THERMODYNAMIC VALUES FOR SUBSTANCES AT 298.15 K (25°C)

Substance	ΔH°_f (kJ/mol)	ΔG°_f (kJ/mol)	S° (J/mol-K)
Aluminum			
$Al_{(s)}$	0	0	28.3
$AlCl_{3(s)}$	-705.6	-630.0	109.3
$Al_2O_{3(s)}$	-1669.8	-1576.5	51.0
Barium			
$Ba_{(s)}$	0	0	63.2
$BaCO_{3(s)}$	-1216.3	-1137.6	112.1
$BaO_{(s)}$	-553.5	-525.1	70.4
Beryllium			
$Be_{(s)}$	0	0	9.44
$BeO_{(s)}$	-608.4	-579.1	13.8
$Be(OH)_{2(s)}$	-905.8	-817.9	50.2
Bromine			
$Br_{(g)}$	111.8	82.4	174.9
$Br^-_{(aq)}$	-120.9	-102.8	80.7
$Br_{2(g)}$	30.7	3.14	245.3
$Br_{2(l)}$	0	0	152.3
$HBr_{(g)}$	-36.2	-53.2	198.5
Calcium			
$Ca_{(g)}$	179.3	145.5	154.8
$Ca_{(s)}$	0	0	41.4
$CaCO_{3(s,\ calcite)}$	-1207.1	1128.8	92.9
$CaCl_{2(s)}$	-795.8	-748.1	104.6
$CaF_{2(s)}$	-1219.6	-1167.3	68.9
$CaO_{(s)}$	-635.5	-604.2	39.8
$Ca(OH)_{2(s)}$	-986.2	-898.5	83.4
$CaSO_{4(s)}$	-1434.0	-1321.8	106.7
Carbon			
$C_{(g)}$	718.4	672.9	158.0

$C_{(s,\ diamond)}$	1.88	2.84	2.43
$C_{(s,\ graphite)}$	0	0	5.69
$CCl_{4(g)}$	-106.7	-64.0	309.4
$CCl_{4(l)}$	-139.3	-68.6	214.4
$CF_{4(g)}$	-679.9	-635.1	262.3
$CH_{4(g)}$	-74.8	-50.8	186.3
$C_2H_{2(g)}$	226.7	209.2	200.8
$C_2H_{4(g)}$	52.3	68.1	219.4
$C_2H_{6(g)}$	-84.7	-32.9	229.5
$C_3H_{8(g)}$	-103.9	-23.5	269.9
$C_4H_{10(g)}$	-124.7	-15.7	310.0
$C_4H_{10(l)}$	-147.6	-15.0	231.0
$C_6H_{6(g)}$	82.9	129.7	269.2
$C_6H_{6(l)}$	49.0	124.5	172.8
$CH_3OH_{(g)}$	-201.2	-161.9	237.6
$CH_3OH_{(l)}$	-238.6	-166.2	126.8
$C_2H_5OH_{(g)}$	-235.1	-168.5	282.7
$C_2H_5OH_{(l)}$	-277.7	-174.8	160.7
$C_6H_{12}O_{6(s)}$	-1273.0	-910.4	212.1
$CO_{(g)}$	-110.5	-137.2	197.9
$CO_{2(g)}$	-393.5	-394.4	213.6
$HC_2H_3O_{2(l)}$	-487.0	-392.4	159.8
Cesium			
$Cs_{(g)}$	76.5	49.5	175.6
$Cs_{(l)}$	2.09	0.03	92.1
$Cs_{(s)}$	0	0	85.2
$CsCl_{(s)}$	-442.8	-414.4	101.2
Chlorine			
$Cl_{(g)}$	121.7	105.7	165.2
$Cl^-_{(aq)}$	-167.2	-131.2	56.5
$Cl_{2(g)}$	0	0	223.0
$HCl_{(aq)}$	-167.2	-131.2	56.5
$HCl_{(g)}$	-92.3	-95.3	186.7

Chromium			
$Cr_{(g)}$	397.5	352.6	174.2
$Cr_{(s)}$	0	0	23.6
$Cr_2O_{3(s)}$	-1139.7	-1058.1	81.2
Cobalt			
$Co_{(g)}$	439	393	179
$Co_{(s)}$	0	0	28.4
Copper			
$Cu_{(g)}$	338.4	298.6	166.3
$Cu_{(s)}$	0	0	33.3
$CuCl_{2(s)}$	-205.9	-161.7	108.1
$CuO_{(s)}$	-156.1	-128.3	42.6
$Cu_2O_{(s)}$	-170.7	-147.9	92.4
Fluorine			
$F_{(g)}$	80.0	61.9	158.7
$F^-_{(aq)}$	-332.6	-278.8	-13.8
$F_{2(g)}$	0	0	202.7
$HF_{(g)}$	-268.6	-270.7	173.5
Hydrogen			
$H_{(g)}$	217.9	203.3	114.6
$H^+_{(aq)}$	0	0	0
$H^+_{(g)}$	1536.2	1517.0	108.9
$H_{2(g)}$	0	0	130.6
Iodine			
$I_{(g)}$	106.6	70.2	180.7
$I^-_{(aq)}$	-55.2	-51.6	111.3
$I_{2(g)}$	62.3	19.4	260.6
$I_{2(s)}$	0	0	116.7
$HI_{(g)}$	25.9	1.30	206.3
Iron			
$Fe_{(g)}$	415.5	369.8	180.5
$Fe_{(s)}$	0	0	27.2
$Fe^{2+}_{(aq)}$	-87.9	-84.9	113.4

