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 $Cu_2(acac)_4 \cdot (H_2O)_2$ complex.

(b) The $[Ni(CN)_4]^{2-}$ ion is square planar whereas $[NiCl_4]^{2-}$ is tetrahedral — Explain.

[Turn Over]

(c) Explain the composition of the following complexes — $[CuF_6]^{3-}$ and $[AuF_4]^-$.

(d) The complex $[Co(H_2O)_6]^{2+}$ is light pink whereas $[COCl_4]^{2-}$ 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 $[Co(NO_2)_6]^{3-}$ 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 $\left[Ni(H_2O)_6\right]^{2+}$ 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 $\left(Ln^{+3}\right)$ complexes are sharp — Explain. 2

   (c) Identify the Ground State term symbol for D_y^{3+} ion. 2

4. (a) Define Russel-Saunder's Coupling. 2

   (b) With the help of CFT predict the structures of Co_3O_4 and Fe_3O_4. 3

[Turn Over]

5. (a) $\left[Co(NH_3)_6\right]^{3+}$ $\Delta_0 = 23,000\ cm^{-1}$

$\left[Rh(NH_3)_6\right]^{3+}$ $\Delta_0 = 34,000\ cm^{-1}$

$\left[Ir(NH_3)_6\right]^{3+}$ $\Delta_0 = 41,000\ cm^{-1}$

— Justify the trend. 2

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

$t_{2g}^3\ e_g^1$ or $t_{2g}^6\ e_g^2$ 1+2

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

(b) $K_2\left[NiF_6\right]$ is diamagnetic while $K_3\left[CoF_6\right]$ 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

(b) $\left[Ni(H_2O)_6\right]^{2+} + 3en \longrightarrow \left[Ni(en)_3\right]^{2+}$

$\left[Cu(H_2O)_6\right]^{2+} + 3en \longrightarrow \left[Cu(H_2O)_2(en)_2\right]^{2+}$

but not $\left[Cu(en)_3\right]^{2+}$

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

(c) The colour of trans - $\left[Co(en)_2 F_2\right]^+$ is less intense than that of ci *s* - $\left[Co(en)_2 F_2\right]^+$ — Explain. 2

(d) The Brown ring compound $\left\{\left[Fe(H_2O)_5 NO\right]SO_4\right\}$ exhibits magnetic moment $(\mu) = 3.9$ 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 $\left[Ti(H_2O)_6\right]^{3+}$ shows one unsymmetrical broad band — Explain. 2

(c) Ionic radius of $\left[V(H_2O)_6\right]^{2+}$ is larger than the $\left[Mn(H_2O)_6\right]^{+2}$ — 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