Energy Levels of Potassium, K I through K XIX

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Data on the energy levels of the potassium atom in all of its stages of ionization, as derived from the analyses of atomic spectra, have been critically compiled. In cases where only line classifications are reported in the literature, level values have been derived. Electron configurations, term designations, *J*-values, experimental *g*-values, and ionization energies are included.

Key words: Atomic energy levels; atomic spectra; potassium energy levels.

Contents

	Page
Introduction	1109
Energy Level Tables	1111
K I	1112
K II	1126
K III	1128
K IV	1129
K V	1130
K VI	1131
K VII	1132
K VIII	1133
K IX	1135
K X	1136
K XI	1137
K XII	1138
K XIII	1139
K XIV	1140
K XV	1141
K XVI	1142
K XVII	1143
K XVIII	1144
K XIX	1145

Introduction

At the time of the compilation of the values of atomic energy levels by Bacher and Goudsmit in 1932, only the first 4 of the 19 spectra of potassium had been studied. By 1949, Moore was able to compile values for the first 11 spectra of potassium. At that time, oxygen was the heaviest atom for which some levels of all stages of ionization were known.

A great amount of new experimental work has been carried out since then, particularly in the higher stages of ionization. Today, reliable energy levels and ionization potentials are available for every stage of ionization of potassium. This is the result of the development of more energetic light sources, which was stimulated by the need to interpret new spectroscopic observations of the sun at short wavelengths from rocket- and satellite-borne spectrographs. A new impetus for the interpretation of spectra of highly ionized atoms has arisen from the investigation of hot laboratory plasmas generated to achieve nuclear fusion.

These activites have produced a substantial increase in spectroscopic information and have made the earlier compilations of energy level data inadequate. The NBS Atomic Energy Levels Data Center has undertaken to provide new compilations of energy levels data, the program at present being concentrated on the elements through zinc. The material on each atom and its ions is being published as a separate paper. Already completed are the compilations for iron by Reader and Sugar (1975), calcium, chromium, and vanadium by Sugar and Corliss (1979, 1977, 1978), manganese and titanium by Corliss and Sugar (1977, 1979), and aluminum by Martin and Zalubas (1979). The present work on potassium will be followed by compilations of the energy levels of scandium and magnesium. When the compilations for the elements potassium through zinc are completed, their collection into a single volume, with some updating, is planned.

The present compilation comprises the energy levels of the potassium atom and all of its ions, as derived from analyses of atomic spectra. For many of the ions the original papers do not give energy level values, but only classifications of observed lines. In these cases we have derived the level values. Although generally we used only published papers as sources of data, unpublished material has been included when it constituted a substantial improvement over information in the literature.

Ionization energies found in the literature are often derived from observed Rydberg series and the values are given in their equivalence in cm^{-1}. The conversion factor

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8065.479±0.021 $\mathrm{cm}^{-1}/\mathrm{eV}$, as given by Cohen and Taylor (1973), was used to obtain values in eV. In a few cases where adequate data were available but the ionization energy had not been derived, we carried out the calculation. For a large number of ions, no suitable series are known. In these cases we have quoted values obtained by extrapolation along isoelectronic sequences. Although uncertainties are not usually provided with these extrapolated values, they are probably accurate to a few units of the last significant figure given.

Nearly all of the data are the result of observations of various types of laboratory light sources. However, they are sometimes supplemented by data obtained from solar observations. This is particularly true where spin-forbidden lines are required to establish the absolute energy of a system of excited levels and also where parity-forbidden transitions between levels of a ground configuration are used to obtain accurate relative energies for the low levels. Whenever both solar data and equivalent laboratory data are available, preference is generally given to the laboratory measurements in order to avoid the problem of blended lines of various elements in the solar spectrum.

For a convenient source of wavelengths of lines below 2000 Å we refer the reader to the compilation by Kelly and Palumbo (1973).

We sometimes assign a calculated value to a level of a term in a system not connected to the ground state. The error in the calculated values is indicated by the letter x following the level values of that system. For K XVIII and XIX, which are isoelectronic with He I and H I, respectively, we give only theoretical level values since they are much more accurate than experimental x-ray wavelengths from which level values may be obtained.

Percentage compositions of the levels are given in K II. A discussion of the percentages may be found in the previous compilations (cited above).

In assembling the data for each spectrum, we referred to the following bibliographies:

i. papers cited by Moore (1949)
ii. C. E. Moore (1968)
iii. L. Hagan and W. C. Martin (1972)
iv. L. Hagan (1977)
v. card file of publications since June 1975 maintained by the NBS Atomic Energy Levels Data Center.

A selection of data was made that, in our judgment, represents the most accurate and reliable available. The text for each ion is not always a complete review of the literature but is intended to credit the major contributions. A final check for new data was made on January 1, 1979, at which time the compilations were considered completed.

Acknowledgments

Throughout this work we have made extensive use of the bibliographical files and reprint collection maintained in the Atomic Energy Levels Data Center by Dr. Romuald Zalubas. Our thanks are extended to him for generous cooperation. The compilation has also benefited greatly from the preprints that were provided by many of our colleagues.

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Energy Level Tables

K I

$Z=19$

Ground state: $1s^22s^22p^63s^23p^64s\ ^2\mathrm{S}_{1/2}$

Ionization energy = 35 009.78±0.02 cm^{-1} (4.34069±0.00001 eV)

On the basis of new measurements of twenty-one lines in the range 5300–9600 Å, Edlén (1936) revised and extended the known term series to include $4s$–$8s$, $4p$–$6p$, $3d$–$6d$, and $4f$–$9f$. To connect the $3d$ and nf terms to the ground state he relied on earlier measurements of the forbidden $4s\ ^2\mathrm{S}$—$3d\ ^2\mathrm{D}$ doublet.

The np series was extended through $n=79$ in absorption observations by Kratz (1949), with resolved fine structure through $n=17$. He derived a value for the ionization energy (corrected by Risberg (1956)) of 35 009.80±0.03 cm^{-1} from this series.

Risberg (1956) has reobserved the spectrum from 3100 to 12 000 Å, using a hollow-cathode discharge. From these measurements and unpublished observations of I. Johansson beyond 12 000 Å, he has determined the term values through $13s$, $10p$, $11d$ and $11f$. Higher members of the s and d series were observed by Harper, Wheatley and Levenson (1977) and by Shen and Curry (1977) by two-photon absorption from the ground state. The fine structure splitting of the nd states from $n=8$ to $n=19$ was measured by Harper and Levenson (1976). Gallagher and Cooke (1978) have measured the intervals of the $15d$, $16d$, $18d$ and $20d$ terms more accurately. The higher members of the nf series were observed by Bensoussan (1975) by means of continuum absorption from the $3d$ state, which was populated by dye laser pumping.

The $5g$ term is from Litzen (1970), who observed the $4f$–$5g$ transition at 40 158.37 Å. The three decimal term values are from infrared measurements of Johansson and Svendenius (1972).

The g factor of the ground state is from Vanden Bout et al. (1968), that for $5p\ ^2\mathrm{P}^\circ_{1/2}$ from Fox and Series (1961), and those for the higher levels are from Belin, Holmgren, Lindgren, and Svanberg (1975).

The $3p^54s^2\ ^2\mathrm{P}^\circ$ term was observed by Beutler and Guggenheimer (1933) at 653.31 and 662.38 Å in absorption from the ground state. Mansfield (1975) observed the absorption spectrum in the autoionizing region from 350 Å to 700 Å. He identified the $3p^54snd$ series to $n=20$ and the $3p^54sns$ series to $n=21$. We have added the $^2\mathrm{P}^\circ$ term designation for the higher members of the s and d series starting with $8s$ and $7d$. The measurements of $3p^54s^2$ are also from his work. Many other absorption features are tentatively identified in his paper.

Risberg's value for the ionization energy of 35 009.77±0.02 cm^{-1} was averaged with that obtained by Kratz. The uncertainty in the equivalent value in eV is determined by the uncertainty of the conversion factor.

Arrangement of Tables

The first table of energy levels presented here for neutral potassium is arranged in the usual way; the terms are listed in order of increasing energy without regard to configuration assignments. Because many long Rydberg series have been observed in K I, we present a second table for this spectrum in which the series are listed separately, followed by their series limits. This table corresponds more closely to the character of the observed spectrum. The series are listed in order of increasing first series member. The series member with the largest value of n for each term type is followed by the limit or limits of that series in K II.

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K I: Ordered by term values

Configuration	Term	J	Level (cm^{-1})	g
$3p^6(^1S)4s$	^2S	1/2	0.000	2.002295
$3p^6(^1S)4p$	$^2P^\circ$	1/2 3/2	*12 985.170* *13 042.876*	
$3p^6(^1S)5s$	^2S	1/2	21 026.551	
$3p^6(^1S)3d$	^2D	5/2 3/2	21 534.680 21 536.988	
$3p^6(^1S)5p$	$^2P^\circ$	1/2 3/2	*24 701.382* *24 720.139*	0.665
$3p^6(^1S)4d$	^2D	5/2 3/2	27 397.077 27 398.147	
$3p^6(^1S)6s$	^2S	1/2	27 450.692	
$3p^6(^1S)4f$	$^2F^\circ$	5/2,7/2	*28 127.85*	
$3p^6(^1S)6p$	$^2P^\circ$	1/2 3/2	*28 999.27* *29 007.71*	0.6663 1.3337
$3p^6(^1S)5d$	^2D	5/2 3/2	30 185.24 30 185.74	1.2004 0.7997
$3p^6(^1S)7s$	^2S	1/2	30 274.28	2.0020
$3p^6(^1S)5f$	$^2F^\circ$	5/2,7/2	*30 606.73*	
$3p^6(^1S)5g$	^2G	7/2,9/2	30 617.31	
$3p^6(^1S)7p$	$^2P^\circ$	1/2 3/2	*31 069.90* *31 074.40*	0.6659 1.3336
$3p^6(^1S)6d$	^2D	5/2 3/2	31 695.89 31 696.15	1.2013 0.7999
$3p^6(^1S)8s$	^2S	1/2	31 765.37	2.0028
$3p^6(^1S)6f$	$^2F^\circ$	5/2,7/2	*31 953.17*	
$3p^6(^1S)8p$	$^2P^\circ$	1/2 3/2	*32 227.44* *32 230.11*	
$3p^6(^1S)7d$	^2D	5/2 3/2	32 598.30 32 598.43	
$3p^6(^1S)9s$	^2S	1/2	32 648.35	
$3p^6(^1S)7f$	$^2F^\circ$	5/2,7/2	*32 764.80*	
$3p^6(^1S)9p$	$^2P^\circ$	1/2 3/2	*32 940.21* *32 941.94*	
$3p^6(^1S)8d$	^2D	5/2 3/2	33 178.12 33 178.23	

K I: Ordered by term values—Continued

Configuration	Term	J	Level (cm^{-1})	g
$3p^6(^1S)10s$	^2S	1/2	33 214.215	
$3p^6(^1S)8f$	$^2F^\circ$	5/2,7/2	*33 291.40*	
$3p^6(^1S)10p$	$^2P^\circ$	1/2	*33 410.23*	
		3/2	*33 411.39*	
$3p^6(^1S)9d$	^2D	5/2	33 572.06	
		3/2	33 572.11	
$3p^6(^1S)11s$	^2S	1/2	33 598.54	
$3p^6(^1S)9f$	$^2F^\circ$	5/2,7/2	*33 652.32*	
$3p^6(^1S)11p$	$^2P^\circ$	1/2	*33 736.60*	
		3/2	*33 737.44*	
$3p^6(^1S)10d$	^2D	5/2	33 851.55	
		3/2	33 851.59	
$3p^6(^1S)12s$	^2S	1/2	33 871.46	
$3p^6(^1S)10f$	$^2F^\circ$	5/2,7/2	*33 910.42*	
$3p^6(^1S)12p$	$^2P^\circ$	1/2	*33 972.34*	
		3/2	*33 972.94*	
$3p^6(^1S)11d$	^2D	5/2	34 056.94	
		3/2	34 057.00	
$3p^6(^1S)13s$	^2S	1/2	34 072.22	
$3p^6(^1S)11f$	$^2F^\circ$	5/2,7/2	*34 101.36*	
$3p^6(^1S)13p$	$^2P^\circ$	1/2	*34 148.15*	
		3/2	*34 148.63*	
$3p^6(^1S)12d$	^2D	3/2,5/2	34 212.3	
$3p^6(^1S)14s$	^2S	1/2	34 224.0	
$3p^6(^1S)12f$	$^2F^\circ$	5/2,7/2	*34 246.37*	
$3p^6(^1S)14p$	$^2P^\circ$	1/2	*34 282.77*	
		3/2	*34 283.15*	
$3p^6(^1S)13d$	^2D	3/2,5/2	34 332.5	
$3p^6(^1S)15s$	^2S	1/2	34 342.4	
$3p^6(^1S)13f$	$^2F^\circ$	5/2,7/2	*34 359.36*	
$3p^6(^1S)15p$	$^2P^\circ$	1/2	*34 388.16*	
		3/2	*34 388.46*	
$3p^6(^1S)14d$	^2D	3/2,5/2	34 427.8	
$3p^6(^1S)16s$	^2S	1/2	34 435.1	

