No. of Printed Pages : 4   **MCH–004**

P.G. DIPLOMA IN ANALYTICAL CHEMISTRY (PGDAC)

Term-End Examination

June, 2024

MCH-004 : ELECTROANALYTICAL AND OTHER METHODS

Time : 3 Hours   *Maximum Marks : 75*

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

1. (a) Describe the calomel electrode. Why is this Preferred over hydrogen electrode.

   (b) What are the advantages of cyclic voltammetry over linear voltametry ?

   (c) A cell is set up as follows :

   Zn/Zn^{2+} $(a = 5 \times 10^{-3})//Cu^{2+}$ $(a = 2 \times 10^{-2})/Cu$

   given :

   E° $Cu^{2+}/Cu = 0.337$ V, $Zn^{2+}/Zn = -0.763$ V

   calculate cell potential.   5 + 5 + 5

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2. (a) Write the Ilkovic equation and define each term.   5 + 5 + 5

   (b) Describe the procedure for the determination of Zn with EDTA amperometrically.

   (c) Draw a labelled polarogram indicating the following :

   (i) Residual current

   (ii) Diffusion current

   (iii) Limiting current

   (iv) Half wave potential.

3. (a) A 9.6 ampere current is passed through a solution of $AgNO_3$ for 50 mm. Calculate the amount of Ag deposited at the Cathod. (Atomic wt of Ag is 108).   5 + 5 + 5

   (b) Describe an electrochemical cell. Write by the reactions taking place at each electrode taking a suitable examples.

   (c) What are electrolytes ? How are these classified ? Write one example of each.

4. (a) Explain the boundary potential of the glass electrode when it is placed in a test solution. How does it affected the pH ?

   (b) Explain the metal-metal ion interface during the development of electrode potential with a suitable illustration.   5 + 5 + 5

(c) (i) Derive an expression for the determination of equilibrium constants from electrode potential mesurement.

(ii) Calculate the solubility product of AgCl from the data given below :

$E°Ag+/Ag = + 0·799V$

$E° AgCl/Ag = + 0·212$ V

5. (a) List the factors which causes error in pH measurements.   5 + 5 + 5

(b) Why does accuracy increase in pH titrations compared to that of direct pH measurement ?

(c) How can a glass electrode be made selective for ions other than hydrogen ions ? Give examples.

6. (a) Explain the terms conductance, specific conductance, equivalent conductivity and molar conductivity.   5 + 5 + 5

(b) The resistance of 0·01 M solution of an electrolyte was found to be 210 Ω at 25ºC. Cell Constant $= 0·88$ cm^{-1}. Calculate the molar conductance of the solution at 25ºC in Sm^2 md^{-1} unit.

(c) Explain the significance of half wave potential in polarography.

7. (a) Which of the following is better and why ?

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(i) Linear sweep voltammetry and cyclic voltammetry.

(ii) Anodic stripping voltammetry and adsorptive stripping voltametry.

(b) Briefly describe the technique of differential thermal analysis (DTA). What kind of information is obtained by this analysis ?

(c) A mixture of CaO and $CaCO_3$ is analysed by TGA, the result indicates that mass of the sample decreases from 250·6 mg to 190·8 mg only between 600ºC to 900ºC. Calculate the percentage of $CaCO_3$ in mixture (Mr of $CaCO_2$ 100·1, CaO = 561 and CO_2 = 44).

8. Write short notes on any *three* of the following :

$5 × 3$

(a) Radio Tracer technique.

(b) Neutron Activation Analysis (NAA)

(c) Solid state membrane electrodes

(d) Limiting molar conductivity.

(e) Geiger muller counter.

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