

## 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 =  $\frac{22.4 \text{ L}}{\text{mole}}$   
 a gas at STP

**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

**Christian G. Meyer**



## **Advanced Chemistry:**

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web  $m \times c \times \Delta t$  equation 1 where  $m$  is the total mass of the solution solute plus solvent  $c$  is the specific heat of the solution and  $\Delta t$  is the observed temperature change the specific heat of the solution is generally assumed to be the same as that of

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web the heat of reaction  $\Delta H_{\text{soln}}$  is written after the products in units of  $\text{kJ mol}^{-1}$  rxn for example sodium hydroxide dissolves exothermically releasing  $44.2$  kilojoules per mole dissolved this process is represented as  $\text{NaOH (s)} \rightarrow \text{NaOH (aq)}$   $\Delta H_{\text{soln}} = 44.2 \text{ kJ mol}^{-1}$  rxn write equations to similarly represent the dissolving process for

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web hand warmers are usually placed inside the gloves to keep your hands warm the heat keeping your hands warm is formed as a result of an exothermic reaction which occurs in a small packet hand warmers have 5 main ingredients in them salt carbon polypropylene vermiculite water and iron

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web when the hand warmer pack is activated the solid dissolves in water and produces a large temperature change in the form of heat in this laboratory experiment the heat of solution will be calculated from the data for six salts in order to *student activity how much heat in a reusable hand warmer* - Jul 02 2023

web background the hand warmers are filled with sodium acetate click the metal disc and you will notice the liquid changes state and becomes a solid in the process heat is released the sodium acetate is a supersaturated solution

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web oct 9 2021 sodium acetate coin or other small piece of metal plastic bags seal the coin inside a small bag place this bag inside a larger bag containing supersaturated sodium acetate get this by dissolving as much sodium acetate as possible in hot water this chemical hand warmer is reusable

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web the goal of my experiment and research is to evaluate the various number of compounds to be used as hand warmers and locate the ones that can raise the temperature to 20 degrees celsius in 100 g water and costs as little as possible

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web in this lab you are challenged to use chemistry to determine which ionic compound makes the best hand warmer in this experiment you will collect data that will allow you to calculate the heat of solution  $\Delta H_{\text{soln}}$  or the amount of energy released or absorbed in kJ/mol of the substance being dissolved

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web mar 4 2014 contains water the hand warmer is struck in a manner that ruptures the inner pouch releasing the ionic salt into the water of the outer pouch the salt dissolves and the water warms this type of hand warmer tends to produce a more vigorous heat than the dry powder type of hand warmer but does not produce heat for quite as long

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web lab investigation in today s experiment you will design and execute an experimental procedure to determine which of three ionic compounds is most suitable for use in a hand warmer the three compounds you will use is determined by the group number you are assigned the ideal hand warmer