[This question paper contains 4 printed pages.]

5756 *Your Roll No.* .....

B.Sc. (H) CHEMISTRY / I Sem. **B**

Paper – CHHT – 101

(Inorganic Chemistry – I)

(Admissions of 2010 and onwards)

Time : 3 Hours *Maximum Marks : 75*

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

Attempt **six** *questions in all. Question No.* **1** *is compulsory and carries* **15** *marks. All other questions carry* **12** *marks each.*

1. Attempt any **five** questions : (5×3=15)

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(a) Explain why ? Boron has oxidation state +3 whereas Tl has +1 though both belong to same group. (3)

(b) First Ionization Energy of Al is less than Mg but reverse is true for second Ionization Energy of Al. (3)

(c) How Cartisan coordinates are related to Polar coordinates ? Give relevant diagram. (3)

(d) Draw the radial probability distribution curves for 4s, 3d and 4d. (3)

(e) List the main drawbacks of Bohr's Theory of Atomic Structure. Explain how these were overcome ? (3)

P.T.O.

(f) Explain why positive ions are smaller than neutral atom but negative ions are larger in size. (3)

2. (a) Electron Capture Enthalpy Values of noble gases are taken as zero, why ? (4)

(b) What is the physical significance of ψ & ψ^2 ? (4)

(c) Explain why Ist Electron Capture Value for oxygen atom is –ve while IInd Enthalpy Value is +ve ? (4)

3. (a) Calculate 2* for 3d & 4s electrons in Copper (At No. 29). (4)

(b) Calculate ionic radii for Na^+ & F^-. The internuclear distance in NaF is 231 pm. (4)

(c) Draw the radial function plots for 2s, 2p and 3s & 3p orbitals. (4)

4. (a) Select from each group of species having smallest size and justify your answer.

(i) O, O^-, O^{2-} (ii) K^+, Sr^{2+} & Al (4)

(b) Which of the elements Na, Mg Si & P will have the greatest difference in Ist Ionization Energy & IInd Ionization Energy. (4)

(c) If the electron shifts from n = 6 to n = 1 and n = 5 to n = 2, what will be the wave lengths of these two lines (Approximately). (4)

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5. Attempt any **four** questions :

(a) Electronegative Values for Sn & Cl are 1.8 & 3.0 respectively. Predict the nature of bond between the two. (3)

(b) Comment upon the bond angles of the following sets of compounds & explain the trends (Any **two**)

(i) H_2S, H_2O, H_2Se, H_2Te

(ii) NH_3 & NF_3

(iii) OF_2 & H_2O (3)

(c) What is diagonal relationship and explain it with the help of two examples. (3)

(d) What is de Broglie equation and how does this equation proves one of Bohr's postulates

$$mvr = \frac{nh}{2\pi}.$$ (3)

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(e) What are the mathematical expressions for normalized and orthogonal wave functions ? (3)

6. (a) F is more electronegative than Cl but Cl has higher value of electron Capture Enthalpy ? (4)

(b) Explain the significance of Heisenbergs Uncertainty Principle for micro & macro particles. (4)

(c) Apply Hinds rule of Maximum Multiplicity for Oxygen and Nitrogen atoms' electronic configurations. (4)

7. (a) What are degenerate orbitals and comment upon the degeneracy of 3s, 3p & 3d for Hydrogen atom and Multielectrons systems. (4)

(b) Why Half filled & fully filled orbitals are more stable, explain ? (2)

(c) Write Schrodinger equation for single electron system & explain various terms involved in it. (3)

(d) Write two exceptions to Aerfbav Principle & explain. (3)

8. (a) Draw the shapes of 3 dxy and $dx^2 - y^2$ and give all the values of n, l & m for these orbitals. (3)

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(b) What are the conditions imposed on wave function ψ, in order to solve the Schrodinger's equation. (3)

(c) Discuss main features of S-Block & p-Block elements in the periodic Table with respect to ionization energy and electron affinity. (3)

(d) Calculate the bond length of HF molecule from the following data :

$$\gamma_H = 0.37 \text{ Å} ; \quad \gamma_F = 0.72 \text{ Å}$$
$$X_H = 2.1 ; \quad X_F = 4.0$$

Take into the account the difference in the electronegativity of wo atoms in HF molecule. (3)

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5757

B.Sc. (Hons.) CHEMISTRY/I Sem. **B**

Paper—CHHT-102 : Organic Chemistry—I

(Admission of 2010 and onwards)

Time : 3 *Hours* *Maximum Marks* : 75

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

Answer *six* questions in all. Question number 1 is compulsory.

