Nomenclature

1. Method for naming a coordination compound

   a. Cation is named before anion.

   b. Within the complex ion, name ligand before metal ion.

   c. *Use prefixes to indicate the number of specific type of ligand attached.

   d. *If the ligand is an anion, change the ending to "-o".
   *If the ligand is neutral, use its name, as is.

   e. If more than one type of ligand, name them alphabetically.

   f. Indicate oxidation number of metal ion using (roman numerals) after metal name.

   g. *If complex ion is anion, change ending of metal name to :-ate".

   *Some special names/rules apply.

2. Fill in these naming charts

Neutral Ligand	Name
H_2O	aqua
NH_3	ammine
CH_3NH_3	methyl ammine
NO	nitrosyl
CO	carbonyl
$NH_2CH_2CH_2NH_2$	ethylenediamine (en)

Anion Ligand	Name
Cl^-	chloro
NO_2^-	nitro
^-OH	hydroxo
$C_2O_4^{2-}$	oxalate
I^-	iodo
CN^-	cyano

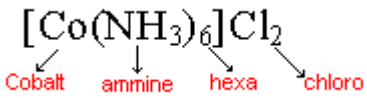
Metal	Name
Fe	ferrate
Cu	cuprate
Ag	argentite
Au	aurate
Sn	stannate
Pb	plumbate

Ligand Number	Prefix
–	–
2	di
3	tri
4	tetra
5	penta
6	hexa

Ligand Number	Prefix
–	–
2	bis
3	tris
4	tetrakis
5	pentakis
6	hexakis

3. Name the following

My recommendation is to first get all of the names for each of the components and then puzzle piece them together following the rules.

a. 

The next thing we need to do is figure out the charge on the cobalt. Remember that the counter ion, chlorine, is there to neutralize the charge on the complex ion. This tells us that the overall charge of the complex ion is +2. Because NH_3 is a neutral ligand, it does not contribute to the overall charge, which means that the cobalt must have a +2 charge.

We name the cation first, which is the complex ion. When we deal with the complex ion we name the ligand (including its prefix)first:

hexaaminne (all one word)

Next we add the name of the metal (including its oxidation number):

hexaaminnecobalt (II)

Lastly we include the name of the counter ion:

<u>hexaamminecobalt (II) chloride</u>

b. 

Now we need to figure out the charge on the platinum. Remember that the counter ion, potassium, is there to neutralize the charge on the complex ion. This tells us that the overall charge of the complex ion is -2. Because Cl^- is a negatively charged ligand. We can use a

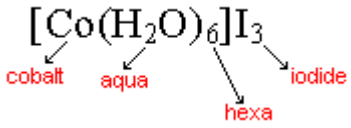
simple algebraic equation to solve for the charge on the platinum.

$$x + 4(-1) = -2$$
$$x = +2$$

So the platinum has a +2 oxidation state.

Name the cation first and then complex anion:

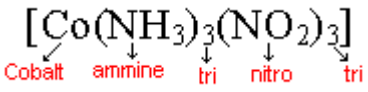
potassium tetrachloroplatinate (II)

c. 

The counter ion indicates that the complex ion has a +3 charge. The ligand, water, does not contribute to the overall charge. So the cobalt has an oxidation state of +3.

Name cation first (ligand before metal) + anion

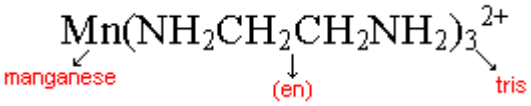
hexaaquacobalt (III) iodide

d. 

There is no counter ion which means that this complex ion is neutral. The ammine does not contribute to the charge and the nitro contributes a total of -2. This indicates that the Co has a +2 charge.

When we name a metal ion with more than one ligand attached we must name them alphabetically.

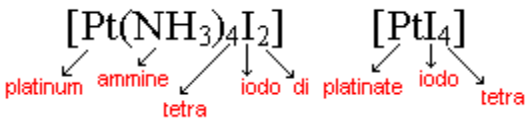
triamminetrinitrocobalt (III)

e. 

Because the ligand has the word "di" in it already we need to use the alternate set of prefixes when naming. It would be confusing to say diethylenediamine. It sounds like there are 2 ethlyene and 2 ammine ligands. By using tris we are able to indicate there are three of the entire ligand attached.

The overall charge on the ion is +2. The ethylenediamine (en) is neutral, so all of the charge can be contributed to the managanese.

<u>trisethylenediaminemanganese (II) ion</u>

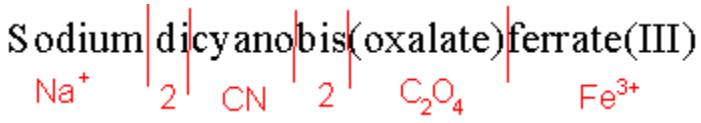
f. 

Now we need to determine the charge on the platinum in the cation and the anion. To accomplish this, you would need to know that the most common oxidation states of platinum are +4 and +2. Using this information we can get the name:

<u>tetraamminediiodoplatinum (IV) tetraiodoplatinate (II)</u>

4. Give the formulas for the following

Going to follow the same basic layout as for the previous naming questions. First we determine the identity of each component and then piece them together.

a. 

Cation = Na^+

Anion = $Fe(CN)_2(C_2O_4)_2$

We then need to determine the overall charge on the complex metal to figure out how many counter ions we need.

$$\underset{Fe^{3+}}{(+3)} + \underset{CN^-}{2(-1)} + \underset{C_2O_4^{2-}}{2(-2)} = -3$$

This indicates that we will need 3 Na^+ ions to neutralize the charge. This means that the formula for this compound is:

$$\underline{Na_3[Fe(CN)_2(C_2O_4)_2]}$$

b. Tetra | carbonyl | dihydroxo | chromium(III) ion
4 | CO | 2 | OH^- | Cr^{3+}

Now we determine the charge on the ion:

$$\underset{CO}{4(0)} + \underset{OH^-}{2(-1)} + \underset{Cr^{3+}}{(+3)} = +1$$

Thus, the formula for this complex ion is:

$$\underline{[Cr(CO)_4(OH)_2]^+}$$

c. Triammine | chloro | ethylenediamine | chromium(III) | iodide
3 | NH_3 | Cl^- | (en) | Cr^{3+} | I^-

The charge on the complex ion:

$$\underset{NH_3}{3(0)} + \underset{Cl^-}{(-1)} + \underset{(en)}{0} + \underset{Cr^{3+}}{(+3)} = +2$$

This tells us that we need 2 iodide anions to neutralize the charge.

Formula:

$[Cr(NH_3)_3Cl(en)]\ I_2$

d. Amminetrichloroplatinate(II) ion

NH_3 | 3 | Cl^- | Pt^{2+}

Charge:

$$\underset{NH_3}{0} + 3\underset{Cl^-}{(-1)} + \underset{Pt^{2+}}{(+2)} = -1$$

Formula:

$[PtNH_3(Cl)_3]^-$