Chemistry | JEE

Class 12 Chemistry - Coordination Compounds

JEE track | Short Notes + 5 CBSE-based questions + 5 JEE Main PYQ-based questions with solutions

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Format: Quick revision + solved practice	Chapter scope: Class 12 Chemistry

1. Quick Short Notes

- A coordination compound contains a central metal atom/ion surrounded by ligands.
- Coordination number is the number of donor atoms directly bonded to the central metal ion.
- Ligands may be monodentate, bidentate or polydentate. Some ligands are ambidentate and can bind through two different atoms.
- Oxidation state of metal is found by balancing charges of ligands and complex ion.
- IUPAC naming: name cation first, then anion; ligand names are written alphabetically; oxidation state of metal is shown in Roman numerals.
- Anionic complexes use metal names ending in -ate, e.g. ferrate, cuprate.
- Isomerism includes ionisation, hydrate, linkage, geometrical and optical isomerism.
- Strong-field ligands can cause pairing of electrons; weak-field ligands often give high-spin complexes.
- Magnetic behaviour depends on number of unpaired electrons.
- Board tip: in naming questions, first find oxidation state and coordination number before writing the final name.

2. CBSE-based Board Practice

Q1. Find the oxidation state of iron and coordination number in K4[Fe(CN)6].

Solution: Let oxidation state of Fe = x. Then x + 6(-1) = -4, so x = +2. Coordination number = 6 because six CN- ligands are directly attached.

Q2. Write the IUPAC name of [Cu(NH3)4]SO4.

Solution: The cation is [Cu(NH3)4]2+. Therefore the compound is tetraamminecopper(II) sulfate.

Q3. Differentiate between a double salt and a coordination compound.

Solution: A double salt dissociates completely in water into all constituent ions. A coordination compound retains its complex ion in solution and does not dissociate completely into simple ions.

Q4. Give one pair of geometrical isomers of [Pt(NH3)2Cl2].

Solution: The complex shows cis and trans geometrical isomerism.

Q5. Why is Ni(CO)4 diamagnetic?

Solution: In Ni(CO)4, nickel is in zero oxidation state with electronic configuration 3d^10. All electrons are paired, so the complex is diamagnetic.

3. JEE Main PYQ-based Practice

Q1. Write the IUPAC name of K3[Fe(C2O4)3].

Solution: Each oxalato ligand is -2. For [Fe(C2O4)3]3-, Fe is +3. Hence the name is potassium tris(oxalato)ferrate(III).

Q2. Find the number of unpaired electrons in [FeF6]3-.

Solution: Fe in +3 state is d^5. F- is a weak-field ligand, so the octahedral complex is high spin with 5 unpaired electrons.

Q3. Which type of isomerism is shown by [Co(NH3)5(NO2)]Cl2?

Solution: NO2- is an ambidentate ligand, so the complex shows linkage isomerism.

Q4. State the hybridisation and magnetic nature of [Ni(CN)4]2-.

Solution: Ni2+ is d^8 and CN- is a strong-field ligand. The complex is square planar with dsp2 hybridisation and is diamagnetic.

Q5. What is the coordination number of EDTA when it acts as a ligand?

Solution: EDTA is a hexadentate ligand, so its coordination number contribution is 6.

Practice tip: First revise the short notes, then attempt CBSE board questions in written format, and finally solve the exam-specific section in timed mode.