

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

Term-End Examination

December, 2017

00861

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

Time : 3 hours

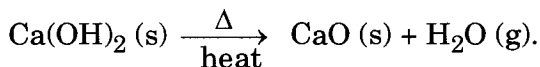
Maximum Marks : 75

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

1. (a) Explain electrogravimetry emphasizing its basic principle. How are deposits affected by various factors ? 5
- (b) A 10 ampere current is passed through a solution of AgNO_3 for 60 minutes. Calculate the amount of Ag deposited at the cathode (At. wt. of Ag = 108). 5
- (c) What are the various precautions taken while measuring pH ? Draw the shapes of different pH titration curves. 5
2. (a) Explain the specifications and construction of a calomel electrode with the help of a sketch of a laboratory made saturated calomel electrode. 5

- (b) Explain conductance, specific conductance, cell constant and molar conductivity. 5
- (c) Calculate the molar conductivity of aqueous solution of KCl. Given that conductivity of 5 m mol dm^{-3} KCl = $7.60 \times 10^{-3} \text{ S m}^{-1}$, conductivity of water = $0.10 \times 10^{-3} \text{ S m}^{-1}$. 5
3. (a) Explain the meaning of Polarization of electrodes. Distinguish between concentration polarization and kinetic polarization. 5
- (b) How can the coulometric methods be classified ? Explain the basic principles of constant current coulometry and controlled potential coulometric analysis. 5
- (c) Explain how solubility and solubility product of sparingly soluble salt such as AgCl may be determined by the conductometric method. Derive an expression for concentration. 5
4. (a) What are the various voltammetric methods of analysis ? Write briefly about Anode Stripping Voltammetry (ASV) and its usefulness in trace element analysis. 5
- (b) Differentiate between linear scan polarography and pulse polarography. 5
- (c) Explain the following types of current used in polarography : 5
- (i) Limiting current
 - (ii) Migration current
 - (iii) Diffusion current

5. (a) What are the two components in the basic instrument used in voltammetry ? Draw a sketch of the instrument used for voltammetry. 5
- (b) Explain the basis of thermal methods of analysis. What are Thermogravimetric (TGA), Differential Thermal (DTA) and Differential Scanning Calorimetric (DSC) methods of analysis ? 5
- (c) Calculate the percentage (%) mass change for the reaction



(At. wt. of Ca = 40.1) 5

6. (a) Explain the Wheatstone Bridge principle with the help of a Wheatstone Bridge circuit. Describe the procedure for measurement of conductance of a solution with the help of a bridge circuit. 5
- (b) Draw the nature of a TG curve for a mixture of calcium, strontium and barium oxalates. How would you determine the amounts of individual carbonates from these curves ? Describe briefly. 5
- (c) Draw the sketch of a block diagram of complete layout of a differential thermal analyzer and briefly describe all the basic components of the instrumental set-up. 5

7. (a) Compare potentiometric and thermometric curves for HCl and H₃BO₃ with NaOH solution. How do thermometric titrations pose problems in non-aqueous systems ? 5
- (b) Describe the factors affecting the Differential Scanning Calorimetric (DSC) curve. Explain the sources of error of DSC technique. 5
- (c) What are the different types of neutron induced reactions ? Explain with the help of reactions of ²⁷Al. Write all the products clearly. 5
8. (a) Draw a sketch of integrated assembly of a well-type scintillation detector and explain the three processes by which gamma rays interact with matter. 5
- (b) Explain the basic principle of Radioimmunoassay (RIA) method and describe its methodology. Which type of hormones may be analyzed by RIA method ? 5
- (c) Describe the procedures of Prompt Gamma Neutron Activation Analysis (PGNAA) and Cyclic Neutron Activation Analysis (CNAA) in brief. 5
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