LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

B.Sc. DEGREE EXAMINATION – CHEMISTRY

FIFTH SEMESTER – November 2009

CH 5507 - PHASE EQUILIBRIA AND KINETICS

Date & Time: 07/11/2009 / 9:00 - 12:00   Dept. No.　　　　　　　　Max. : 100 Marks

PART – A

Answer ALL questions:　　　　　　　　　　　　**(10 x 2 = 20 marks)**

1. Distinguish between congruent melting point and incongruent melting point.
2. Calculate the number of phases and number of components in the system $CaCO_3$ ⇌ $CaO + CO_{2(g)}$.
3. What is UCST?
4. What are azeotropes?
5. Differentiate rate and rate constant of a reaction.
6. What is a pseudo first order reaction?
7. Define activation energy.
8. What is an autocatalyst?
9. Distinguish between homogeneous catalysis and heterogeneous catalysis.
10. What is adsorption?

PART – B

Answer any EIGHT questions:　　　　　　　　　　　　**(8 X 5 = 40 marks)**

11. Explain the phase diagram of sulphur system.
12. Draw and explain the phase diagram of lead silver system.
13. What would be the vapour pressure of 0.5 molal solution of a non volatile solute in water at 298 K? Given the vapour pressure of pure water at 298 K is 3173 Pa.
14. Explain the Fractional distillation acetone – chloroform mixture.
15. Calculate the degree of association of benzoic acid in benzene, given that the molecular weight of benzoic acid in benzene determined by freezing point method is 242.
16. Derive the rate constant expression for the reaction between KI and $K_2S_2O_8$, given that each of the reactant has a first order dependence of the rate of the reaction and the initial concentration of KI is twice that of $K_2S_2O_8$.
17. Calculate the number of collisions occurring per second in a unit volume of the container containing nitrogen and oxygen gas molecules of concentration 2.45×10^{19} molecules cm^{-3} each at 300 K. The radii of nitrogen and oxygen molecules are 1.58 Å and 1.46 Å respectively.
18. The energy required for the decomposition of acetaldehyde is much less than the energy required for breaking C – C bond (almost half of the value). Justify the observation.

19. Compare the reaction rate constant expressions according collision theory and Arrhenius theory.

20. What is primary salt effect? How the added neutral salt affect the rate of a reaction involving ion - ion interactions.

21. Derive Michaelis Menton equation.

22. Describe the steps involved in a heterogeneous catalytic reaction.

PART – C

Answer any FOUR questions: **(4 X 10 = 40 marks)**

23. Draw the phase diagram of $FeCl_3$ – water system and explain in the detail.   (10)

24. a) Explain the principle involved in the construction of a phase diagram of a
    three component system taking an example.   (4)

   b) The vapour pressure of pure liquids A & B at 300 K are 200 mm Hg and 500
      mmHg respectively. Calculate the molefraction in vapour and liquid phase of
      a solution of A and B whose total vapour pressure is 350 mm Hg assuming
      the liquid and vapour behave ideally.   (6)

25. a) Explain any one application of distribution law.   (5)

   b) In the distillation of an organic liquid by steam distillation, the mixture boils at
      99° C at 760 mm Hg pressure. At this temperature vapour pressure of water
      is 733 mm Hg. The composition of the organic component of the liquid
      mixture is ¼. Calculate the molecular weight of the organic liquid.   (5)

26. a) Explain Vant Hoff differential method of determination of order of a reaction
       with respect to time and order with respect to concentration.   (5)

   b) What is half life of a reaction? Describe the method of determining the order
      of the reaction based on the measurements of half life of a reaction.   (5)

27. a) What are chain reactions? Explain.   (5)

    b) Describe Lindemann hypothesis of unimolecular reactions.   (5)

28. a) Derive Langmuir adsorption isotherm expression.   (6)

   b) Compare H_2 – Br_2 reactions under thermal and photochemical reaction
      conditions.   (4)

$$$$$$