

## INORGANIC CHEMISTRY-I

(Common with B.Sc. & B.Sc. Biotechnology,  
Industrial Microbiology)  
Semester-V

Time Allowed : 3 Hours]

[Maximum Marks : 35

**Note :** The candidates are required to attempt *two* questions each from Section A and B carrying 7 marks each and the entire Section C consisting of 7 short answer type questions carrying 1 marks each.

### Section - A

1. What is Crystal Field theory? What are its limitations? How does this theory account for the fact that  $[\text{CoF}_6]^{3-}$  is paramagnetic but  $[\text{Co}(\text{NH}_3)_6]^{3+}$  is diamagnetic though both are octahedral? 2+3+2
  2. (a) Discuss the basic postulates of valence bond theory. 4  
(b) Draw and discuss the hybridization in  $[\text{Cu}(\text{NH}_3)_4]^{2+}$  using valence bond theory. 3
  3. Consider the d-orbital in octahedral field, answer the following questions :
    - (a) Which d-orbitals lie along the x, y or z-axes, and which lie between any two axes? 1
    - (b) Which d-orbitals experience direct head-on interactions with the ligands? 1
    - (c) Which orbitals do not experience a direct head-on interaction with the ligands? 1
    - (d) Divide the five d-orbitals into two sets, the strong-interacting set and the weaker-interacting set with ligands in octahedral field. 1
    - (e) Given that the ligands are negative charges and the d-orbitals have electrons in them, which set d-orbitals are higher in energy? 1
    - (f) What is significance of barycenter? Draw an approximate energy level diagram of the d-orbitals in the field of the six ligands in octahedral geometry. 2
  4. Discuss the substitution reactions in square planar complexes. Why are Ni(II) and Pd(II) square planar complexes more labile than square planar complexes of Pd(II)? 7
- ### Section - B
5. Explain the phenomenon of quenching of orbital angular momentum. What are its implications? 7
  6. What are selection rules in electronic transitions? Explain the various selection rule for d-d transitions. 7
  7. Explain the origin of paramagnetism and diamagnetism. Discuss the Guoy's method for the measurement of magnetic susceptibility. 7
  8. (a) What is spectrochemical series? Explain the significance of the series. 3  
(b) Write the ground term for  $d^2$  configuration. Draw the Orgel diagram for  $d^2$  configuration in octahedral symmetry and show the possible electronic transitions. 4

Section - C

9. Short type questions :

- (a) Why d-d transitions are weaker in octahedral complexes compared to tetrahedral complexes?
- (b) Write hybridization in  $[\text{Co}(\text{NH}_3)_6]^{3+}$  and  $[\text{CoCl}_4]^{2-}$  using valence bond theory. Which of these is inner orbital complex?
- (c) State Curie-Weiss law.
- (d) What is Lande splitting factor?
- (e) Differentiate between term and configuration taking suitable example.
- (f) Define crystal field stabilization energy.
- (g) Calculate the spin only magnetic moment of  $\text{V}^{2+}$  ion.

1×7=7