K I: Ordered by term values—Continued

Configuration	Term	J	Level (cm^{-1})	g
$3p^6(^1S)14f$	$^2F^\circ$	5/2,7/2	*34 448.98*	
$3p^6(^1S)16p$	$^2P^\circ$	1/2	*34 472.18*	
		3/2	*34 472.43*	
$3p^6(^1S)15d$	^2D	3/2,5/2	34 503.9	
$3p^6(^1S)17s$	^2S	1/2	34 510.2	
$3p^6(^1S)17p$	$^2P^\circ$	1/2	*34 540.23*	
		3/2	*34 540.44*	
$3p^6(^1S)16d$	^2D	3/2,5/2	34 566.5	
$3p^6(^1S)18s$	^2S	1/2	34 571.6	
$3p^6(^1S)18p$	$^2P^\circ$	1/2,3/2	*34 596.27*	
$3p^6(^1S)17d$	^2D	3/2,5/2	34 617.9	
$3p^6(^1S)19s$	^2S	1/2	34 622.6	
$3p^6(^1S)19p$	$^2P^\circ$	1/2,3/2	*34 642.78*	
$3p^6(^1S)18d$	^2D	3/2,5/2	34 661.0	
$3p^6(^1S)20s$	^2S	1/2	34 664.7	
$3p^6(^1S)20p$	$^2P^\circ$	1/2,3/2	*34 681.84*	
$3p^6(^1S)19d$	^2D	3/2,5/2	34 697.5	
$3p^6(^1S)21s$	^2S	1/2	34 700.5	
$3p^6(^1S)21p$	$^2P^\circ$	1/2,3/2	*34 714.98*	
$3p^6(^1S)20d$	^2D	3/2,5/2	34 728.4	
$3p^6(^1S)22s$	^2S	1/2	34 731.2	
$3p^6(^1S)22p$	$^2P^\circ$	1/2,3/2	*34 743.37*	
$3p^6(^1S)21d$	^2D	3/2,5/2	34 754.8	
$3p^6(^1S)23s$	^2S	1/2	34 757.5	
$3p^6(^1S)23p$	$^2P^\circ$	1/2,3/2	*34 767.78*	
$3p^6(^1S)22d$	^2D	3/2,5/2	34 778.0	
$3p^6(^1S)24s$	^2S	1/2	34 780.4	
$3p^6(^1S)24p$	$^2P^\circ$	1/2,3/2	*34 789.03*	
$3p^6(^1S)23d$	^2D	3/2,5/2	34 797.7	
$3p^6(^1S)25s$	^2S	1/2	34 799.6	

K I: Ordered by term values—Continued

Configuration	Term	J	Level (cm^{-1})	g
$3p^6(^1S)25p$	$^2P^\circ$	1/2,3/2	*34 807.62*	
$3p^6(^1S)24d$	^2D	3/2,5/2	34 815.9	
$3p^6(^1S)26s$	^2S	1/2	34 817.6	
$3p^6(^1S)26p$	$^2P^\circ$	1/2,3/2	*34 823.83*	
$3p^6(^1S)25d$	^2D	3/2,5/2	34 830	
$3p^6(^1S)27s$	^2S	1/2	34 831	
$3p^6(^1S)27p$	$^2P^\circ$	1/2,3/2	*34 838.30*	
$3p^6(^1S)26d$	^2D	3/2,5/2	34 844	
$3p^6(^1S)28s$	^2S	1/2	34 844	
$3p^6(^1S)28p$	$^2P^\circ$	1/2,3/2	*34 851.11*	
$3p^6(^1S)27d$	^2D	3/2,5/2	34 856	
$3p^6(^1S)29s$	^2S	1/2	34 856	
$3p^6(^1S)29p$	$^2P^\circ$	1/2,3/2	*34 862.52*	
$3p^6(^1S)28d$	^2D	3/2,5/2	34 866	
$3p^6(^1S)30s$	^2S	1/2	34 866	
$3p^6(^1S)30p$	$^2P^\circ$	1/2,3/2	*34 872.70*	
$3p^6(^1S)29d$	^2D	3/2,5/2	34 875	
$3p^6(^1S)31s$	^2S	1/2	34 875	
$3p^6(^1S)31p$	$^2P^\circ$	1/2,3/2	*34 881.94*	
$3p^6(^1S)30d$	^2D	3/2,5/2	34 884	
$3p^6(^1S)32s$	^2S	1/2	34 884	
$3p^6(^1S)32p$	$^2P^\circ$	1/2,3/2	*34 890.20*	
$3p^6(^1S)31d$	^2D	3/2,5/2	34 893	
$3p^6(^1S)33s$	^2S	1/2	34 893	
$3p^6(^1S)33p$	$^2P^\circ$	1/2,3/2	*34 897.75*	
$3p^6(^1S)32d$	^2D	3/2,5/2	34 899	
$3p^6(^1S)34s$	^2S	1/2	34 899	
$3p^6(^1S)34p$	$^2P^\circ$	1/2,3/2	*34 904.57*	
$3p^6(^1S)33d$	^2D	3/2,5/2	34 906	

K I: Ordered by term values—Continued

Configuration	Term	J	Level (cm^{-1})	g
$3p^6(^1\mathrm{S})35s$	^{2}S	1/2	34 906	
$3p^6(^1\mathrm{S})35p$	^{2}P°	1/2,3/2	*34 910.79*	
$3p^6(^1\mathrm{S})34d$	^{2}D	3/2,5/2	34 913	
$3p^6(^1\mathrm{S})36s$	^{2}S	1/2	34 913	
$3p^6(^1\mathrm{S})36p$	^{2}P°	1/2,3/2	*34 916.51*	
$3p^6(^1\mathrm{S})35d$	^{2}D	3/2,5/2	34 919	
$3p^6(^1\mathrm{S})37s$	^{2}S	1/2	34 919	
$3p^6(^1\mathrm{S})37p$	^{2}P°	1/2,3/2	*34 921.69*	
$3p^6(^1\mathrm{S})36d$	^{2}D	3/2,5/2	34 924	
$3p^6(^1\mathrm{S})38s$	^{2}S	1/2	34 924	
$3p^6(^1\mathrm{S})38p$	^{2}P°	1/2,3/2	*34 926.47*	
$3p^6(^1\mathrm{S})37d$	^{2}D	3/2,5/2	34 928	
$3p^6(^1\mathrm{S})39s$	^{2}S	1/2	34 928	
$3p^6(^1\mathrm{S})39p$	^{2}P°	1/2,3/2	*34 930.91*	
$3p^6(^1\mathrm{S})38d$	^{2}D	3/2,5/2	34 933	
$3p^6(^1\mathrm{S})40s$	^{2}S	1/2	34 933	
$3p^6(^1\mathrm{S})40p$	^{2}P°	1/2,3/2	*34 934.97*	
$3p^6(^1\mathrm{S})39d$	^{2}D	3/2,5/2	34 936	
$3p^6(^1\mathrm{S})41s$	^{2}S	1/2	34 936	
$3p^6(^1\mathrm{S})41p$	^{2}P°	1/2,3/2	*34 938.72*	
$3p^6(^1\mathrm{S})42p$	^{2}P°	1/2,3/2	*34 942.20*	
$3p^6(^1\mathrm{S})43p$	^{2}P°	1/2,3/2	*34 945.45*	
$3p^6(^1\mathrm{S})44p$	^{2}P°	1/2,3/2	*34 948.48*	
$3p^6(^1\mathrm{S})45p$	^{2}P°	1/2,3/2	*34 951.26*	
$3p^6(^1\mathrm{S})46p$	^{2}P°	1/2,3/2	*34 953.85*	
$3p^6(^1\mathrm{S})47p$	^{2}P°	1/2,3/2	*34 956.32*	
$3p^6(^1\mathrm{S})48p$	^{2}P°	1/2,3/2	*34 958.61*	
$3p^6(^1\mathrm{S})49p$	^{2}P°	1/2,3/2	*34 960.73*	
$3p^6(^1\mathrm{S})50p$	^{2}P°	1/2,3/2	*34 962.83*	
$3p^6(^1\mathrm{S})51p$	^{2}P°	1/2,3/2	*34 964.67*	
$3p^6(^1\mathrm{S})52p$	^{2}P°	1/2,3/2	*34 966.45*	
$3p^6(^1\mathrm{S})53p$	^{2}P°	1/2,3/2	*34 968.09*	
$3p^6(^1\mathrm{S})54p$	^{2}P°	1/2,3/2	*34 969.69*	
$3p^6(^1\mathrm{S})55p$	^{2}P°	1/2,3/2	*34 971.17*	
$3p^6(^1\mathrm{S})56p$	^{2}P°	1/2,3/2	*34 972.57*	
$3p^6(^1\mathrm{S})57p$	^{2}P°	1/2,3/2	*34 973.88*	
$3p^6(^1\mathrm{S})58p$	^{2}P°	1/2,3/2	*34 975.15*	
$3p^6(^1\mathrm{S})59p$	^{2}P°	1/2,3/2	*34 976.36*	
$3p^6(^1\mathrm{S})60p$	^{2}P°	1/2,3/2	*34 977.50*	

K I: Ordered by term values—Continued

Configuration	Term	J	Level (cm^{-1})	g
$3p^6(^1S)61p$	$^2P^\circ$	1/2,3/2	34 978.62	
$3p^6(^1S)62p$	$^2P^\circ$	1/2,3/2	34 979.60	
$3p^6(^1S)63p$	$^2P^\circ$	1/2,3/2	34 980.65	
$3p^6(^1S)64p$	$^2P^\circ$	1/2,3/2	34 981.58	
$3p^6(^1S)65p$	$^2P^\circ$	1/2,3/2	34 982.47	
$3p^6(^1S)66p$	$^2P^\circ$	1/2,3/2	34 983.27	
$3p^6(^1S)67p$	$^2P^\circ$	1/2,3/2	34 984.10	
$3p^6(^1S)68p$	$^2P^\circ$	1/2,3/2	34 984.83	
$3p^6(^1S)69p$	$^2P^\circ$	1/2,3/2	34 985.57	
$3p^6(^1S)70p$	$^2P^\circ$	1/2,3/2	34 986.25	
$3p^6(^1S)71p$	$^2P^\circ$	1/2,3/2	34 986.96	
$3p^6(^1S)72p$	$^2P^\circ$	1/2,3/2	34 987.53	
$3p^6(^1S)73p$	$^2P^\circ$	1/2,3/2	34 988.19	
$3p^6(^1S)74p$	$^2P^\circ$	1/2,3/2	34 988.85	
$3p^6(^1S)75p$	$^2P^\circ$	1/2,3/2	34 989.4	
$3p^6(^1S)76p$	$^2P^\circ$	1/2,3/2	34 989.9	
$3p^6(^1S)77p$	$^2P^\circ$	1/2,3/2	34 990.5	
$3p^6(^1S)78p$	$^2P^\circ$	1/2,3/2	34 990.8	
$3p^6(^1S)79p$	$^2P^\circ$	1/2,3/2	34 991.2	
K II ($^1S_0$)	*Limit*		**35 009.78**	
$3p^5 4s^2$	$^2P^\circ$	3/2	151 008	
		1/2	153 085	
$3p^5 3d(^3P^\circ)4s$	$^4P^\circ$	1/2	159 367	
		3/2	159 678	
$3p^5 3d(^3P^\circ)4s$	$^2P^\circ$	1/2	162 404	
		3/2	163 006	
$3p^5 3d(^3D^\circ)4s$	$^4D^\circ$	3/2	172 623	
		1/2	172 800	
$3p^5 3d(^1D^\circ)4s$	$^2D^\circ$	3/2	173 043	
$3p^5 3d(^3D^\circ)4s$	$^2D^\circ$	3/2	179 886	
$3p^5 3d(^1P^\circ)4s$	$^2P^\circ$	1/2	180 551	
		3/2	180 791	
$3p^5 4s(^3P^\circ)5s$	$^4P^\circ$	3/2	180 850	
		1/2	181 517	
$3p^5 4s(^3P^\circ)5s$	$^2P^\circ$	3/2	182 152	
$3p^5 3d(^3P^\circ)5s$	$^2P^\circ$	1/2	183 322	
		3/2	183 532	
$3p^5 4s(^1P^\circ)5s$	$^2P^\circ$	3/2	184 342	
		1/2	185 153	
$3p^5 4d(^3D^\circ)4s$	$^4D^\circ$	1/2,3/2	185 153	
$3p^5 4d(^1D^\circ)4s$	$^2D^\circ$	3/2	186 656	
$3p^5 4d(^3D^\circ)4s$	$^2D^\circ$	3/2	187 806	
$3p^5 4d(^1P^\circ)4s$	$^2P^\circ$	1/2,3/2	188 565	

