# LOYOLA COLLEGE (AUTONOMOUS) CHENNAI – 600 034

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

FIFTH SEMESTER – **NOVEMBER 2024**

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

Date: 11-11-2024 Dept. No. Max. : 100 Marks

Time: 09:00 am-12:00 pm

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| | **SECTION A - K1 (CO1)** | |
| | **Answer ALL the Questions -** | **(10 x 1 = 10)** |
| **1.** | **Define the following** | |
| a) | Phase | |
| b) | Colligative property | |
| c) | Activation energy | |
| d) | Ionic strength | |
| e) | Catalyst | |
| **2.** | **True or False** | |
| a) | F = C + P - 3 | |
| b) | Addition of solute increases the freezing point of the solution. | |
| c) | Order of reaction can be obtained theoretically. | |
| d) | Solid form of reactant reacts faster than gaseous form. | |
| e) | Promoters enhance the activity of the catalyst. | |
| | **SECTION A - K2 (CO1)** | |
| | **Answer ALL the Questions** | **(10 x 1 = 10)** |
| **3.** | **Answer the following** | |
| a) | Define triple point. | |
| b) | What is an ideal solution? | |
| c) | Define pseudo-order reaction. | |
| d) | What is meant by parallel reaction? | |
| e) | Define catalytic poison. | |
| **4.** | **Match the following** | |
| a) | Lead - Silver system - depression in freezing point | |
| b) | Cryoscopic constant - opposing reaction | |
| c) | Zero order - enzyme | |
| d) | Reversible reaction - two component system | |
| e) | Bio-catalyst - $Ms^{-1}$ | |
| | **SECTION B - K3 (CO2)** | |
| **Answer any TWO of the following** | | **(2 x 10 = 20)** |
| 5. | a) Draw and explain the phase diagram of water. (5)<br>b) Derive Clausius – Clapeyron equation for a liquid-vapour equilibrium. (5) | |
| 6. | Explain the elevation of boiling point with thermodynamic derivation. (10) | |
| 7. | Derive an integrated rate equation and half-life for second order reaction with equal concentration of reactants. (10) | |
| 8. | Explain the different types of chemical reactions based on the number of steps involved in the | |

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|---|---|---|
| | reaction with examples. | (10) |
| | **SECTION C – K4 (CO3)** | |
| **Answer any TWO of the following** | | **(2 x 10 = 20)** |
| 9. | (a) Explain the intermediate compound theory of homogeneous catalysis. | (5) |
| | (b) Distinguish between catalytic promoter and inhibitor. | (5) |
| 10. | (a) Give an account of graphical representation of three component system. | (5) |
| | (b) Describe the theory of azeotropic distillation. | (5) |
| 11. | (a) The decay constant of C-14 isotope is 4 $x10^{-12}$ $s^{-1}$. Calculate the half-life of C-14 isotope. | (5) |
| | (b) Discuss the Lindeman hypothesis of unimolecular reactions. | (5) |
| 12. | Describe the kinetics of enzyme catalysis and derive Michaelis - Menten equation. | (10) |
| | **SECTION D – K5 (CO4)** | |
| **Answer any ONE of the following** | | **(1 x 20 = 20)** |
| 13. | (a) Elaborate the phase diagram of ferric chloride - water system. | (10) |
| | (b) Explain the effect of addition of solute on critical solution temperature (CST). | (5) |
| | (c) Derive Nernst distribution law and mention its limitations. | (5) |
| 14. | (a) Explain any two methods to determine the order of a reaction. | (10) |
| | (b) Elaborate the factors affecting the rate of chemical reaction. | (10) |
| | **SECTION E – K6 (CO5)** | |
| **Answer any ONE of the following** | | **(1 x 20 = 20)** |
| 15. | (a) Change in temperature and pH alters the enzyme activity - Justify and explain the significance of turn over number. (10) | |
| | (b) Discuss the Henry's law and its relationship with Raoult's law. | (5) |
| | (c) Distinguish between molecularity and order of reaction with example. | (5) |
| 16. | (a) Discuss the significance of transition state theory in explaining kinetics of a reaction. | (10) |
| | (b) Derive a relationship between osmotic pressure and vapour pressure. | (5) |
| | (c) Elaborate the kinetics of acid catalysed hydrolysis of ester. | (5) |

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