RULES FOR NAMING COORDINATION COMPLEXES

- **The name of the positive ion is written before the name of the negative ion.**
- **The name of the ligand is written before the name of the metal to which it is coordinated.**
- **Ligands are listed in the following order: negative ions, neutral molecules, and positive ions. Ligands with the same charge are listed in alphabetical order.**
- **The Greek prefixes *mono-*, *di-*, *tri-*, *tetra-*, *penta-*, *hexa-*, and so on are used to indicate the number of ligands when these ligands are relatively simple. The Greek prefixes *bis-*, *tris-*, and*tetrakis-* are used with more complicated ligands.**
- **The names of negative ligands always end in *o*, as in *fluoro* (F^-), *chloro* (Cl^-), *bromo* (Br^-), *iodo* (I^-), *oxo* (O^{2-}), *hydroxo* (OH^-), and *cyano* (CN^-).**
- **A handful of neutral ligands are given common names, such as *aquo* (H_2O), *ammine* (NH_3), and*carbonyl* (CO).**
- **The oxidation number of the metal atom is indicated by a Roman numeral in parentheses after the name of the metal atom.**
- **The names of complexes with a net negative charge end in *-ate*. $Co(SCN)_4^{2-}$, for example, is the tetrathiocyanatocobaltate(II) ion. When the symbol for the metal is derived from its Latin name,*-ate* is added to the Latin name of the metal. Thus, negatively charged iron complexes are ferrates and negatively charged copper complexes are cuprates.**

List of common ion names

Monatomic anions:

Cl^{-} chloride
S^{2-} sulfide
P^{3-} phosphide

Polyatomic ions:

NH_4^{+} ammonium
H_3O^{+} hydronium
NO_3^{-} nitrate
NO_2^{-} nitrite
ClO^{-} hypochlorite
ClO_2^{-} chlorite
ClO_3^{-} chlorate
ClO_4^{-} perchlorate
SO_3^{2-} sulfite
SO_4^{2-} sulfate
HSO_3^{-} hydrogen sulfite (or bisulfite)
HCO_3^{-} hydrogen carbonate (or bicarbonate)
CO_3^{2-} carbonate
PO_4^{3-} phosphate
HPO_4^{2-} hydrogen phosphate
$H_2PO_4^{-}$ dihydrogen phosphate
CrO_4^{2-} chromate
$Cr_2O_7^{2-}$ dichromate
BO_3^{3-} borate
AsO_4^{3-} arsenate
$C_2O_4^{2-}$ oxalate
CN^{-} cyanide
SCN^{-} thiocyanate
MnO_4^{-} permanganate

Coding for the ligand

ligand	coded by	(old name)
H_2O	aqua	aquo
NH_3	ammine	ammino
OH^-	hydroxo	hydroxy
Cl^-	chloro	
F^-	fluoro	
CN^-	cyano	

Coding for the number of ligands

The normal prefixes apply if there is more than one ligand.

no of ligands	coded by
2	di
3	tri
4	tetra
5	penta
6	hexa

For negatively charged complex ions

A negatively charged complex ion is called an ***anionic complex***. An anion is a negatively charged ion.

In this case the name of the metal is modified to show that it has ended up in a negative ion. This is shown by the ending **-ate**.

With many metals, the basic name of the metal is changed as well - sometimes drastically!

Common examples include:

metal	changed to
cobalt	cobaltate
aluminium	aluminate
chromium	chromate
vanadium	vanadate
copper	cuprate
iron	ferrate

J''rgensen's Chain Theory

J~rgensen's chain theory links ammonia molecules in metal compounds similar to the linking of carbon units in hydrocarbons.

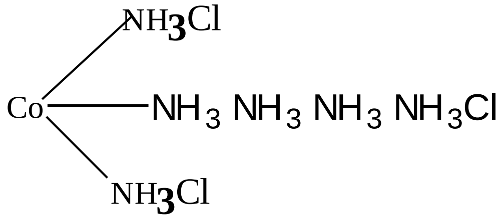
Like carbon, each metal center is thought to have a fixed valence (valency being defined as the number of bonds formed by the atom of interest), with each metal stabilizing different chain lengths.

stabilizing an ammine chain length of two while trivalent cobalt in structure V favors an amrnine chain length of four, Water linkages in metal hydrates (V) were treated similarly. Further, Jergensen astutely noticed that anions such as chloride (CI-) and nitrite *(NOz*-) found in the complex show two distinct reactivities. Chain theory suggests that these anions occupy two different positions, proximal to (or bound directly to) and distal to (far from) the metal ion. Anions far from the metal can be readily removed during a chemical reaction, for example, CI-removal with AgNO:J, equation (2.1), whereas those bound directly to the metal do not react.

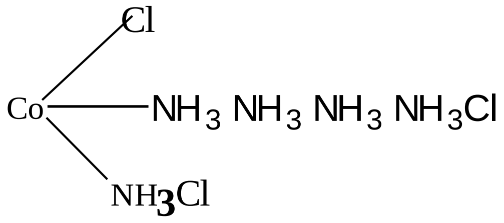
$AgN0_3$(aq) + Cl-(aq) ----+ AgCI(s) + N03(.q)

TABLE 1 Taessert's Cobalt Amine Complexes

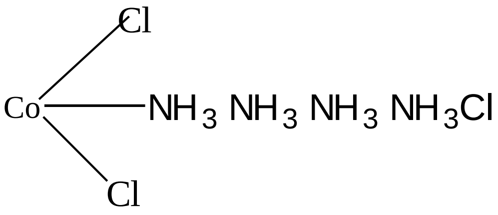
Formula	Original Name	Color	Compound
[Co(NH3)61Ch	complex	Yellow	CoC13' 6NH3
[Co(NH3lsCllClz	Praseocomplex	Purple	CoC13' 5NH3
[Co(NH3) 4ClzlCI	Violeto	Green	CoCI3' 4NH3
[Co(NH3) 4ClzlCI	complex	Violet	CoCI3' 4NH3



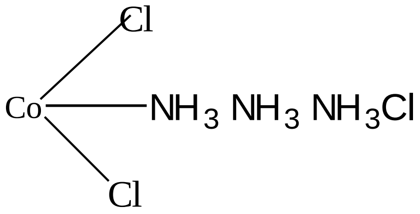
structure (1)



structure (2)



structure (3)



structure (4)

Q- Given a fixed valence of3 for cobalt and the number of precipitated CI-ions in reaction with $AgN0_3$, predict according to chain theory the structure for the metal complexes corresponding to the formulas in Table 2.2. Although chain theory proposes differences in reactivity for each Co-NH3 linkage, these would be spatially equivalent if we consider these molecules to be, for example, trigonal planar arrangements. Jergensen also noticed that compounds richest in ammonia always contained six ammonia molecules for one metal atom, and, upon replacing two ammonias with two anions (X-), the new residues