CHEMISTRY 11
UNIT 4 - CHEMICAL REACTIONS & STOICHIOMETRY - REVIEW PACKAGE

STOICHIOMETRY I:

1. Given the following balanced equations, solve the stoichiometric problems (PLO-D5)

   a. Ammonia combines with oxygen gas in the following reaction:

   $$4\ NH_3 + 5O_2 \rightarrow 6H_2O + 4NO$$

      i. How many moles of NH_3 are needed to combine with 3.57 moles of O_2 gas?

         2.86 moles NH_3

      ii. If 1.5 grams of NO is produced in the above reaction, how many grams of NH_3 were reacted?

         0.85 g NH_3

   b. For the double replacement reaction:

   $$3Na_2CO_3 + 2FeCl_3 \rightarrow 6NaCl + Fe_2(CO)_3$$

      i. How many grams of NaCl will be produced from the reaction of 0.080moles of Na_2CO_3 with excess $FeCl_3$?

         9.4 g NaCl

      ii. How many grams of $FeCl_3$ would be needed to react with 4.2g of Na_2CO_3?

         4.3 g $FeCl_3$

   c. For the following reaction:

   $$2\ Si_4H_{10\ (s)} + 13\ O_{2\ (g)} \rightarrow 8\ SiO_{2\ (s)} + 10\ H_2O_{\ (g)}$$

      i. What volume of oxygen (STP) is required to react with 204.0 g of Si_4H_{10}?

         242.7 L O_2

      ii. What mass of SiO_2 is formed when 345.0 g of H_20 are formed?

         921.5 g SiO_2

      iii. How many molecules of H_2O are formed when 17.92 L of O_2 are used at STP?

         3.705×10^{23} molecules of H_2O

iv. How many moles of Si_4H_{10} are needed to just react with 1.204×10^{26} molecules of oxygen gas?

30.77 mole Si_4H_{10}

d. For the following balanced equation:

$$3\ HCl_{(aq)} + Fe(OH)_{3\ (aq)} \rightarrow 3\ H_2O_{(l)} + FeCl_{3\ (aq)}$$

i. It takes 19.56 mL of 0.50 M HCl to titrate a 25.0 mL sample of a solution of $Fe(OH)_3$. Calculate the $[Fe(OH)_3]$?

0.13 M $Fe(OH)_3$

ii. What mass of $Fe(OH)_3$ is needed to completely react with 10.0 mL of 0.50M HCl solution?

0.18 g $Fe(OH)_3$

iii. What volume of 0.50M HCl is required to titrate a 21.36 gram sample of iron (III) hydroxide?

1.2 L HCl

e. For the following balanced equation:

$$3Mg + 2AlCl_3 \rightarrow 3MgCl_2 + 2Al$$

i. How many grams of $MgCl_2$ would be formed if 50.0mL of 0.200M $AlCl_3$ is reacted with excess Mg?

1.43 g $MgCl_2$

ii. How many mL of 0.150M $AlCl_3$ would be needed to react completely with 2.00g of Mg?

3.66×10^3 mL of AlCl3

STOICHIOMETRY II:

10. Given the following balanced equations, solve the stoichiometric problems (PLO-D5)

a. In a chemical reaction 6.92g of Fe_2S_3 is combined with 4.54g of oxygen gas.

$$2Fe_2S_3 + 9O_2 \rightarrow 2Fe_2O_3 + 6\ SO_2$$

i. Which reactant is the **LIMITING** reagent?

Oxygen gas is limiting reagent

ii. How many grams of the **EXCESS** reactant will be **left over** after the reaction is complete?

0.365 g of Fe_2S_3

iii. How many grams of Fe_2O_3 can be formed in this reaction?

0.0315 g Fe_2O_3

b. $Ca_3(PO_4)_2 + 6\ SiO_2 + 10C \rightarrow P_4 + 6CaSiO_3 + 10CO$

What mass of P_4 will be produced when 41.5g of $Ca_3(PO_4)_2$, 26.3g of SiO_2, and 7.80g of C are reacted according to the following balanced equation?

Limiting reactant: Carbon

8.06 g of Carbon

c. Given the balanced equation:

$$Al_2C_6 + 6\ H_2O \rightarrow 2\ Al(OH)_3 + 3CH_{4\,(g)}$$

i. If 34.5 grams of Al_2C_6 is mixed with 72.0 grams of water, which reactant is in excess? Show by calculations.

Water (H_2O)

ii. If 34.5 grams of Al_2C_6 is mixed with 72.0 grams of water, what mass of $Al(OH)_3$ is formed?

42.7 g $Al(OH)_3$

iii. If 34.5 grams of Al_2C_6 is mixed with 72.0 grams of water, what volume of CH_4 is formed at STP?

13.1 g CH_4

d. Given the equation:

$$4\ NH_3 + 5\ O_2 \rightarrow 4\ NO + 6\ H_2O$$

When 51.0 grams of NH_3 is burned in an excess of oxygen, 52.65 g of water are produced.

i. Calculate the theoretical yield of H_2O.

81.0 g H_2O

ii. Calculate the % yield of H_2O.

65%

e. Given the equation:

$$N_2 + 3\,H_2 \rightarrow 2\,NH_3$$

When 4.0 grams of hydrogen gas is combined with an excess of nitrogen, a 92% yield of NH_3 is obtained.

i. Calculate the theoretical yield of NH_3

2.3×10^1 g NH_3

ii. Calculate the actual yield of NH_3

2.1×10^1 g NH_3

f. For the following reaction:

$$4Al + 3O_2 \rightarrow 2Al_2O_3$$

i. How many grams of aluminum oxide, Al_2O_3, would be expected to form in the reaction of 15.0g Al with 18.43g of oxygen gas?

28.3 g Al_2O_3

ii. If the actual yield of Al_2O_3 produced in the reaction was only 22.4g Al_2O_3, what would the PERCENT YIELD of the reaction be?

79.2%