

COMPLEXING IN BIOLOGICAL SYSTEMS

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Coordination compounds are the higher-order compounds which are stable in aqueous solutions or dissociate insignificantly.



Central atom (ion) or complexing agent takes central place in coordination compounds and is usually a positively charged ion



Ligands are ions of opposite charge or neutral molecules that are located (coordinated) around the complexing agent.





Inner sphere (coordination entity) is formed by complexing agent and ligands.



Outer sphere is formed by ions which are not included in the inner sphere.



Classification of Coordination Compounds

- Depending on the electric charge of the inner sphere

:

1. Coordination compounds containing complex cations -
 $[\text{Zn}(\text{NH}_3)_4]\text{Cl}_2$
2. Coordination compounds containing complex anions -
 $\text{K}_3[\text{Al}(\text{OH})_6]$
3. Neutral complexes - $[\text{Pt}(\text{NH}_3)_2\text{Cl}_2]$

Classification of Coordination Compounds

▪ Depending on the nature of ligands:

1. Acid complexes - $[\text{Fe}(\text{CN})_6]^{4-}$
2. Aqua complexes - $[\text{Cr}(\text{H}_2\text{O})_6]^{3+}$
3. Hydroxide complexes - $[\text{Zn}(\text{OH})_4]^{2-}$
4. Ammonia complexes - $[\text{Cu}(\text{NH}_3)_4]^{2+}$

Classification of Coordination Compounds

- Depending on the chemical compounds class:

1. Acids - $\text{H}[\text{AuCl}_4]$

2. Bases - $[\text{Ag}(\text{NH}_3)_2]\text{OH}$

3. Salts - $\text{K}_2[\text{HgI}_4]$

Classification of Coordination Compounds

- Depending on the quantity of central atoms:
 1. Mononuclear - $[\text{Cr}(\text{NH}_3)_3(\text{H}_2\text{O})_3]\text{Cl}_3$
 2. Polynuclear - $[\text{Pt}_4(\text{OH})_4](\text{ClO}_4)_4$

When didentate or polydentate ligand uses its two or more donor atoms to bind a single metal ion, it is said to be

a chelate ligand

The coordination compounds in which a ligand is bound with central atom by both donor-acceptor bond and ionic bond are called

chelates

CHELATES APPLICATION IN MEDICINE

Disease	Excess metal ion	Used chelating agent
Hemochromatosis, hemosiderosis, iron intoxication	Fe	Deferoxamine, Penicillamine
Cataracts, atherosclerosis	Ca	Na ₂ EDTA , Penicillamine
Wilson's disease	Cu	Mixture of Penicillamine and Calcium Tetacine
Disease "itai-itai-bio"	Cd	Cryptand, Calcium Tetacine
Minimata disease	Hg	Penicillamine, Calcium Tetacine
Plutonium poisoning	Pu	Pentacine
Lead poisoning	Pb	Calcium Tetacine, Na ₂ EDTA
Berylliosis, beryllium rickets	Be	Aluminon