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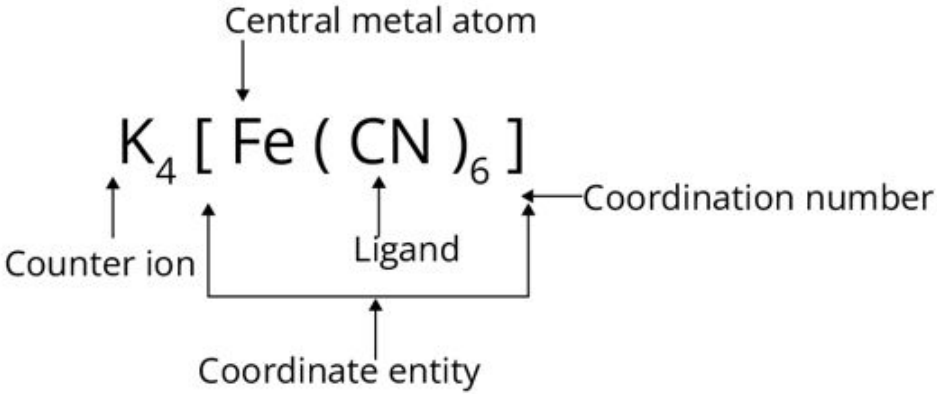
COORDINATION CHEMISTRY

Dr. Elssa George

Basics of Coordination Chemistry

- Transition metals give coordination complexes
- Available in nature
  - Chlorophyll-Mg
  - Haemoglobin-Fe
- Used in industrial catalysts, analytical reagents etc



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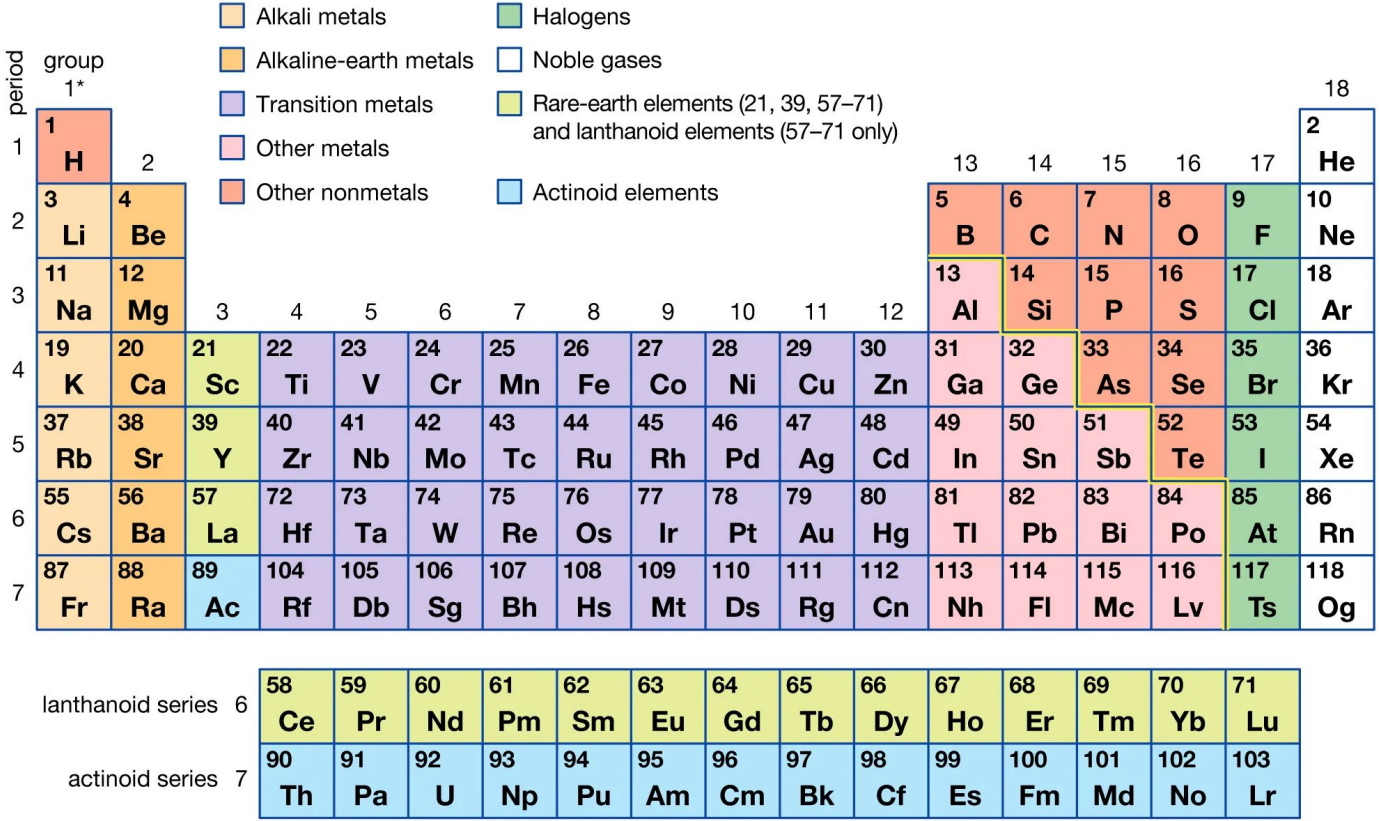
Periodic table of the elements



