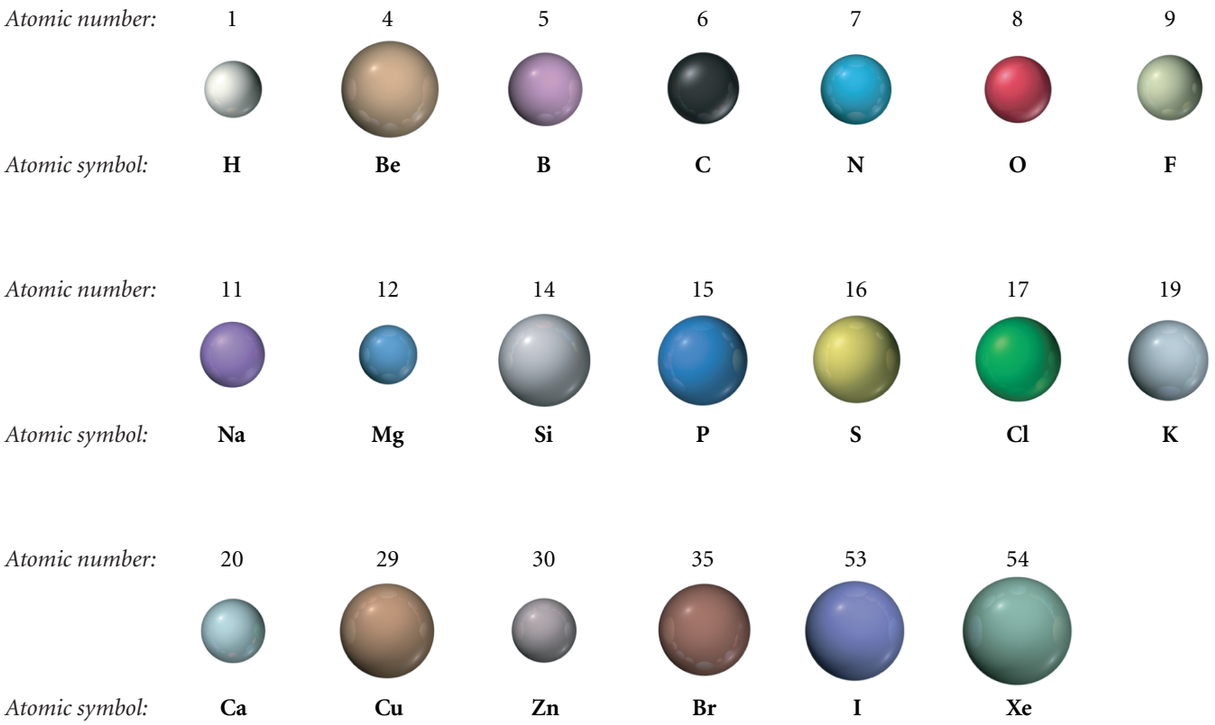
Appendix II: Useful Data

A. Atomic Colors



B. Standard Thermodynamic Quantities for Selected Substances at 25 °C

Substance	ΔH_f° (kJ/mol)	ΔG_f° (kJ/mol)	S° (J/mol · K)
Aluminum			
$Al(s)$	0	0	28.32
$Al(g)$	330.0	289.4	164.6
$Al^{3+}(aq)$	−538.4	−483	−325
$AlCl_3(s)$	−704.2	−628.8	109.3
$Al_2O_3(s)$	−1675.7	−1582.3	50.9
Barium			
$Ba(s)$	0	0	62.5
$Ba(g)$	180.0	146.0	170.2
$Ba^{2+}(aq)$	−537.6	−560.8	9.6
$BaCO_3(s)$	−1213.0	−1134.4	112.1
$BaCl_2(s)$	−855.0	−806.7	123.7
$BaO(s)$	−548.0	−520.3	72.1
$Ba(OH)_2(s)$	−944.7		
$BaSO_4(s)$	−1473.2	−1362.2	132.2
Beryllium			
$Be(s)$	0	0	9.5
$BeO(s)$	−609.4	−580.1	13.8
$Be(OH)_2(s)$	−902.5	−815.0	45.5
Bismuth			
$Bi(s)$	0	0	56.7
$BiCl_3(s)$	−379.1	−315.0	177.0
$Bi_2O_3(s)$	−573.9	−493.7	151.5
$Bi_2S_3(s)$	−143.1	−140.6	200.4
Boron			
$B(s)$	0	0	5.9
$B(g)$	565.0	521.0	153.4

