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B.Tech.
(SEM II) EVEN SEMESTER EXAMINATION 2015-16
ENGINEERING CHEMISTRY

[Time: 3 hrs.] **[Max. Marks: 100]**

Note- Attempt All Questions. All Questions carry equal marks.

Q.1. Attempt any **TWO** parts of the following: **[10x2=20]**

(a) Discuss the salient features of molecular orbital theory of bonding. Calculate the bond order in B_2, N_2, O_2, F_2 and NO.

(b) Give the mechanism of S_N1 and S_N2 organic reaction. Consider the following reactions:

(i) $CH_3CH_2Cl + NaOH\ (aq) \rightarrow CH_3CH_2OH$
(ii) $(CH_3)_3CCl + NaOH\ (aq) \rightarrow (CH_3)_3COH$
Which of these reactions follows S_N1 and which the S_N2 reaction?

(c) State phase rule and explain the terms involved. Draw the phase diagram of the water system and explain the term triple point.

Q.2. Attempt any **FOUR** parts of the following: **[5x4=20]**

(a) What is corrosion? How will you protect an underground pipeline from corrosion by sacrificial anodic and impressed current cathodic protection methods?

(b) How will you distinguish between the isomers CH_3COCH_3 and CH_3CH_2CHO on the basis of NMR spectroscopy?

(c) 216 gm butadiene is copolymerized with 104 gm of styrene. What is the molecular formula of the copolymer?

(d) Calculate the gross and net calorific value of coal sample having the following composition: C=80%, H=7%, O=3%. S=3.5%, N=2.1% and ash=4.4%.

(e) State differences and between enantiomers and diastereoisomers with suitable examples.

(f) Calculate the density of a BCC crystal. Side of cube is 4 A^0, Avogadro's number = $6.023x10^{23}$ and M=60.

Q.3. Attempt any **FOUR** parts of the following: **[5x4=20]**

(a) Calculate the temporary and total hardness of a sample of water containing $Mg(HCO_3)_2$ = 9.3 mg/l, $Ca(HCO_3)_2$ = 17.4 mg/l, $MgCl_2$ = 8.7 mg/l, $CaSO_4$ = 12.6 mg/l.

(b) Explain the structure and applications of graphite & fullerene.

(c) Two isomeric dienes 'A' and 'B' having the molecular formula C_5H_8 absorb at λ_{max} 223 nm and λ_{max} 178 nm respectively. Write the structure of the two isomers.

(d) Derive Bragg's equation for X-ray diffraction by crystals.

(e) An optically active compound 'A' having molecular formula $C_6H_{12}O$ gives optically inactive compound 'B' on hydrogenation. Write the structure of 'A' and 'B'.

(f) What is Zieglar Natta catalyst? Give two examples. What is the significance of a catalyst in polymerization?

Q.4. Attempt any **TWO** parts of the following: **[10x2=20]**

(a) What is Liquid Crystal? Classify liquid crystals on the basis of order of molecules. Explain applications of Liquid Crystals.

(b) What is Plaster of Paris? Write the chemical composition of cement. Write the chemistry of setting and hardening of cement.

(c) Define the term lubricant. Discuss the mechanism of lubrication. Explain and discuss the significance of any two properties of lubricants.

Q.5. Attempt any **TWO** parts of the following: **[10x2=20]**

(a) What are organometallic compounds? Discuss the synthesis of Grignard Reagent. Give at least five reaction of Grignard Reagent.

(b) A sample of coal was analyzed as follows: Exactly 2.5 g was weighed into a silica crucible. After heating for 1 hour at 110 ^{0}C, the residue weighed 2.415 g. The crucible was then covered with a vented lid and strongly heated for exactly 7 minutes at 950 ^{0}C. The residues weighed 1.528 g. The crucible was then heated without the cover, until a constant weight was obtained. The last residue was found to weigh 0.245 g. (i) Calculate the percentage results of the above analysis. (ii) To which type of analysis does the above description belong? (iii) Why is the analysis so-named?

(c) How many NMR signals do you expect from each of the following compound? Indicate also the splitting pattern of the various signals.

(i) CH_3OCH_3 (ii) $CH_3OCH_2CH_3$ (iii) CH_3CH_2OH (iv) CH_3CHBr_2 (v) $HCOOCH_2CH_3$