QTD

2009

CHEMISTRY - II (Optional)

100073

Standard : Degree

Total Marks : 200

Nature : Conventional

Duration : 3 Hours

Note :

(i) *Answers must be written in* ***English.***

(ii) *Question* ***No. 1*** *is* ***Compulsory.*** *Of the remaining questions, attempt* ***any four*** *selecting one question from* ***each section.***

(iii) *Figures to the* ***RIGHT*** *indicate marks of the respective question.*

(iv) *Use of log table, non-programmable calculator is permitted, but any other table/code/reference book are not permitted.*

(v) *Make suitable assumptions, wherever be necessary and state the same.*

(vi) *Number of optional questions upto the prescribed number in the order in which they have been solved will only be assessed. Excess answers will not be assessed.*

(vii) *Credit will be given for orderly, concise and effective writing.*

(viii) *Candidate should not write roll number, any name (including their own), signature, address or any indication of their identity anywhere inside the answer book otherwise he/she will be penalised.*

(ix) *For each slab of 10 and 15 marks, the examinee is expected to write answers in 125 and 200 words respectively.*

1. Answer **any four** of the following questions :

(a) What product would be obtained from the hydroboration oxidation of $(CH_3)_2-C=CH_2$? Explain with a suitable mechanism. **10**

(b) Explain Fischer Indole synthesis with a suitable example along with the reaction mechanism. **10**

(c) What are nucleotides ? Draw the structures of bases that are present in DNA and RNA. **10**

(d) Explain how photochemical reactions occur and state Grothus - Draper law and Stark - Einstein law of photochemistry. **10**

(e) Write the products and mechanism of the reaction of $Na/NH_{3(l)}/C_2H_5OH$ with 2-butyne. **10**

P.T.O.

Marks

SECTION - A

2. (a) Discuss the hybridization of carbon in CH_4 and C_2H_2. What is the shape and bond angles of these molecules ? **10**

(b) (i) Write the structures of all the possible conformers of methyl cyclohexane. Indicate the most stable conformer with suitable explanation. **10**

(ii) Write the Fischer projection formula of 2-bromo-3-chlorobutane. Indicate the R and S configurations of all the possible stereoisomers and indicate their relationship with each other.

(c) What is Beer-Lambert's law ? Discuss the application of this law in UV spectroscopy. **10**

(d) An organic compound has the molecular formula $C_9H_{10}O$. Its IR spectrum contains bands at 1680 cm^{-1}, 3000 cm^{-1}, 1600 cm^{-1} and 1440 cm^{-1}. No absorption was observed at 2700 cm^{-1}. Its NMR spectrum shows the following. A triplet at 1.2 ppm, a quartet at 3.0 ppm and a multiplet at 7.4 – 8.0 ppm with integration ratio 3 : 2 : 5 respectively. Identify the compound with reasoning. **10**

3. (a) (i) Arrange the carbocations $CH_3CH_2^+$, $(CH_3)_3C^+$ and $(CH_3)_2CH^+$ in the increasing order of stability and justify your answer. What is the hybridization of C in CH_3^+ ? **10**

(ii) What is the reactive intermediate formed when 1-chloro-4-methyl benzene is treated with $NaNH_2$? The rate constant for the elimination reaction of 1-bromo-2-phenyl ethane is 7.0 times higher than that of the reaction of 2-bromo-1, 1-dideuterio-1-phenyl ethane. Explain why ?

(b) (i) A sample of (S) – (+) lactic acid was found to have an optical purity of 72%. What is the percentage of R isomer present in the sample ? **10**

(ii) Explain in detail any one method of resolution of enantiomers with a suitable example.

(c) An organic compound with molecular formula C_7H_6O shows a positive silver mirror test and it burn with a sooty flame. Its IR spectrum contains bands at 3080 cm^{-1}, 2760 cm^{-1}, 1735 cm^{-1}, 1615 cm^{-1} and 1500 cm^{-1}. Predict the structure of the molecule with suitable reasoning. **10**

(d) An organic compound has the molecular formula $C_5H_{10}O$. Its NMR spectrum contains the following peaks. 1.2 ppm (triplet) ; 2.5 ppm (quartet) with integration ratio 3 : 2. Identify the compound with suitable explanation of the spectral data. **10**

Marks

SECTION - B

4. (a) (i) Write the major product of the reaction of benzonitrile with nitric acid and small amount of sulphuric acid at high temperatures. Explain the reaction with a suitable mechanism. **10**

(ii) Discuss the mechanism of the reaction of benzoyl chloride with excess aniline.

(b) Discuss the mechanism of the acid catalysed pinacol - pinacolone re-arrangement. **10**

(c) Write the product of the following reaction cyclohexanone $\xrightarrow[\text{heat}]{H_2N-NH_2, KOH}$. **10**

Suggest a suitable mechanism for the reaction.

