

APPENDIX

C

Thermodynamic Quantities for Selected Substances at 298.15 K (25 °C)

Substance	ΔH_f° (kJ/mol)	ΔG_f° (kJ/mol)	S° (J/mol-K)	Substance	ΔH_f° (kJ/mol)	ΔG_f° (kJ/mol)	S° (J/mol-K)
Aluminum				C ₄ H ₁₀ (g)	-124.73	-15.71	310.0
Al(s)	0	0	28.32	C ₄ H ₁₀ (l)	-147.6	-15.0	231.0
AlCl ₃ (s)	-705.6	-630.0	109.3	C ₆ H ₆ (g)	82.9	129.7	269.2
Al ₂ O ₃ (s)	-1669.8	-1576.5	51.00	C ₆ H ₆ (l)	49.0	124.5	172.8
Barium				CH ₃ OH(g)	-201.2	-161.9	237.6
Ba(s)	0	0	63.2	CH ₃ OH(l)	-238.6	-166.23	126.8
BaCO ₃ (s)	-1216.3	-1137.6	112.1	C ₂ H ₅ OH(g)	-235.1	-168.5	282.7
BaO(s)	-553.5	-525.1	70.42	C ₂ H ₅ OH(l)	-277.7	-174.76	160.7
Beryllium				C ₆ H ₁₂ O ₆ (s)	-1273.02	-910.4	212.1
Be(s)	0	0	9.44	CO(g)	-110.5	-137.2	197.9
BeO(s)	-608.4	-579.1	13.77	CO ₂ (g)	-393.5	-394.4	213.6
Be(OH) ₂ (s)	-905.8	-817.9	50.21	CH ₃ COOH(l)	-487.0	-392.4	159.8
Bromine				Cesium			
Br(g)	111.8	82.38	174.9	Cs(g)	76.50	49.53	175.6
Br ⁻ (aq)	-120.9	-102.8	80.71	Cs(l)	2.09	0.03	92.07
Br ₂ (g)	30.71	3.14	245.3	Cs(s)	0	0	85.15
Br ₂ (l)	0	0	152.3	CsCl(s)	-442.8	-414.4	101.2
HBr(g)	-36.23	-53.22	198.49	Chlorine			
Calcium				Cl(g)	121.7	105.7	165.2
Ca(g)	179.3	145.5	154.8	Cl ⁻ (aq)	-167.2	-131.2	56.5
Ca(s)	0	0	41.4	Cl ₂ (g)	0	0	222.96
CaCO ₃ (s, calcite)	-1207.1	-1128.76	92.88	HCl(aq)	-167.2	-131.2	56.5
CaCl ₂ (s)	-795.8	-748.1	104.6	HCl(g)	-92.30	-95.27	186.69
CaF ₂ (s)	-1219.6	-1167.3	68.87	Chromium			
CaO(s)	-635.5	-604.17	39.75	Cr(g)	397.5	352.6	174.2
Ca(OH) ₂ (s)	-986.2	-898.5	83.4	Cr(s)	0	0	23.6
CaSO ₄ (s)	-1434.0	-1321.8	106.7	Cr ₂ O ₃ (s)	-1139.7	-1058.1	81.2
Carbon				Cobalt			
C(g)	718.4	672.9	158.0	Co(g)	439	393	179
C(s, diamond)	1.88	2.84	2.43	Co(s)	0	0	28.4
C(s, graphite)	0	0	5.69	Copper			
CCl ₄ (g)	-106.7	-64.0	309.4	Cu(g)	338.4	298.6	166.3
CCl ₄ (l)	-139.3	-68.6	214.4	Cu(s)	0	0	33.30
CF ₄ (g)	-679.9	-635.1	262.3	CuCl ₂ (s)	-205.9	-161.7	108.1
CH ₄ (g)	-74.8	-50.8	186.3	CuO(s)	-156.1	-128.3	42.59
C ₂ H ₂ (g)	226.77	209.2	200.8	Cu ₂ O(s)	-170.7	-147.9	92.36
C ₂ H ₄ (g)	52.30	68.11	219.4	Fluorine			
C ₂ H ₆ (g)	-84.68	-32.89	229.5	F(g)	80.0	61.9	158.7
C ₃ H ₈ (g)	-103.85	-23.47	269.9	F ⁻ (aq)	-332.6	-278.8	-13.8