(*continued on the next page*)

Substance	ΔH_f° (kJ/mol)	ΔG_f° (kJ/mol)	S° (J/mol · K)
$BCl_3(g)$	−403.8	−388.7	290.1
$BF_3(g)$	−1136.0	−1119.4	254.4
$B_2H_6(g)$	36.4	87.6	232.1
$B_2O_3(s)$	−1273.5	−1194.3	54.0
$H_3BO_3(s)$	−1094.3	−968.9	90.0
Bromine			
$Br(g)$	111.9	82.4	175.0
$Br_2(l)$	0	0	152.2
$Br_2(g)$	30.9	3.1	245.5
$Br^-(aq)$	−121.4	−102.8	80.71
$HBr(g)$	−36.3	−53.4	198.7
Cadmium			
$Cd(s)$	0	0	51.8
$Cd(g)$	111.8	77.3	167.7
$Cd^{2+}(aq)$	−75.9	−77.6	−73.2
$CdCl_2(s)$	−391.5	−343.9	115.3
$CdO(s)$	−258.4	−228.7	54.8
$CdS(s)$	−161.9	−156.5	64.9
$CdSO_4(s)$	−933.3	−822.7	123.0
Calcium			
$Ca(s)$	0	0	41.6
$Ca(g)$	177.8	144.0	154.9
$Ca^{2+}(aq)$	−542.8	−553.6	−53.1
$CaC_2(s)$	−59.8	−64.9	70.0
$CaCO_3(s)$	−1207.6	−1129.1	91.7
$CaCl_2(s)$	−795.4	−748.8	108.4
$CaF_2(s)$	−1228.0	−1175.6	68.5
$CaH_2(s)$	−181.5	−142.5	41.4
$Ca(NO_3)_2(s)$	−938.2	−742.8	193.2
$CaO(s)$	−634.9	−603.3	38.1
$Ca(OH)_2(s)$	−985.2	−897.5	83.4
$CaSO_4(s)$	−1434.5	−1322.0	106.5
$Ca_3(PO_4)_2(s)$	−4120.8	−3884.7	236.0
Carbon			
$C(s, \text{graphite})$	0	0	5.7
$C(s, \text{diamond})$	1.88	2.9	2.4
$C(g)$	716.7	671.3	158.1
$CH_4(g)$	−74.6	−50.5	186.3
$CH_3Cl(g)$	−81.9	−60.2	234.6
$CH_2Cl_2(g)$	−95.4		270.2
$CH_2Cl_2(l)$	−124.2	−63.2	177.8
$CHCl_3(l)$	−134.1	−73.7	201.7
$CCl_4(g)$	−95.7	−62.3	309.7
$CCl_4(l)$	−128.2	−66.4	216.4
$CH_2O(g)$	−108.6	−102.5	218.8
$CH_2O_2(\text{l, formic acid})$	−425.0	−361.4	129.0
$CH_3NH_2(\text{g, methylamine})$	−22.5	32.7	242.9
$CH_3OH(l)$	−238.6	−166.6	126.8
$CH_3OH(g)$	−201.0	−162.3	239.9
$C_2H_2(g)$	227.4	209.9	200.9
$C_2H_4(g)$	52.4	68.4	219.3
$C_2H_6(g)$	−84.68	−32.0	229.2
