7601.
C^+/H_2O	Choose the 90/10 prod. distribution.
C^+/O_2	Disregarded 7601 and 6602.
C^+/HC_3N	Averaged 8518 and 8509.
C^+/CH_3OH	Averaged rate constants, assumed the tandem ICR experiment may have had some excess energy and effected the ICR prod. distribution.
C^+/CO_2	Choose the 90/10 prod. distribution.
C^+/N_2O	Used 7009, because it was the only measurement at 300K.
C^+/SO_2	Used 7507, because it was the only measurement at 300K.
CH^+/CH_4	Disregarded 7012.
CH^+/H_2S	Assumed that the earlier ICR results were in error, the large H_3S^+ peak could easily been lost in the same peak produced in the H_2S^+/H_2S reaction.
CH^+/HCN	Used prod. distribution from 8501, because it was the only sure measurement.
CH_2^+/CH_4	Used 7705 for the prod. distribution,.The $C_2H_3^+$ and $C_2H_5^+$ channels were measured by 7402 indicated that the CH_2^+ reactant ion was probably "hot." They are endothermic by 4.4 and 3.9 kcal/mol respectively.
CH_2^+/NH_3	Averaged 8001 and 7707.
CH_2^+/H_2O	Averaged 8001 and 7705 (Large error bars are reported in both studies. This reaction needs more work).
CH_2^+/H_2S	Averaged the 8401 and 7803 rate con. Assumed that 8401 was a rework of 7305. Assumed the H_3S^+ channel, which is endothermic by 6.5 kcal/mol, was due to some excited states of the CH_2^+ ion.
CH_3^+/NH_3	Disregarded 7707 and 7305.
CH_3^+/H_2S	Averaged 8401 and 7803
CH_3^+/HCN	Assumed 8501 and 8003 were correct.
CH_3^+/CH_3CN	Used 8929 (ICR) results. Assumed 8510 (SIFT) results were pressure saturated.
CH_3^+/HC_3N	Disregarded 7911.
CH_3^+/CH_3OH	Used the prod. distribution of 7804 and the rate con. from 7803.
CH_3^+/CH_3CHO	(Unresolved differences)
CH_3^+/C_2H_5OH	Used the prod. distribution of 7804 and the rate con. from 7609.
CH_4^+/NH_3	Averaged 8001 and 7707 only.
CH_4^+/H_2O	Disregarded 7802.
CH_4^+/H_2S	Averaged 8401 and 7705 only.
CH_4^+/HCN	Used the more recent value in 8501.
CH_4^+/CO_2	Used the 8001 prod. distribution.
CH_4^+/N_2O	Used the 7210 prod. distribution.
CH_5^+/H	Used 8308.
CH_5^+/CO_2	Disregarded 7424.
C_2^+/HCN	Used the prod. distribution from 8501.
C_2^+/HC_3N	Assumed that there was some unknown problem with the prod. distributions of 8509, since the main channel C_3N^+ is endothermic by 12.2 kcal/mol.
C_2H^+/C_2H_2	Disregarded the prod. distribution from 7105.
C_2H^+/HCN	Rate con. were averaged,. A SIFT study (J.S. Knight. Ph.D. Thesis, University of Canterbury, 1986) was used as a reasonable compromise.
C_2H^+/HC_3N	Rate con. were averaged. Assumed that 8509 had a mass assignment problem and averaged the prod. distributions.
$C_2H_2^+/H_2$	Disregarded 7409.
$C_2H_2^+/CH_4$	Disregarded the prod. distribution from 7203.
$C_2H_2^+/C_2H_4$	Averaged the 9029 and 7721 prod. distributions.
$C_2H_2^+/HC_3N$	Disregarded 7911 as an early measurement.
$C_2H_2^+/NO$	9029 was at 15K.
$C_2H_3^+/H$	Assumed 7901 is in error.
$C_2H_3^+/C_2H_2$	Used the arguments in 8501.
$C_2H_3^+/C_2H_6$	Used 7712.
$C_2H_3^+/HC_3N$	Disregarded 7911.
$C_2H_3^+/C_2N_2$	Assume the adduct channel was probably a 3-body component.
