Formula	Form	Mol. wt. g mol^{-1}	$\Delta_f H°$ kJ mol^{-1}	$\Delta_f G°$ kJ mol^{-1}	$S°$ J mol^{-1} K^{-1}	$C°_p$ J mol^{-1} K^{-1}	$V°$ cm^3 mol^{-1}
Fluorine							
F_2	g	37.9968	0	0	202.78	31.30	
HF	g	20.0064	−271.1	−273.2	173.779	29.133	
HF	aq	20.0064	−320.08	−296.82	88.7	—	
F^-		18.9984	−332.63	−278.79	−13.8	−106.7	—
Hydrogen							
H_2	g	2.0160	0	0	130.684	28.824	24465.6
H^+	aq	1.0080	0	0	0	0	0
OH^-	aq	17.0074	−229.994	−157.244	−10.75	−148.5	
H_2O	l	18.0154	−285.830	−237.129	69.91	75.291	18.068
H_2O	g	18.0154	−241.818	−228.572	188.825	33.577	24465.6
Iodine							
I_2	s	253.8088	0	0	116.135	54.438	
I^-	aq	126.9044	−55.19	−51.57	111.3	−142.3	
HI	aq	127.9124	−55.19	−51.57	111.3	—	
IO_3^-	aq	174.9026	−221.3	−128.0	118.4	—	
IO_4^-	aq	190.9020	−155.5	−58.5	222.0	—	
Iron							
Fe	s	55.8470	0	0	27.28	25.10	
Fe^{2+}	aq	55.8470	−89.1	−78.90	−137.7	—	
Fe^{3+}	aq	55.8470	−48.5	−4.7	−315.9	—	
$Fe_{0.947}O$	wüstite	68.8865	−266.27	−245.12	57.49	48.12	
Fe_2O_3	hematite	159.6922	−824.2	−742.2	87.40	103.85	
Fe_3O_4	magnetite	231.5386	−1118.4	−1015.4	146.4	143.43	
FeO(OH)	goethite	88.8538	−559.0	(−487.02)	(60.25)	—	
$Fe(OH)_2$	s	89.8618	−569.0	−486.5	88.	—	
$Fe(OH)_3$	s	106.8692	−823.0	−696.5	106.7	—	
FeS	troilite	87.9110	−100.0	−100.4	60.29	50.54	
FeS_2	pyrite	119.9750	−178.2	−166.9	52.93	62.17	
$FeCO_3$	siderite	115.8564	−740.57	−666.67	92.9	82.13	
Fe_2SiO_4	fayalite	203.7776	−1479.9	−1379.0	145.2	132.88	
Lead							
Pb	s	207.1900	0	0	64.81	26.44	
Pb^{2+}	aq	207.1900	−1.7	−24.43	10.5	—	
PbO	yellow	223.1894	−217.32	−187.89	68.70	45.77	
PbO	red	223.1894	−218.99	−188.93	66.5	45.81	

Formula	Form	Mol. wt. g mol^{-1}	$\Delta_f H°$ kJ mol^{-1}	$\Delta_f G°$ kJ mol^{-1}	$S°$ J mol^{-1} K^{-1}	$C°_p$ J mol^{-1} K^{-1}	$V°$ cm^3 mol^{-1}
PbF_2	s	245.1868	−664.0	−617.1	110.5	—	
$PbCl_2$	s	278.0960	−359.41	−314.10	136.0	—	
PbS	galena	239.2540	−100.42	−98.7	91.2	49.50	
$PbSO_4$	anglesite	303.2516	−919.94	−813.14	148.57	103.207	
$PbCO_3$	cerussite	267.1994	−699.1	−625.5	131.0	87.40	
$PbSiO_3$	s	283.2742	−1145.70	−1062.10	109.6	90.04	
Magnesium							
Mg	s	24.3120	0	0	32.68	24.89	
Mg^{2+}	aq	24.3120	−466.85	−454.8	−138.1	—	
MgO	periclase	40.3114	−601.70	−569.43	26.94	37.15	
$Mg(OH)_2$	brucite	58.3268	−924.54	−833.51	63.18	77.03	
MgF_2	sellaite	62.3088	−1123.4	−1070.2	57.24	61.59	
MgS	s	56.3760	−346.0	−341.8	50.33	45.56	
$MgCO_3$	magnesite	84.3214	−1095.8	−1012.1	65.7	75.52	28.018
$MgCO_3 \cdot 3H_2O$	nesquehonite	138.3676	—	−1726.1	—	—	
$MgSiO_3$	enstatite	100.3962	−1549.00	−1462.09	67.74	81.38	
Mg_2SiO_4	forsterite	140.7076	−2174.0	−2055.1	95.14	118.49	
Manganese							
Mn	s	54.9380	0	0	32.01	26.32	
Mn^{2+}	aq	54.9380	−220.75	−228.1	−73.6	50.	
