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Co-ordination Compounds

- Write IUPAC names of the following compounds :
 - $[\text{Co}(\text{NH}_3)_4 \text{H}_2\text{O Br}](\text{NH}_3)$
 - $[\text{CoCl}_2(\text{en})_2\text{SO}_4]$
 - $\text{K}[\text{Pt}(\text{NH}_3)\text{Cl}_3]$
 - $\text{Na}_3[\text{Fe}(\text{C}_2\text{O}_4)_3]$
 - $\text{Na}[\text{BH}_4]$
 - $\text{K}_3[\text{Fe}(\text{CN})_6]$
 - $\text{Fe}_4[\text{Fe}(\text{CN})_6]_3$
 - $[\text{Pt}(\text{NH}_3)_4\text{Cl}_2][\text{PtCl}_4]$
 - $[\text{Co}(\text{NH}_3)_4\text{Cl}_2]_3 [\text{Cr}(\text{CN})_6]$
 - $\text{K}_3[\text{Ag}(\text{S}_2\text{O}_3)_2]$
 - $[\text{CrCl}_2(\text{en})_2]\text{Cl}$
 - $[\text{Co}(\text{NH}_3)_5(\text{ONO})]\text{Cl}_2$
- Define and illustrate the following types of structural isomerism with an example :
 - Ionisation isomerism
 - Solvate or hydrate isomerism
 - Linkage isomerism
 - Co-ordination isomerism
- Square planar complexes do not exhibit optical isomerism whereas tetrahedral complexes do not exhibit geometrical isomerism. Explain.
- Explain Werner's theory of Co-ordination compounds.
- On the basis of valence bond theory, explain type of hybridization, shape, magnetic behavior and spin of the following coordination entities :
 - $[\text{CoF}_6]^{3-}$
 - $[\text{Co}(\text{NH}_3)_6]^{3+}$
 - $[\text{Co}(\text{C}_2\text{O}_4)_3]^{3-}$
 - $[\text{Ni}(\text{NH}_3)_6]^{2+}$
 - $[\text{Fe}(\text{CN})_6]^{4-}$
 - $[\text{Fe}(\text{CN})_6]^{3-}$
 - $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$
 - $[\text{Fe}(\text{CO})_5]$
 - $[\text{Ni}(\text{CN})_4]^{2-}$
 - $[\text{NiCl}_4]^{2-}$
 - $[\text{Pt}(\text{NH}_3)_2\text{Cl}_2]$
 - $[\text{Pt}(\text{CN})_4]^{2-}$
- Explain the following giving suitable reasons :
 - A solution of $[\text{Ni}(\text{H}_2\text{O})_6]^{2+}$ is green but a solution of $[\text{Ni}(\text{CN})_4]^{2-}$ is colourless.
 - $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ is blue in colour while CuSO_4 is colourless.
 - $[\text{NiCl}_4]^{2-}$ is paramagnetic while $[\text{Ni}(\text{CO})_4]$ is diamagnetic though both are tetrahedral.
 - $[\text{Cr}(\text{NH}_3)_6]^{3+}$ is paramagnetic while $[\text{Ni}(\text{CN})_4]^{2-}$ is diamagnetic.
 - $[\text{Fe}(\text{H}_2\text{O})_6]^{3+}$ is strongly paramagnetic whereas $[\text{Fe}(\text{CN})_6]^{3-}$ is weakly paramagnetic.
 - $[\text{Ti}(\text{H}_2\text{O})_6]^{3+}$ is coloured while $[\text{Sc}(\text{H}_2\text{O})_6]^{3+}$ is colourless.
 - $[\text{Fe}(\text{CN})_6]^{3-}$ is weakly paramagnetic while $[\text{Fe}(\text{CN})_6]^{4-}$ is diamagnetic.
 - $[\text{Ni}(\text{CO})_4]$ possesses tetrahedral geometry while $[\text{Ni}(\text{CN})_4]^{2-}$ is square planar.
 - $[\text{Fe}(\text{CN})_6]^{4-}$ and $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$ are of different colours in dilute solution.
 - $[\text{Co}(\text{NH}_3)_6]^{3+}$ is an inner orbital complex whereas $[\text{Ni}(\text{NH}_3)_6]^{2+}$ is an outer orbital complex.
 - Low spin octahedral complexes of nickel are not known.
 - CO is a stronger ligand than NH_3 for many metals.
- What do you mean by an ambidentate ligand ? Name the type of isomerism when ambidentate ligands are attached to central metal ion. Give two examples ambidentate ligand.
- A metal M^{n+} having d^4 valence electronic configuration combines with three bidentate ligands to form a complex compound. Assuming $\Delta_0 > P$.

- (i) Write the electronic configuration of d^4 ion.
- (ii) What type of hybridization will M^{n+} ion have?
- (iii) Name the type of isomerism exhibited by this complex.
9. A chloride of fourth group cation in qualitative analysis gives a green coloured complex [A] in aqueous solution which when treated with ethane-1, 2-diamine(en) gives pale yellow solution [B] which on subsequent addition of ethane-1, 2-diamine turns to blue/purple [C] and finally to violet [D]. Write the structures of complexes [A], [B], [C] and [D].
10. Write the correct formulae for the following coordination compounds :
- (i) $CrCl_3 \cdot 6H_2O$ (violet with 3 chloride ions precipitated as AgCl)
- (ii) $CrCl_3 \cdot 6H_2O$ (light green colour with 2 chloride ions precipitated as AgCl)
- (iii) $CrCl_3 \cdot 6H_2O$ (dark green colour with 1 chloride ion precipitated as AgCl)
11. $CoSO_4 \cdot 4Cl \cdot 5NH_3$ exists in two isomeric forms 'A' and 'B'. Isomer 'A' reacts with $AgNO_3$ to give white precipitate, but does not react with $BaCl_2$. Isomer 'B' gives white precipitate with $BaCl_2$ but does not react with $AgNO_3$. Answer the following questions :
- (i) Identify 'A' and 'B' and write their structural formulae.
- (ii) Name the type of isomerism involved.
- (iii) Give the IUPAC name of 'A' and 'B'.
12. Using crystal field theory, draw energy level diagram, write electronic configuration of the central metal atom/ion and determine the magnetic moment value in the following: $[CoF_6]^{3-}$, $[Co(H_2O)_6]^{2+}$, $[Co(CN)_6]^{3-}$.
13. The hexaaquamanganese(II) ion contains five unpaired electrons while the hexacyano ion contains only one unpaired electron. Explain using crystal field theory.
14. Give the electronic configuration of the following complexes on the basis of crystal field splitting theory.
 $[CoF_6]^{3-}$, $[Fe(CN)_6]^{4-}$ and $[Cu(NH_3)_6]^{2+}$.
15. Using crystal field theory, draw energy level diagram, write electronic configuration of the central metal atom/ion and determine the magnetic moment value in the following ; $[FeF_6]^{3-}$, $[Fe(H_2O)_6]^{2+}$, $[Fe(CN)_6]^{4-}$.
16. Solve all the NCERT intext & Exercises question.

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