substance	ΔHf° (kJ/mol)	ΔGf° (kJ/mol)	S° (J/mol·K)
Aluminum			
Al(s)	0	0	28.3
Al3+(aq)	-531.0	-485.0	-321.7
AlCl3(s)	-704.2	-628.8	109.3
Al2O3(s)	-1675.7	-1582.3	50.9
Al(OH)3(s)	-647.3	-1147.25	---
Arsenic			
As(s; gray)	0	0	35.1
AsH3(g)	66.4	68.9	222.8
H3AsO4(s)	-906.3	-766.0	184.0
AsO43-(aq)	-888.1	-648.4	-162.8
Barium			
Ba(s)	0	0	62.5
Ba(g)	180.0	146.0	170.2
Ba2+(g)	1648.1	---	---
Ba2+(aq)	-537.6	-560.8	9.6
BaCO3(s)	-1213.0	-1134.4	112.1
BaCl2(s; anhydrous)	-855.0	-806.7	123.7
BaO(s)	-548.0	-520.3	72.1
BaSO4(s)	-1473.2	-1362.2	132.2
Beryllium			
Be(s)	0	0	9.5
BeO(s)	-609.4	-580.1	13.8
Boron			
B(s; rhombohedral)			
BCl3(g)	-403.8	-388.7	290.1
BF3(g)	-1136.0	-1119.4	254.4
B2H6(g)	36.4	87.6	232.1
B2O3(s)	-1273.5	-1194.3	54.0
Bromine			
Br2(l)	0	0	152.2
Br2(g)	30.9	3.1	245.5
Br(g)	111.9	82.4	175.0
Br-(g)	-212.6	---	163.49
Br-(aq)	-121.6	-104.0	82.4
HBr(g)	--	-53.4	--
Cadmium			
Cd(s)	0	0	51.8
Cd(g)	111.8	78.2	167.7

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Cd2+(aq)	-75.9	-77.6	-73.2
CdCl2(s)	-391.5	-343.9	115.3
CdO(s)	-258.4	-228.7	54.8
CdS(s)	-161.9	-156.5	64.9
CdSO4(s)	-933.3	-822.7	123.0
Calcium			
Ca(s)	0	0	41.6
Ca(g)	177.8	144.0	154.9
Ca2+(g)	-1913.107	---	---
Ca2+(aq)	-542.8	-553.6	-53.1
CaCO3(s; calcite)	-1207.6	-1129.1	91.7
CaCO3(s; aragonite)	-1207.8	-1128.2	88.0
CaCl2(s)	-795.4	-748.8	108.4
CaF2(s)	-1228.0	-1175.6	68.5
CaO(s)	-634.9	-603.3	38.1
Ca(OH)2(s)	-985.2	-897.5	83.4
Ca3(PO4)2(s)	-4120.8	-3884.7	236.0
CaSO4(s)	-1434.5	-1322.0	106.5
Carbon			
C(s; graphite)	0	0	5.7
C(s; diamond)	1.9	2.9	2.4
C(g)	716.7	671.3	158.1
CCl4(s)	-136.8	---	---
CCl4(l)	-128.2	-68.6	215.39
CCl4(g)	-95.7	-64.0	309.65
CH3Cl(g)	-81.9	-60.2	234.6
CH2Cl2(l)	-124.2	-63.2	177.8
CHCl3(l)	-134.1	-73.7	201.7
HCN(l)	108.9	125.0	112.8
HCN(g)	135.1	124.7	201.8
HCN(aq)	105.4	112.1	128.9
CN-(aq)	150.6	172.4	94.1
HCO3-(aq)	-692.0	-586.8	91.2
H2CO3(aq)	-698.7	-623.42	191.0
HCHO(g)	-108.6	-102.5	218.8
HCOOH(l)	-425.0	-361.4	129.0
HCOOH(aq)	-410.0	-356.0	164.0
HCOO-(aq)	-425.6	-351.0	92.0
CH4(g)	-74.6	-50.5	186.3
C2H2(g)	227.4	209.9	200.9

