Name_____ Date_____

Formula Mass

Directions: Determine the gram formula mass (the mass of one mole) of each compound below. Show your work for the **ODD** examples only!

1. Iron (II) Sulfide _____
2. $Ca(NO_3)_2$ _____
3. Carbonic acid _____
4. Caffeine, $C_8H_{10}N_4O_2$ _____
5. Calcium hydroxide _____
6. Chlorine gas _____
7. $Mg_3(PO_4)_2$ _____
8. $CuSO_4 \bullet 5H_2O$ _____
9. Ammonium sulfate _____
10. Copper (II) nitrate pentahydrate _____

Name_____ Date_____

Percent Composition

Directions: Determine the percent composition by mass of each of the following compounds.

1. $C_6H_{12}O_6$

   C = _____
   H = _____
   O = _____

2. NH_4NO_3

   N = _____
   H = _____
   O = _____

3. $Mg(NO_3)_2$

   Mg = _____
   N = _____
   O = _____

4. Potassium phosphate tetrahydrate

   K = _____
   P = _____
   O = _____
   H = _____

5. $Pb(CH_3COO)_2$

   Pb = _____
   C = _____
   H = _____
   O = _____

Name_____Date_____

Mole Conversions

Directions: Determine the number of **moles** in each of the quantities below.

1) 130 g of H_2SO_4

2) 87 g of KCl

3) 2.8 grams of calcium carbonate

Directions: Determine the number of **grams** in each of the quantities below.

4) 3.5 moles of NaCl

5) 2.80 moles of $KMnO_4$

6) 1.25 moles of nitrogen gas

Directions: Determine the number of **molecules** in the quantities below.

7) 2.2 moles

8) 0.17 moles

9) 9.43 grams of magnesium chloride

10) 7.5 grams of sulfuric acid

Name_____Date_____

Mixed Mole Conversions

Directions: Solve the following problems.

1) How many grams are there in 1.2×10^{26} molecules of CO_2?

2) What volume would the CO_2 in Problem 1 occupy at STP?

3) A sample of NH_3 gas occupies 82.0 liters at STP. How many molecules is this?

4) What is the mass of the sample of NH_3 in Problem 3?

5) How many moles are there in 1.3×10^{22} molecules of NO_2?

6) How many atoms are there is 12.7×10^{24} molecules of CO_2?

7) A 8.1 g sample of O_2 is in a container at STP. What volume is the container?

8) How many molecules of O_2 are in the container in Problem 7? How many atoms?

Name_____Date_____

Empirical Formula

Directions: Determine the empirical formula for each compound below.

1. 74.51% Pb, 25.49% Cl

2. 52.55% Ba, 10.72% N, 36.73% O

3. 29.15% N, 8.41% H, 12.50% C, 49.94% O

4. Glycerol is a thick, sweet liquid obtained as a byproduct of the manufacture of soap. Its percent composition is 39.12% carbon, 8.75% hydrogen, and 52.12% oxygen. What is its empirical formula?

5. Analysis of a compound containing chlorine and lead reveals that the compound is 59.37% lead. What is the empirical formula of this compound?

6. A 15.0g sample of a compound is found to contain 8.83g sodium and 6.17g sulfur. Calculate the empirical formula of this compound.

7. What is the empirical formula for $H_2C_2O_4$?

Name_____Date_____

Molecular Formula

Directions: Determine the molecular formula for each compound below.

1. empirical formula CH, molar mass 78 g/mol

2. empirical formula NH_2, molar mass 32.06 g/mol

3. empirical formula OCNCl, molar mass 232.41 g/mol

4. A compound with the following composition has a molar mass of 60.10 g/mol: 39.97% carbon, 13.41% hydrogen, 46.62% nitrogen. Find the molecular formula.

5. Determine the molecular formula for ibuprofen, a common headache remedy. Analysis of ibuprofen yields a molar mass of 206 g/mol and a percent composition of 75.7% C, 8.80% H and 15.5% O.

