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

PAPER ID : 9603   Roll No. ☐☐☐☐☐☐☐☐☐

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 NH_3 gas thus evolved was absorbed in 50 ml of 0.1 N H_2SO_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; O_2, O_2^{1-}, 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 $CH_3 CH_2 OH$ 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) $CH_3CH_2CH_2Br$, (ii) CH_3OCH_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 5.5×10^{-4} sec^{-1} at 413 K. Calculate the specific rate constant at 458 K if the energy of activation is 2.37×10^4 cal mol^{-1}.

SECTION—C

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

$$(5 \times 10 = 50)$$

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

   (a) (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 :

   (i)

   (ii)

   (iii)
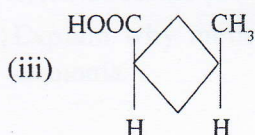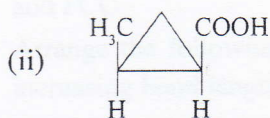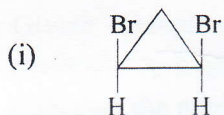
(b) Predict the hybridization and shape of the following compounds on the basis of VSEPR theory : SO_2, PCl_5, NH_3 and XeO_4.

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-chloro-butane.

(b) With the help of data given show that decomposition of H_2O_2 in aqueous solution is of first order.

Time (min.)	:	0	10	20	30
Volume of KM_nO_4 required to decompose H_2O_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 $C_{10}H_{14}$ gave the following set of ^1H NMR data : δ 7.10 (5H, singlet), δ 2.44 (2H, doublet), δ 1.88 (1 H, multiplet), δ 0.86 (6H, doublet). Assign the structure to this compound giving explanation.

(b) (i) Show how does S_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 6.5×10^{-8} cm. Assuming that four molecules of NaCl are associated per unit cell, calculate its density. (Avogadro's number $= 6.023 \times 10^{23}$).