

ISOMERISM IN transition Compds

→ Same mol formula but different properties

→ Phenomenon is isomerism

Structural

- 1) Ionisation isomerism
- 2) Hydrate isomerism
- 3) Coordination isomerism
- 4) Linkage isomerism

Stereoisomerism

- 1) Geometrical isomerism
- 2) Optical isomerism

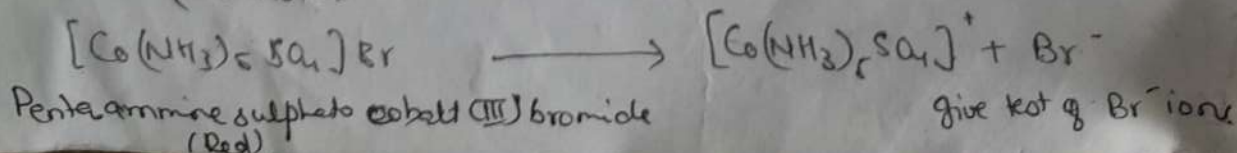
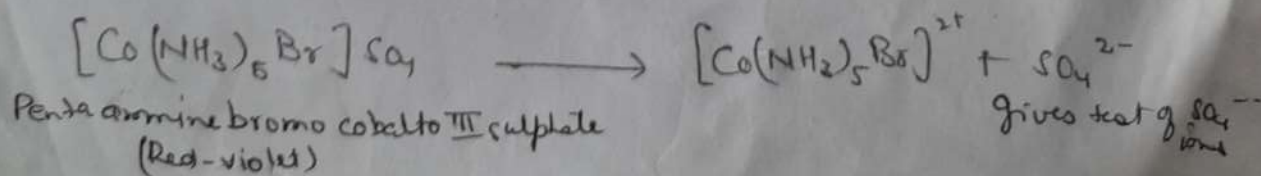
Structural Isomerism: same formula, different structural arrangement of atom / gpe around the central atom.

1. Ionisation Isomerism: → same mol. formula
gives
→ different ions in solⁿ

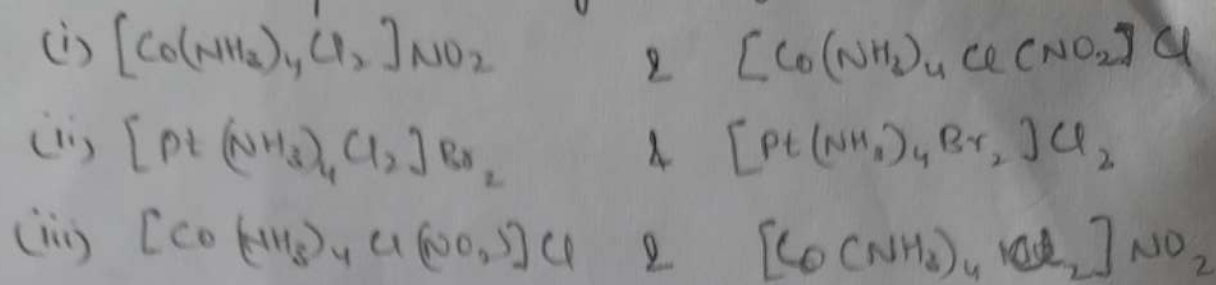
In this type of isomerism, the difference arises from the interchange of groups within / outside the coordⁿ sphere. So these isomers give different ion in solⁿ.

for eg^s, there are 2 isomers of the compd $\text{Co}(\text{NH}_3)_5\text{BrSO}_4$
use as
→ one of red-violet and forms a ppt $\bar{\text{C}} \text{BaCl}_2$ which indicates SO_4^{2-} ion is outside the coordⁿ sphere.

→ Second one is red & does not form ppt $\bar{\text{C}} \text{BaCl}_2$ but forms ppt of $\text{AgBr} \bar{\text{C}} \text{AgNO}_3$ indicating bromide ion outside the sphere.



