

B.Sc.(H) Chemistry
Semester - IV
Core Course - VIII (CC-VIII)
Inorganic Chemistry - III



I. Coordination Chemistry

12. IUPAC Nomenclature of Coordination Compounds-II



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Coordination Chemistry: 20 Lectures

Werner's theory, valence bond theory (inner and outer orbital complexes), electroneutrality principle and back bonding. Crystal field theory, measurement of $10 Dq$ (Δ_o), CFSE in weak and strong fields, pairing energies, factors affecting the magnitude of $10 Dq$ (Δ_o , Δ_t). Octahedral vs. tetrahedral coordination, tetragonal distortions from octahedral geometry Jahn-Teller theorem, square planar geometry. Qualitative aspect of Ligand field and MO Theory.

IUPAC nomenclature of coordination compounds, isomerism in coordination compounds. Stereochemistry of complexes with 4 and 6 coordination numbers. Chelate effect, polynuclear complexes, Labile and inert complexes.

Coverage:

1. IUPAC Nomenclature of Coordination Compounds-II

Nomenclature

- **The positive ion (cation) comes first, followed by the name within the coordination sphere, followed by the negative ion (anion).**

These ions are not in the coordination sphere.

Diamminesilver(I)chloride and potassium hexacyanoferrate (III).

- **The inner coordination sphere is enclosed in brackets in the formula. Within this sphere, the ligands are named before the metal, but in formulas the metal ion is written first.**

Tetraamminecopper(II) sulfate and hexaamminecobalt(III) chloride.

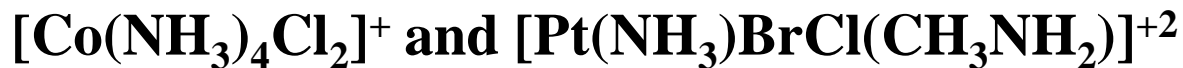
Nomenclature

- **The number of ligands is given by the following prefixes. If the ligand name includes prefixes or is complicated, it is set off in parentheses and the second set of prefixes is used.**
 - $[\text{Co}(\text{en})_2\text{Cl}_2]^+$ and $[\text{Fe}(\text{C}_5\text{H}_4\text{N}-\text{C}_5\text{H}_4\text{N})_3]^{2+}$

2	di	bis
3	tri	tris
4	tetra	tetrakis
5	penta	pentakis
6	hexa	hexakis
7	hepta	heptakis
8	octa	octakis

Nomenclature

- **Ligands are named in alphabetical order (name of ligand, not prefix)**



- **Anionic ligands are given an 'o' suffix. Neutral ligands retain the usual name.**

Coordinated water is called 'aqua'.

Chloro, Cl^-

Sulfato, SO_4^{2-}

Nomenclature

- The calculated oxidation number of the metal ion is placed as a Roman numeral in parentheses after the name of the coordination sphere.



A suffix 'ate' is added to the metal ion if the charge is negative.

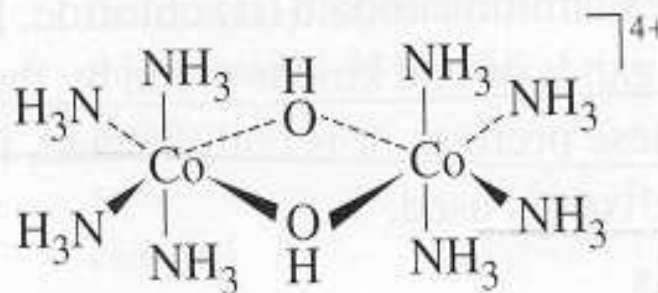
- The prefixes *cis*- and *trans*- designate adjacent and opposite geometric location, respectively.

trans-diamminedichloroplatinum(III) and *cis*-tetraamminedichlorocobalt(III)

Nomenclature

- **Bridging ligands between two metal ions have the prefix ‘ μ ’.**
 μ -amido- μ -hydroxobis(tetraamminecobalt)(IV)

FIGURE 9-5 Bridging Ligands.
 μ -Amido- μ -hydroxobis(tetraamminecobalt)(4+),
 $[(\text{NH}_3)_4\text{Co}(\text{OH})(\text{NH}_2)\text{Co}(\text{NH}_3)_4]^{4+}$.



