

## 30.1: Thermodynamic Data of Inorganic Substances at 298 K

Substance:	$\Delta_f H^\ominus$ [kJ/mol]	$\Delta_f G^\ominus$ [kJ/mol]	$S^\ominus$ [J/(mol K)]	$C_P$ [J/(mol K)]
Ag(g)	284.9	246	173	20.8
Ag(s)	0	0	42.6	25.4
Ag <sup>+</sup> (aq)	105.8	77.1	73.5	
AgCN(s)	146	156.9	107.2	66.7
Ag <sub>2</sub> CO <sub>3</sub> (s)	-505.8	-436.8	167.4	112.3
AgNO <sub>3</sub> (s)	-124.4	-33.4	140.9	93.1
Ag <sub>2</sub> O(s)	-31.1	-11.2	121.3	65.9
Ag <sub>2</sub> S(s)	-32.6	-40.7	144	76.5
AgBr(s)	-100.4	-96.9	107.1	52.4
AgCl(s)	-127.0	-109.8	96.3	50.8
AgF(s)	-204.6	-187	84	
AgI(s)	-61.8	-66.2	115.5	56.8
Al(g)	330	289.4	164.6	21.4
Al(s)	0	0	28.3	24.2
Al <sub>2</sub> O <sub>3</sub> (s)	-1675.7	-1582.3	50.9	79.0
AlF <sub>3</sub> (s)	-1510.4	-1431.1	66.5	75.1
AlI <sub>3</sub> (s)	-302.9		195.9	
AlBr <sub>3</sub> (s)	-527.2		180.2	100.6
AlCl <sub>3</sub> (s)	-704.5	-628.11	112.3	91.1
Al(OH) <sub>3</sub> (s)	-1277			
Al(OH) <sub>4</sub> <sup>-</sup> (aq)	-1490	-1297	117	
AlPO <sub>4</sub> (s)	-1733.8	-1617.9	90.8	93.2
Ar(g)	0		154.9	20.8
B(s)	0	0	5.9	11.1
B(g)	565	521.0	153.4	20.8
BH(g)	442.7	412.7	171.8	29.2
BH <sub>3</sub> (g)	89.2	93.3	188.2	36.0
B <sub>2</sub> S <sub>3</sub> (s)	-240.6		100.0	111.7
Ba(g)	180	146	170.2	
Ba(s)	0	0	62.5	28.1
BaCO <sub>3</sub> (s)	-1213.0	-1134.4	112.1	86.0
BaH <sub>2</sub> (s)	-177	-138.2	63.0	

Substance:	$\Delta_f H^\ominus$ [kJ/mol]	$\Delta_f G^\ominus$ [kJ/mol]	$S^\ominus$ [J/(mol.K)]	$C_P$ [J/(mol.K)]
BaBr <sub>2</sub> (s)	-757.3	-736.8	146.0	
BaCl <sub>2</sub> (s)	-855	-806.7	123.7	75.1
BaF <sub>2</sub> (s)	-1207.1	-1156.8	96.4	71.2
BaI <sub>2</sub> (s)	-602.1	-597	167.0	
BaO(s)	-548.0	-520.3	72.1	47.3
BaSO <sub>4</sub> (s)	-1473.2	-1362.2	132.2	101.8
Be(g)	324	286.6	136.3	20.8
Be(s)	0	0	9.5	13.4
BeBr <sub>2</sub> (s)	-353.5		108	69.4
BeCl <sub>2</sub> (s)	-490.4	-445.6	75.8	62.4
BeF <sub>2</sub> (s)	-1026.8	-979.4	53.4	51.8
BeI <sub>2</sub> (s)	-192.5		121	71.1
BeO(s)	-609.4	-580.1	13.8	25.6
Be(OH) <sub>2</sub> (s)	-902.5	-815.0	45.5	62.1
BeSO <sub>4</sub> (s)	-1205.2	-1093.8	77.9	85.7
Bi(g)	207.1	168.2	187	20.8
Bi(s)	0	0	56.7	25.5
Bi <sub>2</sub> O <sub>3</sub> (s)	-573.9	-493.7	151.5	113.5
BiCl <sub>3</sub> (s)	-379.1	-315.0	177.0	105.0
Br <sup>-</sup> (aq)	-121.4	-104.0	82.6	
Br(g)	111.9	82.4	175	20.8
Br <sub>2</sub> (g)	30.9	3.1	245.5	36.0
Br <sub>2</sub> (l)	0	0	152.2	75.7
BrCl(g)	14.6	-1	240.1	35.0
BrF(g)	-93.8	-109.2	229	33.0
BrF <sub>3</sub> (g)	-1136	1119.4	254.4	66.6
C(g)	716.7	671.3	158.1	0.8
C(s,diamond)	1.9	2.9	2.4	6.1
C(s,graphite)	0	0	5.7	8.5
CBr <sub>4</sub> (g)	83.9	67	358.1	
CBr <sub>4</sub> (s)	29.4	47.7	212.5	
CCl <sub>2</sub> F <sub>2</sub> (g)	-477.4	-439.4	300.8	
CCl <sub>2</sub> O(g)	-219.1	-204.9	283.5	
CCl <sub>4</sub> (g)	-95.7	-53.6	309.9	