Substance	ΔH_f° (kJ/mol)	ΔG_f° (kJ/mol)	S° (J/mol-K)	Substance	ΔH_f° (kJ/mol)	ΔG_f° (kJ/mol)	S° (J/mol-K)
F ₂ (g)	0	0	202.7	MnO(s)	-385.2	-362.9	59.7
HF(g)	-268.61	-270.70	173.51	MnO ₂ (s)	-519.6	-464.8	53.14
Hydrogen				MnO ₄ ⁻ (aq)	-541.4	-447.2	191.2
H(g)	217.94	203.26	114.60	Mercury			
H ⁺ (aq)	0	0	0	Hg(g)	60.83	31.76	174.89
H ⁺ (g)	1536.2	1517.0	108.9	Hg(l)	0	0	77.40
H ₂ (g)	0	0	130.58	HgCl ₂ (s)	-230.1	-184.0	144.5
Iodine				Hg ₂ Cl ₂ (s)	-264.9	-210.5	192.5
I(g)	106.60	70.16	180.66	Nickel			
I ⁻ (g)	-55.19	-51.57	111.3	Ni(g)	429.7	384.5	182.1
I ₂ (g)	62.25	19.37	260.57	Ni(s)	0	0	29.9
I ₂ (s)	0	0	116.73	NiCl ₂ (s)	-305.3	-259.0	97.65
HI(g)	25.94	1.30	206.3	NiO(s)	-239.7	-211.7	37.99
Iron				Nitrogen			
Fe(g)	415.5	369.8	180.5	N(g)	472.7	455.5	153.3
Fe(s)	0	0	27.15	N ₂ (g)	0	0	191.50
Fe ²⁺ (aq)	-87.86	-84.93	113.4	NH ₃ (aq)	-80.29	-26.50	111.3
Fe ³⁺ (aq)	-47.69	-10.54	293.3	NH ₃ (g)	-46.19	-16.66	192.5
FeCl ₂ (s)	-341.8	-302.3	117.9	NH ₄ ⁺ (aq)	-132.5	-79.31	113.4
FeCl ₃ (s)	-400	-334	142.3	N ₂ H ₄ (g)	95.40	159.4	238.5
FeO(s)	-271.9	-255.2	60.75	NH ₄ CN(s)	0.4	—	—
Fe ₂ O ₃ (s)	-822.16	-740.98	89.96	NH ₄ Cl(s)	-314.4	-203.0	94.6
Fe ₃ O ₄ (s)	-1117.1	-1014.2	146.4	NH ₄ NO ₃ (s)	-365.6	-184.0	151
FeS ₂ (s)	-171.5	-160.1	52.92	NO(g)	90.37	86.71	210.62
Lead				NO ₂ (g)	33.84	51.84	240.45
Pb(s)	0	0	68.85	N ₂ O(g)	81.6	103.59	220.0
PbBr ₂ (s)	-277.4	-260.7	161	N ₂ O ₄ (g)	9.66	98.28	304.3
PbCO ₃ (s)	-699.1	-625.5	131.0	NOCl(g)	52.6	66.3	264
Pb(NO ₃) ₂ (aq)	-421.3	-246.9	303.3	HNO ₃ (aq)	-206.6	-110.5	146
Pb(NO ₃) ₂ (s)	-451.9	—	—	HNO ₃ (g)	-134.3	-73.94	266.4
PbO(s)	-217.3	-187.9	68.70	Oxygen			
Lithium				O(g)	247.5	230.1	161.0
Li(g)	159.3	126.6	138.8	O ₂ (g)	0	0	205.0
Li(s)	0	0	29.09	O ₃ (g)	142.3	163.4	237.6
Li ⁺ (aq)	-278.5	-273.4	12.2	OH ⁻ (aq)	-230.0	-157.3	-10.7
Li ⁺ (g)	685.7	648.5	133.0	H ₂ O(g)	-241.82	-228.57	188.83
LiCl(s)	-408.3	-384.0	59.30	H ₂ O(l)	-285.83	-237.13	69.91
Magnesium				H ₂ O ₂ (g)	-136.10	-105.48	232.9
Mg(g)	147.1	112.5	148.6	H ₂ O ₂ (l)	-187.8	-120.4	109.6
Mg(s)	0	0	32.51	Phosphorus			
MgCl ₂ (s)	-641.6	-592.1	89.6	P(g)	316.4	280.0	163.2
MgO(s)	-601.8	-569.6	26.8	P ₂ (g)	144.3	103.7	218.1
Mg(OH) ₂ (s)	-924.7	-833.7	63.24	P ₄ (g)	58.9	24.4	280
Manganese				P ₄ (s, red)	-17.46	-12.03	22.85
Mn(g)	280.7	238.5	173.6	P ₄ (s, white)	0	0	41.08
Mn(s)	0	0	32.0	PCl ₃ (g)	-288.07	-269.6	311.7