K I: Ordered by term values—Continued

Configuration	Term	J	Level (cm^{-1})	g
$3p^5 4s(^3P^\circ)5d$	$^4P^\circ$	$3/2$	*189 900*	
$3p^5 4s(^3P^\circ)5d$	$^2D^\circ$	$3/2$	*190 434*	
$3p^5 4s(^3P^\circ)5d$	$^2P^\circ$	$1/2$ $3/2$	*190 942* *192 251*	
$3p^5 4s(^3P^\circ)5d$	$^4D^\circ$	$3/2$	*191 359*	
$3p^5 4s(^3P^\circ)5d$	$^4F^\circ$	$3/2$	*191 641*	
$3p^5 4s(^1P^\circ)6s$	$^2P^\circ$	$1/2, 3/2$	*193 065*	
$3p^5 4s(^3P^\circ)6d$	$^2D^\circ$	$3/2$	*193 122*	
$3p^5 4s(^3P^\circ)6d$	$^2P^\circ$	$1/2$ $3/2$	*193 244* *194 275*	
$3p^5 4s(^1P^\circ)5d$	$^2D^\circ$	$3/2$	*193 749*	
$3p^5 4s(^1P^\circ)5d$	$^2P^\circ$	$1/2$ $3/2$	*193 948* *194 068*	
$3p^5 4s(^1P^\circ)7s$	$^2P^\circ$	$1/2, 3/2$	*196 319*	
$3p^5 4s(^1P^\circ)6d$	$^2P^\circ$	$3/2$ $1/2$	*196 362* *196 718*	
$3p^5 4s(^1P^\circ)6d$	$^2D^\circ$	$3/2$	*196 826*	
$3p^5 4s(^1P^\circ)7d$ $3p^5 4s(^1P^\circ)8s$	$^2P^\circ$	$1/2, 3/2$	*197 959*	
$3p^5 4s(^1P^\circ)8d$	$^2P^\circ$	$1/2, 3/2$	*198 911*	
$3p^5 4s(^1P^\circ)9s$				
$3p^5 4s(^1P^\circ)9d$ $3p^5 4s(^1P^\circ)10s$	$^2P^\circ$	$1/2, 3/2$	*199 549*	
$3p^5 4s(^1P^\circ)10d$ $3p^5 4s(^1P^\circ)11s$	$^2P^\circ$	$1/2, 3/2$	*199 980*	
$3p^5 4s(^1P^\circ)11d$ $3p^5 4s(^1P^\circ)12s$	$^2P^\circ$	$1/2, 3/2$	*200 268*	
$3p^5 4s(^1P^\circ)12d$ $3p^5 4s(^1P^\circ)13s$	$^2P^\circ$	$1/2, 3/2$	*200 493*	
$3p^5 4s(^1P^\circ)13d$ $3p^5 4s(^1P^\circ)14s$	$^2P^\circ$	$1/2, 3/2$	*200 658*	
$3p^5 4s(^1P^\circ)14d$ $3p^5 4s(^1P^\circ)15s$	$^2P^\circ$	$1/2, 3/2$	*200 780*	
$3p^5 4s(^1P^\circ)15d$ $3p^5 4s(^1P^\circ)16s$	$^2P^\circ$	$1/2, 3/2$	*200 876*	

K I: Ordered by term values—Continued

Configuration	Term	J	Level (cm^{-1})	g
$3p^5 4s(^1P^\circ)16d$ $3p^5 4s(^1P^\circ)17s$	$^2P^\circ$	$\frac{1}{2},\frac{3}{2}$	*200 955*	
$3p^5 4s(^1P^\circ)17d$ $3p^5 4s(^1P^\circ)18s$	$^2P^\circ$	$\frac{1}{2},\frac{3}{2}$	*201 017*	
$3p^5 4s(^1P^\circ)18d$ $3p^5 4s(^1P^\circ)19s$	$^2P^\circ$	$\frac{1}{2},\frac{3}{2}$	*201 074*	
$3p^5 4s(^1P^\circ)19d$ $3p^5 4s(^1P^\circ)20s$	$^2P^\circ$	$\frac{1}{2},\frac{3}{2}$	*201 124*	
$3p^5 4s(^1P^\circ)20d$ $3p^5 4s(^1P^\circ)21s$	$^2P^\circ$	$\frac{1}{2},\frac{3}{2}$	*201 152*	
K II ($^1P^\circ_1$)	***Limit***		201 471.3	

K I: Ordered by series

Configuration	Term	J	Level (cm^{-1})	g
$3p^6(^1S)4s$	^2S	1/2	0.000	2.002295
$3p^6(^1S)5s$	^2S	1/2	21 026.551	
$3p^6(^1S)6s$	^2S	1/2	27 450.692	
$3p^6(^1S)7s$	^2S	1/2	30 274.28	2.0020
$3p^6(^1S)8s$	^2S	1/2	31 765.37	2.0028
$3p^6(^1S)9s$	^2S	1/2	32 648.35	
$3p^6(^1S)10s$	^2S	1/2	33 214.215	
$3p^6(^1S)11s$	^2S	1/2	33 598.54	
$3p^6(^1S)12s$	^2S	1/2	33 871.46	
$3p^6(^1S)13s$	^2S	1/2	34 072.22	
$3p^6(^1S)14s$	^2S	1/2	34 224.0	
$3p^6(^1S)15s$	^2S	1/2	34 342.4	
$3p^6(^1S)16s$	^2S	1/2	34 435.1	
$3p^6(^1S)17s$	^2S	1/2	34 510.2	
$3p^6(^1S)18s$	^2S	1/2	34 571.6	
$3p^6(^1S)19s$	^2S	1/2	34 622.6	
$3p^6(^1S)20s$	^2S	1/2	34 664.7	
$3p^6(^1S)21s$	^2S	1/2	34 700.5	
$3p^6(^1S)22s$	^2S	1/2	34 731.2	
$3p^6(^1S)23s$	^2S	1/2	34 757.5	
$3p^6(^1S)24s$	^2S	1/2	34 780.4	
$3p^6(^1S)25s$	^2S	1/2	34 799.6	
$3p^6(^1S)26s$	^2S	1/2	34 817.6	
$3p^6(^1S)27s$	^2S	1/2	34 831	
$3p^6(^1S)28s$	^2S	1/2	34 844	
$3p^6(^1S)29s$	^2S	1/2	34 856	
$3p^6(^1S)30s$	^2S	1/2	34 866	
$3p^6(^1S)31s$	^2S	1/2	34 875	
$3p^6(^1S)32s$	^2S	1/2	34 884	
$3p^6(^1S)33s$	^2S	1/2	34 893	
$3p^6(^1S)34s$	^2S	1/2	34 899	
$3p^6(^1S)35s$	^2S	1/2	34 906	
$3p^6(^1S)36s$	^2S	1/2	34 913	
$3p^6(^1S)37s$	^2S	1/2	34 919	
$3p^6(^1S)38s$	^2S	1/2	34 924	
$3p^6(^1S)39s$	^2S	1/2	34 928	
$3p^6(^1S)40s$	^2S	1/2	34 933	
$3p^6(^1S)41s$	^2S	1/2	34 936	
K II ($^1S_0$)	*Limit*		**35 009.78**	
$3p^6(^1S)4p$	$^2P^\circ$	1/2	*12 985.170*	
		3/2	*13 042.876*	
$3p^6(^1S)5p$	$^2P^\circ$	1/2	*24 701.382*	0.665
		3/2	*24 720.139*	
$3p^6(^1S)6p$	$^2P^\circ$	1/2	*28 999.27*	0.6663
		3/2	*29 007.71*	1.3337
$3p^6(^1S)7p$	$^2P^\circ$	1/2	*31 069.90*	0.6659
		3/2	*31 074.40*	1.3336
$3p^6(^1S)8p$	$^2P^\circ$	1/2	*32 227.44*	
		3/2	*32 230.11*	
$3p^6(^1S)9p$	$^2P^\circ$	1/2	*32 940.21*	
		3/2	*32 941.94*	

K I: Ordered by series—Continued

Configuration	Term	J	Level (cm^{-1})	g
$3p^6(^1S)10p$	$^2P^\circ$	$1/2$	*33 410.23*	
		$3/2$	*33 411.39*	
$3p^6(^1S)11p$	$^2P^\circ$	$1/2$	*33 736.60*	
		$3/2$	*33 737.44*	
$3p^6(^1S)12p$	$^2P^\circ$	$1/2$	*33 972.34*	
		$3/2$	*33 972.94*	
$3p^6(^1S)13p$	$^2P^\circ$	$1/2$	*34 148.15*	
		$3/2$	*34 148.63*	
$3p^6(^1S)14p$	$^2P^\circ$	$1/2$	*34 282.77*	
		$3/2$	*34 283.15*	
$3p^6(^1S)15p$	$^2P^\circ$	$1/2$	*34 388.16*	
		$3/2$	*34 388.46*	
$3p^6(^1S)16p$	$^2P^\circ$	$1/2$	*34 472.18*	
		$3/2$	*34 472.43*	
$3p^6(^1S)17p$	$^2P^\circ$	$1/2$	*34 540.23*	
		$3/2$	*34 540.44*	
$3p^6(^1S)18p$	$^2P^\circ$	$1/2,3/2$	*34 596.27*	
$3p^6(^1S)19p$	$^2P^\circ$	$1/2,3/2$	*34 642.78*	
$3p^6(^1S)20p$	$^2P^\circ$	$1/2,3/2$	*34 681.84*	
$3p^6(^1S)21p$	$^2P^\circ$	$1/2,3/2$	*34 714.98*	
$3p^6(^1S)22p$	$^2P^\circ$	$1/2,3/2$	*34 743.37*	
$3p^6(^1S)23p$	$^2P^\circ$	$1/2,3/2$	*34 767.78*	
$3p^6(^1S)24p$	$^2P^\circ$	$1/2,3/2$	*34 789.03*	
$3p^6(^1S)25p$	$^2P^\circ$	$1/2,3/2$	*34 807.62*	
$3p^6(^1S)26p$	$^2P^\circ$	$1/2,3/2$	*34 823.83*	
$3p^6(^1S)27p$	$^2P^\circ$	$1/2,3/2$	*34 838.30*	
$3p^6(^1S)28p$	$^2P^\circ$	$1/2,3/2$	*34 851.11*	
$3p^6(^1S)29p$	$^2P^\circ$	$1/2,3/2$	*34 862.52*	
$3p^6(^1S)30p$	$^2P^\circ$	$1/2,3/2$	*34 872.70*	
$3p^6(^1S)31p$	$^2P^\circ$	$1/2,3/2$	*34 881.94*	
$3p^6(^1S)32p$	$^2P^\circ$	$1/2,3/2$	*34 890.20*	
$3p^6(^1S)33p$	$^2P^\circ$	$1/2,3/2$	*34 897.75*	
$3p^6(^1S)34p$	$^2P^\circ$	$1/2,3/2$	*34 904.57*	
$3p^6(^1S)35p$	$^2P^\circ$	$1/2,3/2$	*34 910.79*	
$3p^6(^1S)36p$	$^2P^\circ$	$1/2,3/2$	*34 916.51*	
$3p^6(^1S)37p$	$^2P^\circ$	$1/2,3/2$	*34 921.69*	
$3p^6(^1S)38p$	$^2P^\circ$	$1/2,3/2$	*34 926.47*	
$3p^6(^1S)39p$	$^2P^\circ$	$1/2,3/2$	*34 930.91*	
$3p^6(^1S)40p$	$^2P^\circ$	$1/2,3/2$	*34 934.97*	
$3p^6(^1S)41p$	$^2P^\circ$	$1/2,3/2$	*34 938.72*	
$3p^6(^1S)42p$	$^2P^\circ$	$1/2,3/2$	*34 942.20*	
$3p^6(^1S)43p$	$^2P^\circ$	$1/2,3/2$	*34 945.45*	
$3p^6(^1S)44p$	$^2P^\circ$	$1/2,3/2$	*34 948.48*	
$3p^6(^1S)45p$	$^2P^\circ$	$1/2,3/2$	*34 951.26*	
$3p^6(^1S)46p$	$^2P^\circ$	$1/2,3/2$	*34 953.85*	
$3p^6(^1S)47p$	$^2P^\circ$	$1/2,3/2$	*34 956.32*	
$3p^6(^1S)48p$	$^2P^\circ$	$1/2,3/2$	*34 958.61*	
$3p^6(^1S)49p$	$^2P^\circ$	$1/2,3/2$	*34 960.73*	
$3p^6(^1S)50p$	$^2P^\circ$	$1/2,3/2$	*34 962.83*	

