

## Honors Chemistry Unit 6 – Moles and Stoichiometry Notes

### Intro to the mole

1. What is the chemical mole?
2. What is Avogadro's number? \_\_\_\_\_
3. What does it mean?
4. How is a mole like a dozen doughnuts?

### Formula Mass and Percent Composition

1. Formula Mass:
2. Molar Mass:
3. Try it!
  - a. NaCl
  - b.  $\text{Al}_2(\text{SO}_4)_3$
  - c.  $\text{NiSO}_3 \cdot 6\text{H}_2\text{O}$
4. Percent composition:
5. Formula:
6. Try it! Find the % composition for each of the following compounds:
  - a. NaCl
  - b.  $\text{Al}_2(\text{SO}_4)_3$
  - c.  $\text{NiSO}_3 \cdot 6\text{H}_2\text{O}$

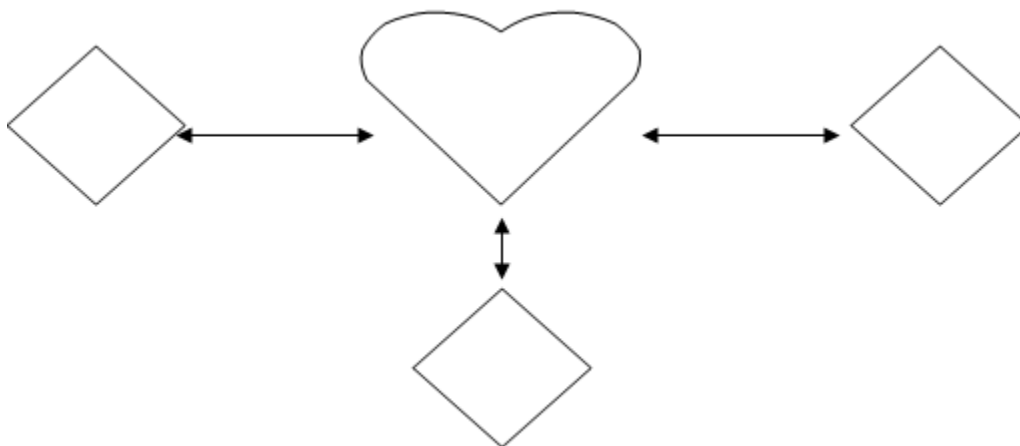
## Empirical and Molecular Formulas

1. Empirical formula:
2. Molecular formula:
3. Steps for determining empirical formula:
  - a. If you are given % you may change the percent to grams.
  - b. Convert grams to moles by dividing by the molar mass of the element
  - c. Divide by the smallest answer
  - d. If the ratio is not a whole number – multiply each value by the same number to make the value a whole number. These values will be subscripts.
4. Try it!
  - a. What is the empirical formula of a compound that is 66% calcium and 34.0% phosphorus?
  
  
  
  
  
  
  
  
  
  
  - b. A compound is found to contain 64.80% carbon, 13.62% hydrogen, and 21.58% oxygen by weight. What is the empirical formula for this compound?
  
  
  
  
  
  
  
  
  
  
  - c. A 170.0 g sample of an unidentified compound contains 29.84g sodium, 67.49g chromium and 72.67g oxygen. What is the compound's empirical formula?
5. Steps to finding the molecular formula:
  - a. Find the mass of the empirical formula
  - b. Divide the molecular mass by the mass of the empirical formula to the “multiplying factor”
  - c. Multiply each of the subscripts in the empirical formula by this factor to get the molecular formula.
6. Try it!
  - a. A compound has an empirical formula of  $\text{CH}_2\text{O}$ . Its molar mass is 180 g/mol. What is the molecular formula?
  
  
  
  
  
  
  
  
  
  
  - b. A compound containing 5.9265% H and 94.0735% O has a molar mass of 34.01468 g/mol. Determine the empirical and molecular formulas.

## Mole Conversions:

1. Review: what is a mole?
2. Review: what is molar mass?
3. Molar volume:

4. Mole diagram: **MEMORIZE THIS!**



5. How many grams are in 2.52 moles of  $\text{NH}_3$ ?
6. How many moles are in 8.75 grams of  $\text{LiBr}$ ?
7. Convert 38 grams  $\text{Al}$  to moles.
8. Convert 2.5 moles calcium oxide to grams
9. Convert 3.1 moles of neon to atoms
10. Convert  $1.2 \times 10^{24}$  molecules of water to moles
11. Convert 5.0L of carbon dioxide to moles (@STP)

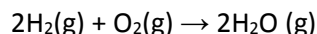
12. Convert 1.5 moles NH<sub>3</sub> gas to liters (@STP)

### Stoichiometry

1. Stoichiometry requires a \_\_\_\_\_ chemical equation.
2. A \_\_\_\_\_ - \_\_\_\_\_ - \_\_\_\_\_ ratio is used to convert from one substance to another in a balanced reaction.
3. This ratio comes from the \_\_\_\_\_ in your reaction.

4. Try it!

- a. Using the following reaction, write ALL of the mole ratios:



- b. How many moles of H<sub>2</sub> are required to produce 6 moles of H<sub>2</sub>O?

5. Steps for mass-mass problems

- a. Write and balance your reaction.
- b. Convert grams of the given to moles of the given.
- c. Convert moles of given to moles of unknown
- d. Convert moles of unknown to grams of unknown

6. Try it!

- a. Laughing gas, N<sub>2</sub>O is produced from the decomposition of ammonium nitrate. Water is your other product. How many grams of ammonium nitrate are required to produce 33.0 grams of laughing gas?

- b.  $2\text{LiCl} + \text{Br}_2 \rightarrow 2\text{LiBr} + \text{Cl}_2$

How many grams of bromine are produced with 10.5 grams of lithium bromide are formed?

7. Mass – Volume Problems

- a. Write a balanced reaction
- b. Convert given grams to moles
- c. Convert given moles to unknown moles
- d. Convert unknown moles to unknown volume

8. Try it!

- a. Hydrogen gas is produced by reacting zinc metal with hydrochloric acid. How many liters of hydrogen gas can be produced at STP from 6.5 grams of zinc and an excess of acid?

- b. How many grams of zinc are needed to produce 100. L of hydrogen?

### Limiting Reactants

1. How are limiting reactants like making peanut butter and jelly sandwiches?
2. Limiting reactant:
3. Excess reactant:
4. Steps
  - a. Write a balanced equation.
  - b. For each reactant, calculate the amount of product formed.
  - c. Smaller answer indicates: limiting reactant and amount product.
5. Try it!
  - a. 79.1 g of zinc react with 0.90 g of HCl. Identify the limiting and excess reactants. How many liters of hydrogen are formed?
  - b. If 10.0 g of sucrose reacts with 10.0 g of oxygen, how many grams of CO<sub>2</sub> will be produced? What is the limiting reactant?

### Percent Yield

1. Theoretical yield:
2. Actual yield:
3. Formula:
4. If you start with 5.00 g of hydrogen gas at STP, how many liters of water vapor will be formed? Find the % yield if 17.5 L of H<sub>2</sub>O were produced.

