

[This question paper contains 2 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 6475

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Unique Paper Code : 2174001001

Name of the Paper : GE: Atomic Structure and Chemical Bonding

Name of the Course : **B.Sc. (Hons.)**

Semester : II/IV/VI

Duration : 2 Hours

Maximum Marks : 60

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. **All** questions carry equal marks.
3. Attempt any **Four** questions in all.
4. Use of scientific calculator is allowed.

1. Explain any five of the following:

(3 x 5= 15)

- (a) MgO has higher lattice energy than NaCl.
- (b) First ionization energy of Al is less than Mg, but second ionization energy of Al is greater than Mg.
- (c) Why orbitals like 2d and 3f are not possible.
- (d) NH_3 has greater bond angle as compared to NF_3 .
- (e) NaCl has higher melting point than CuCl.
- (f) BeCl_2 has zero dipole moment while H_2S has some value.

2. (a) Draw the molecular orbital diagram of C_2 and determine its bond order.

(b) Explain azimuthal quantum number. Give the values of all four quantum numbers for 2p and 3d orbitals.

(c) Define dipole moment. Arrange the following in increasing order of dipole moment and explain: HF, HCl, HBr and HI (5, 5, 5)

3. (a) Based on VSEPR theory predict the geometry and hybridization of PCl_5 and NH_3 .

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- (b) Give the application of lattice energy. Calculate the heat of formation of CsF from its elements using the Born-Haber cycle with the following data:

Lattice enthalpy of CsF = $+740 \text{ kJ/mol}^{-1}$

Heat of sublimation of Cs = $+76.1 \text{ kJ/mol}^{-1}$

Ionisation enthalpy of Cs = $+357.7 \text{ kJ/mol}^{-1}$

Electron gain enthalpy of F = -328 kJ/mol^{-1}

Dissociation energy of F_2 = $+158 \text{ kJ/mol}^{-1}$

- (c) i) Differentiate between MOT and VBT.

ii) Differentiate between lattice energy and solvation energy. (5, 5, 5)

4. (a) Calculate the percent ionic character of LiF having a bond length of 156 pm and a dipole moment of 6.32D.

(b) What is the significance of de-Broglie equation. Give the mathematical expression of normalized and orthogonal wavefunction.

(c) Draw the radial probability of distribution curve of 2s, 3p and 4d. (5, 5, 5)

5. (a) Give the limitation of valence bond theory (VBT). Give the shapes of p-orbitals.

(b) Write down properties of acceptable wave function.

(c) Arrange the following in terms of increasing order of their melting point and explain: LiCl, NaCl, KCl, RbCl, CsCl (5, 5, 5)

6. Write Short notes on any three of the following:

(a) Radial Probability Distribution

(b) Bonding and Antibonding Molecular Orbital

(c) VSEPR Theory

(d) Aufbau Principle (5, 5, 5)