Limiting Reagent Worksheet #1

1. Given the following reaction: (Balance the equation first!)

$$C_3H_8 \ + \ O_2 \ \text{-------}> \ CO_2 \ + \ H_2O$$
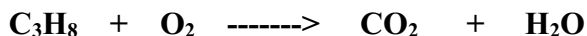
a) If you start with 14.8 g of C_3H_8 and 3.44 g of O_2, determine the limiting reagent

b) determine the number of moles of carbon dioxide produced

c) determine the number of grams of H_2O produced

d) determine the number of grams of excess reagent left

2. Given the following equation:

$$Al_2(SO_3)_3 \ + \ 6 \ NaOH \ \text{------}> 3 \ Na_2SO_3 \ + \ 2 \ Al(OH)_3$$
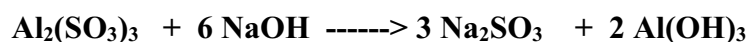
a) If 10.0 g of $Al_2(SO_3)_3$ is reacted with 10.0 g of NaOH, determine the limiting reagent

b) Determine the number of moles of $Al(OH)_3$ produced

c) Determine the number of grams of Na_2SO_3 produced

d) Determine the number of grams of excess reagent left over in the reaction

3. Given the following equation:

$$Al_2O_3 \ + \ Fe \ \text{------}> Fe_3O_4 \ + \ Al$$

a) If 25.4 g of Al_2O_3 is reacted with 10.2 g of Fe, determine the limiting reagent

b) Determine the number of moles of Al produced

c) Determine the number of grams of Fe_3O_4 produced

d) Determine the number of grams of excess reagent left over in the reaction

Limiting Reagent Worksheet #2

1. Consider the reaction

$$I_2O_5(g) + 5\ CO(g) \text{-------}> 5\ CO_2(g) + I_2(g)$$

   a) 80.0 grams of iodine(V) oxide, I_2O_5, reacts with 28.0 grams of carbon monoxide, CO.
   Determine the mass of iodine I_2, which could be produced?

   b) If, in the above situation, only 0.160 moles, of iodine, I_2 was produced.
   i) what mass of iodine was produced?
   ii) what percentage yield of iodine was produced.

2. Zinc and sulphur react to form zinc sulphide according to the equation.

$$Zn\ +\ S\ \text{--------}>\ ZnS$$

   If 25.0 g of zinc and 30.0 g of sulphur are mixed,
   a) Which chemical is the limiting reactant?
   b) How many grams of ZnS will be formed?
   c) How many grams of the excess reactant will remain after the reaction is over?

3. Which element is in excess when 3.00 grams of Mg is ignited in 2.20 grams of pure oxygen?
   What mass is in excess? What mass of MgO is formed?

4. How many grams of Al_2S_3 are formed when 5.00 grams of Al is heated with 10.0 grams S?

5. When MoO_3 and Zn are heated together they react

$$3\ Zn(s) + 2\ MoO_3(s) \text{----------}> Mo_2O_3(s) + 3\ ZnO(s)$$

   What mass of ZnO is formed when 20.0 grams of MoO_3 is reacted with 10.0 grams of Zn?

6. Silver nitrate, $AgNO_3$, reacts with ferric chloride, $FeCl_3$, to give silver chloride, AgCl, and ferric nitrate, $Fe(NO_3)_3$. In a particular experiment, it was planned to mix a solution containing 25.0 g of $AgNO_3$ with another solution containing 45.0 grams of $FeCl_3$.

   a) Write the chemical equation for the reaction.

   b) Which reactant is the limiting reactant?

   c) What is the maximum number of moles of AgCl that could be obtained from this mixture?

   d) What is the maximum number of grams of AgCl that could be obtained?

   e) How many grams of the reactant in excess will remain after the reaction is over?

7. Solid calcium carbonate, $CaCO_3$, is able to remove sulphur dioxide from waste gases by the reaction (balanced as written):

$$CaCO_3\ +\ SO_2\ + \text{other reactants} \text{------}>\ CaSO_3 + \text{other products}$$

   In a particular experiment, 255 g of $CaCO_3$ was exposed to 135 g of SO_2 in the presence of an excess amount of the other chemicals required for the reaction.

   a) What is the theoretical yield of $CaSO_3$?

   b) If only 198 g of $CaSO_3$ was isolated from the products, what was the percentage yield of $CaSO_3$ in this experiment?