Substance:	$\Delta_f H^\ominus$ [kJ/mol]	$\Delta_f G^\ominus$ [kJ/mol]	$S^\ominus$ [J/(mol.K)]	$C_P$ [J/(mol.K)]
CCl <sub>4</sub> (l)	-128.2	-62.6	216.2	
CF <sub>4</sub> (g)	-933.6	-888.3	261.6	
CS <sub>2</sub> (g)	116.7	67.1	237.8	45.4
CS <sub>2</sub> (l)	89	64.6	151.3	76.4
CO(g)	-110.5	-137.2	197.7	29.1
CO <sub>2</sub> (g)	-393.5	-394.4	213.8	37.1
Ca(g)	177.8	144	154.9	20.8
Ca(s)	0	0	41.6	25.9
Ca(OH) <sub>2</sub> (s)	-985.2	-897.5	83.4	87.5
CaBr <sub>2</sub> (s)	-682.8	-663.6	130	
CaCl <sub>2</sub> (s)	-795.4	-748.8	108.4	72.9
CaCN(s)	-184.5			
CaCO <sub>3</sub> (s,ara g.)	-1207.8	-1128.2	88	82.3
CaCO <sub>3</sub> (s,calc.)	-1207.6	-1129.1	91.7	83.5
CaF <sub>2</sub> (s)	-1228.0	-1175.6	68.5	67.0
CaH <sub>2</sub> (s)	-181.5	-142.5	41.4	41.0
CaI <sub>2</sub> (s)	-533.5	-528.9	142	
CaO(s)	-634.9	-603.3	38.1	42.0
CaSO <sub>4</sub> (s)	-1434.5	-1322.0	106.5	99.7
Cd(g)	111.8		167.7	20.8
Cd(s)	0	0	51.8	26.0
CdBr <sub>2</sub> (s)	-316.2	-296.3	137.2	76.7
CdCl <sub>2</sub> (s)	-391.5	-343.9	115.3	74.7
CdCO <sub>3</sub> (s)	-750.6	-669.4	92.5	
CdF <sub>2</sub> (s)	-700.4	-647.7	77.4	
CdS(s)	-161.9	-156.5	64.9	
CdSO <sub>4</sub> (s)	-933.3	-822.7	123.0	99.6
Cl <sup>-</sup> (aq)	-167.1	-131.2	56.6	
Cl(g)	121.3	105.3	165.2	21.8
Cl <sub>2</sub> (g)	0	0	223.1	33.9
ClF(g)	-50.3	-51.8	217.9	32.1
ClF <sub>3</sub> (g)	-163.2	-123.0	281.6	63.9
ClO <sub>2</sub> (g)	89.1	105	263.7	46.0

