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MCH-001

P.G. DIPLOMA IN ANALYTICAL CHEMISTRY (PGDAC)

Term-End Examination

December, 2016

00674

MCH-001 : BASIC ANALYTICAL CHEMISTRY

Time : 3 hours *Maximum Marks : 75*

Note : *Answer any **five** questions. All questions carry equal marks.*

1. (a) Name the commonly used thermal methods of analysis. In which of these do we note the rate of change of weight as a function of temperature ? *5*

(b) The observed and true values of an analyte are 5·25 g and 5·30 g, respectively. Find the relative error in parts per thousand. *5*

(c) What are the different ways by which humans are directly exposed to chemicals ? *5*

2. (a) A set of replicate measurements of an analyte are 0·792 g, 0·794 g, 0·813 g and 0·900 g. Calculate the mean, median and range. *5*

(b) Is chromatography a single stage or a multistage process ? Name three types of chromatography. *5*

(c) Give one example each of the following : 5

(i) Poisonous gas

(ii) Carcinogen

(iii) Flammable solid

(iv) Flammable liquid

(v) Corrosive substance

3. (a) Write the rate equation in differential form and integrated form for a first order reaction involving a single reactant. What will be the unit of rate constant for a first order reaction ? 5

(b) Define a Lewis acid and a Lewis base and give one example of each. 3

(c) Identify the base on the left and the conjugate acid on the right in the following : 2

(i) $CH_3COOH + H_2O \rightleftharpoons H_3O^+ + CH_3COO^-$

(ii) $NH_3 + CH_3OH \rightleftharpoons NH_4^+ + CH_3O^-$

(d) Name one analytical technique based on each of the following : 5

(i) Emission of radiation

(ii) Measurement of mass of substance deposited on electrode

(iii) Absorption of radiation

(iv) Measurement of change in conductivity

(v) Scattering of radiation

4. (a) Draw and explain the titration curve you will obtain when Na_2CO_3 is titrated with HCl. What indicator/indicators will you use and why ? 5

(b) Mention any three requirements of primary standards. Which of these are primary standards — oxalic acid, potassium permanganate, sodium carbonate, sodium hydroxide ? 5

(c) Iodine can be used for estimation of both oxidising and reducing agents. Illustrate with examples. What indicator is used in a titration involving iodine ? 5

5. (a) Calculate the electrode potential of a half cell containing aqueous solution of 0·100 M $KMnO_4$ and 0·100 M $MnCl_2$ at pH 1·00.

Given $E^0_{MnO_4^-|Mn^{2+}} = 1{\cdot}52$ V. 5

(b) What is the difference between accuracy and precision ? Explain with help of suitable examples. 5

(c) What are buffers ? What are the effects of (i) addition of acids and bases, and (ii) dilution on pH of a buffer ? 5

6. (a) Define masking. You are provided with a solution containing Zn^{2+} and Mg^{2+}. Explain how you will estimate both the metals using EDTA as the titrant by using appropriate masking and demasking agents. 5

(b) What is coprecipitation ? How can it be minimized ? 5

(c) Derive the integrated rate equation for a first order reaction $A \rightarrow P$.
What are the units of its rate constant ? 5

7. (a) Give the ionic reaction for the titration between potassium permanganate and oxalic acid in acidic medium. Why is heating needed in this titration ? Which indicator will you use ? Can you use HCl for acidification ? Give reason. 5

(b) Give one example of a metallochromic indicator. Give any two requirements that a substance should possess to be used for this purpose. 5

(c) What is meant by amphiprotic and aprotic solvents ? Give one example of each. 5

8. Write short notes on any ***three*** of the following : $3 \times 5 = 15$

(a) Precipitation titration using Fajans' method

(b) Determinate errors and their sources

(c) Precipitation from homogenous solutions

(d) Storage of chemicals

(e) Physical and chemical adsorption