

II B.Tech. II Semester Regular Examinations, April/May -2005**PHYSICAL CHEMISTRY****(Chemical Engineering)****Time: 3 hours****Max Marks: 80****Answer any FIVE Questions
All Questions carry equal marks**

1. (a) State the law which governs the distribution of a solute between two immiscible solvents. Derive the distribution formula on the assumption that the benzoic acid behaves normally in water and as bimolecular species in benzene.
(b) 12gms of an organic substance A is present in 100gms of its aqueous solution. How much of it would be left behind after extracting the solution with two successive applications of 50ml each of ether? The distribution coefficient of A between water and ether is 2 in favor of ether.
2. Explain the following terms
 - (a) Eutectic point
 - (b) Eutectic mixture
 - (c) condensed phase rule
 - (d) triple point
3. What are the postulates of transition state theory and derive a rate constant for bimolecular reaction.
4. (a) The following mechanism has been suggested for the reaction
 - i. $2\text{NO} \rightleftharpoons \text{N}_2\text{O}_2$
 - ii. $\text{N}_2\text{O}_2 + \text{H}_2 \rightarrow \text{N}_2\text{O} + \text{H}_2\text{O}$
 - iii. $\text{N}_2\text{O} + \text{H}_2 \rightarrow \text{N}_2 + \text{H}_2\text{O}$If the second step is rate-determining step what is rate law for this reaction?
(b) Explain the following
 - i. Upper and lower explosion limits
 - ii. Thermal explosion limits.
5. (a) How is Ultra microscope constructed? What is the principle on which it works?
(b) How do you prepare colloidal solution of gold by chemical method?
6. Explain the following with suitable reasons.
 - (a) Alum is used in shaving
 - (b) Alum is used in municipal water supply
 - (c) A colloidal solution is not precipitated in the presence of gelatin

- (d) A colloidal solution contains electrically charged particles.
 - (e) Tyndall cone is formed when a beam of light is concentrated on colloidal solution
7. (a) What is electrolysis? Explain the mechanism of electrolysis with example
- (b) Explain the first law of faraday law of electrolysis.
8. (a) What is meant by catalysis? Give two important examples of catalyst used in industries
- (b) Explain homogeneous catalysis with suitable examples

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1. (a) Why multiple extraction is more efficient than single extraction?
(b) An aqueous solution contain 8grams of solute per litre. When one litre of solution is treated with 100 ml of ether, 4gms of the solute are extracted. How much more of the solute would be extracted from the aqueous solution by further 100ml ether. Assume that the molecular state of solute is the same in ether and water.
2. Explain the following with suitable examples
 - (a) Phase
 - (b) Component
 - (c) Degrees of freedom
 - (d) Triple point
3. Explain the factors that influence the rate of reactions?
4. (a) The following mechanism has been suggested for the reaction
 - i. $2\text{NO} \rightleftharpoons \text{N}_2\text{O}_2$
 - ii. $\text{N}_2\text{O}_2 + \text{H}_2 \rightarrow \text{N}_2\text{O} + \text{H}_2\text{O}$
 - iii. $\text{N}_2\text{O} + \text{H}_2 \rightarrow \text{N}_2 + \text{H}_2\text{O}$If the second step is rate-determining step what is rate law for this reaction?
(b) Explain the following
 - i. Upper and lower explosion limits
 - ii. Thermal explosion limits.
5. Write short note on
 - (a) Lyophobic sols
 - (b) double decomposition
 - (c) hydrolysis of sols.
 - (d) Ultra filtration
 - (e) Stern double layer.
 - (f) electro kinetics.
6. Discuss about liquids in solids (gels)

7. (a) What is electrolysis? Explain the mechanism of electrolysis with example
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(b) Explain homogeneous catalysis with suitable examples

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1. (a) Give thermodynamic basis for the Nernst distribution law . Indicate its applications.
 - (b) At 25⁰c an aqueous solution of Iodine containing 0.0516 gms per litre is in equilibrium with CCl_4 solutions containing 4.412 gms per litre. The solubility of Iodine in water at 25⁰C is 0.34 gms per litre. Find the solubility of Iodine in CCl_4 .
 2. State and explain the conditions under which the phase rule is represented by the equation $F = C - P + 1$. What is the qualitative difference between the one component system and two component system.
 3. (a) What is the difference between rate and rate constant.
 - (b) Discuss the influence of temperature in the velocity of a chemical reaction.
 - (c) The following data was obtained on hydrolysis of methyl acetate at 25⁰C in 0.35 N HCl established that it is a first order reaction.
- | | | | | |
|-----------------------|-------|-------|-------|----------|
| Time (sec) | 0.0 | 4500 | 7140 | α |
| Alkali used in (ml) | 24.36 | 29.32 | 31.72 | 47.15 |
4. (a) The following three mechanisms have been suggested for the reaction $H_2 + I_2 \rightarrow 2HI$.
 - i. $H_2 + I_2 \rightarrow 2HI$. (Single step)
 - ii. $I_2 \rightarrow 2I$, $2I + H_2 \rightarrow 2HI$ (slow)
 - iii. $I_2 \rightarrow 2I$, $I + H_2 \rightarrow IH_2 + I \rightarrow 2HI$ (slow)

Deduce the rate law expression for each of them.

- (b) Explain explosion limits in the formation of water from hydrogen and oxygen .
5. (a) Explain Brownian movement of colloids with neat diagram?
- (b) Write short notes on
 - i. Gold number
 - ii. schulze-hardy rule
 - iii. Origin of charge on colloidal particles
6. Discuss about liquids in solids (gels)
7. (a) Explain the classification of electrolytes with examples.

- (b) Define the terms cell constant and specific conductance with their units.
8. Explain the following mechanism in acid base catalysis
- (a) Prototypic
 - (b) Prototropic

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1. (a) How is distribution law modified when the solute undergoes dissociation in one of the solvents ? What would happen if the solute were completely dissociated in one of the solvent?
- (b) At 298 K an aqueous solution of Iodine containing 0.0387×10^{-3} kg per dm^3 of the solution in equilibrium with 3.31×10^{-3} kg per dm^3 of Iodine in CCl_4 . If the solubility of Iodine in CCl_4 is 0.0291 kg per dm^3 . What is the solubility of Iodine in water?
2. (a) Derive Gibbs rule from the thermodynamically consideration.
- (b) Explain why the fusion curve of ice has a negative slope where as sublimation curve has positive point.
- (c) What is the number of degrees of freedom at triple point.
3. (a) Discuss the collision theory of bimolecular reaction.
- (b) From the following data for the decomposition of N_2O_5 in CCl_4 solution at 48°C , show that the reaction is of first order

| | | | | |
|--------------------------|-----|-----|------|----------|
| time in (min) | 10 | 15 | 20 | α |
| volume of oxygen evolved | 6.3 | 8.9 | 11.4 | 34.7 |
4. Derive the rate law expression for the formation of HBr from H_2 and Br_2 employing steady state approximations.
5. (a) Discuss the origin of charge on colloidal particles. What is meant by electrical double layer ? What is meant by Zeta potential?
- (b) Explain tyndall effect?
6. Explain the following with suitable reasons.
 - (a) Alum is used in shaving
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