

Name: _____ Period: _____ Date: _____

REACTIONS / MOLES / STOICHIOMETRY NOTES ADVANCED CHEMISTRY

Directions: This packet will serve as your notes for this chapter. Follow along with the PowerPoint presentation and fill in the missing information. Important terms / ideas are in all capitals and bolded!

- **CHEMICAL REACTION:**

-Changes the way _____ are _____ together

-Atoms _____ be created or destroyed!

- Indicators of a Reaction

1)

3)

2)

4)

- **CHEMICAL EQUATION:**

-**REACTANTS:**

-**PRODUCTS:**

_____ → _____

- Symbols in Equations

_____ separates the reactants

_____ liquid

_____ separates reactants from products

_____ aqueous or water solution

_____ indicates a reversible reaction

_____ indicates heat is supplied

_____ solid

CATALYST:

_____ gas

- Rules for Writing Equations

1) Reactants must be on the _____

2) Products must be on the _____

3) Correct _____ (and _____) should be written

4) An _____ should separate the products from reactants

-Ex:

- Equation Practice

-Examples: Write the skeleton equation for the reaction:

- Hydrogen (g) + Bromine (g) form _____

- Balancing Chemical Equations

-Since we cannot break the _____, equations **MUST** be balanced

-Balanced equations have the _____ of each type of atom on both sides of the equation

-_____ go in _____ of the formulas so the # of atoms of each element is the same on each side

WHAT GOES _____ = WHAT COMES _____!

-Coefficients vs. Subscripts:

- Equation Examples

-Example #1:

-Example #2:

- Errors to Avoid

-NEVER change a _____ to balance an equation

- Ex: _____ is a different compound than _____

-NEVER put a _____ in the middle of a formula

- Ex:

- Best Rule for Balancing...

MAKE A _____!!

-Show it:

- Balancing Chemical Equations

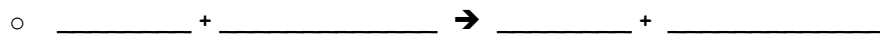
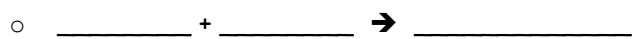
-Example #1:

-Example #2:

***If a polyatomic ion is present on _____ sides of the equation, it can be placed in the table as a _____ and not be _____!**

- Balancing Practice

-Examples: Make a Reactants / Products Table and balance.



- Types of Reactions

- _____ of reactions exist... but there are only several categories of reactions

-We will examine _____ types:

- **SYNTHESIS REACTION:**



-Example: _____... Iron plus oxygen produces _____

-Example: Predict the products for the reaction and balance.

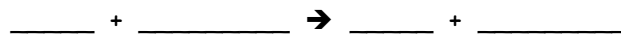
- **DECOMPOSITION REACTION:**



-Example: _____ decomposes into carbon and water with the help of a _____

-Example: Predict the products for the reaction and balance.

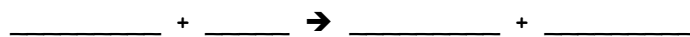
- **SINGLE-REPLACEMENT REACTION:**



-Metals replace _____, nonmetals replace _____!!

-Sometimes it _____!! A must be _____ than B!!

- **COMBUSTION REACTION:**



-If the reaction is COMPLETE, the products are always and !! If INCOMPLETE, the products are and !

-Example: Burning a in the presence of (very common to us) producing

-Example: Predict the products for the reaction and balance.

- **Determining the Reaction Type**

-Examine the to determine the type: (E = element / C = compound)

- E + E
- C + C → C
- C
- E + C
- C + C → C + C
- CH + O₂

- **Reactions Practice**

-Examples: Determine the type of reaction for each. Then, predict the products and balance.

- + →
- + →
- + →
- →
- + →
- + →

- Measurement

-We can measure by mass or volume or we can _____ pieces

-We measure mass in _____

-We measure volume in _____

-We count pieces in numbers, or _____, or _____, or... _____!

- Conversion

-Mole conversions are useful but not _____ in a lab...

1 mole element = _____ (grams)

-Get it right from the _____!!

-For example, 1 mole of arsenic has _____ g

- **MOLAR MASS:**

-How to Determine Molar Mass:

1) Determine the # of _____ of the individual elements that make up the compound (just look at the _____)

2) Look up the _____ of each element

3) Multiply the _____ of each by the # of _____ of each

4) Add up the _____

-Example: Find the molar mass of glucose (_____).

