STOICHIOMETRIC PROBLEMS

SHEET #6 – LIMITING EXCESS REAGENT PROBLEMS

1. 16.0 g of CaC_2 reacts with 42.0 g of H_2O according to the following reaction:

$$CaC_2(s) + 2H_2O(l) \Longrightarrow C_2H_2(g) + Ca(OH)_2(s)$$

   a) Determine which reactant in the limiting reagent.
   b) What mass of $C_2H_2(g)$ and $Ca(OH)_2(s)$ is produced.
   c) Calculate the excess mass of the excess reagent.

2. Consider the following reaction at S.T.P.

$$WO_3(s) + 3H_2(g) \Longrightarrow W(s) + 3H_2O(s)$$

   If 35 g of tungsten trioxide reacts with 15 L of H_2 at S.T.P., what mass of tungsten is produced?

3. What mass of H_2SO_4 can be produced from 50.0 g of SO_2, 15.0 g O_2 and an unlimited amount of H_2O? The equation is:

$$2SO_2(g) + O_2(g) + 2H_2O(l) \Longrightarrow 2H_2SO_4(aq)$$

4. 40.0 L of O_2 react with 19.6 L of methane (CH_4) at S.T.P. according to the reaction shown below. What volume of water and carbon dioxide are produced at S.T.P.

$$CH_4(g) + 2O_2(g) \Longrightarrow CO_2(g) + 2H_2O(g)$$

5. What is the maximum mass of carbon dioxide that can be produced by the reaction between 15.0 g of propane (C_3H_8) with 60.0 g of oxygen gas?

6. What mass of iron (III) oxide is produced when 20.9 g of iron (II) sulphide reacts with 10.0 L of oxygen gas at 105.5 kPa and a temperature of 42 °C? What volume of sulphur dioxide is produced at S.T.P.?

7. Nickel metal can be highly purified using the Mond Process:

$$Ni(s) + 4CO(g) \Longrightarrow Ni(CO)_4(g)$$

   In the first step of this process nickel metal is reacted with carbon monoxide under high pressure and heat to produce a gas product known as nickel carbonyl ($Ni(CO)_4$). If 40.0 g of nickel metal is reacted with 5.00 L of carbon monoxide at 60.75 atm. pressure and a temperature of 875 K, calculate the resulting total pressure of all gases at 25 °C and total volume 5.00 L. Hints: nickel is the limiting reagent, Dalton's Law of Partial Pressures could be used to solve this problem

Answers:
1. a) CaC_2, b) 6.5 g C_2H_2, 18.5 g $Ca(OH)_2$, c) 33 g H_2O
2. 27.8 g W
3. 76.6 g H_2SO_4
4. 39.2 L H_2O, 19.6 L CO_2
5. 44.9 g CO_2
6. 18.4 g Fe_2O_3, 5.16 L SO_2
7. 10.7 atm.