$C_2H_4^+/H$	Assumed 7901 is in error.

$C_2H_4^+/C_2H_4$	Used the rate con. from 7712 and averaged prod. distributions from 7712 and 7203.
$C_2H_4^+/HCN$	Used the 8501 (ICR) result. Assumed that the adduct observed in 8011 (SIFT) is the result of a 3-body reaction.
$C_2H_5^+/H$	Assumed 7901 is in error.
$C_2H_5^+/C_2H_2$	Assumed that 7005 measured the saturated 3-body rate con. Assumed that the $C_3H_5^+$ channel measured in 7703 is in error, since it is endothermic by 49.2 kcal/mol. Assumed that ICR is much better at measuring rate con. than SCT. Assumed that 7703, using tandem mass spectrometer may have driven the $C_3H_5^+$ channel, but the isotopic exchange reaction measured was not driven.
$C_2H_5^+/C_2H_4$	Assumed 7005 had a 3-body contribution.
$C_2H_5^+/C_2H_6$	Averaged the more accurate rate con. measurements, 8305 and 7712. Assumed that the ICR results, 7712, might have missed the $C_3H_7^+$ channel.
$C_2H_5^+/C_2N_2$	Assumed that the $PA(C_2N_2) = 161$ mkcal/mol. This results in a back reaction of $-8E-11$. This is consistent with both 8932 and 8702.
$C_2H_6^+/H$	Assumed 7901 is in error.
C_3^+/D_2	Assumed that the adduct was from a 3-body contribution.
C_3H^+/HCN	Selected the 8924 data because it was consistent with cooler reactant ions. The proton transfer reaction is endothermic by 13.4 kcal/mol.
C_3H^+/CH_3CN	Used the last in the series of the publications as the finial result. There is concern about the association channel that is reported. Generally, the association channels reported in SIFT measurements are not from 2-body kinetics.
C_3H^+/CH_3OH	Used the last in the series of the publications as the finial result.
l-$C_3H_2^+/C_2H_2$	It was assumed that 8624 was incorrect.
l-$C_3H_3^+/C_2H_2$	$C_5H_3^+$ can only be made from l-$C_3H_3^+$ and not from c-$C_3H_3^+$. It was assumed that 8708 was generating l-$C_3H_3^+$ and was disregarded. The results of 9041 are not understood in light of the 8708 results.
C_4H^+/HCN	Both the CN loss and the H loss channels are endothermic by 24.4 and 38.7 kcal/mol respectively. It is not clear if one is more thermal than the other. A simple average was made.
$C_4H_2^+/C_2H_2$	Disregarded 7105 and 8709.
$C_4H_3^+/C_2H_2$	Disregarded 7422 and 8709.
$C_4H_4^+/C_2H_2$	Assumed 8709 measured the saturated 3-body process. Averaged the rest compensating for the formation of c-$C_4H_4^+$.
C_6H^+/C_2H_2	Assumed 8709 measured the saturated 3-body process.
$C_6H_2^+/C_2H_2$	Assumed 8709 measured the saturated 3-body process.
ac-$C_6H_5^+/H_2$	Assumed 8814 accurately determined most $C_6H_5^+$ from benzene is acyclic.
c-$C_6H_5^+/H_2$	Assumed 8814 accurately determined most $C_6H_5^+$ from benzene is acyclic.
N^+/H_2	Disregarded 8307.
N^+/CH_4	Disregarded 8514.
N^+/H_2O	Disregarded 7905.
N^+/O_2	Disregarded 6603. Did not average in the 8619 prod. distribution, because they did not measure the other channels.
N^+/CO	Disregarded 8514.
N^+/CO_2	Disregarded 6701 in the averaging of the prod. distribution.
N^+/NO	Disregarded 6603.
NH_2^+/H_2	Disregarded 6702.
NH_2^+/CH_4	Choose 8010 over 7305.
NH_2^+/H_2O	Disregarded 8617, because the rate con. was much larger than the collision rate and the prod. distributions were so much different from the other techniques.
NH_2^+/H_2S	Assumed that the ICR results overlooked the smaller and overlapping peaks in the spectrometer.