(d) What is the product of the following reaction ? **10**

Phthalimide + KOH + CH_3CH_2 CH_2CH_2 Br $\xrightarrow[\text{heat}]{H_2N-NH_2}$?

Explain the mechanism of the reaction.

5. (a) (i) Predict the product of the following reaction : **10**

$C_6H_5COOH + Na/NH_{3(l)} + C_2H_5OH \longrightarrow$?

Write the major steps of the reaction.

(ii) What is the product formed in the reaction

$H_3C-\overset{O}{\overset{\|}{C}}-Cl + Na-O-\overset{O}{\overset{\|}{C}}-C_6H_5$? Write the major steps of the reaction.

(b) Phenol is treated with K_2CO_3 at 150°C and under 100 bar pressure of CO_2. Suggest a mechanism for the reaction and predict the product. **10**

(c) How does CH_3CHO react with aq. NaOH at high temperatures ? Explain the reaction mechanism. **10**

(d) Aniline is treated with $NaNO_2$ / HCl at 5°C. Write the product of this reaction. The product is further treated with KI. What is the reaction ? Suggest the mechanism of the first reaction. **10**

Marks

SECTION - C

6. (a) What product is expected when 2 moles of $H_3C-\overset{O}{\overset{\|}{C}}-OC_2H_5$ are treated with $NaOC_2H_5$ in C_2H_5OH ? Write the mechanism of this reaction. **10**

(b) What are monosaccharides ? Explain their classification with suitable examples. Based on the structure, how is their configuration determined ? **10**

(c) What is condensation polymerization ? Explain the formation of polyesters and polyamides with suitable stoichiometric equations. **10**

(d) (i) Discuss the synthesis of Indigo dye. **10**

(ii) Write in brief any five principles of green chemistry.

7. (a) In the following conversion, **10**

$$C_2H_5O-\overset{O}{\overset{\|}{C}}-CH_2-\overset{O}{\overset{\|}{C}}-OC_2H_5 \xrightarrow[\text{(ii) } R-X]{\text{(i) } NaOC_2H_5} A \xrightarrow[\text{heat}]{H_3O^+} B$$

Identify A and B. Write the mechanism for the formation of A and B.

(b) Write a short note on disaccharides and polysaccharides. **10**

(c) Discuss the polymerization of ethylene in presence of R_3Al / $TiCl_4$ catalyst. **10**

(d) (i) Write a short note on the classification of synthetic dyes. **10**

(ii) Discuss the concept of 'Atom Economy' in green chemistry with a suitable example.

SECTION - D

8. (a) (i) State Kohlrausch's law of independent migration of ions. If the equivalent conductance at infinite dilution (λ_o) of HCl, NaCl and CH_3COONa are 426.16, 126.45 and 91.01 $ohm^{-1}\ cm^2\ eq.^{-1}$ respectively, calculate λ_o of CH_3COOH at the same temperature, 25°C. **10**

(ii) Discuss the Debye-Huckel theory of strong electrolytes.

(b) (i) An electrochemical cell is made of Standard Hydrogen Electrode (SHE) and a Ag / AgCl electrode. $E°\ Ag^+/Ag = 0.222$ V at 25°C. Write the half cell reactions at both the electrodes. **10**

P.T.O.

Marks

(ii) Calculate E° of the reaction $Cu^+ + e^- \longrightarrow Cu$, using the following E° values. (F = 96,500 Coulombs).

(1) $Cu^{2+} + e^- \longrightarrow Cu^+$ $\quad E_1^\circ = 0.153$ V

(2) $Cu^{2+} + 2e^- \longrightarrow Cu$ $\quad E_2^\circ = 0.337$ V

(c) (i) State any two postulates of quantum mechanics. **10**

(ii) Write the time independent Schrodinger equation. What information can be obtained from this equation ?

(d) (i) Give any three applications of computers in chemistry. **10**

(ii) State any two devices on which computer data can be stored. What is CPU of a computer ?

9. (a) (i) Discuss the conductometric titration of NaOH vs HCl with the suitable plot of titration. **10**

(ii) Discuss the Standard Hydrogen Electrode (SHE). Give one application of the electrochemical series.

(b) (i) The emf of the following cell **10**
Pt, H_2 (1 bar) | HCl (0.01M) | AgCl (s) | Ag is 0.2002 V at 25°C. Write the cell reactions. Calculate the free energy change (ΔG) of the overall cell reaction.

(ii) Discuss galvanic corrosion. Give any one method for its prevention.

(c) (i) Explain magnetic quantum number and spin quantum number. **10**

(ii) What is the significance of the wave function, ψ ? Write the expression for the possible stationary-state energies for a particle in a one dimensional box.

(d) (i) Write a brief note on molecular modelling. **10**

(ii) Give any one application of each of the following softwares. MS-Excel, MS-Power Point.

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