MnO_4^-	aq	118.9356	−541.4	−447.2	191.2	-82.0	
MnO	manganosite	70.9374	−385.22	−362.90	59.71	45.44	
Mn_3O_4	hausmannite	228.8116	−1387.8	−1283.2	155.6	139.66	
Mn_2O_3	s	157.8742	−959.0	−881.1	110.5	107.65	
MnO_2	pyrolusite	86.9368	−520.03	−465.14	53.05	54.14	
$Mn(OH)_2$	amorphous	88.9528	−695.4	−615.0	99.2	—	
MnS	alabandite	87.0020	−214.2	−218.4	78.2	49.96	
$MnCO_3$	rhodochrosite	114.9474	−894.1	−816.7	85.8	81.50	
$MnSiO_3$	rhodonite	131.0222	−1320.9	−1240.5	89.1	86.44	
Mn_2SiO_4	tephroite	201.9596	−1730.5	−1632.1	163.2	129.87	
Mercury							
Hg	l	200.5900	0	0	76.02	27.983	
Hg	g	200.5900	61.317	31.820	174.96	20.786	
Hg^{2+}	aq	200.5900	171.1	164.4	−32.2	—	
Hg_2^{2+}	aq	401.1800	172.4	153.52	84.5	—	
HgS_2^{2-}	aq	264.7180	—	41.9	—	—	
$HgCl_4^{2-}$	aq	342.4020	−554.0	−446.8	293.	—	
Hg_2Cl_2	s	472.0860	−265.22	−210.745	192.5	—	
HgO	s, red	216.5894	−90.83	−58.539	70.29	44.06	
HgO	s, yellow	216.5894	−90.46	−58.409	71.1	—	
HgS	cinnabar	232.6540	−58.2	−50.6	82.4	48.41	
HgS	metacinnabar	232.6540	−53.6	−47.7	88.3	—	

Formula	Form	Mol. wt. g mol^{-1}	$\Delta_f H°$ kJ mol^{-1}	$\Delta_f G°$ kJ mol^{-1}	$S°$ J mol^{-1} K^{-1}	$C_p°$ J mol^{-1} K^{-1}	$V°$ cm^3 mol^{-1}
Aluminum							
Al	s	26.9815	0	0	28.33	24.35	
Al^{3+}	aq	26.9815	−531.	−485.	−321.7	—	−45.3
$Al(OH)^{2+}$	aq		−767.0	−693.7	—	—	
$Al(OH)_2^+$	aq		−1010.7	−901.4	—	—	
$Al(OH)_3^\circ(aq)$	aq		−1250.4	−1100.7	—	—	
$Al(OH)_4^-$	aq	95.0111	−1490.0	−1307.0	102.9	—	45.60
Al_2O_3	α, corundum	101.9612	−1675.7	−1582.3	50.92	79.04	25.575
$Al_2O_3 \cdot H_2O$	boehmite	119.9766	−1980.7	−1831.7	96.86	131.25	39.07
$Al_2O_3 \cdot H_2O$	diaspore	119.9766	−1998.91	−1841.78	70.67	106.19	35.52
$Al_2O_3 \cdot 3H_2O$	gibbsite	156.0074	−2586.67	−2310.21	136.90	183.47	63.912
$Al_2O_3 \cdot 3H_2O$	bayerite	156.0074	−2576.5	—	—	—	
$Al(OH)_3$	amorphous	78.0037	−1276.	—	—	—	
Al_2SiO_5	andalusite	162.0460	−2590.27	−2442.66	93.22	122.72	51.53
Al_2SiO_5	kyanite	162.0460	−2594.29	−2443.88	83.81	121.71	44.09
Al_2SiO_5	sillimanite	162.0460	−2587.76	−2440.99	96.11	124.52	49.90
$Al_2Si_2O_7 \cdot 2H_2O$	kaolinite	258.1616	−4119.6	−3799.7	205.0	246.14	99.52
$Al_2Si_2O_7 \cdot 2H_2O$	halloysite	258.1616	−4101.2	−3780.5	203.3	246.27	99.30
