



(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : **199203**

Roll No.

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B. Tech.

(SEM. II) THEORY EXAMINATION, 2014-15 ENGINEERING CHEMISTRY

Time : 3 Hours]

[Total Marks : 80

Note: Attempt all Sections.

SECTION –A

- 1 Attempt all parts of this question. (2x8=16)
- (i) Explain the order of stability among $(\text{CH}_3)_3\text{C}^+$, $(\text{CH}_3)_2\text{C}^+\text{H}$, $\text{CH}_3\text{C}^+\text{H}_2$ and H_3C^+ ?
 - (ii) Give the reaction by which temporary hardness can be removed by boiling?
 - (iii) Predict the number of ^1H NMR signals and splitting in $(\text{CH}_3)_2\text{CHOCH}_3$ and $\text{H}_2\text{C}=\text{CHCH}_2\text{OH}$.
 - (iv) Give the structure of a diene having a molecular formula C_4H_6 which shows an intense peak at λ_{max} 217 nm in its UV spectrum.
 - (v) On the basis of molecular orbital theory explain why F_2 is diamagnetic while O_2 is paramagnetic?

- (vi) Why is o-Nitrophenol is more volatile than p-nitrophenol ?
- (vii) What is atropisomerism? Give one example.
- (viii) What will happen if a Zn rod is vertically half submerged under water?

SECTION – B

2 Attempt any three parts of the question: (8x3=24)

- (a) (i) Discuss the variation in rate of reaction with respect to temperature.
- (ii) Draw the molecular orbital diagram of O_2 . Calculate the bond order and comment on the magnetic properties of O_2 , O_2^+ and O_2^- .
- (b) (i) What is Chromatography? Write a brief note on Thin Layer Chromatography.
- (ii) Why is TMS used as a standard in NMR spectroscopy? A compound having the molecular formula $C_{10}H_{14}$ gave the following 1H NMR data: δ 0.88 (6H, doublet), δ 1.86 (1H, multiplet), δ 2.45 (2H, doublet) and δ 7.12 (5H, singlet). Giving reasons, assign the structure to the compound which is consistent with the above data.

- (c) (i) Write the mechanism of Friedel-Crafts reaction.
- (ii) Give the energy profile of SN^2 reaction and comment on the stereochemistry of this reaction.
- (d) (i) A zeolite softener was 90% exhausted by removing the hardness completely when 10,000 litres of hard water sample was passed through it. The exhausted zeolite bed required 200 litres of 3% sodium chloride solution for its complete regeneration. Calculate the hardness of water sample.
- (ii) Discuss the stereochemistry of Tartaric acid. What will happen if one of the $-\text{OH}$ group in tartaric acid is replaced by $-\text{NH}_2$ group. Draw all the probable stereoisomers for this compound.
- (e) (i) Give the differences between Thermoplastic and Thermosetting polymers.
- (ii) Give the preparation and uses of Dacron and Nylon- 6.

SECTION – C

Note: Attempt all questions of this section.

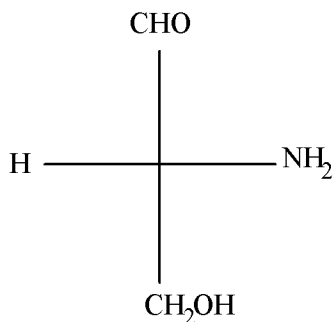
(8x5=40)

3 Attempt any one part of the following:

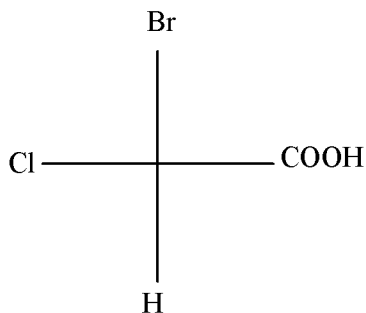
(a) Give three examples of compounds showing optical isomerism without the presence of chiral carbon.

Assign R/S or E/ Z configuration to the following:

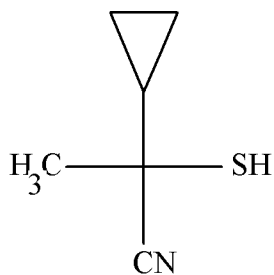
(i)



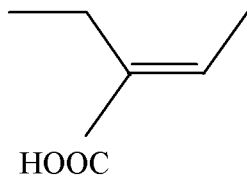
(ii)



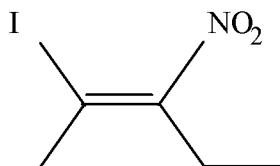
(iii)



(iv)



(v)



- (b) Giving appropriate examples explain the terms Stereo selective and Stereo specific reactions. Comment on geometrical isomerism encountered in cyclic compounds,

- 4 Attempt any one part of the following:
- (a) Deduce the kinetic equation for a second order reaction when both the reactants are same. The half life for a first order reaction is 5×10^4 s. What percentage of the initial reactant will react in 2 hours?
 - (b) Give the mechanism of nitration and sulfonation of benzene.
- 5 Attempt any one part of the following:
- (a) What are conducting polymers? How can their conductivity be increased by doping? Give the applications of conducting polymers.
 - (b) How can corrosion be prevented by proper design? How can anodic and cathodic metallic coatings be usefull in protection against corrosion of a metal?
- 6 Attempt any one part of the following:
- (a) (i) What is the basic requirement for a compound to be IR active? Write the princple of IR Spectroscopy and explain the significance of Finger print region.
 - (ii) What are chromophores and auxochromes? How do auxochromes increase the coloring power of chromophores? A diene has λ_{\max} at 175 nm in its UV spectrum. What inference can be drawn from this data?

- (b) Write a note on:
- (i) Column Chromatography
 - (ii) Paper Chromatography.

7 Attempt any one part of the following:

- (a) Write a note on Calgon conditioning. Calculate the temporary and permanent hardness of a water sample containing: $\text{Mg}(\text{HCO}_3)_2 = 7.3\text{mg/L}$,
 $\text{MgCl}_2 = 9.5\text{mg/L}$, $\text{MgSO}_4 = 27.6\text{mg/L}$,
 $\text{Ca}(\text{HCO}_3)_2 = 16.2\text{mg/L}$, $\text{NaCl} = 10.7\text{mg/L}$ and
 $\text{CaSO}_4 = 13.6\text{ mg/L}$.
- (b) (i) Explain the ion exchange process of water softening.
- (ii) Explain reverse osmosis process.
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