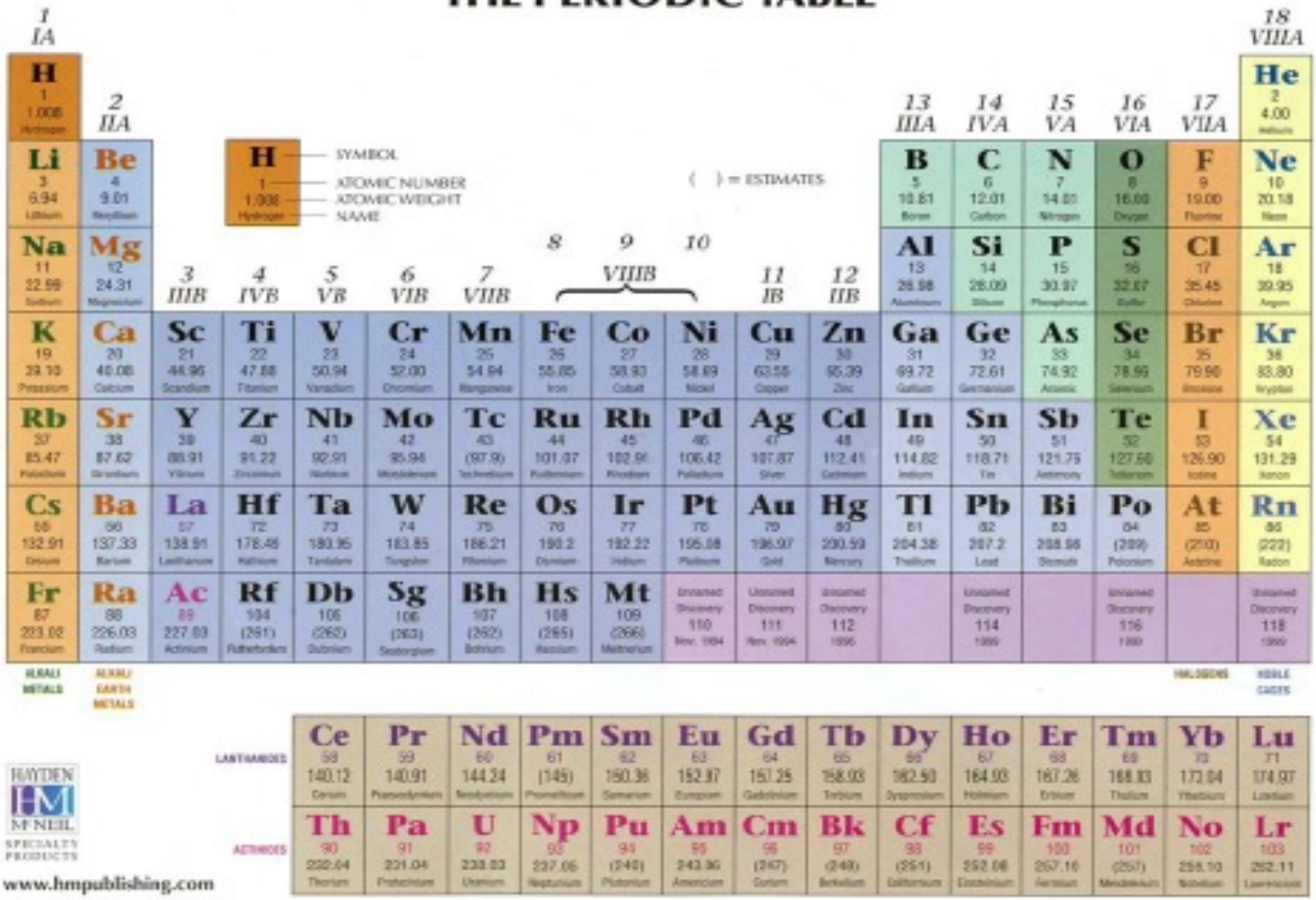
THE PERIODIC TABLE



Week 3

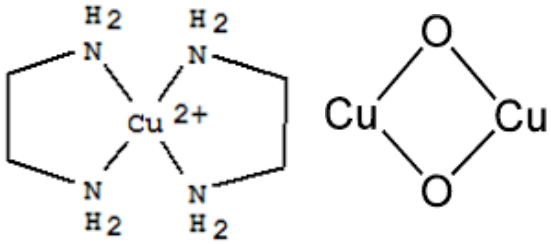
Naming according to IUPAC

1. The name of the cation comes before the anion. $[Ag(NH_3)_2]Cl$ or $K_3[Fe(CN)_6]$
   1st 2nd 1st 2nd

2. The names of the ligands in the inner coordination sphere come before the metal.

   $[Ag(NH_3)_2]Cl$ or $K_3[Fe(CN)_6]$
   Ammine then silver Pottassium, cyano, then iron

   bis(ethylenediamine)copper…
   bis(μ-oxo)copper….



