

Time: 2 Hours

Marks: 50

1. Attempt ANY TWO of the following.
- Draw a molecular orbital diagram for triiodide ion and explain its structure and bonding. 5
  - What is  $sp^3d$  hybridisation? Explain with suitable example. 5
  - What are ion-dipole and dipole-dipole interactions? Give suitable examples. 5
  - Derive the wave functions for the hybrid orbitals of beryllium dichloride molecule. 5
2. Attempt ANY TWO from the following.
- Draw molecular orbital diagram for methane molecule on the basis of SALC. 5
  - State and explain great Orthogonality theorem with suitable example. 5
  - Discuss the criteria for a set of elements to form a group by giving suitable example. 5
  - What are Abelian and Non-Abelian point group? Explain with examples. 5
3. Attempt ANY TWO of the following
- Give structural features of fluorite and antiferite solids. Mention coordination number of ions in it. 5
  - Discuss in detail, biological method of preparation of nanomaterials. 5
  - What are types of LASERS? Describe the principle of solid-state lasers. 5
  - Write a note on, 'Application of Band theory in conductivity of solids' 5

4. Attempt ANY TWO of the following:
- i) Explain in brief, determination of stability constant by spectrophotometric method. 5
  - ii) Schematically represent the stepwise and overall formation constant for metal complexes. 5
  - iii) Write a note on 'Racah Parameters'. 5
  - iv) Draw the Orgel diagram for  $d^1$  configuration in weak octahedral environment. Assign the electronic transitions. 5
5. Attempt ANY FIVE of the following 10
- i) Draw the resonating structures of carbonate ion.
  - ii) Explain the concept of hydrogen bonding with reference to water molecule.
  - iii) Draw group multiplication table for water molecule
  - iv) What are symmetry operations and symmetry elements? State the examples.
  - v) Define the terms: 1. First Brillouin zone 2. Fermi Energy.
  - vi) State any four applications of solid-state lasers.
  - vii) Give any four applications of ESR in Inorganic chemistry.
  - viii) List important methods for detection of complex formation.

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