

IUPAC Nomenclature

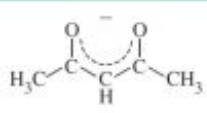
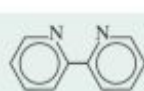
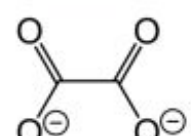
Table: IUPAC name of common monodentate ligands

Common Name	IUPAC Name	Formula
hydrido	hydrido	H^-
fluoro	fluoro	F^-
chloro	chloro	Cl^-
bromo	bromo	Br^-
iodo	iodo	I^-
nitrido	nitrido	N^{3-}
azido	azido	N_3^-
oxo	oxido	O^{2-}
cyano	cyano	CN^-
thiocyano	thiocyanato- <i>S</i> (S-bonded)	SCN^-
isothiocyano	thiocyanato- <i>N</i> (N-bonded)	NCS^-
hydroxo	hydroxo	OH^-
amido	azanido	NH_2^-

Contd.

IUPAC Nomenclature

Table: IUPAC name of multidentate ligands with abbreviation

Common Name	IUPAC Name	Abbreviation	Formula and Structure
acetylacetonato	2,4-pentanediono	acac	$\text{CH}_3\text{COCHCOCH}_3^-$ 
2,2'-bipyridine	2,2'-bipyridyl	bipy	$\text{C}_{10}\text{H}_8\text{N}_2$ 
1,10-phenanthroline, <i>o</i> -phenanthroline	1,10-diaminophenanthrene	phen, <i>o</i> -phen	$\text{C}_{12}\text{H}_8\text{N}_2$ 
Pyridine		py	
Oxalato		ox	

IUPAC Nomenclature

Ligands with common names

Neutral Ligands	Names
N ₂	dinitrogen
O ₂	dioxygen
C ₅ H ₅ N	pyridine
bpy	bipyridyl
CH ₃ NH ₂	methylamine
(CH ₃) ₂ NH	dimethylamine
NH ₂ — NH ₂	hydrazine
NH ₂ OH	hydroxylamine

For ambidentate ligands

Name and Mode of Attachment
—NO ₂ [−] , nitrito — N or nitro
—ONO [−] , nitrito — O or nitrito
—SCN [−] , thiocyanato — S or thiocyanato
—NCS [−] , thiocyanato — N or isothiocyanato

Ligands with special names

Neutral Ligands	Name
NH ₃	ammine
CO	carbonyl
CS	thiocarbonyl
H ₂ O	aqua
NO	nitrosyl

For anionic complex replace -ium with -ate

Metal	Anion Name
aluminium	aluminate
scandium	scandate
titanium	titanate
vanadium	vanadate
chromium	chromate
zirconium	zirconate
palladium	palladate
rhodium	rhodate
rhenium	rhenate

IUPAC Nomenclature

Rules:

1. The cation comes first, followed by the anion.

Examples: diamminesilver(I) chloride, [Ag(NH₃)₂]Cl

potassium hexacyanoferrate(III), K₃[Fe(CN)₆]

2. The inner coordination sphere is enclosed in square brackets. Although the metal is provided first within the brackets, the ligands within the coordination sphere are written before the metal in the formula name.

Examples: tetraamminecopper(II) sulfate, [Cu(NH₃)₄]SO₄

hexaamminecobalt(III) chloride, [Co(NH₃)₆]Cl₃

3. The number of ligands of each kind is indicated by prefixes (in margin). In simple cases, the prefixes in the second column are used. If the ligand name already includes these prefixes or is complicated, it is set off in parentheses, and prefixes in the third column (ending in -is) are used.

IUPAC Nomenclature

Rules:

Examples:

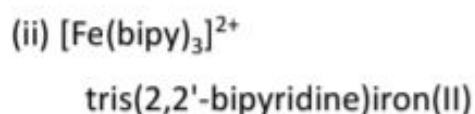
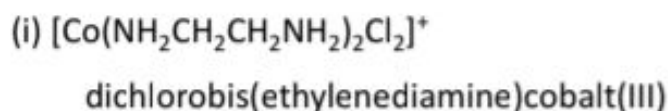


Table of Prefixes

2	di	bis
3	tri	tris
4	tetra	tetrakis
5	penta	pentakis
6	hexa	hexakis
7	hepta	heptakis
8	octa	octakis
9	nona	nonakis
10	deca	decakis

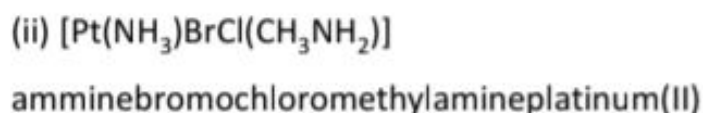
4. Ligands are generally written in alphabetical order

-according to the ligand name, not the prefix.

Examples: (i) $[\text{Co}(\text{NH}_3)_4\text{Cl}_2]^+$

tetraamminedichlorocobalt(III)

(*tetraammine is alphabetized by a and dichloro by c, not by the prefixes*)



IUPAC Nomenclature

Rules:

5. Anionic ligands are given an *o* suffix. Neutral ligands retain their usual name. Coordinated water is called aqua and coordinated ammonia is called ammine.

