Werner's theory:

- Every complex compound has a central metal ion or atom.
- The metal in a complex exhibits two types of valencies

  a) Primary valency

  b) Secondary valency
- Central metal ion/ atom forms dative bonds with electron pair donors or ligands.

Primary valency or Ionizable valency:

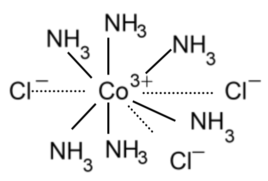
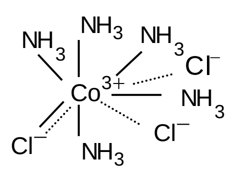
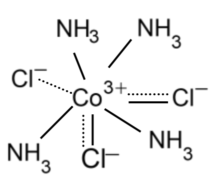
- It is equal to oxidation state of metal ion
- It is satisfied by negative ions. The groups bound by primary valency will ionise.
- These are held by electrostatic attraction by the metal ion, like ionic bond.
- These group are connected to the metal- ions, shown by broken line in the formula, or shown outside the square bracket.
- These are non-directional.

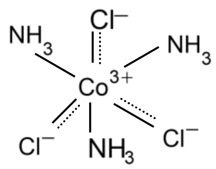
Secondary valency or non-ionizable valency:

- Secondary valency is equal to co-ordination number or number of coordinate covalent bonds.
- Secondary valency may be satisfied by neutral groups NH_3, H_2O or negative ions. CN^-, Cl^- or even positive ion like NO^+.
- The groups satisfying secondary valency are called ligands.
- The number of unidentate ligands around the metal is known as coordination number.
- Ligands donate lone pairs to the metal atom or ion and form coordinate covalent bonds.
- Ligands act as Lewis bases and metal ion/atom acts as Lewis acid.
- Ligands are connected to the metal by thick line or shown inside the square bracket.
- Some ligands may satisfy both primary and secondary valences and they do not ionize.
- Ligands are directed in space around the metal in a symmetric order and acquired a specific shape. Secondary valency is directional in nature and it determines the shape of the complex.

No of lignads	Shape of complex
2	Linear
3	Trigonal planar
4	Tetrahedral (or) Square planar
5	Square pyramidal (or) Trigonal bipyramidal
6	Octahedral
7	Pentagonal bipyramidal

Example:

Complex	No of ligands (or) Coordination no.	Werner Structure	
1. $CoCl_3$ $6NH_3$	6	Octahedral – Three Cl^- ions satisfy pimary valency – Six NH_3 molecules satisfy secondary valency – No.of ions in solution = 4 – AgCl molecules precipitated on adding excess of $AgNO_3$ = 3AgCl	
2. $CoCl_3$ $5NH_3$	6	Octahedral – $2Cl^-$ satisfy primary valency – One Cl^- satisfies both primary and secondary valency – $5NH_3$ molecules satisfy secondary valency – No.of ions in solution = 3 – AgCl molecules precipitated on adding excess of $AgNO_3$ = 2	
3. $CoCl_3$ $4NH_3$	6	Octahedral – 2 Cl^- & $4NH_3$ molecules satisfy both primary and secondary valency – One Cl^- satisifies only	

		primary valency – No.of ions in solution =2 – AgCl molecules precipitated = 1	
4. $CoCl_3$ $3NH_3$	6	Octahedral – The three Cl^- ions satisfy both primary and secondary valencies and $3NH_3$ molecules satisfy secondary valency – No.of species in solution = 1 – AgCl molecules precipitated by adding excess of $AgNO_3$ is zero.	

Defects in Werner's theory:

- This theory does not explain the role of the electronic configuration of metal in forming complexes.
- It is known now in through coordinate bond formation that the metal tries to acquire the nearest inert gas configuration during the formation of complex.
- This theory does not explain the reason for the color of the complex.
- This theory does not explain the magnetic behavior of complex.