K I: Ordered by series—Continued

Configuration	Term	J	Level (cm^{-1})	g
$3p^6(^1S)51p$	$^2P^\circ$	1/2,3/2	*34 964.67*	
$3p^6(^1S)52p$	$^2P^\circ$	1/2,3/2	*34 966.45*	
$3p^6(^1S)53p$	$^2P^\circ$	1/2,3/2	*34 968.09*	
$3p^6(^1S)54p$	$^2P^\circ$	1/2,3/2	*34 969.69*	
$3p^6(^1S)55p$	$^2P^\circ$	1/2,3/2	*34 971.17*	
$3p^6(^1S)56p$	$^2P^\circ$	1/2,3/2	*34 972.57*	
$3p^6(^1S)57p$	$^2P^\circ$	1/2,3/2	*34 973.88*	
$3p^6(^1S)58p$	$^2P^\circ$	1/2,3/2	*34 975.15*	
$3p^6(^1S)59p$	$^2P^\circ$	1/2,3/2	*34 976.36*	
$3p^6(^1S)60p$	$^2P^\circ$	1/2,3/2	*34 977.50*	
$3p^6(^1S)61p$	$^2P^\circ$	1/2,3/2	*34 978.62*	
$3p^6(^1S)62p$	$^2P^\circ$	1/2,3/2	*34 979.60*	
$3p^6(^1S)63p$	$^2P^\circ$	1/2,3/2	*34 980.65*	
$3p^6(^1S)64p$	$^2P^\circ$	1/2,3/2	*34 981.58*	
$3p^6(^1S)65p$	$^2P^\circ$	1/2,3/2	*34 982.47*	
$3p^6(^1S)66p$	$^2P^\circ$	1/2,3/2	*34 983.27*	
$3p^6(^1S)67p$	$^2P^\circ$	1/2,3/2	*34 984.10*	
$3p^6(^1S)68p$	$^2P^\circ$	1/2,3/2	*34 984.83*	
$3p^6(^1S)69p$	$^2P^\circ$	1/2,3/2	*34 985.57*	
$3p^6(^1S)70p$	$^2P^\circ$	1/2,3/2	*34 986.25*	
$3p^6(^1S)71p$	$^2P^\circ$	1/2,3/2	*34 986.96*	
$3p^6(^1S)72p$	$^2P^\circ$	1/2,3/2	*34 987.53*	
$3p^6(^1S)73p$	$^2P^\circ$	1/2,3/2	*34 988.19*	
$3p^6(^1S)74p$	$^2P^\circ$	1/2,3/2	*34 988.85*	
$3p^6(^1S)75p$	$^2P^\circ$	1/2,3/2	*34 989.4*	
$3p^6(^1S)76p$	$^2P^\circ$	1/2,3/2	*34 989.9*	
$3p^6(^1S)77p$	$^2P^\circ$	1/2,3/2	*34 990.5*	
$3p^6(^1S)78p$	$^2P^\circ$	1/2,3/2	*34 990.8*	
$3p^6(^1S)79p$	$^2P^\circ$	1/2,3/2	*34 991.2*	
K II ($^1S_0$)	*Limit*		**35 009.78**	
$3p^6(^1S)3d$	^2D	5/2	21 534.680	
		3/2	21 536.988	
$3p^6(^1S)4d$	^2D	5/2	27 397.077	
		3/2	27 398.147	
$3p^6(^1S)5d$	^2D	5/2	30 185.24	1.2004
		3/2	30 185.74	0.7997
$3p^6(^1S)6d$	^2D	5/2	31 695.89	1.2013
		3/2	31 696.15	0.7999
$3p^6(^1S)7d$	^2D	5/2	32 598.30	
		3/2	32 598.43	
$3p^6(^1S)8d$	^2D	5/2	33 178.12	
		3/2	33 178.23	
$3p^6(^1S)9d$	^2D	5/2	33 572.06	
		3/2	33 572.11	
$3p^6(^1S)10d$	^2D	5/2	33 851.55	
		3/2	33 851.59	
$3p^6(^1S)11d$	^2D	5/2	34 056.94	
		3/2	34 057.00	

K I: Ordered by series—Continued

Configuration	Term	J	Level (cm^{-1})	g
$3p^6(^1S)12d$	^2D	$3/2,5/2$	34 212.3	
$3p^6(^1S)13d$	^2D	$3/2,5/2$	34 332.5	
$3p^6(^1S)14d$	^2D	$3/2,5/2$	34 427.8	
$3p^6(^1S)15d$	^2D	$3/2,5/2$	34 503.9	
$3p^6(^1S)16d$	^2D	$3/2,5/2$	34 566.5	
$3p^6(^1S)17d$	^2D	$3/2,5/2$	34 617.9	
$3p^6(^1S)18d$	^2D	$3/2,5/2$	34 661.0	
$3p^6(^1S)19d$	^2D	$3/2,5/2$	34 697.5	
$3p^6(^1S)20d$	^2D	$3/2,5/2$	34 728.4	
$3p^6(^1S)21d$	^2D	$3/2,5/2$	34 754.8	
$3p^6(^1S)22d$	^2D	$3/2,5/2$	34 778.0	
$3p^6(^1S)23d$	^2D	$3/2,5/2$	34 797.7	
$3p^6(^1S)24d$	^2D	$3/2,5/2$	34 815.9	
$3p^6(^1S)25d$	^2D	$3/2,5/2$	34 830	
$3p^6(^1S)26d$	^2D	$3/2,5/2$	34 844	
$3p^6(^1S)27d$	^2D	$3/2,5/2$	34 856	
$3p^6(^1S)28d$	^2D	$3/2,5/2$	34 866	
$3p^6(^1S)29d$	^2D	$3/2,5/2$	34 875	
$3p^6(^1S)30d$	^2D	$3/2,5/2$	34 884	
$3p^6(^1S)31d$	^2D	$3/2,5/2$	34 893	
$3p^6(^1S)32d$	^2D	$3/2,5/2$	34 899	
$3p^6(^1S)33d$	^2D	$3/2,5/2$	34 906	
$3p^6(^1S)34d$	^2D	$3/2,5/2$	34 913	
$3p^6(^1S)35d$	^2D	$3/2,5/2$	34 919	
$3p^6(^1S)36d$	^2D	$3/2,5/2$	34 924	
$3p^6(^1S)37d$	^2D	$3/2,5/2$	34 928	
$3p^6(^1S)38d$	^2D	$3/2,5/2$	34 933	
$3p^6(^1S)39d$	^2D	$3/2,5/2$	34 936	
K II ($^1S_0$)	*Limit*		**35 009.78**	
$3p^6(^1S)4f$	$^2F^\circ$	$5/2,7/2$	*28 127.85*	
$3p^6(^1S)5f$	$^2F^\circ$	$5/2,7/2$	*30 606.73*	
$3p^6(^1S)6f$	$^2F^\circ$	$5/2,7/2$	*31 953.17*	
$3p^6(^1S)7f$	$^2F^\circ$	$5/2,7/2$	*32 764.80*	
$3p^6(^1S)8f$	$^2F^\circ$	$5/2,7/2$	*33 291.40*	
$3p^6(^1S)9f$	$^2F^\circ$	$5/2,7/2$	*33 652.32*	
$3p^6(^1S)10f$	$^2F^\circ$	$5/2,7/2$	*33 910.42*	
$3p^6(^1S)11f$	$^2F^\circ$	$5/2,7/2$	*34 101.36*	
$3p^6(^1S)12f$	$^2F^\circ$	$5/2,7/2$	*34 246.37*	
$3p^6(^1S)13f$	$^2F^\circ$	$5/2,7/2$	*34 359.36*	
$3p^6(^1S)14f$	$^2F^\circ$	$5/2,7/2$	*34 448.98*	
K II ($^1S_0$)	*Limit*		**35 009.78**	
$3p^6(^1S)5g$	^2G	$7/2,9/2$	30 617.31	
K II ($^1S_0$)	*Limit*		**35 009.78**	
$3p^5\,4s^2$	$^2P^\circ$	$3/2$	*151 008*	
		$1/2$	*153 085*	
$3p^5\,3d(^3P^\circ)4s$	$^4P^\circ$	$1/2$	*159 367*	
		$3/2$	*159 678*	
$3p^5\,3d(^3P^\circ)4s$	$^2P^\circ$	$1/2$	*162 404*	
		$3/2$	*163 006*	

K I: Ordered by series—Continued

Configuration	Term	J	Level (cm^{-1})	g
$3p^5 3d(^3D^\circ)4s$	$^4D^\circ$	$3/2$	*172 623*	
		$1/2$	*172 800*	
$3p^5 3d(^1D^\circ)4s$	$^2D^\circ$	$3/2$	*173 043*	
$3p^5 3d(^3D^\circ)4s$	$^2D^\circ$	$3/2$	*179 886*	
$3p^5 3d(^1P^\circ)4s$	$^2P^\circ$	$1/2$	*180 551*	
		$3/2$	*180 791*	
$3p^5 4s(^3P^\circ)5s$	$^4P^\circ$	$3/2$	*180 850*	
		$1/2$	*181 517*	
$3p^5 4s(^3P^\circ)5s$	$^2P^\circ$	$3/2$	*182 152*	
$3p^5 3d(^3P^\circ)5s$	$^2P^\circ$	$1/2$	*183 322*	
		$3/2$	*183 532*	
$3p^5 4s(^1P^\circ)5s$	$^2P^\circ$	$3/2$	*184 342*	
		$1/2$	*185 153*	
$3p^5 4s(^1P^\circ)6s$	$^2P^\circ$	$1/2, 3/2$	*193 065*	
$3p^5 4s(^1P^\circ)7s$	$^2P^\circ$	$1/2, 3/2$	*196 319*	
$3p^5 4s(^1P^\circ)8s$	$^2P^\circ$	$1/2, 3/2$	*197 959*	
$3p^5 4s(^1P^\circ)9s$	$^2P^\circ$	$1/2, 3/2$	*198 911*	
$3p^5 4s(^1P^\circ)10s$	$^2P^\circ$	$1/2, 3/2$	*199 549*	
$3p^5 4s(^1P^\circ)11s$	$^2P^\circ$	$1/2, 3/2$	*199 980*	
$3p^5 4s(^1P^\circ)12s$	$^2P^\circ$	$1/2, 3/2$	*200 268*	
$3p^5 4s(^1P^\circ)13s$	$^2P^\circ$	$1/2, 3/2$	*200 493*	
$3p^5 4s(^1P^\circ)14s$	$^2P^\circ$	$1/2, 3/2$	*200 658*	
$3p^5 4s(^1P^\circ)15s$	$^2P^\circ$	$1/2, 3/2$	*200 780*	
$3p^5 4s(^1P^\circ)16s$	$^2P^\circ$	$1/2, 3/2$	*200 876*	
$3p^5 4s(^1P^\circ)17s$	$^2P^\circ$	$1/2, 3/2$	*200 955*	
$3p^5 4s(^1P^\circ)18s$	$^2P^\circ$	$1/2, 3/2$	*201 017*	
$3p^5 4s(^1P^\circ)19s$	$^2P^\circ$	$1/2, 3/2$	*201 074*	
$3p^5 4s(^1P^\circ)20s$	$^2P^\circ$	$1/2, 3/2$	*201 124*	
$3p^5 4s(^1P^\circ)21s$	$^2P^\circ$	$1/2, 3/2$	*201 152*	
K II ($^1P_1^\circ$)	***Limit***		**201 471.3**	
$3p^5 4d(^3D^\circ)4s$	$^4D^\circ$	$1/2, 3/2$	*185 153*	
$3p^5 4d(^1D^\circ)4s$	$^2D^\circ$	$3/2$	*186 656*	
$3p^5 4d(^3D^\circ)4s$	$^2D^\circ$	$3/2$	*187 806*	
$3p^5 4d(^1P^\circ)4s$	$^2P^\circ$	$1/2, 3/2$	*188 565*	
$3p^5 4s(^3P^\circ)5d$	$^4P^\circ$	$3/2$	*189 900*	
$3p^5 4s(^3P^\circ)5d$	$^2D^\circ$	$3/2$	*190 434*	
$3p^5 4s(^3P^\circ)5d$	$^2P^\circ$	$1/2$	*190 942*	
		$3/2$	*192 251*	
$3p^5 4s(^3P^\circ)5d$	$^4D^\circ$	$3/2$	*191 359*	
$3p^5 4s(^3P^\circ)5d$	$^4F^\circ$	$3/2$	*191 641*	

K I: Ordered by series—Continued

Configuration	Term	J	Level (cm^{-1})	g
$3p^5 4s(^3P^\circ)6d$	$^2D^\circ$	3/2	*193 122*	
$3p^5 4s(^3P^\circ)6d$	$^2P^\circ$	1/2	*193 244*	
		3/2	*194 275*	
$3p^5 4s(^1P^\circ)5d$	$^2D^\circ$	3/2	*193 749*	
$3p^5 4s(^1P^\circ)5d$	$^2P^\circ$	1/2	*193 948*	
		3/2	*194 068*	
$3p^5 4s(^1P^\circ)6d$	$^2P^\circ$	3/2	*196 362*	
		1/2	*196 718*	
$3p^5 4s(^1P^\circ)6d$	$^2D^\circ$	3/2	*196 826*	
$3p^5 4s(^1P^\circ)7d$	$^2P^\circ$	1/2,3/2	*197 959*	
$3p^5 4s(^1P^\circ)8d$	$^2P^\circ$	1/2,3/2	*198 911*	
$3p^5 4s(^1P^\circ)9d$	$^2P^\circ$	1/2,3/2	*199 549*	
$3p^5 4s(^1P^\circ)10d$	$^2P^\circ$	1/2,3/2	*199 980*	
$3p^5 4s(^1P^\circ)11d$	$^2P^\circ$	1/2,3/2	*200 268*	
$3p^5 4s(^1P^\circ)12d$	$^2P^\circ$	1/2,3/2	*200 493*	
$3p^5 4s(^1P^\circ)13d$	$^2P^\circ$	1/2,3/2	*200 658*	
$3p^5 4s(^1P^\circ)14d$	$^2P^\circ$	1/2,3/2	*200 780*	
$3p^5 4s(^1P^\circ)15d$	$^2P^\circ$	1/2,3/2	*200 876*	
$3p^5 4s(^1P^\circ)16d$	$^2P^\circ$	1/2,3/2	*200 955*	
$3p^5 4s(^1P^\circ)17d$	$^2P^\circ$	1/2,3/2	*201 017*	
$3p^5 4s(^1P^\circ)18d$	$^2P^\circ$	1/2,3/2	*201 074*	
$3p^5 4s(^1P^\circ)19d$	$^2P^\circ$	1/2,3/2	*201 124*	
$3p^5 4s(^1P^\circ)20d$	$^2P^\circ$	1/2,3/2	*201 152*	
K II ($^1P^\circ_1$)	***Limit***		201 471.3	

K II

$Z=19$

Ar I isoelectronic sequence

Ground state: $1s^22s^22p^63s^23p^6\ ^1\mathrm{S}_0$

Ionization energy: 255100 cm^{-1} (31.63 eV)

The early work of de Bruin (1926) and Bowen (1928) remains the only source of energy levels for this ion. The designations are those of Mansfield (1974), whose calculations show that *LS*-coupling is appropriate for all the known configurations except $3p^55s$. The percentage compositions are quoted from his paper.