$C_2H_5OH(l)$	−277.6	−174.8	160.7
$C_2H_5OH(g)$	−234.8	−167.9	281.6
$C_2H_3Cl(\text{g, vinyl chloride})$	37.2	53.6	264.0
$C_2H_4Cl_2(l, \text{dichloroethane})$	−166.8	−79.6	208.5
$C_2H_4O(\text{g, acetaldehyde})$	−166.2	−133.0	263.8
$C_2H_4O_2(l, \text{acetic acid})$	−484.3	−389.9	159.8
$C_3H_8(g)$	−103.85	−23.4	270.3
$C_3H_6O(l, \text{acetone})$	−248.4	−155.6	199.8
$C_3H_7OH(l, \text{isopropanol})$	−318.1		181.1
$C_4H_{10}(l)$	−147.3	−15.0	231.0
$C_4H_{10}(g)$	−125.7	−15.71	310.0
$C_6H_6(l)$	49.1	124.5	173.4
$C_6H_5NH_2(l, \text{aniline})$	31.6	149.2	191.9
$C_6H_5OH(s, \text{phenol})$	−165.1	−50.4	144.0
$C_6H_{12}O_6(s, \text{glucose})$	−1273.3	−910.4	212.1
$C_{10}H_8(s, \text{naphthalene})$	78.5	201.6	167.4
$C_{12}H_{22}O_{11}(s, \text{sucrose})$	−2226.1	−1544.3	360.24
$CO(g)$	−110.5	−137.2	197.7
$CO_2(g)$	−393.5	−394.4	213.8
$CO_2(aq)$	−413.8	−386.0	117.6
$CO_3^{2-}(aq)$	−677.1	−527.8	−56.9
$HCO_3^-(aq)$	−692.0	−586.8	91.2
$H_2CO_3(aq)$	−699.7	−623.2	187.4
$CN^-(aq)$	151	166	118
$HCN(l)$	108.9	125.0	112.8
$HCN(g)$	135.1	124.7	201.8
$CS_2(l)$	89.0	64.6	151.3
$CS_2(g)$	116.7	67.1	237.8
$COCl_2(g)$	−219.1	−204.9	283.5
$C_{60}(s)$	2327.0	2302.0	426.0
Cesium			
$Cs(s)$	0	0	85.2
$Cs(g)$	76.5	49.6	175.6
$Cs^+(aq)$	−258.0	−292.0	132.1
$CsBr(s)$	−400	−387	117
$CsCl(s)$	−438	−414	101.2
$CsF(s)$	−553.5	−525.5	92.8
$CsI(s)$	−342	−337	127
Chlorine			
$Cl(g)$	121.3	105.3	165.2
$Cl_2(g)$	0	0	223.1
$Cl^-(aq)$	−167.1	−131.2	56.6
$HCl(g)$	−92.3	−95.3	186.9
$HCl(aq)$	−167.2	−131.2	56.5
$ClO_2(g)$	102.5	120.5	256.8
$Cl_2O(g)$	80.3	97.9	266.2
Chromium			
$Cr(s)$	0	0	23.8
$Cr(g)$	396.6	351.8	174.5
$Cr^{3+}(aq)$	−1971		

