The Open University of Sri Lanka

Advanced Certificate in Laboratory Technology

Laboratory Techniques in Chemistry PSC- 2322

Assignment test I

Date - 13th September 2014

Question No	Marks
01	
02	
Total	

Duration 1 ½ hrs   **Time- 1.30- 3.00 p.m**

This paper consists of two structured type essay questions.

- Answer all the questions in the spaces given.

- For the questions where calculations are involve, you have to show all the necessary steps.

(1)   A bottle containing HNO_3 acid solution is having the following information on its label.

Purity = 21 %   w/w   density = 1.5 gcm^{-3}

Answer the following questions using above information.

i.   Calculate the molar mass of HNO_3? (relative molar mass of H=1, N=14, O=16)

ii.   What is the mass of the above acid solution containing 1 mole of HNO_3?

iii.   What is the volume of the above acid solution that would contain the 1 mole of HNO_3?

iv.   Calculate the concentration of HNO_3 in the above solution in terms of $moldm^{-3}$.

v.   Calculate the volume of this acid solution that you need to prepare 1 L of 0.5 M solution?

vi.   a. Define the term Solubility

        b. Why Potasssium chlorate (v) should not be ground up with a motar and pestle?

                                                            (50 marks)

(2) .i. Write three properties of a primary standard substance.

ii. For what purpose do you use a primary standard solution in the laboratory?

iii. Underline the primary standard substances form the following.

Copper sulphate, sodium hydroxide, potassium nitrate, potassium dichromate,

Sulphuric acid

iv. A 10 g of benzoic acid (molar mass is 122 $gmol^{-1}$ and the purity is 95%) was dissolved in 100 cm^3 of 50% (v/v) methanol.

a. How do you prepare 100 cm^3 of 50% (v/v) methanol solution from a 99% (v/v) methanol solution?

b. What is the actual weight of pure benzoic acid that was dissolved?

c. Calculate the molarity of resultant solution.

v. State **one major difference** between the following.

a. Distilled water and deionized water.

b. Temporary and permanent hardness in water.

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Laboratory techniques in Chemistry PSC 2322 – 2014 / 2015
Assignment Test 1 Answer Guide

(1) i. $HNO_3 = 1+14+ 3(16) = 63$ g

    ii.   In the solution, 100 g contains 21 g of HNO_3

      Mass containing 63 g = 100 g/21 g x 63 g   = 300 g

    iii.   Density =mass / volume

      Volume = mass /density   = 300 g/ 1.5 g cm^{-3} = 200 cm^3

    iv.   200 cm^3 of solution contain 1 mole of HNO_3

      No. of moles in 1 L = 1/200 x 1000 = 5 moles   :Concentration= 5 mol dm^{-3}

    v.   Concentration of the solution – C_1 Concentration of the new solution – C_2

      Volume to be taken = V_1 Volume of new solution= V_2

      $C_1V_1 = C_2V_2$ $5xV_1 = 0.5 x 1$ $V_1= 0.1$ L = 100 mL

    vi.   a.   It is the maximum amount of the salt that can be dissolved in 1 L of water at constant temperature and pressure.

        b. $KClO_3$ is a strong oxidizing agent. Mechanical stress during grinding might provide enough friction to explode.

(2) i.   1. Must be able to obtain (or easy to purify) and preserve in pure form.

      2. Should not be altered in air during weighing. That is they should not be hygroscopic, oxidized by air or affected by carbon dioxide.

      3. Should be able to subject to the tests for impurities.

      4. Should have a high relative molecular mass.

      5. Should be readily soluble.

      6. Should be able to react stoicheometrically. If this is not fulfilled there will be a difficulty in calculating the concentrations of other substances.

    ii.   To determine the concentration of other solutions.

    iii.   Potassium nuitrate and potassium dichromate

    iv.   a. $C_1V_1 = C_2V_2$ $99 x V_1 = 50 x 100$ $V_1= 50. 05$ mL

          Measure 50.05 mL of 99 % solution and dilute up to 100 cm^3

       b.   In 100 g   = 95 g of pure benzoic acid

          In 10 g = 95 / 100 x 10 = 9.5 g

       c.   No. of moles in 100 cm^3 = 9.5 g/ 122 g mol^{-1}

          No of moles in 1000 cm^3 = 9.5 g / 122 $gmol^{-1}$ x 1000 cm^3/1000 cm^3

                         = 0.77 mol dm^{-3}

    v.   a.   Distilled water – high purity or low conductivity

          De-ionized water - low purity or high conductivity

       b.   Temporary hardness- caused by bicarbonate salts of Ca and Mg or can be removed by boiling.

          Permanent hardness - caused by sulphates and chlorides of Ca and Mg or cannot be removed by boiling.