C2H6(g)	-84.0	-32.0	229.2
C3H8(g)	-103.8	-23.4	270.3
C4H10(l)	-147.3	-15.0	231.0
C4H10(g)	-125.7	-15.7	310.0
C6H6(l)	49.1	124.5	173.4
C6H6(g)	82.9	129.7	269.2
CH3OH(l)	-239.2	-166.6	126.8
CH3OH(g)	-201.0	-162.3	239.9
(CH3)2(CH2)2O(l)	-279.5	-346.74	253.5
CH3COOH(s)	-472.8	---	---
CH3COOH(l)	-484.3	-389.9	159.8
CH3COOH(g)	-432.2	-374.2	283.5
CH3CHO(g)	-166.2	-133.0	263.8
C2H5OH(l)	-277.6	-174.8	160.7
C2H5OH(g)	-234.8	-167.9	281.6
(CH3)2CO(l)	-248.4	-153.55	199.8
(CH3CH2)O(l)	-279.5	-346.74	253.5
C6H12O6(s; glucose)	-1273.3	-910.56	212.1
C12H22O11(s; sucrose)	-2226.1	-1544.3	392.4
CO(g)	-110.5	-137.2	197.7
CO2(g)	-393.5	-394.4	213.8
CO2(aq)	-413.26	-386.2	119.36
CO32-(aq)	-677.1	-527.8	-56.9
COCl2(g)	-219.1	-204.9	283.5
CS2(s)	93.8	---	---
CS2(l)	89.0	64.6	151.3
CS2(g)	116.7	67.1	237.8
(NH2)2CO(s)	-333.1	-197.15	104.26
(NH2)2CO(aq)	-319.2	-203.84	173.85
Cesium			
Cs(s)	0	0	85.2
Cs(g)	76.5	49.6	175.6
Cs+(g)	452.2	427.1	169.84
Cs+(aq)	-258.3	-292.0	133.1
CsBr(s)	-405.8	-391.4	113.1
CsCl(s)	-443.0	-414.5	101.2
CsF(s)	-553.5	-525.5	92.8
CsI(s)	-346.6	-340.6	123.1
Chlorine			
Cl2(g)	0	0	223.1

Cl(g)	121.3	105.3	165.2
Cl-(g)	-227.3	-240.0	153.36
Cl-(aq)	-167.2	-131.2	56.5
HCl(g)	-92.3	-95.3	186.9
HCl(aq)	-167.2	-131.2	56.5
ClO2(g)	89.1	105.0	263.7
Cl2O(g)	80.3	97.9	266.2
Chromium			
Cr(s)	0	0	23.8
Cr2+(aq)	-138.9	-165	---
Cr3+(aq)	-1971.0	---	---
Cr2O3(s)	-1139.7	-1058.1	118.7
CrO42-(aq)	-881.2	-727.8	50.2
Cr2O72-(aq)	-1490.3	-1301.1	261.9
Cobalt			
Co(s)	0	0	30.0
Co2+(aq)	-58.2	-54.4	-113.0
Co3+(aq)	92.0	134.0	-305.0
CoO(s)	-237.9	-214.2	53.0
Copper			
Cu(s)	0	0	33.2
Cu(g)	337.4	297.7	166.4
Cu+(aq)	71.7	50.0	40.6
Cu2+(aq)	64.8	65.5	-99.6
CuCl(s)	-137.2	-119.9	86.2
CuCl2(s)	-220.1	-175.7	108.1
Cu2O(s)	-168.6	-146.0	93.1
CuO(s)	-157.3	-129.7	42.6
Cu2S(s)	-79.5	-86.2	120.9
CuS(s)	-53.1	-53.6	66.5
CuSO4(s)	-771.4	-662.2	109.2
Fluorine			
F2(g)	0	0	202.8
F(g)	79.4	62.3	158.8
F-(g)	-248.8	-262.5	145.58
F-(aq)	-332.6	-278.8	-13.8
HF(g)	-273.3	-275.4	173.8
Gold			
Au(s)	0	0	47.4
AuCl(s)	-34.7	---	92.9