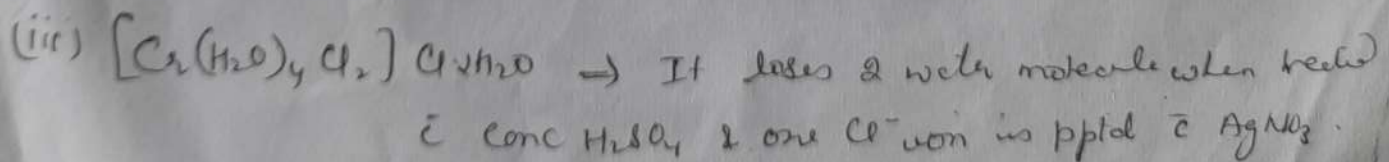
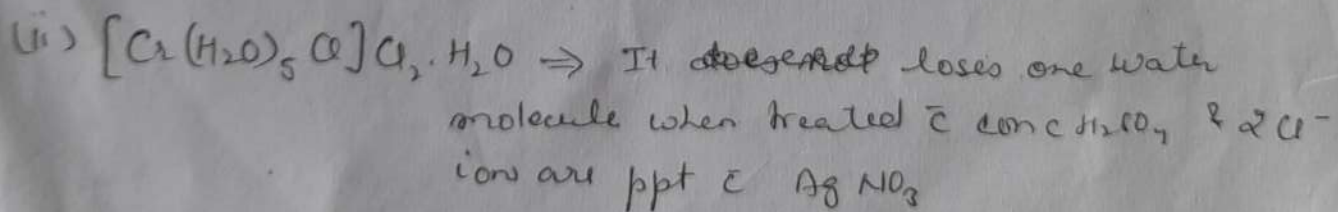
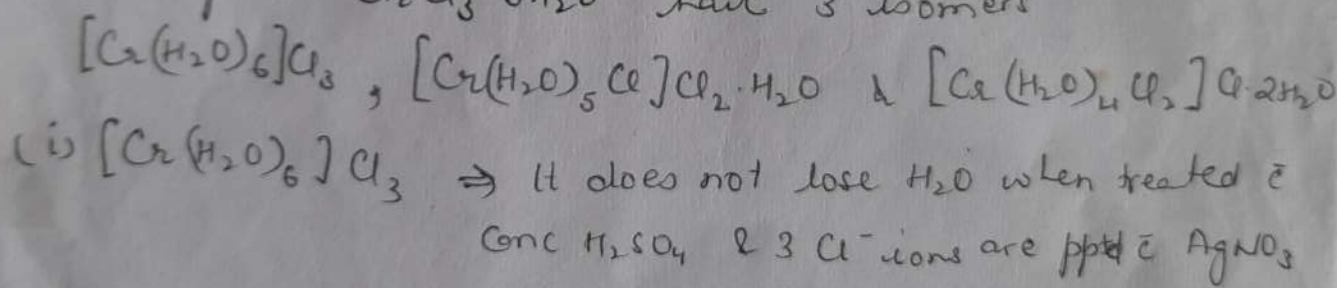
Other compds showing ionisation isomerism are:



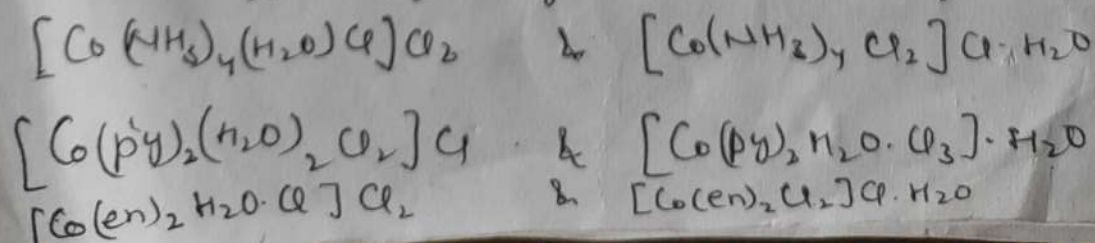
2) Hydrate Isomerism: Compd with same mol. formula but differ in no. of H_2O molecules present as ligands / as molecules of hydration are k/d Hydrate isomers.

