

# Mr. Hamm's Math & Science Information Card

## Boyceville High School, Boyceville, WI

### Version July 2014

1A																	8A																				
1 2.1 <b>H</b> 1.008 +/- 1																	2 — <b>He</b> 4.00																				
		<table style="margin: auto; border: none;"> <tr> <td style="text-align: right;">Atomic Number</td> <td style="text-align: center;">→</td> <td style="text-align: center;">1</td> <td style="text-align: center;">2.1</td> <td style="text-align: left;">←</td> <td style="text-align: left;">Electronegativity</td> </tr> <tr> <td style="text-align: right;">Atomic Mass</td> <td style="text-align: center;">→</td> <td style="text-align: center;">1.008</td> <td style="text-align: center;">+/- 1</td> <td style="text-align: left;">←</td> <td style="text-align: left;">Atomic Symbol</td> </tr> <tr> <td></td> <td style="text-align: center;">↑</td> <td colspan="2"></td> <td style="text-align: left;">←</td> <td style="text-align: left;">Possible Oxidation Numbers</td> </tr> </table>														Atomic Number	→	1	2.1	←	Electronegativity	Atomic Mass	→	1.008	+/- 1	←	Atomic Symbol		↑			←	Possible Oxidation Numbers				
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Atomic Mass	→	1.008	+/- 1	←	Atomic Symbol																																
	↑			←	Possible Oxidation Numbers																																
2A																3A		4A	5A	6A	7A																
3 1.0 <b>Li</b> 6.941 +1	4 1.5 <b>Be</b> 9.011 +2															5 2.0 <b>B</b> 10.81	6 2.5 <b>C</b> 12.01 -4	7 3.0 <b>N</b> 14.01 -3	8 3.5 <b>O</b> 15.99 -2	9 4.0 <b>F</b> 19.00 -1	10 — <b>Ne</b> 20.18																
		<table style="margin: auto; border: none;"> <tr> <td colspan="10"></td> <td style="border: 1px solid black; padding: 2px;">Metalloids</td> <td colspan="5"></td> </tr> </table>																								Metalloids											
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11A	12A	3B	4B	5B	6B	7B	8B	8B	8B	1B	2B	3A	4A	5A	6A	7A	8A																				
11 0.9 <b>Na</b> 22.99 +1	12 1.2 <b>Mg</b> 24.30 +2	19 0.8 <b>K</b> 39.10 +1	20 1.0 <b>Ca</b> 40.08 +2	21 1.3 <b>Sc</b> 44.96 +3	22 1.5 <b>Ti</b> 47.87 +3, +4	23 1.6 <b>V</b> 50.94	24 1.6 <b>Cr</b> 52.00 +2, +3	25 1.5 <b>Mn</b> 54.94 +3, +4	26 1.8 <b>Fe</b> 55.85 +2, +3	27 1.8 <b>Co</b> 58.93 +2, +3	28 1.8 <b>Ni</b> 58.69 +2, +3	29 1.9 <b>Cu</b> 63.55 +1, +2	30 1.6 <b>Zn</b> 65.39 +2	31 1.6 <b>Ga</b> 69.72	32 1.8 <b>Ge</b> 72.61	33 2.0 <b>As</b> 74.92	34 2.4 <b>Se</b> 78.96 -2	35 2.8 <b>Br</b> 79.90 -1	36 3.0 <b>Kr</b> 83.80																		
37 0.8 <b>Rb</b> 85.47 +1	38 1.0 <b>Sr</b> 87.62 +2	39 1.2 <b>Y</b> 88.91	40 1.4 <b>Zr</b> 91.22	41 1.6 <b>Nb</b> 92.91	42 1.8 <b>Mo</b> 95.94	43 1.9 <b>Tc</b> 98	44 2.2 <b>Ru</b> 101.1	45 2.2 <b>Rh</b> 102.9	46 2.2 <b>Pd</b> 106.4	47 1.9 <b>Ag</b> 107.9 +1	48 1.7 <b>Cd</b> 112.4 +2, +4	49 1.7 <b>In</b> 114.8	50 1.8 <b>Sn</b> 118.1 +2, +4	51 1.9 <b>Sb</b> 121.8	52 2.1 <b>Te</b> 127.6	53 2.5 <b>I</b> 126.9 -1	54 2.6 <b>Xe</b> 131.3																				
55 0.7 <b>Cs</b> 132.9 +1	56 0.9 <b>Ba</b> 137.3 +2	71 1.1 <b>Lu</b> 175.0	72 1.3 <b>Hf</b> 178.5	73 1.5 <b>Ta</b> 180.95	74 1.7 <b>W</b> 183.8	75 1.9 <b>Re</b> 186.2	76 2.2 <b>Os</b> 190.2	77 2.2 <b>Ir</b> 192.2	78 2.2 <b>Pt</b> 195.09	79 2.4 <b>Au</b> 197.0	80 1.9 <b>Hg</b> 200.6 +1, +2	81 1.8 <b>Tl</b> 204.4	82 1.8 <b>Pb</b> 207.2 +2, +4	83 1.9 <b>Bi</b> 209.0 +3, +5	84 2.0 <b>Po</b> 209	85 2.2 <b>At</b> 210	86 2.4 <b>Rn</b> 222																				
87 0.7 <b>Fr</b> 223 +1	88 0.9 <b>Ra</b> 226 +2	103 — <b>Lr</b> 260.1	104 — <b>Rf</b> 261	105 — <b>Db</b> 262	106 — <b>Sg</b> 263	107 — <b>Bh</b> 262	108 — <b>Hs</b> 265	109 — <b>Mt</b> 266	110 — <b>Ds</b> 281	111 — <b>Rg</b> 280	112 — <b>Cn</b> 285	113 — <b>Uut</b> 284	114 — <b>Fl</b> 289	115 — <b>Uup</b> 288	116 — <b>Lv</b> 293	117 — <b>Uus</b> 294	118 — <b>Uuo</b> 294																				