Substance:	$\Delta_f H^\ominus$ [kJ/mol]	$\Delta_f G^\ominus$ [kJ/mol]	$S^\ominus$ [J/(mol.K)]	$C_P$ [J/(mol.K)]
Cl <sub>2</sub> O(g)	80.3	97.9	266.2	45.4
Co(g)	424.7	380.3	179.5	23.0
Co(s)	0	0	30	24.8
CoCl <sub>2</sub> (s)	-312.5	-269.8	109.2	78.5
Cr(g)	396.6	351.8	174.5	20.8
Cr(s)	0	0	23.8	23.4
Cr <sub>2</sub> O <sub>3</sub> (s)	-1139.7	-1058.1	81.2	118.7
CrCl <sub>2</sub> (s)	-395.4	-356	115.3	71.2
CrCl <sub>3</sub> (s)	-556.5	-486.1	123	91.8
CrO <sub>2</sub> (g)	-598			
CrO <sub>3</sub> (g)	-292.9		266.2	56.0
Cs(g)	76.5	49.6	175.6	20.8
Cs(s)	0	0	85.2	32.2
CsCl(s)	-443.0	-414.5	101.2	52.5
Cu(g)	337.4	297.7	166.4	20.8
Cu(s)	0	0	33.2	24.2
Cu <sub>2</sub> O(s)	-168.6	-146.0	93.1	63.6
CuO(s)	-157.3	-129.7	42.6	
Cu <sub>2</sub> S(s)	-79.5	-86.2	120.9	76.3
CuS(s)	-53.1	-53.6	66.5	47.8
CuSO <sub>4</sub> (s)	-771.4	-662.2	109.2	
CuBr(s)	-104.6	-100.8	96.1	54.7
CuBr <sub>2</sub> (s)	-141.8			
CuCl(s)	-137.2	-119.9	86.2	48.5
CuCl <sub>2</sub> (s)	-220.1	-175.7	108.1	71.9
CuCN(s)	96.2	111.3	84.5	
F <sup>-</sup> (aq)	-335.4	-278.8	-13.8	
F(g)	79.4	62.3	158.8	22.7
F <sub>2</sub> (g)	0	0	202.8	32.3
F <sub>2</sub> O(g)	24.5	41.8	247.5	43.3
FO(g)	109	105.3	216.4	32.0
FB(g)	-122.2	-149.8	200.5	58.6
Fe(g)	416.3	370.7	180.5	25.7
Fe(s)	0	0	27.3	25.1

Substance:	$\Delta_f H^\ominus$ [kJ/mol]	$\Delta_f G^\ominus$ [kJ/mol]	$S^\ominus$ [J/(mol.K)]	$C_P$ [J/(mol.K)]
FeO(s)	-272.0	-251.4	60.7	
Fe <sup>2+</sup> (aq)	-89.1	-78.9	-137.7	
Fe <sub>2</sub> O <sub>3</sub> (s)	-824.2	-742.2	87.4	103.9
Fe <sup>3+</sup> (aq)	-48.5	-4.7	-315.9	
Fe <sub>3</sub> O <sub>4</sub> (s)	-1118.4	-1015.4	146.4	143.4
FeCO <sub>3</sub> (s)	-740.6	-666.7	92.9	82.1
FeS <sub>2</sub> (s)	-178.2	-166.9	52.9	62.2
FeCl <sub>2</sub> (s)	-341.8	-302.3	118	75.7
FeCl <sub>3</sub> (s)	-399.5	-334.0	142.3	96.7
FeBr <sub>2</sub> (s)	-249.8	-238.1	140.6	
FeBr <sub>3</sub> (s)	-268.2			
Fe <sub>3</sub> C(s)	25.1	20.1	104.6	105.9
H(g)	218.0	203.3	114.7	20.8
H <sup>+</sup> (aq)	0	0	0	
H <sub>2</sub> (g)	0	0	130.7	28.8
H <sub>2</sub> O(g)	-241.8	-228.6	188.8	33.6
H <sub>2</sub> O(l)	-285.8	-237.1	70.0	75.3
H <sub>2</sub> O <sub>2</sub> (g)	-136.3	-105.6	232.7	43.1
H <sub>2</sub> O <sub>2</sub> (l)	-187.8	-120.4	109.6	89.1
H <sub>2</sub> S(g)	-20.6	-33.4	205.8	34.2
H <sub>2</sub> Se(g)	29.7	15.9	219	34.7
H <sub>2</sub> SO <sub>4</sub> (aq)	-909.3	-744.5	20.1	
H <sub>2</sub> SO <sub>4</sub> (l)	-814.0	-690.0	156.9	138.9
H <sub>3</sub> PO <sub>4</sub> (l)	-1271.7	-1123.6	150.8	145.0
H <sub>3</sub> PO <sub>4</sub> (s)	-1284.4	-1124.3	110.5	106.1
HBr(aq)	-121.6	-104.0	82.4	
HBr(g)	-36.3	-53.4	198.7	29.1
HCl(aq)	-167.2	-131.2	56.5	
HCl(g)	-92.3	-95.3	186.9	29.1
HCN(g)	135.1	124.7	201.8	35.9
HCN(l)	108.9	125	112.8	70.6
HF(aq)	-332.6	-278.8	-13.8	
HF(g)	-273.3	-275.4	173.8	
HI(aq)	-55.2	-51.6	111.3	

