

IA										VIII A										
1 H 1.01	IIA																			2 He 4.00
3 Li 6.94	4 Be 9.01											5 B 10.81	6 C 12.01	7 N 14.01	8 O 15.999	9 F 18.998	10 Ne 20.18			
11 Na 22.99	12 Mg 24.31	III B	IV B	V B	VIB	VII B	VIII B		IB	IIB	13 Al 26.98	14 Si 28.086	15 P 30.97	16 S 32.06	17 Cl 35.45	18 Ar 39.95				
19 K 39.10	20 Ca 40.08	21 Sc 44.96	22 Ti 47.90	23 V 50.94	24 Cr 51.996	25 Mn 54.94	26 Fe 55.85	27 Co 58.93	28 Ni 58.70	29 Cu 63.55	30 Zn 65.38	31 Ga 69.72	32 Ge 72.59	33 As 74.92	34 Se 78.96	35 Br 79.90	36 Kr 83.80			
37 Rb 85.47	38 Sr 87.62	39 Y 88.91	40 Zr 91.22	41 Nb 92.91	42 Mo 95.94	43 Tc (98)	44 Ru 101.07	45 Rh 102.91	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 127.60	53 I 126.90	54 Xe 131.30			
55 Cs 132.91	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 Unq (261)	105 Unp (262)	106 Unh (263)															

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 158.93	66 Dy 162.50	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)

Physical Constants:

$R = 0.08206 \text{ L}\cdot\text{atm/mol}\cdot\text{K} = 8.314 \text{ J/mol}\cdot\text{K}$
 $c = 2.998 \times 10^8 \text{ m/s}$
 $F = 96,485 \text{ C/mol } e^-$
 $N_A = 6.022 \times 10^{23}$

Unit Conversions:

$1 \text{ J} = 1 \text{ kg}\cdot\text{m}^2/\text{s}^2$
 $1 \text{ J} = 1 \text{ C}\cdot\text{V}$
 $1 \text{ A} = 1 \text{ C/s}$
 $1 \text{ MeV} = 1.60 \times 10^{-13} \text{ J}$
 $1 \text{ atm} = 760 \text{ mm Hg}$

Formulas:

$m = \frac{\# \text{ mol solute}}{\text{mass solvent (kg)}}$

$M = \frac{\# \text{ mol solute}}{V \text{ of sol}^n \text{ (L)}}$

$X_A = \frac{n_A}{n_{\text{tot}}}$

$C = kP$

$P_A = X_A P^\circ_A$

$P_{\text{tot}} = X_A P^\circ_A + X_B P^\circ_B$

$\Delta T_b = K_b \cdot m$

$\Delta T_f = K_f \cdot m$

$\Pi = MRT$

$i = \frac{\text{measured value for electrolyte solution}}{\text{expected value for nonelectrolyte solution}}$

$\Delta T_b = i (K_b \cdot m)$

$\Delta T_f = i (K_f \cdot m)$

$\Pi = i (MRT)$

First Order:

$\ln \frac{[A]_t}{[A]_0} = -kt$

$t_{1/2} = \frac{0.693}{k}$

Second Order:

$\frac{1}{[A]_t} = kt + \frac{1}{[A]_0}$

$t_{1/2} = \frac{1}{k[A]_0}$

$k = Ae^{-E_a/RT}$

$\ln \frac{k_2}{k_1} = -\frac{E_a}{R} \left(\frac{1}{T_2} - \frac{1}{T_1} \right)$

$K_p = K_c(RT)^{\Delta n}$

$K_a \cdot K_b = K_w$

$K_w = [H_3O^+][OH^-] = 1.0 \times 10^{-14}$

$pH = -\log[H_3O^+]$

$pH = pK_a + \log \frac{[\text{base}]}{[\text{acid}]}$

$S = k \ln W$

$\Delta S_{\text{sys}} = \frac{q_{\text{rev}}}{T}; \quad \Delta S_{\text{surr}} = \frac{-\Delta H}{T}$

$\Delta G = \Delta H - T\Delta S$

$\Delta G^\circ = \Delta H^\circ - T\Delta S^\circ$

$\Delta G = \Delta G^\circ + RT \ln Q$

$\Delta G^\circ = -RT \ln K$

$\Delta G = -w_{\text{max}}$

$\Delta G^\circ = -nFE^\circ$

$E = E^\circ - \frac{0.0592}{n} \log Q \quad \text{at } 25^\circ\text{C}$

$E^\circ = \frac{0.0592}{n} \log K \quad \text{at } 25^\circ\text{C}$

Charge (C) = Current (A) x Time (s)

$I = q/t$

$E = mc^2$

$\ln \frac{N}{N_0} = -kt$

$t_{1/2} = \frac{0.693}{k}$

Reduction Potentials at 25°C

E° (V)

E° (V)

$F_2(g) + 2e^- \rightarrow 2F^-(aq)$	2.87	$Sn^{4+}(aq) + 2e^- \rightarrow Sn^{2+}(aq)$	0.15
$H_2O_2(aq) + 2H^+(aq) + 2e^- \rightarrow 2H_2O(l)$	1.78	$2H^+(aq) + 2e^- \rightarrow H_2(g)$	0.00
$MnO_4^-(aq) + 8H^+(aq) + 5e^- \rightarrow Mn^{2+}(aq) + 4H_2O(l)$	1.51	$Pb^{2+}(aq) + 2e^- \rightarrow Pb(s)$	-0.13
$Cl_2(g) + 2e^- \rightarrow 2Cl^-(aq)$	1.36	$Ni^{2+}(aq) + 2e^- \rightarrow Ni(s)$	-0.26
$Cr_2O_7^{2-}(aq) + 14H^+(aq) + 6e^- \rightarrow 2Cr^{3+}(aq) + 7H_2O(l)$	1.33	$Cd^{2+}(aq) + 2e^- \rightarrow Cd(s)$	-0.40
$O_2(g) + 4H^+(aq) + 4e^- \rightarrow 2H_2O(l)$	1.23	$Fe^{2+}(aq) + 2e^- \rightarrow Fe(s)$	-0.45
$Br_2(l) + 2e^- \rightarrow 2Br^-(aq)$	1.09	$Zn^{2+}(aq) + 2e^- \rightarrow Zn(s)$	-0.76
$Ag^+(aq) + e^- \rightarrow Ag(s)$	0.80	$2H_2O(l) + 2e^- \rightarrow H_2(g) + 2OH^-(aq)$	-0.83
$Fe^{3+}(aq) + e^- \rightarrow Fe^{2+}(aq)$	0.77	$Al^{3+}(aq) + 3e^- \rightarrow Al(s)$	-1.66
$O_2(g) + 2H^+(aq) + 2e^- \rightarrow H_2O_2(aq)$	0.70	$Mg^{2+}(aq) + 2e^- \rightarrow Mg(s)$	-2.37
$I_2(s) + 2e^- \rightarrow 2I^-(aq)$	0.54	$Na^+(aq) + e^- \rightarrow Na(s)$	-2.71
$O_2(g) + 2H_2O(l) + 4e^- \rightarrow 4OH^-(aq)$	0.40	$Li^+(aq) + e^- \rightarrow Li(s)$	-3.04
$Cu^{2+}(aq) + 2e^- \rightarrow Cu(s)$	0.34		