

(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⁺ and NO⁻.
- (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 :
-  + conc. HNO₃/conc. H₂SO₄ → ?
- (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 H₂SO₄ 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? H₂-O₂ fuel cell is to be described in detail.

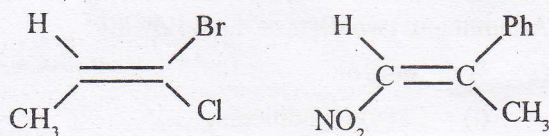
- (e) (i) How will you separate a mixture of chloroform (b.p.334K) and aniline (b.p.457L) ? Describe the process in detail with diagram.
- (ii) Write short-note on electronic transitions caused by energy absorption in uv region.

SECTION-C

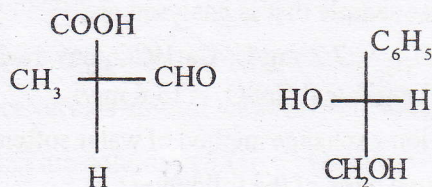
Note :- Attempt all questions of this section. (8×5=40)

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 λ_{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.

- (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 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 τ . Identify the compound 'A' and 'B' and give your reasoning.

5. Attempt any **two** parts of the following :
- Give mechanism and stereochemistry of SN^1 and 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.