Limiting Reagent Worksheet #1

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

 $C_{3}H_{8} + O_{2} -----> CO_{2} + H_{2}O$

a) If you start with 14.8 g of C₃H₈ and 3.44 g of O₂, determine the limiting reagent

b) determine the number of moles of carbon dioxide produced

c) determine the number of grams of H₂O produced

d) determine the number of grams of excess reagent left

2. Given the following equation:

 $Al_2(SO_3)_3 + 6 NaOH -----> 3 Na_2SO_3 + 2 Al(OH)_3$

a) If 10.0 g of Al₂(SO₃)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 Na₂SO₃ produced

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

3. Given the following equation:

 $Al_2O_3 + Fe \longrightarrow Fe_3O_4 + Al$

- a) If 25.4 g of Al₂O₃ 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 Fe₃O₄ produced
- d) Determine the number of grams of excess reagent left over in the reaction

1. Consider the reaction

 $I_2O_5(g) + 5 CO(g) ----> 5 CO_2(g) + I_2(g)$

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 I₂, which could be produced?

- b) If, in the above situation, only 0.160 moles, of iodine, I₂ 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 ----> 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
- 4. grams S?
- 5. When MoO₃ and Zn are heated together they react

3 Zn(s) + 2 MoO₃(s) -----> Mo₂O₃(s) + 3 ZnO(s)

What mass of ZnO is formed when 20.0 grams of MoO₃ is reacted with 10.0 grams of Zn?

- 6. Silver nitrate, AgNO₃, reacts with ferric chloride, FeCl₃, to give silver chloride, AgCl, and ferric nitrate, Fe(NO₃)₃. In a particular experiment, it was planned to mix a solution containing 25.0 g of AgNO₃ with another solution containing 45.0 grams of FeCl₃.
 - 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, CaCO₃, is able to remove sulphur dioxide from waste gases by the reaction (balanced as written):

CaCO₃ + SO₂ + other reactants -----> CaSO₃ + other products In a particular experiment, 255 g of CaCO₃ was exposed to 135 g of SO₂ in the presence of an excess amount of the other chemicals required for the reaction.

a) What is the theoretical yield of CaSO₃?

b) If only 198 g of CaSO₃ was isolated from the products, what was the percentage yield of CaSO₃ in this experiment?

Answers: Limiting Reagent Worksheet #1

1. Balanced equation:

 $C_{3}H_{8} + 5 O_{2} - ----> 3 CO_{2} + 4 H_{2}O$

- a) O₂
- b) 0.065 mol CO₂
- c) 1.56 g H₂O
- d) 13.86 g C₃H₈
- 2a) Al₂(SO₃)₃
- b) 0.068 mol Al(OH)₃
- c) 12.85 g Na₂SO₃
- d) 1.84 g NaOH
- 3. Balanced equation:

$$4 \text{ Al}_2\text{O}_3 + 9 \text{ Fe} -----> 3 \text{ Fe}_3\text{O}_4 + 8 \text{ Al}$$

- a) Fe
- b) 0.16 mol Al
- c) 14.12 g Fe₃O₄
- d) 17.13 g Al₂O₃

Limiting Reagent Worksheet #2

1. Consider the reaction

 $I_2O_5(g) + 5 CO(g) ----> 5 CO_2(g) + I_2(g)$

a) 80.0 grams of iodine(V) oxide, I₂O₅, reacts with 28.0 grams of carbon monoxide,

CO. CO is limiting

Determine the mass of iodine I₂, 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 -----> ZnS Zn=0.3803 mol 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? O₂

What mass is in excess? 0.226 g O₂ What mass of MgO is formed? 4.97 g MgO

- 4. How many grams of Al₂S₃ are formed when 5.00 grams of Al is heated with 10.0 grams S? Al is limiting, 13.9 g Al₂S₃
- 5. When MoO₃ and Zn are heated together they react

 $3 Zn(s) + 2 MoO_3(s) ----> Mo_2O_3(s) + 3 ZnO(s)$

What mass of ZnO is formed when 20.0 grams of MoO₃ is reacted with 10.0 grams of Zn? Zn is limiting, 12.4 g of ZnO will be produced

6. Silver nitrate, AgNO₃, reacts with ferric chloride, FeCl₃, to give silver chloride, AgCl, and ferric nitrate, Fe(NO₃)₃. In a particular experiment, it was planned to mix a solution containing 25.0 g of AgNO₃ with another solution containing 45.0 grams of FeCl₃.

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? AgNO₃

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, CaCO₃, is able to remove sulphur dioxide from waste gases by the reaction:

CaCO₃ + SO₂ + other reactants -----> CaSO₃ + 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 CaSO₃? 253 g CaSO₃

b) If only 198 g of CaSO₃ was isolated from the products, what was the percentage yield of CaSO₃ in this experiment? 78.3%