

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 —
 MnO_4^- , CrO_4^{2-} , VO_4^{3-} .
- (f) Calculate the value of magnetic moment for high spin and low spin complex of Cr^{2+} .
- (g) What change in magnetic properties can be expected when NO_2^- ligand in $[\text{Co}(\text{NO}_2)_6]^{3-}$ are replaced by Cl^- ligand ?
- (h) Actinides have high complex formation ability than lanthanides — Explain.

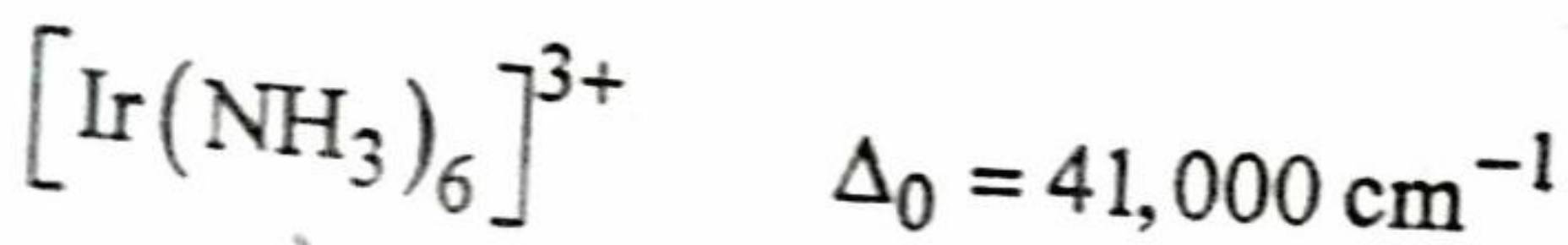
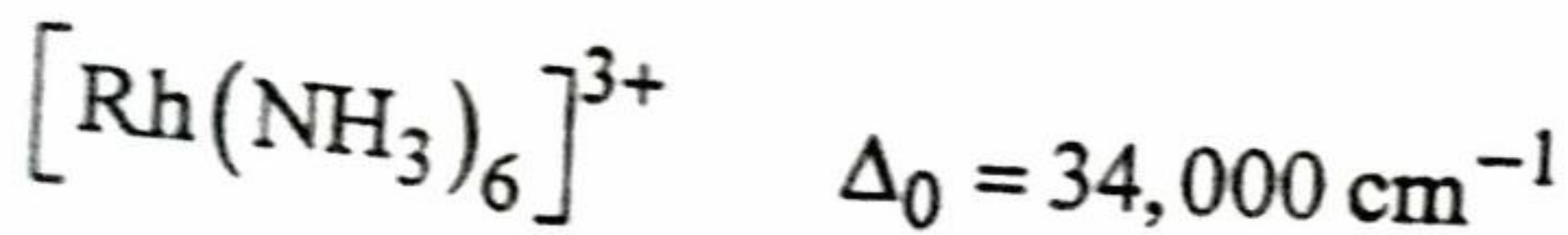
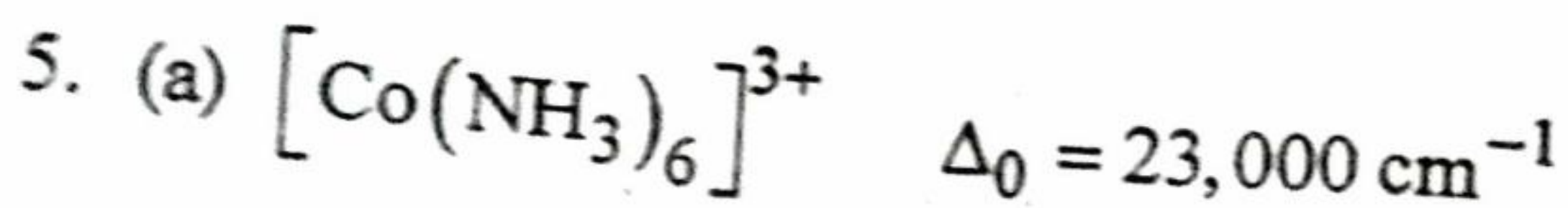
Group - B

