Unit 5 Review

Chemical Reactions and Stoichiometry

Chemical Equations

- Which coefficients are needed to balance the following equation?

$$\_\_\_Al + \_\_\_Fe_3N_2 \rightarrow \_\_\_AlN + \_\_\_Fe$$

a) 3, 1, 3, 1
b) 1, 3, 2, 3
c) 2, 1, 2, 3
d) The equation is balanced

Chemical Equations

- Hydrogen peroxide decomposes into oxygen and water. Which is the balanced equation for this reaction?

a) $H_2O_2 \rightarrow H_2O + O_2$

b) $2H_2O_2 \rightarrow 2H_2O + O_2$

c) $1H_2O_2 \rightarrow 3H_2O + O_2$

d) $3H_2O_2 \rightarrow 3H_2O + 3O_2$

Chemical Reactions

- Classify the following reaction:

$$C + O_2 \rightarrow CO_2$$

a) Synthesis
b) Single replacement
c) Decomposition
d) Double replacement

Stoichiometry

- Consider the following balanced reaction:

$$6Na + Fe_2O_3 \rightarrow 3Na_2O + 2\ Fe$$

If 3 moles of Fe_2O_3 react with excess Na, how many moles of Na_2O will be produced

a) 3
b) 6
c) 9
d) 12

Limiting Reactants

- In the equation A + B → C + D, if the quantity of A is insufficient to react completely with B, then:

a) B is the limiting reactant
b) The reaction will not take place
c) A is the limiting reactant
d) More C will form than D

Chemical Formulas

- Which of the following is an empirical formula?

a) C_6H_6
b) C_4H_8
c) C_3H_4
d) C_3H_6

Moles

- Convert 132 g of CO_2 to moles

$$132\ g \quad X \ \frac{1\ mol}{44\ g} = 3\ mol\ CO_2$$

Moles

- Convert 0.825 mol Iron to atoms of Iron

$$0.825 \text{ mol X} \quad \frac{6.02 \times 10^{23}}{1 \text{ mol}} = 4.97 \times 10^{23}$$

Percent Composition

- What is the percent composition of fluorine in MgF_2?

$$MgF_2 = 24 + 19 + 19 = 62$$

$$\% \text{ F} = (38 \div 62) \times 100 = 61.29\%$$

Empirical Formula

- What is the empirical formula of a compound that is 27.27% Carbon and 72.72% Oxygen?

27.27 g C x 1 mol/12 g = 2.27 mol C

72.72 g O x 1 mol/16 g = 4.55 mol O

2.27/2.27 = 1 mol C
4.55/2.27 = 2 mol O

Empirical formula = CO_2

Molecular formula

- A compound's empirical formula is CH_2O. The molecular mass is 180 g. What is the molecular formula?

Mass of empirical formula = 12 + 2 + 16 = 30 g

Ratio of empirical mass to molecular mass = 180 ÷ 30 = 6

Molecular formula = $C_6H_{12}O_6$

Balancing Equations

- Balance the following equation:

$$C_2H_5OH + \quad O_2 \rightarrow \quad CO_2 + \quad H_2O$$

$$C_2H_5OH + \quad 3O_2 \rightarrow \quad 2CO_2 + \quad 3H_2O$$

Stoichiometry

- What volume of gas is produced if there are 130.0 g of NaN_3 used in the reaction? (the density of nitrogen gas is 0.916 g/L)

$$2NaN_3\ (s) \rightarrow 2Na(s) + 3N_2\ (g)$$

$$130\ g\ NaN_3 \times (1\ mol/65) = 2\ mol\ NaN_3$$

$$2\ mol\ NaN_3 \times (3\ mol\ N_2/2\ mol\ NaN_3) = 3\ mol\ N_2$$

$$3\ mol\ N_2 \times (28\ g\ /\ 1\ mol) = 84\ g\ N_2$$

$$84\ g\ N_2 \times (1\ Liter/0.916\ g) = 91.7\ L\ N_2$$

Limiting reactant

- If 25 g of P_4 and 50 g O_2 react according to the following equation, how much P_4O_{10} will be produced?

$$P_4 + 5\ O_2 \rightarrow P_4O_{10}$$

25 g P_4 x (1 mol/124 g) = 0.20 mol P_4

50 g O_2 x (1 mol/32 g) = 1.56 mol O_2

Ratio = 1.56/0.20 = 7.8 O_2 / 1 P_4

P_4 is limiting

0.2 mol P_4 x (1 mol P_4 / 1 mol P_4O_{10}) = 0.2 mol P_4O_{10}

0.2 mol P_4O_{10} x (284 g / 1 mol) = 56. 8 g P_4O_{10}

Percent Yield

- What is the percent yield if 0.5 g of $AgNO_3$ acutally produces 0.455 g Ag_2CrO_4?

$$2AgNO_3 + K_2CrO_4 \rightarrow Ag_2CrO_4 + 2\ KNO_3$$

0.5 g $AgNO_3$ x (1 mol/169.9 g) = 0.00294 mol

0.00294 mol x (1 mol / 1 mol) = 0.00294 mol

0.00294 mol Ag_2CrO_4 x (331.7 g / 1 mol) = 0.488 g Ag_2CrO_4

(0.455 g / 0.488 g) x 100 = 93.2 % yield