Substance:	$\Delta_f H^\ominus$ [kJ/mol]	$\Delta_f G^\ominus$ [kJ/mol]	$S^\ominus$ [J/(mol.K)]	$C_P$ [J/(mol.K)]
HI(g)	26.5	1.7	206.6	29.2
HNO <sub>2</sub> (g)	-79.5	-46.0	254.1	
HNO <sub>3</sub> (aq)	-207.4	-111.3	146.4	
HNO <sub>3</sub> (g)	-133.9	-73.5	266.9	54.1
HNO <sub>3</sub> (l)	-174.1	-80.7	155.6	109.9
He(g)	0	0	126.2	20.8
Hg(g)	61.4	31.8	175	
Hg(l)	0	0	75.9	28.0
Hg <sub>2</sub> (g)	108.8	68.2	288.1	
HgO(s)	-90.8	-58.5	70.3	44.1
HgS(s,red)	-58.2	-50.6	82.4	48.4
Hg <sub>2</sub> SO <sub>4</sub> (s)	-743.1	-625.8	200.7	132.0
HgSO <sub>4</sub> (s)	-707.5			
Hg <sub>2</sub> Cl <sub>2</sub> (s)	-265.4	-210.7	191.6	191.6
HgCl <sub>2</sub> (s)	-224.3	-178.6	146.0	146.0
Hg <sub>2</sub> Br <sub>2</sub> (s)	-206.9	-181.1	218.0	218.0
HgBr <sub>2</sub> (s)	-170.7	-153.1	172.0	172.0
Hg <sub>2</sub> I <sub>2</sub> (s)	-121.3	-111	233.5	233.5
HgI <sub>2</sub> (s)	-105.4	-101.7	180.0	180.0
I <sup>-</sup> (aq)	-56.8	-51.6	106.5	
I(g)	106.8	70.2	180.8	20.8
I <sub>2</sub> (g)	62.4	19.3	260.7	36.9
I <sub>2</sub> (s)	0	0	116.1	54.4
HIO <sub>3</sub> (s)	-230.1			
IBr(g)	40.8	3.7	258.8	36.4
ICl(g)	17.8	-5.5	247.6	35.6
IF(g)	-95.7	-118.5	236.2	33.4
K(g)	89.0	60.5	160.3	20.8
K(s)	0	0	64.7	29.6
K <sub>2</sub> CO <sub>3</sub> (s)	-1151.0	-1063.5	155.5	114.4
K <sub>2</sub> O(s)	-361.5	-322.1	94.1	
K <sub>2</sub> O <sub>2</sub> (s)	-494.1	-425.1	102.1	
K <sub>2</sub> SO <sub>4</sub> (s)	-1437.8	-1321.4	175.6	131.5
KBr(s)	-393.8	-380.7	95.9	52.3