1. (*a*) Arrange the following in the increasing order of the basic strength. Give reasons for your answer.

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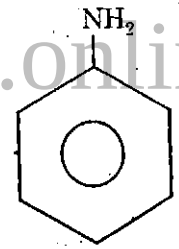
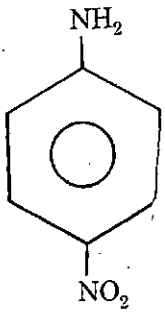
(*i*)



(*ii*)



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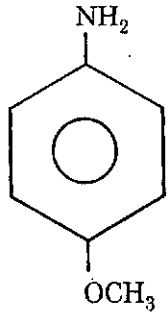
(*iii*) 

(*b*) Write the structural formula of (S), (E)-2-Bromo-3-heptene.

(*c*) Identify A, B and C in the following sequence and write their structures with E|Z or R|S configurations.

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$$CH_3C \equiv CH \xrightarrow[(ii)\ CH_3Br]{(i)\ NaNH_2} A \xrightarrow{H_2/Pd(CaCO_3)} B \xrightarrow{\text{dil. } KMnO_4} C$$

3, 4, 8

2. (*a*) Arrange the following in the increasing order of stability. Give reasons for your answer :

(*i*) $(CH_3)_3C^{\oplus}$

(*ii*) $(CH_3)_2\overset{\oplus}{C}H$

(*iii*) $CH_3\overset{\oplus}{C}H_2$

(*iv*) $\overset{\oplus}{C}H_3$

(*b*) Draw the Newman Projection formulae for the chair and boat conformations of cyclohexane and explain giving reasons, which conformation is most stable.

(*c*) The C—O bond lengths in formic acid are 1.23Å and 1.36 Å but both bonds in sodium formate are 1.27 Å. Explain. 4,4,4

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3. How will you prepare the following ? Attempt any *three* :

(*a*) *m*-Bromobenzoic acid from benzene

(*b*) 2, 3-Dimethyl butane from propane

(*c*) 1-Bromo-2-methyl propane from 2-bromo-2-methyl propane.

(*d*) Butanone-2 from ethyne. 4×3=12

4. (*a*) Write the Fischer's projections for all the possible stereoisomers of 2, 3 dibromobutane. Indicate which of

these are optically active and how they are related to each other. Write R|S configuration of any *one* of them.

(*b*) Although *p*-hydroxybenzoic acid is less acidic than benzoic acid, salicylic acid (*o*-hydroxybenzoic acid) is 15 times more acidic than benzoic acid. 7, 5

5. Write down the product(s) obtained. Attempt any *three* :

(*a*) When propene is treated with bromine in the presence of sodium iodide. Explain with mechanism.

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(*b*) Although chlorine deactivates the benzene ring. Yet it is ortho - and para - directing. Explain.

(*c*) What happens when 2-methylpropene is treated with 2-methylpropane in acidic medium ? Explain the reaction.

(*d*) Explain with mechanism the product(s) obtained when butene-1 is treated with HBr in presence of peroxides. 4×3=12

6. Explain any *three* of the following :

(*a*) Aromatic character is observed in 1, 3 cyclopentadienyl anion but not in 1, 3 cyclopentadiene.

(*b*) Mixture of 3-bromo-2,2-dimethyl butane and 2-bromo-2,3 dimethylbutane is obtained when HBr adds to 3,3 dimethyl-1- butene.

(*c*) Meso-2, 3 dibromobutane is obtained when bromine adds to trans-2-butene.

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(*d*) Chlorine is more reactive while bromine is more selective in halogenation of alkanes. 4×3=12

7. Write short notes on any *two* of the following :

(*a*) Friedel Craft s Reaction

(*b*) Wurtz-Fittig reaction

(*c*) Resolution of racemic mixtures by the diastereomeric salt formation. 6×2=12

8. Complete the following reactions and identify A, B and C :

(*a*) $CH_3CH_2CH{=}CH_2 \xrightarrow{B_2H_6} A \xrightarrow[NaOH]{H_2O_2} B$

(*b*) $CH_3C{\equiv}CH \xrightarrow[HgSO_4]{\text{dil. } H_2SO_4} A$

(*c*) $CH_3CH_2CH_2CH{=}CH_2 + CHBr_3 + \text{peroxide} \longrightarrow A$

(*d*) $CH_3CH{=}CH_2 \xrightarrow{Cl_2,\ 500°C} A$

(*e*) $CH_3CH{=}CHCH_2CH{=}CH_2 \xrightarrow{(i)\ O_3;\ (ii)\ Zn, H_2O} A + B + C$

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12=1½ (marks for each)