Substance	ΔH_f° (kJ/mol)	ΔG_f° (kJ/mol)	S° (J/mol · K)
$CrO_4^{2-}(aq)$	−872.2	−717.1	44
$Cr_2O_3(s)$	−1139.7	−1058.1	81.2
$Cr_2O_7^{2-}(aq)$	−1476	−1279	238
Cobalt			
$Co(s)$	0	0	30.0
$Co(g)$	424.7	380.3	179.5
$CoO(s)$	−237.9	−214.2	53.0
$Co(OH)_2(s)$	−539.7	−454.3	79.0
Copper			
$Cu(s)$	0	0	33.2
$Cu(g)$	337.4	297.7	166.4
$Cu^+(aq)$	51.9	50.2	−26
$Cu^{2+}(aq)$	64.9	65.5	−98
$CuCl(s)$	−137.2	−119.9	86.2
$CuCl_2(s)$	−220.1	−175.7	108.1
$CuO(s)$	−157.3	−129.7	42.6
$CuS(s)$	−53.1	−53.6	66.5
$CuSO_4(s)$	−771.4	−662.2	109.2
$Cu_2O(s)$	−168.6	−146.0	93.1
$Cu_2S(s)$	−79.5	−86.2	120.9
Fluorine			
$F(g)$	79.38	62.3	158.75
$F_2(g)$	0	0	202.79
$F^-(aq)$	−335.35	−278.8	−13.8
$HF(g)$	−273.3	−275.4	173.8
Gold			
$Au(s)$	0	0	47.4
$Au(g)$	366.1	326.3	180.5
Helium			
$He(g)$	0	0	126.2
Hydrogen			
$H(g)$	218.0	203.3	114.7
$H^+(aq)$	0	0	0
$H^+(g)$	1536.3	1517.1	108.9
$H_2(g)$	0	0	130.7
Iodine			
$I(g)$	106.76	70.2	180.79
$I_2(s)$	0	0	116.14
$I_2(g)$	62.42	19.3	260.69
$I^-(aq)$	−56.78	−51.57	106.45
$HI(g)$	26.5	1.7	206.6
Iron			
$Fe(s)$	0	0	27.3
$Fe(g)$	416.3	370.7	180.5
$Fe^{2+}(aq)$	−87.9	−84.94	113.4
$Fe^{3+}(aq)$	−47.69	−10.54	293.3
$FeCO_3(s)$	−740.6	−666.7	92.9
$FeCl_2(s)$	−341.8	−302.3	118.0
$FeCl_3(s)$	−399.5	−334.0	142.3
$FeO(s)$	−272.0	−255.2	60.75
$Fe(OH)_3(s)$	−823.0	−696.5	106.7
$FeS_2(s)$	−178.2	−166.9	52.9
$Fe_2O_3(s)$	−824.2	−742.2	87.4
$Fe_3O_4(s)$	−1118.4	−1015.4	146.4
Lead			
$Pb(s)$	0	0	64.8
$Pb(g)$	195.2	162.2	175.4
$Pb^{2+}(aq)$	0.92	−24.4	18.5
$PbBr_2(s)$	−278.7	−261.9	161.5
$PbCO_3(s)$	−699.1	−625.5	131.0
$PbCl_2(s)$	−359.4	−314.1	136.0
$PbI_2(s)$	−175.5	−173.6	174.9
$Pb(NO_3)_2(s)$	−451.9		
$PbO(s)$	−217.3	−187.9	68.7
$PbO_2(s)$	−277.4	−217.3	68.6
$PbS(s)$	−100.4	−98.7	91.2
$PbSO_4(s)$	−920.0	−813.0	148.5
Lithium			
$Li(s)$	0	0	29.1
$Li(g)$	159.3	126.6	138.8
$Li^+(aq)$	−278.47	−293.3	12.24
$LiBr(s)$	−351.2	−342.0	74.3
$LiCl(s)$	−408.6	−384.4	59.3
$LiF(s)$	−616.0	−587.7	35.7
$LiI(s)$	−270.4	−270.3	86.8
$LiNO_3(s)$	−483.1	−381.1	90.0
$LiOH(s)$	−487.5	−441.5	42.8
$Li_2O(s)$	−597.9	−561.2	37.6
Magnesium			
$Mg(s)$	0	0	32.7
$Mg(g)$	147.1	112.5	148.6
$Mg^{2+}(aq)$	−467.0	−455.4	−137
$MgCl_2(s)$	−641.3	−591.8	89.6
$MgCO_3(s)$	−1095.8	−1012.1	65.7
$MgF_2(s)$	−1124.2	−1071.1	57.2
$MgO(s)$	−601.6	−569.3	27.0
$Mg(OH)_2(s)$	−924.5	−833.5	63.2
$MgSO_4(s)$	−1284.9	−1170.6	91.6
$Mg_3N_2(s)$	−461	−401	88
Manganese			
$Mn(s)$	0	0	32.0
$Mn(g)$	280.7	238.5	173.7
$Mn^{2+}(aq)$	−219.4	−225.6	−78.8
$MnO(s)$	−385.2	−362.9	59.7
$MnO_2(s)$	−520.0	−465.1	53.1
$MnO_4^-(aq)$	−529.9	−436.2	190.6
Mercury			
$Hg(l)$	0	0	75.9
$Hg(g)$	61.4	31.8	175.0

