

Nomenclature of Coordination Complexes

Rule 1: The names of neutral coordination complexes are given without spaces. For coordination compounds that are ionic (i.e., the coordination complex is either an anion or anion of an ionic substance), the cation is named first and separated by a space from the anion, as is the case for all ionic compounds.



Sodium amminetrichloroplatinate(II)



Potassium tetrabromocuprate(II)

In the above examples, the cations sodium and potassium are named first and then separated by a space from the names of the anions.



***trans*-Aquabis(ethylenediamine)iodocobalt(III) nitrate**

In this example the coordination cation is written without spaces and then separated from the name of the anion.



***mer*-trichlorotris(triphenylphosphine)ruthenium(III)**

Here the coordination complex is neutral, so no spaces are necessary.

Rule 2: The name of the coordination compound (neutral, cationic or anionic) begins with the names of the ligands. The metal is listed next, following in parentheses by the oxidation state of the metal.

Rule 3: When more than one of a given ligand is bound to the same metal atom or ion, the number of such ligands is designated by the following prefixes:

2 di	6 hexa	10 deca
2 tri	7 hepta	11 undeca
4 tetra	8 octa	12 dodeca
5 penta	9 nona	

However, when the name of the ligand in question already contains one of these prefixes (generally ligand names that are three syllables or longer), then a prefix from the following list is used instead:

2 bis	6 hexakis
3 tris	7 heptakis
4 tetrakis	8 octakis
5 pentakis	9 ennea

Rule 4: Neutral ligands are given the same name as the uncoordinated molecule, but with spaces omitted. Some examples are:

$(\text{CH}_3)_2\text{SO}$	dimethylsulfoxide (DMSO)
$(\text{NH}_2)_2\text{CO}$	urea
$\text{C}_5\text{H}_5\text{N}$	pyridine
terpy	terpyridine
bpy	2,2'-bipyridine
en	ethylenediamine
PCl_3	trichlorophosphine
PPh_3	triphenylphosphine

EXCEPTIONS: Some neutral molecules, when serving as ligands are given special names. These are:

NH_3	ammine
H_2O	aqua
NO	nitrosyl
CO	carbonyl
CS	thiocarbonyl

Rule 5: Anionic ligands are given names that end in the letter "o". When the name of the free, uncoordinated anion ends in "ate", the ligand name is changed to end in "ato". Some examples are :

CH_3CO_2^- (acetate)	acetato
SO_4^{2-} (sulfate)	sulfato
CO_3^{2-} (carbonate)	carbonato
acac	acetylacetonato

When the name of the free, uncoordinated anion ends in "ide", the ligand name is changed to end in "ido". Some examples are:

N^{3-} (nitride)	nitrido
N_3^- (azide)	azido
NH_2^- (amide)	amido

$(\text{CH}_3)_2\text{N}^-$ (dimethylamide) dimethylamido

When the name of the free, uncoordinated anion ends in “ite”, the ligand name is changed to end in “ito”. Some examples are:

NO_2^- (nitrite)	nitrito
SO_3^{2-} (sulfite)	sulfido
ClO_3^- (chlorite)	chlorito

Certain anionic ligands are given special names, all ending in “o”:

CN^-	cyano
F^-	fluoro
Cl^-	chloro
Br^-	bromo
I^-	iodo
O^{2-}	oxo
O_2^-	superoxo
OH^-	hydroxo
H^-	hydrido
CH_3O^-	methoxo

Rule 6: The ligands are named alphabetically, ignoring the prefixes *bis*, *tris*, etc...

Rule 7: When the coordination entity is either neutral or cationic, the usual name of the metal is used, followed in parentheses by the oxidation state of the metal. However, when the coordination entity is an anion, the name of the metal is altered to end in “ate”. This is done for some metals by simply changing the ending “ium” to “ate”:

Scandium	scandate
Titanium	titanate
Chromium	chromate
Zirconium	zirconate
Niobium	niobate
Ruthenium	ruthenate
Palladium	palladate
Rhenium	rhenate

For other metals, the name is given the ending “ate”:

Manganese	manganate
Cobalt	cobaltate
Nickel	nickelate
Tantalum	tantalate
Tungsten	tungstate

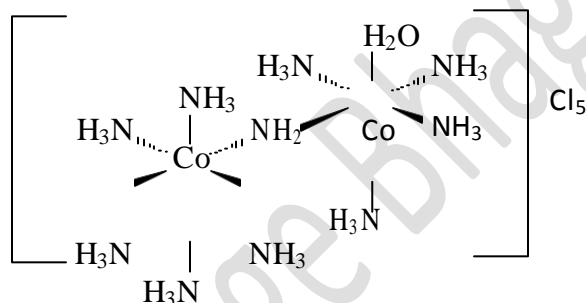
Platinum platinate

Finally, the names of some metals are based on the Latin name of the element:

