[MCQ – 1 2M – 1 3M – 3]

One mark Questions:

1. What are coordination compounds?
2. What is a primary valency?
3. What is secondary valency?
4. What is coordination number of a complex compound?
5. What is the coordination number of copper in tetraamminecopper (II) sulphate?
6. What is the coordination number of Iron in $K_4[Fe(CN)_6]$ and $K_3[Fe(CN)_6]$?
7. What is the coordination number of the central metal ion in the following **a)** $[Co(NH_3)_5Cl]^{2+}$ **b)** $[pt(OX)_2]^{2-}$ **c)** $[Cr(EDTA)]^{3+}$?
8. Write the IUPAC name of the following:
   - **a)** $[Co(NH_3)_6]Cl_3$
   - **b)** $K_3[Fe(C_2O_4)_3]$
   - **c)** $[Pt(NH_3)_2Cl(NO_2)]$
   - **d)** $K_3[Fe(CN)_6]$
9. Write the formula for the following coordination compounds
   - **a)** tetraamminediaquacobalt(III) chloride
   - **b)** tris(ethane-1,2-diamine)chromium(III) chloride
   - **c)** Potassiumtetrahydroxidozincate(II)
   - **d)** Iron(III) hexacyanidoferrate(II)
10. Give an example for a coordination compound where the ligand satisfies both primary and secondary valency.
11. What is crystal field splitting?
12. What is crystal field splitting energy (CFSE)?
13. What is spectrochemical series?
14. What is the geometry of the complex $[Ni(CO)_4]$?
15. Cuprammonium ion is square planar, why?
16. Potassium ferrocyanide is an octahedral complex .Why?
17. How many ions are formed per molecule when potassium ferrocyanide is dissolved in water?
18. How many ions are produced from the complex $[Co(NH_3)_6]Cl_2$ in solution?
19. Name the compound used for measuring the hardness of water.
20. Name two complexes which are used in medicines.
21. What is Stereoisomerism?
22. Why are low spin tetrahedral complexes not formed?
23. Name the ionisation isomer of $[Cr(H_2O)_5Br]SO_4$.
24. Name the type of isomerism shown by $[Co(NH_3)_5NO_2]Cl_2$ and $[Co(NH_3)_5ONO]Cl_2$.

TWO marks questions:

1. Define the following with an example each :

(a) Ligand. (b) Unidentate ligands. (c) Didentate ligands. (d) Polydentate ligands.
(e) Ambidentate ligand. (f) Chelate ligand, Denticity. (g) Coordination number.
(h) Coordination sphere. (h) Coordination polyhedron. (i) Homoleptic complexes.
(j) Hetroleptic complexes. (k) Cationic complex/ Complex cation.
(l) Anionic complex / Complex anion. (m) Neutral complex. (n) Strong field ligand.
(o) Weak field ligand. (p) Inner orbital complex. (q) Outer orbital complex.
(r) Coordination entity/Complex ion.

2. What is ionization Isomerism? Give example.

3. What is linkage Isomerism? Give example.

4. What is solvate Isomerism? Give example.

5. What is coordination Isomerism? Give example.

6. What is geometrical isomerism? Give example.

7. Explain optical isomerism with an example.

8. Indicate the types of isomerism exhibited by the following complexes and draw the structures **a)** $[Co(NH_3)_4Cl_2]^+$ **b)** $[CoCl_2(en)_2]^+$.

9. Explain geometrical isomerism in $[Co(NH_3)_3(NO_2)_3]$.

10. Draw the structures of optical isomers of $[PtCl_2(en)_2]^{2+}$.

11. Draw structures of geometrical isomers of $[Fe(NH_3)_2(CN)_4]^-$.

12. Out of the following two coordination entities **a)** Cis-$[CrCl_2(ox)_2]^{3-}$ **b)** trans $[CrCl_2(ox)_2]^{3-}$ which is chiral (optically active)?

