LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

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

FIFTH SEMESTER – **APRIL 2023**

16/17/18UCH5MC02 – PHASE EQUILIBRIA AND KINETICS

Date: 03-05-2023 Dept. No. Max. : 100 Marks

Time: 01:00 PM - 04:00 PM

Part-A

Answer ALL questions. **(10 × 2 = 20 Marks)**

1. Write the reduced phase rule equation and explain the terms involved in it.
2. How is a ternary system represented?
3. What are azeotrope mixtures?
4. 18.2 g of urea is dissolved in 100 g of water at 50 ^{o}C. The lowering of vapour pressure produced is 5mm Hg. The vapour pressure of water at 50 ^{o}C is 92 mm Hg. Calculate the molecular weight of urea.
5. The time for half change in a first-order decomposition of a substance 'A' is 60 seconds. Calculate the rate constant.
6. What are zero order reactions? Give an example.
7. What are consecutive reactions? Give an example.
8. Write the effect of a catalyst on the reversible reaction.
9. What are catalytic promoters? Give an example.
10. Define the term turnover number.

Part-B

Answer any EIGHT questions. **(8× 5 = 40 Marks)**

11. Derive Clausius – Clapeyron equation for a liquid-vapor equilibrium.
12. Explain the phase diagram of lead-silver system and discuss its application in the desilverization of lead.
13. State and explain Raoult's law. Explain the negative deviation from this law with an example.
14. Explain the effect of addition of solute on critical solution temperature (CST).
15. A solution containing 2.5 g of a solute in 100 g of water boiled at 100.25 ^{0}C. Calculate the molar mass of the solute. $K_b = 0.52$ K Kg mol^{-1} .
16. Derive the expression for the rate constant of a first order reaction.
17. Distinguish between order and molecularity.
18. Write the different methods to determine the order of a reaction and describe the graphical method in detail.
19. Explain the mechanism of hydrogen-bromine chain reaction.
20. Describe in detail Lindemann's theory of unimolecular reactions.
21. Discuss the homogenous and heterogeneous catalysis with an example.
22. Explain kinetics of acid-base catalysis.

Part-C

Answer any FOUR questions. **(4 × 10 = 40 Marks)**

23. Discuss the salient features of phase diagram of sulfur system and identify the number of triple points by using Gibbs's phase rule.

24a. Describe the phase diagram of ferric chloride-water system.

b. Draw and explain the vapor pressure-composition diagram for the ideal solution. (5+5)

25. Derive thermodynamically the relation connecting elevation in freezing point of a solution and its molality.
26. State Nernst distribution law. How does it vary when the solute undergoes association and dissociation in the solvent?

27a. Discuss the collision theory of bimolecular reactions.

b. The activation energy of a chemical reaction is 100 kJ/mol and its Arrhenius factor is 10 $M^{-1}s^{-1}$. Find the rate constant of the reaction at a temperature of 300 K. (7+3)

28. Derive Michaelis – Menton equation and discuss the kinetics of enzyme catalysis.

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