

IA										VIII A									
1 H 1.01	IIA																		
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	(98)	43 Ru 101.07	44 Rh 102.91	45 Pd 106.4	46 Ag 107.87	47 Cd 112.41	48 In 114.82	49 Sn 118.69	50 Sb 121.75	51 Te 127.60	52 I 126.90	53 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 L·atm/mol·K = 8.314 J/mol·K
 c = 2.998 x 10⁸ m/s
 F = 96,485 C/mol e⁻
 N_A = 6.022 x 10²³

Unit Conversions:

1 J = 1 kg·m²/s²
 1 J = 1 C·V
 1 A = 1 C/s
 1 MeV = 1.60 x 10⁻¹³ J
 1 atm = 760 mm Hg

Formulas:

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

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

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

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

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

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

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

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

$$K_a \cdot K_b = K_w$$

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

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

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

$$S = k \ln W$$

$$\Delta S_{\text{surr}} = \frac{-\Delta H}{T}$$

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

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

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

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

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

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

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

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

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)

F ₂ (g) + 2 e ⁻ → 2 F ⁻ (aq)	2.87
H ₂ O ₂ (aq) + 2 H ⁺ (aq) + 2 e ⁻ → 2 H ₂ O(l)	1.78
MnO ₄ ⁻ (aq) + 8 H ⁺ (aq) + 5 e ⁻ → Mn ²⁺ (aq) + 4 H ₂ O(l)	1.51
Cl ₂ (g) + 2 e ⁻ → 2 Cl ⁻ (aq)	1.36
Cr ₂ O ₇ ²⁻ (aq) + 14 H ⁺ (aq) + 6 e ⁻ → 2 Cr ³⁺ (aq) + 7 H ₂ O(l)	1.33
O ₂ (g) + 4 H ⁺ (aq) + 4 e ⁻ → 2 H ₂ O(l)	1.23
Br ₂ (l) + 2 e ⁻ → 2 Br ⁻ (aq)	1.09
Ag ⁺ (aq) + e ⁻ → Ag(s)	0.80
Fe ³⁺ (aq) + e ⁻ → Fe ²⁺ (aq)	0.77
O ₂ (g) + 2 H ⁺ (aq) + 2 e ⁻ → H ₂ O ₂ (aq)	0.70
I ₂ (s) + 2 e ⁻ → 2 I ⁻ (aq)	0.54
O ₂ (g) + 2 H ₂ O(l) + 4 e ⁻ → 4 OH ⁻ (aq)	0.40
Cu ²⁺ (aq) + 2 e ⁻ → Cu(s)	0.34

E°(V)

Sn ⁴⁺ (aq) + 2 e ⁻ → Sn ²⁺ (aq)	0.15
2 H ⁺ (aq) + 2 e ⁻ → H ₂ (g)	0.00
Pb ²⁺ (aq) + 2 e ⁻ → Pb(s)	-0.13
Ni ²⁺ (aq) + 2 e ⁻ → Ni(s)	-0.26
Cd ²⁺ (aq) + 2 e ⁻ → Cd(s)	-0.40
Fe ²⁺ (aq) + 2 e ⁻ → Fe(s)	-0.45
Zn ²⁺ (aq) + 2 e ⁻ → Zn(s)	-0.76
2 H ₂ O(l) + 2 e ⁻ → H ₂ (g) + 2 OH ⁻ (aq)	-0.83
Al ³⁺ (aq) + 3 e ⁻ → Al(s)	-1.66
Mg ²⁺ (aq) + 2 e ⁻ → Mg(s)	-2.37
Na ⁺ (aq) + e ⁻ → Na(s)	-2.71
Li ⁺ (aq) + e ⁻ → Li(s)	-3.04