→ Similar to ionisation isomerism, in which water molecules may occur inside & outside the coordⁿ sphere as a ~~coord~~ Coordinate gp or as water of hydration.

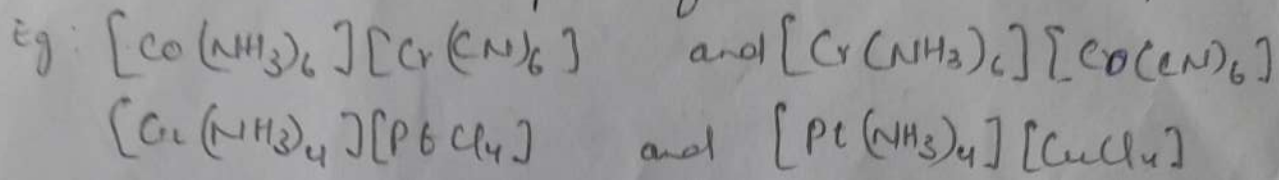
For example: $\text{CrCl}_3 \cdot 6\text{H}_2\text{O}$ have 3 isomers



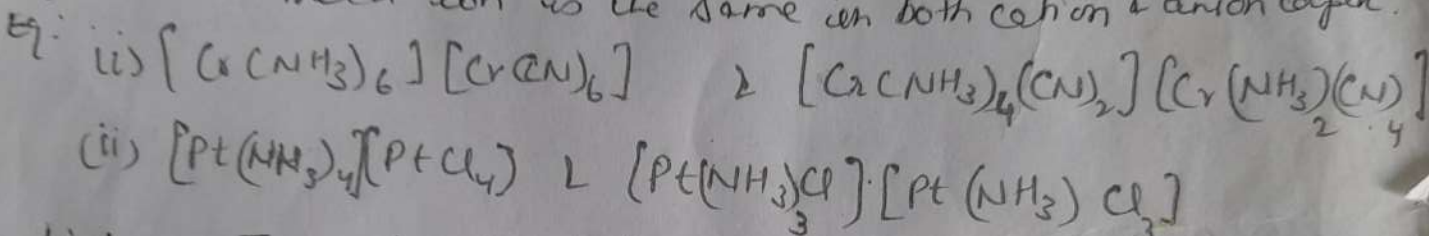
Similarly, the following 2 isomers are hydrate isomers:



3) Coordination Isomerism: This type of isomerism occurs in compds containing both cationic & anionic complexes and the isomers differ in the distribution of ligands in the coordination sphere of cationic & anionic parts.



This type of isomerism is also shown by compds in which the metal ion is the same in both cation & anion complex.



4) Linkage Isomerism: Compds with same mol formula but differ in the mode of linkage/attachment of a ligand to the metal atom or ion are called linkage isomers.

For eg. NO_2^- (Nitro) ion, N- as well as O-atom can donate their lone pairs. This gives rise to isomerism.

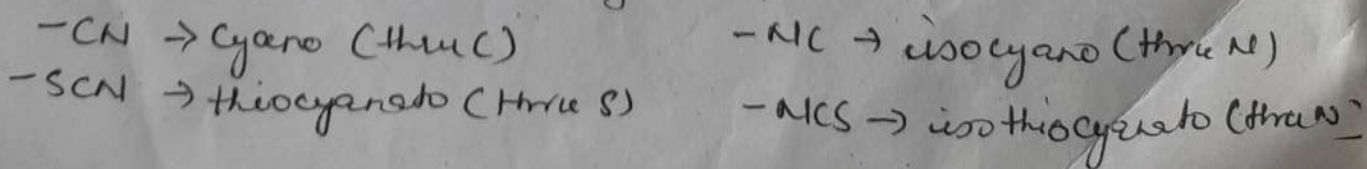
Eg. Pentaammine cobalt(III) chloride containing NO_2^- group in complex



Pentaammine nitro cobalt(III) chloride Pentaammine nitrito cobalt(III) chloride

The unidentate ligands which can bind to the central atom thru a donor atom are also called ambidentate ligands.

