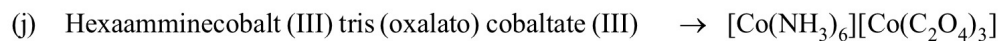
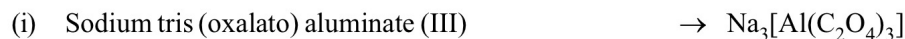
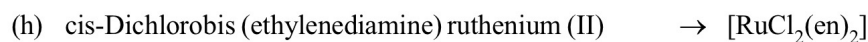
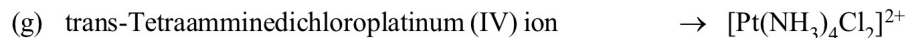
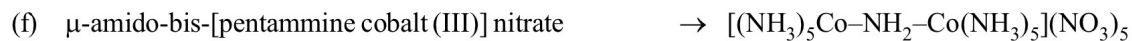
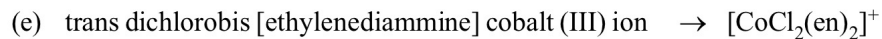
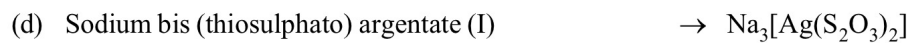
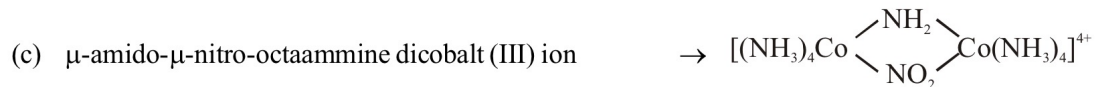
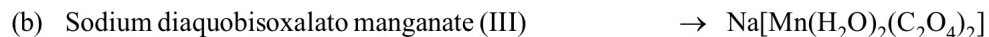
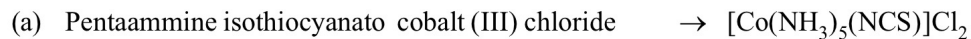


(1) Write down formula of the following complex compounds :



- (2) Explain the following with appropriate reasons :
- $\text{NH}_2\text{-NH}_2$ has two lone pairs. However, it does not act as chelating agent.
 - Cu(OH)_2 is soluble in NH_4OH where as it is insoluble in NaOH .
 - A blue coloured solution of $[\text{CoCl}_4]^{2-}$ ion changes to pink on reaction with HgCl_2 .
 - What happens when $[\text{Ni(H}_2\text{O)}_6]^{2+}$ is mixed with ethylenediamine in excess?
 - $[\text{Fe(CN)}_6]^{3-}$ ion has magnetic moment 1.73 BM, while $[\text{Fe(H}_2\text{O)}_6]^{3+}$ has a magnetic moment 5.92 BM.

Solutions

- (a) If $\text{NH}_2\text{-NH}_2$ acts as a bidentate ligand, it will form a three membered ring with central metal ion, which is very unstable.

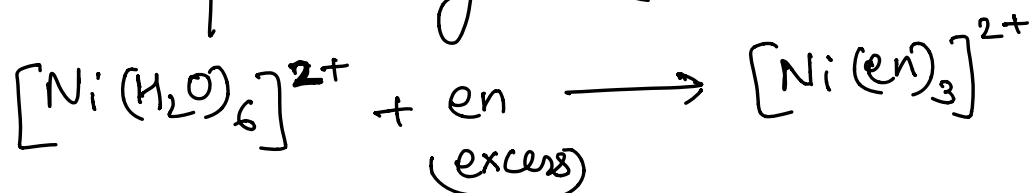


Hence it does not act as chelating ligand.

- (b) Cu(OH)_2 is a basic hydroxide. Hence it does not reacts with NaOH and remains insoluble. However, on reaction with NH_4OH , it forms a stable complex $[\text{Cu(NH}_3)_4]^{+2}$ and give a deep blue solution and thus becomes soluble.

- (c) On reaction with HgCl_2 , $[\text{CoCl}_4]^{2-}$ ion changes to $[\text{Co(H}_2\text{O)}_6]^{+2}$ which shows pink color along with the formation of $[\text{HgCl}_4]^{2-}$.

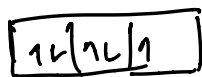
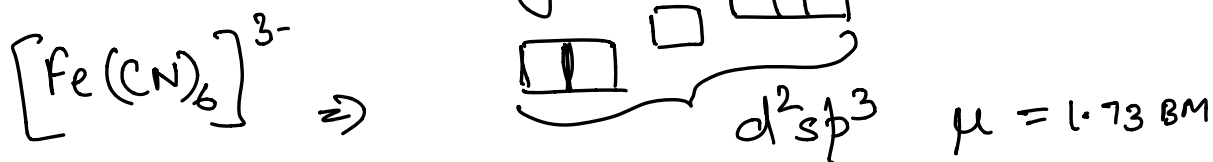
(d) If $[\text{Ni}(\text{H}_2\text{O})_6]^{2+}$ is added in excess of ethylenediamine, the H_2O (W.F.L) is replaced by en (S.F.L)



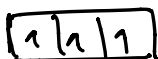
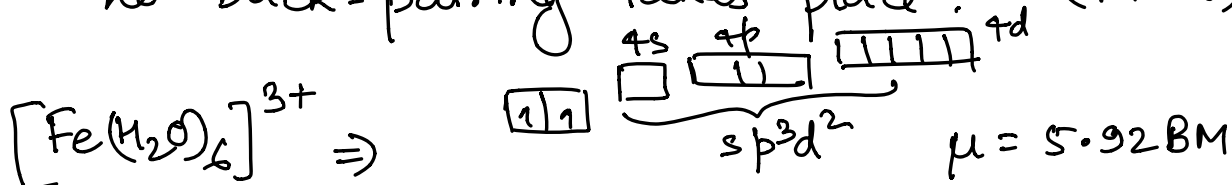
There is no change in shape and magnetic moment.

