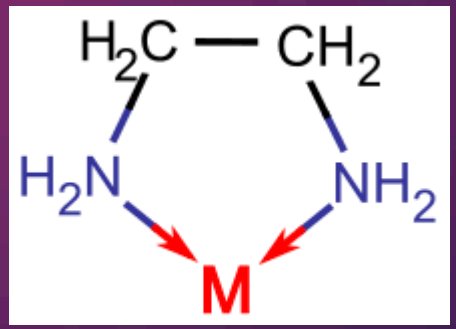
Presentation- I
Coordination Compounds.

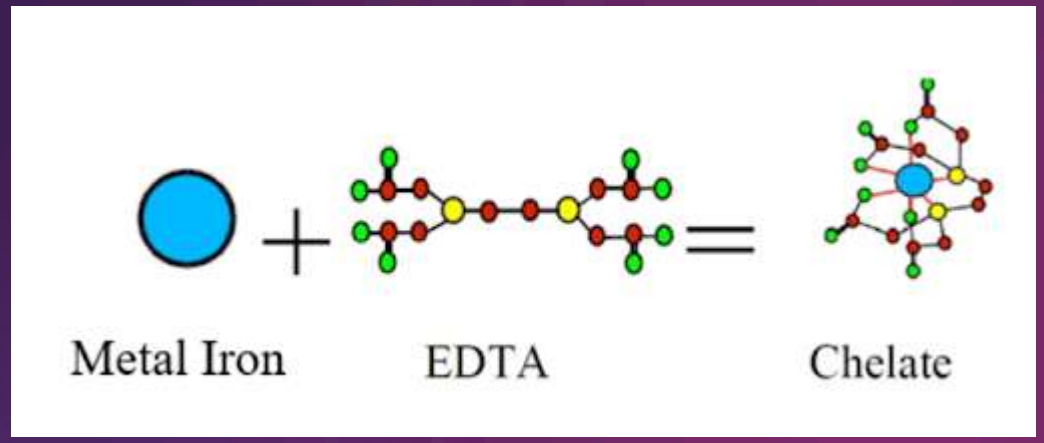
- By-
- **Dr.Rajita D.Ingle,**
- Associate Professor,
- Department of Chemistry,
- Deogiri College,
- Aurangabad.

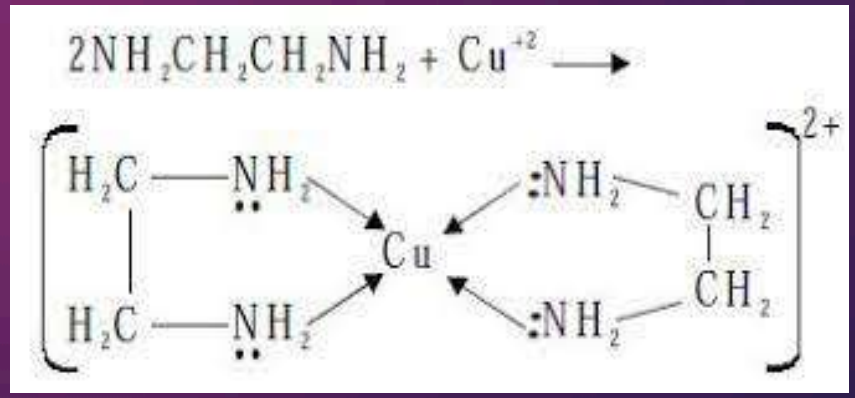
Coordination Compounds.

- A **chelate** is an organic compound formed when a polydentate ligand bonds to a central metal atom.
- Chelation, according to the IUPAC, involves the formation of two or more separate coordinate bonds between the ligand and central atom. The ligands are terms of chelating agents, chelants, chelators, or sequestering agents.