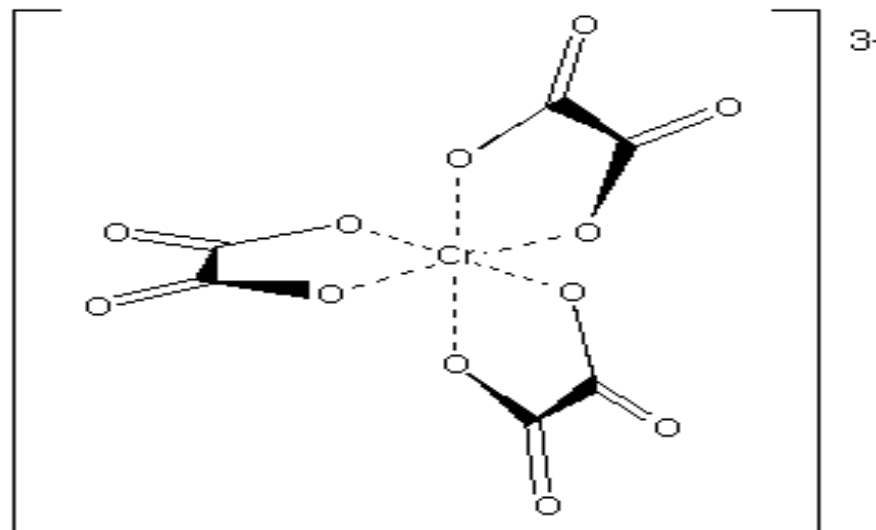
There is an error in this picture. What is it?

Chelating Ligands

- **Chelating ligands (chelates):** ligands that have two or more points of attachment to the metal atom or ion.

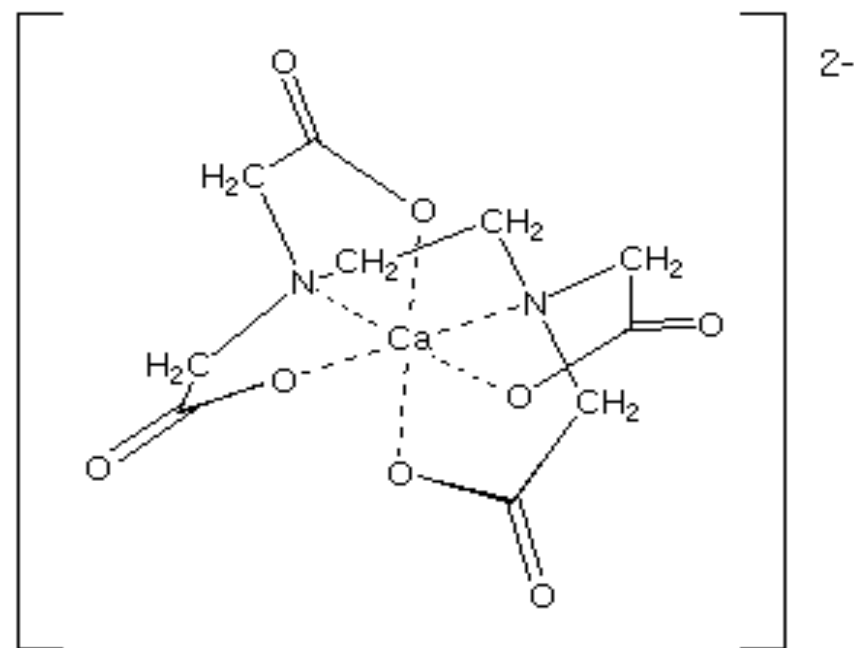
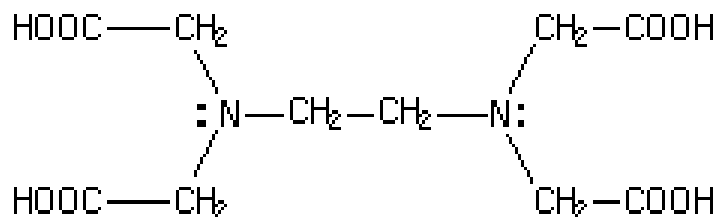
**Bidentate, tridentate,
tetra..., penta..., hexa...
(EDTA).**

trioxalatochromate(III) ion or just $[\text{Cr}(\text{ox})_3]^{3-}$



A Hexadentate Ligand, EDTA

- **There are six points of attachment to the calcium metal.**
 - **Octahedral-type geometry ethylene diamine tetraacetic acid (EDTA)**



ethylenediaminetetraacetatocalcium ion
or just $[\text{Ca}(\text{EDTA})]^{2-}$

Thank You



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