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[This question paper contains 6 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 7318

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Unique Paper Code : 42171103 – OC

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

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. Attempt any **three** questions from each Section.
3. Use separate Answer booklet for each section.

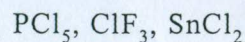
SECTION – A

1. (a) Electronic Configuration of Cu is $3d^{10} 4s^1$ and not $3d^9 4s^2$. Explain.

(b) What are some special properties which must be fulfilled by the acceptable solution of the wave equation?

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- (c) Though the radii of Ag^+ is comparable with the radii of K^+ , but the melting point of AgCl is much lower than that of KCl . Explain.
- (d) How Born Haber's Cycle can explain the stability of ionic compounds?
- (e) Explain why PCl_5 is more reactive than SF_6 Molecule. (2.5,2.5,2.5,2.5,2.5)
2. (a) Write Schrodinger's wave equation and explain various terms involved in it.
- (b) Explain why orbitals 1p, 2d or 3f are not possible?
- (c) Explain the stability of half-filled and fully-filled orbitals.
- (d) Plot radial probability distribution curves for 4s, 4p, 4d and 4f orbitals. (2.5,3,3,4)
3. (a) Observed dipole moment of HX molecule is 1.92 D and bond distance is 1.20 Å. Calculate the % ionic character of the molecule, HX .
- (b) Write the hybridization of the central atom and shape of the following molecules.



- (c) Draw the Molecular Orbital diagram for N_2 molecule.
- (d) Calculate the heat of formation ΔH_f of MgF_2 from its elements using Born-Haber's cycle with the given data.
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|--|-------------------------------|
| Sublimation Energy of Mg, (S) | = 146.4 kJmol ⁻¹ |
| Dissociation Energy of F_2 , (D) | = 158.9 kJmol ⁻¹ |
| Ionization Energy of Mg^{2+} (I) | = 2184.0 kJmol ⁻¹ |
| Electron Affinity of F(g) to F^- (E) | = -334.7 kJmol ⁻¹ |
| Lattice Enthalpy of MgF_2 (U_o) | = -2922.5 kJmol ⁻¹ |
| | (2.5,3,3,4) |
4. (a) Compare the covalent character in NaCl and CuCl by giving reason.
- (b) How does Molecular Orbital Theory account for the paramagnetic character in O_2 molecule?
- (c) Write the expression of Born-Landé equation and explain the terms involved in it.
- (d) Write short notes on :
- Heisenberg's Uncertainty Principle
 - Fajan's Rule
 - Solvation Energy (1.5,2,3,2×3)

SECTION - B

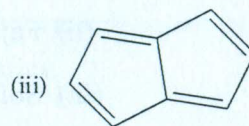
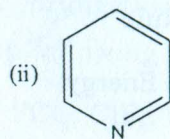
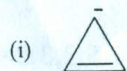
5. (a) Two isomeric hydrocarbons (A) and (B) have molecular formula C_4H_6 . Both compounds decolorize Br_2 in CCl_4 and react slowly with conc. H_2SO_4 . (A) forms precipitate with ammonical silver oxide and on oxidation yields propionic acid and CO_2 . Compound (B) does not produce any precipitate with ammonical silver oxide but on oxidation gives oxalic acid and CO_2 . Suggest the structural formulae for (A) and (B).

(b) Explain relative stabilities of primary, secondary and tertiary carbanion with suitable examples.

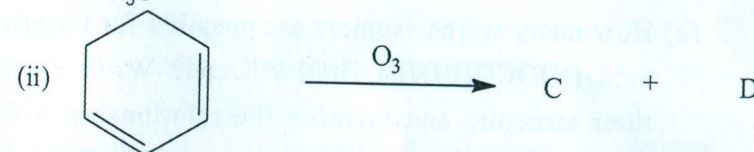
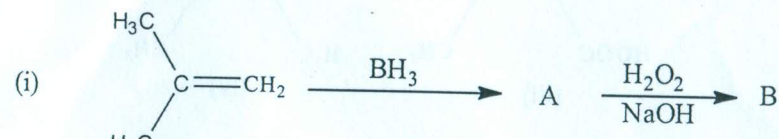
(c) An aqueous solution of tropylium bromide on treatment with silver nitrate yields precipitate of silver bromide. How will you account for this observation?

(d) The boiling point of n-alkanes increases as the molecular mass increases. Explain. (4.5,3,3,2)

6. (a) What is Huckel's rule of aromaticity? Which of the following are aromatic, non-aromatic or anti-aromatic.



(b) Complete the following reactions and identify A, B, C and D



(c) What does conformation mean? Draw Boat and Chair conformations for cyclohexane. Giving reasons state which one is more stable of the two. (4.5,4,4)

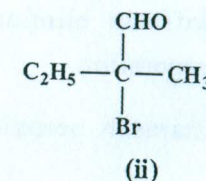
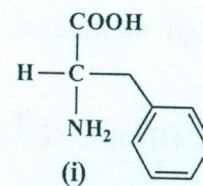
7. (a) Differentiate between the following (any two) :

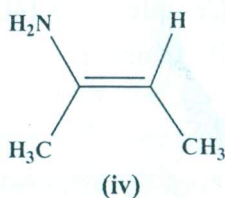
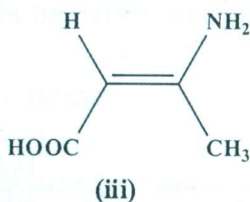
(i) Homolytic and Heterolytic fission

(ii) Resonance and hyperconjugation

(iii) Inductive and Electromeric Effect

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





- (c) How many stereo-isomers are possible for tartaric acid $\text{HOOCCH(OH)CH(OH)COOH}$? Write down their structure and mention the relationship with respect to each other. $(2 \times 2, 1 \times 4, 4.5)$
8. (a) Which of the following species behave as a nucleophile, an electrophile, both or neither:
 I^- , H_3N , BeCl_2 , CH_4 , Cr^{3+} , $\text{CH}_3\text{C}\equiv\text{N}$, H_2 , SnCl_4 , $\text{H}_2\text{C}=\text{O}$ and NO^{2+}
- (b) Why is Wurtz synthesis not a good method for preparing propane?
- (c) Write short notes on the following (**any three**):
- (i) β Elimination reaction
 - (ii) Koble's electrolysis method
 - (iii) Hoffman elimination method for alkene preparation
 - (iv) Kharasch peroxide effect $(2.5, 2.5, 2.5 \times 3)$