

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

**Term-End Examination**

01452

**June, 2019**

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

*Time : 3 hours*

*Maximum Marks : 75*

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

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1. (a) In all the electroanalytical methods, how many electrodes are required ? Which one has constant potential ? 5
  
- (b) What are the limitations of precipitation titrations ? 5
  
- (c) With reference to potentiometric titrations, draw labelled diagrams of the plots of all three types of titration curves. 5

2. (a) Explain why the  $\text{Li}^+$  ion has a lower mobility than potassium ion. Further explain exceptional mobilities of  $\text{H}^+$  and  $\text{OH}^-$  ions. 5
- (b) At 298 K, the resistance of  $3.00 \times 10^{-2}$  M KCl is  $325.48 \Omega$  and that of  $7.5 \times 10^{-3}$  M  $\text{K}_2\text{SO}_4$  is  $935.77 \Omega$ . The conductivity of  $3.00 \times 10^{-2}$  M KCl at 298 K is  $0.3654 \text{ Sm}^{-1}$ . Calculate molar conductivity of  $\text{K}_2\text{SO}_4$  solution. 5
- (c) Explain the concentration potential in the context of electrogravimetry. How can it be minimised? 5
3. (a) How are coulometric methods classified? 5
- (b) Explain coulometric titration with the help of a suitable diagram. 5
- (c) How would you carry out quantitative analysis of a mixture of metal ions by electrogravimetry? 5
4. (a) Why is stripping voltammetry applicable to the analysis of a few organic compounds only? 5

- (b) When a 100 mL sea-water sample is analysed by anodic stripping voltammetry, it gave a peak current of  $1.772 \mu\text{A}$ . A  $10.00 \mu\text{dm}^3$  spike of 20 ppm  $\text{Cu}^{++}$  is added to the sample and the resulting peak current is  $7.04 \mu\text{A}$ . Calculate the concentration of  $\text{Cu}^{++}$  in ppm in the given sea-water sample. 5
- (c) In amperometric titrations, why is a rotating platinum electrode used instead of a mercury electrode ? Draw a schematic diagram of rotating platinum electrode. 5
5. (a) Why are catalytic currents important in polarography ? How are they useful for trace analysis of metal ions ? 5
- (b) How is cyclic voltammetry useful for the qualitative diagnosis of certain coupled chemical reactions ? Explain with a suitable example. 5
- (c) How does thermogravimetric analysis provide information whether gravimetric precipitates should be dried or ignited ? Explain with the help of a suitable example. 5

6. (a) Write briefly the principle of Differential Thermal Analysis (DTA). 5
- (b) How can errors be avoided in Differential Scanning Calorimetry (DSC) ? 5
- (c) Explain the principle of thermometric titrations with the help of suitable plots. 5
7. (a) Explain the first law of radioactivity and draw decay plot of radioactive elements. 5
- (b) Explain the factors affecting the choice of Radiotracers. 5
- (c) Compare the methods — Neutron Activation Analysis (NAA) and Isotope Dilution Analysis (IDA). 5
8. Write brief notes on any *five* of the following : 5×3=15
- (a) Calomel Electrode
- (b) pH Meter
- (c) Advantages of Coulometric Titrations
- (d) Pulse Methods in Voltammetry
- (e) Decay Series of  $^{238}\text{U}$
- (f) Principle of Scintillation Detector with Schematic Diagram
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