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B.Sc./5th Sem (H)/CHEM/23(CBCS)

2023

5th Semester Examination

CHEMISTRY (Honours)

Paper : C 11-T

[Inorganic Chemistry-IV]

[CBCS]

Full Marks : 40

Time : Two 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

Answer any **five** questions : $2 \times 5 = 10$

1. $[Co(H_2O)_6]^{2+}$ is light pink whereas $[CoCl_4]^{2-}$ is deep blue — Explain.
2. An tetrahedral complexes are low spin — Explain.
3. Why Co_3O_4 adopt a normal spinal rather than inverse spinal structure?
4. What do you mean by “Lanthanide Contraction”? Explain the reason behind it.

P.T.O.

5. Determine the Ground state term symbol for Dy^{3+} ion.
6. Actinides have high complex formation ability than Lanthanides — Explain.
7. What do you mean by “Mischmetal”?
8. Both $[Ni(CN)_4]^{2-}$ and $[Ni(CO)_4]$ are diamagnetic but they have different geometry — Explain.

Group - B

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

9. (a) Define Russell-Saunders' coupling. 2
 (b) Discuss Ion exchange method for separation of Lanthanides. 3
10. (a) Discuss structure and magnetic property of $Fe(CO)_5$ using VBT concept. 3
 (b) A deep blue solution contain $Co(II)$ in concentrated HCl gradually turns pale pink on addition of excess H_2O — why? 2
11. (a) Explain the energy ordering $\Delta_t < \Delta_0 < \Delta_{sp}$ for coordination compounds. 3
 (b) Ionisation enthalpies of Ca , Pr and Nd are higher than Th , Pa and U , respectively. — Explain. 2

12. (a) Lanthanides exhibit +3 oxidation state in general, while actinides can show variable oxidation state — Explain. 3
- (b) Discuss about the Laporte selection rule for electronic spectral transition. 2
13. (a) $K_2[NiF_6]$ is diamagnetic, while $K_3[CoF_6]$ is paramagnetic though both have same d-electron configuration — Explain on the basis of CFT. 3
- (b) Explain the variation of hydration energies of the divalent 3d series transition metal halides. 2
14. (a) Predict the type of spinel structure for $NiFe_2O_4$ with explanation. 3
- (b) 10 Dq value of $[Rh(H_2O)_6]^{3+}$ is higher than $[Co(H_2O)_6]^{3+}$. Justify. 2

Group - C

Answer any *one* question : $10 \times 1 = 10$

15. (a) Why many transition metal hydroxide is readily oxidised by atmospheric oxygen? 3
- (b) Explain why OH^\ominus is a weak field ligand than H_2O . 2

P.T.O.

- (c) State Jahn-Teller theorem. In which of the following electronic configuration, this effect would be observed and why?

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

- (d) The crystal field splitting energy, Δ_0 in $[Ti(H_2O)_6]$ is 243 kJ mol^{-1} . Find out its absorption maxima in nm. 2

16. (a) Draw the Orgel diagram for $[Ni(H_2O)_6]^{2+}$ complex and calculate the value of Δ_0 . 3

- (b) The colour of *trans*- $[Co(en)_2 F_2]^+$ is less intense than that of *cis*- $[Co(en)_2 F_2]^+$ — Explain. 2

- (c) Find the expression for CFSE for d^6 and d^7 ion in weak and strong octahedral field in terms of Dq and Pairing Energy (PE). 3

- (d) The magnetic moment of $VO(acac)_2$ is 1.7 BM. Explain. 2