*Numbering system adopted by the International Union of Pure and Applied Chemistry (IUPAC).

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Ligands

Types of Ligands- based on donor atom/ coordinate site

- Monodentate ligands
- Bidentate ligands
- Polydentate ligands
- Ambidentate ligands
- Chelating ligands

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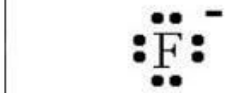
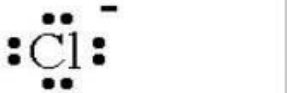
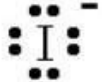
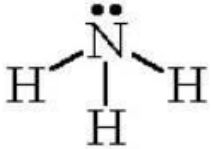
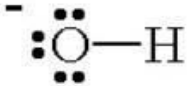
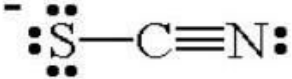
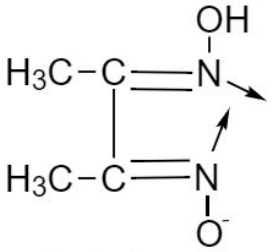
Ligands

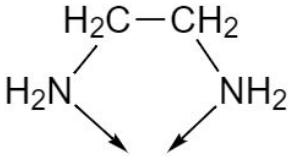
F^-		Cl^-	
Br^-		I^-	
H_2O		NH_3	
OH^-		CO	
CN^-		SCN^-	

Monodentate Ligands

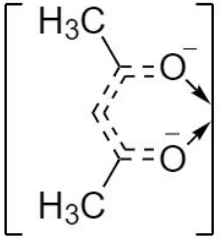
Ligands



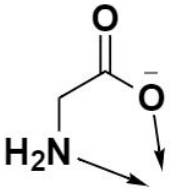
Dimethyl glyoxime (DMG)



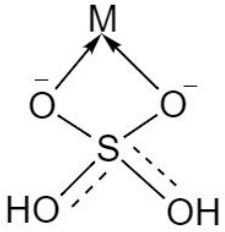
Ethylene Diamine (en)



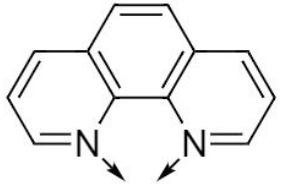
Acetylacetonate anion (acac)



Glycine (gly)



SO_4^{2-}



Phenanthroline (phen)