6. A certain compound has an empirical formula for NH_2O and its molar mass is between 55 g/mol and 65 g/mol. Wat is the possible molecular formula?
   a. $N_2H_4O_2$
   b. $N_2H_2O_2$
   c. NH_2O
   d. Not possible

Name_____Date_____Block_____

Intro Stoichiometry

Directions: Be sure to show all work, correct significant figures and include units.

1. Predict the products and balance the equation for the reaction between sodium bicarbonate and hydrochloric acid.

$NaHCO_3$ + HCl -----> _____+ _____ + _____

2. If you use 3.2 moles of sodium bicarbonate in the reaction in question #1,
a. How many moles of HCl would be used?

b. How many moles of each product would be produced?

3) Given this equation: $C_{(s)} + 2Cl_{2\,(g)} \rightarrow CCl_{4\,(s)}$, write the following molar ratios:

a) Cl_2 to CCl_4 b) C to CCl_4 c) CCl_4 to Cl_2

4) Answer the following questions for this equation: $2H_2 + O_2 \rightarrow 2H_2O$

If you mix 20.0 moles of H_2 with excess O_2, how many moles of H_2O can you make?

5) Balance this equation and use it to answer the following question.

_____Ca + _____O_2 → _____CaO

How many moles of oxygen will be required to produce 14.0 mol calcium oxide?

Use this equation: $N_2 + 3H_2 \rightarrow 2NH_3$, for the following problems

a) If 2.5 moles of N_2 react, how many moles of NH_3 can be produced?

b) If 10.0 moles of NH_3 are produced, how many moles of H_2 would be required?

Name_____Date_____Block_____

Molar Mass Stoichiometry

Directions: Be sure to show all work, correct significant figures and include units.

1. How many grams of NaCl are produced when 13.0 grams of sodium react with excess chlorine?

2. When sulfur trioxide and water react they produce sulfuric acid. What mass of sulfur trioxde is needed to create 4.00 mol of sulfuric acid?

3. How many grams of magnesium nitrate are produced when 8.00 g of nitric acid react with magnesium hydroxide?

4. How many moles of $KClO_3$ decompose into 250.0 grams of oxygen?

5. When 100. g of methane (CH_4) combust how many grams of carbon dioxide form?

Name_____Date_____Block_____

Volume Stoichiometry

Directions: Be sure to show all work, correct significant figures and include units.

1. Use the reaction below to answer the question. What volume of chlorine gas at STP is required to react with 4.80 g of K_2MnO_4?

$$2K_2MnO_4 + Cl_2 \rightarrow 2KMnO_4 + 2KCl$$

2. When 1.6 L of hydrogen gas reacts with excess chlorine gas reacts at STP what volume of hydrogen chloride gas is formed?

3. How many liters of CO_2 can be produced from 0.67 mole of Fe_2O_3 at STP?

$$Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$$

Name_____Date_____Block_____

Limiting Reactants

Directions: Be sure to show all work, correct significant figures and include units.

1. To determine the limiting reactant in a problem one must know _____.
a) the available amount of one reactant
b) the available mount of each reactant
c) the speed of the reaction

2. In the reaction A + B → C + D, if the quantity of B is insufficient to react with all of A then _____.
a) A is the limiting reactant
b) B is the limiting reactant
c) there is no limiting reactant
d) no product can be formed

3. How much aluminum sulfide can form when 9.00 g of aluminum react with 8.00 g of sulfur?

4. If 4.44 g of CaO reactant with 7.77 g of water how many calcium hydroxide is formed?

5. Answer all parts of the following question using the reaction when 9.8 g of calcium hydroxide and 9.8 g of phosphoric acid react.

$$3\ Ca(OH)_2 + 2\ H_3PO_4 \rightarrow Ca_3(PO_4)_2 + 6H_2O$$

a) What is the limiting reactant?
b) What is the theoretical yield?
c) How much excess reactant remains when the reaction goes to completion?
d) If 12.5 grams of calcium phosphate were made, what is the percent yield?