Answers: Limiting Reagent Worksheet #1

1. **Balanced equation:**

$$C_3H_8 + 5\ O_2\ \text{-------> }3\ CO_2 + 4\ H_2O$$
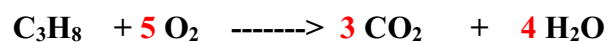
a) O_2

b) 0.065 mol CO_2

c) 1.56 g H_2O

d) 13.86 g C_3H_8

2a) $Al_2(SO_3)_3$

b) 0.068 mol $Al(OH)_3$

c) 12.85 g Na_2SO_3

d) 1.84 g NaOH

3. **Balanced equation:**

$$4\ Al_2O_3 + 9\ Fe\ \text{------> }3\ Fe_3O_4 + 8\ Al$$

a) Fe

b) 0.16 mol Al

c) 14.12 g Fe_3O_4

d) 17.13 g Al_2O_3

Limiting Reagent Worksheet #2

1.

Consider the reaction

$$I_2O_5(g) + 5\ CO(g) \text{ -------> } 5\ CO_2(g) + I_2(g)$$

a) 80.0 grams of iodine(V) oxide, I_2O_5, reacts with 28.0 grams of carbon monoxide, CO. CO is limiting
   Determine the mass of iodine I_2, which could be produced? **50.7 g**

b) If, in the above situation, only 0.160 moles, of iodine, I_2 was produced.
   i) what mass of iodine was produced? 40.6 g
   ii) what percentage yield of iodine was produced. **80.1%**

2. Zinc and sulphur react to form zinc sulphide according to the equation.

$$Zn\ +\ S \text{ ---------> } ZnS \quad Zn=0.3803\ mol \quad S=0.9356\ mol$$

If 25.0 g of zinc and 30.0 g of sulphur are mixed,
a) Which chemical is the limiting reactant? Zn
b) How many grams of ZnS will be formed? **0.3803 mol = 37.1 g**
c) How many grams of the excess reactant will remain after the reaction is over?
17.7 g

3. Which element is in excess when 3.00 grams of Mg is ignited in 2.20 grams of pure oxygen? O_2
What mass is in excess? **0.226 g O_2** What mass of MgO is formed? **4.97 g MgO**

4. How many grams of Al_2S_3 are formed when 5.00 grams of Al is heated with 10.0 grams S? **Al is limiting, 13.9 g Al_2S_3**

5. When MoO_3 and Zn are heated together they react

$$3\ Zn(s) + 2\ MoO_3(s) \text{ -----------> } Mo_2O_3(s) + 3\ ZnO(s)$$

What mass of ZnO is formed when 20.0 grams of MoO_3 is reacted with 10.0 grams of Zn? **Zn is limiting, 12.4 g of ZnO will be produced**

6. Silver nitrate, $AgNO_3$, reacts with ferric chloride, $FeCl_3$, to give silver chloride, AgCl, and ferric nitrate, $Fe(NO_3)_3$. In a particular experiment, it was planned to mix a solution containing 25.0 g of $AgNO_3$ with another solution containing 45.0 grams of $FeCl_3$.

a) Write the chemical equation for the reaction. **$3AgNO_3 + FeCl_3 \rightarrow 3AgCl + Fe(NO_3)_3$**

b) Which reactant is the limiting reactant? **$AgNO_3$**

c) What is the maximum number of moles of AgCl that could be obtained from this mixture? **0.147 mol**

d) What is the maximum number of grams of AgCl that could be obtained? **21.1 g**

e) How many grams of the reactant in excess will remain after the reaction is over?
37.1 g ferric chloride

7. Solid calcium carbonate, $CaCO_3$, is able to remove sulphur dioxide from waste gases by the reaction:

$$CaCO_3\ +\ SO_2\ + \text{other reactants} \text{ ------> } CaSO_3 + \text{other products}$$

In a particular experiment, 255 g of $CaCO_3$ was exposed to 135 g of **SO_2 (limiting)** in the presence of an excess amount of the other chemicals required for the reaction.

a) What is the theoretical yield of $CaSO_3$? **253 g $CaSO_3$**

b) If only 198 g of $CaSO_3$ was isolated from the products, what was the percentage

yield of CaSO₃ in this experiment? 78.3%