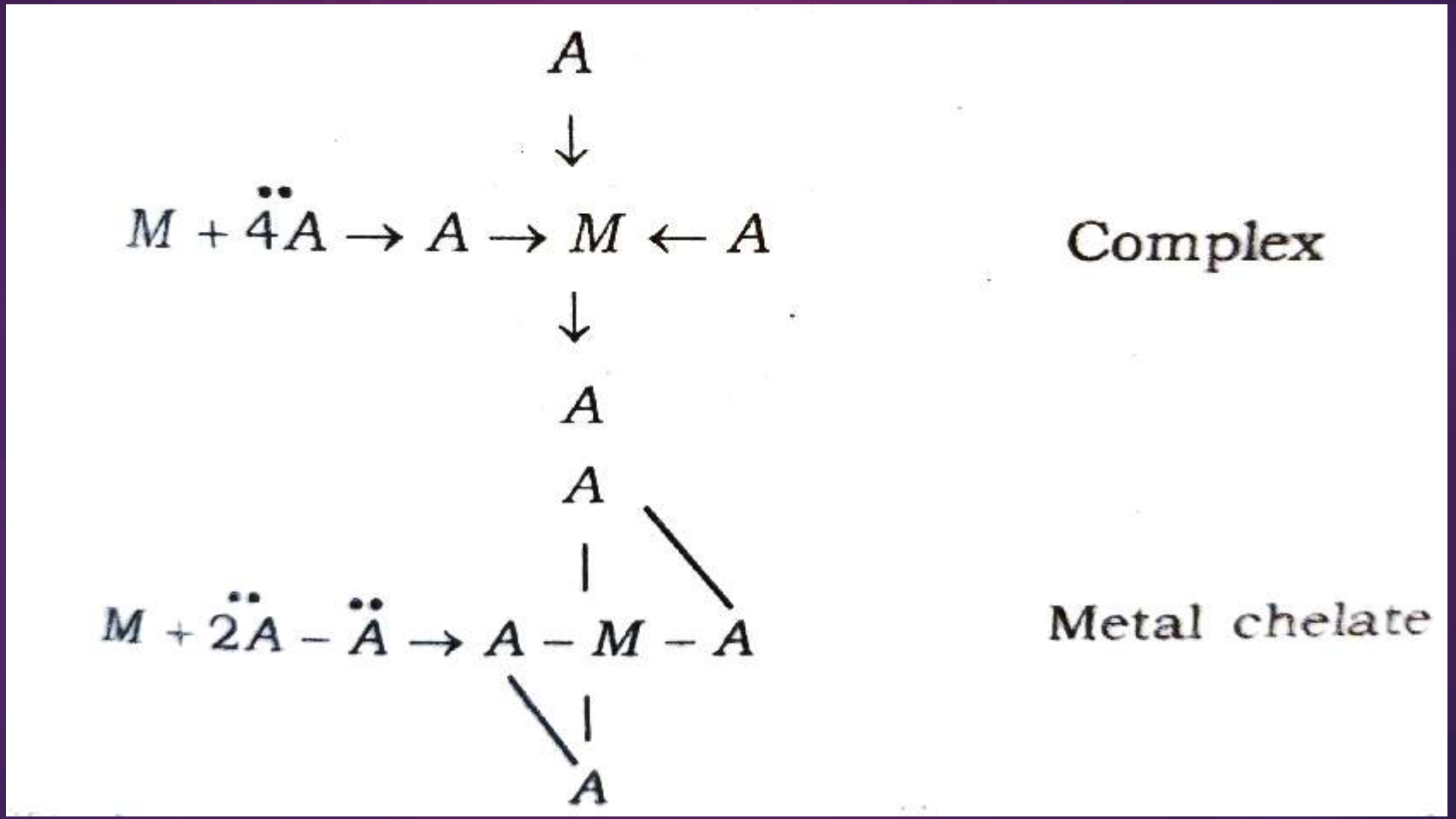
Coordination Compounds.

