Chem 1H AMSAT Mr. Dehne

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

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) x 100% → element A
- yB/*MM*(A_xB_y) x 100% → element B

Empirical formula (EF)

- EF = simplest whole number ratio of the elements in a compound
  - $C_6H_{12}O_6$ → 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

$xA_1 + yA_2 \rightarrow zB_1 + wB_2$

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

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

Mole to Mass (A given, B unknown)

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

Mass to Mole (A given, B unknown)

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

Mass to Mass (A given, B unknown)

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

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

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

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

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

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