

B 231

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2005.

Fourth Semester

Chemical Engineering

CH 242 — PHYSICAL CHEMISTRY

(Common to Leather Technology and Textile Technology)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Account for the abnormally high conductance of H^+ and OH^- ions in aqueous solutions. Representative data is given below :

Ion :	H^+	Li^+	Na^+	OH^-	Cl^-
Molar conductance ($sm^2 mol^{-1}$):	349.8	38.7	50.1	198.5	76.3

2. The resistance of 0.01 M solution of an electrolyte was found to be 210 ohm at 25°C. Calculate the molar conductance of the solution at 25°C. Cell constant = 0.88 cm^{-1} .
3. For the reaction $2HI \rightarrow H_2 + I_2$, value of k are 1.2×10^{-3} and $3.0 \times 10^{-5} dm^3 mol^{-1} s^{-1}$ at 700 and 629 K respectively. Estimate E_a .
4. Does the Term "reversible" have the same meaning in kinetics as in thermodynamics?
5. List out the general characteristics of catalyst.
6. Consider the reaction $CaCO_3 \rightleftharpoons CaO + CO_2$ predict C, P and F when (a) CaO and CO_2 are formed only by decomposition of $CaCO_3$ and (b) different quantities of all these are added to form the system.
7. What are the characteristics of an emulsifier? Give examples.

8. What are catalyst poisons? Give examples.
9. How are electrical properties of colloids helpful in their purification?
10. Predict the number of degrees of freedom required to define the state of the following systems without using the phase rule.
- (a) one mole of a pure gas enclosed in a cylinder
 - (b) a liquid in equilibrium with its vapour at its boiling point
 - (c) all the three forms of water in equilibrium.

PART B — (5 × 16 = 80 marks)

11. Discuss in detail the mechanism and kinetics of specific and general acid base catalysed reactions. (16)
12. (a) (i) Explain any one method of determination of transport number of ions. (10)
- (ii) Bring out the applications of emf series. (6)

Or

- (b) (i) State Kohlrausch's law. Give an account on the applications of Kohlrausch's law. (10)
- (ii) Derive the Nernst equation. (6)
13. (a) (i) Discuss the kinetics of a parallel first order reaction and arrive at the expressions for concentrations of various species present. (10)
- (ii) The rate constant of a second order reaction is $5.70 \times 10^{-5} \text{ dm}^3 \text{ mol}^{-1} \text{ s}^{-1}$ at 25°C and $1.64 \times 10^{-4} \text{ dm}^3 \text{ mol}^{-1} \text{ s}^{-1}$ at 40°C . Calculate the activation energy and the Arrhenius factor A. (6)

Or

- (b) (i) Explain the collision theory of bimolecular gaseous reactions. What are limitations of this theory and what improvement does the introduction of steric factor bring in to the equation? (10)
- (ii) Explain the mechanism and kinetics of enzyme catalysed reactions. (6)

14. (a) (i) Draw the phase diagram of water system and interpret it using phase rule. (10)
- (ii) How are phase diagrams of alloy systems constructed from cooling curves? Explain the construction of a eutectic diagram. (6)

Or

- (b) (i) Draw a neat diagram of Pb–Ag alloy system and interpret. (10)
- (ii) Define all the terms present in the phase rule and explain using examples. (6)
15. (a) (i) Write briefly on preparation, properties and industrial applications of emulsions. (10)
- (ii) What is the origin of electrical charge on colloidal particles? Explain the concept of electrical double layer and zeta potential. (6)

Or

- (b) (i) Explain the mechanisms of photosensitisation and quenching in photochemical reactions using suitable examples. (10)
- (ii) Derive the Lambert–Beer law. (6)