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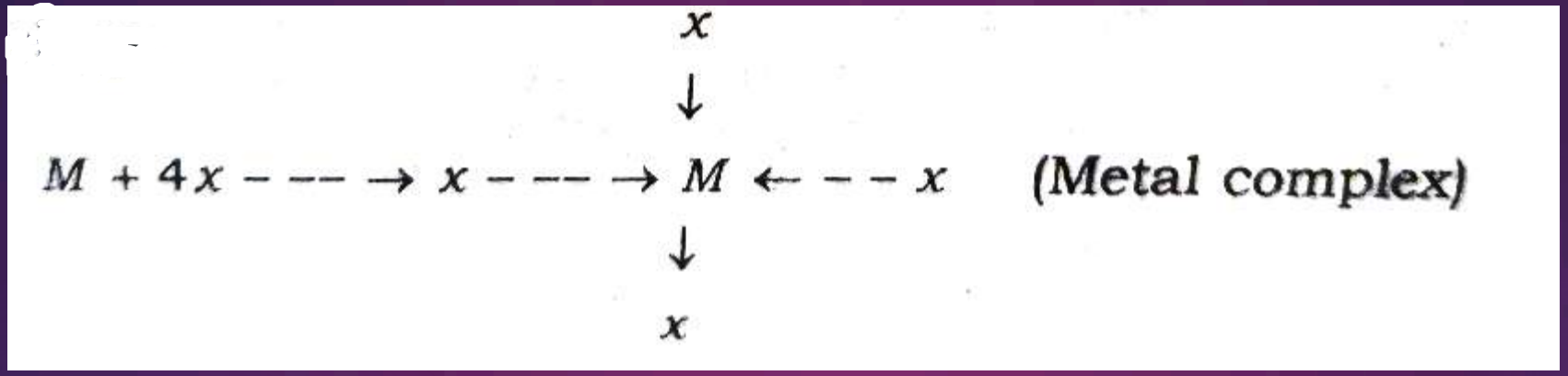
Coordination Compounds.

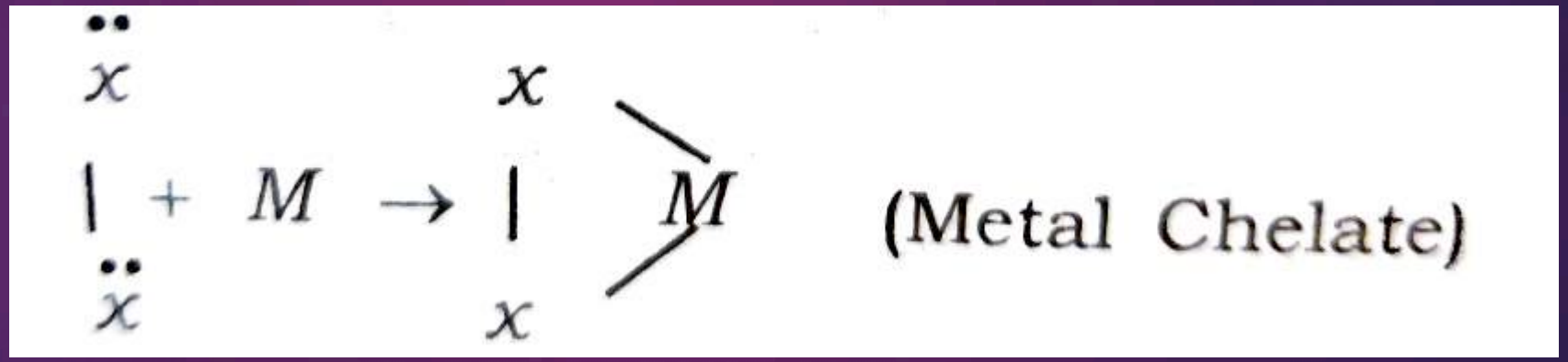
- **Distinction between Metal chelates and Metal complexes:-….**



Coordination Compounds.

- …





Coordination Compounds.

- **CHELATES & CHELATING AGENTS**
- Many essential biological chemicals are chelates. Chelates play important roles in oxygen transport and in photosynthesis. Furthermore, many biological catalysts (enzymes) are chelates. In addition to their significance in living organisms, chelates are also economically important, both as products in themselves and as agents in the production of other chemicals.
- A chelate is a chemical compound composed of a metal ion and a chelating agent. A chelating agent is a substance whose molecules can form several bonds to a single metal ion. In other words, a chelating agent is a multidentate ligand. An example of a simple chelating agent is ethylenediamine.