Substance:	$\Delta_f H^\ominus$ [kJ/mol]	$\Delta_f G^\ominus$ [kJ/mol]	$S^\ominus$ [J/(mol.K)]	$C_P$ [J/(mol.K)]
KCl(s)	−436.5	−408.5	82.6	51.3
KF(s)	−567.3	−537.8	66.6	49.0
KI(s)	−327.9	−324.9	106.3	52.9
KClO <sub>3</sub> (s)	−397.7	−296.3	143.1	100.3
KMnO <sub>4</sub> (s)	−837.2	−737.6	171.7	117.6
KNO <sub>2</sub> (s)	−369.8	−306.6	152.1	107.4
KNO <sub>3</sub> (s)	−494.6	−394.9	133.1	96.4
KSCN(s)	−200.2	−178.3	124.3	88.5
Kr(g)	0	0	164.1	20.8
Li(g)	159.3	126.6	138.8	20.8
Li(s)	0	0	29.1	24.9
Li <sup>+</sup> (aq)	−278.5	−293.3	12.4	
Li <sub>2</sub> O(s)	−597.9	−561.2	37.6	54.1
LiOH(s)	−487.5	−441.5	42.8	49.6
LiNO <sub>3</sub> (s)	−483.1	−381.1	90.0	
LiBr(s)	−351.2	−342	74.3	
LiCl(s)	−408.6	−384.4	59.3	48.0
LiF(s)	−616	−587.7	35.7	41.6
LiI(s)	−270.4	−270.3	86.8	51.0
Mg(g)	147.1	112.5	148.6	20.8
Mg(s)	0	0	32.7	24.9
MgO(s)	−601.6	−569.3	27.0	37.2
Mg(OH) <sub>2</sub> (s)	−924.5	−833.5	63.2	77.0
MgS(s)	−346.0	−341.8	50.3	45.6
MgSO <sub>4</sub> (s)	−1284.9	−1170.6	91.6	96.5
MgBr <sub>2</sub> (s)	−524.3	−503.8	117.2	
MgCl <sub>2</sub> (s)	−641.3	−591.8	89.6	71.4
MgF <sub>2</sub> (s)	−1124.2	−1071.1	57.2	61.6
Mn(g)	280.7	238.5	173.7	20.8
Mn(s)	0	0	32	26.3
MnO(s)	−385.2	−362.9	59.7	45.4
MnO <sub>2</sub> (s)	−520.0	−465.1	53.1	54.1
MnO <sub>4</sub> <sup>−</sup> (aq)	−541.4	−447.2	191.2	
MnBr <sub>2</sub> (s)	−384.9			

Substance:	$\Delta_f H^\ominus$ [kJ/mol]	$\Delta_f G^\ominus$ [kJ/mol]	$S^\ominus$ [J/(mol.K)]	$C_P$ [J/(mol.K)]
MnCl <sub>2</sub> (s)	−481.3	−440.5	118.2	72.9
Mo(g)	658.1	612.5	182	20.8
Mo(s)	0	0	28.7	24.1
MoO <sub>2</sub> (s)	−588.9	−533.0	46.3	56.0
MoO <sub>3</sub> (s)	−745.1	−668.0	77.7	75.0
MoS <sub>2</sub> (s)	−235.1	−225.9	62.6	63.6
MoS <sub>3</sub> (s)	−364	−354	119	
N(g)	472.7	455.5	153.3	20.8
N <sub>2</sub> (g)	0	0	191.6	29.1
NF <sub>3</sub> (g)	−132.1	−90.6	260.8	53.4
NH <sub>3</sub> (g)	−45.9	−16.4	192.8	35.1
NH <sub>4</sub> <sup>+</sup> (aq)	−133.3	−79.3	111.2	
NH <sub>4</sub> Cl(s)	−314.4	−202.9	94.6	84.1
NH <sub>4</sub> NO <sub>3</sub> (s)	−365.6	−183.9	151.1	139.3
NH <sub>4</sub> OH(l)	−361.2	−254.0	165.6	154.9
(NH <sub>4</sub> ) <sub>2</sub> SO <sub>4</sub> (s)	−1180.9	−901.7	220.1	187.5
N <sub>2</sub> H <sub>4</sub> (g)	95.4	159.4	238.5	
N <sub>2</sub> H <sub>4</sub> (l)	50.6	149.3	121.2	
NO <sub>2</sub> (g)	33.2	51.3	240.1	37.2
N <sub>2</sub> O(g)	81.6	103.7	220	38.6
NO(g)	91.3	87.6	210.8	
N <sub>2</sub> O <sub>4</sub> (g)	11.1	99.8	304.4	79.2
N <sub>2</sub> O <sub>4</sub> (l)	−19.5	97.5	209.2	142.7
Na(g)	107.5	77	153.7	20.8
Na(s)	0	0	51.3	28.2
Na <sup>+</sup> (aq)	−240.2	−261.9	58.5	
Na <sub>2</sub> CO <sub>3</sub> (s)	−1130.7	−1044.4	135	112.3
Na <sub>2</sub> O(s)	−414.2	−375.5	75.1	69.1
Na <sub>2</sub> O <sub>2</sub> (s)	−510.9	−447.7	95	89.2
Na <sub>2</sub> SO <sub>4</sub> (s)	−1387.1	−1270.2	149.6	128.2
NaBr(aq)	−361.7	−365.8	141.4	
NaBr(g)	−143.1	−177.1	241.2	36.3
NaBr(s)	−361.1	−349.0	86.8	51.4
NaCl(aq)	−407.3	−393.1	115.5	