Substance	ΔH_f° (kJ/mol)	ΔG_f° (kJ/mol)	S° (J/mol-K)	Substance	ΔH_f° (kJ/mol)	ΔG_f° (kJ/mol)	S° (J/mol-K)
$\text{PCl}_3(l)$	-319.6	-272.4	217	Sodium			
$\text{PF}_5(g)$	-1594.4	-1520.7	300.8	$\text{Na}(g)$	107.7	77.3	153.7
$\text{PH}_3(g)$	5.4	13.4	210.2	$\text{Na}(s)$	0	0	51.45
$\text{P}_4\text{O}_6(s)$	-1640.1	—	—	$\text{Na}^+(aq)$	-240.1	-261.9	59.0
$\text{P}_4\text{O}_{10}(s)$	-2940.1	-2675.2	228.9	$\text{Na}^+(g)$	609.3	574.3	148.0
$\text{POCl}_3(g)$	-542.2	-502.5	325	$\text{NaBr}(aq)$	-360.6	-364.7	141.00
$\text{POCl}_3(l)$	-597.0	-520.9	222	$\text{NaBr}(s)$	-361.4	-349.3	86.82
$\text{H}_3\text{PO}_4(aq)$	-1288.3	-1142.6	158.2	$\text{Na}_2\text{CO}_3(s)$	-1130.9	-1047.7	136.0
Potassium				$\text{NaCl}(aq)$	-407.1	-393.0	115.5
$\text{K}(g)$	89.99	61.17	160.2	$\text{NaCl}(g)$	-181.4	-201.3	229.8
$\text{K}(s)$	0	0	64.67	$\text{NaCl}(s)$	-410.9	-384.0	72.33
$\text{K}^+(aq)$	-252.4	-283.3	102.5	$\text{NaHCO}_3(s)$	-947.7	-851.8	102.1
$\text{K}^+(g)$	514.2	481.2	154.5	$\text{NaNO}_3(aq)$	-446.2	-372.4	207
$\text{KCl}(s)$	-435.9	-408.3	82.7	$\text{NaNO}_3(s)$	-467.9	-367.0	116.5
$\text{KClO}_3(s)$	-391.2	-289.9	143.0	$\text{NaOH}(aq)$	-469.6	-419.2	49.8
$\text{KClO}_3(aq)$	-349.5	-284.9	265.7	$\text{NaOH}(s)$	-425.6	-379.5	64.46
$\text{K}_2\text{CO}_3(s)$	-1150.18	-1064.58	155.44	$\text{Na}_2\text{SO}_4(s)$	-1387.1	-1270.2	149.6
$\text{KNO}_3(s)$	-492.70	-393.13	132.9	Strontium			
$\text{K}_2\text{O}(s)$	-363.2	-322.1	94.14	$\text{SrO}(s)$	-592.0	-561.9	54.9
$\text{KO}_2(s)$	-284.5	-240.6	122.5	$\text{Sr}(g)$	164.4	110.0	164.6
$\text{K}_2\text{O}_2(s)$	-495.8	-429.8	113.0	Sulfur			
$\text{KOH}(s)$	-424.7	-378.9	78.91	$\text{S}(s, \text{rhombic})$	0	0	31.88
$\text{KOH}(aq)$	-482.4	-440.5	91.6	$\text{S}_8(g)$	102.3	49.7	430.9
Rubidium				$\text{SO}_2(g)$	-296.9	-300.4	248.5
$\text{Rb}(g)$	85.8	55.8	170.0	$\text{SO}_3(g)$	-395.2	-370.4	256.2
$\text{Rb}(s)$	0	0	76.78	$\text{SO}_4^{2-}(aq)$	-909.3	-744.5	20.1
$\text{RbCl}(s)$	-430.5	-412.0	92	$\text{SOCl}_2(l)$	-245.6	—	—
$\text{RbClO}_3(s)$	-392.4	-292.0	152	$\text{H}_2\text{S}(g)$	-20.17	-33.01	205.6
Scandium				$\text{H}_2\text{SO}_4(aq)$	-909.3	-744.5	20.1
$\text{Sc}(g)$	377.8	336.1	174.7	$\text{H}_2\text{SO}_4(l)$	-814.0	-689.9	156.1
$\text{Sc}(s)$	0	0	34.6	Titanium			
Selenium				$\text{Ti}(g)$	468	422	180.3
$\text{H}_2\text{Se}(g)$	29.7	15.9	219.0	$\text{Ti}(s)$	0	0	30.76
Silicon				$\text{TiCl}_4(g)$	-763.2	-726.8	354.9
$\text{Si}(g)$	368.2	323.9	167.8	$\text{TiCl}_4(l)$	-804.2	-728.1	221.9
$\text{Si}(s)$	0	0	18.7	$\text{TiO}_2(s)$	-944.7	-889.4	50.29
$\text{SiC}(s)$	-73.22	-70.85	16.61	Vanadium			
$\text{SiCl}_4(l)$	-640.1	-572.8	239.3	$\text{V}(g)$	514.2	453.1	182.2
$\text{SiO}_2(s, \text{quartz})$	-910.9	-856.5	41.84	$\text{V}(s)$	0	0	28.9
Silver				Zinc			
$\text{Ag}(s)$	0	0	42.55	$\text{Zn}(g)$	130.7	95.2	160.9
$\text{Ag}^+(aq)$	105.90	77.11	73.93	$\text{Zn}(s)$	0	0	41.63
$\text{AgCl}(s)$	-127.0	-109.70	96.11	$\text{ZnCl}_2(s)$	-415.1	-369.4	111.5
$\text{Ag}_2\text{O}(s)$	-31.05	-11.20	121.3	$\text{ZnO}(s)$	-348.0	-318.2	43.9
$\text{AgNO}_3(s)$	-124.4	-33.41	140.9				

