

Name: _____

Date: _____

Per#: _____

Stoichiometry

Topic#10

Objectives

Stoichiometry

- Calculate formula mass/molecular mass from experimental data.
- Find percent composition of a compound or mixture.
- Define mole in terms of Avogadro's number.
- Discuss relationship between mass and mole.
- Calculate the empirical formula and molecular formula from experimental data.
- Calculate the mass of an unknown from the mass of a known reactant or product.
- Distinguish between limiting and excess reactants.

Vocabulary

- | | | |
|----------------|--------------------------|-----------------------|
| • composition | • reaction stoichiometry | • percent composition |
| stoichiometry | • empirical formula | • limiting reactant |
| • molar mass | • actual yield | • theoretical yield |
| • mole ratio | • molecular formula | • percent yield |
| • formula mass | • excess reactant | |

Formulas/Conversion Definitions/Diagrams

Composition Stoichiometry

Formulas:

Molar Mass (*MM*)

- $A_xB_y = xA + yB$
- $A_x(BC)_y = xA + yB + yC$
- $A_x(BC_z)_y = xA + yB + yzC$

Percent Composition (% comp)

- $xA/MM(A_xB_y) \times 100\% \rightarrow \text{element A}$
- $yB/MM(A_xB_y) \times 100\% \rightarrow \text{element B}$

Empirical formula (EF)

- EF = simplest whole number ratio of the elements in a compound
 - $C_6H_{12}O_6 \rightarrow CH_2O$ (empirical formula)
- *EM* = the mass of the EF
 - $C + 2H + O$

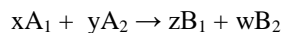
Molecular Formula (MF)

- $n(EF) = MF$
- $n = MM/EM$
 - *MM* – molar mass
 - *EM* – empirical mass

Reaction Stoichiometry

Formulas:

Generic Chemical Equation



mole ratio: x:y:z:w

(**A** given and **B** unknown; **x** coefficient for **A**, **z** coefficient for **B**)

(If the given is **B**, then just reverse the process.)

Mole to Mole

$$A \text{ (mol)} \left(\frac{(z)}{(x)} \right) = B \text{ (mol)}$$

Mole to Mass (A given, B unknown)

$$A \text{ (mol)} \left(\frac{(z)(MM_B)}{(x)} \right) = B \text{ (grams)}$$

Mass to Mole (A given, B unknown)

$$A \text{ (grams)} \left(\frac{(z)}{(x)(MM_A)} \right) = B \text{ (mol)}$$

Mass to Mass (A given, B unknown)

$$A \text{ (grams)} \left(\frac{(z)(MM_B)}{(x)(MM_A)} \right) = B \text{ (grams)}$$

Limiting Reactant (A_1 vs. A_2 givens, B unknown)

$$A_1 \text{ (grams)} \left(\frac{(z)(MM_B)}{(x)(MM_{A1})} \right) = B \text{ (grams) (from } A_1)$$

$$A_2 \text{ (grams)} \left(\frac{(z)(MM_B)}{(x)(MM_{A2})} \right) = B \text{ (grams) (from } A_2)$$

You can solve for either B_1 or B_2 , but it must be consistent.
 $A_1 \rightarrow B_1$ and $A_2 \rightarrow B_1$
 or
 $A_1 \rightarrow B_2$ and $A_2 \rightarrow B_2$
 (when using B_2 use the coefficient (w) instead of (y).)

Percent Yield

$$\% \text{ yield} = \frac{\text{actual}}{\text{theoretical}} \times 100\%$$