8. ELECTRONIC STRUCTURE OF THE ELEMENTS

Table 8.1. Reviewed 1993 by W.C. Martin, NIST. The electronic configurations and ionization energies here are taken from the *CRC Handbook of Chemistry and Physics*, 74th Edition, ed. D.R. Lide (CRC Press, Boca Raton, FL, 1993). The electron configuration for, say, iron indicates an argon electronic core (see argon) plus six $3d$ electrons and two $4s$ electrons. The ionization energy is the least energy necessary to remove to infinity one electron from an *atom* of the element.

	Element		Electron configuration ($3d^5$ = five $3d$ electrons, *etc.*)		Ground state $^{2S+1}L_J$	Ionization energy (eV)
1	H	Hydrogen	$1s$		$^2S_{1/2}$	13.5984
2	He	Helium	$1s^2$		$^1S_0$	24.5874
3	Li	Lithium	(He) $2s$		$^2S_{1/2}$	5.3917
4	Be	Beryllium	(He) $2s^2$		$^1S_0$	9.3226
5	B	Boron	(He) $2s^2\ 2p$		$^2P_{1/2}$	8.2980
6	C	Carbon	(He) $2s^2\ 2p^2$		$^3P_0$	11.2603
7	N	Nitrogen	(He) $2s^2\ 2p^3$		$^4S_{3/2}$	14.5341
8	O	Oxygen	(He) $2s^2\ 2p^4$		$^3P_2$	13.6181
9	F	Fluorine	(He) $2s^2\ 2p^5$		$^2P_{3/2}$	17.4228
10	Ne	Neon	(He) $2s^2\ 2p^6$		$^1S_0$	21.5645
11	Na	Sodium	(Ne) $3s$		$^2S_{1/2}$	5.1391
12	Mg	Magnesium	(Ne) $3s^2$		$^1S_0$	7.6462
13	Al	Aluminum	(Ne) $3s^2\ 3p$		$^2P_{1/2}$	5.9858
14	Si	Silicon	(Ne) $3s^2\ 3p^2$		$^3P_0$	8.1517
15	P	Phosphorus	(Ne) $3s^2\ 3p^3$		$^4S_{3/2}$	10.4867
16	S	Sulfur	(Ne) $3s^2\ 3p^4$		$^3P_2$	10.3600
17	Cl	Chlorine	(Ne) $3s^2\ 3p^5$		$^2P_{3/2}$	12.9676
18	Ar	Argon	(Ne) $3s^2\ 3p^6$		$^1S_0$	15.7596
19	K	Potassium	(Ar) $4s$		$^2S_{1/2}$	4.3407
20	Ca	Calcium	(Ar) $4s^2$		$^1S_0$	6.1132
21	Sc	Scandium	(Ar) $3d\ 4s^2$	Transition elements	$^2D_{3/2}$	6.5614
22	Ti	Titanium	(Ar) $3d^2\ 4s^2$		$^3F_2$	6.8282
23	V	Vanadium	(Ar) $3d^3\ 4s^2$		$^4F_{3/2}$	6.7463
24	Cr	Chromium	(Ar) $3d^5\ 4s$		$^7S_3$	6.7666
25	Mn	Manganese	(Ar) $3d^5\ 4s^2$		$^6S_{5/2}$	7.4340
26	Fe	Iron	(Ar) $3d^6\ 4s^2$		$^5D_4$	7.9024
27	Co	Cobalt	(Ar) $3d^7\ 4s^2$		$^4F_{9/2}$	7.8810
28	Ni	Nickel	(Ar) $3d^8\ 4s^2$		$^3F_4$	7.6398
29	Cu	Copper	(Ar) $3d^{10}\,4s$		$^2S_{1/2}$	7.7264
30	Zn	Zinc	(Ar) $3d^{10}\,4s^2$		$^1S_0$	9.3941
31	Ga	Gallium	(Ar) $3d^{10}\,4s^2\ 4p$		$^2P_{1/2}$	5.9993
32	Ge	Germanium	(Ar) $3d^{10}\,4s^2\ 4p^2$		$^3P_0$	7.900
33	As	Arsenic	(Ar) $3d^{10}\,4s^2\ 4p^3$		$^4S_{3/2}$	9.8152
34	Se	Selenium	(Ar) $3d^{10}\,4s^2\ 4p^4$		$^3P_2$	9.7524
35	Br	Bromine	(Ar) $3d^{10}\,4s^2\ 4p^5$		$^2P_{3/2}$	11.8138
36	Kr	Krypton	(Ar) $3d^{10}\,4s^2\ 4p^6$		$^1S_0$	13.9996
37	Rb	Rubidium	(Kr) $5s$		$^2S_{1/2}$	4.1771
38	Sr	Strontium	(Kr) $5s^2$		$^1S_0$	5.6948
39	Y	Yttrium	(Kr) $4d\ 5s^2$	Transition elements	$^2D_{3/2}$	6.217
40	Zr	Zirconium	(Kr) $4d^2\ 5s^2$		$^3F_2$	6.6339
41	Nb	Niobium	(Kr) $4d^4\ 5s$		$^6D_{1/2}$	6.7589
42	Mo	Molybdenum	(Kr) $4d^5\ 5s$		$^7S_3$	7.0924
43	Tc	Technetium	(Kr) $4d^5\ 5s^2$		$^6S_{5/2}$	7.28
44	Ru	Ruthenium	(Kr) $4d^7\ 5s$		$^5F_5$	7.3605
45	Rh	Rhodium	(Kr) $4d^8\ 5s$		$^4F_{9/2}$	7.4589
46	Pd	Palladium	(Kr) $4d^{10}$		$^1S_0$	8.3369
47	Ag	Silver	(Kr) $4d^{10}\,5s$		$^2S_{1/2}$	7.5762
48	Cd	Cadmium	(Kr) $4d^{10}\,5s^2$		$^1S_0$	8.9937