$Al_2Si_2O_7 \cdot 2H_2O$	dickite	258.1616	−4118.3	−3795.9	197.1	239.49	99.30
$Al_6Si_2O_{13}$	mullite	426.0532	−6816.2	−6432.7	255.	326.10	-
$Al_2Si_4O_{10}(OH)_2$	pyrophyllite	360.3158	−5642.04	−5268.14	239.41	294.34	126.6
Barium							
Ba	s	137.3400	0	0	62.8	28.07	
Ba^{2+}	aq	137.3400	−537.64	−560.77	9.6	—	−12.9
BaO	s	153.3394	−553.5	−525.1	70.42	47.78	
BaO_2	s	169.3388	−634.3	—	—	66.9	
BaF_2	s	175.3368	−1207.1	−1156.8	96.36	71.21	
BaS	s	169.4040	−460.	−456.	78.2	49.37	
$BaSO_4$	barite	233.4016	−1473.2	−1362.2	132.2	101.75	52.10
$BaCO_3$	witherite	197.3494	−1216.3	−1137.6	112.1	85.35	45.81
$BaSiO_3$	s	213.4242	−1623.60	−1540.21	109.6	90.00	
Calcium							
Ca	s	40.0800	0	0	41.42	25.31	
Ca^{2+}	aq	40.0800	−542.83	−553.58	−53.1	—	−18.4
CaO	s	56.0794	−635.09	−604.03	39.75	42.80	
$Ca(OH)_2$	portlandite	74.0948	−986.09	−898.49	83.39	87.49	
CaF_2	fluorite	78.0768	−1219.6	−1167.3	68.87	67.03	24.542
CaS	s	72.1440	−482.4	−477.4	56.5	47.40	
$CaSO_4$	anhydrite	136.1416	−1434.11	−1321.79	106.7	99.66	45.94

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Formula	Form	Mol. wt. g mol^{-1}	$\Delta_f H°$ kJ mol^{-1}	$\Delta_f G°$ kJ mol^{-1}	$S°$ J mol^{-1} K^{-1}	$C_p°$ J mol^{-1} K^{-1}	$V°$ cm^3 mol^{-1}
$CaSO_4 \cdot 2H_2O$	gypsum	172.1724	−2022.63	−1797.28	194.1	186.02	
$Ca_3(PO_4)_2$	β,whitlockite	310.1828	−4120.8	−3884.7	236.0	227.82	
$Ca_3(PO_4)_2$	α	310.1828	−4109.9	−3875.5	240.91	231.58	
$CaCO_3$	calcite	100.0894	−1206.92	−1128.79	92.9	81.88	36.934
$CaCO_3$	aragonite	100.0894	−1207.13	−1127.75	88.7	81.25	34.150
$CaSiO_3$	wollastonite	116.1642	−1634.94	−1549.66	81.92	85.27	39.93
$CaSiO_3$	pseudowollastonite	116.1642	−1628.4	−1544.7	87.36	86.48	
$CaAl_2SiO_6$	Ca-Al pyroxene	218.1254	−3298.2	−3122.0	141.4	165.7	
$CaAl_2Si_2O_8$	anorthite	278.2102	−4227.9	−4002.3	199.28	211.42	100.79
$CaTiO_3$	perovskite	135.9782	−1660.6	−1575.2	93.64	97.65	
$CaTiSiO_5$	sphene	196.0630	−2603.3	−2461.8	129.20	138.95	
$CaMg(CO_3)_2$	dolomite	184.4108	−2326.3	−2163.4	155.18	157.53	64.365
$CaMgSi_2O_6$	diopside	216.5604	−3206.2	−3032.0	142.93	166.52	66.090
Carbon							
C	graphite	12.0112	0	0	5.740	8.527	5.298