3. Ligand or ion names are placed in alphabetical order.

   $[Ag(NH_3)(H_2O)]Cl$ ammine is before aqua
   $NaK_2[Fe(CN)_6]$ potassium is before sodium

4. The number of species of one kind is often given by two sets of prefixes.

Always use the 1st set of prefixes unless:

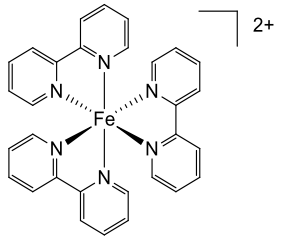
- If the name includes already the first set of prefixes
- If the ligand is polydentate
- If there are multiple bridges of the same kind

Note: 2nd set of prefixes is used in conjunction with parenthesis for the name of the ligand.

Number of ligands	First set of prefixes	Second set of prefixes
2	di	bis
3	tri	tris
4	tetra	tetrakis
5	penta	pentakis
6	hexa	hexakis
7	hepta	heptakis

Naming according to IUPAC

5. There are two possibilities for designating the charge or the oxidation state.
(a) Put the oxidation state as a Roman numeral in parenthesis after the name of the metal.
(b) Put the charge of the coordination sphere in parenthesis after the name of the metal



= tris(bipyridine)iron(II)
=tris(bipyridine)iron (2+)

$[Co(NH_2CH_2CH_2NH_2)_2Cl_2]^+$

Dichlorobis(ethylenediamine) cobalt(III)
Dichlorobis(ethylendiamine) cobalt(1+)

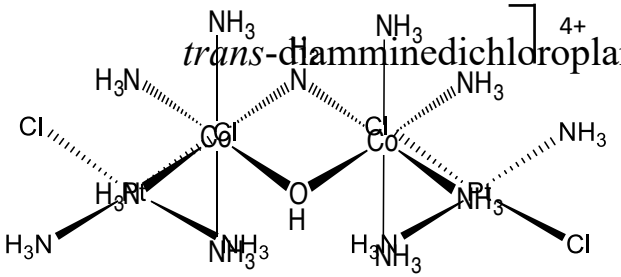
6. If complex charge is negative, the suffix –ate is added to the name of the metal name.

$[Pt(NH_3)_4]^{2+}$ tetraammineplatinum(II) or tetraammineplatinum(2+)

$[PtCl_6]^{2-}$ hexachloroplatinate(IV) or hexachloroplatinate(2-)

metal	changed to
cobalt	cobaltate
aluminum	aluminate
chromium	chromate
vanadium	vanadate
copper	cuprate
iron	ferrate
platinum	platinate
silver	argentate
gold	Aurate

7. Prefix *cis*- and *trans*- designate adjacent and opposite geometric locations.
fac- and *mer*- or Λ or Δ



trans-diamminedichloroplantium(II)

8. Bridging ligands between metal ions have the prefix "μ-"

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

cis-diamminedichloroplantium(II)

Name these compounds…

a. $[Cu(NH_3)_4]SO_4$

b. $[PtCl_4]^{2-}$

c. $[Co(en)_3]^{3+}$

d. $[Cr_2(\mu\text{-}O)(NH_3)_{10}]^{4+}$ draw it and name it....

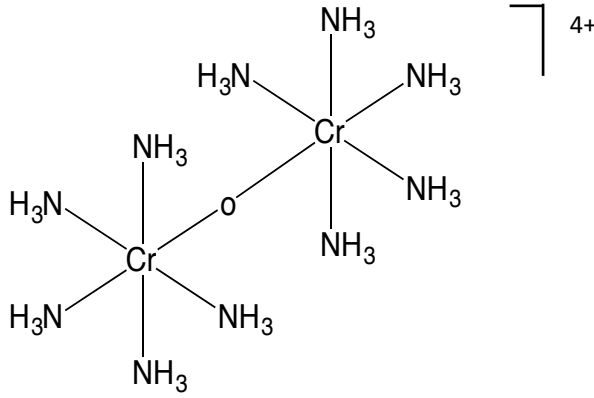
e. $[Ag(NH_3)_2][Ag(CN)_2]$

f. $[Fe(CO)_5]$

g. $[Rh_2(\mu\text{-}CO)(\mu\text{-}NH_2)(NH_3)_8]^{2+}$ draw it and name it....

