Review Problems

1. (a) Tin (II) iodide, SnI_2, can be prepared by adding a solution of potassium iodide to a solution of tin (II) chloride, $SnCl_2$, and precipitating the insoluble iodide.

2.280 grams of $SnCl_2$ were dissolved in $25.0cm^3$ of water and mixed with 10.0 cm^3 of 1.40 M KI solution to precipitate the iodide.

(i) Determine which of the reagents is present in excess.
(ii) Determine the mass of this reagent remaining at the end of the experiment.
(iii) Calculate the maximum mass of tin (II) iodide that could be formed
(iv) In an experiment carried out as described above, 1.893 g of tin (II) iodide were obtained.

(b) A second compound of tin and iodine was prepared by adding small pieces of tin her to a solution of iodine in 1,1,1-trichloroethane and refluxing the solution until that day in the old caller until the deep purple colour disappeared. The result of this experiment were:

Mass of iodine used   3.105 g
Mass of tin added initially   4.100 g
Mass of tin remaining at end of experiment   3.385 g

Determine the formula of the compound formed.

2. An organic compound was found by CHN analysts to contain 40.45% C; 7.86% H and 15.73% N. The remainder was an element commonly found in nature and all organic acids ... like acetic acid. A separate experiment determined the nuclear mass of the compound to be 89.0g mol^{-1}.

(a) Determine the empirical formula of the compound.

(b) What is the molecular formula of the compound?

3. A white powder is a mixture of X mol of hydrated magnesium sulfate ($MgSO_4 \bullet 7H_2O$, Relative Molecular Mass = 246.5) and Y ml of hydrated zinc sulfate ($ZnSO_4 \bullet 7H_2O$, Relative Molecular Mass = 287.5). 0.3973 g of the powder was dissolved in water and an excess of barium chloride solution was added to precipitate barium sulfate. This precipitate was filtered off, dried and weighted. The mass of barium sulfate isolated was 0.3550g.

(a) How many mol of barium sulfate were precipitated?

(b) In terms of X and Y, what is the total number of the two compounds in the weighted sample of mixture?

(c) Stated also in terms of X and Y, what is the total number of mol of sulfate in the sample which was tested?

(d) Calculate the numerical value of X.

(e) What is the percentage by weight of hydrated magnesium sulfate in the mixture?

4. A 0.496g of an unknown hydrocarbon (a compound containing just carbon and hydrogen) was completely burned in oxygen. The sample produced 1.5 6g of carbon dioxide and 0.638g of water.

(a)   (i) How many moles of carbon dioxide were formed?
        (ii) How many moles of water were formed?
        (iii) What is the empirical formula of the hydrocarbon?

(b) A 1.12g sample of the hydrocarbon occupied 448 cm^3 at 0°C and 101.3 kPa pressure. What is the molecular mass of the compound? (1.00 mol of gas occupies 22.4 L at 0°C and 101.3 kPa pressure.)

(c) What is the molecular formula of the compound?