Coordination Compounds.

- Chelate is any of a class of coordination or complex compounds consisting of a central metal atom attached to a large molecule, called a ligand, in a cyclic or ring structure.
- Many commercial dyes and a number of biological substances, including chlorophyll and hemoglobin, are chelate compounds.
- Chelating agents are employed as extractants in industrial and laboratory separation of metals and as metal-ion buffers and indicators in analytical chemistry. Chelating agents are used in several applications, including:
- Scale removal
- Water treatment
- Corrosion control

Coordination Compounds.

- Chelate ligands, or chelates, are by definition ligands where the ligating atoms and the coordination center form at least one closed loop, when the connectivity of atoms is considered. The category of coordination compounds which is formed by chelating ligands is known as chelates. For example, iron has six coordination sites, as does EDTA (ethylenediaminetetraacetic acid). Iron ions entering a boiler (such as contamination from the condensate system) combine with EDTA. All coordination sites on the iron ion are used by the EDTA, and a stable metal chelate is formed.
- Chelates are more stable than nonchelated compounds of comparable composition, and the more extensive the chelation — that is, the larger the number of ring closures to a metal atom — the more stable the compound. This phenomenon is called the chelate effect. The stability of a chelate is also related to the number of atoms in the chelate ring. In general, chelates containing five- or six-membered rings are more stable than chelates with four-, seven- or eight-membered rings. The stability of complexes is greatly increased by chelating ligand. The total number of ligand atoms that can bind simultaneously to one metal center is the density of the ligand.

- The chelates play an important role in micro detection and determination of metal ions in analytical chemistry and water treatment.
- Although chelating agents can be used for corrosion control, the formation of soluble chelates may provoke stimulation of a corrosion process. Uncontrolled agent application may lead to chelant corrosion. This can be prevented by applying the precise amount that does not leave residuals in the boiler.

Coordination Compounds.

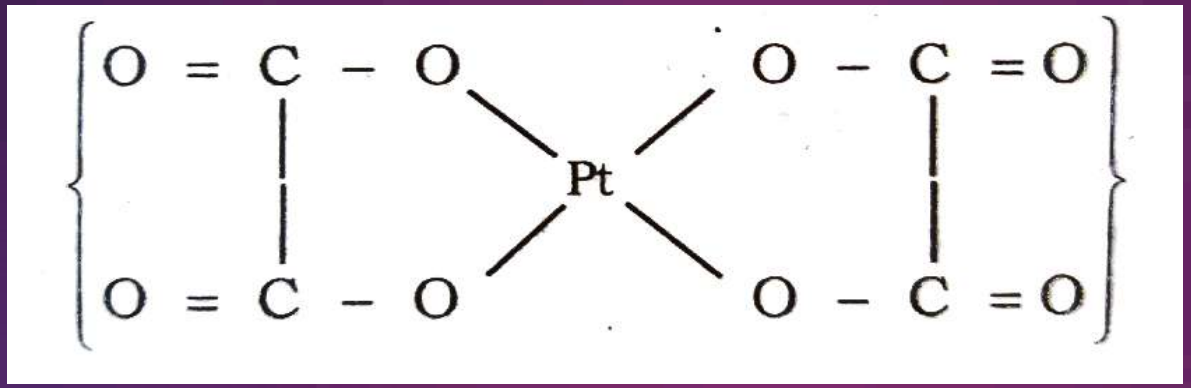
Characteristics of Chelates :