- Practice

-Examples: Calculate the molar mass of each.

○ _____:

○ _____:

○ _____:

- **PERCENT COMPOSITION:**

-Determine the mass of each _____ and divide each by the total mass of the _____

-Formula:

-Example: Calculate the % composition of a compound that is _____ g of Ag and _____ g of S.

-Example: A compound is formed when _____ g Mg combines with _____ g N. What is the % composition?

-Example: Calculate the % composition of _____.

-Example: What is the % composition of _____?

- **MOLE:**

-When measuring _____ and _____, we use moles

-Used to count very _____ items

-Helps convert from the _____ to the _____

-BUT, WHAT AMOUNT?: _____ " _____ "

-THAT AMOUNT, BUT OF WHAT?

- **REPRESENTATIVE PARTICLES:**

Ex:

- **Conversions**

1 mole = _____ atoms

1 mole = _____ molecules

1 mole = _____ formula units

These can be used in _____ problems!!

- **Atoms to Moles**

-Example: A sample of Mg has _____ atoms of Mg. How many moles of Mg are contained in the sample?

- **Practice**

-Example: How many atoms are there in _____ moles of Xe?

-Example: How many moles of $MgCl_2$ are _____ formula units of $MgCl_2$?

-Example: How many molecules of CO_2 are there in _____ moles of CO_2 ?

- Mole-Mass Relationship

-Sometimes it is convenient to have measurements in _____ instead of _____

-We already know that _____ = _____ from the Periodic Table

-_____ using Dimensional Analysis!

-Example: How many grams are there in _____ moles of H_2O ?

-Example: How many moles are there in _____ grams of Cu ?

- Practice

-Example: How many moles is _____ g $NaOH$?

-Example: How many grams are there in _____ moles of CO_2 ?

-Example: How many atoms are there in _____ g of C ?

- Mole-Volume Relationship

-Many chemicals exist as _____ but difficult to _____

-Moles of a gas can be related to volume (_____), but temperature and pressure also play a role

-**Standard Temp. and Pressure (STP):**

-At STP:

1 mole gas = _____ liters

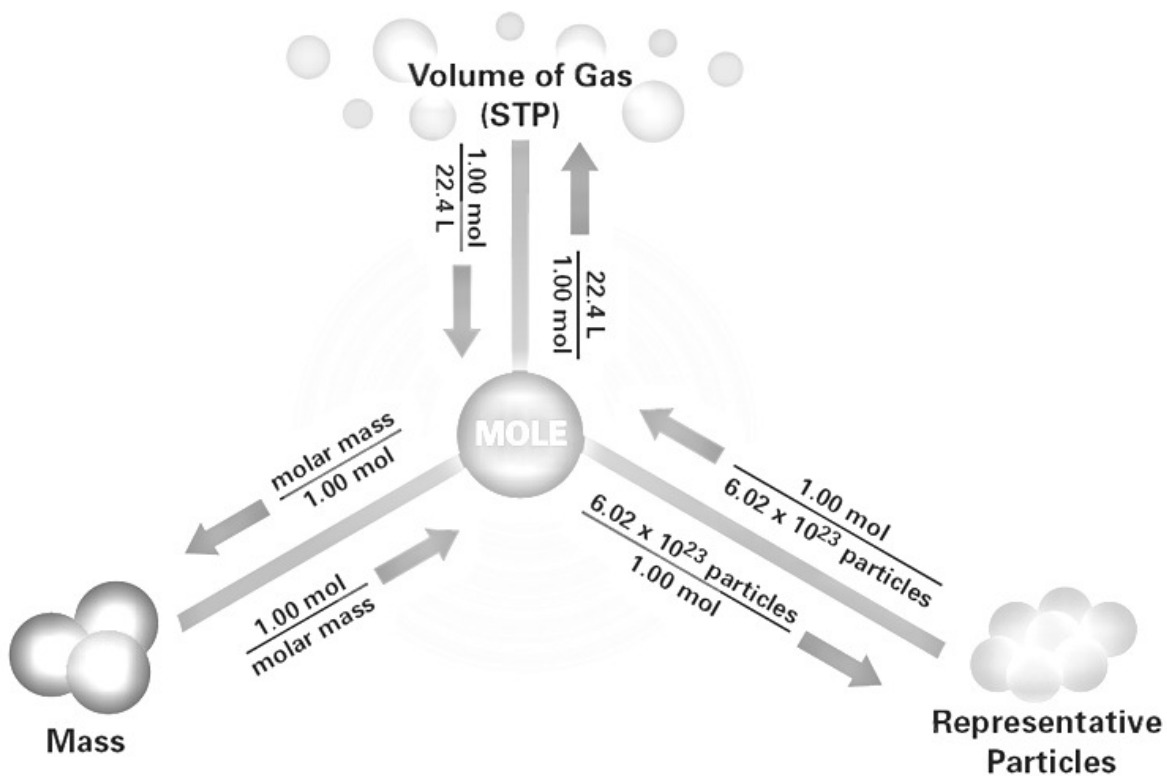
-Example: What is the volume of _____ moles of CO_2 at STP?

