

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

PAPER ID : 9603

Roll No.

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**B.Tech.**

(SEM. I) ODD SEMESTER THEORY EXAMINATION 2012-13

**ENGINEERING CHEMISTRY**

Time : 3 Hours

Total Marks : 100

Note : Attempt all questions. All questions carry equal marks.

**SECTION—A**

1. Attempt all ten parts. Each part carries equal marks.

(10×2=20)

- (i) Explain why Teflon is highly chemical resistant.
- (ii) Low density and high density polythene differ in density. Why ?
- (iii) 3.12 g of coal was kjeldahlized and  $\text{NH}_3$  gas thus evolved was absorbed in 50 ml of 0.1 N  $\text{H}_2\text{SO}_4$ . After absorption, the excess of acid required 12.5 ml of 0.1 N NaOH for neutralization. Calculate the % age of nitrogen in given coal sample.
- (iv) Giving example differentiate between intra- and inter molecular hydrogen bondings.
- (v) Calculate the number of atoms per unit cell in SC, BCC and FCC.
- (vi) Arrange the following molecules/ions in order of their increasing bond length;  $\text{O}_2$ ,  $\text{O}_2^{1-}$ ,  $\text{O}_2^{2-}$ .
- (vii) Write down the chemical unit of Nylon and Polystyrene.
- (viii) Explain why methyl amine is a stronger base than ammonia.

- (ix) Why is TMS used as a standard reference in NMR spectroscopy ?
- (x) Why can human beings digest starch but not cellulose although both are made up of D(+)-glucose ?

**SECTION—B**

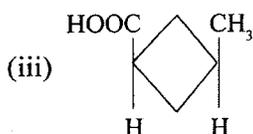
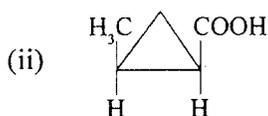
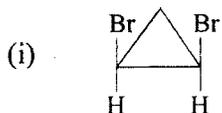
2. Attempt any **three** parts of the following : **(3×10=30)**
- (a) (i) With the help of molecular orbital diagram, explain why hydrogen forms diatomic molecule, while helium remains monoatomic.
- (ii) What is spin-spin coupling ? Explain the NMR spectrum of  $\text{CH}_3\text{CH}_2\text{OH}$  molecule.
- (b) (i) Describe the structure of Graphite. How it acts as conductor of electricity ?
- (ii) Describe preparation, properties and application of (i) Buna-S, (ii) Nylon 6,6.
- (c) (i) Explain the order and stability of primary, secondary and tertiary carbocations.
- (ii) How many NMR signals do you expect from each of the following compounds ?  
(i)  $\text{CH}_3\text{CH}_2\text{CH}_2\text{Br}$ , (ii)  $\text{CH}_3\text{OCH}_3$ .
- (d) (i) Calculate the NCV and GCV of coal having the following compositions; C = 85%, H = 8%, S = 1%, N = 2% and ash = 4%. (Latent heat of water vapour = 587 cal/g).
- (ii) Explain Relative configuration. What are the drawbacks of this system of configuration assignment ?
- (e) (i) What is biogas ? How biogas is produced ? With the help of a diagram, explain the process of biogasification.
- (ii) The specific rate constant for the decomposition of formic acid is  $5.5 \times 10^{-4} \text{ sec}^{-1}$  at 413 K. Calculate the specific rate constant at 458 K if the energy of activation is  $2.37 \times 10^4 \text{ cal mol}^{-1}$ .

### SECTION—C

Note : Attempt all five questions. Each question carries equal marks.

(5×10=50)

3. Attempt any **one** part of the following :
- (i) What are the organometallic compounds ? Give the preparation and applications of Grignard reagent.
  - (ii) Explain sacrificial anodic and impressed cathodic protection method for prevention of corrosion.
- (b) What do you mean by the term titrimetric analysis ? How is the completion of reaction indicated in titrations ? Discuss the titrimetric analysis of : NaOH against oxalic acid.
4. Attempt any **one** part of the following :
- (a) Discuss the mechanism of Hoffmann rearrangement and Cannizzaro reaction.
  - (b) Define and explain the terms involved in phase rule. Draw a neat labeled phase diagram of water system and explain the areas and curves in it. What is the significance of the triple point and metastable curve in this system ?
5. Attempt any **one** part of the following :
- (a) Predict the number and draw all the possible stereoisomers for the following :



- (b) Predict the hybridization and shape of the following compounds on the basis of VSEPR theory :  $\text{SO}_2$ ,  $\text{PCl}_5$ ,  $\text{NH}_3$  and  $\text{XeO}_4$ .

6. Attempt any **one** part of the following :

- (a) Differentiate between Enantiomers and Diastereoisomers. Which of the following compounds are optically active and why ? Allenes, n-butanol, n-propanol and 2-chlorobutane.
- (b) With the help of data given show that decomposition of  $\text{H}_2\text{O}_2$  in aqueous solution is of first order.

Time (min.)	:	0	10	20	30
Volume of $\text{KMnO}_4$ required to decompose $\text{H}_2\text{O}_2$ (ml)	:	12.5	25.0	20.0	15.7

7. Attempt any **one** part of the following :

- (a) (i) Explain why an underground iron pipe is connected through an insulated wire to a block of zinc metal.
- (ii) A compound having molecular formula  $\text{C}_{10}\text{H}_{14}$  gave the following set of  $^1\text{H}$  NMR data :  $\delta$  7.10 (5H, singlet),  $\delta$  2.44 (2H, doublet),  $\delta$  1.88 (1 H, multiplet),  $\delta$  0.86 (6H, doublet). Assign the structure to this compound giving explanation.
- (b) (i) Show how does  $\text{S}_{\text{N}}^2$  reaction gives rise to inverted product. Discuss the energy profile of such a reaction.
- (ii) An edge of cubic cell of NaCl crystal is  $6.5 \times 10^{-8}$  cm. Assuming that four molecules of NaCl are associated per unit cell, calculate its density. (Avogadro's number =  $6.023 \times 10^{23}$ ).