The level at 223124.1 cm^{-1} has not been designated by Mansfield because he considered it to be a strong mixture of the $3p^53d$ and $3p^54d$ configurations for the $^1\mathrm{P}^{\circ}_1$ term. His calculation does not take this into account. The level $3p^54p\ ^1\mathrm{S}_0$ at 194776.1 cm^{-1} is questioned by Mansfield because it deviated from the calculated position by 977 cm^{-1} and is determined by only one line.

Semenov (1965) has measured the *g*-values quoted here. All but one, that for the level $3p^53d\ ^3\mathrm{F}^{\circ}_2$, agree with Mansfield's calculation.

A new analysis of this spectrum was reported in progress by Minnhagen (1971).

The ionization energy was derived from a semi-empirical treatment of the complete Fe period by Catalan and Rico (1958).

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K II

Configuration	Term	*J*	Level (cm^{-1})	*g*	Leading percentages		
$3p^6$	^{1}S	0	0				
$3p^5\,4s$	$^3\mathrm{P}^{\circ}$	2	*162 507.0*	1.48	92	8	$3d\ ^3\mathrm{P}^{\circ}$
		1	*163 237.0*	1.47	58	26	
		0	*165 149.5*		80	20	
$3p^5\,3d$	$^3\mathrm{P}^{\circ}$	0	*163 436.3*		80	20	$4s\ ^3\mathrm{P}^{\circ}$
		1	*164 496.1*	1.38	64	35	
		2	*164 932.3*	1.47	92	8	
$3p^5\,4s$	$^1\mathrm{P}^{\circ}$	1	*166 461.5*	1.07	83	10	$3d\ ^3\mathrm{P}^{\circ}$
$3p^5\,3d$	$^3\mathrm{F}^{\circ}$	3	*170 835.4*	1.09	99		
		2	*171 526.8*	1.36	99		
$3p^5\,4p$	^{3}S	1	183 208.4	1.96	98		
$3p^5\,4p$	^{3}D	3	186 388.5	1.35	100		
		2	186 685.6	1.11	74	16	^{3}P
		1	187 531.1	0.72	77	23	^{1}P
$3p^5\,4p$	^{1}D	2	188 154.4	1.19	52	24	^{3}P
$3p^5\,4p$	^{1}P	1	189 243.7	0.95	53	32	^{3}P
$3p^5\,4p$	^{3}P	2	189 661.7	1.31	60	38	^{1}D
		0	189 772.0		97		
		1	190 134.8	1.38	66	24	^{1}P
$3p^5\,4p$	^{1}S	0	194 776.1?		97		

K II—Continued

Configuration	Term	J	Level (cm^{-1})	g	Leading percentages		
$3p^5(^2P^\circ_{3/2})5s$	$^2[3/2]^\circ$	2	*212 575.5*	1.51	100		
		1	*212 992.9*	1.19	97		
$3p^5(^2P^\circ_{1/2})5s$	$^2[1/2]^\circ$	0	*214 727.0*		100		
		1	*215 018.8*	1.25	97		
$3p^5 4d$	$^3P^\circ$	1	*215 404.9*	1.44	97		
		2	*215 855.8*	1.46	89	11	$^3D^\circ$
$3p^5 4d$	$^3F^\circ$	2	*217 066.3*		64	36	$^1D^\circ$
$3p^5 4d$	$^3D^\circ$	3	*217 726.4*		66	26	$^1F^\circ$
		2	*219 196.2*		54	25	$^1D^\circ$
$3p^5 4d$?	$^1P^\circ$	1	*223 124.1*				
K III ($^2P^\circ_{3/2}$)	*Limit*		255 100				

K III

$Z=19$

Cl I isoelectronic sequence

Ground state: $1s^22s^22p^63s^23p^5\ ^2\mathrm{P}^\circ_{3/2}$

Ionization energy = 369 450 cm^{-1} (45.806 eV)

The initial work on the analysis of this spectrum was by Bowen (1928), who found the ground term splitting as well as the $3s3p^6\ ^2\mathrm{S}$ and $3p^4(^3\mathrm{P})4s\ ^2\mathrm{P}$ terms. The ground term interval given here is from Svensson (1971).

The analysis was extended by de Bruin (1929), who observed the $3p^44s$–$3p^44p$ transition array between 2500 and 3500 Å, and by Ram (1933) who found levels of the $3p^43d$, $4s$, and $5s$ configurations.

Edlén (1937) extended the analysis of $3p^44s$ and established the position of the $^4\mathrm{P}$ term. Tsien (1939) changed some of Ram's assignments and found two new levels in $3p^43d$. Finally $3p^4(^3\mathrm{P})3d\ ^2\mathrm{P}$ and $^2\mathrm{D}$ were established by Svensson and Ekberg (1968).

With the exception of the measurements of Bowen and of de Bruin, the levels below are based on the observations of Ekefors (1931).

The ionization energy was derived by Catalan and Rico (1958) from a treatment of data in the complete iron period.

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K III

Configuration	Term	J	Level (cm^{-1})
$3s^2\,3p^5$	$^2\mathrm{P}^\circ$	$3/2$	*0.0*
		$1/2$	*2 166.1*
$3s3p^6$	$^2\mathrm{S}$	$1/2$	130 610
$3s^2\,3p^4(^3\mathrm{P})3d$	$^2\mathrm{P}$	$1/2$	183 878
		$3/2$	185 276
$3s^2\,3p^4(^3\mathrm{P})3d$	$^2\mathrm{D}$	$3/2$	190 917
		$5/2$	192 082
$3s^2\,3p^4(^3\mathrm{P})3d$	$^2\mathrm{F}$	$5/2$	201 165
$3s^2\,3p^4(^3\mathrm{P})4s$	$^4\mathrm{P}$	$5/2$	207 421.9
		$3/2$	208 687.8
		$1/2$	209 461.3
$3s^2\,3p^4(^3\mathrm{P})4s$	$^2\mathrm{P}$	$3/2$	212 725.4
		$1/2$	214 232.3
$3s^2\,3p^4(^1\mathrm{D})4s$	$^2\mathrm{D}$	$5/2$	225 051
		$3/2$	225 084
$3s^2\,3p^4(^3\mathrm{P})4p$	$^4\mathrm{P}^\circ$	$5/2$	*237 512.0*
		$3/2$	*237 912.2*
		$1/2$	*238 455.1*
$3s^2\,3p^4(^3\mathrm{P})4p$	$^4\mathrm{D}^\circ$	$7/2$	*240 829.9*
		$5/2$	*241 443.5*
		$3/2$	*242 165.3*
		$1/2$	*242 526.7*
$3s^2\,3p^4(^1\mathrm{D})3d$	$^2\mathrm{P}$	$3/2$	241 042
		$1/2$	242 549
$3s^2\,3p^4(^1\mathrm{S})4s$	$^2\mathrm{S}$	$1/2$	241 667
$3s^2\,3p^4(^3\mathrm{P})4p$	$^2\mathrm{D}^\circ$	$5/2$	*243 120.6*
		$3/2$	*243 448.2*
$3s^2\,3p^4(^3\mathrm{P})4p$	$^2\mathrm{P}^\circ$	$3/2$	*243 947.4*
		$1/2$	*245 382.3*
$3s^2\,3p^4(^1\mathrm{D})3d$	$^2\mathrm{D}$	$5/2$	244 523
		$3/2$	246 010
$3s^2\,3p^4(^3\mathrm{P})4p$	$^4\mathrm{S}^\circ$	$3/2$	*246 625.6*
$3s^2\,3p^4(^1\mathrm{D})3d$	$^2\mathrm{S}$	$1/2$	250 858
$3s^2\,3p^4(^3\mathrm{P})5s$	$^2\mathrm{P}$	$3/2$	262 828
		$1/2$	263 770
$3s^2\,3p^4(^1\mathrm{D})5s$	$^2\mathrm{D}$	$5/2$	289 400
		$3/2$	289 519
$3s^2\,3p^4(^1\mathrm{S})3d$	$^2\mathrm{D}$	$5/2$	302 404
		$3/2$	303 902
K IV ($^3\mathrm{P}_2$)	***Limit***		**369 450**

K IV

$Z=19$

S I isoelectronic sequence

Ground state: $1s^22s^22p^63s^23p^4\ {}^3\mathrm{P}_2$

Ionization energy = 491 300 cm^{-1} (60.91 eV)

The analysis was initiated by Hopfield and Dieke (1926), who discovered the resonance triplet ($3s^23p^4$–$3s3p^5$). Smitt, Svensson and Outred (1976) remeasured this array and extended the analysis to include the present levels. Ram (1933), using the line-list of Ekefors (1931), reported the levels of $3p^33d$ and $4s$. His configuration assignments to $3d$ and $4s$ were interchanged by Bowen (1934), who also added seven new levels, including the $^3\mathrm{S}^\circ$ of $3p^35s$. Svensson and Ekberg (1968) confirmed the work of Bowen except for the substitution of a new level for $3p^3(^2\mathrm{D}^\circ)3d\ {}^1\mathrm{P}^\circ_1$ and added $3p^3$ parent state identifications to the designations. Tsien (1939), also working from the line-list of Ekefors, reported the $3p^3(^4\mathrm{S}^\circ)3d\ {}^3\mathrm{D}^\circ$ and $3p^3(^2\mathrm{D}^\circ)3d\ {}^3\mathrm{P}^\circ$ terms.

The ionization energy was determined by Edlén (1937).

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K IV

Configuration	Term	J	Level (cm^{-1})
$3s^2 3p^4$	$^3\mathrm{P}$	2	0.0
		1	1 671.4
		0	2 321.2
$3s^2 3p^4$	$^1\mathrm{D}$	2	16 384.1
$3s^2 3p^4$	$^1\mathrm{S}$	0	38 546.3
$3s3p^5$	$^3\mathrm{P}^\circ$	2	*134 181.8*
		1	*135 658.3*
		0	*136 453.0*
$3s3p^5$	$^1\mathrm{P}^\circ$	1	*171 139.5*
$3s^2 3p^3(^4\mathrm{S}^\circ)3d$	$^3\mathrm{D}^\circ$	3	*189 952*
		2	*191 203*
		1	*191 400*
$3s^2 3p^3(^2\mathrm{D}^\circ)3d$	$^1\mathrm{D}^\circ$	2	*216 387*
$3s^2 3p^3(^2\mathrm{D}^\circ)3d$	$^3\mathrm{P}^\circ$	2	*225 445*
		1	*226 082*
		0	*227 650*
$3s^2 3p^3(^2\mathrm{D}^\circ)3d$	$^1\mathrm{F}^\circ$	3	*242 475*
$3s^2 3p^3(^2\mathrm{D}^\circ)3d$	$^3\mathrm{S}^\circ$	1	*249 867*
$3s^2 3p^3(^2\mathrm{P}^\circ)3d$	$^3\mathrm{P}^\circ$	2	*256 032*
		1	*257 122*
		0	*257 809*
$3s^2 3p^3(^2\mathrm{D}^\circ)3d$	$^1\mathrm{P}^\circ$	1	*260 910*
$3s^2 3p^3(^2\mathrm{P}^\circ)3d$	$^3\mathrm{D}^\circ$	3	*261 623*
		2	*262 829*
		1	*263 658*
$3s^2 3p^3(^2\mathrm{P}^\circ)3d$	$^1\mathrm{D}^\circ$	2	*273 398*
$3s^2 3p^3(^2\mathrm{D}^\circ)4s$	$^3\mathrm{D}^\circ$	1	*277 792*
		2	*277 850*
		3	*277 986*
$3s^2 3p^3(^2\mathrm{P}^\circ)3d$	$^1\mathrm{F}^\circ$	3	*279 627*
$3s^2 3p^3(^2\mathrm{D}^\circ)4s$	$^1\mathrm{D}^\circ$	2	*282 371*
$3s^2 3p^3(^2\mathrm{P}^\circ)4s$	$^3\mathrm{P}^\circ$	0	*293 382*
		1	*293 471*
		2	*293 720*
$3s^2 3p^3(^2\mathrm{P}^\circ)4s$	$^1\mathrm{P}^\circ$	1	*298 132*
$3s^2 3p^3(^2\mathrm{P}^\circ)3d$	$^1\mathrm{P}^\circ$	1	*298 898*
$3s^2 3p^3(^4\mathrm{S}^\circ)5s$	$^3\mathrm{S}^\circ$	1	*367 888*
K V ($^4\mathrm{S}^\circ_{3/2}$)	*Limit*		**491 300**

K V

$Z=19$

P I isoelectronic sequence

Ground state: $1s^2 2s^2 2p^6 3s^2 3p^3\ {}^4S^\circ_{3/2}$

Ionization energy = 666 700 cm^{-1} (82.66 eV)

The analysis was begun by Ram (1933) with the classification of the $3s^2 3p^3$–$3s3p^4$ array from the measurements of Ekefors. Bowen (1934) supplemented these measurements and found many more terms of this spectrum, including the $^2P^\circ$ and $^2D^\circ$ of $3s^2 3p^3$, the ^2P of $3s3p^4$, and levels of $3s^2 3p^2 3d$ and $3s^2 3p^2 4s$. Tsien (1939) found the ^2S and ^2D of $3s3p^4$.

Bowen's (1955) measurements of nebular spectra provided him with the forbidden intra-configuration transition $^4S^\circ$—$^2D^\circ$ of $3s^2 3p^3$. This is the only observed connection between the doublets and quartets.

