Inorganic Nomenclature Handout (for coordination/ organometallic compounds)
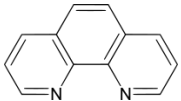
What's in a name?

Nomenclature needs to provide basic information about the complex:

1. what is the metal? *obviously*
2. What is the oxidation state of the metal? *A little less obvious perhaps, but most transition metals have more than one*
3. Is the metal in the cation or the anion? *In a salt, the metal can be part of either or both*
4. What are the ligands? *Again, this is pretty obvious*
5. How many ligands are there? *Well, yes, of course…*
6. How are they arranged? *The geometric arrangement of the ligands plays a huge role in the properties of the complex and must be specified.*

How do we do this?

THE RULES:

1. In naming a salt, cation first, then anion *(no problem, that's just like genchem)*
2. To name a complex/ complex ion: two parts written together as one long word, ligands first, metal second
    a. Greek prefixes denote "how many"
        i.   Mono-, di-, tri-….
        ii. Bis, tris, tetrakis… *(used when the mono, di, tri names just won't do… e.g. when the ligand name itself already has a greek prefix in it, as in ethylene**di**amine)*
    b. Ligand names in alphabetical order *(for consistency)*
        i.   Anionic ligands get –o ending, (i.e. Chloride, Cl^-, becomes chloro)
        ii. Neutral ligands simply keep the name of the molecule,(e.g. phenanthroline,), with a few exceptions
            1. NH_3 is ammine
            2. CO is carbonyl

3. H_2O is aquo
    iii. Arrangement of ligands should be specified
        1. Cis- (beside) vs. trans- (across)
        2. fac- (facial) vs. mer- (meridional – along an edge)
        3. $\Lambda-$ vs. $\Delta-$ (for optical isomers)
  c. Metal name must include both the oxidation state and tell whether the metal is part of the cation or anion
      i. Use parenthetical roman numerals to denote oxidation state (e.g. Fe^{3+} is iron(III))
      ii. If the metal is part of an anion, add an –ate ending (e.g. Mn^{3+} in an anionic complex ion becomes manganate (III), for some metals the common root name is used as in ferrate (III) for Fe^{3+} in an anionic complex ion)

examples

$K_4[Fe(CN)_6]$ - potassium hexacyanoferrate(II)

6 CN⁻ ligands, Fe^{2+} is in the anion, "ironate" just doesn't sound right so ferrate(II)

$[Co(NH_3)_6]Cl_3$ - hexaamminecobalt(III) chloride

6 ammonia ligands, Co^{3+}... do not use "trichloride"... it's wrong for magnesium chloride ($MgCl_2$) and it's wrong here too

$[Co(en)_3]Cl_3$ - trisethylenediaminecobalt(III) chloride

If the structure was given you would have to specify Λ or Δ here since this is optically active.

cis-diamminedichloroplatinum(II)