

INDIAN INSTITUTE OF ENGINEERING SCIENCE AND TECHNOLOGY, SHIBPUR
 B. TECH-M.TECH DUAL DEGREE 1st Sem (CE,ME,MET,MIN,AE) EXAMINATION, 2015
 Chemistry (CH-1201)

FULL MARKS : 70

TIME : 3 Hrs

*Use separate answer scripts for each half***FIRST HALF**[Question No.1 compulsory and from Unit-I (*answer any two*) and Unit-II (*answer any two*)]

1. (a) What is Teflon?
- (b) Write all possible isomers of Tartaric acid and indicates the relationship among them.
- (c) Write short note on (i) Chelation Therapy, Or (ii) Neutron Capture Therapy.

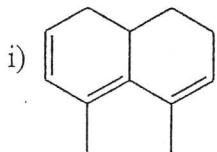
[1+2+3]

Unit -I [*answer any Two*]

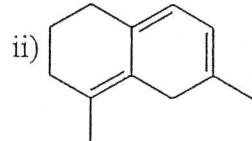
2. (a) Show all steps of radical polymerization of ethylene by using AIBN initiator.
- (b) Differentiate between addition and condensation polymerization with examples.
- (c) In a polystyrene polymer, there are 100 molecules of molecular weight 100, 200 molecules of molecular weight 1000 and 300 molecules of molecular weight 10,000. Find out, \overline{M}_n , \overline{M}_w and \overline{DP}_n

[3+3+4]

3. (a) State Lambert-Beer's law of absorption of light and hence prove: $A = \epsilon cl$, where A = absorbance, ϵ = molar extinction co-efficient, c = molar concentration, l = path length.
- (b) Calculate the λ_{max} in nm each of the following compounds:



and



- (c) Explain why in presence trace of alkali colorless phenolphthalein solution shows deep orange color.

[4+4+2]

- 4.(a) Predict the products of the following reaction with plausible mechanism and mention stereochemistry of the final products:

(S)-1-phenylethanol is allowed to react separately with thionyl chloride in the presence and absence of pyridine.

(b) Write notes on (any two):

- (i) Nylon 6 and Nylon 66; (ii) Bathochromic and Hypsochromic shift; and (iii) Hofmann degradation reaction.

[5+(2½×2)]

Unit II [answer any Two]

5. (a) Discuss the *d*-orbital splitting in square planar geometry starting from the crystal field splitting in octahedral geometry.

(b) $[\text{CoF}_6]^{3-}$ is paramagnetic, whereas $[\text{Co}(\text{CN})_6]^{3-}$ is diamagnetic—Explain from Crystal Field Theory.

(c) What are the factors that govern the magnitude of Crystal Field splitting?

[4+3+3]

6. (a) Explain why Mn_3O_4 exhibits normal spinel whereas Fe_3O_4 exhibits inverse spinel structure?

(b) Write down the names and structures of two anti cancer and anti diabetic drugs.

(c) Draw structure of two complexes which can act as superoxide dismutase mimics.

[4+3+3]

7. (a) The absorption spectrum of $[\text{Ti}(\text{H}_2\text{O})_6]^{3+}$ shows a maximum around $20,300\text{cm}^{-1}$. Calculate the magnitude of Δ_O in $[\text{Ti}(\text{H}_2\text{O})_6]^{3+}$.

(b) Calculate the crystal field stabilisation energy (CFSE) for a d^7 ion, such as Co^{2+} , in octahedral high spin and tetrahedral complexes. Use units of Δ_O in both cases. Calculate OSSE for Co^{2+} .

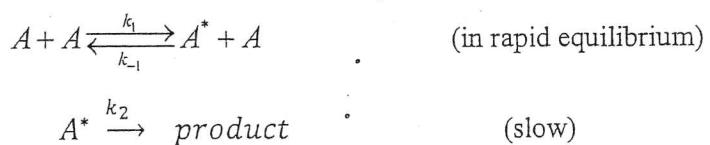
(c) What is meant by spectrochemical series? CO , being a neutral ligand, lies above the other anionic ligands in the spectrochemical series – Explain.

[3+4+3]

SECOND HALF

(Answer Question No. 11 and *any two* from the rest)

8. (a) Lindeman model for a unimolecular reaction is as follows:



It leads to a rate equation as follows,

$$\frac{d(\text{product})}{dt} = \frac{k_2 k_1 [A]^2}{k_{-1}[A] + k_2}$$

(b) Show that the Lindeman model has the ability to follow the experimentally observed change from the first-order to second order kinetics with decreasing concentration of A.

(c) The rate constant of thermal decomposition of ethane is given as,

$$K = \left(\frac{k_1 k_3 k_4}{k_5} \right)^{\frac{1}{2}}$$

Following Arrhenius equation, show that the activation energy of the decomposition is,

$$E_a = \frac{1}{2} [E_{a1} + E_{a3} + E_{a4} - E_{a5}]$$

[4+3+3]

9. (a) Consider the electrochemical cell $\text{Cd}/\text{Cd}^{2+}//\text{KCl}/\text{Hg}_2\text{Cl}_2-\text{Hg}$

Express the half cell reactions

Given $E_{\text{anode}}^0 = 0.402 \text{ V}$ and $E_{\text{cathode}}^0 = -0.268 \text{ V}$, calculate the E_{cell}^0 .

Derive the standard free energy for the electrochemical reaction.

(b) Calculate λ_0 for $\text{CH}_3\text{COONH}_4$ acid transport number of NH_4^+ and CH_3COO^- , given at 25°C the mobilities of the two ions at infinite dilution are 76×10^{-5} and $42 \times 10^{-5} \text{ cm}^2 \text{ volt}^{-1} \text{ sec}^{-1}$ respectively.

(c) Express the Gibb's Phase Rule and defines the terms involved in it.

[(2×3)+2+2]

10. (a) What is the Michaelis-Menten kinetic scheme and how does this explain generally the enzyme kinetics?

(b) Give the schematic and the half cell reactions of H_2-O_2 fuel cell. What are the anode and cathode materials used in a PEM fuel cell.

[(1+4)+5]

11. What is the slope of $\ln k$ vs $1/T$ plot according to the Arrhenius equation? Explain the physical significance of activation energy.

[1+3]