(*continued on the next page*)

Substance	ΔH_f° (kJ/mol)	ΔG_f° (kJ/mol)	S° (J/mol · K)
$Hg^{2+}(aq)$	170.21	164.4	−36.19
$Hg_2^{2+}(aq)$	166.87	153.5	65.74
$HgCl_2(s)$	−224.3	−178.6	146.0
$HgO(s)$	−90.8	−58.5	70.3
$HgS(s)$	−58.2	−50.6	82.4
$Hg_2Cl_2(s)$	−265.4	−210.7	191.6
Nickel			
$Ni(s)$	0	0	29.9
$Ni(g)$	429.7	384.5	182.2
$NiCl_2(s)$	−305.3	−259.0	97.7
$NiO(s)$	−239.7	−211.7	37.99
$NiS(s)$	−82.0	−79.5	53.0
Nitrogen			
$N(g)$	472.7	455.5	153.3
$N_2(g)$	0	0	191.6
$NF_3(g)$	−132.1	−90.6	260.8
$NH_3(g)$	−45.9	−16.4	192.8
$NH_3(aq)$	−80.29	−26.50	111.3
$NH_4^+(aq)$	−133.26	−79.31	111.17
$NH_4Br(s)$	−270.8	−175.2	113.0
$NH_4Cl(s)$	−314.4	−202.9	94.6
$NH_4CN(s)$	0.4		
$NH_4F(s)$	−464.0	−348.7	72.0
$NH_4HCO_3(s)$	−849.4	−665.9	120.9
$NH_4I(s)$	−201.4	−112.5	117.0
$NH_4NO_3(s)$	−365.6	−183.9	151.1
$NH_4NO_3(aq)$	−339.9	−190.6	259.8
$HNO_3(g)$	−133.9	−73.5	266.9
$HNO_3(aq)$	−207	−110.9	146
$NO(g)$	91.3	87.6	210.8
$NO_2(g)$	33.2	51.3	240.1
$NO_3^-(aq)$	−206.85	−110.2	146.70
$NOBr(g)$	82.2	82.4	273.7
$NOCl(g)$	51.7	66.1	261.7
$N_2H_4(l)$	50.6	149.3	121.2
$N_2H_4(g)$	95.4	159.4	238.5
$N_2O(g)$	81.6	103.7	220.0
$N_2O_4(l)$	−19.5	97.5	209.2
$N_2O_4(g)$	11.1	99.8	304.4
$N_2O_5(s)$	−43.1	113.9	178.2
$N_2O_5(g)$	13.3	117.1	355.7
Oxygen			
$O(g)$	249.2	231.7	161.1
$O_2(g)$	0	0	205.2
$O_3(g)$	142.7	163.2	238.9
$OH^-(aq)$	−230.02	−157.3	−10.90
$H_2O(l)$	−285.8	−237.1	70.0
$H_2O(g)$	−241.8	−228.6	188.8
$H_2O_2(l)$	−187.8	−120.4	109.6
$H_2O_2(g)$	−136.3	−105.6	232.7

Substance	ΔH_f° (kJ/mol)	ΔG_f° (kJ/mol)	S° (J/mol · K)
Phosphorus			
P(*s*, white)	0	0	41.1
P(*s*, red)	−17.6	−12.1	22.8
$P(g)$	316.5	280.1	163.2
$P_2(g)$	144.0	103.5	218.1
$P_4(g)$	58.9	24.4	280.0
$PCl_3(l)$	−319.7	−272.3	217.1
$PCl_3(g)$	−287.0	−267.8	311.8
$PCl_5(s)$	−443.5		
$PCl_5(g)$	−374.9	−305.0	364.6
$PF_5(g)$	−1594.4	−1520.7	300.8
$PH_3(g)$	5.4	13.5	210.2
$POCl_3(l)$	−597.1	−520.8	222.5
$POCl_3(g)$	−558.5	−512.9	325.5
$PO_4^{3-}(aq)$	−1277.4	−1018.7	−220.5
$HPO_4^{2-}(aq)$	−1292.1	−1089.2	−33.5
$H_2PO_4^-(aq)$	−1296.3	−1130.2	90.4
$H_3PO_4(s)$	−1284.4	−1124.3	110.5
$H_3PO_4(aq)$	−1288.3	−1142.6	158.2
$P_4O_6(s)$	−1640.1		
$P_4O_{10}(s)$	−2984	−2698	228.9
Platinum			
$Pt(s)$	0	0	41.6
$Pt(g)$	565.3	520.5	192.4
Potassium			
$K(s)$	0	0	64.7
$K(g)$	89.0	60.5	160.3
$K^+(aq)$	−252.14	−283.3	101.2
$KBr(s)$	−393.8	−380.7	95.9
$KCN(s)$	−113.0	−101.9	128.5
$KCl(s)$	−436.5	−408.5	82.6
$KClO_3(s)$	−397.7	−296.3	143.1
$KClO_4(s)$	−432.8	−303.1	151.0
$KF(s)$	−567.3	−537.8	66.6
$KI(s)$	−327.9	−324.9	106.3
$KNO_3(s)$	−494.6	−394.9	133.1
$KOH(s)$	−424.6	−379.4	81.2
$KOH(aq)$	−482.4	−440.5	91.6
$KO_2(s)$	−284.9	−239.4	116.7
$K_2CO_3(s)$	−1151.0	−1063.5	155.5
$K_2O(s)$	−361.5	−322.1	94.14
$K_2O_2(s)$	−494.1	−425.1	102.1
$K_2SO_4(s)$	−1437.8	−1321.4	175.6
Rubidium			
$Rb(s)$	0	0	76.8
$Rb(g)$	80.9	53.1	170.1
$Rb^+(aq)$	−251.12	−283.1	121.75
$RbBr(s)$	−394.6	−381.8	110.0
$RbCl(s)$	−435.4	−407.8	95.9
$RbClO_3(s)$	−392.4	−292.0	152

