

## Advanced Chemistry useful handout #1

### Metric conversion chart

$10^9$ g =	1 Gg	giga	
$10^6$ g =	1 Mg	mega	
$10^3$ g =	1 kg	kilo	$1000 \text{ g} = 1 \text{ kg}$
1 g =	1 g	BASE	
1 g =	$10^1$ dg	deci	$1 \text{ g} = 10 \text{ dg}$
1 g =	$10^2$ cg	centi	$1 \text{ g} = 100 \text{ cg}$
1 g =	$10^3$ mg	milli	$1 \text{ g} = 1000 \text{ mg}$
1 g =	$10^6$ $\mu$ g	micro	
1 g =	$10^9$ ng	nano	
1 g =	$10^{12}$ pg	pico	

$10^{10}$  Å (Angstroms) = 1 meter (atomic size)

**Linear to Volume:** When converting between linear and volume measurements, you need to *cube* the conversion factor!  $10 \text{ cm} = 1 \text{ dm}$  ; so  $(10 \text{ cm})^3 = (1 \text{ dm})^3$  thus  $1000 \text{ cm}^3 = 1 \text{ dm}^3 = 1 \text{ Liter}$

### Some Helpful Formulas:

**Gas Laws:** Conversions: STP for gases =  $0^\circ\text{C}$  and  $1 \text{ atm}$  ; (or  $273 \text{ K}$  ,  $760 \text{ mm Hg}$ )

Combined :  $\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$       Diffusion:  $\frac{\text{rate A}}{\text{rate B}} = \frac{\sqrt{FW B}}{\sqrt{FW A}}$       Molar volume of =  $\frac{22.4 \text{ L}}{\text{mole}}$   
gas law

**Ideal Gas Law:**  $PV = nRT$     If you know  $P$ ,  $V$ ,  $T$  of a gas, you can calculate moles!

For  $PV = nRT$ :  $P$  in atm,  $V$  in L,  $n$  = moles,  $T$  in K, Ideal Gas Constant,  $R = 0.0821 \text{ L atm/mol K}$   
(use Partial Pressure of a gas in  $PV = nRT$  to get mol of that particular gas)

Dalton's law of Partial Pressures:  $P_{\text{total}} = P_a + P_b + P_c + \dots$      $P_{\text{dry gas}} = P_{\text{total}} - P_{\text{water vapor}}$

Partial pressure =  $P_a = X_a P_{\text{total}}$     where    mol fraction =  $X_a = \frac{\text{mol a}}{\text{Total mol of gases}}$

**Solutions:** Molarity =  $\frac{\text{moles solute}}{\text{L of solution}}$  or     $M = \frac{\text{mol}}{\text{L}}$     mol =  $V M$      $V = \frac{\text{mol}}{M}$  ( $V$  must be in Liters)

Or : can use millimoles and milliliters:     $M = \frac{\text{mmol}}{\text{mL}}$     mmol = mL  $M$     mL =  $\frac{\text{mmol}}{M}$

Dilutions:  $V_1 M_1 = V_2 M_2$  (can use mL for Volumes)    Acid Base Titration:  $V_a M_a (\#H) = V_b M_b (\#OH)$

molality =  $m = \frac{\text{mol solute}}{\text{kg solvent}}$     mol fraction =  $X_a = \frac{\text{mol a}}{\text{total mol}}$     Weight % =  $\frac{\text{g solute}}{100 \text{ g solution}}$

Additional conversion factors and constants:

**Energy:**

$4.18 \text{ joules} = 1 \text{ calorie}$        $1 \text{ Joule} = \frac{1 \text{ kg m}^2}{\text{sec}^2}$

**Volume:**  $1 \text{ cm}^3 = 1 \text{ mL}$        $1 \text{ dm}^3 = 1 \text{ L}$

$1 \text{ m}^3 = 10^3 \text{ L}$

**Density** =  $\frac{\text{Mass}}{\text{Volume}}$  ;     $\frac{1 \text{ gram}}{\text{mL}}$  (water only)

Avogadro's number:  $N = \frac{6.02 \times 10^{23} \text{ particles}}{1 \text{ mole}}$

Kelvin =  $^\circ\text{Celsius} + 273$

$1 \text{ atm} = 760 \text{ mm Hg}$

# Advanced Chemistry

**G Orfield**



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