$Fe^{3+}_{(aq)}$	-47.7	-10.5	293.3
$FeCl_{2(s)}$	-341.8	-302.3	117.9
$FeCl_{3(s)}$	-400.	-334	142.3
$FeO_{(s)}$	-271.9	-255.2	60.8
$Fe_2O_{3(s)}$	-822.2	-741.0	90.0
$Fe_3O_{4(s)}$	-1117.1	-1014.2	146.4
$FeS_{2(s)}$	-171.5	-160.1	52.9
Lead			
$Pb_{(s)}$	0	0	68.9
$PbBr_{2(s)}$	-277.4	-260.7	161
$PbCO_{3(s)}$	-699.1	-625.5	131.0
$Pb(NO_3)_{2(aq)}$	-421.3	-246.9	303.3
$Pb(NO_3)_{2(s)}$	-451.9	—	—
$PbO_{(s)}$	-217.3	-187.9	68.7
Lithium			
$Li_{(g)}$	159.3	126.6	138.8
$Li_{(s)}$	0	0	29.1
$Li^{+}_{(aq)}$	-278.5	-273.4	12.2
$Li^{+}_{(g)}$	685.7	648.5	133.0
$LiCl_{(s)}$	-408.3	-384.0	59.3
Magnesium			
$Mg_{(g)}$	147.1	112.5	148.6
$Mg_{(s)}$	0	0	32.5
$MgCl_{2(s)}$	-641.6	-592.1	89.6
$MgO_{(s)}$	-601.8	-569.6	26.8
$Mg(OH)_{2(s)}$	-924.7	-833.7	63.2
Manganese			
$Mn_{(g)}$	280.7	238.5	173.6
$Mn_{(s)}$	0	0	32.0
$MnO_{(s)}$	-385.2	-362.9	59.7
$MnO_{2(s)}$	-519.6	-464.8	53.1
$MnO_4^{-}{}_{(aq)}$	-541.4	-447.2	191.2
Mercury			
$Hg_{(g)}$	60.8	31.8	174.9

$Hg_{(l)}$	0	0	77.4
$HgCl_{2(s)}$	-230.1	-184.0	144.5
$Hg_2Cl_{2(s)}$	-264.9	-210.5	192.5
Nickel			
$Ni_{(g)}$	429.7	384.5	182.1
$Ni_{(s)}$	0	0	29.9
$NiCl_{2(s)}$	-305.3	-259.0	97.65
$NiO_{(s)}$	-239.7	-211.7	38.0
Nitrogen			
$N_{(g)}$	472.7	455.5	153.3
$N_{2(g)}$	0	0	191.5
$NH_{3(aq)}$	-80.3	-26.5	111.3
$NH_{3(g)}$	-46.2	-16.7	192.5
$NH_4^{+}{}_{(aq)}$	-132.5	-79.3	113.4
$N_2H_{4(g)}$	95.4	159.4	238.5
$NH_4CN_{(s)}$	0	—	—
$NH_4Cl_{(s)}$	-314.4	-203.0	94.6
$NH_4NO_{3(s)}$	-365.6	-184.0	151
$NO_{(g)}$	90.4	86.7	210.6
$NO_{2(g)}$	33.8	51.8	240.5
$N_2O_{(g)}$	81.6	103.6	220.0
$N_2O_{4(g)}$	9.66	98.3	304.3
$N_2O_{5(g)}$	13.3	117.1	355.7
$NOCl_{(g)}$	52.6	66.3	264
$HNO_{3(aq)}$	-206.6	-110.5	146
$HNO_{3(g)}$	-134.3	-73.9	266.4
Oxygen			
$O_{(g)}$	247.5	230.1	161.0
$O_{2(g)}$	0	0	205.0
$O_{3(g)}$	142.3	163.4	237.6
$OH^{-}{}_{(aq)}$	-230.0	-157.3	-10.7
$H_2O_{(g)}$	-241.8	-228.6	188.8
$H_2O_{(l)}$	-285.8	-237.1	69.9
$H_2O_{2(g)}$	-136.1	-105.5	232.9