C	diamond	12.0112	1.895	2.900	2.377	6.113	3.417
CO_3^{2-}	aq	60.0094	−677.149	−527.81	−56.9	—	−6.1
HCO_3^-	aq	61.0174	−691.99	−586.77	91.2	—	24.2
CO	g	28.0106	−110.525	−137.168	197.674	29.142	24465.6
CO_2	g	44.0100	−393.509	−394.359	213.74	37.11	24465.6
CO_2	aq	44.0100	−413.80	−385.98	117.6	—	32.8
H_2CO_3	aq	62.0254	−679.339	−623.109	283.65	—	
CH_4	g	16.0432	−74.81	−50.72	186.264	35.309	24465.6
C_2H_6	g	30.0704	−84.68	−32.82	229.60	52.63	24465.6
CN	g	26.0179	437.6	407.5	202.6	29.16	
CN^-	aq	26.0179	150.6	172.4	94.1	—	
HCN	g	27.0259	135.1	124.7	201.78	35.86	
HCN	aq	27.0259	107.1	119.7	124.7	—	
Chlorine							
Cl_2	g	70.9060	0	0	233.066	33.907	24465.6
Cl^-	aq	35.4530	−167.159	−131.228	56.5	−136.4	17.3
HCl	aq	36.4610	−167.159	−131.228	56.5	−136.4	17.3
HCl	g	36.4610	−92.307	−95.299	186.908	29.12	24465.6
Copper							
Cu	s	63.5400	0	0	33.15	24.435	
Cu^+	aq	63.5400	71.67	49.98	40.6	—	
Cu^{2+}	aq	63.5400	64.77	65.49	−99.6	—	
CuO	tenorite	79.5394	−157.3	−129.7	42.63	42.30	
Cu_2O	cuprite	143.0794	−168.6	−146.0	93.14	63.64	
CuS	covellite	96.6040	−53.1	−53.6	66.5	47.82	
Cu_2S	chalcocite	159.1440	−79.5	−86.2	120.9	76.32	

Formula	Form	Mol. wt. g mol^{-1}	$\Delta_f H°$ kJ mol^{-1}	$\Delta_f G°$ kJ mol^{-1}	$S°$ J mol^{-1} K^{-1}	C_p° J mol^{-1} K^{-1}	$V°$ cm^3 mol^{-1}
Molybdenum							
Mo	s	95.9400	0	0	28.66	24.06	
MoO_3	s	127.9388	−745.09	−667.97	77.74	74.98	
MoS_2	molybdenite	160.0680	−235.1	−225.9	62.59	63.55	
Nickel							
Ni	s	58.7100	0	0	29.87	26.07	
Ni^{2+}	aq	58.7100	−54.0	−45.6	−128.9	—	
NiO	bunsenite	74.7094	−239.7	−211.7	37.99	44.31	
NiS	s	90.7740	−82.0	−79.5	52.97	47.11	
Nitrogen							
N_2	g	28.0134	0	0	191.61	29.125	
NO	g	30.0061	90.25	86.55	210.761	29.844	
NO_2	g	46.0055	33.18	51.31	240.06	37.20	
N_2O	g	44.0128	82.05	104.2	219.85	38.45	
N_2O_4	l	92.0110	−19.50	97.54	209.2	142.7	
N_2O_4	g	92.0110	9.16	97.89	304.29	77.28	
N_2O_5	s	108.0104	−43.1	113.9	178.2	143.1	
N_2O_5	g	108.0104	11.3	115.1	355.7	84.5	
NH_3	g	17.0307	−46.11	−16.45	192.45	35.06	
NO_3^-	aq	62.0049	−205.0	−108.74	146.45	−86.6	
NH_4^+	aq	18.0837	−132.51	−79.31	113.4	79.9	
NH_4OH	aq	35.0461	−366.12	−263.63	181.21	—	
Oxygen							
O_2	g	31.9988	0	0	205.138	29.355	
