

# Coordination chemistry Summary

- ❖ When two or more stable compounds in solution are mixed together and allowed to evaporate, in certain cases there is a possibility for the formation of double salts or coordination compounds. The double salts lose their identity and dissociate into their constituent simple ions in solutions, whereas the complex ion in a coordination compound, does not lose its identity and never dissociates to give simple ions.
- ❖ According to Werner, most of the elements exhibit two types of valence namely primary valence and secondary valence and each element tends to satisfy both the valences. In modern terminology, the primary valence is referred to as the oxidation state of the metal atom and the secondary valence as the coordination number.
- ❖ A coordination entity is an ion or a neutral molecule, composed of a central atom, usually a metal and the array of other atoms or groups of atoms (ligands) that are attached to it.
- ❖ The central atom/ion is the one that occupies the central position in a coordination entity and binds other atoms or groups of atoms (ligands) to itself, through a coordinate covalent bond.
- ❖ The ligands are the atoms or groups of atoms bound to the central atom/ion. The atom in a ligand that is bound directly to the central metal atom is known as a donor atom.
- ❖ The complex ion of the coordination compound containing the central metal atom/ion and the ligands attached to it, is collectively called a coordination sphere and are usually enclosed in square brackets with the net charge.
- ❖ The three-dimensional spatial arrangement of ligand atoms/ions that are directly attached to the central atom is known as the coordination polyhedron (or polygon).

- ❖ The number of ligand donor atoms bonded to a central metal ion in a complex is called the coordination number of the metal.
- ❖ The oxidation state of a central atom in a coordination entity is defined as the charge it would bear if all the ligands were removed along with the electron pairs that were shared with the central atom.
- ❖ This type of isomers arises when an ambidentate ligand is bonded to the central metal atom/ion through either of its two different donor atoms.
- ❖ This type of isomers arises in the coordination compounds having both the cation and anion as complex ions. The interchange of one or more ligands between the cationic and the anionic coordination entities result in different isomers.
- ❖ **Ionisation isomers** arises when an ionisable counter ion (simple ion) itself can act as a ligand. The exchange of such counter ions with one or more ligands in the coordination entity will result in ionisation isomers.
- ❖ Geometrical isomerism exists in heteroleptic complexes due to different possible three dimensional spatial arrangements of the ligands around the central metal atom. This type of isomerism exists in square planer and octahedral complexes.
- ❖ Coordination compounds which possess chirality exhibit optical isomerism similar to organic compounds. The pair of two optically active isomers which are mirror images of each other are called enantiomers.
- ❖ Linus Pauling proposed the Valence Bond Theory (VBT) which assumes that the bond formed between the central metal atom and the ligand is purely covalent. Bethe and Van Vleck treated the interaction between the metal ion and the ligands as electrostatic and extended the Crystal Field Theory (CFT) to explain the properties of coordination compounds.