(e) $[\text{Fe}(\text{CN})_6]^{3-}$ has cyanido as a S.F.L.

Hence back-pairing takes place. ($P < \Delta_o$)



$[\text{Fe}(\text{H}_2\text{O})_6]^{3+}$ has H_2O as a W.F.L, hence no back-pairing takes place. ($P > \Delta_o$)



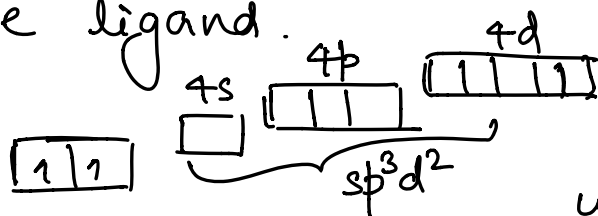
(3) Explain the following with appropriate reasons :

[10]

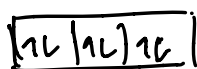
- All octahedral complexes of Ni^{2+} ion must be outer orbital complexes.
- $[\text{Co}(\text{en})_3]^{2+}$ and $[\text{Co}(\text{NO}_2)_6]^{4-}$ ions are easily oxidisable
- 4-coordinated complexes of $\text{Pd}(\text{II})$ and $\text{Pt}(\text{II})$ are diamagnetic square planar
- Tetrahedral complexes do not show geometrical isomerism while square planar complexes do show this kind of isomerism.
- $[\text{Cu}(\text{NH}_3)_4]^{2+}$ is coloured while $[\text{Cu}(\text{CN})_4]^{3-}$ is colourless.

Solutions

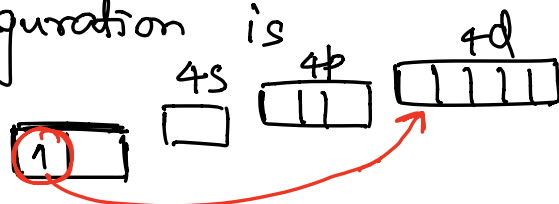
(a) For octahedral Ni^{2+} complexes, the configuration will be identical irrespective of the ligand.



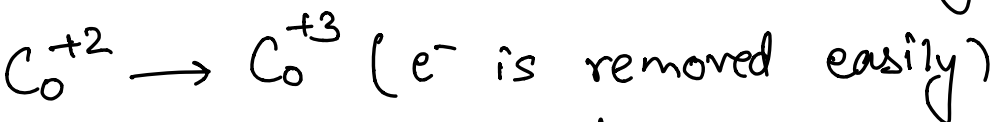
Hence it always will be an outer orbital complex.



(b) In both $[\text{Co}(\text{en})_3]^{2+}$ & $[\text{Co}(\text{NO}_2)_6]^{4-}$ configuration is

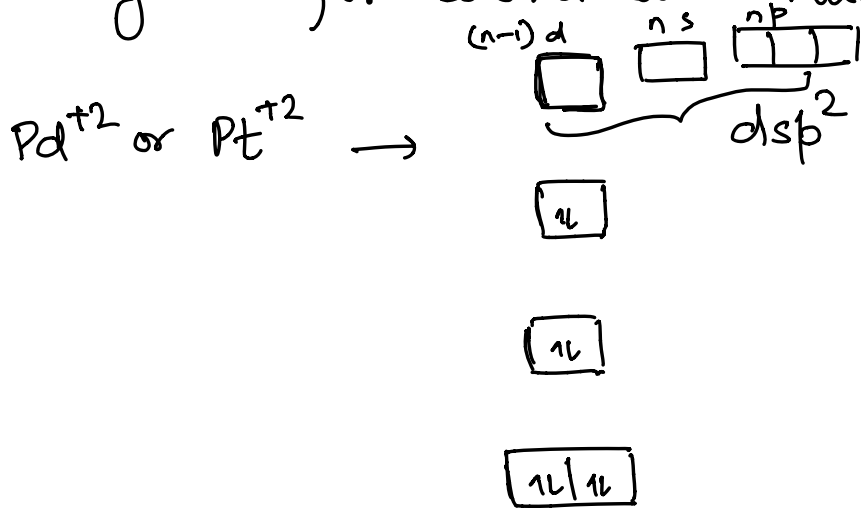


Here, the unpaired electron is present in 4d which can be removed easily.



Hence are easily oxidizable.

(c) Due to high effective nuclear charge in Pd & Pt, their field becomes very strong. Hence, even in case of weak ligands, pairing energy comes less than CFSE and therefore they form inner orbital complexes with any ligand for coordination number 4.



(d) In tetrahedral geometry, all positions are equivalent and therefore bond angles do not change on exchanging the position of ligands. Hence G.I is not possible.

In square planar, cis & trans forms are possible.

(c) In $[\text{Cu}(\text{NH}_3)_4]^{2+}$; Cu is present as Cu^{2+} which has d^9 configuration, which has one unpaired e^- that can show d-d transition & can show color.

In $[\text{Cu}(\text{CN})_4]^{3-}$; Cu is present as Cu^+ , which has d^{10} configuration which has no unpaired electron and cannot show d-d transition and is therefore colorless.