-Example: What is the volume of _____ grams of He at STP?

- Practice

-Example: How many moles are _____ L of O_2 at STP?

-Example: What is the volume of _____ g of CH_4 at STP?



- **EMPIRICAL FORMULA:**

-How to Determine:

- 1) Change the % to _____ (if necessary)
- 2) Convert grams to _____ for each element
- 3) Divide **ALL** of the mole answers by the _____ (mole ratio)
- 4) If all _____, then move on... if not then _____ to get whole #
- 5) Use the whole # to represent the number of each _____... write the formula

-Example: Determine the empirical formula of the following compound: _____% C, _____% O, and _____% Cl.

- Practice

-Example: Determine the empirical formula of a compound that is _____% K, _____% C, _____% H, and _____% O.

-Example: Methamphetamine is made of _____% C, _____% H, and _____% N. What is its empirical formula?

- **MOLECULAR FORMULA:**

-How to Determine:

- 1) Calculate the _____ formula (if needed)
- 2) Calculate the _____ of the empirical formula
- 3) Divide the given _____ molar mass by the _____ molar mass
- 4) Multiply _____ of empirical formula by this #
- 5) Write the molecular formula

-Example: Determine the molecular formula of a compound composed of _____% C and _____% H with a molar mass of 70 g/mol.

-Example: A compound is known to be composed of _____% C, _____% H, and _____% Cl. Its molar mass is known to be 197.92 g. What is its molecular formula?

- **STOICHIOMETRY:**

-Balanced equation is much like a _____... tells you the necessary _____, amounts, and the amount of product that will be made

-Use this information to " _____" the _____ to make how much you want

-Example: ___ eggs + ___ cups flour + ___ cup sugar + ___ cups milk → ___ cookies

I need ___ eggs for every ___ cookies

I need ___ cups flour for every ___ sugar

I need ___ cups milk for every ___ cookies

There's a _____ for each ingredient and product!

-Example: ___ H₂ + ___ O₂ → ___ H₂O

I need ___ H₂ for every ___ O₂

I need ___ H₂O for every ___ O₂

I need ___ H₂ for every ___ H₂O

There's a _____ for each reactant and product... _____!!

- **Balanced Equations**

-Coefficients in a balanced chemical equation can represent a ratio of _____, molecules, _____ (gases), or _____... NOT _____!

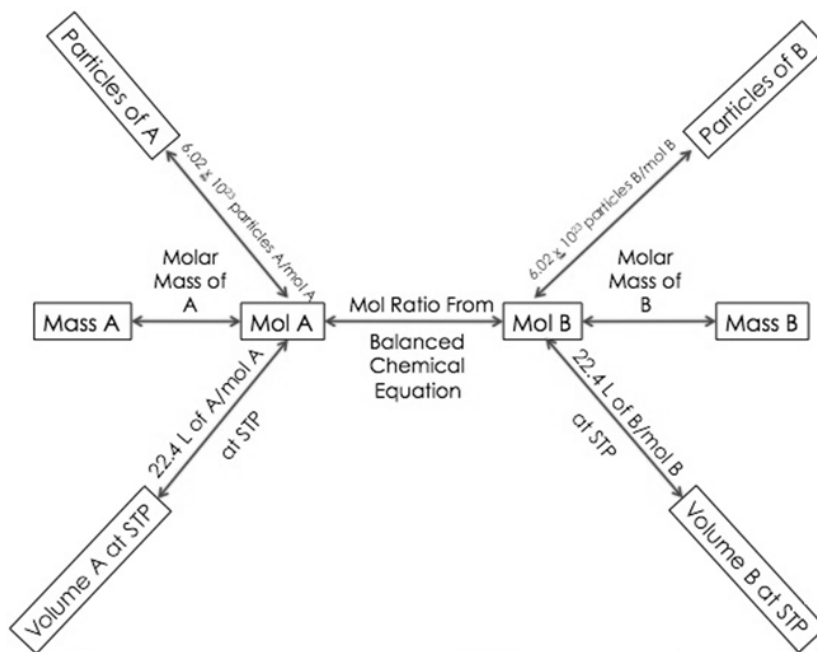
-Convert from an amount of one _____ to another or to amounts of _____