Substance	ΔH_f° (kJ/mol)	ΔG_f° (kJ/mol)	S° (J/mol · K)
RbF(*s*)	−557.7		
RbI(*s*)	−333.8	−328.9	118.4
Scandium			
Sc(*s*)	0	0	34.6
Sc(*g*)	377.8	336.0	174.8
Selenium			
Se(*s*, gray)	0	0	42.4
Se(*g*)	227.1	187.0	176.7
$H_2Se(g)$	29.7	15.9	219.0
Silicon			
Si(*s*)	0	0	18.8
Si(*g*)	450.0	405.5	168.0
$SiCl_4(l)$	−687.0	−619.8	239.7
$SiF_4(g)$	−1615.0	−1572.8	282.8
$SiH_4(g)$	34.3	56.9	204.6
SiO_2(*s*, quartz)	−910.7	−856.3	41.5
$Si_2H_6(g)$	80.3	127.3	272.7
Silver			
Ag(*s*)	0	0	42.6
Ag(*g*)	284.9	246.0	173.0
$Ag^+(aq)$	105.79	77.11	73.45
AgBr(*s*)	−100.4	−96.9	107.1
AgCl(*s*)	−127.0	−109.8	96.3
AgF(*s*)	−204.6	−185	84
AgI(*s*)	−61.8	−66.2	115.5
$AgNO_3(s)$	−124.4	−33.4	140.9
$Ag_2O(s)$	−31.1	−11.2	121.3
$Ag_2S(s)$	−32.6	−40.7	144.0
$Ag_2SO_4(s)$	−715.9	−618.4	200.4
Sodium			
Na(*s*)	0	0	51.3
Na(*g*)	107.5	77.0	153.7
$Na^+(aq)$	−240.34	−261.9	58.45
NaBr(*s*)	−361.1	−349.0	86.8
NaCl(*s*)	−411.2	−384.1	72.1
NaCl(*aq*)	−407.2	−393.1	115.5
$NaClO_3(s)$	−365.8	−262.3	123.4
NaF(*s*)	−576.6	−546.3	51.1
$NaHCO_3(s)$	−950.8	−851.0	101.7
$NaHSO_4(s)$	−1125.5	−992.8	113.0
NaI(*s*)	−287.8	−286.1	98.5
$NaNO_3(s)$	−467.9	−367.0	116.5
$NaNO_3(aq)$	−447.5	−373.2	205.4
NaOH(*s*)	−425.8	−379.7	64.4
NaOH(*aq*)	−470.1	−419.2	48.2
$NaO_2(s)$	−260.2	−218.4	115.9
$Na_2CO_3(s)$	−1130.7	−1044.4	135.0
$Na_2O(s)$	−414.2	−375.5	75.1
$Na_2O_2(s)$	−510.9	−447.7	95.0
$Na_2SO_4(s)$	−1387.1	−1270.2	149.6
$Na_3PO_4(s)$	−1917	−1789	173.8
Strontium			
Sr(*s*)	0	0	55.0
Sr(*g*)	164.4	130.9	164.6
$Sr^{2+}(aq)$	−545.51	−557.3	−39
$SrCl_2(s)$	−828.9	−781.1	114.9
$SrCO_3(s)$	−1220.1	−1140.1	97.1
SrO(*s*)	−592.0	−561.9	54.4
$SrSO_4(s)$	−1453.1	−1340.9	117.0
Sulfur			
S(*s*, rhombic)	0	0	32.1
S(*s*, monoclinic)	0.3	0.096	32.6
S(*g*)	277.2	236.7	167.8
$S_2(g)$	128.6	79.7	228.2
$S_8(g)$	102.3	49.7	430.9
$S^{2-}(aq)$	41.8	83.7	22
$SF_6(g)$	−1220.5	−1116.5	291.5
$HS^-(aq)$	−17.7	12.4	62.0
$H_2S(g)$	−20.6	−33.4	205.8
$H_2S(aq)$	−39.4	−27.7	122
$SOCl_2(l)$	−245.6		
$SO_2(g)$	−296.8	−300.1	248.2
$SO_3(g)$	−395.7	−371.1	256.8
$SO_4^{2-}(aq)$	−909.3	−744.6	18.5
$HSO_4^-(aq)$	−886.5	−754.4	129.5
$H_2SO_4(l)$	−814.0	−690.0	156.9
$H_2SO_4(aq)$	−909.3	−744.6	18.5
$S_2O_3^{2-}(aq)$	−648.5	−522.5	67
Tin			
Sn(*s*, white)	0	0	51.2
Sn(*s*, gray)	−2.1	0.1	44.1
Sn(*g*)	301.2	266.2	168.5
$SnCl_4(l)$	−511.3	−440.1	258.6
$SnCl_4(g)$	−471.5	−432.2	365.8
SnO(*s*)	−280.7	−251.9	57.2
$SnO_2(s)$	−577.6	−515.8	49.0
Titanium			
Ti(*s*)	0	0	30.7
Ti(*g*)	473.0	428.4	180.3
$TiCl_4(l)$	−804.2	−737.2	252.3
$TiCl_4(g)$	−763.2	−726.3	353.2
$TiO_2(s)$	−944.0	−888.8	50.6
Tungsten			
W(*s*)	0	0	32.6
W(*g*)	849.4	807.1	174.0
$WO_3(s)$	−842.9	−764.0	75.9

