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May-2026

B.Sc. IV SEMESTER

Inorganic Chemistry-III

(BCHT-DS-401)

Time: 3 Hours] [Max. Marks : 75

Instructions :

1. *It is compulsory to answer all the questions (1.5 marks each) of Part-A in short.*
2. *Answer any four questions from Part-B in detail.*
3. *Different sub-parts of a question are to be attempted adjacent to each other.*
4. *Log table may be used if necessary.*

PART—A

1. (a) Write IUPAC name of $[Pt(NH_3)_4]$ $[PtCl_4]$. (1.5)

   (b) Draw the structural formula of two isomers of the complex ion $[Co(NH_3)_5NO_2]^{2+}$. (1.5)

   (c) Which mechanism is generally followed in Substitution reactions in square planar complexes? (1.5)

   (d) What is an anation reaction? (1.5)

(e) Why transition metals are less reactive than alkali and alkaline earth metals? (1.5)

(f) Why are salts of zinc, cadmium and mercury white? (1.5)

(g) What are transuranic elements? (1.5)

(h) Why actinides show greater tendency to form complexes than lanthanides? (1.5)

(i) Why does NH_3 readily form complexes with metal/ ions but NH_4^+ does not? (1.5)

(j) What is the equivalent weight of potassium dichromate in its oxidising reactions in acidic medium? (1.5)

PART–B

2. (a) Calculate the number of unpaired electrons in the following :

(i) Cr^{3+} (octahedral strong field).

(ii) Co^{3+} (octahedral strong field).

(iii) Fe^{3+} (octahedral weak field). (3)

(b) What is the difference between inner orbital and outer orbital complexes? Explain with examples. (5)

(c) Explain the effect of nature of ligands and the geometry of the complex on the magnitude of Δo. (5)

(d) What is chelate effect? Discuss in short. (2)

3. (a) Write a detailed note on ligand substitution reactions in Co(III) octahedral complexes. (5)

(b) Explain the conjugate base mechanism for base hydrolysis reactions. (5)

(c) Explain the factors affecting rate of substitution reactions of octahedral complexes with special focus on role of leaving groups. (5)

4. (a) "*4s* subshell is filled prior to *3d* but on ionization, *4s* electrons are removed first." Justify. (3)

(b) First ionization energy of copper is higher than those of alkali metals while second and third energies are lower than those of alkali metals. Explain. (3)

(c) Melting points of *d*-block elements in a series reach a maximum upon the middle, thereafter show a decrease. Explain. (3)

(d) Why do transition elements in zero and lower oxidation state form complexes with weak ligands like CO, NO or PR_3? (3)

(e) Draw and discuss the structure of manganate ion and permanganate ion. (3)

5. (a) Give the important oxidation states of lanthanides. How would you account for them? Why is +3 most stable? (3)

(b) What is lanthanide contraction? What are its consequences? (3)

(c) Why it is difficult to interpret the paramagnetic behaviour of actinides? (3)

(d) Discuss the electronic structure and position of actinides in periodic table. Why is the chemistry of actinides difficult to study? (3)

(e) Actinides have a great tendency to form complexes than lanthanides. Explain. (3)

6. (a) What are tetragonal distortions from octahedral geometry. Discuss Jahn Teller distortions in d^7 configuration. (8)

(b) Define the trans-effect. Explain the theories of trans-effect. (7)

7. (a) Why are the physical properties of second and third series of transition elements more similar to each other than they are to the first transition series? (3)

(b) Why *d*-block elements have greater tendency to form complexes? (3)

(c) Differentiate between potassium ferrocyanide and potassium ferricyanide on the basis of their structure and properties. (3)

(d) How are lanthanides separated from each other by ion-exchange method? (6)