NAMING THE CHEMICAL COMPOUNDS

We divide the compounds into two main types ---- the binary compounds (those that contain only two elements) and those which contain more than two elements.

Naming the Binary Compounds: The names of the binary compounds (only two elements present) end in IDE. There are two kinds of binary compounds --- those whose first element is a metal and those whose first element is a non-metal. In both cases, the second element is a non-metal.

For binary compounds whose first element is a metal we use the following system:

Name the metal follow it with a stem of the non-metal and add IDE.

The stem is merely an abbreviation for the name of the second element (the non-metal). The most commonly used elements have the following stems:

oxygen----------ox	chlorine-----chlor	carbon------carb
iodine----------iod	hydrogen---hydro	nitrogen----nitr
phosphorus---phosph	fluorine------flour	bromine----brom
	sulfur--------sulf	

EXERCISE A: Name these compounds:

1. NaCl
2. CaO
3. CaI_2
4. AIN
5. K_2S
6. *HCl

* When written first, Hydrogen is considered a metal.

There are a few special cases in this system of naming. The ammonium polyatomic ion NH_4^+ is considered as a simple metallic ion.

NH_4Cl is ammonium chloride. Name $(NH_4)_2S$

There are also two negative polyatomic ions which are considered to be special cases; the hydroxide (OH^-) and the cyanide (CN^-) are considered as simple negative ions.

KCN is potassium cyanide. Name these: $Mg(OH)_2$ and NH_4CN.

If a metal forms two different ions, the charges on these ions may be indicated by Roman numerals. Or according to the classical system, the ion with the smaller charge is given the ending OUS and the ion with the greater charge is given the IC ending.

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

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

Hg_2^{+2} is mercury (I) or mercurous while Hg^{+2} is mercury (II) or mercuric.

Sn^{+2} is the tin (II) or stannous and Sn^{+4} is tin (IV) or stannic.

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

When using these mental ions is binary compounds or others indicate the oxidation state present by using the Roman numeral or the –OUS or –IC ending with the metal name.

$FeCl_2$ is iron (II) chloride or ferrous chloride.

EXERCISE B: Name these compounds both ways:

1. CuS
2. Cu_2O
3. HgO
4. SnO_2
5. $PbBr_2$

Now write these compounds as formulas:

1. ammonium fluoride

2. iron (II) sulfide

3. stannic chloride

4. cuprous oxide

For a binary compound whose first element is a non-metal, use this system:

Name the first element with prefix, then the prefix for the second element + stem + ide.

where the stem is again the abbreviation for the second element. In addition a prefix is used to tell how many atoms of the second element are present. The prefixes used are:

mono	= 1	tri	= 3	penta	= 5	hepta	= 7
di	= 2	tetra	= 4	hexa	= 6	octa	= 8

When naming the compound CO_2. Name the first element add the prefix for the number of second type atoms, the stem to identify the second element and the IDE to show it is binary.

CO_2 is carbon di + ox + ide or carbon dioxide

P_2O_3 is diphosphorus trioxide. What is P_2O_5?

EXERCISE C: Name these compounds:

1. SO_2 2. CO 3. CCI_4 4. Cl_2O_7

NAMING ACIDS DERIVED FROM BINARY COMPOUNDS:

For binary compounds with hydrogen as the first element, place the term HYDRO at the front of the stem of the second element, the letters IC at the end of the stem and add the word ACID.

HCl becomes hydrochloric acid.

EXERCISE D: Name these acides: 1. HBr 2. H_2S 3. HF

NAMING ACIDS WHOSE NEGATIVE GROUP CONTAINS OXYGEN:

The highest oxidation state is usually the best known or the most common one and is so designated by adding the letters IC to the stem plus the word ACID . There are a few exceptions to the highest state being the IC ACID. There are mostly members of the GROUP VIIA and some of the transition elements such as manganese. The student must remember which is the most common acid derived from several elements. The only ones we will consider are the common acids of phosphorus, sulfur, nitrogen, chlorine, carbon, boron manganese and arsenic.

H_2SO_4	sulfuric acid	$HClO_3$	chloric acid
H_3PO_4	phosphoric acid	H_2CO_3	carbonic acid
HNO_3	nitric acid	H_3BO_3	boric acid
$HMnO_3$	manganic acid	H_3AsO_4	arsenic acid

If the acid contains ONE LESS OXYGEN ATOM than the most common one, the end on the stem is changed to OUS.

H_2SO_3	sulfurous acid	$HClO_2$	chlorous acid
H_3PO_3	phosphorous acid	H_3AsO_3	arsenous acid
HNO_2	nitrous acid	$HMnO_2$	manganous acid

If the acid contains TWO LESS OXYGEN ATOMS than the common one, the ending on the stem is the OUS and the prefix HYPO is added.