Using new laboratory measurements, Smitt, Svensson, and Outred (1976) have redetermined the level values for the $3s^2 3p^3$ and $3s3p^4$ configurations with an uncertainty of about ±2 cm^{-1}. We have combined these values with identifications given by Tsien (1939) and by Ekberg and Svensson (1970) of lines measured by Ekefors (1931), to derive new level values for the $3p^2 3d$ and $4s$ configurations. The uncertainty of these upper levels is about ±10 cm^{-1}. The $3p^2(^3P)3d\ {}^2F$ and ^2D terms of Tsien are rejected, as suggested by Martin (1959).

The ionization energy is from an extrapolation of Lotz (1967).

References

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K V

Configuration	Term	J	Level (cm^{-1})
$3s^2 3p^3$	$^4S^\circ$	3/2	*0.0*
$3s^2 3p^3$	$^2D^\circ$	3/2	*24 012.5*
		5/2	*24 249.6*
$3s^2 3p^3$	$^2P^\circ$	1/2	*39 758.1*
		3/2	*40 080.2*
$3s3p^4$	^4P	5/2	136 636.5
		3/2	138 037.5
		1/2	138 804.1
$3s3p^4$	^2D	3/2	169 579.5
		5/2	169 705.8
$3s3p^4$	^2P	3/2	194 805.1
		1/2	196 331.2
$3s3p^4$	^2S	1/2	205 799.9
$3s^2 3p^2(^3P)3d$	^4F	3/2	206 720
		5/2	207 165
$3s^2 3p^2(^3P)3d$	^4D	5/2	222 366
		3/2	222 711
$3s^2 3p^2(^3P)3d$	^4P	5/2	257 865
		3/2	259 276
		1/2	259 726
$3s^2 3p^2(^3P)3d$	^2P	3/2	259 218
		1/2	260 882
$3s^2 3p^2(^1D)3d$	^2D	5/2	280 585
		3/2	281 035
$3s^2 3p^2(^1D)3d$	^2P	3/2	290 236
		1/2	290 784
$3s^2 3p^2(^1D)3d$	^2F	5/2	292 497
		7/2	292 960
$3s^2 3p^2(^1D)3d$	^2S	1/2	292 987
$3s^2 3p^2(^1S)3d$	^2D	5/2	303 850
		3/2	304 476
$3s^2 3p^2(^3P)4s$	^4P	1/2	336 628
		3/2	337 645
		5/2	339 172
$3s^2 3p^2(^3P)4s$	^2P	1/2	343 740
		3/2	345 540
$3s^2 3p^2(^1D)4s$	^2D	5/2	357 012
		3/2	357 050
$3s^2 3p^2(^1S)4s$	^2S	1/2	380 994
K VI ($^3P_0$)	***Limit***		**666 700**

K VI

$Z=19$

Si I isoelectronic sequence

Ground state: $1s^2 2s^2 2p^6 3s^2 3p^2\ {}^3\mathrm{P}_0$

Ionization energy = 802 000 cm^{-1} (99.4 eV)

The early analysis in K VI was done by Ram (1933) and Whitford (1934), who found most of the triplets, and by Robinson (1937), who found two singlets. They all used the observations of Ekefors (1931).

The present level values for $3s^2 3p^2$ and $3s3p^3$ are taken from Smitt, Svensson, and Outred (1976). The values for the $3p3d$ and $3p4s$ configurations are derived from the measurements of Ekberg and Svensson (1970), between 374 and 726 Å. They have obtained the value for the ionization energy quoted here by extrapolation.

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Whitford, A. E. (1934), Phys. Rev. **46**, 793.

K VI

Configuration	Term	J	Level (cm^{-1})
$3s^2 3p^2$	^{3}P	0	0.0
		1	1 133.4
		2	2 927.2
$3s^2 3p^2$	^{1}D	2	18 977.8
$3s^2 3p^2$	^{1}S	0	43 358.8
$3s3p^3$	^{3}D°	1	*140 741.3*
		2	*140 795.4*
		3	*140 995.7*
$3s3p^3$	^{3}P°	0	*163 421.3*
		1	*163 435.0*
		2	*163 438*
$3s3p^3$	^{1}D°	2	*178 872.9*
$3s3p^3$	^{3}S°	1	*218 317.3*
$3s3p^3$	^{1}P°	1	*223 840.1*
$3s^2 3p3d$	^{3}P°	2	*252 327*
		1	*253 503*
		0	*254 037*
$3s^2 3p3d$	^{3}D°	1	*260 069*
		2	*260 503*
		3	*260 786*
$3s^2 3p3d$	^{1}F°	3	*285 687*
$3s^2 3p3d$	^{1}P°	1	*293 723*
$3s^2 3p4s$	^{3}P°	0	*387 423*
		1	*388 116*
		2	*390 496*
$3s^2 3p4s$	^{1}P°	1	*394 420*
K VII ($^2\mathrm{P}^{\circ}_{1/2}$)	*Limit*		802 000

K VII

$Z=19$

Al I isoelectronic sequence

Ground state: $1s^22s^22p^63s^23p\ ^2\mathrm{P}^\circ_{1/2}$

Ionization energy = 948 200±900 cm^{-1} (117.56±0.10 eV)

Using the wavelength measurements of Ekefors (1931), Whitford (1934) established the first known levels of the $3s^23p$, $3s3p^2$, $3p^3$, $3s^24s$, and $3s3p4s$ configurations. He found both doublet and quartet terms but no connection between them. The work was carried forward by Phillips (1939), who added levels of the configurations $3s^23d$, $3s^24d$, and $3s3p3d$ in both systems.

With new measurements between 397 and 673 Å, Ekberg and Svensson (1970) redetermined the energy levels and added the $3s3p3d\ ^4\mathrm{P}^\circ$ term as well as the $3s^2nf(n=4,5)$, $3s^2nd(n=5,6)$, and $3s^2ns(n=5,6)$ series members. Somewhat improved wavelength values for the transition array $3s^23p$–$3s3p^2$ were given by Smitt, Svensson, and Outred (1976). No connection has been observed between the doublets and quartets.

The doublet terms of $3s^23p$ and $3s3p^2$ in this compilation are from Smitt, Svensson, and Outred (1976). The uncertainty of their measurements is about 1 cm^{-1}. The remaining terms are derived from the measurements of Ekberg and Svensson. They have given an extrapolated value for the position of the quartets.

The ionization energy was derived by Ekberg and Svensson from the $nf\ ^2\mathrm{F}^\circ$ series. They estimated the error to be less than 1000 cm^{-1}.

References

Ekberg, J. O., and Svensson, L. A. (1970), Phys. Scr. **2**, 283.
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Phillips, L. W. (1939), Phys. Rev. **55**, 708.
Smitt, R., Svensson, L. A., and Outred, M. (1976), Phys. Scr. **13**, 293.
Whitford, A. E. (1934), Phys. Rev. **46**, 793.

K VII

Configuration	Term	J	Level (cm^{-1})
$3s^2 3p$	$^2\mathrm{P}^\circ$	1/2	*0.0*
		3/2	*3 134.0*
$3s3p^2$	$^4\mathrm{P}$	1/2	114 650+x
		3/2	115 786+x
		5/2	117 523+x
$3s3p^2$	$^2\mathrm{D}$	3/2	151 883.9
		5/2	152 051.7
$3s3p^2$	$^2\mathrm{S}$	1/2	193 084.5
$3s3p^2$	$^2\mathrm{P}$	1/2	206 502.9
		3/2	208 432.5
$3s^2 3d$	$^2\mathrm{D}$	3/2	250 663
		5/2	250 781
$3p^3$	$^4\mathrm{S}^\circ$	3/2	*307 777*+x
$3s3p3d$	$^4\mathrm{P}^\circ$	5/2	*362 492*+x
		3/2	*363 321*+x
$3s3p3d$	$^4\mathrm{D}^\circ$	1/2	*365 688*+x
		3/2	*366 101*+x
		5/2	*366 409*+x
		7/2	*366 556*+x
$3s^2 4s$	$^2\mathrm{S}$	1/2	439 322
$3s3p4s$	$^4\mathrm{P}^\circ$	1/2	*565 985*+x
		3/2	*567 062*+x
		5/2	*569 034*+x
$3s^2 4d$	$^2\mathrm{D}$	3/2	570 738
		5/2	570 922
$3s^2 4f$	$^2\mathrm{F}^\circ$	5/2	*608 532*
		7/2	*608 536*
$3s^2 5s$	$^2\mathrm{S}$	1/2	654 074
$3s^2 5d$	$^2\mathrm{D}$	3/2	716 949
		5/2	716 986
$3s^2 5f$	$^2\mathrm{F}^\circ$	5/2,7/2	*732 500*
$3s^2 6s$	$^2\mathrm{S}$	1/2	754 539
$3s^2 6d$	$^2\mathrm{D}$	3/2	789 578
		5/2	789 600
K VIII ($^1\mathrm{S}_0$)	*Limit*		948 200

K VIII

$Z=19$

Mg I isoelectronic sequence

Ground state: $1s^2 2s^2 2p^6 3s^2\ {}^1\mathrm{S}_0$

Ionization energy = 1 247 800 ± 1000 cm^{-1} (154.71 ± 0.12 eV)

The principal analysis is by Ekberg (1971), who lists 71 classified lines in the range of 91–927 Å. The wavelengths are from unpublished measurements of Bodén. Several of the classifications were made by earlier investigators. Fawcett (1970) classified 10 additional lines that provide the levels of the $3p3d$ configuration and the ^{1}D of $3p^2$. No experimental intersystem connection has been found; for the level $3s3p\ {}^3\mathrm{P}^{\circ}_1$ we use the value obtained by Ekberg by extrapolation.

The ionization energy was calculated by Ekberg from the first three members of the $3snf\ {}^3\mathrm{F}^{\circ}$ series ($n=4$, 5 and 6).

References

Ekberg, J. O. (1971), Phys. Scr. **4**, 101.
Fawcett, B. C. (1970), J. Phys. B **3**, 1732.

K VIII

Configuration	Term	J	Level (cm^{-1})
$3s^2$	^{1}S	0	0
$3s3p$	^{3}P°	0	*126 812*+x
		1	*127 924*+x
		2	*130 297*+x
$3s3p$	^{1}P°	1	*192 537*
$3p^2$	^{1}D	2	300 387
$3p^2$	^{3}P	0	303 515+x
		1	304 874+x
		2	307 451+x
$3p^2$	^{1}S	0	357 660
$3s3d$	^{3}D	1	366 822+x
		2	366 901+x
		3	367 032+x
$3s3d$	^{1}D	2	419 100
$3p3d$	^{3}F°	2	*502 500*+x
		3	*503 900*+x
		4	*505 700*+x
$3p3d$	^{1}D°	2	*510 990*
$3p3d$	^{3}P°	2	*534 040*+x
$3p3d$	^{3}D°	2	*537 260*+x
		3	*537 880*+x
$3p3d$	^{1}P°	1	*553 620*
$3s4s$	^{3}S	1	630 486+x
$3s4s$	^{1}S	0	644 451
$3s4p$	^{1}P°	1	*695 376*
$3s4d$	^{3}D	1	769 065+x
		2	769 121+x
		3	769 271+x
$3s4d$	^{1}D	2	773 844
$3p4s$	^{3}P°	0	*793 532*+x
		1	*794 439*+x
		2	*797 162*+x
$3s4f$	^{3}F°	2–4	*800 375*+x
$3s4f$	^{1}F°	3	*809 388*
$3p4p$	^{3}D	1	848 167+x
		2	849 189+x
		3	851 626+x
$3p4p$	^{3}P	0	854 679+x
		1	855 449+x
		2	857 241+x
$3p4p$	^{3}S	1	857 985+x
$3s5s$	^{3}S	1	883 774+x
$3s5s$	^{1}S	0	893 057
$3s5p$	^{1}P°	1	*912 975*
$3s5d$	^{1}D	2	947 117
$3s5d$	^{3}D	3	947 204+x
		2	947 233+x
		1	947 264+x
$3s5f$	^{3}F°	2–4	*962 505*+x
$3s5f$	^{1}F°	3	*966 616*

K viii—Continued

Configuration	Term	J	Level (cm^{-1})	Configuration	Term	J	Level (cm^{-1})
$3s6s$	$^{3}\mathrm{S}$	1	1 006 186+x	$3s6f$	$^{3}\mathrm{F}^{\circ}$	2–4	*1 050 169*+x
$3s6p$	$^{1}\mathrm{P}^{\circ}$	1	*1 022 558*	$3s7p$	$^{1}\mathrm{P}^{\circ}$	1	*1 097 914*
$3s6d$	$^{3}\mathrm{D}$	1	1 041 700+x	$3s7d$	$^{3}\mathrm{D}$	1–3	1 097 977+x
		2	1 041 733+x				
		3	1 041 791+x	$3s7f$	$^{3}\mathrm{F}^{\circ}$	2–4	*1 102 948*+x
				K ix ($^{2}\mathrm{S}_{1/2}$)	***Limit***		**1 247 800**

K IX

$Z=19$

Na I isoelectronic sequence

Ground state: $1s^22s^22p^63s\ ^2S_{1/2}$

Ionization energy-1 418 060±50 cm^{-1} (175.818±0.006 eV)

The early work on this spectrum has been revised and considerably extended on the basis of new measurements in the range of 75 Å to 640 Å by Edlén and Bodén (1976). They state that the experimental uncertainty of their wavelengths is ±0.005 Å. We have rounded off their values for the energy levels accordingly. They also give calculated level values and intervals which are probably more accurate than the observed values for series members above $n=5$.

The ionization energy was derived by Edlén and Bodén from the first four members of the nf series.