Some of ambidentate ligands are



②

Stereoisomers: Isomers \bar{c} same mol formula ^{and position} but ~~same~~ ^{different} spatial arrangements around central atom.

Two types \swarrow \searrow
Geometrical Isomerism
Optical Isomerism

1) Geometrical Isomerism: It is due to ligands occupying different positions around the central ion. Positions can be either adjacent to one another or opposite to one another, which are referred as cis form & trans form respectively.

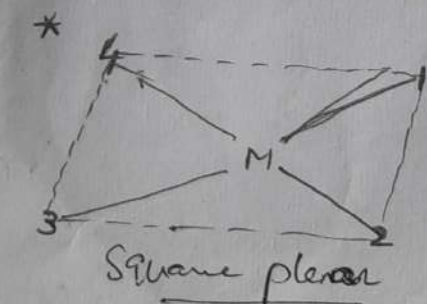
\rightarrow Also k/d as cis-trans isomers.

\rightarrow very common in coordⁿ compds; due to different coordⁿ no.'s varying from 2-9.

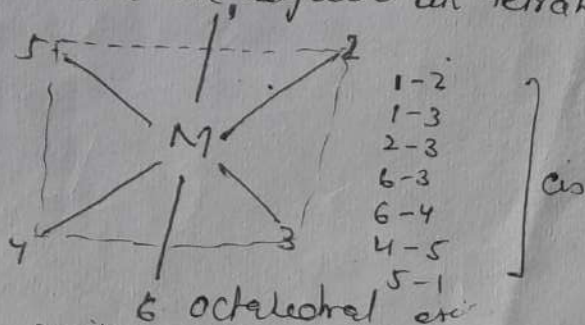
\rightarrow Geometrical isomerism of compds with C.N 4 & 6 is very imp & discussed.

i) Geometrical isomerism in complexes \bar{c} C.N. 4

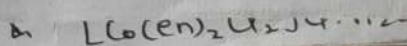
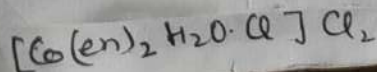
Complexes \bar{c} C.N 4 adopt tetrahedral / square planar geometry. In tetrahedral, geometrical isomerism is not possible bcos all the positions are adjacent in tetrahedral.



positions
 $\left. \begin{matrix} 1-2 \\ 2-3 \\ 3-4 \\ 1-4 \end{matrix} \right\} \text{cis}$ $\left. \begin{matrix} 1-3 \\ 2-4 \end{matrix} \right\} \text{trans}$



positions
 $\left. \begin{matrix} 1-6 \\ 2-4 \\ 3-5 \end{matrix} \right\} \text{trans}$

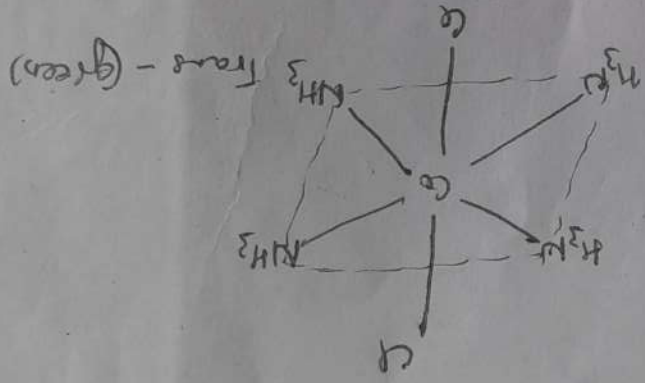
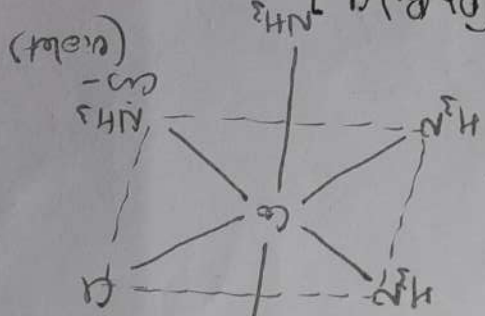


Geometrical isomerism in Oct. 6

→ Oct. 6 complex adopt octahedral complexes.

