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MCH-001

P.G. DIPLOMA IN ANALYTICAL CHEMISTRY (PGDAC)

Term-End Examination

01771

June, 2019

MCH-001 : BASIC ANALYTICAL CHEMISTRY

Time : 3 hours *Maximum Marks : 75*

Note : *Attempt any **five** questions. All questions carry equal marks. Log tables may be provided.*

1. (a) Mention any two commonly used thermal methods of analysis. *2*

(b) Give an example each of classical methods and modern methods of separation. *2*

(c) The following set of replicate measurements of an analyte are reported : 0·792, 0·794, 0·813 and 0·900 g. The true value is 0·830 g. Calculate (i) Mean, (ii) Median, and (c) Standard Deviation. *6*

(d) How are the physicochemical determinants of water classified ? Expand the term BOD. *5*

2. (a) Define any ***two*** of the following and give an appropriate example of each : *5*

(i) Corrosive substance

(ii) Toxic substance

(iii) Carcinogen

(b) Define order of a reaction. Consider the following elementary reaction : 5

$$X + 2Y \rightarrow P$$

(i) What is the overall order of reaction ?

(ii) What is the order of reaction with respect to X ?

(iii) What is the order of reaction when Y is hundred fold in excess ?

(c) What is meant by a buffer solution and buffer capacity ? Calculate the pH of a solution containing 0·01 M CH_3COOH and 0·01 M CH_3COONa.

K_a of $CH_3COOH = 1{\cdot}76 \times 10^{-5}$ (25°C) 5

3. (a) Mention any three requirements of a primary standard and give two examples of the same. 5

(b) Match the indicator in A with the type of titration in B. 5

A		B	
(i)	Methyl Orange	I.	Precipitation (Mohr's method)
(ii)	Eriochrome Black T	II.	Acid-Base
(iii)	Diphenylamine	III.	Complexometric
(iv)	Fluorescein	IV.	Redox
(v)	Potassium chromate	V.	Precipitation (Fajan's method)

(c) What is a titration curve ? Sketch the neutralization titration curves obtained when the following are titrated with NaOH : 5

(i) HCl

(ii) CH_3COOH

4. (a) Write the equation to show the reaction between potassium permanganate and ferrous ions in acidic medium. What indicator will you use in this titration and what is the colour change ? What will happen if this titration is carried out in presence of dilute HCl ? *5*

(b) What does EDTA stand for ? Differentiate between direct and back titration with EDTA. *5*

(c) What are the essential requirements of a metallochromic indicator ? *5*

5. (a) What is coprecipitation ? How can it be minimized ? $PbSO_4$ is soluble in ammonium acetate solution. However, when $PbSO_4$ is coprecipitated with $BaSO_4$, it cannot be removed by washing the host precipitate with ammonium acetate. Why ? *5*

(b) What reagents will you use to generate the following ions in precipitation from homogeneous solutions ?

(i) Oxalate

(ii) Sulphate

Why are precipitates of small particle size not suitable in gravimetry ? *5*

(c) What is peptization ? What type of wash liquid is used for precipitates which tend to peptize ? What will you use to wash hydrated iron (III) oxide ? *5*

6. (a) Name an analytical technique based on each of the following principles : 5

(i) Scattering of radiation

(ii) Absorption of radiation

(iii) Change in diffusion current with respect to potential

(iv) Measurement of mass of substance deposited on electrode

(v) Mass to charge determination

(b) Iodine can be used for estimation of oxidizing as well as reducing agents. Illustrate with appropriate examples. 5

(c) Write the equations showing autoprotolysis of any ***two*** of the following :

(i) H_2O

(ii) CH_3OH

(iii) NH_3

What is levelling effect ? 5

7. (a) Define the following types of solvents and give an example of each : 5

(i) Amphiprotic

(ii) Aprotic

(b) A replicate analysis of potassium in blood serum yielded concentration of K^+ in mg/100 mL as 15·55, 15·30, 15·85 and 16·30. Calculate the 90% confidence interval for the set. Assume the value of C_n for 4 observations at 90% level = 0·53. 5

(c) Describe in short, methods of collection of gaseous pollutants with concentration. 5

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

(a) χ^2 (chi-square) test

(b) Random and Representative sampling of food materials

(c) Advantages and disadvantages of graphical logarithmic extrapolation methods

(d) Masking and demasking and their application for determination of zinc and magnesium in a sample

(e) Advantages of organic precipitants over inorganic ones