O_2	aq	31.9988	−11.7	16.4	110.9	—	
OH^-	aq	17.0074	−229.994	−157.244	−10.75	−148.5	
H_2O	l	18.0154	−285.830	−237.129	69.91	75.291	18.068
H_2O	g	18.0154	−241.818	−228.572	188.825	33.577	24465.6
Potassium							
K	s	39.1020	0	0	64.18	29.58	
K^+	aq	39.1020	−252.38	−283.27	102.5	21.8	9.0
KCl	sylvite	74.5550	−436.747	−409.14	82.59	51.30	
$KAlSi_3O_8$	sanidine	278.3367	−3959.7	−3739.9	232.88	204.51	
$KAlSi_3O_8$	microcline	278.3367	−3968.1	−3742.9	214.22	202.38	108.741
$KAlSiO_4$	kaliophilite	158.1671	−2121.3	−2005.3	133.1	119.79	
$KAlSi_2O_6$	leucite	218.2519	−3034.2	−2871.4	200.08	164.14	
$KAl_3Si_3O_{10}OH_2$	muscovite	398.3133	−5984.4	−5608.4	306.3	—	14.087

Formula	Form	Mol. wt. g mol^{-1}	$\Delta_f H°$ kJ mol^{-1}	$\Delta_f G°$ kJ mol^{-1}	$S°$ J mol^{-1} K^{-1}	C_p° J mol^{-1} K^{-1}	$V°$ cm^3 mol^{-1}
Silicon							
Si	s	28.0860	0	0	18.83	20.00	
SiO_2	α-quartz	60.0848	−910.94	−856.64	41.84	44.43	22.688
SiO_2	α-cristobalite	60.0848	−909.48	−855.43	42.68	44.18	
SiO_2	α-tridymite	60.0848	−909.06	−855.26	43.5	44.60	25.740
SiO_2	coesite	60.0848	−906.31	−851.62	40.376	43.51	20.641
SiO_2	amorphous	60.0848	−903.49	−850.70	46.9	44.4	
SiO_2	aq	60.0848	−877.699	−833.411	75.312	318.40	16.1
H_4SiO_4	aq		−1449.359	−1307.669	215.132	468.98	
$HSiO_3^-$	aq		−1125.583	−1013.783	41.84	−137.24	9.5
Silver							
Ag	s	107.8700	0	0	42.55	25.351	
Ag^+	aq	107.8700	105.579	77.107	72.68	21.8	
Ag_2O	s	231.7394	−31.05	−11.20	121.3	65.86	
AgCl	cerargyrite	143.3230	−127.068	−109.789	96.2	50.79	
Ag_2S	acanthite	247.8040	−32.59	−40.67	144.01	76.53	
Ag_2S	argentite	247.8040	−29.41	−39.46	150.6	—	
Sodium							
Na	s	22.9898	0	0	51.21	28.24	
Na^+	aq	22.9898	−240.12	−261.905	59.0	46.4	−1.2
NaCl	halite	58.4428	−411.153	−384.138	72.13	50.50	27.015
Na_2SiO_3	s	122.0638	−1554.90	−1462.80	113.85	—	
$NaAlSiO_4$	nepheline	142.0549	−2092.8	−1978.1	124.3	—	54.16
$NaAlSi_3O_8$	low albite	262.2245	−3935.1	−3711.5	207.40	205.10	100.07
$NaAlSi_2O_6$	jadeite	202.1397	−3030.9	−2852.1	133.5	—	60.40
Sulfur							
S	orthorhombic	32.0640	0	0	31.80	22.64	
S^{2-}	aq	32.0640	33.1	85.8	−14.6	—	
HS^-	aq	33.0720	−17.6	12.08	62.8	—	
SO_4^{2-}	aq	96.0616	−909.27	−744.53	20.1	−293.	
