

(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 2013-14

**ENGINEERING CHEMISTRY**

*Time : 3 Hours*

*Total Marks : 80*

**Note :- Attempt all Sections.**

**SECTION-A**

1. Attempt **all** parts of this question : **(2×8=16)**
- (a) Show hybridization in  $H_2O$  and  $NH_3$ .
  - (b) What is the difference between racemic mixture and meso compounds ?
  - (c) Explain why  $H_2O$  is a liquid and  $H_2S$  is a gas at room temperature.
  - (d) Draw hyperconjugative structures of ethyl carbocation.
  - (e) Give various units of hardness with their interrelation.
  - (f) What are adhesives ? Give examples.
  - (g) Why iron tank corrodes just beneath the waterline ?
  - (h) What is the effect of temperature on the rate of chemical reaction ? Explain why ?

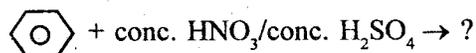
## SECTION-B

2. Attempt any **three** parts of this question : (8×3=24)

(a) (i) Draw molecular orbital diagram of NO. Calculate bond orders and predict the magnetic behaviours of NO, NO<sup>+</sup> and NO<sup>-</sup>.

(ii) What are the fundamental conditions for a compound to be optically active? How many optical isomers can exist for 2,3-Butane-diol? Would all of these be optically active?

(b) (i) Complete the following reaction. Also give its type and write its mechanism :



(ii) Show that half-life time of second-order reaction depends upon initial concentration of reactant. A first order reaction is 25% complete in 30 minutes. Calculate time required for 75% completion.

(c) (i) 50 mL of a sample of water required 5 mL of N/50 H<sub>2</sub>SO<sub>4</sub> using methyl orange as indicator but did not give any colouration with phenolphthalein. What type of alkalinity is present? Express the same in ppm.

(ii) Explain the process of electrodialysis for desalination of brackish water.

(d) (i) Give mechanism for free radical polymerisation.

(ii) What are fuel cells? H<sub>2</sub>-O<sub>2</sub> fuel cell is to be described in detail.

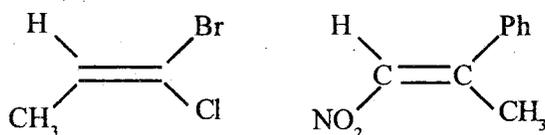
- (e) (i) How will you separate a mixture of chloroform (b.p.334K) and aniline (b.p.457L) ? Describe the process in detail with diagram.
- (ii) Write short-note on electronic transitions caused by energy absorption in uv region.

### SECTION-C

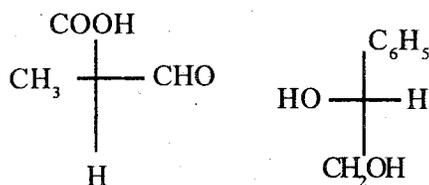
**Note :-** Attempt all questions of this section. (8×5=40)

3. Attempt any **two** parts of the following :

- (a) Explain the phenomenon of atropisomerism with suitable example.
- (b) Explain regiochemistry and stereospecificity with examples.
- (c) (i) Assign E/Z nomenclature of the following :



- (ii) Designate R/S to the following :



4. Attempt any **two** parts of the following :

- (a) A compound having concentration  $10^{-3}$  mg/L, resulted absorbance value 0.20 at  $\lambda_{max}$  510 nm using 1 cm cell. Calculate the absorptivity and molar absorptivity. Molecular weight of compound is 400.
- (b) What are cements ? Give different types of cements.

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- (c) A gaseous hydrocarbon 'A' on passing through a quartz tube heated at 600°C gave a liquid compound 'B' (Molecular weight : 78 amu). The later compound under electrophilic substitution reactions gave the following physical data on analysis :

The IR spectrum showed a characteristic absorption band at 3040  $\text{cm}^{-1}$  and uv absorption, due to  $\pi \rightarrow \pi^*$  transition, at 204nm ( $\log \epsilon$  3.84). The  $^1\text{H-NMR}$  spectrum displayed a down field singlet (6H) at 7.3 $\tau$ . Identify the compound 'A' and 'B' and give your reasoning.

5. Attempt any **two** parts of the following :
- Give mechanism and stereochemistry of  $\text{SN}^1$  and  $\text{SN}^2$ .
  - What is catalysis ? Explain adsorption theory of catalysis.
  - Derive rate equation for second order reaction when the concentration of reactants are different.
6. Attempt any **two** parts of the following :
- Write note on :
    - Calgon conditioning
    - Hardness of water.
  - Calculate temporary, permanent hardness and total hardness of a water sample that is analysed as :  
 $\text{Mg}(\text{HCO}_3)_2 = 7.3 \text{ mg/L}$ ;  $\text{Ca}(\text{HCO}_3)_2 = 16.2 \text{ mg/L}$ ;  $\text{MgCl}_2 = 9.5 \text{ mg/L}$  and  $\text{CaSO}_4 = 13.6 \text{ mg/L}$ .
  - Explain ion-exchange method of water softening.
7. Attempt any **two** parts of the following :
- What are silicones ? Give their preparation, properties and uses.
  - Give preparation, properties and applications of :  
Nylon 6,6 and Teflon
  - Explain different methods employed for prevention of corrosion.