



**UCH 5502 – PHASE EQUILIBRIA AND CHEMICAL KINETICS**

Date: 11-11-2024

Dept. No.

Max. : 100 Marks

Time: 09:00 am-12:00 pm

**SECTION A**

**Answer ANY FOUR of the following**

**4 x 10 = 40 Marks**

1. Explain the phase diagram of lead-silver system and discuss its application in the desilverisation of lead.
2. a) Derive Gibb's phase rule equation. (5)  
b) Determine the number of components, number of phases and degrees of freedom in the following system: (5)  
$$\text{CaCO}_{3(s)} \rightleftharpoons \text{CaO}_{(s)} + \text{CO}_{2(g)}$$
3. Derive the relation between the depression in freezing point of a solution with the molar mass of the dissolved solute.
4. Explain the critical solution temperature (CST) of phenol-water system. What is the effect of addition of solute on CST?
5. Derive the integrated rate expression for a second-order reaction with equal concentration of reactants.  
$$2A \rightarrow \text{Product.}$$
6. Describe in detail the collision theory and its limitations.
7. Explain the mechanism of the following reactions:  
(i) Thermal decomposition of acetaldehyde (ii) Hydrogen-bromine chain reaction.
8. Derive Michaelis-Menten equation and explain the kinetics of enzyme catalysis.

**SECTION B**

**Answer ANY THREE of the following**

**3 x 20 = 60 Marks**

9. a) Discuss the salient features of phase diagram of sulphur system and identify the number of degrees of freedom at triple points using Gibbs's phase rule. (10)  
b) Derive Clausius-Clapeyron equation for a liquid-vapour equilibrium. Mention its applications. (10)
10. a) Derive Nernst distribution law. How is it modified when the solute undergoes association and dissociation in the solvent? (10)  
b) Discuss the principle and theory of azeotropic distillation. (10)
11. a) Draw and explain the positive and negative deviations of the vapour pressure— composition curves for non-ideal solutions. (10)  
b) Discuss Arrhenius equation and its significance. (10)
12. a) Discuss any three methods of determining order of a reaction. (10)  
b) What is meant by half-life period of a reaction? Obtain an expression for the  $t_{1/2}$  of a first order reaction. (5)  
c) Write the differences between order and molecularity of a chemical reaction. (5)
13. a) Explain the various factors affecting the rate of chemical reactions. (10)  
b) Discuss the Lindeman hypothesis of unimolecular reactions. (10)
14. a) Illustrate the types of enzyme inhibition with mechanism. (10)  
b) Explain homogeneous and heterogeneous catalysis with suitable examples. (10)

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