AuCl3(s)	-117.6	---	---
Au2O3(s)	80.8	163.2	125.5
Hydrogen			
H2(g)	0	0	130.7
H(g)	218.0	203.3	114.7
H+(g)	1530.1	1517.1	108.95
H+(aq)	0	0	0
Iodine			
I2(s)	0	0	116.1
I2(g)	62.4	19.3	260.7
I(g)	106.8	70.2	180.8
I-(g)	-188.36	---	169.26
I-(aq)	-55.2	-51.6	111.3
HI(g)	26.5	1.7	206.6
Iron			
Fe(s)	0	0	27.3
Fe2+(aq)	-89.1	-78.9	-137.7
Fe3+(aq)	-48.5	-4.7	-315.9
FeCl2(s)	-341.8	-302.3	118.0
FeCl3(s)	-399.5	-334.0	142.3
FeO(s)	-272.0	-255.2	60.75
Fe2O3(s)	-824.2	-742.2	87.4
Fe3O4(s)	-1118.4	-1015.4	146.4
Fe(OH)2(s)	-574.04	-483.55	87.93
Fe(OH)3(s)	-832.62	-696.5	104.56
Lead			
Pb(s)	0	0	64.8
Pb2+(aq)	-1.7	-24.4	10.5
PbBr2(s)	-278.7	-261.9	161.5
PbCl2(s)	-359.4	-314.1	136.0
PbO(s; litharge)	-219.0	-188.9	66.5
PbO(s; massicot)	-217.3	-187.9	68.7
PbO2(s)	-277.4	-217.3	68.6
PbS(s)	-100.4	-98.7	91.2
PbSO4(s)	-920.0	-813.0	148.5
Lithium			
Li(s)	0	0	29.1
Li(g)	159.3	126.6	138.8
Li+(g)	679.54	649.989	133.02
Li+(aq)	-278.5	-293.3	13.4

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
Li2O(s)	-597.9	-561.2	37.6
LiOH(s)	-487.5	-441.5	42.8
Magnesium			
Mg(s)	0	0	32.7
Mg(g)	147.1	112.5	148.6
Mg2+(g)	2335.6	---	---
Mg2+(aq)	-466.9	-454.8	-138.1
MgCO3(s)	-1095.8	-1012.1	65.7
MgCl2(s)	-641.3	-591.8	89.6
Mg3N2(s)	-461.08	-401.00	87.86
MgO(s)	-601.6	-569.3	27.0
Mg(OH)2(s)	-924.5	-833.5	63.2
MgSO4(s)	-1284.9	-1170.6	91.6
Manganese			
Mn(s; alpha)	0	0	32.0
Mn2+(aq)	-220.8	-228.1	-73.6
MnO2(s)	-520.0	-465.1	53.1
MnO4-(aq)	-541.4	-447.2	191.2
Mercury			
Hg(s)	-2.29	---	---
Hg(l)	0	0	75.9
Hg(g)	61.4	31.8	175.0
Hg22+(aq)	172.4	153.5	84.5
Hg2+(aq)	171.1	164.4	-32.2
Hg2Cl2(s)	-265.4	-210.7	191.6
HgCl2(s)	-224.3	-178.6	146.0
HgO(s)	-90.8	-58.5	70.3
HgS(s; red)	-58.2	-50.6	48.4
Hg2SO4(s)	-743.1	-625.8	200.7
Nickel			
Ni(s)	0	0	29.9
Ni2+(aq)	-54.0	-45.6	-128.9
NiO(s)	-244.35	-216.3	38.58
Ni(OH)2(s)	-529.7	-447.2	88.0
Nitrogen			
N2(g)	0	0	191.6

