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MCH-004

P.G. DIPLOMA IN ANALYTICAL CHEMISTRY (PGDAC)

Term-End Examination

01375

June, 2018

MCH-004 : ELECTROANALYTICAL AND OTHER METHODS

Time : 3 hours *Maximum Marks : 75*

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

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1. (a) Distinguish between e.m.f. and potential difference. *5*

(b) Explain why pH of an aqueous solution lies between 0 and 14. Does change in temperature of solution, alter its observed pH ? State reason. *5*

(c) Calculate the mass of $^{24}NaCl$ in solution having activity of 5·7 me_i; $t_{1/2}$ of $^{24}_{11}Na$ is 15 h. *5*

2. (a) Explain any ***two*** of the following : *5*

(i) Alkaline error

(ii) Acid error

(iii) Junction potential

(b) Define overvoltage. List its importance. 5

(c) Calculate the time taken to deposit 0·50 g of silver from a solution through which current of 0·50 amps flows at 80% efficiency. (At. mass of Ag = 108) 5

3. (a) Explain, why it is necessary to add a small amount of a surface active substance during measurement of diffusion current. Give example. 5

(b) What are the common sources of error in thermogravimetric analysis ? Discuss how these errors can be prevented. 5

(c) What is the principle of Neutron Activation Analysis ? Explain how the following are responsible for higher sensitivity of NAA. 5

(i) Neutron absorption cross section, σ

(ii) Neutron flux, ϕ

4. (a) Draw a plot between $P(n)$ and mean value counts, $\bar{x}$. Name this plot and state its use/importance. 5

(b) Describe the essential features of a Calomel electrode. Write half cell reaction and its use in pH-metry. 5

(c) Calculate the equilibrium constant for the reaction between Fe(II) and Ce(III). 5

(E° Fe^{3+}/Fe^{2+} = 0·771 V and
E° Ce^{4+}/Ce^{3+} = 1·70 V).

5. (a) Distinguish between Voltametry and Polarography. 5

(b) A conductivity cell is filled with a solution of 0·0100 M KCl at 298 K. It has a conductivity of 0·001409 $\Omega^{-1}\,cm^{-1}$ and resistance of 161·8 Ω. When this cell is filled with a 0·0050 M NaOH solution, it has a resistance of 190 Ω at 298 K. Calculate cell constant, and molar conductivity of NaOH solution. 5

(c) Draw a schematic diagram showing a three electrode polarograph. Name each electrode and mention its function. 5

6. (a) How can non-polarographic active groups be determined polarographically ? Give two examples. 5

(b) Draw a DTA plot of a mixture containing three organic components. Illustrate how m.p. of each component can be determined. 5

(c) State the advantages of using a mercury cathode in coulometric analysis at controlled potential. 5

7. (a) What is the principle of Isotope Dilution Analysis ? How does substoichiometric isotope dilution analysis differ from the parent technique ? 5

(b) Which of the two methods – DTA or DSC, will you prefer for quantitative analysis ? State reasons in support of your choice. 5

(c) Describe isothermal method used for kinetic studies of solid state decomposition reaction. Give expression for calculating the order of reaction. 5

8. (a) Explain principle of amperometric titrations, with two examples. 5

(b) Discuss the role of tartrate in electrogravimetric determination of Cu, Bi, Pb and Sn. 5

(c) Explain the principle of Anodic stripping voltametry. State the advantages of this technique. 5