57 1.1 <b>La</b> 138.9	58 1.1 <b>Ce</b> 140.1	59 1.1 <b>Pr</b> 140.9	60 1.1 <b>Nd</b> 144.2	61 1.1 <b>Pm</b> 144.9	62 1.2 <b>Sm</b> 150.4	63 1.1 <b>Eu</b> 152.0	64 1.2 <b>Gd</b> 157.2	65 1.1 <b>Tb</b> 158.9	66 1.2 <b>Dy</b> 162.5	67 1.2 <b>Ho</b> 164.9	68 1.2 <b>Er</b> 167.3	69 1.3 <b>Tm</b> 168.9	70 1.1 <b>Yb</b> 173.0
89 1.1 <b>Ac</b> 227	90 1.3 <b>Th</b> 232.0	91 1.5 <b>Pa</b> 231	92 1.3 <b>U</b> 238.0	93 1.4 <b>Np</b> 237	94 1.3 <b>Pu</b> 244	95 1.3 <b>Am</b> 243	96 1.3 <b>Cm</b> 247	97 1.3 <b>Bk</b> 247	98 1.3 <b>Cf</b> 242.1	99 1.3 <b>Es</b> 254	100 1.3 <b>Fm</b> 257.1	101 1.3 <b>Md</b> 258.1	102 1.3 <b>No</b> 259.1

## Newtonian Mechanics

$$v_f = v_o + at$$

$$d_f = d_o + v_f t + \frac{1}{2} a t^2$$

$$v_f^2 = v_o^2 + 2ad$$

$$F = ma$$

$$F_{\text{fric}} \leq \mu F_N$$

$$a_c = \frac{v^2}{r}$$

$$\tau = rF \sin \theta$$

$$p = mv$$

$$J = F \Delta t = \Delta p$$

$$K = \frac{1}{2} mv^2$$

$$U_g = mgh$$

$$W = F \Delta d \cos \theta$$

$$P_{\text{avg}} = \frac{W}{\Delta t}$$

$$P = Fv \cos \theta$$

$$F_s = -kx$$

$a$  = acceleration  
 $d$  = distance  
 $F$  = force  
 $f$  = frequency  
 $h$  = height  
 $J$  = impulse  
 $K$  = kinetic energy  
 $k$  = spring constant  
 $l$  = length  
 $m$  = mass  
 $F_N$  = Normal Force  
 $P$  = power  
 $p$  = momentum  
 $r$  = radius  
 $T$  = period  
 $t$  = time  
 $U$  = potential energy  
 $v$  = velocity or speed  
 $W$  = work done on system  
 $\mu$  = coefficient of friction  
 $\theta$  = angle  
 $\tau$  = torque