N(g)	472.7	455.5	153.3
N3-(aq)	275.1	348.2	107.9
NH3(l)	-69.54	-26.5	95.09
NH3(g)	-45.9	-16.4	192.8
NH3(aq)	-80.3	-26.5	111.3
NH4+(aq)	-132.5	-79.3	113.4
N2H4(l)	50.6	149.3	121.2
N2H4(g)	95.4	159.4	238.5
NH4Cl(s)	-314.4	-202.9	94.6
NH4NO3(s)	-365.6	-183.9	151.1
NF3(g)	-132.1	-90.6	260.8
HNO2(g)	-79.5	-46.0	254.1
HNO2(aq)	-118.8	-53.6	254.1
HNO3(l)	-174.1	-80.7	155.6
HNO3(g)	-133.9	-73.5	266.9
HNO3(aq)	-207.4	-111.3	146.4
N2O(g)	81.6	103.7	220.0
NO(g)	91.3	87.6	210.8
NO2(g)	33.2	51.3	240.1
N2O4(g)	11.1	99.8	304.4
N2O5(s)	-43.1	113.9	178.2
N2O5(g)	13.3	117.1	355.7
NO3-(aq)	-207.4	-111.3	146.4
NOCl(g)	51.7	66.1	261.7
Oxygen			
O2(g)	0	0	205.2
O(g)	249.2	231.7	161.1
O3(g)	142.7	163.2	238.9
O3(aq)	-12.09	16.3	110.8
OH-(aq)	-230.0	-157.2	-10.8
H2O(l)	-285.8	-237.1	70.0
H2O(g)	-241.8	-228.6	188.8
H2O2(l)	-187.8	-120.4	109.6
H2O2(g)	-136.3	-105.6	232.7
H2O2(aq)	-191.2	-134.1	144.0
Phosphorus			
P(s; red)	-17.6	-12.1	22.8
P(g)	316.5	280.1	163.2
P2(g)	144.0	104.0	218.1
P4(s; white)	0	0	41.1

P4(g)	58.9	24.4	280.0
PCl3(l)	-319.7	-272.3	217.1
PCl3(g)	-287.0	-267.8	311.8
PCl5(s)	-443.5	---	---
PCl5(g)	-374.9	-305.0	364.6
PF5(g)	-1594.4	-1520.7	300.8
PH3(g)	5.4	13.5	210.2
PO43-(aq)	-1277.4	-1018.7	-220.5
HPO42-(aq)	-1292.1	-1089.2	-33.5
H2PO4-(aq)	-1296.3	-1130.2	90.4
H3PO4(s)	-1284.4	-1124.3	110.5
H3PO4(l)	-1271.7	-1123.6	150.8
H3PO4(aq)	-1277.0	-1019.0	228.0
P4O10(s)	-2984	-2675.2	228.9
Platinum			
Pt(s)	0	0	41.6
PtCl42-(aq)	-516.3	-384.5	175.7
Potassium			
K(s)	0	0	64.7
K(g)	89.0	60.5	160.3
K+(g)	507.8	481.2	154.58
K+(aq)	-252.4	-283.3	102.5
KBr(s)	-393.8	-380.7	95.9
KCl(s)	-436.5	-408.5	82.6
KClO3(s)	-397.7	-296.3	143.1
KClO4(s)	-432.8	-303.1	151.0
KF(s)	-567.3	-537.8	66.6
KI(s)	-327.9	-324.9	106.3
KNO3(s)	-494.6	-394.9	133.1
KOH(s)	-424.6	-379.4	81.2
Rubidium			
Rb(s)	0	0	76.8
Rb(g)	80.9	53.1	170.1
Rb+(g)	483.9	---	164.33
Rb+(aq)	-251.2	-284.0	121.5
RbBr(s)	-394.6	-381.8	110.0
RbCl(s)	-435.4	-407.8	95.9
RbF(s)	-557.7	---	---
RbI(s)	-333.8	-328.9	118.4
Silicon			