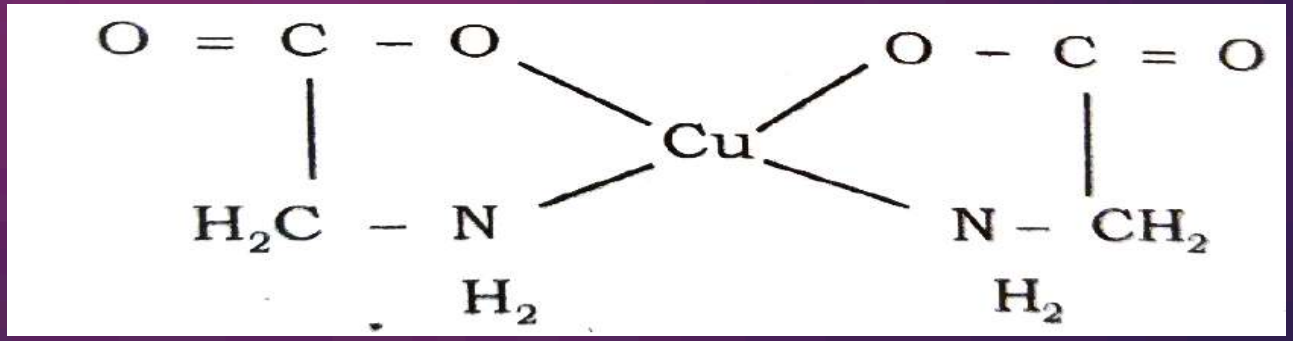
1) They do not exhibit any of the properties of the salts. It is because that central metal atom has valency more than one.
2) The donor groups are linked firmly to the metal ions present in the ring. However, it is covalent or coordinated covalent linkage which holds the metal ion into the chelating ring.
3) The presence of heterocyclic ring is essential for the formation of chelates.
4) The metal ion must have a suitable size.
5) The charge on the metal ions is generally large which is responsible for attracting the lone pairs of the electrons of the donor atoms.
6) In most of the chelates, the number of atoms forming the ring of the chelate is five or six but the former is more stable.

Coordination Compounds.

Classification ofChelates:-…..