6. Two systems exist for designating charge or oxidation number:

a. The *Stock system* puts the calculated oxidation number of the metal as a Roman numeral in parentheses after the metal name (**most common**)

b. The *Ewing-Bassett system* puts the charge on the coordination sphere in parentheses after the name of the metal.

(In either case, if the charge is negative, the suffix -ate is added to the name)

Examples: (i) $[\text{Pt}(\text{NH}_3)_4]^{2+}$

tetraammineplatinum(II) **or** tetraammineplatinum(2+)

(ii) $[\text{PtCl}_4]^{2-}$

tetrachloroplatinate(II) **or** tetrachloroplatinate(2-)

(iii) $[\text{PtCl}_6]^{2-}$

hexachloroplatinate(IV) **or** hexachloroplatinate(2-)

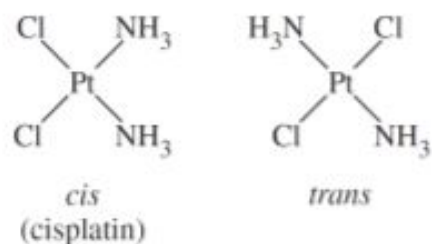
7. Prefixes designate adjacent (*cis* -) and opposite (*trans* -) geometric locations.

Examples: (i) $[\text{PtCl}_2(\text{NH}_3)_2]$

cis - and *trans* -diamminedichloroplatinum(II)

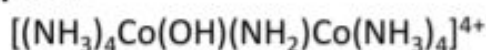
(ii) $[\text{CoCl}_2(\text{NH}_3)_4]^+$

cis - and *trans* -tetraamminedichlorocobalt(III)

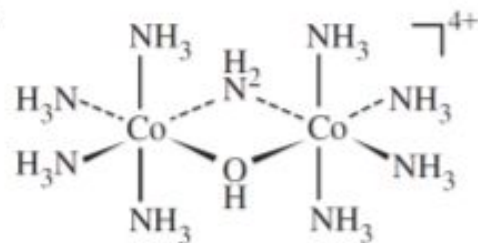


8. Bridging ligands between two metal ions have the prefix, μ

Examples :



μ -amido- μ -hydroxobis(tetramminecobalt)(4+)



9. When the complex is negatively charged, the names for these metals are derived from the sources of their symbols:

Examples: (i) $[\text{FeCl}_4]^-$

iron (Fe)	ferrate	lead (Pb)	plumbate
silver (Ag)	argentate	tin(Sn)	stannate
gold (Au)	aurate	Pt	platinate

tetrachloroferrate(III) or tetrachloroferrate(1-)

(ii) $[\text{Au}(\text{CN})_2]^-$

dicyanoaurate(I) or dicyanoaurate(1-)

IUPAC Nomenclature

Examples:

(i) $\text{Na}_2[\text{Fe}(\text{CN})_5\text{NO}]$

sodium pentacyanonitrosylferrate(II)

(ii) $[\text{CuCl}_2\{\text{O}=\text{C}(\text{NH}_2)_2\}_2]$

dichlorobis(urea)copper(II)

(iii) $[\text{Ni}(\text{CO})_4]$

tetracarbonylnickel(0)

(iv) $[\text{Fe}(\text{C}_5\text{H}_5)_2]$

bis(cyclopentadienyl)iron(II)

(v) $[\text{Co}(\text{NH}_3)_4(\text{H}_2\text{O})_2]\text{Cl}_3$

tetraaminediaquacobalt(III) chloride

(vi) $[\text{Co}(\text{en})_3]\text{Cl}_3$

tris(ethylenediamine)cobalt(III) chloride

(vii) $[\text{Co}(\text{NH}_3)_5\text{ONO}]\text{SO}_4$

pentaaminenitrito-Ocobalt(III) sulfate

(viii) $[\text{Co}(\text{NH}_3)_5\text{SO}_4]\text{Cl}$

pentaaminesulfatocobalt(III) chloride

(ix) $\text{Fe}_4[\text{Fe}(\text{CN})_6]$

iron hexacyanoferrate(II)

(x) $[(\text{CH}_3)_4\text{N}][\text{VOCl}_4]$

tetramethylammonium tetrachlorooxovanadate(IV)

(xi) $\text{K}_2[\text{Cr}(\text{CN})_2(\text{O})_2(\text{O}_2)(\text{NH}_3)]$

potassium aminedicyanodioxoperoxochromate (VI)

(Xii) $[\text{Pt}(\text{NH}_3)_4][\text{PtCl}_4]$

tetraamineplatinum(II) tetrachloroplatinate(II)

(Pt exhibits oxidation states of +2 (C.N. = 4) and +4 (C.N. = 6))

(Xiii) $\text{K}_2[\text{Fe}(\text{CN})_5\text{NO}]\cdot 2\text{H}_2\text{O}$

potassium pentacyanonitrosylferrate(II) dihydrate