

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

**Term-End Examination**

**June, 2014**

00815

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

*Time : 3 hours*

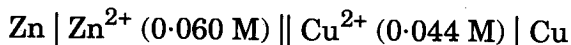
*Maximum Marks : 75*

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

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1. (a) Calculate the potential of the cell represented by the expression below :



Given  $E^\circ$  for Cu electrode = + 0.337 V and Zn electrode = - 0.763 V.

4

- (b) Calculate the pH during titration of 50 cm<sup>3</sup> 0.05 M NaOH with 0.10 M HCl after adding 24.50 cm<sup>3</sup> of the acid.

4

- (c) What are ion selective electrodes ? Explain their working by citing an example. Comment on the applications of these types of electrodes.

7

2. (a) Define molar and equivalent conductivity. How are they related with each other? 5
- (b) The resistance of 0.10 M solution of a salt occupying a volume between platinum electrodes 2.0 cm apart and 6.0 cm<sup>2</sup> in area was found to be 30 ohms. Calculate the molar conductivity of the solution. 4
- (c) What are the requirements of a good electrodeposition? Discuss the conditions which favour good electrodeposition. 6
3. (a) Discuss the principle of coulometric titrations. How is the titrant generated externally? 6
- (b) How many minutes will it take for a current of 0.60 amps to cause the deposition of 0.60 g of silver from a solution on the basis of 80.0% current efficiency? At. mass of silver = 107.9 amu. 4
- (c) What is meant by the term voltammetry? Give a broad classification of commonly used voltammetric techniques. 5
4. (a) Explain the principle of Linear Sweep Voltammetry. 4
- (b) Write Ilkovic equation and explain each term in it. 3

- (c) Draw a typical polarogram explaining each part of the curve. What is half-wave potential? 4
- (d) What is migration current? How can it be eliminated? 4
5. (a) How are cadmium and lead determined quantitatively by polarography? 8
- (b) Explain the basic principle of amperometric titration. Discuss the advantages of this titrimetric method. 7
6. (a) Discuss the factors affecting a TGA curve. 4
- (b) Describe the application of TGA in the analysis of polymeric materials and reaction kinetics with suitable examples. 4
- (c) What type of basic information is derived from DTA curves? Illustrate your answer with a suitable example. 3
- (d) What are the essential components for the experimental set-up for carrying out enthalpy titrations? Explain the role of each component. 4
7. (a) What is the principle and working of a gas ionization type detector? Explain the different parts of a typical current voltage curve highlighting the different features. 7
- (b) Discuss the advantages of isotope dilution technique. 4

(c) A solution contains an unknown amount of cobalt. A spike solution which contains 8.00 mg of cobalt spiked with  $\text{Co}^{60}$  and has a measured activity of 400 cpm is added to  $10 \text{ cm}^3$  of the unknown solution. After mixing a portion of cobalt is isolated as a pure cobalt metal sample by electrodeposition. The isolated cobalt has a mass of 10.0 mg and a measured activity of 200 cpm. Calculate the mass of cobalt, in  $\text{mg/cm}^3$ , in the original sample solution. 4

8. (a) What are the advantages of neutron activation analysis over other instrumental methods of analysis? What are the limitations of the technique? 5

(b) 1.00 g of an ore containing 0.10% Au was irradiated inside a nuclear reactor at a thermal neutron flux of  $1.0 \times 10^{12} \text{ n cm}^{-2} \text{ sec}^{-1}$  for 2.69 days. Calculate the radioactivity due to  $\text{Au}^{198}$  in  $\mu\text{C}$  immediately after the end of the irradiation.

Given :

- (i) percentage abundance of  $\text{Au}^{197} = 100$
- (ii) cross section of  $\text{Au}^{197} (\text{n}, \text{r}) \text{Au}^{198} = 9 \text{ barns}$
- (iii) half life of  $\text{Au}^{198} = 2.69 \text{ days}$  6

(c) What are radiometric titrations? How are they conducted? Explain the technique by giving an example of the titration. 4