### Metric Prefixes

Giga	G	$10^9$	Centi	c	$10^{-2}$
Mega	M	$10^6$	Milli	m	$10^{-3}$
Kilo	k	$10^3$	Micro	$\mu$	$10^{-6}$
Hecto	h	$10^2$	Nano	n	$10^{-9}$
Deca	da	$10^1$	Ang.	A	$10^{-10}$
Base Unit		1	Pico	p	$10^{-12}$
Deci	d	$10^{-1}$			

### 7 Fundamental SI Units

Meter	Ampere	Mole
Kilogram	Kelvin	
Second	Candela	

$$F_G = -\frac{Gm_1 m_2}{r^2}$$

$$U_G = -\frac{Gm_1 m_2}{r}$$

## Atomic & Nuclear Physics

$$E = hf = pc$$

$$K_{\text{max}} = hf - \phi$$

$$\lambda = \frac{h}{p}$$

$$\Delta E = (\Delta m)c^2$$

$E$  = energy  
 $f$  = frequency  
 $K$  = kinetic energy  
 $m$  = mass  
 $p$  = momentum  
 $\lambda$  = wavelength  
 $\phi$  = wave function

## Electricity & Magnetism

$$F = \frac{1}{4\pi\epsilon_o} \frac{q_1 q_2}{r^2}$$

$$E = \frac{F}{q}$$

$$U_E = qV = \frac{1}{4\pi\epsilon_o} \frac{q_1 q_2}{r}$$

$$E_{\text{avg}} = -\frac{V}{d}$$

$$V = \frac{1}{4\pi\epsilon_o} \sum_i \frac{q_i}{r_i}$$

$$C = \frac{Q}{V}$$

$$C = \frac{\epsilon_o A}{d}$$

$$U_C = \frac{1}{2} QV = \frac{1}{2} CV^2$$

$$I_{\text{avg}} = \frac{\Delta Q}{\Delta t}$$

$$R = \frac{\rho l}{A}$$

$$V = IR$$

$$P = IV$$

$$C_p = \sum_i C_i$$

$$\frac{1}{C_s} = \sum_i \frac{1}{C_i}$$

$$R_s = \sum_i R_i$$

$$\frac{1}{R_p} = \sum_i \frac{1}{R_i}$$

$A$  = area  
 $B$  = magnetic field  
 $C$  = capacitance  
 $d$  = distance  
 $E$  = electric field  
 $\epsilon$  = emf  
 $F$  = force  
 $I$  = current  
 $l$  = length  
 $P$  = power  
 $Q$  = charge  
 $q$  = point charge  
 $R$  = resistance  
 $r$  = distance  
 $t$  = time  
 $U$  = potential energy  
 $V$  = electric potential or potential difference  
 $v$  = velocity or speed  
 $\rho$  = resistivity  
 $\theta$  = angle  
 $\phi$  = magnetic flux

$$F_B = qvB \sin \theta$$

$$F_B = BIl \sin \theta$$

$$B = \frac{\mu_o I}{2\pi r}$$

$$\phi_m = BA \cos \theta$$

$$\epsilon_{\text{avg}} = \frac{\Delta \phi_m}{\Delta t}$$

$$\epsilon = Blv$$

## Waves and Optics

$$v = f\lambda$$

$$f = \frac{R}{2}$$

$$n = \frac{c}{v}$$

$$d \sin \theta = m\lambda$$

$$n_1 \sin \theta_1 = n_2 \sin \theta_2$$

$$\sin \theta_c = \frac{n_2}{n_1}$$

$$x_m \approx \frac{m\lambda L}{d}$$

$$\frac{1}{s_i} + \frac{1}{s_o} = \frac{1}{f}$$

$$M = \frac{h_i}{h_o} = -\frac{s_i}{s_o}$$

$d$  = separation  
 $f$  = frequency  
 $f$  = focal length  
 $h$  = height  
 $L$  = distance  
 $M$  = magnification  
 $m$  = an integer  
 $n$  = index of refraction  
 $R$  = radius of curvature  
 $s$  = distance  
 $v$  = speed  
 $x$  = position  
 $\lambda$  = wavelength  
 $\theta$  = angle

