Chapter 09

Co-Ordination Compounds

Very Short Answer Type Questions

01. Give the IUPAC name of the linkage isomer of $[Pt(NH_3)_3(NO_2)]Cl$.

02. Give the IUPAC name of the ionization isomer of $[Ni(NH_3)_3(NO_2)]Cl$.

03. Define a 'ligand'. Give an example also.

04. What complex formation is used in the identification of Ni^{2+} ions in qualitative analysis?

05. What type of hybrid orbitals are associated with Ni atom in $[Ni(CN)_4]^{2-}$?

06. Give one example of the application of coordination compounds in medicines.

07. What is an ambidentate ligand? Give an example.

08. Give an example of co-ordination isomerism.

09. What do you understand by 'denticity of a ligand'?

10. Why is CO a stronger ligand than Cl^-? Give the reason for CO is a stronger complexing reagent than NH_3?

Short Answer Type Questions

11. Describe the hybridization scheme, the resultant geometry, and the magnetic behavior of $[Co(NH_3)_6]^{3+}$.

12. How would you account for the following:

(i) $[Fe(CN)_6]^{3-}$ is weakly paramagnetic while $[Fe(CN)_6]^{4-}$ is diamagnetic.

(ii) $[Ni(CO)_4]$ possesses tetrahedral geometry while $[Ni(CN)_4]^{2-}$ is square planar.

13. Select a complex formation reaction and write an expression for the stability constant of the complex species. What information is conveyed regarding the strength of ligands from the stability constant values of their complexes with a metal ion? Illustrate your answer with examples of monodentate ligands.

14. Explain geometrical isomerism concerning square planar complexes giving one example. How is it that the tetrahedral complex with simple ligands does not exhibit geometrical isomerism?

15. Describe the following:

(i) Optical isomerism (ii) Magnetic behavior of $Ni(CN)_4]^{2-}$ ion. (Atomic number of Ni = 28

16. Write the chemical formulae of the following complexes:
(i) hexaammineplatinum(IV) chloride. (ii) tetramminedichloridocobalt(III) ion.

17. What magnetic behaviors are expected for $[Ni(CO)_4]$ and $[NiCl_4]^{2-}$ and why?

18. Tetrahedral Ni(II) complexes are paramagnetic but square planar Ni(II) complexes are diamagnetic. Explain.

19. Using the valence bond approach, predict the shape and magnetic behavior of $[CoCl_6]^{2-}$. (Given Atomic number of Co = 27).

20. Discuss the factors on which magnitude of octahedral splitting depends.

21. Sketch to show the splitting of d-orbitals in an octahedral crystal field. State for a d^6 configuration, how the actual configuration of the split d-orbitals in an octahedral of the split d-orbitals in an octahedral crystal field is decided by the relative values of Δ_0 and P?

22. Using valence bond theory explain the geometry and magnetic behavior of pentacarbonyliron(0).

23. Describe for any two of the following complex ions, the type of hybridization, shape and magnetic property: (i) $[Fe(H_2O)_6]^{3+}$ (ii) $[Co(NH_3)_6]^{3+}$ (iii) $[NiCl_4]^{2-}$
(At Nos. Fe = 26, Co = 27, Ni = 28)

24. (a) Illustrate the following with an example each:
(i) linkage isomerism (ii) co-ordination isomerism (iii) Why is $NiCl_4^{2-}$ paramagnetic(Ni = 28)?

25. (a) What is the basis of the formation of the spectro-chemical series?
(b) Draw the structures of geometrical isomers of the following co-ordination complexes:
$[Co(NH_3)_3Cl_3]$ and $[CoCl_2(en)_2]^+$ (en = ethane diamine and atomic number of Co is 27)

26. Describe the shape, nature of hybrid orbitals and the magnetic behaviour of the following co-ordination entities: (i) $[Cr(NH_3)_6]^{3+}$ (ii) $[Fe(CN)_6]^{4-}$ (iii) $[Ni(CO)]_4$
(At Nos. Cr = 24, Fe = 26, Ni = 28)

27. Giving a suitable example for each, explain the following:
(i) Crystal field splitting (ii) Linkage isomerism (iii) Ambidentate ligand.

28. Explain the following:
(i) Low spin octahedral complexes of nickel are not known.
(ii) The π-complexes are known for transition elements only.
(iii) CO is a stronger ligand than NH_3 for many metals.

29. Three geometrical isomers are possible for $[Co(en)(H_2O)_2(NH_3)_2]^{3+}$. Draw the molecular structure of three isomers and indicate which one of them is chiral.

30. Explain the following terms:(i) Crystal field splitting in an octahedral complex.
(ii) Spectrochemical series.