LOYOLA COLLEGE (AUTONOMOUS) CHENNAI – 600 034

B.Sc. DEGREE EXAMINATION – **CHEMISTRY**

FIFTH SEMESTER – **APRIL 2025**

UCH 5502 – PHASE EQUILIBRIA AND CHEMICAL KINETICS

Date: 28-04-2025   Dept. No.   Max. : 100 Marks
Time: 01:00 PM - 04:00 PM

	SECTION A - K1 (CO1)	
	Answer ALL the Questions	**(10 x 1 = 10)**
1.	**Multiple Choice Questions**	
a)	A triple point is (i) trivariant (ii) univariant (iii) invariant (iv) bivariant	
b)	Solutions with components which obey Raoult's law over the entire composition range are said to be (i) real solution (ii) dilute solution (iii) binary solution (iv) ideal solution	
c)	If 75% of a first order reaction was completed in 32 minutes, then 50% of the reaction was completed in (i) 24 min (ii) 4 min (iii) 16 min (iv) 8 min	
d)	Which one of the following sentence is incorrect? (i) Activation energy of simple reaction can be negative (ii) More molecules in a gas have energies above some threshold value as the temperature is increasing (iii) The rate does not depend on the magnitude of ΔE (iv) Lower the activation energy, faster the rate if equal number of collisions are always involved.	
e)	Under high concentration of substrate, enzyme catalysed reaction follows (i) second order kinetics (ii) first order kinetics (iii) zero order kinetics (iv) third order kinetics	
2.	**Multiple Choice Questions**	
a)	The number of component(s) present in the system, $NH_{3(g)} \rightleftharpoons N_{2(g)} + 3H_{2(g)}$ is/are (i) 1 (ii) 2 (iii) 3 (iv) 4	
b)	The temperature at which two conjugate solutions change into homogenous solution is called the (i) azeotrope (ii) conjugate temperature (iii) consolute temperature (iv) trash temperature	
c)	The minimum amount of energy required by the reacting molecules at the time of collisions in order to produce effective collision is called (i) threshold energy (ii) potential energy (iii) internal energy (iv) activation energy	
d)	Enzymes catalyse a reaction by _____ of the reaction. (i) reducing the activation energy (ii) increasing activation energy (iii) decreasing pH value (iv) increasing the pH value	
e)	The ionic strength of 0.1 M sodium chloride solution is (i) 0.05 M (ii) 0.2 M (iii) 0.4 M (iv) 0.1 M	
	SECTION A - K2 (CO1)	
	Answer ALL the Questions	**(10 x 1 = 10)**
3.	**Answer the following**	
a)	Write the mathematical form of Gibbs phase rule.	
b)	State Nernst distribution Law.	
c)	Define rate law.	
d)	What is meant by parallel reaction?	
e)	Give an example for catalyst promoter.	

4.	Answer the following
a)	Define phase.
b)	What are azeotropes?
c)	Give the unit for the rate constant of zero order reaction.
d)	What is meant by opposing reaction?
e)	Give an example for the catalyst poison.

SECTION B - K3 (CO2)

Answer any TWO of the following (2 x 10 = 20)

5.	Discuss the phase diagram of lead-silver system. (10)
6.	Derive the relation between molecular weight and depression of freezing point of a non-volatile solute. (10)
7.	(a) Explain why solute obeys Henry's law and solvent obeys Raoult's law in ideal dilute solutions.(5)
	(b) Starting from the integrated rate law equation, show that the half-life period is independent of concentration for a first order reaction. (5)
8.	(a) Discuss the collision theory of bimolecular reaction. (5)
	(b) Explain the differences between homogenous and heterogenous catalysis. (5)

SECTION C – K4 (CO3)

Answer any TWO of the following (2 x 10 = 20)

9.	(a) Derive the Clausius-Clapeyron equation for a liquid - vapour equilibrium. (5)
	(b) Explain any two applications of Nernst distribution law. (5)
10.	Explain the determination of upper critical solution temperature for phenol-water system. (10)
11.	Derive the integrated rate constant equation for a second order reaction when the initial concentration of both reactants are same. (10)
12.	(a) Illustrate the influence of ionic strength and nature of the solvent on the rates of ionic reaction. (5)
	(b) Explain the types of reversible enzyme inhibition mechanism. (5)

SECTION D – K5 (CO4)

Answer any ONE of the following (1 x 20 = 20)

13.	(a) Obtain the relation between osmotic pressure and vapour pressure. (5)
	(b) Explain the phase diagram of water system. (10)
	(c) Describe the principle of steam distillation. (5)
14.	(a) Derive the integrated Arrhenius equation to study the effect of temperature on reaction rate. (5)
	(b) Describe the Lindemann theory of unimolecular reactions. (5)
	(c) Discuss the intermediate compound formation theory of catalysis. (10)

SECTION E – K6 (CO5)

Answer any ONE of the following (1 x 20 = 20)

15.	(a) Discuss the application of reduced phase rule to ferric chloride- water system. (10)
	(b) State and explain van't Hoff's theory of dilute solutions. (5)
	(c) Derive an expression for the rate constant of a first order reaction. (5)
16.	(a) Discuss activated complex theory of bimolecular reaction. Explain how this theory helps in evaluating standard enthalpy of activation and standard entropy of activation. (10)
	(b) Derive Michaelis-Menten equation for studying the kinetics of enzyme catalysis. (10)