HSO_4^-	aq	32.0640	−33.1	−85.8	−14.6	—	
S_2	g	64.1280	128.37	79.30	228.18	32.47	
H_2S	g	34.0800	−20.63	−33.56	205.79	34.23	
H_2S	aq	34.0800	−39.7	−27.83	121.	—	
SO_2	g	64.0628	−296.830	−300.194	248.22	39.87	
SO_3	g	80.0622	−395.72	−371.06	256.76	50.67	

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Titanium							
Ti	s	47.9000	0	0	30.63	25.02	
TiO	s	63.8994	−519.7	−495.0	50.0	39.96	
TiO_2	anatase	79.8988	−939.7	−884.5	49.92	55.48	
TiO_2	brookite	79.8988	−941.8	—	—	—	
TiO_2	rutile	79.8988	−944.7	−889.5	50.33	55.02	
Uranium							
U	s	238.0290	0	0	50.21	27.665	
UO_2	uraninite	270.0278	−1084.9	−1031.7	77.03	63.60	
UO_3	orthorhombic	286.0272	−1223.8	−1145.9	96.11	81.67	
U^{3+}	aq	238.0290	−489.1	−475.4	192.	—	
U^{4+}	aq	238.0290	−591.2	−531.0	410.	—	
UO_2^{2+}	aq	270.0278	−1019.6	−953.5	−97.5	—	
Zinc							
Zn	s	65.3700	0	0	41.63	25.40	
Zn^{2+}	aq	65.3700	−155.89	−147.06	−112.1	46.	
ZnO	zincite	81.3694	−348.28	−318.30	43.64	40.25	
ZnS	wurtzite	97.4340	−192.63	—	—	—	
ZnS	sphalerite	97.4340	−205.98	−201.29	57.7	46.0	
$ZnCO_3$	smithsonite	125.3794	−812.78	−731.52	82.4	79.71	
Zn_2SiO_4	willemite	222.8236	−1636.74	−1523.16	131.4	123.34	

Part 2. Organic Substances

N.B.: columns for $\Delta_f G°$ and $\Delta_f H°$ are reversed from Part 1, and $\Delta_f G°$ and $\Delta_f H°$ are in J rather than kJ.

Data from Shock and Helgeson, Geochimica et Cosmochimica Acta, v. 54, pp. 915-945, 1990.

Formula	Form	Name g mol^{-1}	$\Delta_f G°$ J mol^{-1}	$\Delta_f H°$ J mol^{-1}	$S°$ J mol^{-1} K^{-1}	$C_p°$ J mol^{-1} K^{-1}	$V°$ cm^3 mol^{-1}
n-Alkanes							
CH_4	aq	methane	−34451	−87906	87.82	277.4	37.30
CH_4	g	methane	−50720	−74810	186.26	35.31	24465.6
C_2H_6	aq	ethane	−16259	−103136	112.17	369.4	51.20
C_3H_8	aq	propane	−8213	−127570	141.00	462.8	67.00
C_4H_{10}	aq	*n*-butane	151	−151586	167.44	560.2	82.80
C_5H_{12}	aq	*n*-pentane	8912	−173887	198.74	640.2	98.60
C_6H_{14}	aq	*n*-hexane	18493	−198322	221.33	733.0	114.40
C_7H_{16}	aq	*n*-heptane	27070	−221543	251.04	821.7	130.20
C_8H_{18}	aq	*n*-octane	35899	−248571	266.94	910.4	146.00
1-Alkenes							
C_2H_4	aq	ethylene	81379	35857	120.08	261.5	45.50
C_3H_6	aq	1-propene	74935	−1213	153.55	350.2	61.30
C_4H_8	aq	1-butene	84977	−23577	181.59	438.9	77.10
C_5H_{10}	aq	1-pentene	94014	−46861	209.62	527.6	92.90
C_6H_{12}	aq	1-hexene	101964	−71233	237.65	616.3	108.70
C_7H_{14}	aq	1-heptene	110667	−94851	265.68	705.0	124.50
C_8H_{16}	aq	1-octene	120164	−117654	293.72	793.7	140.30
Alkylbenzenes							
C_6H_6	aq	benzene	133888	51170	148.53	361.1	83.50
$C_6H_5CH_3$	aq	toluene	126608	13724	183.68	430.1	97.71