

U.G. 6th Semester Examination - 2026

CHEMISTRY

[MAJOR-VIII]

Course Code : CHEM-MAT-08

(Inorganic-3)

[NEP-2020]

Full Marks : 60

Time : $2\frac{1}{2}$ Hours*The figures in the right-hand margin indicate marks.**Candidates are required to give their answers in their own words as far as practicable.*1. Answer any **ten** questions from the following: $2 \times 10 = 20$

- Write the IUPAC nomenclature of $[(\text{en})_2\text{Co}(\mu\text{-NH}_2)(\mu\text{-O}_2)\text{Co}(\text{en})_2]$.
- Give an example with structural formula of low spin tetrahedral complex.
- What is Curie temperature?
- Why MnO_4^- is deep intense coloured although the central metal manganese is d^0 system?
- Define ferromagnetism with example.
- Copper(II) forms a stable complex with 'trien' not 'tren' ligand but Zn(II) forms a stable complex with 'tren' not 'trien' ligand – explain.
- Predict the spin magnetic moment of $\text{Li}[\text{Ti}(\text{bpy})_3]$ complex.
- Draw the d-orbital splitting pattern in square pyramidal ligand field.
- Calculate the μ_{eff} of Gd^{3+} .

[Turn Over]

- j) Explain the modes of decay of $^{14}_6\text{C}$ and $^{13}_7\text{N}$.
- k) $[\text{Cr}(\text{H}_2\text{O})_6]^{2+}$ is labile complex but $[\text{Cr}(\text{NH}_3)_6]^{2+}$ is inert – Explain.
- l) Give an example of purely inorganic optically active complex.
- m) The basicity of lanthanide Tri-hydroxide $\text{Ln}(\text{OH})_3$ gradually decreases from La to Lu – explain.
- n) The Cr-F bond length in CrF_2 (Crystalline Solid) are not equal – explain.
- o) Give an example of inner orbital and outer orbital complex.
- p) Explain why the experimental μ_{eff} of Octahedral Ni(II) complexes do not match with $\mu_{\text{s.o.}}$ (calculated).

2. Answer any four questions from the following:

$$5 \times 4 = 20$$

- a) i) The magnetic moment of $[\text{Mn}(\text{CN})_6]^{3-}$ is 2.8 B.M, predict the type of hybridization and geometry of the complex ion.
- ii) What do you mean by spin-state isomerism? Give example. $3+2=5$
- b) i) Explain the fact: Two strong electronic absorptions near 11kk and 14 kk are exhibited by $\text{Fe}[(\text{H}_2\text{O})_6]^{2+}$ in aqueous solution.
- ii) What is the basic difference between Tetragonal distortion and Jahn Teller distortion in octahedral complexes? $3+2=5$
- c) i) What do you mean by inner metallic complex of third order? Give example.

ii) What is sodide ion? How it is synthesized?
 $3+2=5$

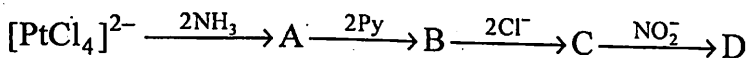
- d) What is meant by magic number? Give evidence in its favour from binding energy curve. State how does radioactive equilibrium differ from chemical equilibrium? $2+1+2=5$
- e) i) Explain why the binding energy per nucleon for majority of elements lie in the range 7.5 to 8.0 MeV.
- ii) Explain why $[\text{Fe}(\text{H}_2\text{O})]^{3+}$ is labile while $[\text{Cr}(\text{H}_2\text{O})_6]^{3+}$ is inert. $3+2=5$
- f) i) Predict the magnetic moment of Sm^{3+} utilising the equation $\mu = g\{J(J+1)\}^{1/2}$ at room temperature. Why it is lower than the experimental magnetic moment of 1.54 BM at room temperature?
- ii) Explain why Mn_3O_4 is normal spinel. $3+2=5$

3. Answer any two questions from the following:

$$10 \times 2 = 20$$

- a) i) Explain why $[\text{Co}(\text{NH}_3)_6]^{3+}$ is less intense in colour than $[\text{Co}(\text{NH}_3)_5\text{X}]^{2+}$ where X is halide ion.
- ii) The half-life of ^{60}Co is 5.27 years. Find out the activity (dpm) of a 2.0 g sample.
- iii) How Prussian blue compound is prepared? Write the formula of the compound commonly known as Turnbull's blue.
- iv) Explain with reason whether Fe_3O_4 exist as normal or inverse spinel. $2+3+3+2=10$

- b) i) Calculate the effective magnetic moment (μ_{eff}) of $[\text{Co}(\text{NO}_2)_6]^{4-}$. Given: Spin-orbit coupling constant (λ) = -496 cm^{-1} ; crystal field splitting parameter ($10Dq$) = $12,000 \text{ cm}^{-1}$.
- ii) Radioactive equilibrium is differed from chemical equilibrium – justify.
- iii) Starting from K_2PtCl_6 , how do you synthesize cis and trans $[\text{Pt}(\text{NH}_3)(\text{NO}_2)\text{Cl}_2]$? $4+2+(2+2)=10$
- c) i) Draw the Orgel diagram for $[\text{Cr}(\text{NH}_3)_6]^{3+}$ (d^3) complex and indicate spin allowed transition.
- ii) What is spallation reaction? Give an example.
- iii) Explain why Pt(II) square planar complexes follow associative mechanisms in general.
- iv) Predict the products:



$$4+2+(2+2)=10$$

- d) i) Electronic spectrum of $[\text{Ti}(\text{H}_2\text{O})_6]^{3+}$ shows a broad shoulder with a maximum around 20300 cm^{-1} .
- ii) What are magnetically concentrated and magnetically diluted substance?
- iii) How would you prepare anhydrous chromium (II) chloride from chromium?
- iv) Compare the Δ_0 values of $[\text{Co}(\text{H}_2\text{O})_6]^{2+}$ and $[\text{Ni}(\text{H}_2\text{O})_6]^{2+}$. $4+2+2+2=10$