L Selected Thermodynamic Values

Table 20 Selected Thermodynamic Values*

Species	$\Delta_f H^\circ$ (298.15 K) (kJ/mol)	S° (298.15 K) (J/K · mol)	$\Delta_f G^\circ$ (298.15 K) (kJ/mol)
<i>Aluminum</i>			
Al(s)	0	28.3	0
AlCl ₃ (s)	-705.63	109.29	-630.0
Al ₂ O ₃ (s)	-1675.7	50.92	-1582.3
<i>Barium</i>			
BaCl ₂ (s)	-858.6	123.68	-810.4
BaCO ₃ (s)	-1213	112.1	-1134.41
BaO(s)	-548.1	72.05	-520.38
BaSO ₄ (s)	-1473.2	132.2	-1362.2
<i>Beryllium</i>			
Be(s)	0	9.5	0
Be(OH) ₂ (s)	-902.5	51.9	-815.0
<i>Boron</i>			
BCl ₃ (g)	-402.96	290.17	-387.95
<i>Bromine</i>			
Br(g)	111.884	175.022	82.396
Br ₂ (ℓ)	0	152.2	0
Br ₂ (g)	30.91	245.47	3.12
BrF ₃ (g)	-255.60	292.53	-229.43
HBr(g)	-36.29	198.70	-53.45
<i>Calcium</i>			
Ca(s)	0	41.59	0
Ca(g)	178.2	158.884	144.3
Ca ²⁺ (g)	1925.90	—	—
CaC ₂ (s)	-59.8	70.	-64.93
CaCO ₃ (s, calcite)	-1207.6	91.7	-1129.16
CaCl ₂ (s)	-795.8	104.6	-748.1
CaF ₂ (s)	-1219.6	68.87	-1167.3
CaH ₂ (s)	-186.2	42	-147.2
CaO(s)	-635.09	38.2	-603.42
CaS(s)	-482.4	56.5	-477.4
Ca(OH) ₂ (s)	-986.09	83.39	-898.43
Ca(OH) ₂ (aq)	-1002.82	—	-868.07
CaSO ₄ (s)	-1434.52	106.5	-1322.02

