

Name _____ Date _____ Hour _____

Molecular Formulas and Stoichiometry

- 1) A gaseous compound has a percent composition of 82.4% nitrogen, and 17.6% hydrogen. What is the molecular formula if the molecular mass of the compound is 17.0 g/mol?

$$\frac{1 \text{ mol N} \mid 82.4 \text{ g N}}{14.01 \text{ g N}} = \frac{5.8815 \text{ mol N}}{5.8815} = 1 \quad \text{Empirical: } \text{NH}_3 \quad 17.0 \text{ g}$$

$$\frac{1 \text{ mol H} \mid 17.6 \text{ g H}}{1.01 \text{ g H}} = \frac{17.426 \text{ mol H}}{5.8815} = 3 \quad \text{Molecular } \text{NH}_3$$

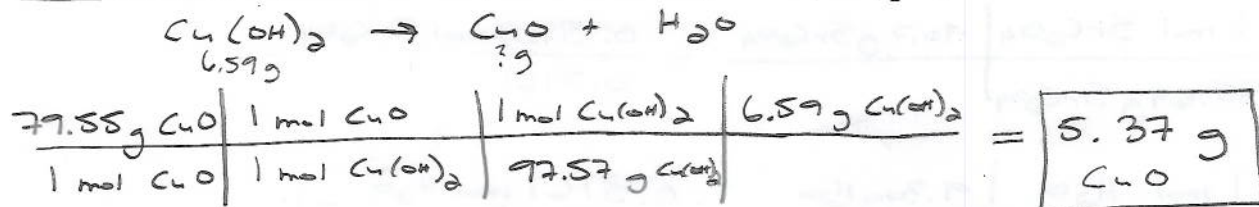
- 2) Find the formula of the following hydrate: 75.5 g CaCl_2 , 24.5 g H_2O .

$$\frac{1 \text{ mol } \text{CaCl}_2 \mid 75.5 \text{ g } \text{CaCl}_2}{110.98 \text{ g } \text{CaCl}_2} = \frac{0.6803 \text{ mol } \text{CaCl}_2}{0.6803} = 1$$

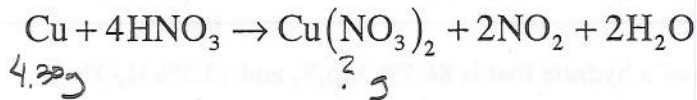
$$\frac{1 \text{ mol } \text{H}_2\text{O} \mid 24.5 \text{ g } \text{H}_2\text{O}}{18.02 \text{ g } \text{H}_2\text{O}} = \frac{1.3596 \text{ mol } \text{H}_2\text{O}}{0.6803} = 2$$

$\text{CaCl}_2 \cdot 2\text{H}_2\text{O}$

- 3) When $\text{Cu}(\text{OH})_2$ is heated, it decomposes to black CuO and H_2O . How many grams of CuO will be formed from the decomposition of 6.59 g of $\text{Cu}(\text{OH})_2$?



- 4) How many grams of copper (II) nitrate would be produced from 4.30 g of copper metal reacting with excess nitric acid in the following reaction?



$$\frac{187.57 \text{ g } \text{Cu}(\text{NO}_3)_2 \mid 1 \text{ mol } \text{Cu}(\text{NO}_3)_2 \mid 1 \text{ mol } \text{Cu} \mid 4.30 \text{ g } \text{Cu}}{1 \text{ mol } \text{Cu}(\text{NO}_3)_2 \mid 1 \text{ mol } \text{Cu} \mid 63.55 \text{ g } \text{Cu}} = 12.7 \text{ g } \text{Cu}(\text{NO}_3)_2$$

- 5) What type of reaction is the reaction in question 3?

Decomposition

1) Name the following hydrates:

- a. $\text{Na}_2\text{S}_2\text{O}_3 \cdot 5 \text{H}_2\text{O}$ Sodium Thiosulfate Pentahydrate
 b. $\text{CaSO}_4 \cdot 2 \text{H}_2\text{O}$ Calcium Sulfate Dihydrate
 c. $\text{MgSO}_4 \cdot \text{H}_2\text{O}$ Magnesium Sulfate Monohydrate
 d. $\text{Mn}(\text{NO}_3)_2 \cdot 4 \text{H}_2\text{O}$ Manganese (II) Nitrate Tetrahydrate

2) Write the formulas of the following hydrates:

- a. magnesium nitrate hexahydrate $\text{Mg}(\text{NO}_3)_2 \cdot 6 \text{H}_2\text{O}$
 b. iron (II) sulfate heptahydrate $\text{FeSO}_4 \cdot 7 \text{H}_2\text{O}$
 c. copper (II) nitrate trihydrate $\text{Cu}(\text{NO}_3)_2 \cdot 3 \text{H}_2\text{O}$
 d. tin (II) chloride dihydrate $\text{SnCl}_2 \cdot 2 \text{H}_2\text{O}$

3) What is the formula for a hydrate that is 90.7g SrC_2O_4 and 9.30g H_2O ?

$$\frac{1 \text{ mol } \text{SrC}_2\text{O}_4}{175.64 \text{ g } \text{SrC}_2\text{O}_4} \left| \frac{90.7 \text{ g } \text{SrC}_2\text{O}_4}{175.64 \text{ g } \text{SrC}_2\text{O}_4} \right| = \frac{0.5164 \text{ mol } \text{SrC}_2\text{O}_4}{0.5161} = 1$$

$$\frac{1 \text{ mol } \text{H}_2\text{O}}{18.02 \text{ g } \text{H}_2\text{O}} \left| \frac{9.30 \text{ g } \text{H}_2\text{O}}{18.02 \text{ g } \text{H}_2\text{O}} \right| = \frac{0.5161 \text{ mol } \text{H}_2\text{O}}{0.5161} = 1$$

formula of hydrate = $\text{SrC}_2\text{O}_4 \cdot \text{H}_2\text{O}$ name of hydrate = Strontium Oxalate Monohydrate

4) What is the formula of a hydrate that is 86.7% Mo_2S_5 and 13.3% H_2O ?

$$\frac{1 \text{ mol } \text{Mo}_2\text{S}_5}{352.23 \text{ g } \text{Mo}_2\text{S}_5} \left| \frac{86.7 \text{ g } \text{Mo}_2\text{S}_5}{352.23 \text{ g } \text{Mo}_2\text{S}_5} \right| = \frac{0.2461 \text{ mol } \text{Mo}_2\text{S}_5}{0.2461} = 1$$

$$\frac{1 \text{ mol } \text{H}_2\text{O}}{18.02 \text{ g } \text{H}_2\text{O}} \left| \frac{13.3 \text{ g } \text{H}_2\text{O}}{18.02 \text{ g } \text{H}_2\text{O}} \right| = \frac{0.7381 \text{ mol } \text{H}_2\text{O}}{0.2461} = 3$$

formula of hydrate = $\text{Mo}_2\text{S}_5 \cdot 3 \text{H}_2\text{O}$ name of hydrate = Molybdenum Sulfide Trihydrate