H_3PO_2	is hypophosphorous acid.	$(HNO)_2$	is hyponitrous acid.
HClO	is hypochlorous acid.		

If the acid contains ONE MORE OXYGEN ATOM than the most common one, the prefix PER is added to the name of the most common acid.

$HClO_4$	is perchloric acid.	$HMnO_4$	is permanganic acid.

NAMING SALTS FROM THE CORRESPONDING OXY-ACIDS:

For salts derived form the most common acids (IC ACIDS), remove the acid name, change the IC of the stem to ATE and prefix the name of the positive ion replacing the hydrogen.

Na_2SO_4 (derived from H_2SO_4 -- sulfuric acid) is sodium sulfate.

EXERCISE E: Name these salts from common acids.

1. KNO_3
2. $(NH_4)_3PO_4$
3. $Ca(ClO_3)_2$

For salts derived from the OUS acids, drop the OUS ending, add the letters ITE and prefix the name of the positive ion.

K_2SO_3 (from the sulfurous acid -- H_2SO_3) is potassium sulfite.

EXERCISE F: Name these salts.

1. $Al(NO_2)_3$
2. $KClO_2$

For salts derived from the HYPO-------OUS acids, drop the OUS ending from the stem, add the ITE and prefix the name of the positive ion.

KClO (from hypochlorous acid – HClO) is potassium hypochlorite.

For salts derived from the PER---IC acids, drip the IC ending from the stem, add the ATE (keeping the per) and prefix the name of the positive ion.

$KClO_4$ (from perchloric acid---$HClO_4$) is potassium perchlorate.

EXERCISE G: Name these salts.

1. Na_2SO_3
2. K_3PO_4
3. $Mg(ClO_4)_2$
4. $Ca(NO_3)_2$
5. $Mg(ClO_2)_2$
6. $Al(ClO)_3$

NAMING SALTS CONTAINING MORE THAN ONE POSITIVE ION:

A) Salts containing two positive ion, one of which is hydrogen. Give the name of the positive ion other than hydrogen. Use the letters BI to indicate the hydrogen OR name hydrogen. Give the proper name of the negative ion according to the rules above.

$NaHSO_4$ is sodium bisulfate or sodium hydrogen sulfate.

EXAMPLE H: Name these.

1. $LiHSO_3$
2. $NaHCO_3$
3. $Mg(HCO_3)_2$

B) Phosphate salts containing more than 1 type of positive ion, one of which is hydrogen or may be hydrogen.

Give the name of the first positive ion prefixing the term MONO or DI to indicate how many atoms of it are present.

Give the name of the second positive ion, prefixing the term MONO or DI to indicate the count of atoms per molecule.

Name the negative ion.

NaH_2PO_4 is monosodium dihydrogen phosphate.

Note: The MONO prefix is often omitted so the above compound can also be called sodium dihydrogen phosphate. The DI MUST be used, it is NOT optional.

1.	zinc sulfide	1.	LiCl
2.	iron (II) sulfate or ferrous sulfate	2.	H_3PO_4
3.	magnesium sulfite	3.	BCl_3
4.	magnesium phosphate	4.	$FeCl_3$
5.	hydrogen sulfide or hydrosulfuric acid	5.	$BaCO_3$

6.	silver nitrite	6.	ICl
7.	barium sulfate	7.	CCl_4
8.	potassium oxide	8.	Ag_2S
9.	aluminum nitrate	9.	H_2S
10.	tin (IV) iodide or stannic iodide	10.	Na_2HPO_4
11.	cupric sulfite or copper (II) sulfite	11.	$Mg(ClO)_2$
12.	arsenic pentachloride	12.	$KClO_4$
13.	arsenic trichloride	13.	$Fe_2(SO_4)_3$
14.	potassium cyanide	14.	CuO
15.	ammonium hydroxide	15.	$CuSO_4$
16.	ferric perchlorate or iron (III) perchlorate	16.	$(NH_4)_3PO_4$
17.	cuprous cyanide or copper (1) cyandide	17.	SnO_2
18.	dilithium monohydrogen phosphate or dilithium hydrogen phosphate	18.	Na_2CO_3
19.	calcium bicarbonate or calcium hydrogen carbonate	19.	$NaHCO_3$
20.	silicon dioxide	20.	$Al(OH)_3$
21.	sodium chlorite	21.	Ca_3N_2
22.	phosphorus trioxide	22.	$CA(NO_2)_2$
23.	sodium hydride	23.	SO_3
24.	lead (II) nitrate or plumbous nitrate	24.	$PbSO_4$
25.	hypochlorous acid or hydrogen hypochlorite	25.	$HBrO_2$