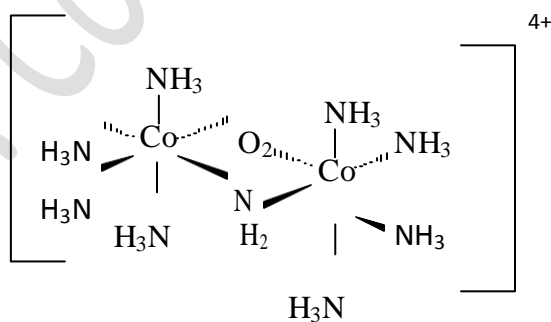
Iron	ferrate
Copper	cuprate
Silver	argentate
Gold	aurate

Rule 8: Geometrical isomers are designated by *cis-* or *trans-* and *mer-* or *fac-*, the latter two standing for meridional or facial, respectively.

Rule 9: Bridging ligands are designated with the prefix μ -. When there are two bridging ligands of the same kind, the prefix di- μ - is used. Bridging ligands are listed in order with other ligands, according to Rule 6, and set off between hyphens. An important exception arises when the molecule is symmetrical, and a more compact name can be given by listing the bridging ligand first. Rule 9 is illustrated in the following examples:

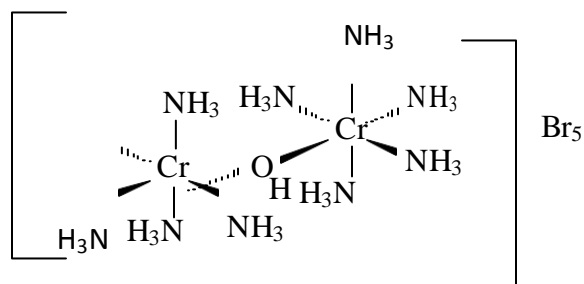


Pentamminecobalt(III)- μ -amidotetraammineaquacobalt(III) chloride

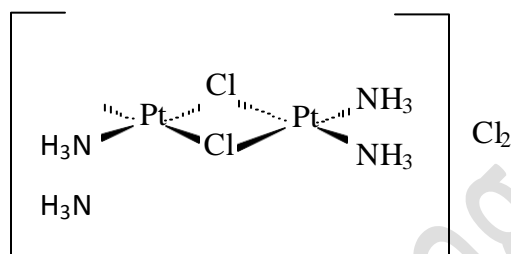


Tetraamminecobalt(III)- μ -amido- μ -superoxotetraamminecobalt(III)

The bridging $-O_2-$ group in the above example is named from the superoxide anion O_2^- , because the physical data suggest the -1 charge.



μ -Hydroxobis[pentaamminechromium(III)] bromide



Di- μ -chloro-bis[diammineplatinum(II)] chloride

Rule 10: Ligands that are capable of linkage isomerism are given specific names for each mode of attachment.

-SCN ⁻	thiocyanato (S-thiocyanato)
-NCS ⁻	isothiocyanato (N-thiocyanato)
-NCSe ⁻	isoselenocyanato (N-selenocyanato)
-NO ₂ ⁻	nitro
-ONO ⁻	nitrito

Examples

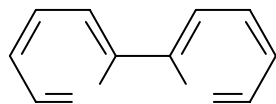
[Co(NH₃)₅CO₃]Cl
Pentaamminecarbonatocobalt(III) chloride

[Cr(H₂O)₄Cl₂]Cl
Tetraaquadichlorochromium(III) chloride

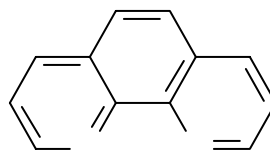
K₂[OsCl₅N]
Potassium pentachloronitridoosmate(VI)

K₃[Fe(CN)₅NO]
Potassium pentacyanonitrosylferrate(II)

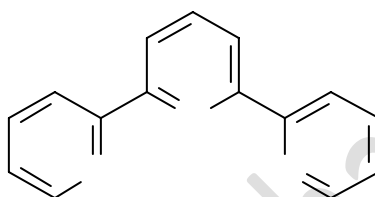
Structures of Common Chelating Ligands



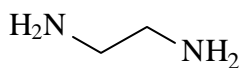
2,2'-bipyridine (bpy)



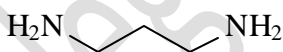
1,10-phenanthroline (phen)



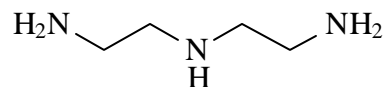
terpyridine (terpy)



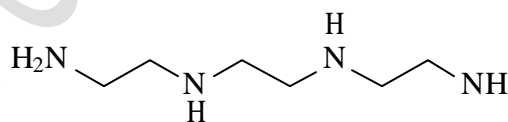
ethylenediamine (en)



propylenediamine (prn)



diethylenetriamine (dien)



triethylenetetramine (trien)

