

Roll No. ....

Total Pages : 4

**GSQ/D-21**

**1071**

**CHEMISTRY**

(Inorganic Chemistry)

Paper-XV-CH-301

Time : Three Hours]

[Maximum Marks : 32

**Note :** Attempt *five* questions in all, selecting *two* questions from each Section. Q. No. 1 is compulsory.

**Compulsory Question**

1. (a) Why anhydrous  $\text{CuSO}_4$  is colourless ?
- (b) The d-orbitals which participate in  $d^2sp^3$  hybridization are ..... and .....
- (c) CFSE for tetrahedral field is always ..... than that for octahedral field.
- (d)  $\log \beta$  is a measure of ..... of the complex.
- (e) In low spin octahedral complex  $\text{K}_4[\text{Cr}(\text{CN})_6] \cdot 3\text{H}_2\text{O}$ , Cr has ..... configuration.
- (f)  $d-d$  transitions in an octahedral complex are Laporte .....  
.....
- (g)  $\text{In}^{2s+1}L_J$ , J is .....
- (h) Pt-halogen bond is ..... labile than Pt-nitrogen bond. (1×8=8)

## SECTION-A

2. (a)  $[\text{Cr}(\text{NH}_3)_6]^{+3}$  is paramagnetic while  $[\text{Ni}(\text{CN})_4]^{-2}$  is diamagnetic. Explain why ? 2
- (b) On the basis of crystal field theory, explain why  $[\text{Ti}(\text{H}_2\text{O})_6]^{+3}$  is coloured ? 2
- (c) Calculate CFSE for  $d^6$  tetrahedral complex. Show the number of unpaired electrons also. 2
3. (a) Why is the magnitude of crystal field splitting in tetrahedral complexes ( $\Delta_t$ ) smaller than in octahedral complexes ( $\Delta_o$ ). 2
- (b) In case of  $d^5$  electronic configuration in an octahedral complex, if  $\Delta_o < P$ , then what type of complex will it be ? 2
- (c) What is the effect of oxidation state of metal ion on crystal field splitting ? Give example. 2
4. (a) Give synthesis of three isomers of  $[\text{Pt}(\text{NH}_3)(\text{Py})(\text{Br}) \text{I}]$  starting from  $[\text{Pt}(\text{Cl})_4]^{-2}$ . 2
- (b) Write an expression for the stability constant,  $\beta_n$  for the complex  $[\text{Cu}(\text{NH}_3)_4]^{+2}$  ion.  $1\frac{1}{2}$
- (c) Which is more stable complex and why :  $[\text{Ni}(\text{en})_3]^{+2}$  or  $[\text{Ni}(\text{NH}_3)_6]^{+2}$ ?  $1\frac{1}{2}$
5. (a) How does the nature of ligand affect the stability of the complex ? 2

(b) What do you mean by trans effect ? Arrange the following in order of increasing trans effect :

$\text{Br}^-$ ,  $\text{NH}_3$ ,  $\text{OH}^-$ ,  $\text{H}_2\text{O}$ ,  $\text{Cl}^-$ . 2

(c) Elaborate the term 'associative' in the reaction :

$\text{PtL}_2\text{TX} + \text{Y} \rightarrow \text{PtL}_2\text{TY} + \text{X}$ . 2

### SECTION-B

6. (a) Calculate  $\mu_s$  for  $\text{Cu}^{+2}$  and  $\text{Ni}^{+2}$ . 2

(b) What is magnetic susceptibility ? How does it vary with temperature ? 2

(c) Discuss antiferromagnetism and paramagnetism. 2

7. (a) Predict which of the following configurations are expected to have orbital contribution in tetrahedral field : (i)  $d^2$  (ii)  $d^4$  (iii)  $d^7$  (iv)  $d^8$ . 2

(b) Calculate  $\mu_S$  and  $\mu_{S+L}$  for  $[\text{Co}(\text{NH}_3)_6]^{+3}$  ion. 2

(c) Elaborate spin orbital coupling. How does it affect the magnetic moment of an ion ? 2

8. (a) Identify the ground state terms for each set of terms :

(i)  $^1\text{S}$ ,  $^2\text{P}$ ,  $^2\text{D}$ ,  $^3\text{F}$ ,  $^1\text{G}$ . 2

(ii)  $^1\text{S}$ ,  $^3\text{P}$ ,  $^1\text{D}$ . 2

(b) Derive the ground state terms for  $d^{10}$  configuration. 2

9. (a) Draw Orgel diagram for  $d^1$  and  $d^9$  configurations in octahedral complexes. 2
- (b) In  $[\text{Mn}(\text{H}_2\text{O})_6]^{+2}$ , all transitions are both spin multiplicity and Laporte forbidden, but it is pale pink in colour. Explain. 2
- (c) In the absorption spectrum of  $\text{Ti}^{+3}(\text{aq})$ ,  $d^1$  is attributed to single  $t_{2g} \rightarrow e_g$  transition. Explain the position, intensity and broad nature of the band. 2
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