No. of Printed Pages : 4

MCH-004

P. G. DIPLOMA IN ANALYTICAL CHEMISTRY (PGDAC)

Term-End Examination

June, 2023

MCH-004 : ELECTROANALYTICAL AND OTHER METHODS

Time : 3 Hours *Maximum Marks : 75*

Note : *Answer any* ***five*** *questions. All questions carry equal marks. Marks of each sub-part of a question are indicated at the end of the part.*

1. (a) Using metal-metal ion interface, explain the development of electrode potential. 5

   (b) What do you understand by the term 'liquid junction potential' ? How can it be minimised ? 5

   (c) Calculate the e.m.f. of cell in which the reaction is :

   $$Mg + 2Ag^{+} \rightleftharpoons Mg^{2+} + 2Ag$$

   Given : Conc. of Mg^{2+} is 0.1 M Ag^{+} is 1×10^{-4} M, and $E^{\circ}_{Mg^{2+}/Mg} = -2.363$ V and $E^{\circ}_{Ag^{+}/Ag} = +0.799$ V. 5

2. (a) Explain the term 'ohmic potential' ? Give its units. How is it related to (i) cell potential, and (ii) applied potential ? 5

   (b) Explain molar conductivity. How is it related to conductivity ? 5

   (c) Sparingly soluble AgCl precipitate is dissolved in water. Conductivity of the solution at 298 K is 2.28×10^{-4} Sm^{-1}; molar conductivities of Ag^{+} and Cl^{-} are 6.19×10^{-3} Sm^{2} mol^{-1} and 7.63×10^{-3} Sm^{2} mol^{-1} respectively. Calculate the concentration of Ag^{+} and Cl^{-} in the solution. 5

3. (a) Explain, what do you understand by the term 'Overvoltage'. State its importance. 5

   (b) Conductivity of 0.1 M HCl is 0.0394 Sm^{-1}. Calculate its molar conductivity. 5

   (c) Explain, how isotope dilution analysis is useful in estimating the volume of blood in a living being. 5

4. (a) Explain the principle of activation analysis. Why neutron activation is preferred over activation by charged particles ? 5

   (b) 0.6 ml solution containing ^{59}Fe having activity of 27.75×10^4 cps cm^{-3} was injected into an animal. After equilibration the blood was drawn, its activity was found to be 73.55 cps ml^{-1}. Calculate the volume of the blood in the animal body. 5

   (c) Explain 'Carbon dating'. Give *one* example to find out the age. For which kind of samples, it cannot be used ? 5

5. (a) Give the advantages of using a mercury cathode during control potential coulometry. 5

   (b) State advantages of coulometric titration over conductometric titrations. 5

   (c) At which electrode of the galvanic cell, reduction takes place ? Give reason. 5

6. (a) Define the terms Isotope, Isobars and Isotones. Give *two* examples of each. 5

   (b) Write Ilkovic equation and indicate what each term stand for. 5

   (c) Briefly describe the techniques of DTA. What information is obtained from this analysis ? 5

7. (a) State the advantages of stripping method over other voltammetric procedures. 5

   (b) How can equation of a polarographic wave predict whether the reaction is reversible or not ? 5

   (c) Define the role of supporting electrolyte. Give examples. 5

8. Write brief notes on any *three* of the following : 5 each

   (i) Radioimmunoassay

   (ii) Radioactive series

   (iii) Sources of errors in TGA

   (iv) Alkaline error

   (v) Factors affecting conductivity of solution