

(2½ Hours)

[Total Marks : 60

- N.B. (1) All questions are compulsory.**
(2) Figures to the right indicate full marks.

1. (a) Attempt any two of the following :-
- (i) On the basis of the concept of hybridization, derive the wave function for the hybrid orbitals formed in the molecule of BF_3 . 4
 - (ii) What are electron deficient species ? Describe the LCAO-MO approach in diborane. 4
 - (iii) Discuss : (1) Ion-dipole interaction. 4
(2) London forces.
 - (iv) Define magnetic susceptibility. How is it determined by the Faraday's method. 4
- (b) Attempt any one of the following :-
- (i) Obtain the wave functions for the hybrid orbitals of Beryllium dihydride molecule. 4
 - (ii) With respect to Molecular Orbital Theory, discuss the formation of triiodide ion. 4
2. (a) Attempt any two of the following :-
- (i) Construct a character table for D_{2h} point group. 4
 - (ii) Explain the systematic procedure for symmetry classification of molecules. 4
 - (iii) On the basis of group theory explain the sigma and pi-bonding in AB_4 tetrahedral molecule. 4
 - (iv) Obtain matrix representation for Proper Rotation operation. 4
- (b) Attempt any one of the following :-
- (i) What is irreducible representation ? State the properties of irreducible representation. 4
 - (ii) Discuss the optical activity in a molecule by applying the concept of group theory. 4
3. (a) Attempt any two of the following :-
- (i) Describe four examples of direct utilization of solar energy. 4
 - (ii) Explain the biochemical effects, toxicology and toxicity of Cadmium. 4
 - (iii) Give the treatment and control measures for Lead poisoning. 4
 - (iv) Explain : "Hydropower can be used to generate electricity." 4
- (b) Attempt any one of the following :-
- (i) How does mercury poisoning manifest itself in human being ? 4
 - (ii) Discuss the somatic and genetic effect of radioactivity on human being. 4

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4. (a) Attempt any two of the following :-
- (i) Explain the conversion of atmospheric nitrogen into ammonia by Nitrogenase. 4
 - (ii) Discuss the cooperative binding of oxygen to haemoglobin with the help of Hill equation and Hill plot. 4
 - (iii) Describe the transport of metal ions across the cell membrane by Valinomycin. 4
 - (iv) Explain the mechanism of catalysis by Superoxide Dismutase in biological system. 4
- (b) Attempt any one of the following :-
- (i) Give the mechanism of action of cis-platin as an anticancer drug. 4
 - (ii) Discuss the steps involved in the reaction catalysed by Cytochrome P-450. 4
5. Attempt any four of the following :- 12
- (a) Density of ice is less than that of water. Explain.
 - (b) Discuss Curie, Curie – Weiss Law for antiferromagnetic substance.
 - (c) Explain non-abelian point group with a suitable example.
 - (d) Describe the subgroups for C_{2v} point group.
 - (e) Give the environmental impact and control measures of oil shales.
 - (f) Explain – “Hexavalent chromium is found to be more toxic than the trivalent chromium.”
 - (g) Write a note on Hydrogenases.
 - (h) Explain the role of any three metal compounds as medicines.
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