Substance:	$\Delta_f H^\ominus$ [kJ/mol]	$\Delta_f G^\ominus$ [kJ/mol]	$S^\ominus$ [J/(mol.K)]	$C_P$ [J/(mol.K)]
NaCl(s)	−411.2	−384.1	72.1	50.5
NaCN(s)	−87.5	−76.4	115.6	70.4
NaF(aq)	−572.8	−540.7	45.2	
NaF(s)	−576.6	−546.3	51.1	46.9
NaN <sub>3</sub> (s)	21.7	93.8	96.9	76.6
NaNO <sub>3</sub> (aq)	−447.5	−373.2	205.4	
NaNO <sub>3</sub> (s)	−467.9	−367.0	116.5	92.9
NaO <sub>2</sub> (s)	−260.2	−218.4	115.9	72.1
NaOH(s)	−425.8	−379.7	64.4	59.5
NaH(s)	−56.3	−33.6	40	36.4
Ne(g)	0	0	146.3	20.8
Ni(g)	429.7	384.5	182.2	23.4
Ni(s)	0	0	29.9	26.1
Ni <sub>2</sub> O <sub>3</sub> (s)	−489.5			
Ni(OH) <sub>2</sub> (s)	−529.7	−447.2	88	
NiBr <sub>2</sub> (s)	−212.1			
NiCl <sub>2</sub> (s)	−305.3	−259.0	97.7	71.7
NiF <sub>2</sub> (s)	−651.4	−604.1	73.6	64.1
O(g)	249.2	231.7	161.1	21.9
O <sub>2</sub> (g)	0	0	205.2	29.4
O <sub>3</sub> (g)	142.7	163.2	238.9	39.2
OH <sup>−</sup> (aq)	−230.0	−157.2	−10.9	
Os(g)	791	745	192.6	20.8
Os(s)	0	0	32.6	24.7
OsO <sub>4</sub> (g)	−337.2	−292.8	293.8	74.1
OsO <sub>4</sub> (s)	−394.1	−304.9	143.9	
P(g,white)	316.5	280.1	163.2	20.8
P(s,black)	−39.3			
P(s,red)	−17.6	−12.5	22.8	21.2
P(s,white)	0	0	41.1	23.8
P <sub>2</sub> (g)	144.0	103.5	218.1	
P <sub>4</sub> (g)	58.9	24.4	280.0	
PCl <sub>3</sub> (g)	−287.0	−267.8	311.8	71.8
PCl <sub>3</sub> (l)	−319.7	−272.3	217.1	

Substance:	$\Delta_f H^\ominus$ [kJ/mol]	$\Delta_f G^\ominus$ [kJ/mol]	$S^\ominus$ [J/(mol.K)]	$C_P$ [J/(mol.K)]
PCl <sub>5</sub> (g)	-374.9	-305.0	364.6	112.8
PH <sub>3</sub> (g)	5.4	13.5	210.2	37.1
POCl <sub>3</sub> (g)	-558.5	-512.9	325.5	
POCl <sub>3</sub> (l)	-597.1	-520.8	222.5	
Pb(g)	195.2	162.2	175.4	20.8
Pb(s)	0	0	64.8	26.8
PbCl <sub>2</sub> (s)	-359.4	-314.1	136	
PbCO <sub>3</sub> (s)	-699.1	-625.5	131	87.4
PbO(s,lithar ge)	-219.0	-188.9	66.5	45.8
PbO(s,massi c.)	-217.3	-187.9	68.7	45.8
PbO <sub>2</sub> (s)	-277.4	-217.3	68.6	64.6
Pb(NO <sub>3</sub> ) <sub>2</sub> (aq )	-416.3	-246.9	303.3	
Pb(NO <sub>3</sub> ) <sub>2</sub> (s)	-451.9			
PbS(s)	-100.4	-98.7	91.2	49.5
PbSO <sub>4</sub> (s)	-920.0	-813.0	148.5	103.2
Rb(g)	80.9	53.1	170.1	20.8
Rb(s)	0	0	76.8	31.1
RbCl(s)	-435.4	-407.8	95.9	52.4
S(g,rhombic )	277.2	236.7	167.8	23.7
S(s,rhombic)	0	0	32.1	22.6
SO <sub>2</sub> (g)	-296.8	-300.1	248.2	39.9
SO <sub>3</sub> (g)	-395.7	-371.1	256.8	50.7
SO <sub>4</sub> <sup>2-</sup> (aq)	-909.3	-744.5	18.5	
SOCl <sub>2</sub> (g)	-212.5	-198.3	309.8	
Se(g,gray)	227.1	187	176.7	
Se(s,gray)	0	0	42.4	25.4
Si(g)	450	405.5	168.0	22.3
Si(s)	0	0	18.8	20.0
SiC(s,cubic)	-65.3	-62.8	16.6	26.9
SiC(s,hexag. )	-62.8	-60.2	16.5	26.7
SiCl <sub>4</sub> (g)	-657.0	-617.0	330.7	

