This question paper contains 6 printed pages.

Your Roll No. ....

Sl. No. of Ques. Paper	: **8292** **J**
Unique Paper Code	: **32175901**
Name of Paper	: **Atomic Structure, Bonding, General Organic Chemistry and Aliphatic Hydrocarbons**
Name of Course	: **Generic Elective : Chemistry**
Semester	: **III**
Duration	: **3 hours**
Maximum Marks	: **75**

(Write your Roll No. on the top immediately on receipt of this question paper.)

Use of Calculator is permitted.

Answer ***three*** *questions each from Section A and Section B.*

Please indicate the section you are attempting by putting a heading and do not intermix the Sections.

The question should be numbered in accordance to the number in the question paper.

SECTION – A

(INORGANIC CHEMISTRY)

Attempt any ***three*** *questions.*

Question No. ***1*** *is compulsory.*

1. (a) (i) Compare the valence bond and molecular orbital approaches to bonding.

(ii) Explain the geometry and hybridization in case of PF_5 molecule. Also give reason why all P-F bonds in PF_5 are not equivalent.

(b) Explain Fajan's rules. Using these rules, explain the relative ionic/covalent nature of the following pairs of molecules :

(i) LiI and CsI

(ii) CuCl and NaCl

(iii) $FeCl_2$ and $FeCl_3$.

(c) Draw the molecular orbital energy level diagram for nitric oxide molecule. Calculate its bond order. The NO molecule can readily lose an electron to form NO^+ ion. Explain this observation. 4½,4½,4½

2. (a) Why is it necessary to transform the Schrödinger's equation from the cartesian coordinates to polar coordinates? Explain the transformations of the coordinates involved.

(b) Calculate the percentage ionic character of the A-B bond given that the bond length is 127 pm and that the observed dipole moment is 1.03D. (Elementary charge, $e = 1.6 \times 10^{-19}$ C.)

(c) Justify which of the following orbitals are not feasible :

5f, *3g*, *2d*, *1p* 4,4,4

3. (a) Write the time independent Schrödinger's equation for the hydrogen atom explaining briefly the terms involved.

(b) Predict the type of hybridization of the central atom and shape of the following on the basis of valence bond theory:–

(i) CO_3^{2-}

(ii) XeF_4

(iii) ClF_3

(iv) IF_7.

(c) Write a short note on radial probability curves. Draw the radial probability distribution curves for the *3s*, *3p* and *3d* atomic orbitals. 4,4,4

4. (a) Write short notes on :

(i) Pauli's exclusion principle

(ii) Hund's rule of maximum multiplicity.

(b) Write the Born Lande's equation for the calculation of lattice energy. Explain the various terms involved in it.

(c) What are quantum numbers? Draw the shapes of *3d* orbitals indicating the sign of wave function. 4,4,4

SECTION – B

(ORGANIC CHEMISTRY)

Attempt any three questions.

Question No. 5 is compulsory.

5. Account for the following statement :

(a) Dipole moment of cis-1,2-dibromoethane is higher them trans-1,2-dibromoethane.

(b) Arrange the following in increasing order of acidic strength:

(i) *o*-Nitrophenol; *p*-Nitrophenol; *m*-Nitrophenol

(ii) Ethane; Ethyne; Ethene

(c) The Kharasch peroxide effect is observed only in HBr and not in HF, HCl and HI.

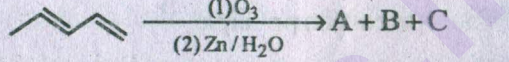
(d) Define Aromaticity. Cyclopentadienyl anion is aromatic while cyclopentadiene is not.

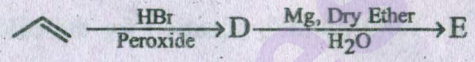
(e) Cycloalkanes exhibit Geometrical Isomerism.

(f) Allyl carbocation is more stable than vinyl carbocation.

2,3,2,3,2,1½

6. (a) Complete the following reactions :

(i) 

(ii) 

(iii) $H_3C-C\equiv C-CH_3 \xrightarrow[\text{Lindlar's Catalyst}]{H_2} F$

(b) A hydrocarbon C_6H_{12} decolorizes Br_2 solution, when dissolved in conc H_2SO_4 yields 2,2-dimethylbutane on hydrogenation and on ozonolysis gives formaldehyde and 2,2-dimethylpropanal. What is the structure of hydrocarbon? Give all the reactions involved. Also give the product obtained after the hydroboration oxidation of C_6H_{12}.

(c) How will you distinguish between 1-Butyne and 2-Butyne.

6,5,1

7. (a) Carry out the following conversions (any *two*) :

(i) 2-Bromopropane to 1-Bromopropane

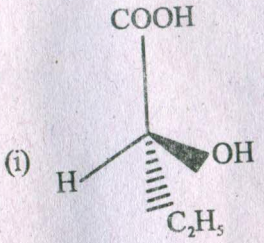
(ii) Propyne to Pent-2-yne

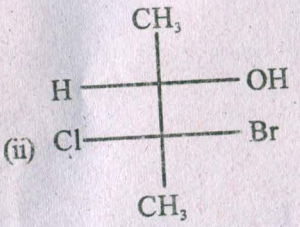
(iii) Propyne to Trans-but-2-ene.

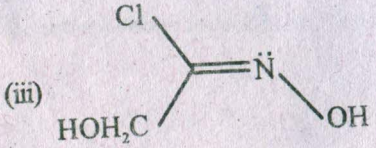
(b) Define Markownikov's Rule. Explain with suitable example.

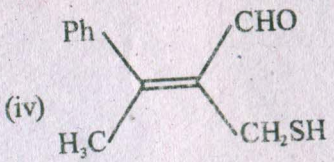
(c) Draw the Fischer projection of Erythro-3-bromobutan-2-ol and convert it into Newmann projection.

(d) Assign the absolute configuration :

(i) 

(ii) 

(iii) 

(iv) 

3,2,3,4

8. Write short notes on (any *three*) :

(a) Structure and stability of carbocation

(b) Conformations of *n*-Butane

(c) Oxymercuration and Demercuration

(d) Enantiomers and Diastereomers. 3×4