Name these compounds…

a. $[Cu(NH_3)_4]SO_4$ tetraamminecopper(II) sulfate or tetraamminecopper(2+) sulfate



b. $[PtCl_4]^{2-}$ tetrachloroplantinate(II) or tetrachloroplantinate(2-)

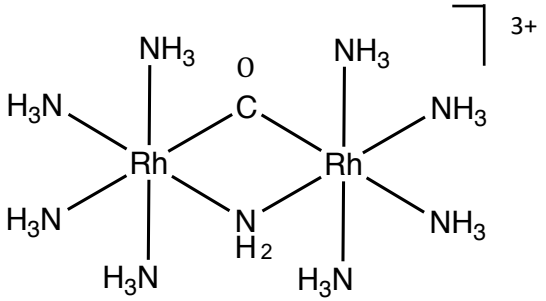
c. $[Co(en)_3]^{3+}$ tris(ethylenediamine)cobalt(III) or tris(ethylenediamine)cobalt(3+)

d. $[Cr_2(\mu\text{-}O)(NH_3)_{10}]^{4+}$ m-oxo-bis(pentaamminechromium (III)) or m-oxo-bis(pentaamminechromium) (4+)

e. $[Ag(NH_3)_2][Ag(CN)_2]$ $[Ag(NH_3)_2]$ is +1 and $[Ag(CN)_2]$ is -1. diamminesilver(I)dicyanoargentate(I) or diamminesilver(1+)dicyanoargentate(1-)

f. $[Fe(CO)_5]$ pentacarbonyliron(0)

g. $[Rh_2(\mu\text{-}CO)(\mu\text{-}NH_2)(NH_3)_8]^{3+}$

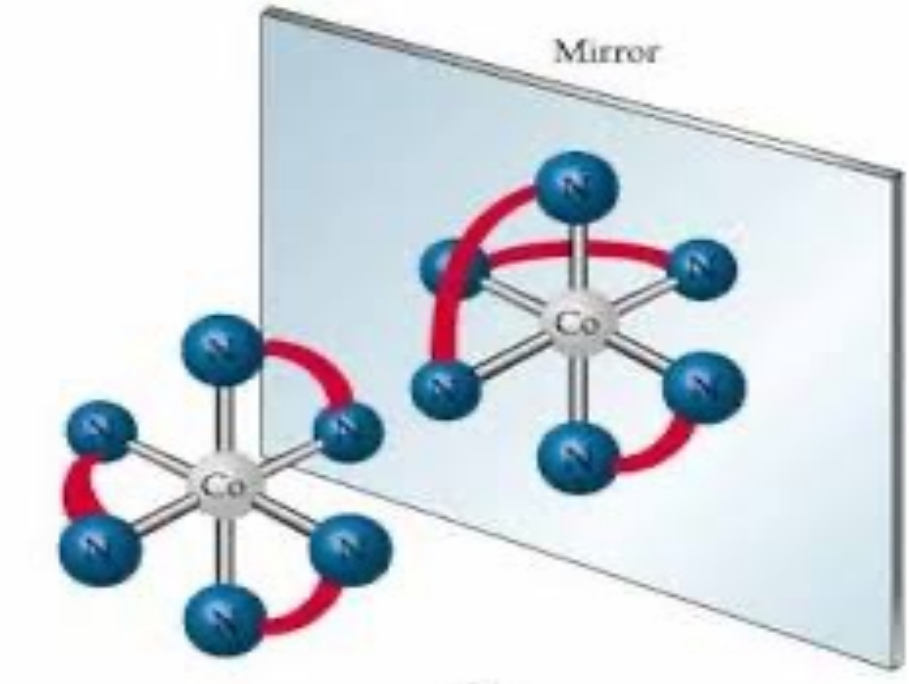


μ-amido-μ-carbonylbis(tetraamminerhodium)(3+) or μ-amido-μ-carbonylbis(tetraamminerhodium(II))

Symmetry Elements

Symmetry element	Symmetry operation	Symbol
axis of rotation	rotation by 360°/n	C_n
mirror plane	reflection	σ
center of inversion*	inversion	i
improper axis of rotation	rotation of 360°/n followed by mirror reflection that is perpendicular to the rotational axis.	S_n

**For S_1 and S_2 = σ and i, respectively.*



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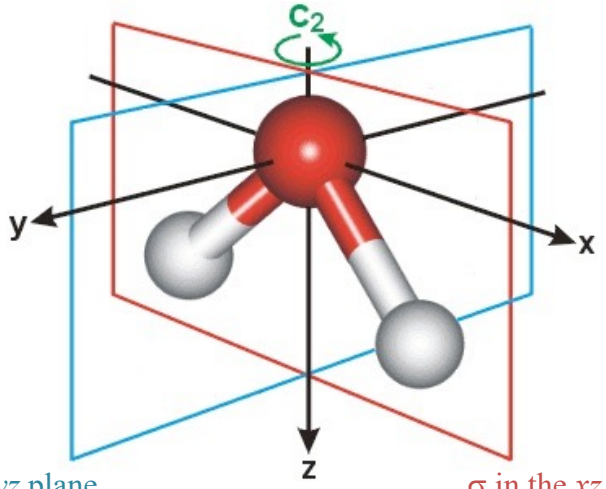
Symmetry elements of water, which has a C_2 axis of rotation and two mirror planes, σ



σ In the *yz* plane

σ in the *xz* plane