Table 20 Selected Thermodynamic Values (continued)

Species	$\Delta_f H^\circ$ (298.15 K) (kJ/mol)	S° (298.15 K) (J/K · mol)	$\Delta_f G^\circ$ (298.15 K) (kJ/mol)
<i>Carbon</i>			
C(s, graphite)	0	5.6	0
C(s, diamond)	1.8	2.377	2.900
C(g)	716.67	158.1	671.2
CCl ₄ (ℓ)	−128.4	214.39	−57.63
CCl ₄ (g)	−95.98	309.65	−53.61
CHCl ₃ (ℓ)	−134.47	201.7	−73.66
CHCl ₃ (g)	−103.18	295.61	−70.4
CH ₄ (g, methane)	−74.87	186.26	−50.8
C ₂ H ₂ (g, ethyne)	226.73	200.94	209.20
C ₂ H ₄ (g, ethene)	52.47	219.36	68.35
C ₂ H ₆ (g, ethane)	−83.85	229.2	−31.89
C ₃ H ₈ (g, propane)	−104.7	270.3	−24.4
C ₆ H ₆ (ℓ, benzene)	48.95	173.26	124.21
CH ₃ OH(ℓ, methanol)	−238.4	127.19	−166.14
CH ₃ OH(g, methanol)	−201.0	239.7	−162.5
C ₂ H ₅ OH(ℓ, ethanol)	−277.0	160.7	−174.7
C ₂ H ₅ OH(g, ethanol)	−235.3	282.70	−168.49
CO(g)	−110.525	197.674	−137.168
CO ₂ (g)	−393.509	213.74	−394.359
CS ₂ (ℓ)	89.41	151	65.2
CS ₂ (g)	116.7	237.8	66.61
COCl ₂ (g)	−218.8	283.53	−204.6
<i>Cesium</i>			
Cs(s)	0	85.23	0
Cs ⁺ (g)	457.964	—	—
CsCl(s)	−443.04	101.17	−414.53
<i>Chlorine</i>			
Cl(g)	121.3	165.19	105.3
Cl [−] (g)	−233.13	—	—
Cl ₂ (g)	0	223.08	0
HCl(g)	−92.31	186.2	−95.09
HCl(aq)	−167.159	56.5	−131.26
<i>Chromium</i>			
Cr(s)	0	23.62	0
Cr ₂ O ₃ (s)	−1134.7	80.65	−1052.95
CrCl ₃ (s)	−556.5	123.0	−486.1

(continued)

Table 20 Selected Thermodynamic Values (continued)