Si(s)	0	0	18.8
SiF4(g)	-1615.0	-1572.8	282.8
SiO2(s)	-910.7	-856.3	41.5
Silver			
Ag(s)	0	0	42.6
Ag(g)	284.9	246.0	173.0
Ag+(aq)	105.6	77.1	72.7
AgBr(s)	-100.4	-96.9	107.1
AgCl(s)	-127.0	-109.8	96.3
Ag2CrO4(s)	-731.7	-641.8	217.6
AgI(s)	-61.8	-66.2	115.5
AgNO3(s)	-124.4	-33.4	140.9
Ag2S(s)	-32.6	-40.7	144.0
Sodium			
Na(s)	0	0	51.3
Na(l)	2.4	0.5	57.86
Na(g)	107.5	77.0	153.7
Na+(g)	603.4	574.9	147.95
Na+(aq)	-240.1	-261.9	59.0
NaBr(s)	-361.1	-349.0	86.8
Na2CO3(s)	-1130.7	-1044.4	135.0
NaCl(s)	-411.2	-384.1	72.1
NaF(s)	-576.6	-546.3	51.1
NaHCO3(s)	-950.8	-851.0	101.7
NaI(s)	-287.8	-286.1	98.5
NaNO3(s)	-467.9	-367.0	116.5
Na2O(s)	-414.2	-375.5	75.1
NaOH(s)	-425.8	-379.7	64.4
NaOH(aq)	-469.6	-419.2	49.8
Na2SO4(s)	-1387.1	-1270.2	149.6
Strontium			
Sr(s)	0	0	55.0
Sr(g)	164.4	130.9	164.6
Sr2+(g)	1778.1	---	---
Sr2+(aq)	-545.8	-559.5	-32.6
SrCO3(s)	-828.9	-781.1	114.9
SrCl2(s)	-1220.1	-1140.1	97.1
SrO(s)	-592.0	-561.9	54.4
SrSO4(s)	-1453.1	-1340.9	117.0
Sulfur			

S8(s; rhombic)	0	0	32.1
S8(s; monoclinic)	0.3	0.1	32.6
S(g)	277.2	236.7	167.8
S2(g)	128.6	79.7	228.2
S8(g)	101.3	48.8	432.5
S2-(aq)	33.1	85.8	-14.6
SF6(g)	-1220.5	-1116.5	291.5
HS-(aq)	-17.6	12.1	62.8
H2S(g)	-20.6	-33.4	205.8
H2S(aq)	-39.0	-27.4	122.0
SO(g)	6.3	-19.9	222.0
SO2(g)	-296.8	-300.1	248.2
SO3(g)	-395.7	-371.1	256.8
SO32-(aq)	-635.5	-486.5	-29.0
SO42-(aq)	-909.3	-744.5	20.1
HSO3-(aq)	-626.2	-527.7	139.7
HSO4-(aq)	-887.3	-755.9	131.8
H2SO4(l)	-814.0	-690.0	156.9
H2SO4(aq)	-909.3	-744.5	20.1
Tin			
Sn(s; white)	0	0	51.2
Sn(s; gray)	-2.1	0.1	44.1
SnCl4(l)	-511.3	-440.1	258.6
SnO2(s)	-577.6	-515.8	49.0
Titanium			
Ti(s)	0	0	30.7
TiCl4(l)	-804.2	-737.2	252.3
TiCl4(g)	-763.2	-726.3	353.2
TiO2(s)	-944.0	-888.8	50.6
Uranium			
U(s)	0	0	50.2
UF6(s)	-2147.4	-2063.7	377.9
Zinc			
Zn(s)	0	0	41.3
Zn(g)	130.4	94.8	161.0
Zn2+(aq)	-153.9	-147.1	-112.1
ZnCl2(s)	-415.1	-369.4	111.5
ZnO(s)	-350.5	-320.5	43.7
ZnS(s; sphalerite)	-206.0	-201.3	57.7
ZnSO4(s)	-982.8	-871.5	110.5