NH_3^+/H_2O	8313 has shown the very sensitive nature of this reaction to internal energy of the NH_3^+ ion. 8313 was judged the most thorough analysis and therefore the most accurate. It is not clear why 8010 saw no reaction.
NH_3^+/H_2S	Disregarded 7410.
N_2^+/D	Assumed 7901 is in error.
N_2^+/H_2	Disregarded 7209, 6907, or 6702 in average.
N_2^+/O	Disregarded 6501.
N_2^+/O_2	Disregarded 7209 and 6603.
N_2^+/Ar	This reaction is 4.1 kcal/mol endothermic. The expected rate con. is therefore $\sim 8E-13$. This supports the suggested value and also is reasonable for the plots in 9107.
O^+/N_2	Disregarded 8718.
O^+/H_2S	Averaged the rate con., but used the SIFT prod. distributions since it is more reliable than FA.
OH^+/H_2	Disregarded 6702.
OH^+/CH_4	Averaged rate con. of 8006 and 8001. Used the prod. distribution from 8006.
OH^+/H_2S	Disregarded 7410.
OH^+/N_2O	Have not weighted 7806 very heavy, since it has been shown to have large discrepancies in other cases. In this case 7806 has a rate constant much higher than the collision rate. Averaged the other references.
OH^+/NO	Disregarded 7806, since it has been shown to have large discrepancies in other cases. In this case 7806 has a rate con. much higher than the other rates. Disregarded the prod. distribution of 8104 because it was not strong enough to contradict the other results..
H_2O^+/CH_4	Used the prod. distribution of 8001.
H_2O^+/O_2	Disregarded 7806.
H_2O^+/CO	Disregarded 7806. Disregarded the endothermic channel CO^+ reported in 8818.
H_2O^+/NO	Disregarded 7806.
O_2^+/CH_4	Disregarded 7314.
O_2^+/NO	Disregarded 6603.
Ne^+/H_2O	There is obviously something wrong with the prod. distribution measurement of 7801. This can be seen when a comparison is made of the charge transfer reactions in the series He^+, Ne^+, Ar^+, and Kr^+. Ne^+ would not produce more dissociation than He^+.
Mg^+/O_3	Assumed authors superseded their earlier data.
Si^+/C_2H_4	Assumed 9110 had some interfering 3-body component.
Si^+/c-C_6H_6	Assumed 9111 had some interfering 3-body component.
Si^+/SiH_4	Used the collision rate con., 8723 exceeded the collision rate con. and showed that 7213 and 7214 are consistent with the energy dependence determined.
SiH^+/H_2	Favored 8722, because it is estimated that the 7609 channel is 56 kcal/mol endothermic
SiH^+/SiH_4	Favored 7214 over 7313, the SiH_3^+ channel in 7313 is 25.8 kcal/mol endothermic, also the tandem experiment states that the kinetic energy of the ion is 1 eV.
SiH_2^+/SiH_4	Picked the 7214 rate con,, since the tandem experiment is known to have energy effects.
P^+/NH_3	Assumed that the ICR results might have missed the NH_3^+ peak, due to the large amount of NH_3^+ produced in a NH_3 environment.
P^+/PH_3	Used a weighted average using known error limits.
P^+/HCN	Assumed 8912 had a 3-body contribution.
PH^+/NH_3	Used a weighted average using known error limits.
PH^+/H_2O	Used a weighted average using known error limits.

PH^+/PH_3	Used a weighted average using known error limits.
PH^+/HCN	Assumed 8912 had a 3-body contribution.
S^+/CH_4	Averaged all, weighted the latest results heavier.
S^+/H_2S	Averaged all, weighted the latest results heavier.
HS^+/H_2O	Averaged all, weighted the latest results heavier.
HS^+/H_2S	Assumed 8401 superseded 7304, averaged 8401 and 8110 for the rate con. Assumed 8401 for the prod. distribution, since 8110 had measured the H_2S^+ channel which is 1.9 kcal/mol endothermic and should not be larger than 4%.
H_2S^+/CH_4	Used 8110, since the proton transfer reaction is 7.0 kcal/mol endothermic. This corresponds to an expected rate con. of about 8E−15.
