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

PAPER ID : 1108   Roll No. | | | | | | | | | | |

B. Tech.

(SEM. I) ODD SEMESTER THEORY EXAMINATION 2013-14

ENGINEERING CHEMISTRY

Time : 3 Hours   *Total Marks : 80*

SECTION—A

1. Attempt **all** parts of this question :   **(2×8=16)**

    (a) Differentiate between bonding molecular orbital and anti bonding molecular orbital.

    (b) What is the difference between enantiomers and diastereomers ?

    (c) Explain why o-nitrophenol is steam voltatile whereas p-nitrophenol is not ?

    (d) Why phenol is more acidic than methanol ?

    (e) Define negative catalyst and catalytic poison with suitable example.

    (f) What are functioning materials ?

    (g) What is the effect of dilution on specific conductance ?

    (h) Why an underground iron pipe is connected through an insulated wire to a block of magnesium metal ?

SECTION—B

Attempt any **three** parts of this question :   **(8×3=24)**

2. (a) (i) What is MOT ? Draw the MO Diagram of O_2 molecule. Calculate the bond order of the following : O_2^+, O_2^-, O_2^{2-}.

(ii)   What is chirality ? How many optical isomers are possible in 2, 3, 4-trihydroxybutanal.

(b)   (i)   What is hyperconjugation ? Explain the relative stabilities of $1°$, $2°$ and $3°$ free radicals on the basis of hyperconjugation.

(ii)   What are nucleophilic substitution reactions ? Explain the mechanisms of SN^1 and SN^2 reactions along with their energy profile diagram.

(c)   (i)   What is activation energy ? Give its determination. Calculate the Ea for a first order reaction whose rate constant is tripled when the temperature of the reaction is increased from 30°C to 60°C.

(ii)   Explain the Zeolite process of water softening. Mention its merits and demerits also.

(d)   (i)   Give the preparation, properties and applications of following polymers :

        NBR, PET, NYLON-6.

(ii)   Predict the multiplicities of the signals in the proton NMR spectra of :

        $C_6H_5CH_3$, $CH_2=CHCl$, CH_3CH_2OH, $CH_3-CO-CH_3$.

(e)   (i)   What is chromatography ? Explain TLC in detail.

(ii)   What are the conditions for molecule to be IR active ? Discuss the various modes of vibrations in AB_2, non linear molecule.

SECTION—C

Attempt **all** questions of this section :   (8×5=40)

3. Attempt any **two** parts of the following :

 (a) What are conducting polymers ? Give their applications.

 (b) What is corrosion ? Write the mechanism of wet corrosion.

 (c) What are electrolytic cells ? How aluminium is extracted from alumina ?

4. Attempt any **two** parts of the following :

 (a) What is conformational analysis ? Discuss the conformations of n-butane along with its energy profile diagram.

 (b) What is hybridization ? Explain the geometries of $AlBr_3$ and TeF_6.

 (c) Explain how the absolute configuration of optical isomers is determined ?

5. Attempt any **two** parts of the following :

 (a) Complete the following reactions and write their mechanisms :

$$p\text{-}NO_2\text{-}C_6H_4\text{-}Br + OH^- \cdots\cdots\cdots\rightarrow$$
$$C_6H_6 + CH_3COCl + AlCl_3 \cdots\cdots\cdots\rightarrow$$

 (b) Derive the integrated rate equation for first order reaction. Show that half life period of first order reaction is independent of the initial concentration of the reactant molecule. A first order reaction is one fifth completed in 40 minutes. Calculate the time required for its 95% completion.

(c) Define catalysis. Explain five important industrial applications of catalytic reactions.

6. Attempt any **two** parts of the following :

   (a) What is hardness of water ? A sample of water on analysis was found to contain the following impurities :

   $Ca(HCO_3)_2$ = 40.5 ppm, $Mg(HCO_3)_2$ = 29.1 ppm, $CaCl_2$ = 11.1 ppm, $MgCl_2$ = 15.82 ppm.

   Calculate carbonate and non carbonate hardness.

   (b) What is alkalinity of a water sample ? Give its determination.

   (c) 50 ml of standard hard water (1.2 gm $CaCO_3$/L) requires 32 ml of EDTA solution. 100 ml of water sample consumes 14 ml of EDTA solution. 100 ml of boiled water sample consumes 8.5 ml EDTA solution. Calculate total, temporary and permanent hardness of water sample.

7. Attempt any **two** parts of the following :

   (a) What is H-Bonding ? Discuss various types of H-Bonding. Explain why alcohols are water soluble.

   (b) What is nanotechnology ? Write a note on nano materials.

   (c) A compound having molecular formula $C_4H_8O_2$ shows absorption bands at 1130 cm^{-1}, 1260 cm^{-1} and 1670 cm^{-1} in the IR spectrum. In 1H NMR spectrum it has three signals at δ 1.25 (t, 3 H), δ 2.03 (s, 3H) and δ 4.12 (q, 2 H). It gave negative test with $NaHCO_3$. Identify the compound.