

ANSWERS

I. Multiple Choice Questions (Type-I)

- | | | | | | |
|----------|-----------|---------|----------|---------|----------|
| 1. (ii) | 2. (iii) | 3. (ii) | 4. (iv) | 5. (i) | 6. (iii) |
| 7. (i) | 8. (iii) | 9. (i) | 10. (iv) | 11. (i) | 12. (ii) |
| 13. (ii) | 14. (iii) | | | | |

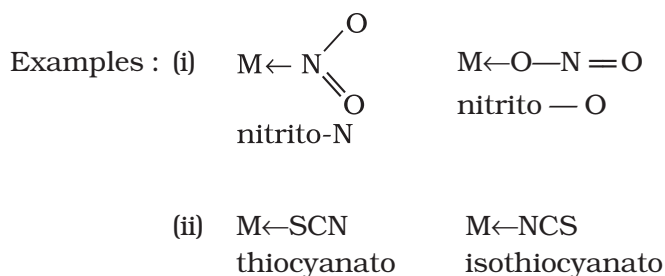
II. Multiple Choice Questions (Type-II)

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|----------------|----------------|----------------|----------------------|
| 15. (i), (iii) | 16. (i), (iii) | 17. (i), (iii) | 18. (ii), (iii) |
| 19. (i), (iii) | 20. (ii), (iv) | 21. (i), (iii) | 22. (i), (ii), (iii) |
| 23. (i), (iii) | | | |

III. Short Answer Type

24. $[\text{Co}(\text{NH}_3)_3\text{Cl}_3] < [\text{Cr}(\text{NH}_3)_5\text{Cl}]\text{Cl} < [\text{Co}(\text{NH}_3)_5\text{Cl}]\text{Cl}_2 < [\text{Co}(\text{NH}_3)_6]\text{Cl}_3$
25. $[\text{Co}(\text{H}_2\text{O})_4\text{Cl}_2]\text{Cl}$ (tetraaquadichloridocobalt(III) chloride)
26. An optically active complex of the type $[\text{M}(\text{AA})_2\text{X}_2]^{n+}$ indicates *cis*-octahedral structure, e.g. *cis*- $[\text{Pt}(\text{en})_2\text{Cl}_2]^{2+}$ or *cis*- $[\text{Cr}(\text{en})_2\text{Cl}_2]^+$
27. The magnetic moment of 5.92 BM corresponds to the presence of five unpaired electrons in the *d*-orbitals of Mn^{2+} ion. As a result the hybridisation involved is sp^3 rather than dsp^2 . Thus tetrahedral structure of $[\text{MnCl}_4]^{2-}$ complex will show 5.92 BM magnetic moment value.
28. With weak field ligands; $\Delta_0 < p$, the electronic configuration of Co (III) will be $t_{2g}^4 e_g^2$ and it has 4 unpaired electrons and is paramagnetic. With strong field ligands, $\Delta_0 > p$, the electronic configuration will be $t_{2g}^6 e_g^0$. It has no unpaired electrons and is diamagnetic.
29. Because for tetrahedral complexes, the crystal field stabilisation energy is lower than pairing energy.
30. $[\text{CoF}_6]^{3-}$, $\text{Co}^{3+}(d^6) t_{2g}^4 e_g^2$,
 $[\text{Fe}(\text{CN})_6]^{4-}$, $\text{Fe}^{2+}(d^6) t_{2g}^6 e_g^0$,
 $[\text{Cu}(\text{NH}_3)_6]^{2+}$, $\text{Cu}^{2+}(d^9) t_{2g}^6 e_g^3$,
31. $[\text{Fe}(\text{CN})_6]^{3-}$ involves d^2sp^3 hybridisation with one unpaired electron and $[\text{Fe}(\text{H}_2\text{O})_6]^{3+}$ involves sp^3d^2 hybridisation with five unpaired electrons. This difference is due to the presence of strong ligand CN^- and weak ligand H_2O in these complexes.
32. Crystal field splitting energy increases in the order $[\text{Cr}(\text{Cl})_6]^{3-} < [\text{Cr}(\text{NH}_3)_6]^{3+} < [\text{Cr}(\text{CN})_6]^{3-}$

