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

PAPER ID : 9603 Roll No.

B. Tech.

(Semester-I) Theory Examination, 2012-13

ENGINEERING CHEMISTRY–I

Time : 3 Hours] *[Total Marks : 100*

Note : Attempt questions from each Section as per instructions.

Section-A

Attempt *all* parts of this question. Each part carries 2 marks. 2×10=20

1. (a) Has the peroxide ion, O_2^-, a longer or shorter bond length than O_2? Explain.

   (b) Derive an expression for the density (ρ) of a cubic cell.

   (c) Differentiate between Racemic mixture and Meso compound.

   (d) What are reaction intermediates?

   (e) What is gross and net calorific value?

   (f) What is invariant system? Give an example of invariant system.

   (g) Classify the polymers on the basis of stereochemistry.

   (h) Define the term chromophore and auxochrome.

   (i) Show that in case of a first order reaction, the time required for 99.9% of the reaction to take place is about 10 times that required for half the reaction.

   (j) Water contains 408mg $CaSO_4$ per litre. Calculate the hardness in terms of $CaSO_3$ equivalent.

Section-B

Attempt any *three* parts of this question. Each part carries 10 marks. 10×3=30

2. (a) (i) On the basis of band theory, differentiate between conductors, semiconductors and insulators.

   (ii) Calculate density of BCC crystal. Side of cube is 4A° and M = 60.

(b) What is the basic principle of Nuclear Magnetic Resonance? A compound has molecular formula C_2H_3Cl. It can show geometrical isomerism. The compound has two NMR signals. The splitting under high resolution of NMR show one doublets and one triplet. Identify the compound with the help of proper explanation.

(c) Describe in detail about conducting polymers with their applications.

(d) Write the mechanism and application of :

(i) Cannizzaro reaction

(ii) Diels-Alder reaction.

(e) What is boiler feed water? Discuss the problems created by using hard water in boiler.

Section-C

Attempt *all* questions of this Section. Each question carries 10 marks.

3. Attempt any two parts of the following : 10×5=50

(a) Draw molecular orbital diagram and calculate bond order for CO, C_2, O_2^+.

(b) What do you understand by liquid crystalline state? Discuss the classification of liquid crystals.

(c) What is meant by intermolecular and intramolecular H-bonding?

4. Attempt any two parts of the following : 5×2=10

(a) For a first order reaction, the rate constant is found to be 7.0×10^{-7} at 7°C and 9×10^{-4} at 57°C. Calculate the energy of activation of reaction. ($\log_{10} 7 = 0.8451$, $\log_{10} 9 = 0.9542$).

(b) What is electrochemical corrosion? Discuss the mechanism of electrochemical corrosion.

(c) What are concentration cells? Explain electrode concentration cells.

5. Attempt any two parts of the following : 5×2=10

(a) What is optical activity? Give stereoisomer of tartaric acid. How do you account for lack of optical activity in meso form and racemic mixture?

(b) Differentiate between $S_{N}1$ and $S_{N}2$ reactions.

(c) What is inductive effect ? Give any two examples where this effect is operative.

6. Attempt any two parts of the following : 5×2=10

(a) What is natural rubber? Discuss the vulcanization of rubber.

(b) In a polymer, there are 100 molecules of molecular weight 100, 200 molecule of molecular weight 1000 and 300 molecule of molecular weight 10000. Find out number average and weight average molecular weight and degree of polymerization.

(c) What are the differences between thermosetting and thermoplastic polymers?

7. Attempt any two parts of the following : 5×2=10

(a) What is fingerprint region? Write down the stretching frequency of corresponding to the structural units :

(i) OH

(ii) CO

(iii) CHO

(iv) C≡C.

(b) State zeolite process for the removal of hardness of water. Discuss its merits over sodalime.

(c) On burning 0.83g of a solid fuel in a bomb calorimeter, the temperature of 3500 g of water increased from 26.5. to 29.2°C. Water equivalent of calorimeter and latent heat of steam are 385.0 g and 587.0 cal/g respectively. If the fuel contains 0.7% hydrogen, calculate its gross and net calorific value.