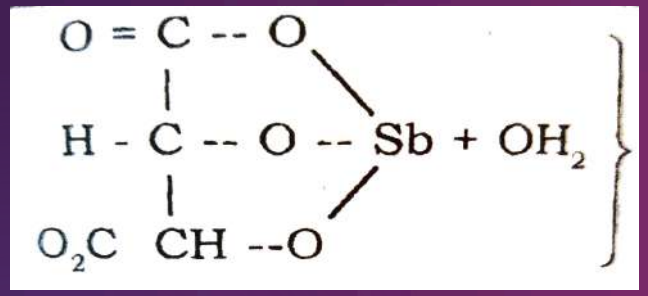
- **Bidentate groups:-**

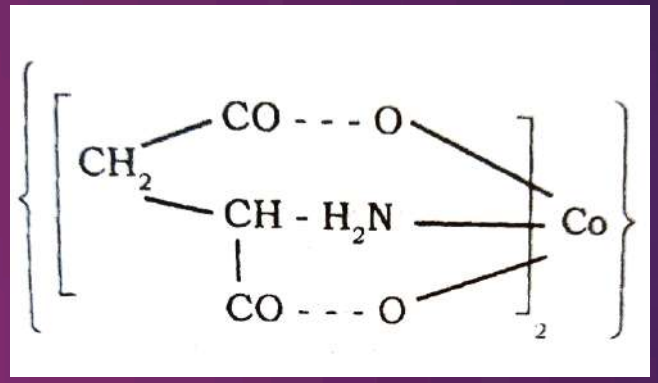


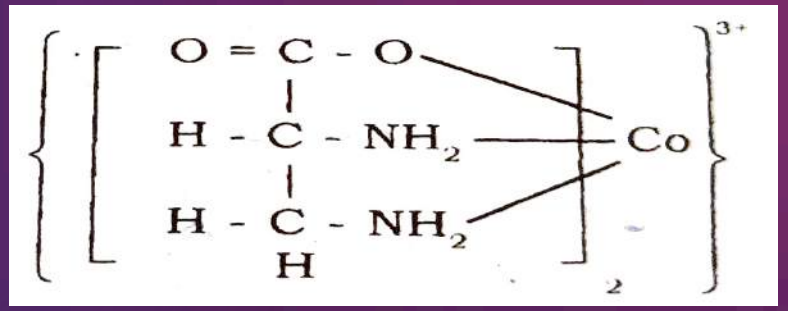


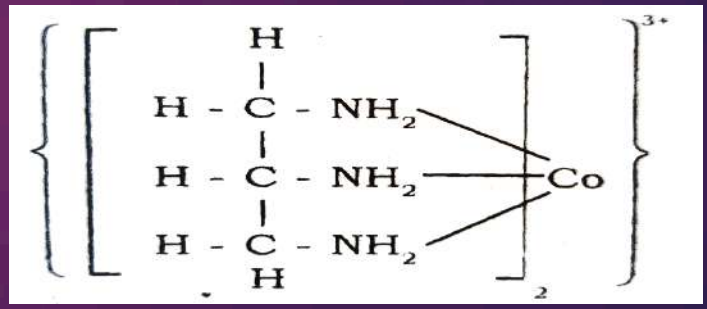
Coordination Compounds.