Species	$\Delta_f H^\circ$ (298.15 K) (kJ/mol)	S° (298.15 K) (J/K · mol)	$\Delta_f G^\circ$ (298.15 K) (kJ/mol)
<i>Copper</i>			
Cu(s)	0	33.17	0
CuO(s)	-156.06	42.59	-128.3
CuCl ₂ (s)	-220.1	108.07	-175.7
CuSO ₄ (s)	-769.98	109.05	-660.75
<i>Fluorine</i>			
F ₂ (g)	0	202.8	0
F(g)	78.99	158.754	61.91
F ⁻ (g)	-255.39	—	—
F ⁻ (aq)	-332.63	—	-278.79
HF(g)	-273.3	173.779	-273.2
HF(aq)	-332.63	88.7	-278.79
<i>Hydrogen</i>			
H ₂ (g)	0	130.7	0
H(g)	217.965	114.713	203.247
H ⁺ (g)	1536.202	—	—
H ₂ O(ℓ)	-285.83	69.95	-237.15
H ₂ O(g)	-241.83	188.84	-228.59
H ₂ O ₂ (ℓ)	-187.78	109.6	-120.35
<i>Iodine</i>			
I ₂ (s)	0	116.135	0
I ₂ (g)	62.438	260.69	19.327
I(g)	106.838	180.791	70.250
I ⁻ (g)	-197	—	—
ICl(g)	17.51	247.56	-5.73
<i>Iron</i>			
Fe(s)	0	27.78	0
FeO(s)	-272	—	—
Fe ₂ O ₃ (s, hematite)	-825.5	87.40	-742.2
Fe ₃ O ₄ (s, magnetite)	-1118.4	146.4	-1015.4
FeCl ₂ (s)	-341.79	117.95	-302.30
FeCl ₃ (s)	-399.49	142.3	-344.00
FeS ₂ (s, pyrite)	-178.2	52.93	-166.9
Fe(CO) ₅ (ℓ)	-774.0	338.1	-705.3
<i>Lead</i>			
Pb(s)	0	64.81	0
PbCl ₂ (s)	-359.41	136.0	-314.10
PbO(s, yellow)	-219	66.5	-196
PbO ₂ (s)	-277.4	68.6	-217.39
PbS(s)	-100.4	91.2	-98.7

Table 20 Selected Thermodynamic Values (continued)

Species	$\Delta_f H^\circ$ (298.15 K) (kJ/mol)	S° (298.15 K) (J/K · mol)	$\Delta_f G^\circ$ (298.15 K) (kJ/mol)
<i>Lithium</i>			
Li(s)	0	29.12	0
Li ⁺ (g)	685.783	—	—
LiOH(s)	−484.93	42.81	−438.96
LiOH(aq)	−508.48	2.80	−450.58
LiCl(s)	−408.701	59.33	−384.37
<i>Magnesium</i>			
Mg(s)	0	32.67	0
MgCl ₂ (s)	−641.62	89.62	−592.09
MgCO ₃ (s)	−1111.69	65.84	−1028.2
MgO(s)	−601.24	26.85	−568.93
Mg(OH) ₂ (s)	−924.54	63.18	−833.51
MgS(s)	−346.0	50.33	−341.8
<i>Mercury</i>			
Hg(ℓ)	0	76.02	0
HgCl ₂ (s)	−224.3	146.0	−178.6
HgO(s, red)	−90.83	70.29	−58.539
HgS(s, red)	−58.2	82.4	−50.6
<i>Nickel</i>			
Ni(s)	0	29.87	0
NiO(s)	−239.7	37.99	−211.7
NiCl ₂ (s)	−305.332	97.65	−259.032
<i>Nitrogen</i>			
N ₂ (g)	0	191.56	0
N(g)	472.704	153.298	455.563
NH ₃ (g)	−45.90	192.77	−16.37
N ₂ H ₄ (ℓ)	50.63	121.52	149.45
NH ₄ Cl(s)	−314.55	94.85	−203.08
NH ₄ Cl(aq)	−299.66	169.9	−210.57
NH ₄ NO ₃ (s)	−365.56	151.08	−183.84
NH ₄ NO ₃ (aq)	−339.87	259.8	−190.57
NO(g)	90.29	210.76	86.58
NO ₂ (g)	33.1	240.04	51.23
N ₂ O(g)	82.05	219.85	104.20
N ₂ O ₄ (g)	9.08	304.38	97.73
NOCl(g)	51.71	261.8	66.08
HNO ₃ (ℓ)	−174.10	155.60	−80.71
HNO ₃ (g)	−135.06	266.38	−74.72
HNO ₃ (aq)	−207.36	146.4	−111.25

(continued)

Table 20 Selected Thermodynamic Values (continued)

