**CHE1031 Moles, Formulas, Reactions & Stoichiometry: *Practice* Quiz 3**

**Moles**

1. How many sulfur atoms are there in 25 molecules of C4H4S2?

25 molecules 2 sulfur atoms = 50 sulfur atoms

1 molecule

2. How many molecules of methane (CH4) are there in 0.123 moles?

0.123 mole 6.02 x 1023 molecules = 7.40 x 1022 molecules CH4

1 mole CH4

**Atomic & Molecular Weight**

3. How many molecules in 23.0 g of N2O5?

23.0 g 1 mole 6.02 x 1023 molecules = 1.28 x 1023 molecules N2O5

107.97 g 1 mole

**Percent Composition**

4. A compound contains 40.0% C, 6.71% H, and 53.29% O by mass. Its molecular

weight is 60.05 g/mol. What is the molecular formula of this compound?

40.0 g/12.01 g/mol = 3.3 mol C /3.3 = 1 6.71 g/1.01 g/mol = 6.6 mol H /3.3 = 2 53.29 g/16.00 g/mol = 3.3 mol O /3.3 = 1 empirical formula = CH2O --> EW = 30.03

MW/EW = 60.05/30.03 = 2........... So C2H4O2

**Empirical & Molecular Formulas**

5. Calculate the empirical formula of a compound with this %mass composition:

10.4% C 10.4 g \* 1 mol/12.01 g = 0.87 mol /0.87 = 1

27.8% S 27.8 g \* 1 mol/32.06 g = 0.87 mol /0.87 = 1 CSCl2

61.7% Cl 61.7 g \* 1 mol/35.45 g = 1.74 mol /0.87 = 2

6. A compound is composed of C, H & O in these amounts: 70.6% C, 5.9% H, and 23.5% O by mass. It’s molecular weight is 136 g/mol.

a) What’s the empirical formula?

b) What’s the molecular formula?

(70.6 g)(1 mol/12.01 g) = 5.87 mol C / 1.47 = 4

(5.9 g)(1 mol/1.01 g) = 5.84 mol H / 1.47 = 4 empirical formula = C4H4O

(23.5 g)(1 mol/16.00 g) = 1.47 mol O / 1.47 = 1 EW = 68.08 g/mol

MW/EW = 136/68.08 = 2 molecular formula = C8H8O2

**Balancing Chemical Equations**

7. Balance the chemical reaction shown below by adding COEFFICIENTS.

C3H8 + O2 🡪 CO2 + H2O

1 5 3 4

8. Predict the products and balance the chemical equation started below:

Na3(PO4) + Fe2(SO4)3 🡪

2Na3(PO4) + Fe2(SO4)3 🡪 3Na2(SO4) + 2Fe(PO4)

**Patterns of Chemical Reactivity**

9. Identify each of these reactions by TYPE:

a) 2CO + O2 -> 2CO2 combination

b) 2KBr + CaCl2 -> 2KCl + CaBr2 exchange

c) 2Li3N -> 6Li + N2 decomposition

d) CH4 + 2O2 -> CO2 + 2H2O combustion

**Stoichiometry & Conversions**

10. If 0.87 mol of NaN3 is decomposed by the reaction shown below:

2NaN3 🡪 2Na + 3N2

a) How many moles of sodium metal are produced?

b) How many moles of nitrogen gas are produced?

a) 0.87 mol NaN3 2 mol Na = 0.87 mol Na

2 mol NaN3

b) 0.87 mol NaN3 3 mol N2 = 1.3 mol N2 gas

2 mol NaN3

11. These two ionic compounds react via exchange reaction:

H3(PO4) + Ca(OH)2 🡪

i) Predict the products of this exchange reaction.

ii) Balance the equation.

iii) How many grams of calcium hydroxide are required to react with 10.0 g of acid?

2H3(PO4) + 3Ca(OH)2 🡪 6H(OH) + Ca3(PO4)2

10.o g 1 mol acid 3 mol base 74.10 g = 11.3 g Ca(OH)2

98.00 g 2 mol acid 1 mol base

**Limiting Reactants & Theoretical Yields**

12. Aluminum hydroxide is used as an antacid and reacts with the reaction shown below.

2Al(OH)3 + 3H2(SO4) 🡪 6H(OH) + Al2(SO4)3

A 1.5-g tablet of aluminum hydroxide is reacted with 1.5 g of acid. Which reactant is limiting?

1.5 g 1 mole Al(OH)3 6 mol H2O = 0.058 mol H2O

77.99 g 2 mol Al(OH)3

1.5 g 1 mol H2(SO4) 6 mol H2O = 0.031 mol H2O 🡨 limiting

98.03 g 3 mol H2(SO4)

13. Magnesium burns in oxygen to produce magnesium oxide by the balanced equation shown below. When 4.00 g of Mg combines with 4.00 g of oxygen gas, the actual yield is 6.00 g of magnesium oxide.

2Mg + O2 🡪 2MgO

Calculate:

i) limiting reactant

i) theoretical yield

ii) percent yield

4.00 g 1 mol Mg 2 mol MgO 40.30 g = 6.71 g MgO 🡪 so Mg is limiting

24.03 g 2 mol Mg 1 mol MgO 🡪 theoretical = 6.71 g

4.00 g 1 mol O2 2 mol MgO 40.30 g = 10.1 g MgO

32.00 g 1 mol O2 1 mol MgO

% yield = (6.00 g/6.71 g)(100) = 89.41%