Substance:	$\Delta_f H^\ominus$ [kJ/mol]	$\Delta_f G^\ominus$ [kJ/mol]	$S^\ominus$ [J/(mol.K)]	$C_P$ [J/(mol.K)]
SiCl <sub>4</sub> (l)	−687.0	−619.8	239.7	
SiH <sub>4</sub> (g)	34.3	56.9	204.6	42.8
Sn(g, white)	301	266.2	168.5	21.3
Sn(s, gray)	−2.1	0.1	44.1	25.8
Sn(s, white)	0	0	51.2	27.0
SnCl <sub>4</sub> (g)	−471.5	−432.2	365.8	98.3
SnCl <sub>4</sub> (l)	−511.3	−440.1	258.6	165.3
SnO <sub>2</sub> (s)	−557.6	−515.8	49	52.6
Ti(g)	473	428.4	180.3	24.4
Ti(s)	0	0	30.7	25.1
TiCl <sub>2</sub> (s)	−513.8	−464.4	87.4	69.8
TiCl <sub>3</sub> (s)	−720.9	−653.5	139.7	97.2
TiCl <sub>4</sub> (g)	−763	−726.3	353	95.4
TiCl <sub>4</sub> (l)	−804.2	−737.2	252.3	145.2
TiO <sub>2</sub> (s)	−944.0	−888.8	50.6	55.0
U(g)	533	488.4	199.8	23.7
U(s)	0	0	50.2	27.7
UF <sub>4</sub> (g)	−1598.7	−1572.7	368	91.2
UF <sub>4</sub> (s)	−1914.2	−1823.3	151.7	116.0
UF <sub>6</sub> (g)	−2147.4	−2063.7	377.9	129.6
UF <sub>6</sub> (s)	−2197.0	−2068.5	227.6	166.8
UO <sub>2</sub> (g)	−465.7	−471.5	274.6	51.4
UO <sub>2</sub> (s)	−1085.0	−1031.8	77.0	63.6
V(g)	514.2	754.4	182.3	26.0
V(s)	0	0	28.9	24.9
V <sub>2</sub> O <sub>5</sub> (s)	−1550.6	−1419.5	131.0	127.7
VCl <sub>3</sub> (s)	−580.7	−511.2	131.0	93.2
VCl <sub>4</sub> (g)	−525.5	−492.0	362.4	96.2
VCl <sub>4</sub> (l)	−569.4	−503.7	255.0	
Xe(g)	0	0	169.7	20.8
Zn(g)	130.4	94.8	161.0	20.8
Zn(s)	0	0	41.6	25.4
ZnBr <sub>2</sub> (s)	−328.7	−312.1	138.5	
ZnCl <sub>2</sub> (s)	−415.1	−369.4	111.5	71.3

Substance:	$\Delta_f H^\ominus$ [kJ/mol]	$\Delta_f G^\ominus$ [kJ/mol]	$S^\ominus$ [J/(mol.K)]	$C_P$ [J/(mol.K)]
ZnF <sub>2</sub> (s)	-764.4	-713.3	73.7	65.7
ZnI <sub>2</sub> (s)	-208.0	-209.0	161.1	
Zn(NO <sub>3</sub> ) <sub>2</sub> (s)	-483.7			
ZnS(s, sphalerite)	-206.0	-201.3	57.7	46.0
ZnSO <sub>4</sub> (s)	-982.8	-871.5	110.5	99.2
Zr(g)	608.8	566.5	181.4	26.7
Zr(s)	0	0	39	25.4
ZrCl <sub>2</sub> (s)	-502.0	-386	110	
ZrCl <sub>4</sub> (s)	-980.5	-889.9	181.6	119.8

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