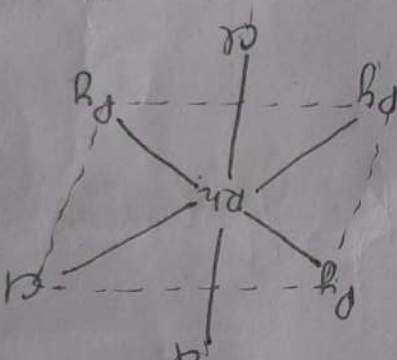
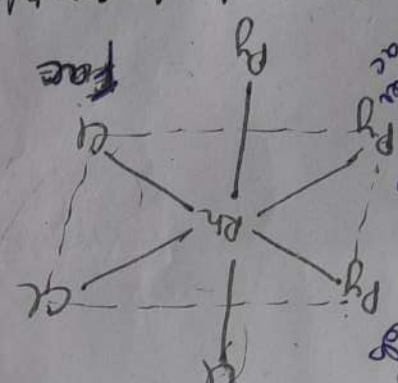
a) Octahedral complexes of type MA_6 , MA_5X , MA_4X_2 , MA_3X_3 etc. ~~MA_4X_2~~ exhibit geometrical isomerism -

Eg $[Co(NH_3)_4Cl_2]^+$



(i)

Eg $[Rh(PPh_3)_3Cl_3]$



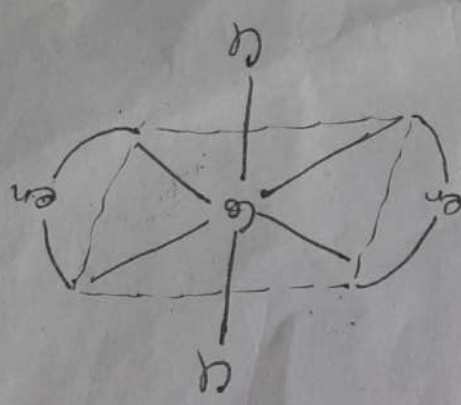
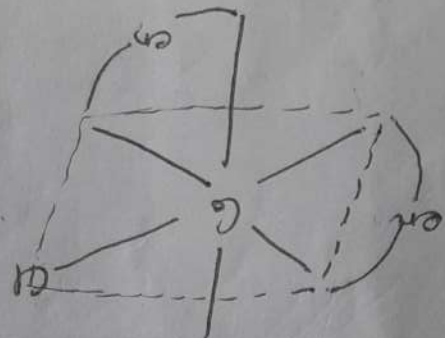
When 3 bidentate ligands occupy one face of an octahedral complex, it is called facial isomer.