Bidentate Ligands

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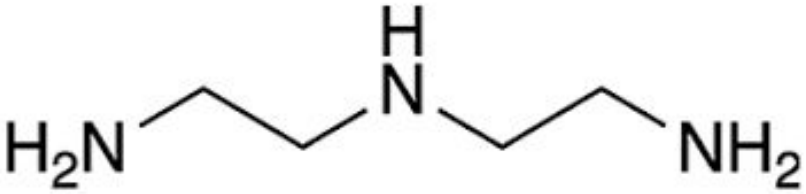
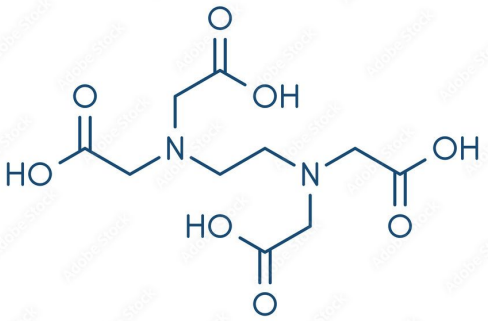
Ligands





Polydentate Ligands

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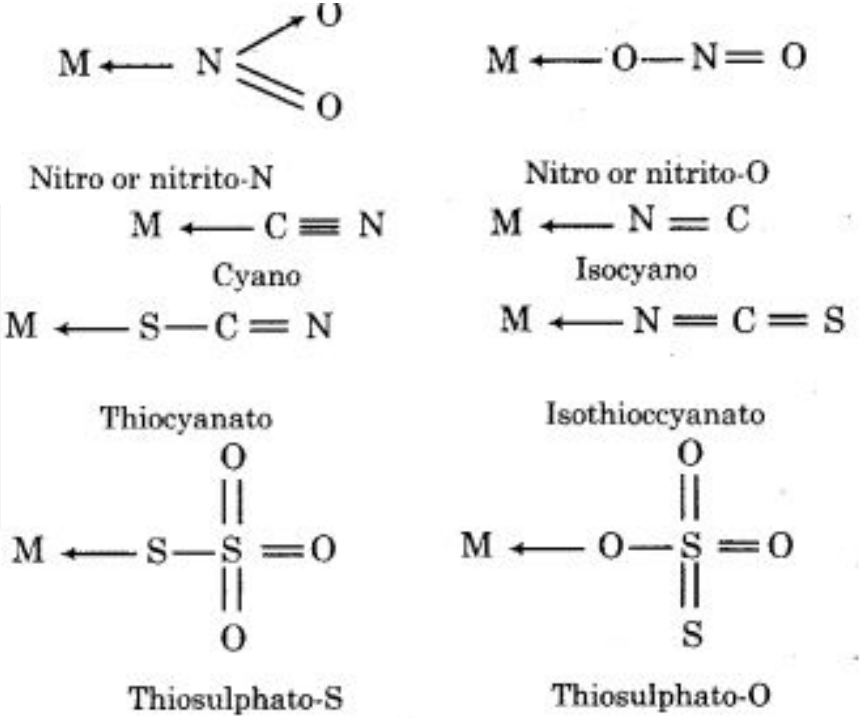
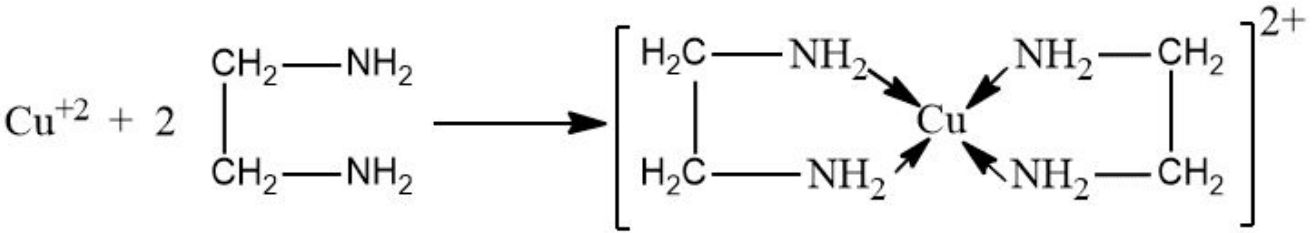
Ligands