(*continued on the next page*)

Substance	ΔH_f° (kJ/mol)	ΔG_f° (kJ/mol)	S° (J/mol · K)
Uranium			
U(*s*)	0	0	50.2
U(*g*)	533.0	488.4	199.8
$UF_6(s)$	−2197.0	−2068.5	227.6
$UF_6(g)$	−2147.4	−2063.7	377.9
$UO_2(s)$	−1085.0	−1031.8	77.0
Vanadium			
V(*s*)	0	0	28.9
V(*g*)	514.2	754.4	182.3

Substance	ΔH_f° (kJ/mol)	ΔG_f° (kJ/mol)	S° (J/mol · K)
Zinc			
Zn(*s*)	0	0	41.6
Zn(*g*)	130.4	94.8	161.0
$Zn^{2+}(aq)$	−153.39	−147.1	−109.8
$ZnCl_2(s)$	−415.1	−369.4	111.5
ZnO(*s*)	−350.5	−320.5	43.7
ZnS(*s*, zinc blende)	−206.0	−201.3	57.7
$ZnSO_4(s)$	−982.8	−871.5	110.5

C. Aqueous Equilibrium Constants

1. Dissociation Constants for Acids at 25 °C

Name	Formula	K_{a_1}	K_{a_2}	K_{a_3}
Acetic	$HC_2H_3O_2$	1.8×10^{-5}		
Acetylsalicylic	$HC_9H_7O_4$	3.3×10^{-4}		
Adipic	$H_2C_6H_8O_4$	3.9×10^{-5}	3.9×10^{-6}	
Arsenic	H_3AsO_4	5.5×10^{-3}	1.7×10^{-7}	5.1×10^{-12}
Arsenous	H_3AsO_3	5.1×10^{-10}		
Ascorbic	$H_2C_6H_6O_6$	8.0×10^{-5}	1.6×10^{-12}	
Benzoic	$HC_7H_5O_2$	6.5×10^{-5}		
Boric	H_3BO_3	5.4×10^{-10}		
Butanoic	$HC_4H_7O_2$	1.5×10^{-5}		
Carbonic	H_2CO_3	4.3×10^{-7}	5.6×10^{-11}	
Chloroacetic	$HC_2H_2O_2Cl$	1.4×10^{-3}		
Chlorous	$HClO_2$	1.1×10^{-2}		
Citric	$H_3C_6H_5O_7$	7.4×10^{-4}	1.7×10^{-5}	4.0×10^{-7}
Cyanic	HCNO	2×10^{-4}		
Formic	$HCHO_2$	1.8×10^{-4}		
Hydrazoic	HN_3	2.5×10^{-5}		
Hydrocyanic	HCN	4.9×10^{-10}		
Hydrofluoric	HF	3.5×10^{-4}		
Hydrogen chromate ion	$HCrO_4^-$	3.0×10^{-7}		
Hydrogen peroxide	H_2O_2	2.4×10^{-12}		
Hydrogen selenate ion	$HSeO_4^-$	2.2×10^{-2}		
Hydrosulfuric	H_2S	8.9×10^{-8}	1×10^{-19}	
Hydrotelluric	H_2Te	2.3×10^{-3}	1.6×10^{-11}	