13. Indicate the types of isomerism exhibited by the following complexes and draw the structures for these isomers. **a)** $K[Cr(H_2O)_2(C_2O_4)_2]$ **b)** $[Co(NH_3)_5(NO_2)]$ **c)** $[Pt(NH_3)(H_2O)Cl_2]$

14. Give evidence that $[Co(NH_3)_5Cl]SO_4$ and $[Co(NH_3)_5SO_4]Cl$ are ionisation isomers.

15. Why is geometrical isomerism not possible in tetrahedral complexes having two different types of unidentate ligands coordinated with the central metal ion?

16. A solution of $[Ni(H_2O)_6]^{2+}$ is green but a solution of $[Ni(CN)_4]^{2-}$ is colourless. Explain.

17. $[Fe(CN)_6]^{4-}$ and $[Fe(H_2O)_6]^{2+}$ are of different colours in dilute solutions. Why?

18. $CuSO_4.5H_2O$ is blue in colour while $CuSO_4$ is colourless. Why?

19. What are t_{2g} and e_g orbitals?

20. Why do compounds having similar geometry have different magnetic moment?

21. On the basis of crystal field theory explain why Co (III) forms paramagnetic octahedral complex with weak field ligands whereas it forms diamagnetic octahedral complex with strong field ligands.

22. What is meant by chelate effect? Give an example.

23. The spin only magnetic moment of $[MnBr_4]^{2-}$ is 5.9 B.M. Predict the geometry of the complex ion.

24. Explain why $[Ni(CN)_4]^{2-}$ ion with square planar structure is diamagnetic while $[NiCl_4]^{2-}$ ion with tetrahedral geometry is paramagnetic?

25. $[NiCl_4]^{2-}$ is paramagnetic while $[Ni(CO)_4]$ is diamagnetic though both are tetrahedral, why?

26. $[Fe(H_2O)_6]$ is strongly paramagnetic where as $[Fe(CN)_6]^{3-}$ is weakly paramagnetic. Explain.

27. Predict the number of unpaired electrons in the square Planar $[Pt(CN_4)]^{2-}$ ion.

28. The hexaaquamanganese (II) ion contains five unpaired electrons while the hexacyanomanganese(II) ion contains only one unpaired electron. Explain using Crystal Field Theory.

29. Calculate the overall complex dissociation equilibrium constant for the $[Cu(NH_3)_4]^{2+}$ ion, given that β_4 for this complex is 2.1×10^{13}.

30. Explain $[Co(NH_3)_6]^{3+}$ is an inner orbital complex whereas $[Ni(NH_3)_6]^{2+}$ is an outer orbital complex.

31. How does the magnitude of Δ_0 decide the actual configuration of d-orbitals in a co-ordination entity?

32. $[Fe(C_2O_4)_3]^{3-}$ is more stable than $[FeCl_6]^{3-}$ .Why?

33. Explain the role of co-ordination compounds **(a)** in biological systems **(b)** In medicine **(c)** In metallurgy.

34. What is meant by stability of a coordination compound in solution? State the factors which govern the stability of complexes.

THREE marks questions:

1. Write the assumptions of Werner's theory.

2. Explain the sailent features of valence bond theory.

3. On the basis of valence bond theory explain the hybridisation, electron arrangement, geometrical shape and magnetic properties of $[Co(NH_3)_6]^{3+}$.

4. On the basis of valence bond theory explain the hybridisation, electron arrangement, geometrical shape and magnetic properties of $[CoF_6]^{3-}$.

5. On the basis of valence bond theory explain the hybridisation, electron arrangement, geometrical shape and magnetic properties of $[NiCl_4]^{2-}$.

6. On the basis of valence bond theory explain the hybridisation, electron arrangement, geometrical shape and magnetic properties of $[Ni(CO)_4]$.

7. On the basis of valence bond theory explain the hybridisation, electron arrangement, geometrical shape and magnetic properties of $[Ni(CN)_4]^{2-}$.

8. Explain the bonding in coordination compounds in terms of Werner's postulates.

9. Explain the bonding in metal carbonyls.

10. Explain crystal field splitting in tetrahedral coordination entities.

11. Explain crystal field splitting in octahedral coordination entities.

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