

2022
B.A./B.Sc.
Third Semester
CORE – 7
CHEMISTRY
Course Code: CHC 3.31
(Physical Chemistry – III)

Total Mark: 70
Time: 3 hours

Pass Mark: 28

Answer five questions, taking one from each unit.

UNIT-I

1. (a) State Gibbs phase rule. Give thermodynamic derivation of phase rule. 1+6=7
(b) Draw a schematic diagram of KI-H₂O system. Explain the main points of information about the equilibria represented in various areas along different lines and at various points in the diagram. 7
2. (a) Derive Clausius-Clapeyron equation and show how it can be applied to solid-liquid equilibria. 5
(b) Draw well-labelled phase diagram of Mg-Zn system. Discuss the main features of this diagram. 5
(c) Explain the terms: 2×2=4
 - (i) Congruent melting point
 - (ii) Incongruent melting point

UNIT-II

3. (a) Using the triangular plot, explain the water-chloroform-acetic acid system. 5
(b) Explain how Nernst distribution law can be applied to determine the solubility of a solute in a particular solvent. 5
(c) Explain the process of steam distillation. 4

4. (a) Define the term critical solution temperature. Explain one system which has upper CST. 5
 (b) Thermodynamically derive Nernst distribution law. 5
 (c) Discuss Pattinson's process for desilverisation of lead. 4

UNIT-III

5. (a) Define the rate of chemical reaction. Mention the factors affecting the rate of reaction. 1+3=4
 (b) Derive the expression of the rate constant for the first order reaction. 4
 (c) From the following values obtained in an experiment, show that the conversion of N-chloroacetamide into P-chloroacetamide is a reaction of first order reaction. 3

Time (Hour)	0	1	2	3
Na ₂ S ₂ O ₃ (Required)	49.3	35.6	25.75	18.5

- (d) Write a note on the hit and trial method for the determination of order of reaction. Give its limitation. 3
6. (a) What do you understand by zero order reaction? Support your answer with specific examples. 3
 (b) Determine the order of a reaction by half-life period method. 4
 (c) In the hydrolysis of ethyl acetate by NaOH using equivalent concentration, the progress of the reaction was examined by titrating 25 ml of the reaction mixture against standard acid. From the experiment, the following values were obtained. Show that the reaction is of second order reaction. 4

Time (Minutes)	0	5	15	25	35
Volume of acid	11.6	10.24	6.13	4.32	3.41

- (d) What is molecularity of a reaction? Explain pseudo-molecular reaction taking specific example. 3

UNIT-IV

7. (a) Explain how to determine the activation energy of a reaction by using Arrhenius equation. 6

- (b) Citing example, explain the following: 6
- (i) Reversible or opposing reaction
 - (ii) Parallel or side reaction
- (c) Give two reasons for the failure of collision theory of reaction rate. 2
8. (a) Discuss the kinetics of the first order consecutive reaction
- A C
- Deduce expression for the concentration of A, B and C at any time. Show graphically the variation of concentration of A, B and C with time. 7
- (b) State and explain the theory of activated complex formation for predicting the rate of reaction. 5
 - (c) Give reason why higher order of reactions are rare. 2

UNIT-V

9. (a) With the help of a suitable diagram, explain the mechanisms of catalysed reactions at solid surfaces. 5
- (b) Derive expression for the Freundlich adsorption isotherm. 5
 - (c) Differentiate between physical and chemical adsorption. 4
10. (a) Derive the Michaelis-Menten equation for enzyme catalysed reaction. 7
- (b) Highlight the eliminating ideas of Langmuir adsorption. 3
 - (c) Write short notes on the following: 4
 - (i) Two factors affecting adsorption
 - (ii) Efficiency of nanoparticles as catalysts
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