Name	Formula	K_{a_1}	K_{a_2}	K_{a_3}
Hypobromous	HBrO	2.8×10^{-9}		
Hypochlorous	HClO	2.9×10^{-8}		
Hypoiodous	HIO	2.3×10^{-11}		
Iodic	HIO_3	1.7×10^{-1}		
Lactic	$HC_3H_5O_3$	1.4×10^{-4}		
Maleic	$H_2C_4H_2O_4$	1.2×10^{-2}	5.9×10^{-7}	
Malonic	$H_2C_3H_2O_4$	1.5×10^{-3}	2.0×10^{-6}	
Nitrous	HNO_2	4.6×10^{-4}		
Oxalic	$H_2C_4O_4$	5.9×10^{-2}	6.4×10^{-5}	
Paraperiodic	H_5IO_6	2.8×10^{-2}	5.3×10^{-9}	
Phenol	HC_6H_5O	1.3×10^{-10}		
Phosphoric	H_3PO_4	7.5×10^{-3}	6.2×10^{-8}	4.2×10^{-13}
Phosphorous	H_3PO_3	5×10^{-2}	2.0×10^{-7}	
Propanoic	$HC_3H_5O_2$	1.3×10^{-5}		
Pyruvic	$HC_3H_3O_3$	4.1×10^{-3}		
Pyrophosphoric	$H_4P_2O_7$	1.2×10^{-1}	7.9×10^{-3}	2.0×10^{-7}
Selenous	H_2SeO_3	2.4×10^{-3}	4.8×10^{-9}	
Succinic	$H_2C_4H_4O_4$	6.2×10^{-5}	2.3×10^{-6}	
Sulfuric	H_2SO_4	Strong acid	1.2×10^{-2}	
Sulfurous	H_2SO_3	1.7×10^{-2}	6.4×10^{-8}	
Tartaric	$H_2C_4H_4O_6$	1.0×10^{-3}	4.6×10^{-5}	
Trichloroacetic	$HC_2Cl_3O_2$	2.2×10^{-1}		
Trifluoroacetic acid	$HC_2F_3O_2$	3.0×10^{-1}		

2. Dissociation Constants for Hydrated Metal Ions at 25 °C

Cation	Hydrated Ion	K_a
Al^{3+}	$Al(H_2O)_6^{3+}$	1.4×10^{-5}
Be^{2+}	$Be(H_2O)_6^{2+}$	3×10^{-7}
Co^{2+}	$Co(H_2O)_6^{2+}$	1.3×10^{-9}
Cr^{3+}	$Cr(H_2O)_6^{3+}$	1.6×10^{-4}
Cu^{2+}	$Cu(H_2O)_6^{2+}$	3×10^{-8}
Fe^{2+}	$Fe(H_2O)_6^{2+}$	3.2×10^{-10}

Cation	Hydrated Ion	K_a
Fe^{3+}	$Fe(H_2O)_6^{3+}$	6.3×10^{-3}
Ni^{2+}	$Ni(H_2O)_6^{2+}$	2.5×10^{-11}
Pb^{2+}	$Pb(H_2O)_6^{2+}$	3×10^{-8}
Sn^{2+}	$Sn(H_2O)_6^{2+}$	4×10^{-4}
Zn^{2+}	$Zn(H_2O)_6^{2+}$	2.5×10^{-10}