Reference

Edlén, B., and Bodén, E. (1976), Phys. Scr. **14**, 31.

K IX

Configuration	Term	J	Level (cm^{-1})
$2p^6(^1S)3s$	^2S	$1/2$	0
$2p^6(^1S)3p$	$^2P^\circ$	$1/2$	*157 152*
		$3/2$	*160 913*
$2p^6(^1S)3d$	^2D	$3/2$	374 867
		$5/2$	375 122
$2p^6(^1S)4s$	^2S	$1/2$	698 893
$2p^6(^1S)4p$	$^2P^\circ$	$1/2$	*758 262*
		$3/2$	*759 685*
$2p^6(^1S)4d$	^2D	$3/2$	836 869
		$5/2$	837 003
$2p^6(^1S)4f$	$^2F^\circ$	$5/2$	*860 849*
		$7/2$	*860 889*
$2p^6(^1S)5s$	^2S	$1/2$	982 977
$2p^6(^1S)5p$	$^2P^\circ$	$1/2$	*1 011 520*
		$3/2$	*1 012 210*
$2p^6(^1S)5d$	^2D	$3/2$	1 049 050
		$5/2$	1 049 130
$2p^6(^1S)5f$	$^2F^\circ$	$5/2$	*1 061 400*
		$7/2$	*1 061 410*
$2p^6(^1S)6s$	^2S	$1/2$	1 126 510
$2p^6(^1S)6p$	$^2P^\circ$	$1/2$	*1 142 410*
		$3/2$	*1 142 750*
$2p^6(^1S)6d$	^2D	$3/2$	1 163 250
		$5/2$	1 163 310
$2p^6(^1S)6f$	$^2F^\circ$	$5/2$	*1 170 430*
		$7/2$	*1 170 440*
$2p^6(^1S)7s$	^2S	$1/2$	1 209 140
$2p^6(^1S)7p$	$^2P^\circ$	$1/2,3/2$	*1 218 980*
$2p^6(^1S)7d$	^2D	$3/2$	1 231 620
		$5/2$	1 231 640
$2p^6(^1S)7f$	$^2F^\circ$	$5/2$	*1 236 130*
		$7/2$	*1 236 160*
$2p^6(^1S)8p$	$^2P^\circ$	$1/2,3/2$	*1 267 390*
$2p^6(^1S)8d$	^2D	$3/2$	1 275 770
		$5/2$	1 275 780
$2p^6(^1S)8f$	$^2F^\circ$	$5/2,7/2$	*1 278 770*
$2p^6(^1S)9p$	$^2P^\circ$	$1/2,3/2$	*1 300 170*
$2p^6(^1S)9d$	^2D	$3/2,5/2$	1 305 900
$2p^6(^1S)9f$	$^2F^\circ$	$5/2,7/2$	*1 308 000*
K X ($^1S_0$)	***Limit***		**1 418 060**

K X

$Z=19$

Ne I isoelectronic sequence

Ground state: $1s^2 2s^2 2p^6\ {}^1S_0$

Ionization energy$=4\ 063\ 000\pm5000$ cm^{-1} (503.8±0.6 eV)

Only resonance lines between 29 and 42 Å are classified in this rare-gas-type system of energy levels by Edlén and Tyrén (1936), who identified 11 transitions from upper $J=1$ levels to the ${}^1S_0$ ground state.

We use *jj*-coupling designations for the $2p^5ns$ levels and $j\ell$-coupling designations for the $2p^5nd$ levels.

We derived the ionization energy from the $2s^2 2p^5({}^2P^\circ_{3/2})nd\ {}^2[3/2]^\circ$ series for $n=3$ and 4, with the change in quantum defect, $n^*(3d)$-$n^*(4d)$, taken from Ti XIII. The value obtained by Lotz (1967) by extrapolation is in agreement with this result.

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K X

Configuration	Term	J	Level (cm^{-1})	Configuration	Term	J	Level (cm^{-1})
$2s^2 2p^6$	${}^1S$	0	0	$2s2p^6 3p$	${}^3P^\circ$	1	*3 219 400*
$2s^2 2p^5({}^2P^\circ_{3/2})3s$	$(3/2,1/2)^\circ$	1	*2 407 260*	$2s^2 2p^5({}^2P^\circ_{1/2})4s$	$(1/2,1/2)^\circ$	1	*3 232 400*
$2s^2 2p^5({}^2P^\circ_{1/2})3s$	$(1/2,1/2)^\circ$	1	*2 430 250*	$2s2p^6 3p$	${}^1P^\circ$	1	*3 237 600*
$2s^2 2p^5({}^2P^\circ_{3/2})3d$	${}^2[1/2]^\circ$	1	*2 760 200*	$2s^2 2p^5({}^2P^\circ_{3/2})4d$	${}^2[3/2]^\circ$	1	*3 356 400*
$2s^2 2p^5({}^2P^\circ_{3/2})3d$	${}^2[3/2]^\circ$	1	*2 794 900*	$2s^2 2p^5({}^2P^\circ_{1/2})4d$	${}^2[3/2]^\circ$	1	*3 379 700*
$2s^2 2p^5({}^2P^\circ_{1/2})3d$	${}^2[3/2]^\circ$	1	*2 832 300*	K XI (${}^2P^\circ_{3/2}$)	***Limit***		**4 064 300**
$2s^2 2p^5({}^2P^\circ_{3/2})4s$	$(3/2,1/2)^\circ$	1	*3 205 100*				

K XI

$Z=19$

F I isoelectronic sequence

Ground state: $1s^2 2s^2 2p^5\ {}^2\mathrm{P}^\circ_{3/2}$

Ionization energy = 4 555 000 cm^{-1} (564.7 eV)

The first work on this spectrum was by Edlén and Tyrén (1936), who classified 8 lines of the $2s^2 2p^5$—$2s^2 2p^4\ 3s$ and $3d$ transition arrays between 27 and 33 Å. This work was extended by Feldman, Doschek, Cowan, and Cohen (1973), from whose wavelengths, between 31 and 39 Å, the $3s$ and $3d$ levels are determined. Fawcett, Burgess, and Peacock (1967) identified the $2s^2 2p^5$—$2s2p^6$ resonance doublet at ~155 Å. The $^2\mathrm{P}^\circ$ ground state splitting was redetermined from new measurements of this doublet by Edlén and Bodén (1976) with an uncertainty of ±20 cm^{-1}.

The $2s2p^5 3s\ {}^2\mathrm{P}^\circ$ term is from Feldman et al. (1973).

The ionization energy was obtained by extrapolation by Lotz (1967).

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K XI

Configuration	Term	J	Level (cm^{-1})
$2s^2 2p^5$	$^2\mathrm{P}^\circ$	3/2 1/2	*0* *23 467*
$2s2p^6$	$^2\mathrm{S}$	1/2	655 918
$2s^2 2p^4(^3\mathrm{P})3s$	$^4\mathrm{P}$	5/2 3/2 1/2	2 640 500 2 653 000 2 662 600
$2s^2 2p^4(^3\mathrm{P})3s$	$^2\mathrm{P}$	3/2 1/2	2 671 500 2 685 600
$2s^2 2p^4(^1\mathrm{D})3s$	$^2\mathrm{D}$	5/2 3/2	2 727 800 2 728 500
$2s^2 2p^4(^1\mathrm{S})3s$	$^2\mathrm{S}$	1/2	2 811 800
$2s^2 2p^4(^3\mathrm{P})3d$	$^4\mathrm{P}$	1/2 3/2 5/2	3 018 000 3 022 300 3 029 200
$2s^2 2p^4(^3\mathrm{P})3d$	$^4\mathrm{F}$	5/2	3 020 500
$2s^2 2p^4(^3\mathrm{P})3d$	$^2\mathrm{P}$	1/2	3 027 800
$2s^2 2p^4(^3\mathrm{P})3d$	$^2\mathrm{F}$	5/2	3 034 300
$2s^2 2p^4(^3\mathrm{P})3d$	$^2\mathrm{D}$	3/2 5/2	3 034 400 3 048 000
$2s^2 2p^4(^1\mathrm{D})3d$	$^2\mathrm{S}$	1/2	3 094 300
$2s^2 2p^4(^1\mathrm{D})3d$	$^2\mathrm{F}$	5/2	3 098 100
$2s^2 2p^4(^1\mathrm{D})3d$	$^2\mathrm{D}$	5/2 3/2	3 107 700 3 115 400
$2s^2 2p^4(^1\mathrm{D})3d$	$^2\mathrm{P}$	3/2	3 107 900
$2s^2 2p^4(^1\mathrm{S})3d$	$^2\mathrm{D}$	5/2 3/2	3 176 300 3 179 100
$2s2p^5(^3\mathrm{P}^\circ)3s$	$^2\mathrm{P}^\circ$	3/2 1/2	*3 265 800* *3 279 800*
K XII ($^3\mathrm{P}_2$)	*Limit*		4 555 000

K XII

$Z=19$

O I isoelectronic sequence

Ground state: $1s^2 2s^2 2p^4$ $^3\mathrm{P}_2$

Ionization energy = 5 077 000 cm^{-1} (629.4 eV)

The observed spectrum of K XII consists of the strong transition array $2s^2 2p^4$—$2s2p^5$, which lies between 140 and 180 Å, and the arrays $2p^4$—$2p^3 3s$ at 34 Å and $2p^4$—$2p^3 3d$ at 30 Å. The $2s2p^5$ $^1\mathrm{P}^\circ_1$—$2p^6$ $^1\mathrm{S}_0$ line is at 183 Å.

The ground term $2p^4$ $^3\mathrm{P}$ and the configuration $2s2p^5$ are from the observations of Deutschman and House (1967). Since no intersystem transitions have been observed, we based the singlet system on Edlén's (1972) value for $2p^4$ $^1\mathrm{D}$ found by extrapolation. Its uncertainty is probably ±100 cm^{-1}. The $2p^4$ $^1\mathrm{S}_0$ term would be placed by the line identified by Fawcett, Burgess, and Peacock (1967) at 137 200 cm^{-1}, whereas the position calculated by Edlén is at 162 886 cm^{-1}. We omit this term from our compilation, since it seems to need further study.

The $2p^3 3s$ levels were determined from the observations of Doschek, Feldman, and Cohen (1973). The $2p^6$ $^1\mathrm{S}_0$ is from a line identified by Fawcett, Galanti, and Peacock (1974) in an isoelectronic sequence. The $2p^3 3d$ levels are due to Fawcett and Hayes (1975). Some revisions of the $2p^3 3d$ classifications were suggested by Bromage and Fawcett (1977) on the basis of new calculations. The six levels put in question are omitted pending further study.

The ionization energy was obtained by Lotz (1967) by extrapolation.

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K XII

Configuration	Term	J	Level (cm^{-1})
$2s^2 2p^4$	$^3\mathrm{P}$	2	0
		1	18 970
		0	23 260
$2s^2 2p^4$	$^1\mathrm{D}$	2	79 700+x
$2s2p^5$	$^3\mathrm{P}^\circ$	2	*573 400*
		1	*589 260*
		0	*598 440*
$2s2p^5$	$^1\mathrm{P}^\circ$	1	*789 680+x*
$2p^6$	$^1\mathrm{S}$	0	1 336 900+x
$2s^2 2p^3(^4\mathrm{S}^\circ)3s$	$^3\mathrm{S}^\circ$	1	*2 930 400*
$s^2 2p^3(^2\mathrm{D}^\circ)3s$	$^3\mathrm{D}^\circ$	1	*3 004 200*
		2	*3 005 400*
		3	*3 008 700*
$2s^2 2p^3(^2\mathrm{D}^\circ)3s$	$^1\mathrm{D}^\circ$	2	*3 024 600+x*
$2s^2 2p^3(^4\mathrm{S}^\circ)3d$	$^3\mathrm{D}^\circ$	2	*3 265 700*
		3	*3 271 100*
$2s^2 2p^3(^2\mathrm{D}^\circ)3d$	$^3\mathrm{D}^\circ$	1	*3 358 200*
		2	*3 361 100*
$2s^2 2p^3(^2\mathrm{D}^\circ)3d$	$^1\mathrm{D}^\circ$	2	*3 374 500+x*
$2s^2 2p^3(^2\mathrm{D}^\circ)3d$	$^3\mathrm{S}^\circ$	1	*3 383 100*
$2s^2 2p^3(^2\mathrm{D}^\circ)3d$	$^1\mathrm{F}^\circ$	3	*3 396 300+x*
$2s^2 2p^3(^2\mathrm{P}^\circ)3d$	$^3\mathrm{D}^\circ$	2	*3 427 100*
K XIII ($^4\mathrm{S}^\circ_{3/2}$)	*Limit*		5 077 000

K XIII

$Z=19$

N I isoelectronic sequence

Ground state: $1s^22s^22p^3\ ^4S^\circ_{3/2}$

Ionization energy = 5 764 000 cm^{-1} (714.6 eV)

The transition array $2s^22p^3$–$2s2p^4$ lies between 138 and 208 Å and has been observed by Fawcett, Burgess, and Peacock (1967), by Deutschman and House (1967), by Fawcett (1970), and most completely by Boiko, Voinov, Gribkov, and Sklizkov (1970). The levels are derived from Boiko et al. Since no intersystem transitions have been identified, we based the doublet system on Edlén's (1972) calculated value for $2s^22p^3\ ^2D^\circ_{3/2}$. Its uncertainty is probably ±100 cm^{-1}.

