(ii) Conformations of n-Butane

(iii) Oxymercuration Demercuration Reaction

(iv) E1 and E2 Reactions (3×3=9)

[This question paper contains 8 printed pages.]

Your Roll No. .....

Sr. No. of Question Paper : 1550 **C**

Unique Paper Code : 42171103

Name of the Paper : Atomic Structure, Chemical Bonding, General Organic Chemistry & Aliphatic Hydrocarbons

Name of the Course : **B.Sc. (Prog.)**

Semester : I

Duration : 3 Hours Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Use separate answer booklet for each section.
3. Attempt all parts of a question together.
4. Use of calculator is allowed.

SECTION A

(Attempt any **THREE** *questions from Section A)*

1. (a) Write the time independent Schrodinger wave equation for hydrogen atom and define the terms involved in it.

(b) Melting points of NaCl and CuCl are 442°C and 800°C respectively. Justify.

(c) Predict the hybridization of NH_3, SO_4^{2-}, XeF_2.

(d) Draw the molecular orbital diagram for O_2 molecule. Predict its magnetic character.

(3,3,3,3.5)

2. (a) Write the Born-Lande expression for Lattice energy and define the terms involved in it.

(b) Bond angle in CH^4 is 109.5° whereas in NH3 the bond angle is 107.5°. Explain.

(c) Draw the radial probability distribution plots for 2s, 2p and 3p orbitals.

(d) Arrange the following in terms of increasing order of their lattice energy and Explain the order. LiF, CaF_2, MgS. (3,3,3,3.5)

(d) Explain why addition of HBr to propene in presence and absence of peroxide give different products. (3)

3. (a) Arrange the following in the order mentioned in parentheses with suitable reasons :

(i) CH_3^-, $(CH_3)_2CH^-$, $(CH_3)_3C^-$ (decreasing order of stability)

(ii) HCOOH, CH_3COOH, CH_3CH_2COOH (decreasing order of acid strength) (4)

(b) Why terminal alkynes are acidic in nature in comparison to alkanes and alkenes? How will you chemically distinguish a terminal and non-terminal alkyne? (3)

(c) What happens when 3-Methylbutene is subjected to hydroboration oxidation? Give the steps involved and name of the product formed? (2½)

(d) Write short notes on any **three** of the following :

(i) Mesomeric Effect and its Applications

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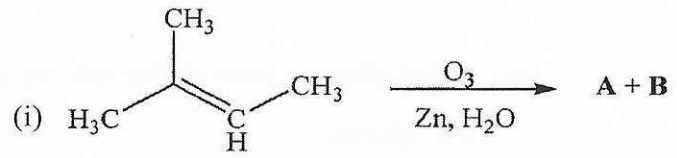
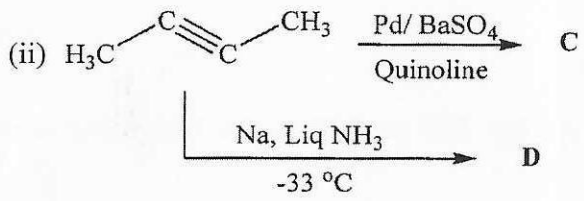
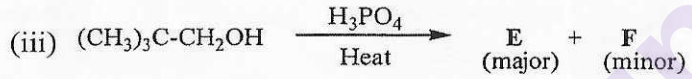
2. (a) Write the products of the following reactions :







(6)

(b) How many optical isomers are possible for 2,3-Dicholoropentane? Drawtheir Fischer projections and give the relationship between them. (6)

(c) What happens when propane is subjected to chlorine gas in presence of light? Predict the product(s) and give the mechanism involved.

(4)

3. (a) Arrange O_2, O_2^+, O_2^-, O_2^{2-} in the increasing order of their bond length.

(b) Arrange the following in the increasing order of their melting point and explain the order.

CaF_2, $CaCl_2$, $CaBr_2$ and CaI_2

(c) Calculate the wavelength of a line in the Balmer series of the hydrogen spectra that corresponds to an electronic transition from 4^{th} orbit. R = 109679 cm^{-1}.

(d) Calculate the lattice energy of KC1 using Bom-Haber Cycle

Sublimation energy of K(s) = 89 $KJmol^{-1}$, Ionization energy of K (g) = 425 $KJmol^{-1}$, Dissociation energy of Cl_2(g) = 244 $KJmol^{-1}$, Electron gain enthalpy for Cl(g) = –355 $KJmol^{-1}$ and heat of formation of KC1 (s) = –438 $KJmol^{-1}$.

(3,3,3,3.5)

P.T.O.

4. (a) Calculate the % ionic character in the HX molecule, if the dipole moment is 1.92D, bond length is $1.2A^0$ and charge on H is 4.8×10^{-10} esu.

(b) Draw the resonating structures of CO_3^{2-} and N_3^-.

(c) Write the complete electronic configuration of two transition metals exhibiting anomalous pattern.

(d) Write a short note on Fajan's rule. (3,3,3,3.5)

SECTION B

ORGANIC CHEMISTRY

(*Attempt any* **TWO** *questions from Section B*)

1. (a) Give reasons for the following :

(i) Cyclopentadienyl anion is aromatic while cyclopentadiene is not.

(ii) pka of nitroacetic acid is 1.68 while pk_a of acetic acid is 4.76.

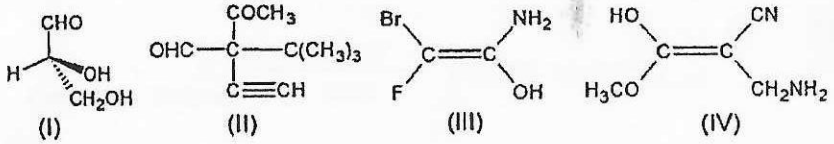
(iii) Benzyl carbocation is more stable than Isopropyl carbocation.

(iv) Trans alkenes have lower boiling point than cis alkenes.

(v) Racemic Mixture is optically inactive.

(1½×5=7½)

(b) Assign R/S or E/Z to the following compounds



(2×4=8)

(c) Carry out the following conversions :

(i) Propane to 2,3-Dimethyl butane

(ii) Propyne to Pent-2-yne (3)

P.T.O.