

# Atomic Energy Central School, Indore

Class XII Chemistry CO-ORDINATION COMPOUNDS Handout 3/6

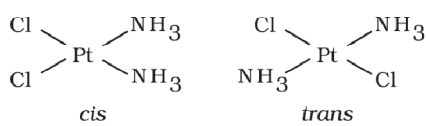
## Isomerism in Coordination Compounds

Two principal types of isomerism are known among coordination compounds. Each of which can be further subdivided.

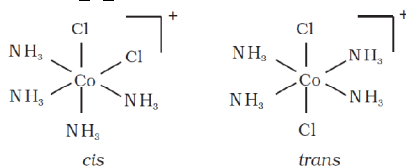
### (a) Stereoisomerism

(i) **Geometrical isomerism:** This type of isomerism arises in heteroleptic complexes due to different possible geometric arrangements of the ligands. The two similar ligands may be arranged adjacent to each other in a *cis* isomer, or opposite to each other in a *trans* isomer.

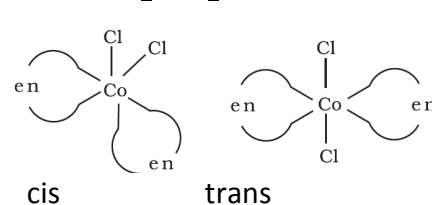
#### $[MX_2L_2]$ square planar



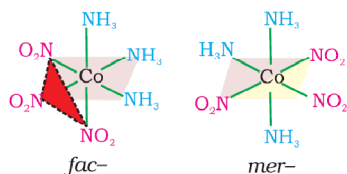
#### $[MX_4L_2]$ Octahedral



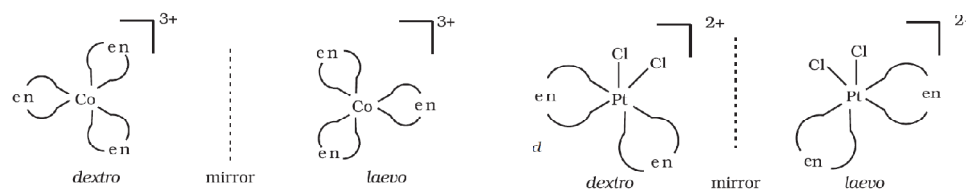
#### $[MX_2(L-L)_2]$ Octahedral



#### $[MX_3L_3]$ Octahedral



(ii) **Optical isomerism:** Optical isomers are mirror images that cannot be superimposed on one another. These are called as *enantiomers*.



### (b) Structural isomerism

(i) **Linkage isomerism:** Linkage isomerism arises in a coordination compound containing ambidentate ligand. They differ in the types of donor atoms. Ex  $[Co(NH_3)_5(NO_2)]Cl_2$  &  $[Co(NH_3)_5(ONO)]Cl_2$

(ii) **Coordination isomerism:** This type of isomerism arises from the interchange of ligands between cationic and anionic entities of different metal ions present in a complex.

Ex.  $[Cr(NH_3)_6][Co(CN)_6]$  &  $[Co(NH_3)_6][Cr(CN)_6]$

(iii) **Ionisation isomerism:** This form of isomerism arises when the counter ion in a complex salt is itself a potential ligand and can displace a ligand which can then become the counter ion.

Ex.  $[Co(NH_3)_5SO_4]Br$  and  $[Co(NH_3)_5Br]SO_4$ .

(iv) **Solvate isomerism:** Solvate isomers differ by whether or not a solvent molecule is directly bonded to the metal ion or merely present as free solvent molecules in the crystal lattice. An example is provided by the aqua complex  $[Cr(H_2O)_6]Cl_3$  (violet) and  $[Cr(H_2O)_5Cl]Cl_2 \cdot H_2O$  (grey-green).