Ambidentate Ligands

Chelating Ligand

- Ring structure
- Chelate
- Chelation
- Denticity
- Chelating effect



Nomenclature Of Coordination Compounds

1) Naming cations first followed by anions

$[Co(NH_3)_6]Cl_3$ Hexaamminecobalt (III) chloride

$K_4[Fe(CN)_6]$ Potassium hexacyanoferrate (II)

2) Naming ligands followed by metal ion in coordination entity

$[CrCl_2(H_2O)_4]Cl$ tetraaquadichlorochromium (III) chloride

$[Co(NO_2)_3(NH_3)_3]$ triamminetrinitrito-N-cobalt(III)

$[CoCl_2(en)_2]SO_4$ dichlorobis(ethylenediammine)cobalt (IV) sulphate

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Isomerism in Coordination Compounds

1. Structural isomerism
   - 1.1 Ionisation isomerism
   - 1.2 Hydrate isomerism
   - 1.3 Linkage isomerism
   - 1.4 Coordinate isomerism
2. Stereo isomerism
   - 2.1 Geometrical/cis-trans isomerism
   - 2.2 Optical isomerism

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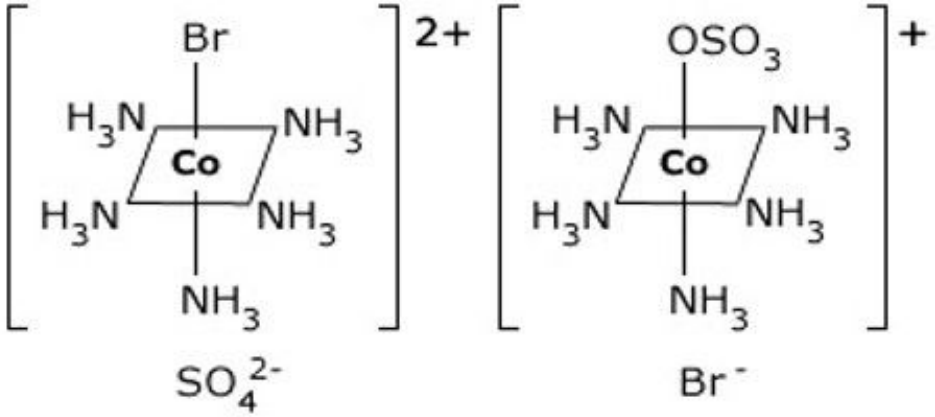
Structural Isomerism

1. Ionisation isomerism



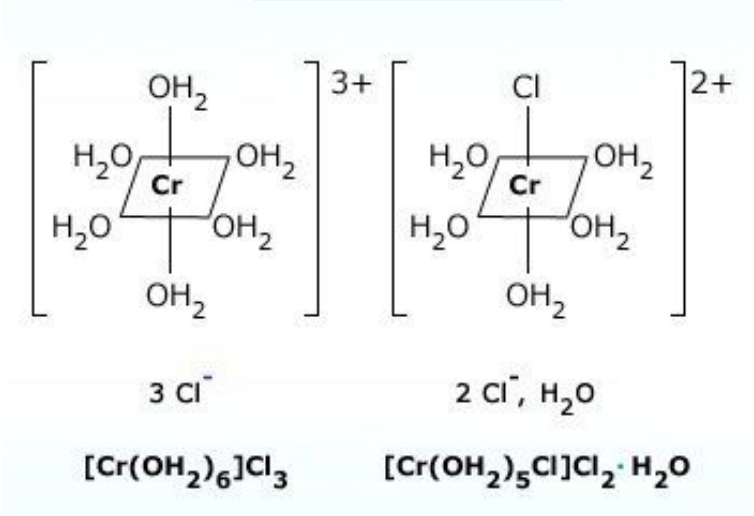
$[CO(NH_3)_5Br]SO_4$ $[CO(NH_3)_5SO_4]Br$

