[This question paper contains 4 printed pages.]

Sr. No. of Question Paper : 6010 **D** **Your Roll No.....**

Unique Paper Code : 217301

Name of the Course : **B.Sc. (H) Chemistry**

Name of the Paper : CHHT 305, Inorganic Chemistry – II

Semester : III

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 **Five** questions.
3. **All** questions carry equal marks.

1. (a) Why are ionic crystals hard and brittle while metals are hard, malleable and ductile. (4)

   (b) Derive Born- Lande equation for calculating the Lattice energy of ionic crystals. Explain the various terms involved in the equation. (5)

   (c) Which one will have high Lattice energy and why ? NaCl or CsCl (If both adopt same crystal structure). (2)

   (d) Calculate the value of Madelung constant A for MgO using Born-Lande equation.

   $r = 2.1 \times 10^{-8}$ cm, $n = 7$, $N = 6.023 \times 10^{23}$, $U = -3940 \times 10^{10}$ ergs/mol, $e = 4.8 \times 10^{-10}$ esu (4)

2. (a) Using M. O. Theory, explain why B_2 is paramagnetic and C_2 is diamagnetic. (6)

P.T.O.

(b) $BaSO_4$ is ionic in nature but insoluble in water, while sugar although covalent is soluble in water. (4)

(c) The bond distance in HF is 0.917×10^{-10} m. Find out the % ionic character, given that the observed dipole moment of the molecule is 6.6×10^{-30} Coulomb.meter. (electronic charge = 1.602×10^{-19}Coulomb). (5)

3. (a) $[BF_4]^-$ is tetrahedral while $[BrF_4]^-$ is planar. Explain. (4)

(b) The bond angle of $NH_3 > NF_3$ while the bond angle of $PF_3 > PH_3$. Explain. (4)

(c) All three N-O bond lengths in NO_3^- (nitrate ion) are equal. Explain. (3)

(d) Using VSEPR theory, predict the geometry of the following species :

SO_4^{2-}, SF_4, XeO_3F_2, CO_3^{2-} (4)

4. (a) $PC1_3$ is a Lewis base and not a Lewis acid, while PCl_5 is a Lewis acid and not a Lewis base. Explain. (4)

(b) Write and explain the following molecules in the decreasing order of basicity, methylamine, pyridine and methylcyanide. (5)

(c) Arrange the molecules by giving reason in the order of decreasing acidic strength.

H_2SO_3, H_2SeO_3, H_2TeO_3 (2)

(d) Does urea behaves as a base or an acid in water medium ? What will be its behaviour, when dissolved in liquid ammonia. (4)

5. (a) Distinguish between any **two** of the following with examples :

(i) Intermolecular and intramolecular hydrogen bonding.

(ii) Equivalent and Non-equivalent hybrid orbitals.

(iii) Ionic and covalent bond. (6)

(b) Explain HSAB principle and what are its applications. (4)

(c) What is Bent's rule ? Using this rule explain which of the following is more stable.

PCl_3F_2 or PF_3Cl_2 (5)

6. (a) Using Band theory, explain why some substances are electrical conductors while others are not. (6)

(b) Why is doping done in semi conductors ? (5)

(c) Find the electron gain enthalpy of sodium chloride using following data.

Enthalpy of formation = –381 kJ/mol

Lattice energy = –757 kJ/mol

Ionisation energy = 496 kJ/mol

Dissociation energy (Cl_2) = 242 kJ/mol

Sublimation energy = 108 kJ/mol (4)

7. (a) Write short notes on any **two** :

(i) Stoichiometric defects

(ii) Resonance and resonating energy

(iii) Limitations of Radius ratio rules (8)

P.T.O.

(b) Which will be more ionic and why ?

(i) $FeCl_2$, $FeCl_3$

(ii) $CaCl_2$, $HgCl_2$ (5)

(c) Calculate the formal charge on nitrogen in NH_4^+. (2)