33. It is due to the presence of weak and strong ligands in complexes, if CFSE is high, the complex will show low value of magnetic moment and vice versa, e.g. $[\text{CoF}_6]^{3-}$ and $[\text{Co}(\text{NH}_3)_6]^{3+}$, the former is paramagnetic and the latter is diamagnetic.
34. In $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$, water acts as ligand as a result it causes crystal field splitting. Hence d—d transition is possible in $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ and shows colour. In the anhydrous CuSO_4 due to the absence of water (ligand), crystal field splitting is not possible and hence no colour.
35. Linkage isomerism



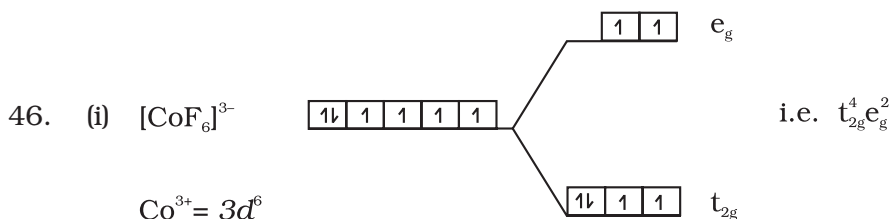
IV. Matching Type

36. (ii) 37. (i) 38. (ii) 39. (iv) 40. (i)

V. Assertion and Reason Type

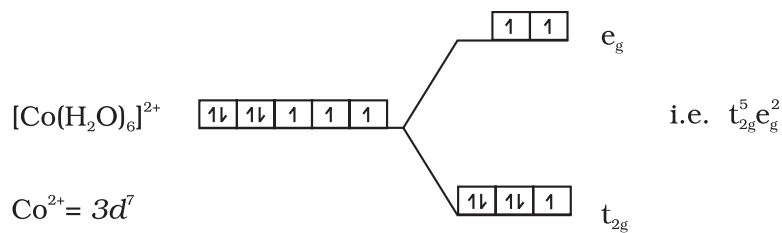
41. (i) 42. (ii) 43. (i) 44. (ii) 45. (iv)

