

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

Term-End Examination

June, 2022

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

Time : 3 hours

Maximum Marks : 75

Note : Attempt any **five** questions. All questions carry equal marks. Marks of each part of a question are indicated on the right hand side.

1. (a) The resistance of a conductivity cell containing 0.01 mol dm^{-3} KCl is 150Ω whereas that of 0.01 mol dm^{-3} HCl is 51.4Ω . If the conductivity of KCl solution is $1.41 \times 10^{-3} \text{ S cm}^{-1}$, calculate the values of
- (i) cell constant, and
- (ii) conductivity of HCl solution. 5+5

- (b) Identify which of the following are isotopes/isobars : 5
- (i) ^{14}C , ^{14}N
- (ii) ^{12}C , ^{13}C , ^{14}C
- (iii) ^1H , ^2D , ^3T
- (iv) ^{40}K , ^{40}Ca
- (v) ^{40}Ca , ^{46}Ca
- 2.** (a) Draw a labelled polarogram indicating the following : 5
- (i) Residual current
- (ii) Diffusion current
- (iii) Limiting current
- (iv) Half-wave potential
- (b) Write Ilkovic equation and define the terms. 5
- (c) Briefly describe the technique of Differential Thermal Analysis (DTA). What information is obtained by this analysis ? 5
- 3.** (a) Distinguish between a Galvanic cell and an Electrolytic cell. 5
- (b) Write polarographic equation. How will you decide by plotting $\log \frac{i}{(i_d - i)}$ vs. electrode potential, whether the reaction is reversible or not ? Explain. 5

- (c) What does an enthalpogram represent and what type of information does it provide ? 5
4. (a) State and explain the first law of radioactivity. Derive its integrated form. 5
- (b) What is the potential range over which DME can be used ? What happens if the potential is increased to more positive value or decreased to more negative value ? 5
- (c) Draw a labelled pH titration curve between a strong acid and a strong base. When is it necessary to draw a first derivative plot ? Explain. 5
5. (a) How many naturally occurring radioactive series are known ? What are the initial and end products of $4n + 2$ series ? How many α and β particles are emitted during the course of decay ? 5
- (b) What are electrolytes ? How are they classified ? Write an example of each. 5
- (c) What is ohmic potential ? Write its units. How is it related to (i) cell potential, and (ii) applied potential ? 5

6. (a) Explain working of an end-window G.M. Counter with the help of a schematic diagram. 5
- (b) When DME is used during polarographic analysis, why does the current fluctuate during lifetime of each drop? 5
- (c) Briefly describe the technique of Neutron Activation Analysis. 5
7. (a) A cell is set up as follows :
- $$\text{Zn/Zn}^{2+} (a = 5 \times 10^{-3}) \parallel \text{Cu}^{2+} (a = 5 \times 10^{-3}) | \text{Cu}$$
- given $E^\circ \text{Cu}^{2+}/\text{Cu} = 0.337 \text{ V}$ and $\text{Zn}^{2+}/\text{Zn} = -0.763 \text{ V}; \log 50 = 1.6990$
- (i) Calculate the cell potential.
- (ii) Indicate the polarity of the electrodes and direction of spontaneous reaction. 5
- (b) Briefly discuss Calomel electrode. 5
- (c) What are the advantages of Cyclic voltammetry over Linear sweep voltammetry? 5

8. (a) Fill in the blanks :

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- (i) Two electrodes used for pH measurements are _____ and _____ electrodes.
- (ii) Physical and chemical changes which are not accompanied by change in mass are studied by the thermal method known as _____.
- (iii) A depolarizer is a substance that is easily _____ or _____.
- (iv) In lead accumulator, metal is deposited on cathode instead of liberation of hydrogen gas because of _____ of lead.
- (v) In an electrolytic cell _____ energy is converted into _____ energy.

(b) What are the advantages of Coulometric determination over Electrogravimetric determination ?

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