

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

00992

Term-End Examination

December, 2014

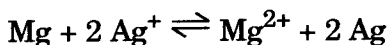
**MCH-004 : ELECTROANALYTICAL AND OTHER
METHODS**

Time : 3 hours

Maximum Marks : 75

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

1. (a) Calculate the emf of the cell in which the following reaction occurs :



Given :

$$[\text{Mg}^{2+}] = 0.10 \text{ M}; [\text{Ag}^+] = 1.0 \times 10^{-4} \text{ M}$$

$$E^\circ_{\text{Mg}^{2+}/\text{Mg}} = -2.363 \text{ V}$$

$$E^\circ_{\text{Ag}^+/\text{Ag}} = +0.799 \quad 4$$

- (b) What are the advantages of a pH metric titration over a direct pH metry ? 3

- (c) Explain the source of potential of an ion selective electrode used to determine the concentration of fluoride ion. 4
- (d) Explain various factors which cause error in pH measurement. 4
2. (a) Define equivalent conductivity and molar conductivity. Cite their units also. How are the two terms related with each other? 5
- (b) Discuss the factors which affect the conductance of a solution. 5
- (c) At 298 K, the resistance of 2.00×10^{-2} M KCl is 200.0Ω and that of 2.50×10^{-3} M K_2SO_4 is 775.0Ω . The conductivity (κ) of 2.00×10^{-2} M KCl at 298 K is 0.277 Sm^{-1} . Calculate the molar conductivity of K_2SO_4 solution. 5
3. (a) What is the basic principle of controlled potential coulometry? Point out the inherent advantages of the technique. Discuss any two applications of this technique. 7
- (b) Why is there a need of external generation of titrant in coulometric titrations? Discuss the advantages of coulometric titrations. 5
- (c) Distinguish between concentration polarization and kinetic polarization. 3

4. (a) Describe a broad classification of commonly used voltammetric methods. Explain the principle of Linear Sweep Voltammetry. 5
- (b) Discuss the advantages of dropping mercury electrode. 4
- (c) Explain the origins of migration current. How can it be eliminated? 4
- (d) Why is there a need of maxima suppressor in polarography? Name two of the maxima suppressors. 2
5. (a) Draw a diagram showing the basic components of a manual polarograph. Label each component and explain the working of the instrument. 5
- (b) Explain the principle of amperometric titrations. Discuss the different types of curves obtained between volume of the reagent and current during the titration. 5
- (c) Discuss the advantages of amperometry. 5
6. (a) Discuss the factors which affect the shape of a TGA curve. 5
- (b) What are the basic components of a DTA instrument? Discuss the essential characteristics of each component and its working. 5
- (c) How is DTA used in the characterization of polymers? Explain with examples. 5

7. (a) What is the basic principle of enthalpy titrations ? Discuss the shape of a typical enthalpogram for an exothermic and an endothermic reaction. Explain the different portions of the curves. 6
- (b) Draw the diagram of an integrated assembly of a well type NaI (Tl) scintillation detector. Label each component and explain its working. Explain how does gamma ray interact with the detector material. 6
- (c) What are the different sources of natural radioactive background in the human environment ? 3
8. (a) What are the advantages of neutron activation analysis over other commonly used instrumental methods of analysis ? Point out the limitations of the technique. 4
- (b) 1.00 g of an ore containing 5.0% sodium was irradiated in a nuclear reactor at a thermal neutron flux of $5.0 \times 10^{12} \text{ n cm}^{-2} \text{ sec}^{-1}$ for 15 hr. Calculate the amount of radioactivity due to Na^{24} in mCi immediately after the end of the irradiation.
- Given :
- (i) Percentage abundance of Na^{23} in natural sodium = 100.
- (ii) Cross section of
 $\text{Na}^{23} (\text{n}, \text{r}) \text{Na}^{24} = 0.13 \text{ barn}$
- (iii) Half life of $\text{Na}^{24} = 15 \text{ hr}$ 6