Species	$\Delta_f H^\circ$ (298.15 K) (kJ/mol)	S° (298.15 K) (J/K · mol)	$\Delta_f G^\circ$ (298.15 K) (kJ/mol)
<i>Oxygen</i>			
O ₂ (g)	0	205.07	0
O(g)	249.170	161.055	231.731
O ₃ (g)	142.67	238.92	163.2
<i>Phosphorus</i>			
P ₄ (s, white)	0	41.1	0
P ₄ (s, red)	-17.6	22.80	-12.1
P(g)	314.64	163.193	278.25
PH ₃ (g)	5.47	210.24	6.64
PCL ₃ (g)	-287.0	311.78	-267.8
P ₄ O ₁₀ (s)	-2984.0	228.86	-2697.7
H ₃ PO ₄ (ℓ)	-1279.0	110.5	-1119.1
<i>Potassium</i>			
K(s)	0	64.63	0
KCl(s)	-436.68	82.56	-408.77
KClO ₃ (s)	-397.73	143.1	-296.25
KI(s)	-327.90	106.32	-324.892
KOH(s)	-424.72	78.9	-378.92
KOH(aq)	-482.37	91.6	-440.50
<i>Silicon</i>			
Si(s)	0	18.82	0
SiBr ₄ (ℓ)	-457.3	277.8	-443.9
SiC(s)	-65.3	16.61	-62.8
SiCl ₄ (g)	-662.75	330.86	-622.76
SiH ₄ (g)	34.31	204.65	56.84
SiF ₄ (g)	-1614.94	282.49	-1572.65
SiO ₂ (s, quartz)	-910.86	41.46	-856.97
<i>Silver</i>			
Ag(s)	0	42.55	0
Ag ₂ O(s)	-31.1	121.3	-11.32
AgCl(s)	-127.01	96.25	-109.76
AgNO ₃ (s)	-124.39	140.92	-33.41
<i>Sodium</i>			
Na(s)	0	51.21	0
Na(g)	107.3	153.765	76.83
Na ⁺ (g)	609.358	—	—
NaBr(s)	-361.02	86.82	-348.983
NaCl(s)	-411.12	72.11	-384.04
NaCl(g)	-181.42	229.79	-201.33
NaCl(aq)	-407.27	115.5	-393.133

Table 20 Selected Thermodynamic Values (continued)

Species	$\Delta_f H^\circ$ (298.15 K) (kJ/mol)	S° (298.15 K) (J/K · mol)	$\Delta_f G^\circ$ (298.15 K) (kJ/mol)
<i>Sodium (continued)</i>			
NaOH(s)	-425.93	64.46	-379.75
NaOH(aq)	-469.15	48.1	-418.09
Na ₂ CO ₃ (s)	-1130.77	134.79	-1048.08
<i>Sulfur</i>			
S(s, rhombic)	0	32.1	0
S(g)	278.98	167.83	236.51
S ₂ Cl ₂ (g)	-18.4	331.5	-31.8
SF ₆ (g)	-1209	291.82	-1105.3
H ₂ S(g)	-20.63	205.79	-33.56
SO ₂ (g)	-296.84	248.21	-300.13
SO ₃ (g)	-395.77	256.77	-371.04
SOCl ₂ (g)	-212.5	309.77	-198.3
H ₂ SO ₄ (ℓ)	-814	156.9	-689.96
H ₂ SO ₄ (aq)	-909.27	20.1	-744.53
<i>Tin</i>			
Sn(s, white)	0	51.08	0
Sn(s, gray)	-2.09	44.14	0.13
SnCl ₄ (ℓ)	-511.3	258.6	-440.15
SnCl ₄ (g)	-471.5	365.8	-432.31
SnO ₂ (s)	-577.63	49.04	-515.88
<i>Titanium</i>			
Ti(s)	0	30.72	0
TiCl ₄ (ℓ)	-804.2	252.34	-737.2
TiCl ₄ (g)	-763.16	354.84	-726.7
TiO ₂ (s)	-939.7	49.92	-884.5
<i>Zinc</i>			
Zn(s)	0	41.63	0
ZnCl ₂ (s)	-415.05	111.46	-369.398
ZnO(s)	-348.28	43.64	-318.30
ZnS(s, sphalerite)	-205.98	57.7	-201.29