Nomenclature of inorganic compounds

Before a systematic method of naming different chemical substances was established, various compounds were named after people, places, or things. Some examples would be washing soda (sodium carbonate, which is used for softening wash water), and Glauber's salt (sodium sulfate, discovered by J.R. Glauber). Because of the vast number of compounds known to man, numbering into the millions, a system of naming was devised to prevent total confusion from occurring. **Chemical nomenclature** is the systematic naming of chemical compounds.

Compounds can be divided into two basic categories, those which are true binary compounds (they contain only two types of elements), and those which contain more than two different types of elements. There is also a system of naming for organic (carbon-based) compounds.

A binary compound is a compound that consists of a combination of two elements. Compounds that end in **IDE** indicate that they contain only two elements. The first element is usually a positively charged metal, and the second element is usually a negatively charged nonmetal. The positively charged ion is the name of the metal, while the negatively charged ion consists of the stem plus the suffix **IDE**.

Stems of the most commonly used elements:

Element	Stem
oxygen	ox
chlorine	chlor
carbon	carb
iodine	iod
bromine	brom
selenium	selen
nitrogen	nitr
phosphorus	phosph
fluorine	fluor
sulfur	sulf or sulfur

These stems are placed in the second part of the binary compound's chemical name, before the **ide**. Here are some examples using the element stems and the suffix **ide**.

CaO is calcium oxide

CaO is calcium oxide because you have a calcium atom bonded to an oxygen atom. Since this is a binary compound (meaning that it is a compound comprised of only two elements) there is a positive and a negative ion. The positive ion is calcium, because it is a metal,so the oxygen is the negative ion. Now we write **calcium** as the name of the metal, and **ox** as the prefix of the second word (because oxygen's stem is ox). Lastly, we attach the suffix **ide** behind the **ox** to get the name calcium oxide.

AlN is aluminum nitride

AlN is aluminum nitride because you have an aluminum atom bonded to a nitrogen atom. Since this is a binary compound there is a positive and a negative ion. The positive ion is aluminum, because it is a metal,so the nitrogen is the negative ion. Now we write **aluminum** as the name of the metal, and **nitr** as the prefix of the second word (because nitrogen's stem is **nitr**). Lastly, we attach the suffix **ide** behind the **nitr** to get the name aluminum nitride.

K_2S is potassium sulfide

K_2S is potassium sulfide because you have a potssium atom bonded to a sulfur atom. Since this is a binary compound there is a positive and a negative ion. The positive ion is potassium, because it is a metal, so the sulfur is the negative ion. Now we write **potassium** as the name of the metal, and **sulf** as the prefix of the second word (because sulfur's stem is **sulf**). Lastly, we attach the suffix **ide** behind the **sulf** to get the name potassium sulfide.

NaCl is sodium chloride

NaCl is sodium chloride because you have a sodium atom bonded to a chlorine atom. Since this is a binary compound there is a positive and a negative ion. The positive ion is sodium, because it is a metal, so the chlorine is the negative ion. Now we write **sodium** as the name of the metal, and **chlor** as the prefix of the second word (because chlorine's stem is **chlor**). Lastly, we attach the suffix **ide** behind the **chlor** to get the name sodium chloride.

Remember that the positively charged ion is the name of the metal, while the negatively charged ion consists of its stem plus a suffix (so far we have only used **IDE**). So far we have seen that in the name of a chemical compound, the first element usually is positive, and is the first part of the name. The second element in the compound's name is usually negative.

NaCl

Na is the metal, and has a positive charge of 1

Cl is the second part of the compound, a nonmetal, and has a charge of -1

We now find that the ammonium radical, NH_4^+, is considered as a simple positive ion, and even though it is not a metal, it would go at the front of a compound name. Here are some examples:

NH_4Cl is ammonium chloride

NH_4Cl is ammonium chloride because you have an ammonium radical bonded to a chlorine atom. Since this is considered a binary compound there is a positive and a negative ion. The positive ion is ammonium even though it is not a metal. That makes the the chlorine the negative ion. Now we write **ammonium** as the name of the metal, and **chlor** as the prefix of the second word (because chlorine's stem is **chlor**). Lastly, we attach the suffix **ide** behind the **chlor** to get the compound's name, ammonium chloride.

$(NH_4)_2S$ is ammonium sulfide

$(NH_4)_2S$ is ammonium sulfide because you have an ammonium radical bonded to a sulfur atom. Since this is a binary compound there is a positive and a negative ion. The positive ion is ammonium even though it is not a metal. That makes the sulfur the negative ion. Now we write **ammonium** as the name of the metal, and **sulf** as the prefix of the second word (because sulfur's stem is **sulf**). Lastly, we attach the suffix **ide** behind the **sulf** to get the compound's name, ammonium sulfide.

There are also two negative groups which are considered as special cases: the hydroxide radical, OH^-, and the cyanide radical, CN^-, are considered as simple negative ions. This means that they are added at the end of the compound name.

KCN is potassium cyanide

KCN is potassium cyanide because you have a potassium atom bonded to a cyanide atom. Since this is a binary compound, there is a positive and a negative ion. The positive ion is potassium because it has a positive charge. CN^-, the cyanide ion, is considered the negative ion. Now we write **potassium** as the name of the metal, and cyanide is the negative ion.

$Mg(OH)_2$ is magnesium hydroxide

NH_4CN is ammonium cyanide

Some metallic ions can have two valence states, the one with the lower valence has the ending **OUS** while the one with the higher valence has the ending **IC**. Under the new international system, the valence is designated by a Roman numeral.

Fe^{+2} is the ferrous ion or iron (II) ion
Fe^{+3} is the ferric ion or iron (III) ion

Cu^{+1} is the cuprous ion or copper (I) ion
Cu^{+2} is the cupric ion or copper (II) ion

Pb^{+2} is the plumbous ion or lead (II) ion
Pb^{+4} is the plumbic ion or lead (IV) ion

Sn^{+2} is the stannous ion or tin (II) ion
Sn^{+2} is the stannic ion or tin (IV) ion

The rules given above apply to compounds of these elements in the same manner.

CuS is cupric sulfide or copper (II) sulfide
$FeCl_2$ is ferrous chloride or iron (II) chloride

When naming binary covalent compounds formed between two nonmetals, another system of nomenclature is preferred in which the numbers of each atom in a molecule are specified by a Greek prefix.

Number	Prefix
2	di
3	tri
4	tetra
5	penta
6	hexa
7	hepta
8	octa
9	nona
10	deca

NO_2 is nitrogen dioxide

NO_2 is nitrogen dioxide because you have a nitrogen atom bonded to two oxygen atoms. Since this is a binary compound of two nonmetals, we use the new way of naming we just

learned. We keep nitrogen as the first name, and attach the prefix **di** before the oxygen because there are two atoms of oxygen. We then add the **ox** stem from oxygen after the di prefix. We attach the **ide** suffic after ox, and we have the finished product, nitrogen dioxide.

N_2O_4 is dinitrogen tetroxide
PCl_3 is phosphorus trichloride

In some cases the prefix mono is used to avoid ambiguity.

Examples :

CO is carbon monoxide
CO_2 is carbon dioxide