## Fluid Mechanics & Thermodynamics

$P = P_o + \rho gh$ $F_{buoy} = \rho Vg$ $A_1 V_1 = A_2 V_2$ $P + \rho gy + \frac{1}{2} \rho v^2 = cons$ $\Delta l = \alpha l_o \Delta T$ $H = \frac{kA\Delta T}{L}$ $P = \frac{F}{A}$ $PV = nRT = Nk_B T$ $K_{avg} = \frac{3}{2} k_B T$ $v_{rms} = \sqrt{\frac{3RT}{M}} = \sqrt{\frac{3k_B T}{\mu}}$ $W = P\Delta V$ $\Delta U = Q + W$ $e = \left  \frac{W}{Q_H} \right  \quad e_c = \frac{T_H - T_C}{T_H} \quad \rho = \frac{mass}{V} \quad \frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$	A = area e = efficiency F = force h = depth H = rate of heat transfer k = thermal conductivity K <sub>avg</sub> = average molecular KE l = length L = thickness M = molar mass n = number of moles N = number of molecules P = pressure Q = heat transferred to a system T = temperature U = internal energy V = volume v = velocity or speed v <sub>rms</sub> = root-mean-square velocity W = work done on a system y = height α = coeff. of linear expansion μ = mass of molecule
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### Conversion Factors

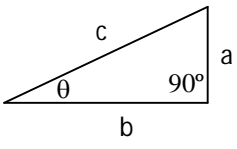
<b>Mass</b> 1 lb = 454 g 1 lb = 16 oz 1 kg = 2.2 lb	<b>Temperature</b> K = °C + 273 °C = (°F - 32) x 0.56 °F = (1.8 x °C) + 32
<b>Length</b> 1 in = 2.54 cm 1 yd = 3 ft 1 mile = 5280 ft 1 m = 1.09 yd	<b>Volume</b> 1 cm <sup>3</sup> = 1 mL 2 cups = 1 pint 2 pints = 1 quart 4 quarts = 1 gallon 1 quart = 946 mL 1 L = 1.057 quarts
<b>Energy</b> 1 calorie = 4.184 J 1 eV = 1.602 x 10 <sup>-19</sup> J 1 BTU = 1054 J 1 food calorie = 1000 calories	<b>Pressure</b> 1 atm = 760 mm Hg 1 atm = 760 Torr 1 atm = 101300 Pa 1 atm = 14.9 psi
<b>Area</b> 1 sq mile = 640 acres	

### Specific Heat, Latent Heats of Selected Substances

	Specific Heat (J/ kg K)	L <sub>f</sub> (J/kg)	L <sub>v</sub> (J/kg)
Water	4184	33400	2260000
Ice	2058	33400	2260000
Copper	385	20900	4730000
Iron	452	24700	6090000
Mercury	237	11400	2950000

## Geometry and Trigonometry

Rectangle $A = bh$ Triangle $A = \frac{1}{2}bh$ Circle $A = \pi r^2$ $C = 2\pi r$ Cylinder $V = \pi r^2 h$ $S = 2\pi r l + 2\pi r^2$ Sphere $V = \frac{4}{3}\pi r^3$ $S = 4\pi r^2$	A = area C = circumference V = volume S = surface area b = base h = height r = radius
	Right Triangle $a^2 + b^2 = c^2$ $\sin \theta = \frac{a}{c}$ $\cos \theta = \frac{b}{c}$ $\tan \theta = \frac{a}{b}$



### Calculus

<b>Differentiation</b> $\frac{df}{dx} = \frac{df}{du} \frac{du}{dx}$ $\frac{d}{dx}(x^n) = nx^{n-1}$ $\frac{d}{dx}(e^x) = e^x$ $\frac{d}{dx}(\ln x) = \frac{1}{x}$ $\frac{d}{dx}(\sin x) = \cos x$ $\frac{d}{dx}(\cos x) = -\sin x$	<b>Integration</b> $\int x^n dx = \frac{1}{n+1} x^{n+1}, n \neq -1$ $\int e^x dx = e^x$ $\int \frac{dx}{x} = \ln x $ $\int \cos x dx = \sin x$ $\int \sin x dx = -\cos x$
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### Constants