$H_2O_{2(l)}$	-187.8	-120.4	109.6
Phosphorus			
$P_{(g)}$	316.4	280.0	163.2
$P_{2(g)}$	144.3	103.7	218.1
$P_{4(g)}$	58.9	24.4	280
$P_{4(s, red)}$	-17.5	-12.0	22.9
$P_{4(s, white)}$	0	0	41.1
$PCl_{3(g)}$	-288.1	-269.6	311.7
$PCl_{3(l)}$	-319.6	-272.4	217
$PF_{5(g)}$	-1594.4	-1520.7	300.8
$PH_{3(g)}$	5.4	13.4	210.2
$P_4O_{6(s)}$	-1640.1	—	—
$P_4O_{10(s)}$	-2940.1	-2675.2	228.9
$POCl_{3(g)}$	-542.2	-502.5	325
$POCl_{3(l)}$	-597.0	-520.9	222
$H_3PO_{4(aq)}$	-1288.3	-1142.6	158.2
Potassium			
$K_{(g)}$	90.0	61.17	160.2
$K_{(s)}$	0	0	64.7
$KCl_{(s)}$	-435.9	-408.3	82.7
$KClO_{3(s)}$	-391.2	-289.9	143.0
$KClO_{3(aq)}$	-349.5	-284.9	265.7
$K_2CO_{3(s)}$	-1150.2	-1064.6	155.4
$KNO_{3(s)}$	-492.7	-393.1	288.1
$K_2O_{(s)}$	-363.2	-322.1	94.1
$KO_{2(s)}$	-284.5	-240.6	122.5
$K_2O_{2(s)}$	-495.8	-429.8	113.0
$KOH_{(s)}$	-424.7	-378.9	78.91
$KOH_{(aq)}$	-482.4	-440.5	91.6
Rubidium			
$Rb_{(g)}$	85.8	55.8	170.0
$Rb_{(s)}$	0	0	76.8
$RbCl_{(s)}$	-430.5	-412.0	92

$RbClO_{3(s)}$	-392.4	-292.0	152
Scandium			
$Sc_{(g)}$	377.8	336.1	174.7
$Sc_{(s)}$	0	0	34.6
Selenium			
$H_2Se_{(g)}$	29.7	15.9	219.0
Silicon			
$Si_{(g)}$	368.2	323.9	167.8
$Si_{(s)}$	0	0	18.7
$SiC_{(s)}$	-73.2	-70.9	16.6
$SiCl_{4(l)}$	-640.1	-572.8	239.3
$SiO_{2(s,\ quartz)}$	-910.9	-856.5	41.8
Silver			
$Ag_{(s)}$	0	0	42.6
$Ag^+_{(aq)}$	105.9	77.11	73.9
$AgCl_{(s)}$	-127.0	-109.7	96.1
$Ag_2O_{(s)}$	-31.1	-11.2	121.3
$AgNO_{3(s)}$	-124.4	-33.4	140.9
Sodium			
$Na_{(g)}$	107.7	77.3	153.7
$Na_{(s)}$	0	0	51.5
$Na^+_{(aq)}$	-240.1	-261.9	59.0
$Na^+_{(g)}$	609.3	574.3	148.0
$NaBr_{(aq)}$	-360.6	-364.7	141.0
$NaBr_{(s)}$	-361.4	-349.3	86.8
$Na_2CO_{3(s)}$	-1130.9	-1047.7	136.0
$NaCl_{(aq)}$	-407.1	-393.0	115.5
$NaCl_{(g)}$	-181.4	-201.3	229.8
$NaCl_{(s)}$	-410.9	-384.0	72.3
$NaHCO_{3(s)}$	-947.7	-851.8	102.1
$NaNO_{3(aq)}$	-446.2	-372.4	207
$NaNO_{3(s)}$	-467.9	-367.0	116.5

$NaOH_{(aq)}$	-469.6	-419.2	49.8
$NaOH_{(s)}$	-425.6	-379.5	64.5
Strontium			
$SrO_{(s)}$	-592.0	-561.9	54.9
$Sr_{(g)}$	164.4	110.0	164.6
Sulfur			
$S_{(s, rhombic)}$	0	0	31.88
$S_{8(g)}$	102.3	49.7	430.9
$SO_{2(g)}$	-296.9	-300.4	248.5
$SO_{3(g)}$	-395.2	-370.4	256.2
$SO_4^{2-}{}_{(aq)}$	-909.3	-744.5	20.1
$SOCl_{2(l)}$	-245.6	—	—
$H_2S_{(g)}$	-20.2	-33.0	205.6
$H_2SO_{4(aq)}$	-909.3	-744.5	20.1
$H_2SO_{4(l)}$	-814.0	-689.9	156.1
Titanium			
$Ti_{(g)}$	468	422	180.3
$Ti_{(s)}$	0	0	30.76
$TiCl_{4(g)}$	-763.2	-726.8	354.9
$TiCl_{4(l)}$	-804.2	-728.1	221.9
$TiO_{2(s)}$	-944.7	-889.4	50.29
Vanadium			
$V_{(g)}$	514.2	453.1	182.2
$V_{(s)}$	0	0	28.9
Zinc			
$Zn_{(g)}$	130.7	95.2	160.9
$Zn_{(s)}$	0	0	41.63
$ZnCl_{2(s)}$	-415.1	-369.4	111.5
$ZnO_{(s)}$	-348.0	-318.2	43.9