-Use _____

Equations must be _____ and _____ in order to do these problems!!

- **Stoichiometry Problems**

-Always follow this same basic format...



- Mole to Mole Conversions

-Example: Sodium and chlorine gas react to produce sodium chloride. How many moles of sodium chloride can be produced from _____ moles of sodium?

-Example: How many moles of O_2 are produced when _____ moles of aluminum oxide decompose?

- Mass to Mass Conversions

-Example: If _____ g of Fe (3+) are added to a solution of copper (II) sulfate, how much solid copper would form?

-Example: Silicon computer chips are made using the following reaction: $SiCl_4 + 2 Mg \rightarrow 2 MgCl_2 + Si$. How many grams of Mg are needed to make _____ g of Si?

- Mass to Volume Conversions

-Example: Potassium metal reacts with water to produce potassium hydroxide and hydrogen gas. If _____ g K is reacted completely, how many liters of H_2 gas can be produced at STP?

- Practice

-Example: In order to combust _____ moles of C_2H_2 , how many moles of O_2 are required? Balance the following: $C_2H_2 + O_2 \rightarrow CO_2 + H_2O$

-Example: Sodium and chlorine gas react to give sodium chloride. If you end up with _____ g of NaCl, how many grams of Na did you start with?

-Example: If Mg and _____ L of HCl gas are reacted, how many grams of $MgCl_2$ are formed?

- **LIMITING REAGENT:**

-Amount of reactants available for a reaction _____ the amount of product that can be made

- **-EXCESS REAGENT:**

-To determine the limiting reagent, you must do _____ stoichiometry problems with the reactants

-Reactant that makes the _____ amount of _____ is the limiting reagent!!!

-How to Determine:

1) Convert to _____ for each of the givens (remember two problems!)

2) Use the _____ to convert to moles of the product

3) Keep going to _____ of the product (could just compare moles, but usually the question asks you this anyway)

4) Reactant that produces the _____ product is the limiting reactant

- Limiting Reagent Problems

-Example: Copper reacts with sulfur to form copper (I) sulfide. If _____ g of Cu reacts with _____ g S, how much product will be formed?

-Example: How much of the _____ reagent will be left over from the previous problem?

- Practice

-Example: Identify the limiting reagent and how much ammonia gas can be produced when _____ g of nitrogen gas reacts with _____ g of hydrogen gas.

-Example: How many _____ of excess reagent are left over from the previous problem?

-Example: Use the equation: $\text{Mg} + 2 \text{HCl} \rightarrow \text{MgCl}_2 + \text{H}_2$. Identify the limiting reagent when _____ g HCl reacts with _____ g Mg. How much MgCl_2 will form?

- **PERCENT YIELD:**

-No one is _____ in the laboratory... used to figure out how _____ the methods were

-**ACTUAL YIELD:**

-**THEORETICAL YIELD:**

-Equation:

-How to Determine:

- 1) _____ is given or found in lab
- 2) Calculate _____ by dimensional analysis (may need limiting reagent)
- 3) Use the _____

***SHOULD _____ BE GREATER THAN _____... WHY?**

-Example: A group of students determined that they should get _____ g of product from a reaction. They actually ended up with _____ g. What is their percent yield?

- Practice

-Example: About _____ g of aluminum are reacted with _____ g of copper (II) sulfate producing aluminum sulfate and copper. If _____ g of copper are produced, what is the percent yield?