Stoichiometry Problems II

SCH3UE_07 - 08

1. Consider the chemical reaction below:

$$MnO_2(s) + 4\,HCI(aq) \longrightarrow MnCl_2(aq) + Cl_2(g) + 2\,H_2O(l)$$

(a) What are the mol ratios of all products to all reactants?

(b) How many moles of $Cl_2(g)$ are produced if 2 mol of HCl are consumed?

(c) How many molecules of HCl are consumed if 3.01×10^{23} molecules of H_2O are formed?

2. A chemist makes nitroglycerin, $C_3H_5(NO_3)_3$ from glycerol $C_3H_5(OH)_3$ and HNO_3. The balanced chemical reaction is listed below:

$$C_3H_5(OH)_3(l) + 3\,HNO_3(aq) \longrightarrow C_3H_5(NO_3)_3(l) + 3\,H_2O(l)$$

If 4.11 g of glycerol and an excess of HNO_3 is used, what mass of nitroglycerin is produced by the chemist?

3. Sulfuric acid can be prepared by reacting sulfur dioxide, oxygen, and water. The chemical reaction is:

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

If 50.0 g of sulfur dioxide are reacted with an unlimited quantity of water and an excess of oxygen, what mass of sulphuric acid will be produced?

4. Sodium carbonate, Na_2CO_3, is used in the manufacture of glass and is made from calcium carbonate, $CaCO_3$, and sodium chloride, NaCl, according to the equation:

$$CaCO_3 + 2\,NaCl \longrightarrow Na_2CO_3 + CaCl_2$$

a) What mass in kg of NaCl is required to completely react with 1.00 kg of $CaCO_3$?

b) What mass of Na_2CO_3 could be produced from the reaction of 1.00 kg of $CaCO_3$?

5. Iron (II) sulphide, FeS, reacts in air, O_2, to produce Fe_2O_3, and SO_2

a) Write a balanced equation for the reaction of FeS in air.

b) How many grams of Fe_2O_3 are produced when 20.9 g of FeS react with an excess of O_2 ?

6. Propane burns in excess oxygen according to the following equation:

$$C_3H_{8\,(g)} + 5\,O_{2\,(g)} \longrightarrow 3\,CO_{2\,(g)} + 4\,H_2O_{(g)}$$

a. What mass of water is produced when 25.0 g propane, $C_3H_{8(g)}$ undergoes combustion?

b. What mass of oxygen is required if 444.0 g of carbon dioxide gas is produced?