H_3S^+/H_2O	This value agrees with that calculated from the proton affinities and the expected equilibrium con.
Ar^+/H_2	Disregarded 8020.
Ar^+/N_2	Used only the latest 4 references. There is some indication in Liao et al, JCP **85**, 3874 (1986) that the ground vibrational state of Ar^+ is unreactive with N_2.
Ar^+/O_2	Disregarded 6605.
Ar^+/Hg	Used 8016, which discounts 7317 and had the same authors.
Ar^+/CO	Disregarded 6605.
Ar^+/CO_2	Disregarded 6605.
Ar^+/CS_2	Assumed that the authors superseded their earlier work 8614 with the results in 8716.
Ar^+/NO	Disregarded 8020.
ArH^+/H_2	Disregarded 7702.
ArH^+/CH_4	Used the 8211 prod. distribution, since 7614 had noted that their ArH^+ was initially hot and had evidence of it cooling during the experiment and that the production of CH_3^+ is an endothermic process.
ArD^+/H_2	Assumed that the SIFT experiment, 9016, is more reliable than the TICR experiment, 7612. The TICR results showed that the amount of H_2D^+ was continually decreasing.
Kr^+/Hg	Used 8016, which discounts 7317 and had the same authors.
Kr^+/CO	Disregarded 7318.
Kr^+/N_2O	Used 8013, because it was clear which electronic state was been investigated.
CN^+/CH_4	Used the SIFT prod. distributions. Assumed that there was some energetics problem with the tandem ICR CH_3^+ beam effecting the prod. distribution.
CN^+/C_2H_4	Used the SIFT prod. distributions, assumed that there was some energetics problem with the tandem ICR's CH_3^+-beam effecting the prod. distribution.
CN^+/HC_3N	Used the SIFT value for the prod. distribution.
CN^+/CO	Disregarded the adduct product of the SIFT experiment.
HCN^+/C_2H_2	A reasonable compromise was made for a prod. distribution. The H_2CN^+ channel was proven not to exist by the SIFT experiments. Some of the $H_2C_3N^+$ could be coming from a HNC^+ reaction.
HCN^+/HC_3N	Used authors most recent results.
HCN^+/CO	Assumed 8101 missed the rearrangement channel and under estimated the rate con.
HCN^+/CO_2	Assumed 8101 missed the rearrangement channel and under estimated the rate con.
CNC^+/C_2H_2	Averaged the 8802 and 8012 rate con. Used the 8802 prod. distribution.
CNC^+/HCN	Assumed the two SIFT results represented saturated 3-body reactions.
$CHCCN^+/HC_3N$	Assumed 8616 had a 3-body contribution.
C_4N^+/HCN	Assumed 8727 had a 3-body contribution.
$HC_2N_2^+/C_2H_4$	Assumed that the adduct was from a 3-body contribution.
CO^+/H_2	Disregarded 6702.
CO^+/H_2O	Used the ICR value for the prod. distribution.
CO^+/H_2S	Used the ICR value for the prod. distribution.
HCO^+/HCl	The thermodynamics agrees with the SIFT results more closely.
HOC^+/H_2	Used a weighted average using known error limits.
CH_2OH^+/H_2O	Used a weighted average using known error limits.
CH_2OH^+/H_2S	Used a weighted average using known error limits.
CH_2OH^+/HCN	Used a weighted average using known error limits.
$CH_3OH_2^+/C_4H_2$	Assumed 9118 had a 3-body contribution.
CO_2^+/H	Disregarded 7901. The 7101 prod. distribution seemed the most reliable.
CO_2^+/H_2	Disregarded 7207 and 6702.
CO_2^+/O_2	Disregarded 6804.
CO_2^+/H_2S	Disregarded the upper limit on the HCO_2^+ channel.
$CH(OH)_2^+/C_4H_2$	Assumed 9118 had a 3-body contribution.
CS^+/H_2	Disregarded 7414.
CS^+/O_2	Used 8401 for prod. distributions, since the O_2^+ channel observed by 8303 is 15.4 kcal/mol. endothermic and suggest that the 8303 prod. distribution is for hot CS^+ ions.