CHEM 154 Equation and Data Sheet

Equations

$PV = nRT$	$\left(P + a\left(\frac{n}{V}\right)^2\right)(V - nb) = nRT$	$\Delta S = \frac{q_{rev}}{T}$ (constant T)	
$\Delta U = q + w$			
$H = U + PV$	$q = nC_{p,m}\Delta T = mc_p\Delta T$	$w = -P_{ext}\Delta V$ (constant P)	
$G = H - TS$	$\Delta G_{rxn} = \Delta G^0 + RT\ln Q$	$\Delta G^0 = -RT\ln K$	$\Delta G = w_{elec} = -nFE$
$S = k\ln W$	$\ln\left(\frac{K_2}{K_1}\right) = -\frac{\Delta H^o}{R}\left(\frac{1}{T_2} - \frac{1}{T_1}\right)$	$\ln k = \frac{-E_a}{R}\left(\frac{1}{T}\right) + \ln A$	
$Q = It$			
$[A]_t = -kt + [A]_0$	$\frac{1}{[A]_t} - \frac{1}{[A]_0} = kt$	$E^0_{cell} = \frac{RT}{nF}\ln K$	$E_{cell} = E^0_{cell} - \frac{RT}{nF}\ln Q$
$[A]_t = [A]_0 e^{-kt}$			

Fundamental Constants

$R = 8.3145$ J K^{-1} mol^{-1} = 62.364 L torr K^{-1} mol^{-1} = 1.9872 cal K^{-1} mol^{-1} = 0.082057 L atm K^{-1} mol^{-1}		
1 L atm = 101.325 J = 24.217 cal	1 m = 10^6 µm = 10^9 nm = 10^{12} pm = 10^{10} Å	
Kelvin = degrees Celsius + 273.15	1 atm = 760 mmHg ~ 1 bar = 10^5 Pa	$N_A = 6.0221 \times 10^{23}$ mol^{-1}
F = 96,485 Coulombs mol^{-1}	1 J = 1 volt Coulomb	$k = 1.3806 \times 10^{-23}$ J K^{-1}

Bond Enthalpies, in kJ/mol

H—H	432	C—C	347	C=O	745	N—O	201
H—C	413	C=C	614	C≡O	1072	N=O	607
H—N	391	C≡C	839	C—S	259	N—Cl	200
H—O	467	C—N	305	C—Cl	339	O—O	146
H—S	347	C=N	615	N—N	160	O=O	495
H—Cl	427	C—O	358	N≡N	941	Cl—Cl	239

Group

1												13	14	15	16	17	18
1 H 1.008	2																2 He 4.003
3 Li 6.941	4 Be 9.012											5 B 10.811	6 C 12.011	7 N 14.007	8 O 15.999	9 F 18.998	10 Ne 20.179
11 Na 22.99	12 Mg 24.305	3	4	5	6	7	8	9	10	11	12	13 Al 26.982	14 Si 28.086	15 P 30.974	16 S 32.064	17 Cl 35.453	18 Ar 39.948
19 K 39.098	20 Ca 40.08	21 Sc 44.956	22 Ti 47.9	23 V 50.941	24 Cr 51.996	25 Mn 54.938	26 Fe 55.847	27 Co 58.933	28 Ni 58.7	29 Cu 63.546	30 Zn 65.38	31 Ga 69.72	32 Ge 72.59	33 As 74.922	34 Se 78.96	35 Br 79.904	36 Kr 83.8
37 Rb 85.468	38 Sr 87.62	39 Y 88.906	40 Zr 91.22	41 Nb 92.906	42 Mo 95.94	43 Tc "(98)"	44 Ru 101.07	45 Rh 102.9	46 Pd 106.4	47 Ag 107.87	48 Cd 112.41	49 In 114.82	50 Sn 118.69	51 Sb 121.75	52 Te 127.6	53 I 126.9	54 Xe 131.3
55 Cs 132.9	56 Ba 137.33	57 La* 138.91	72 Hf 178.49	73 Ta 180.95	74 W 183.85	75 Re 186.21	76 Os 190.2	77 Ir 192.22	78 Pt 195.09	79 Au 196.97	80 Hg 200.59	81 Tl 204.37	82 Pb 207.2	83 Bi 208.98	84 Po "(209)"	85 At "(210)'	86 Rn "(222)"
87 Fr 223	88 Ra 226.03	89 Ac# 227.03	104 Rf	105 Db {261}	106 Sg	107 Bh	108 Hs	109 Mt									

*	58 Ce 140.12	59 Pr 140.91	60 Nd 144.24	61 Pm 145	62 Sm 150.4	63 Eu 151.96	64 Gd 157.25	65 Tb 158.92	66 Dy 162.5	67 Ho 164.93	68 Er 167.26	69 Tm 168.93	70 Yb 173.04	71 Lu 174.97
#	90 Th 232.04	91 Pa 231.04	92 U 238.03	93 Np 237.05	94 Pu 244	95 Am 243	96 Cm 247	97 Bk 247	98 Cf 251	99 Es 252	100 Fm 257	101 Md 258	102 No 259	103 Lr 260