

[This question paper contains 4 printed pages.]

Sr. No. of Question Paper : 6010

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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.

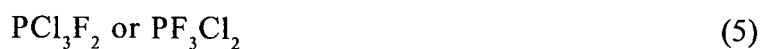
$$r = 2.1 \times 10^{-8} \text{ cm}, n = 7, N = 6.023 \times 10^{23}, U = -3940 \times 10^{10} \text{ ergs/mol},$$
$$e = 4.8 \times 10^{-10} \text{ esu} \quad (4)$$

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) $[\text{BF}_4]^-$ is tetrahedral while $[\text{BrF}_4]^-$ is planar. Explain. (4)
- (b) The bond angle of $\text{NH}_3 > \text{NF}_3$ while the bond angle of $\text{PF}_3 > \text{PH}_3$. 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) PCl_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 methylocyanide. (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.



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

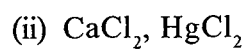
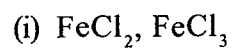
Ionisation energy = 496 kJ/mol

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)

(b) Which will be more ionic and why ?



(5)

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

(2)