B. Tech.

(SEM. IV) EXAMINATION, 2006-07

PHYSICAL & ANALYTICAL CHEMISTRY

Time : 3 Hours] [Total Marks : 100

Note : Attempt all questions.

1 Attempt any two parts of the following : 10×2
   (a) How is the rate law of a chemical reaction written? Discuss in detail the appropriate method for the study of kinetics of a chemical reaction having half life less than $10^{-3}$ sec.
   (b) Explain the terms: Chain carriers, chain length, stationary chain and non-stationary chain. By applying steady state approximation derive the rate law for any gas phase chain reaction.
   (c) In what way does the kinetics of a reaction between ions differ from non-ionic reactions? Derive the relationship, which depicts the effect of ionic strength on the rate constant of ionic reactions. Explain with graphical plots also the variation of rate constant with ionic strength.

2 Attempt any two parts of the following : 10×2
   (a) Why enzyme catalysts are very specific in nature? For an enzyme catalyzed reaction:

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\[ E + S \xrightleftharpoons[k_{-1}]{k_1} ES \xrightarrow{k_2} E + P \]

derive the Michaelis- Mentien equation. Explain the effect of pH on the enzyme-catalysed reaction.

(b) Discuss the phenomenon of adsorption, types of adsorption and its applications in industries. Give a qualitative treatment of adsorption isotherm.

(c) Why does water rise in a capillary tube? Define surface tension, interfacial tension and discuss one method of determination of surface tension. Also, explain the influence of temperature on surface tension.

3 Attempt any two parts of the following: 10×2

(a) How colloidal solutions are classified? Discuss the methods of preparation and their important properties.

(b) Explain osmosis and osmotic pressure. ‘Osmotic pressure is only colligative property which is useful for investigating macromolecules’, justify the statement. A solution contains 0.60 g urea and 1.8 g glucose in 100 cc of water at 27°C. Calculate the osmotic pressure of the solution.

(c) Establish the relationship between the elevation of boiling point of a solution and mole fraction of the dissolved solute. Acetic acid gets associated in benzene forming a dimer. Dissolution of 1.65g of acetic acid in 100g benzene raised the boiling point of solution by 0.36°C (k_b=2.57°C). Calculate the degree of association.
4 Attempt any two parts of the following: 10×2
(a) Differentiate between galvanic and concentration cell. How does the Nernst equation get modified in the case of concentration cells? Can liquid junction potential arise in these cells? If, yes, then how is it eliminated?
(b) What are the terms: standard electrode potential, single electrode potential and EMF? What are the experimental requirements for measurement of electrode potential and EMF of a cell? Explain the principle involved in these measurements with suitable examples.
(c) What do you understand by the terms: activity and activity coefficients? How mean molal activity coefficient of an electrolyte is determined?

5 Attempt any two parts of the following: 10×2
(a) Define cell constant, specific conductance, equivalent conductance and molar conductance. Give their units and how are they related. Discuss conductometry in terms of the analysis of solutions.
(b) What is the basic principle of polarography? What is Ilkovic's equation? Explain the terms diffusion current, residual current and half wave potential.
(c) Discuss the basic principle of HPLC. What are applications of HPLC in industries? Highlight advantages and limitations of this method.