(b) Octahedral complexes of type $M(AA)_2X_2$ & $M(AA)_3X_2$

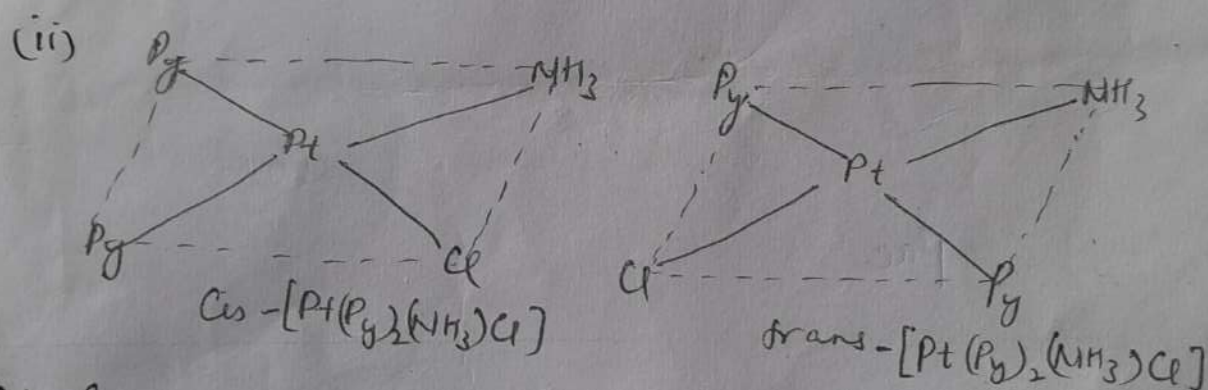
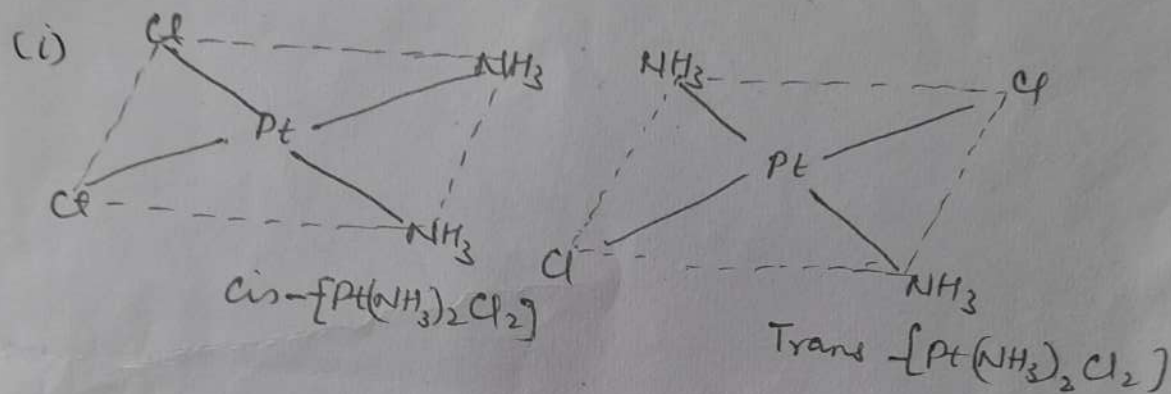
$AA \rightarrow$ symmetrical bidentate ligand such as ethylenediamine (en)

or oxalate (ox) etc.

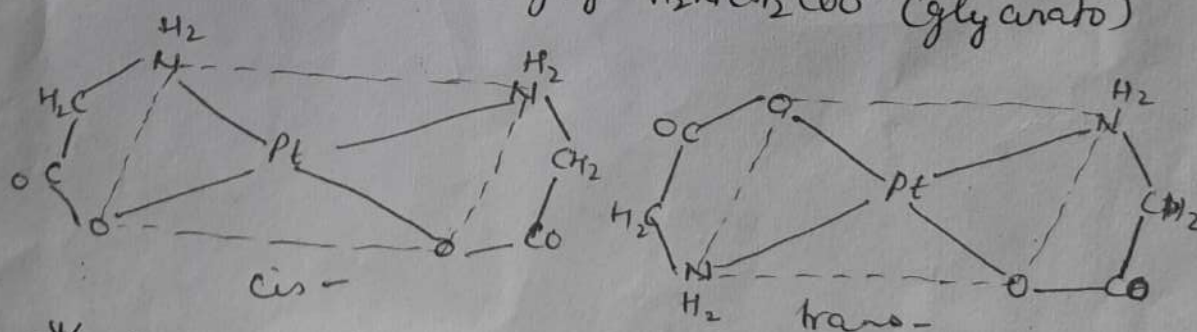
Eg. $[Co(en)_2Cl_2]^+$



- (a) Square planar complexes of the type MA_2X_2 , MA_2XY , $MABX_2$, ~~$MABX_2$~~ can exist as geometrical isomers (where A & B are neutral ligands such as H_2O , NH_3 , CO , NO , C_5H_5N whereas X & Y are anionic ligands such as Cl^- , NO_2^- , CN^- , SCN^- etc.)
for eg.



- (b) Square planar complexes containing unsymmetrical bidentate ligand such as $[M(AB)_2]$ also show geometrical isomerism for eg. $[Pt(gly)_2]$ where $gly = H_2NCH_2COO^-$ (glycinate)



* Square planar complexes of type MA_4 , MA_3X , MA_2X_2 will not show geometrical isomerism bco in each case, spatial arrangement of complexes are same.