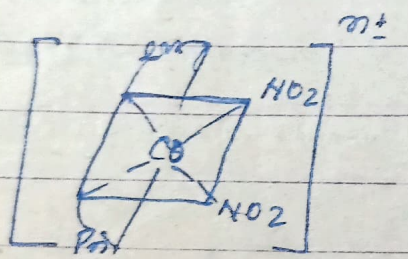
Octahedral Complexes Containg Opticaly active bidentate unsymmetrical Ligands: →

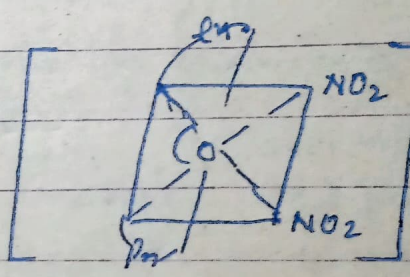
Interesting example of this type of Complex is $[Co(en)(Pn)(NO_2)_2]^+$ (where (en) = ethylenediamine and Pn = 1, 2,-Propane diamine) This exist in two forms.

(a) Cis-form → These are unsymmetrical and hence opticaly active. these are shown in fig. (a) and (b)

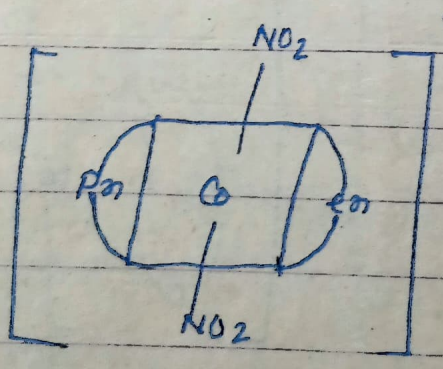
(b) Trans form: → These are symmetrical and hence opticaly inactive. these are shown in fig (c) and (d)



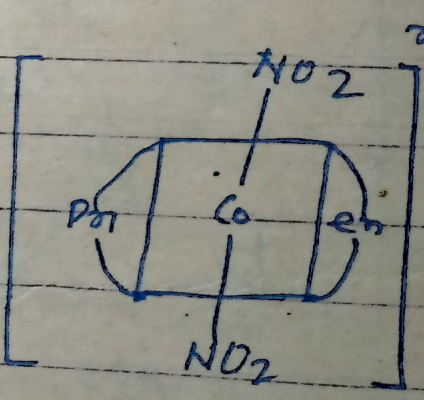
(a)



(b)



(c)



(d)

Each of the two Cis. isomers shown in fig (a) and (b) gives its Corresponding optical isomers.

Discuss the factors which affect the Stability of a Complex ion or Complex formation.

The Stability of a Complex ion depends upon

(1) the nature of the Central ion.

(2) the Nature of ligands.

Nature of the Central ion :—

(1) In general, the greater the charge density on the Central ion, the greater is the Stability of its Complex.

In other words, we say, that the greater the charge and the smaller the Size of ion (i.e larger $\frac{\text{Charge}}{\text{radius}}$ ratio), the greater is the Stability of its Complexes.

Let us Consider the Fe atom.

$Fe \longrightarrow Fe^{++} + 2e^-$

and, $Fe \longrightarrow Fe^{+++} + 3e^-$

In both the cases the radious of Fe ion is nearly equal.

Hence $\frac{\text{Charge}}{\text{radius}}$ ratio in Case of Fe^{+++} ion is greater than that of Fe^{++} ion, so the Complex of Fe^{+++} ion are more Stable that of Fe^{++} ion.

This is also supported by the fact, that Stability Constant of $[Fe(CN)_6]^{3-}$ (i.e $x = 6-3$, $x = 3$) is 10^{31} but the Stability Constant of

or, $x = 3$

(ii) $x - 6 = -4$
or $x = 6 - 4 = 2$

$[Fe(CN)_6]^{4-}$ is only 10^{6}.

The stability of complex also depends upon the electronegativity of the central metal ion.

The electronegativity of the central ion i.e its property to attract electrons, also influences the stability of its complexes.

The higher the electronegativity of the central ion, the greater is the stability of its complexes.

Nature of the ligand :—

If the nature of the ligand is more basic. i.e the greater is the case with which it can donate its lone pairs of electrons and, therefore, the greater is the stability of the complexes formed by it.

Hence CN^-, and F^- ions and NH_3 molecules, which are strong bases, are good ligands and form many complexes.

For anionic ligand, the higher the charge and the smaller the size, the more stable is the complex formed.

Thus F^- ion gives more stable complex than Cl^- ion.