$[PtCl_2(NH_3)_4]Br_2$ $[PtBr_2(NH_3)_4]Cl_2$

$[CoCl_2(NH_3)_4]NO_2$ $[CoCl(NO_2)(NH_3)_4]Cl$

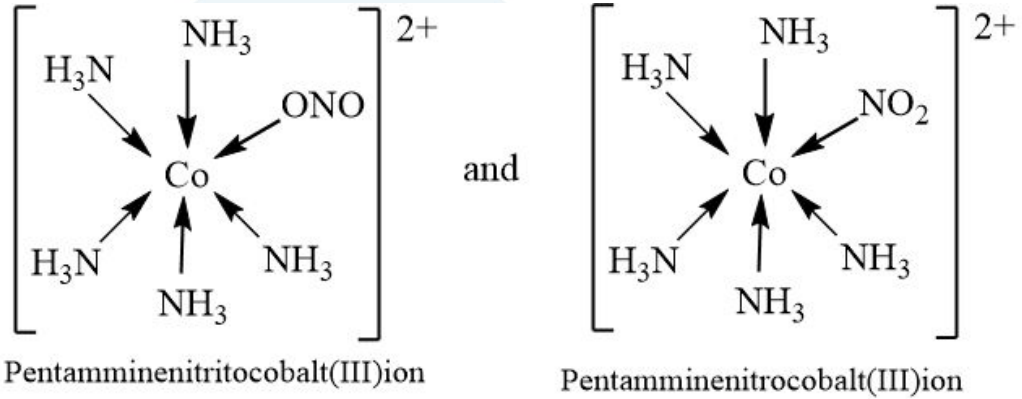
Structural Isomerism

2. Hydrate isomerism



Structural Isomerism

3. Linkage isomerism



Pentamminenitritocobalt(III)ion

Pentamminenitrocobalt(III)ion

$[Co(NH_3)_5NO_2]^{2+}$

$[Co(CN)_5SCN]^{3-}$

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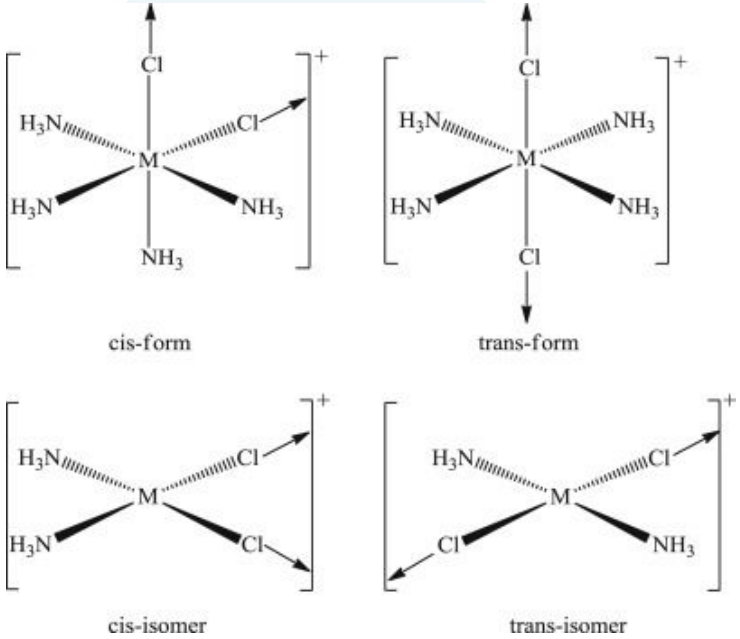
Structural Isomerism

4. Coordination Isomerism

- $[Cu(NH_3)_4]\ [PtCl_4]$ and $[Pt(NH_3)_4]\ [CuCl_4]$
- $[Co(NH_3)_6]\ [Cr(CN)_6]$ and $[Cr(NH_3)_6]\ [Co(CN)_6]$