- **Tridentate groups:-**



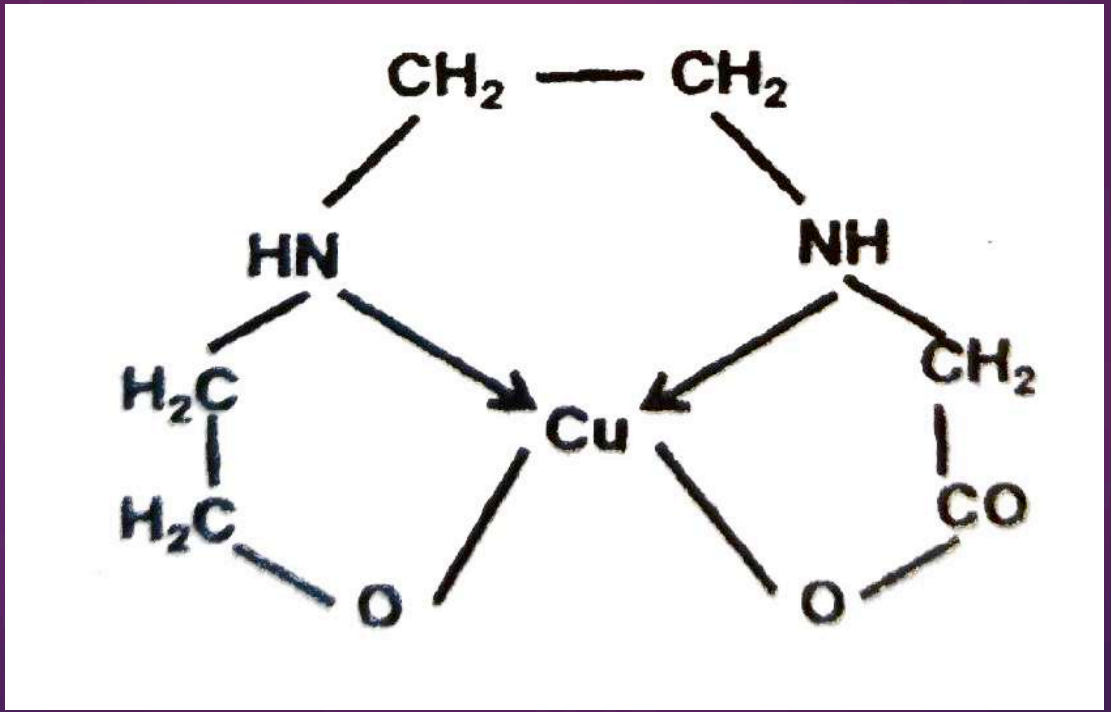






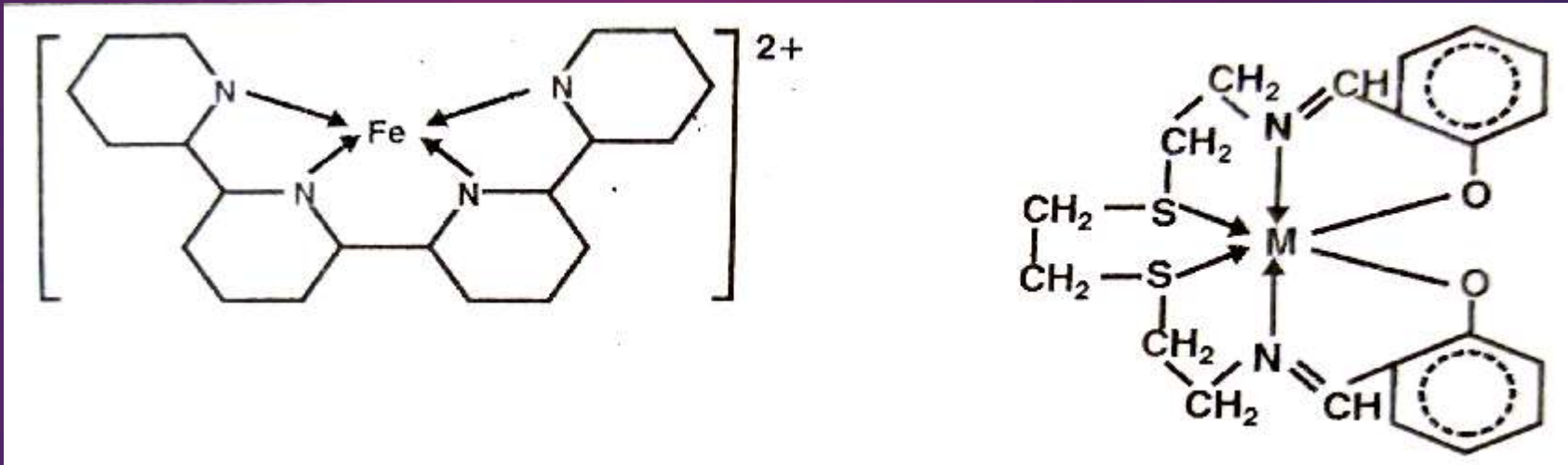
Coordination Compounds.

- **Quadridenate groups:-**



Coordination Compounds.

- **Sexadentate groups:-**



Coordination Compounds.

- **Effective atomic number (EAN) :** Stability of complex compound is explained by the fact that central metal atom aquires the effective atomic number of the next inert gas. The number of electrons of the central metal in a complex including those gained by bonding.

  In most of the cases effective atomic number is the same as atomic number of the next inert gas. However, these are a few cases, where the effective atomic number is more or less by one or two units as compared to next inert gas.

  The tendency to attain an inert gas configuration is a significant factor but not a necessary condition for complexes formation some complexes of cromium and platinum are equally stable, yet the effective atomic number is short of inert gas configuration. For example formation, It is essential to produce symmertical structure, i.e. tetrahedral, square planer, ortahedral, without any consideration of the number of electron involved.

Coordination Compounds.

- **Effective atomic number (EAN):-**

Atom	Atomic No.	Complex ion	Ele.lost ion formation	Ele. gained by coordination	E.A.N.	At.No. of next inert gas
Fe	26	$[Fe(CN)_6]^{4-}$	2	12	26-2+12=36	36 [Kr]
Co	27	$[Co(NH_3)_6]^{3+}$	3	12	27-3+12=36	36 [Kr]
Ni	28	$[Ni(CO)_4]$	0	8	28-0+8=36	36 [Kr]
Cu	29	$[Cu(CN)_4]^{3-}$	1	8	29-1+8=36	36 [Kr]
Pd	46	$[Pd(NH_3)_6]^{4+}$	4	12	46-4+12=54	54 [Xe]
Cr	24	$[Cr(NH_3)_6]^{3+}$	3	12	24-3+12=33	36 [Kr]
Pd	46	$[PdCl_4]^{2-}$	2	8	46-2+8=54	54 [Xe]
Pt	78	$[Pt(NH_3)_4]^{2+}$	3	8	78-2+8=84	86 [Rn]