Proton mass: 1.67 x 10 <sup>-27</sup> kg Neutron mass: 1.67 x 10 <sup>-27</sup> kg Electron mass: 9.11 x 10 <sup>-31</sup> kg Avogadro's Number: 6.02 x 10 <sup>23</sup> /mol Univ gas const: R = 8.31 J/mol K Boltzmann's const: k <sub>B</sub> = 1.38 x 10 <sup>-23</sup> J/K Electron charge: 1.60 x 10 <sup>-19</sup> C Speed of Light: c = 3.00 x 10 <sup>8</sup> m/s Univ. grav. const.: $G = 6.67 \times 10^{-11} \text{ m}^3/\text{kg s}^2$ Accel. due to gravity near Earth: $g = 9.8 \text{ m/s}^2$	Planck's Const: h = 6.63 x 10 <sup>-34</sup> J s Vacuum permittivity: $\epsilon_o = 8.85 \times 10^{-12} \text{ C}^2 / \text{N m}^2$ Vacuum permeability: $\mu_o = 4\pi \times 10^{-7} (\text{T m}) / \text{A}$ One atmosphere pressure: 1 atm = 101300 Pa Standard Temp & Press (STP): T = 273 K, P = 1.00 atm molar volume = 22.4 L
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Common Polyatomic Ions	Activity Series	Solubility of Common Ionic Compounds	Stoichiometry
Acetate = $C_2H_3O_2^-$ Ammonium = $NH_4^+$ Carbonate = $CO_3^{2-}$ Chlorate = $ClO_3^-$ Chlorite = $ClO_2^-$ Cyanide = $CN^-$ Dichromate = $Cr_2O_7^{2-}$ Dihydrogen Phosphate = $H_2PO_4^-$ Hydrogen Carbonate = $HCO_3^-$ Hydrogen Phosphate = $HPO_4^{2-}$ Hydrogen Sulfate = $HSO_4^-$ Hydrogen Sulfite = $HSO_3^-$ Hypochlorite = $ClO^-$ Hydroxide = $OH^-$ Nitrate = $NO_3^-$ Nitrite = $NO_2^-$ Oxalate = $C_2O_4^{2-}$ Perchlorate = $ClO_4^-$ Permanganate = $MnO_4^-$ Peroxide = $O_2^-$ Phosphate = $PO_4^{3-}$ Sulfate = $SO_4^{2-}$ Sulfite = $SO_3^{2-}$ Thiocyanate = $SCN^-$ Thiosulfate = $S_2O_3^{2-}$	Displaces $H^+$ from water and steam Displaces $H^+$ from steam Decreasing Activity Decreasing Activity Li K Ca Na Mg Al Zn Cr Fe Cd Co Ni Sn Pb H Cu Hg Ag Pt  F Cl Br I	<b>Soluble Salts</b> Acetates and Nitrates Ammonium, Potassium, Lithium, & Sodium Bromides <b>EXCEPT</b> $PbBr_2$ , $HgBr_2$ , & $AgBr$ . Chlorides, <b>EXCEPT</b> $PbCl_2$ , $HgCl_2$ , and $AgCl$ . Iodides, <b>EXCEPT</b> $PbI_2$ , $HgI_2$ , and $AgI$ . Sulfates, <b>EXCEPT</b> $BaSO_4$ , $CaSO_4$ , $SrSO_4$ , & $PbSO_4$ .  <b>Insoluble Salts</b> Carbonates, <b>EXCEPT</b> $Li_2CO_3$ , $K_2CO_3$ , $Na_2CO_3$ , & $(NH_4)_2CO_3$ Chromates, <b>EXCEPT</b> $Li_2CrO_4$ , $Na_2CrO_4$ , $K_2CrO_4$ , & $(NH_4)_2CrO_4$ Hydroxides, <b>EXCEPT</b> $LiOH$ , $KOH$ , $NaOH$ , $NH_4OH$ , $Ba(OH)_2$ , $Ca(OH)_2$ , & $Sr(OH)_2$ . Phosphates, <b>EXCEPT</b> $Li_3PO_4$ , $K_3PO_4$ , $(NH_4)_3PO_4$ , & $Na_3PO_4$ . Sulfides, <b>EXCEPT</b> $BaS$ , $CaS$ , $Li_2S$ , $K_2S$ , $Na_2S$ , $(NH_4)_2S$ , & $SrS$ .	$n = \frac{m}{M}$ $\% \text{ yield} = \frac{AY}{TY} \times 100$ $\% \text{ comp} = \frac{m_{\text{element}}}{m_{\text{compound}}}$ n = number of moles m = mass M = molar mass AY = actual yield TY = theoretical yield
		<b>Order of Filling Orbitals</b> $1s \rightarrow 2s \rightarrow 2p \rightarrow 3s \rightarrow 3p \rightarrow 4s \rightarrow 3d \rightarrow 4p \rightarrow 5s \rightarrow 4d \rightarrow 5p \rightarrow 6s \rightarrow 4f \rightarrow 5d \rightarrow 6p \rightarrow 7s \dots$	<b>Double-Replacement Reactions</b> <b>Requirements to complete a double-replacement reaction. Only one of these need to be satisfied:</b> <ol style="list-style-type: none"> <li>1. Water is a product</li> <li>2. A gas is a product</li> <li>3. A precipitate is formed</li> </ol>
		<b>Diatomic Molecules ... "Dirty Seven"</b> $H_2, N_2, O_2, F_2, Cl_2, Br_2, I_2$	

