NAMING INORGANIC COMPOUNDS

Inorganic compounds are often classified as ionic and covalent. The method for naming these compounds is slightly different. We will first look at naming ionic compounds and then covalent compounds.

Naming Ionic Compounds

To name ionic compounds you have to recognize that the compound is ionic. An ionic compound consists of the combination of metal and nonmetal elements. You also need to know which metal ions form only one possible ion. The elements in groups IA, IIA, and IIIA (except Tl), can only form one ion. The charge of the ion is the same as the group number. For monoatomic nonmetal ions, take the group number and subtract eight, i.e., oxide ion is -2 since oxygen is in group VIA, so 6 - 8 gives -2 for the ion charge. The polyatomic ions must be memorized. You should know the formula and the charge for a select number of these ions. Refer to any general chemistry text for a table of polyatomic ions which are of common use. Armed with this knowledge, let's look at naming some ionic compounds.

1. Name the cation (usually the metal ion) using the same name as the element. If the metal forms only one ion, a Stock number (Roman numeral) is not needed. For elements forming more than one ion, use the Stock number (a Roman numeral) following the element name. Do not put a space between the metal name and the Stock number. The Stock number is the same as the charge of the ion. For example, Na^{+}, would be named as sodium ion, since sodium can only form a +1 ion. On the other hand, Cu^{2+}, would be called copper(II) ion since copper can form both a +1 and a +2 ion.

2. If the anion is monoatomic, take the first syllable (sometimes two syllables) of the element name and use the prefix -ide. So O^{2-} becomes oxide, Cl^{-} becomes chloride, etc. Where more than one syllable of the element name is needed is usually obvious: I^{-} is iodide, Se^{2-} is selenide, etc. If the anion is polyatomic, use the name of the polyatomic ion. These ion names must be memorized. So, SO_4^{2-} is sulfate, NO_3^{-} is nitrate, etc.

3. The cation is always named first, followed by the anion.

4. Unless you are starting a sentence, names of compounds are not capitalized.

Here are some examples for you to try. The correct names are found at the end of the tutorial:

1. NaBr _____

2. $CaSO_4$ _____

3. K_2S _____

4. $Ni(NO_3)_2$ _____

5. Mg_3N_2_____

6. $Fe_2(CO_3)_3$ _____

7. Cr_2O_3 _____

8. $Ti(ClO_4)_4$ _____

9. $AlCl_3$ _____

10. PbC_2O_4 _____

Naming Binary Covalent Compounds

Naming covalent compounds is easier than ionic compounds. To indicate how many of an element is present, prefixes are used:

1 is called mono-	6 is called hexa-
2 is called di-	7 is called hepta-
3 is called tri-	8 is called octa-
4 is called tetra-	9 is called nona-
5 is called penta-	10 is called deca-

1. Name the first element in the compound as the element. If more than one of that element is found in the formula, use the appropriate prefix. Note that mono is never used as a prefix for the first element, when only one of that element is present.

2. Name the second element using the appropriate prefix to indicate how many and the -ide suffix at the end of the name, just as if the element were a monoatomic ion. If the element begins with a vowel, and the prefix ends with the letter a, drop the letter a in the prefix.

Here are some examples for you try. The correct names are given at the end of the tutorial:

1. CO _____

2. CO_2 _____

3. S_2F_6 _____

4. P_4O_{10} _____

5. N_2O_4 _____

6. NCl_3 _____

7. PBr_5 _____

8. SiS_2 _____

9. N_2F_4 _____

10. $SeBr_2$ _____

Naming Acids

1. Some acids are formed by the addition of hydrogen ions, (H^+), to a monatomic anion. To name an acid which contains a monatomic anion, drop the start the name with hydro, drop the -ide ending of the anion and add the suffix, -ic acid. For example, HBr is hydrobromic acid.

2. Oxyacids contain polyatomic anions such as nitrite, carbonate, etc. To namean acid with an anion ending with the -ite suffix, drop the -ite suffix and add the suffix, -ous acid. For example, HNO_2 , would be name as nitrous acid. To name an acid with an anion ending with the -ate suffix, drop the -ate suffix and add the suffix, -ic acid. For example, H_2CO_3 , would be named carbonic acid.

3. The oxyacids of the Group VII elements (halogens) have more complex names because there are four different possible oxyanions. The -ite/ous acid and -ate/ic acid changes still apply, the only difference is the additional prefixes of hypo- or per- are carried along in both the anion and the acid name.

Here is an example using chlorine as the halogen:
ClO^- is hypochlorite ion; the corresponding acid name is hypochlorous acid, HClO.
ClO_2^- is chorite ion; the corresponding acid name is chlorous acid, $HClO_2$.
ClO_3^- is chlorate ion; the corresponding acid name is chloric acid, $HClO_3$.
ClO_4^- is perchlorate ion; the corresponding acid name is perchloric acid, $HClO_4$.

Answers to problems in naming ionic compounds:

1. sodium bromide
2. calcium sulfate
3. potassium sulfide
4. nickel(II) nitrate

5. magnesium nitride
6. iron(III) carbonate
7. chromium(III) oxide
8. titanium(IV) perchlorate
9. aluminum chloride
10. lead(II) oxalate

Answers to naming binary compounds:

1. carbon monoxide
2. carbon dioxide
3. disulfur hexafluoride
4. tetraphosphorus decoxide
5. dinitrogen tetroxide
6. nitrogen trichloride
7. phosphorus pentabromide
8. silicon disulfide
9. dinitrogen tetrafluoride
10. selenium dibromide