The $2p^23d$ terms are from Fawcett and Hayes (1975), who observed the spectrum at 28 Å. They also reported the $2s2p^4\ ^2D$–$2p^5\ ^2P^\circ$ transitions. Some revisions of the classifications involving $2p^23d$ were proposed by Bromage and Fawcett (1977) on the basis of new calculations. The levels put in question are omitted pending further study.

The ionization energy is from Lotz's (1967) extrapolation.

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K XIII

Configuration	Term	J	Level (cm^{-1})	Configuration	Term	J	Level (cm^{-1})
$2s^2\,2p^3$	$^4S^\circ$	3/2	*0*	$2s2p^4$	^2P	3/2	800 980+x
						1/2	822 120+x
$2s^2\,2p^3$	$^2D^\circ$	3/2	*100 100+x*				
		5/2	*105 380+x*	$2p^5$	$^2P^\circ$	3/2	*1 256 300+x*
						1/2	*1 281 300+x*
$2s^2\,2p^3$	$^2P^\circ$	1/2	*160 080+x*				
		3/2	*167 520+x*	$2s^2\,2p^2(^3P)3d$	^2P	3/2	3 620 800+x
$2s2p^4$	^4P	5/2	480 490	$2s^2\,2p^2(^3P)3d$	^4P	5/2	3 651 800
		3/2	496 330			3/2	3 658 000
		1/2	503 800				
				$2s^2\,2p^2(^3P)3d$	^2F	7/2	3 656 500+x
$2s2p^4$	^2D	3/2	661 420+x				
		5/2	662 610+x	$2s^2\,2p^2(^1D)3d$	^2F	7/2	3 730 400+x
$2s2p^4$	^2S	1/2	769 250+x	$2s^2\,2p^2(^1D)3d$	^2P	3/2	3 750 000+x
				K XIV ($^3P_0$)	*Limit*		5 764 000

K XIV

$Z=19$

C I isoelectronic sequence

Ground state: $1s^2 2s^2 2p^2\ {}^3P_0$

Ionization energy$=$6 345 000 cm^{-1} (786.6 eV)

Lines of the transition array $2s^2 2p^2$—$2s2p^3$ were identified by Boiko, Voinov, Gribkov, and Sklizkov (1970) in a laser-produced plasma between 147 and 175 Å. A more extensive analysis of this array was obtained by Fawcett and Hayes (1975) using a similar light source. The latter group also reported the $2s2p^3\ {}^3D°$–$2p^4\ {}^3P$ multiplet and transitions between $2s^2 2p^2$ and $2s^2 2p3d$. All the levels are derived from their measurements. Several additional tentative identifications based on a new calculation are given by Bromage and Fawcett (1977).

No intersystem combinations have been identified. Edlén (1972) has estimated the value for $2p^2\ {}^1D_2$ to be 95 908 cm^{-1}. We used that value as the reference value for the singlet system.

The ionization energy was derived by Lotz (1967) by extrapolation.

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K XIV

Configuration	Term	J	Level (cm^{-1})
$2s^2 2p^2$	^3P	0	0
		1	13 200
		2	28 100
$2s^2 2p^2$	^1D	2	95 900$+x$
$2s^2 2p^2$	^1S	0	178 900$+x$
$2s2p^3$	$^3P°$	2	*539 900*
$2s2p^3$	$^1D°$	2	*676 400*$+x$
$2s2p^3$	$^3S°$	1	*677 700*
$2s2p^3$	$^1P°$	1	*755 200*$+x$
$2p^4$	^1D	2	1 109 300$+x$
$2s^2 2p3d$	$^3D°$	2	*3 901 000*
		3	*3 911 600*
$2s^2 2p3d$	$^3P°$	2	*3 919 200*
$2s^2 2p3d$	$^1F°$	3	*3 955 600*$+x$
K XV ($^2P°_{1/2}$)	*Limit*		**6 345 000**

K XV

$Z=19$

B I isoelectronic sequence

Ground state: $1s^2 2s^2 2p\ ^2\mathrm{P}^\circ_{1/2}$

Ionization energy = 6 945 000 cm^{-1} (861.1 eV)

The analysis is from Fawcett and Hayes (1975), who observed the $2s^2 2p$–$2s2p^2$ transition array at 180 Å and lines from the $2s^2 3d$, $2s2p3p$ and $2s2p3d$ configurations near 24 Å. The uncertainty of the high levels is about ±2000 cm^{-1}.

The quartets are based on an extrapolated position for $2s2p^2\ ^4\mathrm{P}_{5/2}$ from Ti XVIII and Ca XVI.

The ionization energy is from the extrapolation of Lotz (1967).

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K XV

Configuration	Term	J	Level (cm^{-1})	Configuration	Term	J	Level (cm^{-1})
$2s^2 2p$	$^2\mathrm{P}^\circ$	½	*0*	$2s^2 3d$	$^2\mathrm{D}$	3/2	4 132 000
		3/2	*29 010*			5/2	4 140 000
$2s2p^2$	$^4\mathrm{P}$	½	246 020+x	$2s2p(^3\mathrm{P}^\circ)3p$	$^2\mathrm{P}$	½	4 239 000
		3/2	257 250+x			3/2	4 260 000
		5/2	271 900+x				
				$2s2p(^3\mathrm{P}^\circ)3p$	$^2\mathrm{D}$	3/2	4 320 000
$2s2p^2$	$^2\mathrm{S}$	½	552 850			5/2	4 343 000
$2s2p^2$	$^2\mathrm{P}$	½	588 270	$2s2p(^3\mathrm{P}^\circ)3d$	$^4\mathrm{D}^\circ$	7/2	*4 404 000*+x
		3/2	599 100				
				$2s2p(^3\mathrm{P}^\circ)3d$	$^4\mathrm{P}^\circ$	5/2	*4 416 000*+x
$2p^3$	$^4\mathrm{S}^\circ$	3/2	*773 030*+x				
				$2s2p(^1\mathrm{P}^\circ)3d$	$^2\mathrm{D}^\circ$	5/2	*4 636 000*
				K XVI ($^1\mathrm{S}_0$)	***Limit***		**6 945 000**

K XVI

$Z=19$

Be I isoelectronic sequence

Ground state: $1s^2 2s^2\ {}^1S_0$

Ionization energy = 7 810 000 cm^{-1} (968 eV)

Fawcett and Hayes (1975) have provided the only spectral identifications for this ion. They observed the resonance line ${}^1S_0$–${}^1P^\circ_1$ at 206 Å and a group of transitions between 21 and 24 Å. They did not report any intersystem combinations; we used the value for $2s2p\ {}^3P^\circ_2$ calculated by Fawcett (1975) to locate the triplet system relative to the ground level.

The ionization energy was derived by Lotz (1967) by extrapolation.

Classifications of lines in the $2p^2$—$2p3d$ array were given by Fawcett and Hayes, but they are not connected to the present system of levels.

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K XVI

Configuration	Term	J	Level (cm^{-1})	Configuration	Term	J	Level (cm^{-1})
$2s^2$	${}^1S$	0	0	$2s3d$	${}^3D$	3	4 637 000+x
$2s2p$	${}^3P^\circ$	2	*274 200+x*	$2s3d$	${}^1D$	2	4 679 000
$2s2p$	${}^1P^\circ$	1	*484 800*	$2p3p$	${}^3D$	3	4 875 000+x
$2s3p$	${}^1P^\circ$	1	*4 564 000*	K XVII (${}^2S_{1/2}$)	*Limit*		7 810 000

K XVII

$Z=19$

Li I isoelectronic sequence

Ground state: $1s^2 2s\ ^2S_{1/2}$

Ionization energy $=8\ 344\ 000\pm1000$ cm^{-1} (1033.4±0.1 eV)

The $2p$–$3d$ transition was reported by Goldsmith, Feldman, Oren, and Cohen (1972). The value of the $2p\ ^2P^\circ$ term is from the $2s$–$2p$ transitions observed at 326 and 365 Å in a solar flare by Widing and Purcell (1976). They note, however, that the intensity ratio of the two lines is much too great.

Boiko, Faenov, and Pikuz (1978) identified the $4p$, $4d$, and $5d$ terms. The doubly excited levels were obtained from lines classified by Aglitskii, Boiko, Zakharov, Pikuz, and Faenov (1974) at 3.5 Å in a laser-produced plasma.

The ionization energy is from Edlén (1979).

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K XVII

Configuration	Term	J	Level (cm^{-1})	Configuration	Term	J	Level (cm^{-1})
$1s^2 2s$	^2S	1/2	0	K XVIII ($^1S_0$)	***Limit***		**8 344 000**
$1s^2 2p$	$^2P^\circ$	1/2	*273 500?*	$1s(^2S)2s2p(^3P^\circ)$	$^4P^\circ$		*27 871 000*
		3/2	*306 000?*				
				$1s(^2S)2s2p(^3P^\circ)$	$^2P^\circ$	1/2	*28 079 000*
$1s^2 3d$	^2D	3/2	4 814 800				
		5/2	4 818 000	$1s2p^2$	^4P		28 160 000
$1s^2 4p$	$^2P^\circ$	1/2,3/2	*6 347 200*	$1s(^2S)2s2p(^1P^\circ)$	$^2P^\circ$	1/2,3/2	*28 182 000*
$1s^2 4d$	^2D	3/2	6 361 000	$1s2p^2$	^2D	3/2	28 318 000
		5/2	6 367 700			5/2	28 321 000
$1s^2 5d$	^2D	3/2	7 069 300	$1s2p^2$	^2P	3/2	28 385 000
		5/2	7 073 700				
				$1s2p^2$	^2S	1/2	28 511 000

K XVIII

$Z=19$

He I isoelectronic sequence

Ground state: $1s^2\ ^1S_0$

Ionization energy = 37 190 400 ± 200 cm^{-1} (4611.06 ± 0.03 eV)

The theoretical values calculated by Ermolaev and Jones (1974) for the singlet and triplet S and P terms of this two-electron ion are expected to be more accurate than the observed values, and we have quoted them up to $n=5$. The uncertainty of the ionization energy and level values was estimated to be of the order of ±40 cm^{-1}, but this should probably be increased to several hundred cm^{-1}. For comparison, the $1s^2$–$1s2p$ transition of this ion has been observed by Aglitskii et al. (1974) in a laser-produced plasma. They place $1s2p\ ^3P_1^\circ$ at 28 182 000 cm^{-1} and $1s2p\ ^1P_1^\circ$ at 28 321 000 cm^{-1}.

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K XVIII

Configuration	Term	J	Level (cm^{-1})	Configuration	Term	J	Level (cm^{-1})
$1s^2$	^{1}S	0	0	$1s4s$	^{3}S	1	34 931 960
$1s2s$	^{3}S	1	28 007 500	$1s4p$	^{3}P°	0	*34 950 370*
						1	*34 951 150*
$1s2p$	^{3}P°	0	*28 168 470*			2	*34 954 690*
		1	*28 174 820*				
		2	*28 202 850*	$1s4s$	^{1}S	0	34 950 670
$1s2s$	^{1}S	0	28 182 370	$1s4p$	^{1}P°	1	*34 967 170*
$1s2p$	^{1}P°	1	*28 315 640*	$1s5s$	^{3}S	1	35 749 610
$1s3s$	^{3}S	1	33 154 180	$1s5p$	^{3}P°	0	*35 758 920*
						1	*35 759 320*
$1s3p$	^{3}P°	0	*33 198 570*			2	*35 761 130*
		1	*33 200 410*				
		2	*33 208 810*	$1s5s$	^{1}S	0	35 758 960
$1s3s$	^{1}S	0	33 200 340	$1s5p$	^{1}P°	1	*35 767 440*
$1s3p$	^{1}P°	1	*33 239 390*	K XIX ($^2S_{1/2}$)	*Limit*		**37 190 400**

K XIX

$Z=19$

H I isoelectronic sequence

Ground state: 1*s* $^2S_{1/2}$

Ionization energy = 39 795 600 ± 200 cm^{-1} (4934.07 ± 0.03 eV)

No observations of this spectrum are reported. Erickson (1977) has calculated the absolute binding energies for each of the states through $n=13$. We have compiled the relative energy levels from this calculation. The levels have a greater accuracy, relative to each other, than that reported for the absolute energies. The levels are therefore given to ±10 cm^{-1}.

Reference

Erickson, G. W. (1977), J. Phys. Chem. Ref. Data **6**, 831.

K XIX

Configuration	Term	J	Level (cm^{-1})
1*s*	^{2}S	1/2	0
2*p*	^{2}P°	1/2	*29 831 830*
		3/2	*29 880 110*
2*s*	^{2}S	1/2	29 833 400
3*p*	^{2}P°	1/2	*35 372 650*
		3/2	*35 386 960*
3*s*	^{2}S	1/2	35 373 120
3*d*	^{2}D	3/2	35 386 930
		5/2	35 391 660
4*p*	^{2}P°	1/2	*37 309 960*
		3/2	*37 316 000*
4*s*	^{2}S	1/2	37 310 160
4*d*	^{2}D	3/2	37 315 990
		5/2	37 317 980
4*f*	^{2}F°	5/2	*37 317 980*
		7/2	*37 318 970*
5*p*	^{2}P°	1/2	*38 205 820*
		3/2	*38 208 910*
5*s*	^{2}S	1/2	38 205 930
5*d*	^{2}D	3/2	38 208 910
		5/2	38 209 930
5*f*	^{2}F°	5/2	*38 209 930*
		7/2	*38 210 440*
5*g*	^{2}G	7/2	38 210 440
		9/2	38 210 740
	Limit		**39 795 600**