

**P.G. DIPLOMA IN ANALYTICAL CHEMISTRY
(PGDAC)**

Term-End Examination

00172

December, 2018

**MCH-004 : ELECTROANALYTICAL AND OTHER
METHODS**

Time : 3 hours

Maximum Marks : 75

Note : Answer any five questions. All questions carry equal marks. Log-table may be used.

1. (a) Illustrate how varying furnace heating rate affects the TG curves ? List other factors, that also affect them. 5
- (b) Describe briefly the application of polarography. 5
- (c) Compare working of a NaI (Tl) detector with a GeLi detector in terms of resolution and efficiency of detection. 5
2. (a) Explain χ^2 test. How is it useful in evaluating the working of a counter ? 5

- (b) Calculate E_{cell} when a silver and a copper electrode with unit activities are in contact. $E^{\circ}_{\text{Cu}^{2+}, \text{Cu}} = + 0.337 \text{ V}$ and $E^{\circ}_{\text{Ag}^+, \text{Ag}} = + 0.799 \text{ V}$. 5
- (c) What do you understand by an ion selective electrode ? Describe any two uses of such electrodes. 5
3. (a) Calculate the pH during titration of 50.00 mL of 0.05 M HCl with 0.10 M NaOH when (i) 10.00 mL of titrant is added, and (ii) 25.50 mL of titrant is added. 5
- (b) State S.I. units of the following explaining the abbreviations/symbols used : 5
- (i) Conductivity
 - (ii) Equivalent conductivity
 - (iii) Molar conductivity at infinite dilution
 - (iv) Resistivity
 - (v) Ionic mobility
- (c) Draw a labelled polarogram and show the following : 5
- (i) Half-wave potential
 - (ii) Diffusion current
 - (iii) Limiting current
 - (iv) Residual current

4. (a) What is the principle of Differential Thermal Analysis ? Draw a labelled DTA diagram showing exotherm and endotherm. 5
- (b) Discuss the advantages of DTA over TGA in case of pure fusion reactions, crystalline transition, glass transition and solid state reactions. 5
- (c) Calculate the solubility product of AgCl. Limited molar conductivities of Ag^+ and Cl^- are $0.00619 \text{ Sm}^2\text{mol}^{-1}$ and $0.00763 \text{ Sm}^2\text{mol}^{-1}$ respectively; conductivity of AgCl solution at 298 K is $2.28 \times 10^{-4} \text{ Sm}^{-1}$. 5

5. (a) Distinguish between (i) Polarography and Voltametry, (ii) Linear scan polarography and Pulse polarography. Draw labelled graph of each. 5
- (b) Discuss the role of supporting electrolyte with two examples. Does addition of supporting electrolyte affect the $E_{1/2}$ of the electroactive species ? 5
- (c) What is the principle of Inverse Isotope Dilution Analysis ? Describe its application. 5

6. (a) A thermogram shows a loss of 91.0 mg from a total of 175.0 mg of analyte. Identify the compound amongst NH_4NO_3 or MgCO_3 . Write the equation of the reaction in each case. 5
- (b) Explain with the aid of a graph, the technique of cyclic voltametry. Give advantages of using a Pt electrode instead of a DME. 5
- (c) Explain, what do you understand by the term Cell Constant. Derive mathematical expression to evaluate it. 5
7. (a) Explain, how copper and lead can be deposited during controlled cathode potential electrolysis. 5
- (b) 0.180 g of a purified organic acid sample was titrated coulometrically with OH^- ions produced in 5.0 minutes by a constant current of 0.514 amp. Calculate the molar mass of the acid if n is 1. 5
- (c) Explain any *two* of the following : 5
- (i) Standard cell
 - (ii) Calomel electrode
 - (iii) Indicator electrode

8. (a) What are the various neutron sources available for neutron activation analysis ? Draw a neutron energy spectrum in a nuclear reactor. 5
- (b) Describe all the sources of background activity. Explain how background activity is minimized. 5
- (c) Explain thermometric titrations. In what respects are these different from ordinary acid-base titrations ? 5
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