

Note that complex ions are always enclosed in brackets []. The names of complicated ligands are enclosed in parentheses. e.g., ethylenediamine, oxalato, methylamine, dimethylamine, carbonato, sulfato, thiosulfato, nitrate.

Charges within a complex ion are fairly easy to obtain. For example, in the compound $\text{Na}[\text{Al}(\text{OH})_4]$, we know the sodium ion must be $1+$ and, therefore, the tetrahydroxoaluminate complex ion must be $1-$. The $1-$ results because the Al is $3+$ and the hydroxide is 4 times $1-$; $(3+) + (4-)$ equals $1-$. In the compound $[\text{Cr}(\text{H}_2\text{O})_4\text{Cl}_2]\text{Cl}$ we know the charge of the chloride ion is $1-$. Therefore, the complex ion tetraaquodichlorochromium(III) must have a total charge of $1+$. The charge on four water molecules is zero (a neutral compound), and the two chloride ions equal 2 times $1-$ or $2-$. The charge on the chromium must be $3+$ because $[3+ \text{ plus } 4(0) \text{ plus } 2(1-)] = 1+$, the charge of the complex cation.

Example:

Given the compound $[\text{Cu}(\text{NH}_3)_4](\text{NO}_3)_2$, determine the charge on the copper ion and name the compound according to the IUPAC system.

Solution:

The charge on the nitrate ion is $1-$ and 2 times $1- = 2-$. NH_3 is a neutral compound (ammonia); therefore, 4 times $0 = 0$. Since the compound must be neutral overall, $x + 4(0) + 2(1-) = 0$; $x = 2+$. Cu must be $2+$. The IUPAC name of $[\text{Cu}(\text{NH}_3)_4](\text{NO}_3)_2$ is tetraamminecopper(II) nitrate!

Exercise 5-1: Name the following.

- $[\text{Ag}(\text{NH}_3)_2]\text{Cl}$
- $(\text{NH}_4)_3[\text{Fe}(\text{SCN})_6]$
- $\text{Na}_2[\text{Ni}(\text{CN})_4]$
- $[\text{Fe}(\text{ox})_3]^{3-}$
- $[\text{Co}(\text{NH}_3)_6]\text{Br}_2$
- $[\text{Cr}(\text{H}_2\text{O})_4\text{Cl}_2]\text{Cl}$
- $[\text{Pt}(\text{NH}_3)_2]\text{Cl}_2$
- $\text{K}_2[\text{Cu}(\text{CN})_4]$
- $[\text{Cr}(\text{H}_2\text{O})_6](\text{NO}_3)_3$
- $[\text{Co}(\text{en})_3]\text{Br}_3$

Exercise 5-2: Write formulas for the following.

- potassium hexacyanoferrate(III)
- sodium hexafluoroaluminate
- diamminesilver ion
- tetraamminezinc nitrate
- sodium tetrahydroxochromate(III)
- trans-dichlorobis(ethylenediamine)cobalt(III) chloride
- hexaammineruthenium(III) tetrachloronickelate(II)
- tetraamminecopper(II) pentacyanohydroxoferrate(III)
- sodium tetracyanocadmate
- diamminezinc iodide