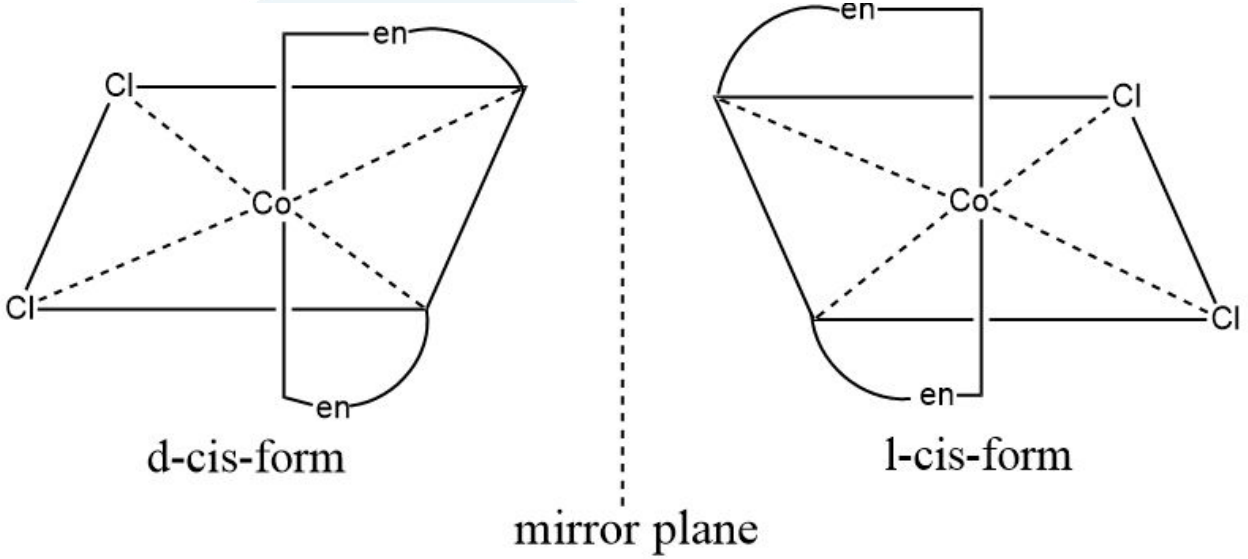
Stereo Isomerism

1. Geometrical/Cis-trans isomerism



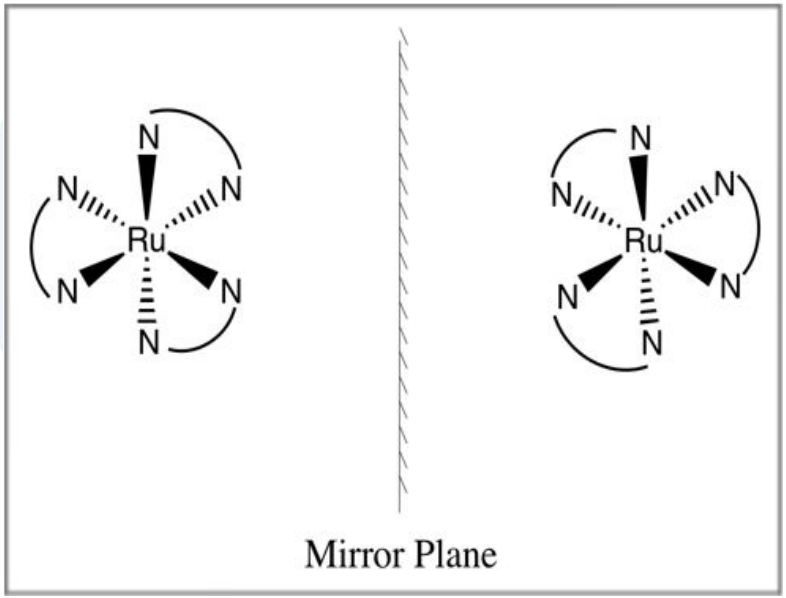
Stereo Isomerism

2. Optical isomerism



Stereo Isomerism

2. Optical isomerism



$[Ru(en)_3]^{2+}$

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THANK YOU