VI. Long Answer Type



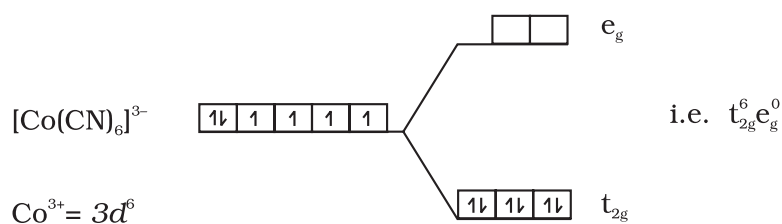
Number of unpaired electrons = 4

$$\sqrt{n(n+2)} = \sqrt{4(4+2)} = \sqrt{24} = 4.9 \text{ BM}$$

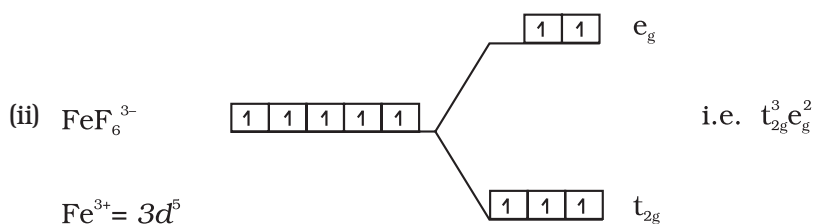


Number of unpaired electrons = 3

$$\sqrt{3(3+2)} = \sqrt{15} = 3.87 \text{ BM}$$

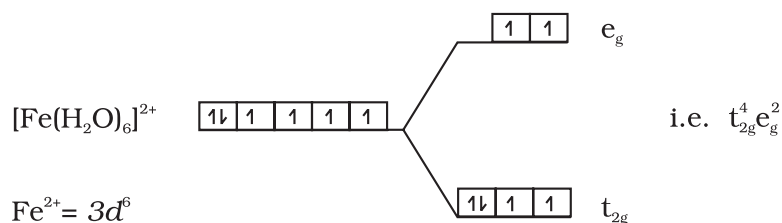


No unpaired electrons so diamagnetic



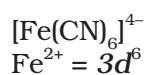
Number of unpaired electrons = 5

$$\sqrt{5(5+2)} = \sqrt{35} = 5.92 \text{ BM}$$

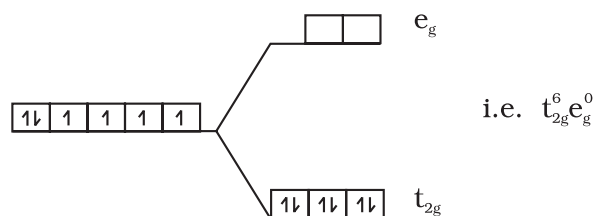


Number of unpaired electrons = 4

$$\sqrt{4(4+2)} = \sqrt{24} = 4.9 \text{ BM}$$

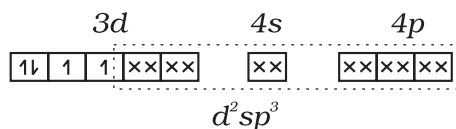
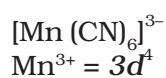


Since CN^- is strong field ligand all the electrons get paired.

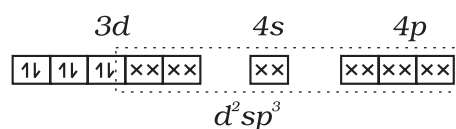
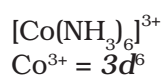


No unpaired electrons so diamagnetic

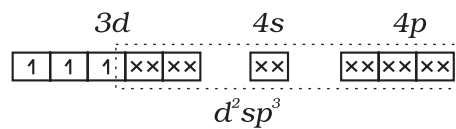
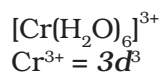
47.



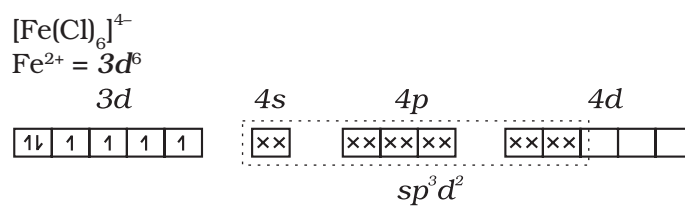
- (i) $d^2 sp^3$
- (ii) Inner orbital complex
- (iii) Paramagnetic
- (iv) $\sqrt{2(2+2)} = \sqrt{8} = 2.87 \text{ BM}$



- (i) $d^2 sp^3$
- (ii) Inner orbital complex
- (iii) Diamagnetic
- (iv) Zero



- (i) $d^2 sp^3$
- (ii) Inner orbital complex
- (iii) Paramagnetic
- (iv) 3.87 BM



- (i) sp^3d^2 (ii) Outer orbital complex
 (iii) Paramagnetic
 (iv) 4.9 BM
48. (i) A - $[\text{Co}(\text{NH}_3)_5\text{SO}_4]\text{Cl}$
 B - $[\text{Co}(\text{NH}_3)_5\text{Cl}]\text{SO}_4$
 (ii) Ionisation isomerism
 (iii) (A), Pentaamminesulphatocobalt (III) chloride
 (B), Pentaamminechlorocobalt (III) sulphate.
49. When white light falls on the complex, some part of it is absorbed. Higher the crystal field splitting, lower will be the wavelength absorbed by the complex. The observed colour of complex is the colour generated from the wavelength left over.
50. $t \left(\frac{4}{9}\right) \Delta_0$. So higher wavelength is absorbed in octahedral complex than tetrahedral complex for same metal and ligands.