Solution Chemistry	
$M_1V_1 = M_2V_2$ $ppm_A = \frac{m_A}{m_{\text{solution}}} \times 10^6$ $M = \frac{n_{\text{solute}}}{V_{\text{solvent(L)}}}$ $m_m = \frac{n_{\text{solute}}}{m_{\text{solvent(kg)}}}$ $\Delta T_B = BP_{\text{solution}} - BP_{\text{solvent}} = k_b m_i$ $\Delta T_f = FP_{\text{solvent}} - FP_{\text{solution}} = k_f m_i$	M = molarity V = volume m = mass n = number of moles BP = boiling point FP = freezing point i = Van't Hoff constant $k_b$ = BP elevation const. $k_f$ = FP depression const. $m_m$ = molality

Values of $k_b$ & $k_f$		
<b>Solvent</b>	<b>BP, °C</b>	<b><math>k_b</math>(°C/m)</b>
Acetic Acid	118.5	3.08
Benzene	80.2	2.61
Carbon Disulfide	46.3	2.40
Cyclohexane	80.74	2.79
Ethanol	78.3	1.07
Water	100.0	0.52
<b>Solvent</b>	<b>FP, °C</b>	<b><math>k_f</math>(°C/m)</b>
Acetic Acid	16.60	3.59
Benzene	5.455	5.065
Cyclohexane	6.55	20.0
Water	0.000	1.86

Matrix Arithmetic	
$\begin{bmatrix} 3 & 2 & -1 \\ 4 & 5 & 6 \\ 5 & 0 & 2 \end{bmatrix}$ columns rows	$A = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$ $A \times A^{-1} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ $\det(A) = ad - bc$ $A^{-1} = \frac{1}{\det(A)} \begin{bmatrix} d & -b \\ -c & a \end{bmatrix}$
$\begin{bmatrix} 2 & 1 & 0 \\ 3 & 2 & 5 \end{bmatrix} \times \begin{bmatrix} -1 & 2 \\ 0 & 0 \\ 6 & 3 \end{bmatrix} = \begin{bmatrix} -2 & 4 \\ 27 & 21 \end{bmatrix}$ 2 x 3      3 x 2	must be equal      column dimension of answer row dimension of answer
<b>Trigonometric Identities</b> $\sin(2a) = 2 \sin a \cos a$ $\cos(2a) = 2 \cos^2 a - 1$ $\tan(2a) = \frac{2 \tan a}{1 - \tan^2 a}$ $\sec a = \frac{1}{\cos a}$ $\cot a = \frac{1}{\tan a}$ $\csc a = \frac{1}{\sin a}$ $\tan a = \frac{\sin a}{\cos a}$ $\tan(a+b) = \frac{\tan a + \tan b}{1 - \tan a \tan b}$ $\tan(a-b) = \frac{\tan a - \tan b}{1 + \tan a \tan b}$	<b>Row matrix</b> = only one row in matrix <b>Column matrix</b> = only one column in matrix <b>Identity matrix</b> = all zeros except ones along main diagonal only

Chemical Equilibrium	
$K_c = \frac{[C]^c [D]^d}{[A]^a [B]^b}$ $K_p = \frac{P_C P_D}{P_A P_B}$ $K_p = K_c (RT)^{\Delta n}$	a & b = coefficients of reactants A & B c & d = coefficients of products C & D $K_c$ = Equilibrium constant in terms of conc. $K_p$ = Equilibrium constant in terms of partial press. $\Delta n$ = moles of gaseous products—moles of gaseous reactants P = partial pressure [ ] = concentration in Molarity

Pythagorean Relationships in Trigonometry	
$\sin^2 \theta + \cos^2 \theta = 1$ $1 + \tan^2 \theta = \sec^2 \theta$	$1 + \cot^2 \theta = \csc^2 \theta$

Law of Sines & Cosines for $\Delta ABC$	
$c^2 = a^2 + b^2 - 2ab \cos \theta$ $\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$	$\cos(a \pm b) = \cos a \cos b \mp \sin a \sin b$ $\sin(a \pm b) = \sin a \cos b \pm \cos a \sin b$