

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

Term-End Examination

December, 2013

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

Time : 3 hours

Maximum Marks : 75

Note : Attempt any five questions.

All questions carry equal marks.

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1. (a) Explain electrode potential and its development. How is it measured ? 5
 - (b) Derive Nernst equation for the reaction 5
$$\text{MnO}_4^- + 8\text{H}^+ + 5\text{e}^- = \text{Mn}^{2+} + 4\text{H}_2\text{O}$$
 - (c) How do you distinguish between voltammetry and polarography ? Draw the nature of polarogram depicting residual current, limiting current and half-wave potential. 5

 2. (a) Draw the nature of typical titration curves for emf vs titrant volume. Further draw the first derivative and second derivative indicating equivalence point. 5
 - (b) Explain the construction of Western Cadmium cell with illustration. What is its potential at 20°C? 5

- (c) Define the terms conductivity, equivalent conductivity and molar conductivity. Calculate molar conductivity of 5.0×10^{-4} mol dm⁻³ NaCl solution if its conductivity is 7.5×10^{-3} Sm⁻¹, conductivity of water is 6×10^{-5} Sm⁻¹. 5
3. (a) Draw a conductivity bridge circuit and typical design of a conductivity cell. Explain the measurement of conductance of a solution. 5
- (b) What do you understand by electrogravimetric analysis? Draw the nature of plot between current vs potential in an electrolytic cell. Why it shows deviation with increasing voltage? 5
- (c) Explain constant potential electrolysis. Draw a sketch of its apparatus. How do cell potential and current change with time during a controlled cathode potential deposition of copper ? 5
4. (a) Explain the determination of solubility product of AgCl by conductivity measurement. Why this value is so low ? 5
- (b) What do you understand by cyclic voltammetry? Draw a labelled sketch of its instrumentation. 5
- (c) What do you understand by polarographic maxima? How is it suppressed? 5
5. (a) Describe the effect of complexing agent on half-wave potential, $E_{1/2}$ of metal ions. Draw the nature of plot between $\log [x]$ and $E_{1/2}$ and discuss its applications. 5

- (b) Draw a schematic sketch of apparatus for polarographic analysis. Explain why is it essential to pass N_2 through solution before recording a polarogram ? 5
- (c) What are the common sources of error in thermogravimetric analysis ? How are these avoided ? 5
6. (a) Explain characteristics of DTA curve of a typical polymeric sample. How are these identified for a mixture of polymers ? 5
- (b) Explain why standards are required for mass and temperature calibration in thermogravimetric analysis ? List the standards and describe procedure for calibration. 5
- (c) Draw the nature of typical DTA curve for $C_aC_2O_4 \cdot H_2O$ showing all the peaks. Interpret each peak with a suitable explanation. 5
7. (a) How would you determine Ca^{2+} and Mg^{2+} in a mixture by thermometric titrations ? Show all calculations and discuss main limitations of thermometric titrations. 5
- (b) What are the various sources of background radioactivity ? Is it possible to eliminate or minimize these? How is it done? 5
- (c) Explain the basic principle of isotope dilution analysis and derive its equation. How would you determine glycine in a sample. 5

8. Write brief notes on **any five** of the following : 3x5=15
- (a) Transport number.
 - (b) Factors affecting measurement of pH.
 - (c) Dropping mercury electrode (DME).
 - (d) Semiconductor detector.
 - (e) Radiometric titrations.
 - (f) Cyclic neutron activation analysis (CNAA).
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