



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

PAPER ID : 199221

Roll No.

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B. Tech.

**(SEM. II) THEORY EXAMINATION, 2014-15
ENGINEERING CHEMISTRY**

Time : 3 Hours]

[Total Marks : 100

SECTION-A

- I. Attempt all ten parts. Each part carries equal marks. 10×2=20
- (i) Name the main constituents of Portland Cement.
 - (ii) The density of NaCl is 2.163 g/cc. Calculate the edge of its cubic cell, assuming that four molecules of NaCl are present per unit cell.
 - (iii) Show the number of expected ¹H NMR signal and their splitting pattern in CH₃OCOCH₂CH₃ and HCOOCH₂CH₃
 - (iv) Why is a block of magnesium attached through an insulated metallic wire to the hull of the ship?
 - (v) On the basis of MO theory explain why hydrogen forms diatomic molecule while helium remains monatomic.
 - (vi) Why can human beings digest starch but cannot digest cellulose although both are made up of D- (+) - Glucose.
 - (vii) A sample of water contained 40.5 mg/L Ca(HCO₃)₂, 13.6 mg/L CaSO₄, 46.5 mg/L of Mg(HCO₃)₂ and 27.6 mg/L of MgSO₄. Calculate the temporary hardness in the given water sample.
 - (viii) Give two examples of initiators used for free radical polymerization.

- (ix) Why S_N2 reaction is accompanied by inversion of configuration?
- (x) Why the λ_{max} for the diene (I) is observed at a lower nm than (II)?



(I)



(II)

SECTION-B

2 Attempt any three parts of the following: $3 \times 10 = 30$

- (a) (i) What are stoichiometric and non-stoichiometric defects? Explain Frenkel and Schottky defects found in solids.
- (ii) Discuss the structure and applications of Fullerenes.
- (b) (i) What is meant by Tacticity? With suitable examples, explain Isotactic, Syndiotactic and Atactic polymers.
- (ii) How is Grignard reagent prepared? How will $\text{CH}_3\text{CH}_2\text{MgBr}$ react with HCHO , CH_3CHO and $(\text{CH}_3)_2\text{CO}$?
- (c) (i) Discuss the stereochemistry of Tartaric acid. What will happen if one of the $-\text{OH}$ group in tartaric acid is replaced by $-\text{NH}_2$ group. Draw all the probable stereoisomers for this new compound.
- (ii) What is Saytzeff's rule? Predict the major and minor products obtained by base catalyzed 1, 2- elimination of 2-Bromobutane and 2-Bromo-2-methyl butane.
- (d) (i) A water sample on analysis gives the following data (in mg/L):
- $\text{Mg}(\text{HCO}_3)_2 = 73$; $\text{CaSO}_4 = 68$;
- $\text{MgCl}_2 = 95$; $\text{MgSO}_4 = 12$;
- $\text{Ca}(\text{HCO}_3)_2 = 81$; $\text{NaCl} = 4.8$. Calculate the amount of Lime (90% pure) and Soda (85% pure) required for softening 20,000 liters of water.

- (ii) Explain the process of scale and sludge formation in boilers. How can this be prevented?
- (e) (i) How can corrosion be minimized by proper design?
- (ii) What are lubricants? Give the structure of graphite and explain its lubricating properties.

SECTION-C

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

- 3 Attempt any one part of the following: 5×10=50
- (a) What is Liquid crystalline state? Describe the various types of liquid crystals. Give the applications of liquid crystals.
 - (b) (i) Draw the molecular orbital diagram of CO and NO. Calculate their bond orders.
 - (ii) Derive Bragg's equation for the diffraction of X-rays by crystal lattice. The unit cell of an element of atomic mass 96 and density 10.3 g cm^{-3} is a cube with edge length of 314 pm. Find whether the structure of the crystal lattice is SC, BCC or FCC. (Avogadro's number is 6.023×10^{23} atoms mole^{-1})
- 4 Attempt any one part of the following:
- (a) Discuss the differences between Thermoplastic and Thermosetting polymers. Write a brief note on conducting polymers.
 - (b) Discuss the mechanism of the preparation of polypropylene using Ziegler-Natta catalyst. Give the preparation and applications of PTFE and Butyl rubber.
5. Attempt any one part of the following: (a)
- Giving examples explain optical isomerism shown by compounds without any chiral carbon. Draw all the possible stereoisomers for 1, 2 Dimethyl cyclopropane and 1, 3- Dimethyl cyclobutane. Comment on the optical activity of these stereoisomers.

- (b) (i) What are equivalent and non equivalent protons in NMR spectroscopy? A compound having molecular formula C_4H_9Br gave the following set of 1H NMR signals: δ 1.04 (6H, d); δ 1.95 (1H, m) and δ 3.33 (2H, d). Giving proper reasons suggest a structure consistent with the above data.
- (ii) For XY_2 bent molecule show various types of stretching and bending vibrations in IR spectroscopy. Discuss the significance of Finger print region.

6 Attempt any one part of the following:

- (a) Explain the terms Phase, Component and Degree of freedom. State the phase rule and discuss its application to water, vapour and ice system. Is it possible to have a quadruple point in one component system?
- (b) What do you understand by temporary and permanent hardness of water? Describe the zeolite process for removal of hardness from water. The hardness of 10,000 litres of water sample was removed by passing it through a zeolite softener. The zeolite softener then required 200 litres of sodium chloride solution containing 150 g/L of NaCl for regeneration. Calculate the hardness of water sample.

7 Attempt any one part of the following:

- (a) What are the characteristics of a good fuel? List the raw materials which can be utilized for biogas manufacture? Explain the stages involved in production of biogas from cattle dung.
- (b) Explain the mechanism of electrochemical corrosion of iron with absorption of oxygen. How can anodic and cathodic metallic coatings help in protection against corrosion?