Table A-6

Thermodynamic Properties (at 25°C and 100.000 kPa)

$\Delta H_f°$ (kJ/mol) $\Delta G_f°$ (kJ/mol) $S°$ (J/mol · K)
(concentration of aqueous solutions is 1*M*)

Substance	$\Delta H_f°$	$\Delta G_f°$	$S°$
Ag(cr)	0	0	42.55
AgCl(cr)	−127.068	−109.789	96.2
AgCN(cr)	146.0	156.9	107.19
Al(cr)	0	0	28.33
Al_2O_3(cr)	−1675.7	−1582.3	50.92
$BaCl_2$(aq)	−871.95	−823.21	122.6
$BaSO_4$(cr)	−1473.2	−1362.2	132.2
Be(cr)	0	0	9.50
BeO(cr)	−609.6	−580.3	—
Bi(cr)	0	0	56.74
$BiCl_3$(cr)	−379.1	−315.0	177.0
Bi_2S_3(cr)	−143.1	−140.6	200.4
Br_2(l)	0	0	152.231
CH_4(g)	−74.81	−50.72	186.264
C_2H_2(g)	+226.73	+209.20	200.94
C_2H_4(g)	+52.26	+68.15	219.56
C_2H_6(g)	−84.68	−32.82	229.60
CO(g)	−110.525	−137.168	197.674
CO_2(g)	−393.509	−394.359	213.74
CS_2(l)	+89.70	+65.27	151.34
Ca(cr)	0	0	41.42
$Ca(OH)_2$(cr)	−986.09	−898.49	—
Cl_2(g)	0	0	223.066
Co_3O_4(cr)	−891	−774	—
CoO(cr)	−237.94	−214.20	52.97
Cr_2O_3(cr)	−1139.7	−1058.1	81.2
CsCl(cr)	−443.04	−414.53	101.17
Cs_2SO_4(cr)	−1443.02	−1323.58	211.92
CuI(cr)	−67.8	−69.5	96.7
CuS(cr)	−53.1	−53.6	66.5
Cu_2S(cr)	−79.5	−86.2	120.9
$CuSO_4$(cr)	−771.36	−661.8	109
F_2(g)	0	0	202.78
$FeCl_3$(cr)	−399.49	—	—
FeO(cr)	−272.0	—	—
Fe_2O_3(cr)	−824.2	−742.2	87.40
Fe_3O_4(cr)	−1118.4	−1015.4	146.4
H(g)	+217.965	—	114.713
H_2(g)	0	0	130.684
HBr(g)	−36.40	−53.45	198.695
HCl(g)	−92.307	−95.299	186.908
HCl(aq)	−167.159	−131.228	56.5
HCN(aq)	+150.6	+172.4	94.1
HCHO(g)	−108.57	−102.53	218.77
HCOOH(l)	−424.72	−361.35	128.95
HF(g)	−271.1	−273.2	173.779
HI(g)	+26.48	+1.70	206.594
H_2O(l)	−285.830	−237.129	69.91
H_2O(g)	−241.818	−228.572	188.825
H_2O_2(l)	—	−120.35	109.6
H_3PO_2(l)	−595.4	—	—

Substance	$\Delta H_f°$	$\Delta G_f°$	$S°$
H_3PO_3(aq)	−964.4	—	—
H_3PO_4(aq)	−1279.0	−1119.1	110.50
H_2S(g)	−20.63	−33.56	205.79
H_2SO_3(aq)	−608.81	−537.81	232.2
H_2SO_4(aq)	−909.27	−744.53	20.1
$HgCl_2$(cr)	−224.3	−178.6	—
Hg_2Cl_2(cr)	−265.22	−210.745	192.5
Hg_2SO_4(cr)	−743.12	−625.815	200.66
I_2(cr)	0	0	116.135
K(cr)	0	0	64.18
KBr(cr)	−393.798	−380.66	95.90
$KMnO_4$(cr)	−837.2	−737.6	171.71
KOH(cr)	−424.764	—	—
LiBr(cr)	−351.213	—	—
LiOH(cr)	−484.93	−438.95	42.80
Mn(cr)	0	0	32.01
$MnCl_2$(aq)	−555.05	−490.8	38.9
$Mn(NO_3)_2$(aq)	−635.5	−450.9	218
MnO_2(cr)	−520.03	−465.14	53.05
MnS(cr)	−214.2	—	—
N_2(g)	0	0	191.61
NH_3(g)	−46.11	−16.45	192.45
NH_4Br(cr)	−270.83	−175.2	113
NO(g)	+90.25	86.55	210.761
NO_2(g)	+33.18	+51.31	240.06
N_2O(g)	+82.05	+104.20	219.85
Na(cr)	0	0	51.21
NaBr(cr)	−361.062	—	—
NaCl(cr)	−411.153	−384.138	72.13
$NaNO_3$(aq)	−447.48	—	—
NaOH(cr)	−425.609	—	—
Na_2S(aq)	−447.3	—	—
Na_2SO_4(cr)	−1387.08	−1270.16	149.58
O_2(g)	0	0	205.138
P_4O_6(cr)	−1640.1	—	—
P_4O_{10}(cr)	−2984.0	−2697.7	228.86
$PbBr_2$(cr)	−278.7	−261.92	161.5
$PbCl_2$(cr)	−359.41	−314.10	136.0
S(cr)	0	0	31.80
SO_2(g)	−296.830	−300.194	248.22
SO_3(g)	−454.51	−374.21	70.7
SrO(cr)	−592.0	−561.9	54.4
Ti(cr)	0	0	30.63
TiO_2(cr)	−939.7	−884.5	49.92
TlI(cr)	−123.8	−125.39	127.6
UCl_4(cr)	−1019.2	−930.0	197.1
UCl_5(cr)	−1059	−950	242.7
Zn(cr)	0	0	41.63
$ZnCl_2$(aq)	−488.19	−409.50	0.8
ZnO(cr)	−348.28	−318.30	43.64
$ZnSO_4$(aq)	−1063.15	−891.59	−92.0

0

From Appendix A in the back of your black textbook

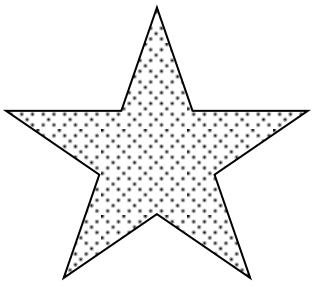
TABLE 8.4 Average Bond Enthalpies (kJ/mol)

Single Bonds

C—H	413	N—H	391	O—H	463	F—F	155
C—C	348	N—N	163	O—O	146		
C—N	293	N—O	201	O—F	190	Cl—F	253
C—O	358	N—F	272	O—Cl	203	Cl—Cl	242
C—F	485	N—Cl	200	O—I	234		
C—Cl	328	N—Br	243			Br—F	237
C—Br	276			S—H	339	Br—Cl	218
C—I	240	H—H	436	S—F	327	Br—Br	193
C—S	259	H—F	567	S—Cl	253		
		H—Cl	431	S—Br	218	I—Cl	208
Si—H	323	H—Br	366	S—S	266	I—Br	175
Si—Si	226	H—I	299			I—I	151
Si—C	301						
Si—O	368						
Si—Cl	464						

Multiple Bonds

C=C	614	N=N	418	O_2	495
C≡C	839	N≡N	941		
C=N	615	N=O	607	S=O	523
C≡N	891			S=S	418
C=O	799				
C≡O	1072				



TABLES FOR ENERGY CALCULATIONS