Answer any *four* questions:

5×4=20

2. (a) Draw the Orgel diagram for $[\text{Ni}(\text{H}_2\text{O})_6]^{2+}$ complex and calculate the value of Δ_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 (Ln^{+3}) complexes are sharp — Explain. 2
- (c) Identify the Ground State term symbol for D_y^{3+} ion. 2
4. (a) Define Russel-Saunders's Coupling. 2
- (b) With the help of CFT predict the structures of Co_3O_4 and Fe_3O_4 . 3

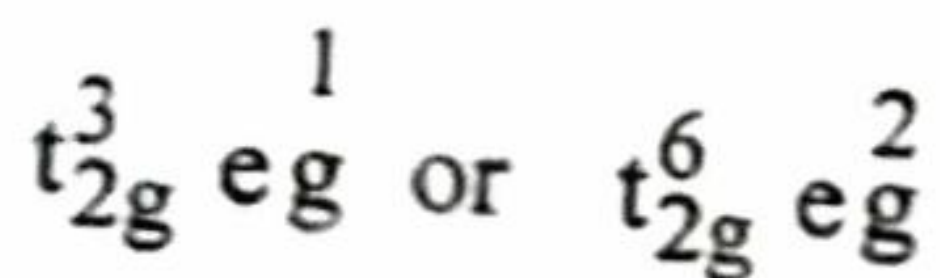
[Turn Over]



— Justify the trend.

2

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



1+2

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 Ca^{+2} , Mn^{+2} and Zn^{+2} .

1

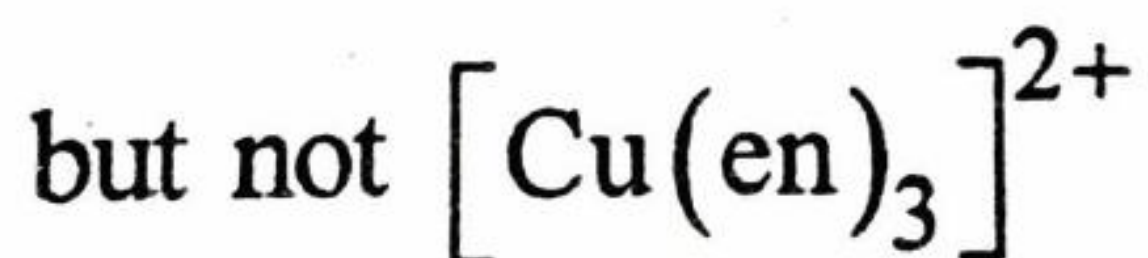
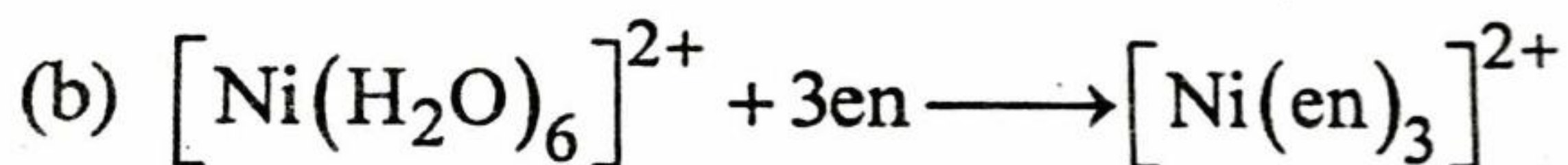
7. (a) Explain the Ion exchange method for separation of lanthanides. 3

(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]

(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 OH^- is a weak field ligand than H_2O . 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) F^- is a weak field ligand whereas CN^- is a strong field ligand. Explain on the basis of LFT. 2

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