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UG/5th Sem/CHEM(H)/T/19

2019

B.Sc. (Honours)

5th Semester Examination

**CHEMISTRY**

Paper - C11T

**Inorganic Chemistry - IV**

Full Marks : 40

Time : 2 Hours

*The figures in the margin indicate full marks.  
Candidates are required to give their answers  
in their own words as far as practicable.*

**Group - A**

1. Answer any *five* questions : 2×5=10

(a) Explain the abnormal magnetic moment of  $\text{Cu}_2(\text{acac})_4 \cdot (\text{H}_2\text{O})_2$  complex.

(b) The  $[\text{Ni}(\text{CN})_4]^{2-}$  ion is square planar whereas  $[\text{NiCl}_4]^{2-}$  is tetrahedral — Explain.

*[ Turn Over ]*

( 2 )

- (c) Explain the composition of the following complexes —  $[\text{CuF}_6]^{3-}$  and  $[\text{AuF}_4]^-$ .
- (d) The complex  $[\text{Co}(\text{H}_2\text{O})_6]^{2+}$  is light pink whereas  $[\text{CoCl}_4]^{2-}$  is deep blue — Explain.
- (e) Explain the order of LMCT energies for the following anions —  
 $\text{MnO}_4^-$ ,  $\text{CrO}_4^{2-}$ ,  $\text{VO}_4^{3-}$ .
- (f) Calculate the value of magnetic moment for high spin and low spin complex of  $\text{Cr}^{2+}$ .
- (g) What change in magnetic properties can be expected when  $\text{NO}_2^-$  ligand in  $[\text{Co}(\text{NO}_2)_6]^{3-}$  are replaced by  $\text{Cl}^-$  ligand ?
- (h) Actinides have high complex formation ability than lanthanides — Explain.

( 3 )

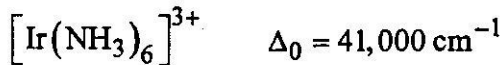
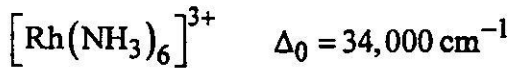
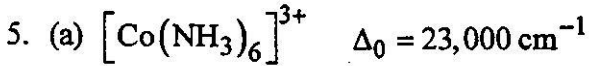
**Group - B**

Answer any *four* questions:  $5 \times 4 = 20$

2. (a) Draw the Orgel diagram for  $[\text{Ni}(\text{H}_2\text{O})_6]^{2+}$  complex and calculate the value of  $\Delta_0$ . 3
- (b) High spin octahedral complexes of Co(II) have magnetic moments much higher than the spin-only values on the other hand, the low spin complexes of Co(II) have magnetic moment slightly higher than the spin only values — Comment. 2
3. (a) What type of electronic transitions are responsible for colour of lanthanides? 1
- (b) In general UV visible absorption bands of transition metal complex are unsymmetric and broad, whereas those of lanthanoid ion ( $\text{Ln}^{+3}$ ) complexes are sharp — Explain. 2
- (c) Identify the Ground State term symbol for  $\text{D}_y^{3+}$  ion. 2
4. (a) Define Russell-Saunders's Coupling. 2
- (b) With the help of CFT predict the structures of  $\text{Co}_3\text{O}_4$  and  $\text{Fe}_3\text{O}_4$ . 3

[ Turn Over ]

( 4 )



— Justify the trend. 2

- (b) State John-Teller Theorem. In which of the following electronic configuration this effect would be observed —



6. (a) Explain the variation of hydration energies of the divalent 3d series transition metal halides. 2

- (b)  $\text{K}_2[\text{NiF}_6]$  is diamagnetic while  $\text{K}_3[\text{CoF}_6]$  is paramagnetic though both have same 'd' configuration — Explain on the basis of CFT.

2

Write down the correct order of enthalpies of hydration of  $\text{Ca}^{+2}$ ,  $\text{Mn}^{+2}$  and  $\text{Zn}^{+2}$ . 1

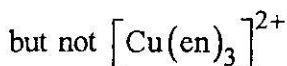
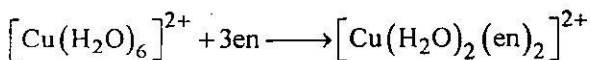
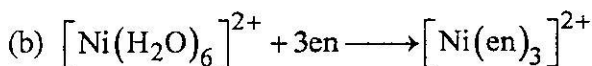
( 5 )

7. (a) Explain the Ion exchange method for separation of lanthanides. 3
- (b) What do you mean by "Mischmetal" ? 2

### Group - C

Answer any *one* question: 10×1=10

8. (a) What are magnetically dilute and magnetically concentrated substances ? Give example of each. 2



For the 1st case complete substitution occurs but in the 2nd case Partial Substitution occurs. —  
Explain. 3

[ Turn Over ]

( 6 )

(c) The colour of trans -  $[\text{Co}(\text{en})_2\text{F}_2]^+$  is less intense than that of cis -  $[\text{Co}(\text{en})_2\text{F}_2]^+$  — Explain. 2

(d) The Brown ring compound  $\{[\text{Fe}(\text{H}_2\text{O})_5\text{NO}]\text{SO}_4\}$  exhibits magnetic moment  $(\mu) = 3.9 \text{ BM}$ . Find the oxidation state of Fe in this compound. 3

9. (a) Explain why  $\text{OH}^-$  is a weak field ligand than  $\text{H}_2\text{O}$ . 2

(b) The absorption spectrum of  $[\text{Ti}(\text{H}_2\text{O})_6]^{3+}$  shows one unsymmetrical broad band — Explain. 2

(c) Ionic radius of  $[\text{V}(\text{H}_2\text{O})_6]^{2+}$  is larger than the  $[\text{Mn}(\text{H}_2\text{O})_6]^{2+}$  — Explain. (2)

(d)  $\text{F}^-$  is a weak field ligand whereas  $\text{CN}^-$  is a strong field ligand. Explain on the basis of LFT. 2

(e) Why do actinides show higher oxidation state than lanthanides ? 2

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