Naming Compounds

Anions and Cations

There are two types of ions, positive and negative.
POSITIVE ions are called **cations** (cat – ions)
NEGATIVE ions are called **anions** (ann - ions)

Any positive ion is a cation, whether one atom or several: Na^+, NH_4^+, Hg_2^+
Any negative ion is an anion: Cl^-, OH^-, COO^-, $C_2H_3O_2^-$, SO_3^{2-}

You will need to remember what anions and a cations are!!!

Common Groups

Some groups of atoms have specific names. There are a LOT of these, but here are the most useful ones to know. You don't need to remember these, but be familiar with them.

cyanide	CN^-	perchlorate	ClO_4^-
hydroxide	OH^-	chlorate	ClO_3^-
ammonium	NH_4^+	chlorite	ClO_2^-
nitrate	NO_3^-	hypochlorite	ClO^-
nitrite	NO_2^-	phosphite	PO_3^{3-}
sulfate	SO_4^{2-}	phosphate	PO_4^{3-}
peroxide	O_2^{2-}	sulfite	SO_3^{2-}
carbonate	CO_3^{2-}	carbonate	$C_2O_3^{2-}$

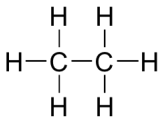
Organic Molecules

Molecules with a carbon backbone are organic. Mostly these are made of carbon and hydrogen, and are known as hydrocarbons. Here are four you may see often.

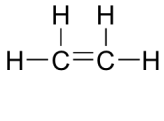
Alkane — Hydrocarbons with only single bonds
methane, ethane, propane, butane, octane

Alkene — Hydrocarbons with at least one double bond
ethene, propene, butene, octene

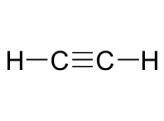
Alkyne — Hydrocarbons with at least one triple bond
ethyne, propyne, butyne, octyne



eth**ane**
(an alk**ane**)

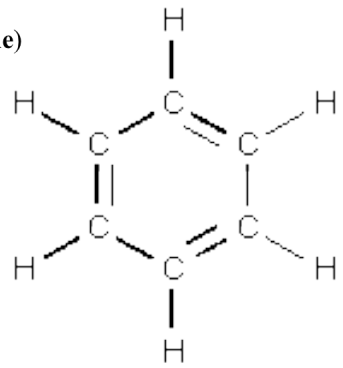


eth**ene**
(an alk**ene**)



eth**yne**
(an alk**yne**)

Benzene (phenyl)
A carbon ring made with some double bonds



Ions

-ide

Ions have different names than elements. You've already seen this, but may not have noticed. Examples:

Chlorine becomes chloride – as in sodium chloride

These are usually the "takers" and their normal taker state is the "ide"

Other -ide examples

H^- Hydride	F^- Fluoride	O^{2-} Oxide
S^{2-} Sulfide	N^{3-} Nitride	P^{3-} Phosphide

-ite and -ate

Some ions have many atoms. When these include oxygen, they become -ites and -ates. "When an element forms two oxyanions, the one with less oxygen is given a name ending in **-ite** and the one with more oxgyen is given a name that ends in **-ate**."

NO_2^- Nitrite

NO_3^- Nitrate

SO_3^{2-} Sulfite

SO_4^{2-} Sulfate

hypo- and per-

In the case where there is a series of four oxyanions, the **hypo-** and **per-** prefixes are used in conjunction with the **-ite** and **-ate** suffixes. The **hypo-** and **per-** prefixes indicate less oxygen and more oxygen, respectively.

ClO^- Hypochlorite

ClO_2^- Chlorite

ClO_3^- Chlorate

ClO_4^- Perchlorate

bi- and di- hydrogen

Negative ions sometimes gain one or more H^+ ions to form anions of a lower charge. These ions are named by adding the word **hydrogen** or **dihydrogen** in front of the name of the anion. It is still common to see and use the older naming convention in which the prefix **bi-** is used to indicate the addition of a single hydrogen ion.

HCO_3^- Hydrogen carbonate or bicarbonate

HSO_4^- Hydrogen sulfate or bisulfate

$H_2PO_4^-$ Dihydrogen phosphate

Metals

Compound	Modern method	Common (Old) name
FeF_2	iron (II) fluoride	ferrous fluoride
FeF_3	iron (III) fluoride	ferric fluoride
Hg_2Br_2	mercury (I) bromide	mercurous bromide
$HgBr_2$	mercury (II) bromide	mercuric bromide

Naming the Compounds - Key

Directions: Follow the steps to name the compound

1. Is the first element a non-metal (or a hydrogen)? Yes = 2, No = 15
2. Is the compound binary (only two elements)? Yes = 3, No = 8
3. Is the first element a hydrogen? Y = 4, No = 6
4. Is the compound a gas? No = 5,
   Yes = The first part of the name is hydrogen. Go to #17 for the last half.
5. The compound is a binary acid.
   To name it, the prefix is "hydro", and then it is followed by the root of the second element. Add the ending "ic" and follow it with "acid."
   Example HCl = hydrochloric acid.
   STOP Your compound is named.
6. Is the second element hydrogen, such as NH_3 or CH_4?
   No = 7, Yes = read below
   Your compound has a common name, often ending in -ane. It is likely one of the following:

BH_3	borane	NH_3	ammonia
PH_3	phosphane	CH_4	methane

   STOP Your compound is either named, or you need to look it up.
7. You have a binary compound with two non-metals. To name these, each of the two parts are given a Greek prefix designating the number of elements in the formula. NOTE: Do not use "mono" with the first element, but only with the second. The compound should end with "ide"

GREEK PREFIXES		EXAMPLES
mono-	1	CO = carbon monoxide
di-	2	CCl_4 = carbon tetrachloride
tri-	3	P_2O_5 = diphosphorous pentoxide
tetra-	4	
penta-	5	
hexa-	6	
hepta-	7	
octa-	8	
nona-	9	
deca-	10	

   STOP – You have named your compound
8. Is the positive ion NH_4^+? No = 9,
   Yes, write ammonium for the first part of the name and go to #17.
9. Is the first element hydrogen? If so, find the name of the negative ion and go to #10.
10. Does the name of the negative ion end in -ide? Yes = 11, No = 13
11. Is the compound a gas? No = 12,
    Yes = write "hydrogen" followed by the name of the negative ion
    Example: HCN = hydrogen cyanide
    STOP – You have named your compound

12. Is the compound aqueous (liquid) solution? No = Start over.
    Yes = change the "-ate" ending of the negative ion to "-ic", and add the prefix "hydro-" to the negative ion. Add the word "acid" to the compound name. Example: $HCN_{(aq)}$ = hydrocyanic acid
    STOP – You have named your compound
13. Does the name of the negative ion end in "-ate"? No = 14
    Yes = Change the "-ate" ending to "-ic" and add the word "acid"
    Example: H_3BO_3 = boric acid
    STOP – You have named your compound
14. Does the name of the negative ion end in "-ite"? No = Start over.
    Yes = change the "-ite" ending to "-ous" and add the word "acid."
    Example: HNO_2 = nitrous acid
    STOP – You have named your compound
15. The first element is a metal. Does it have a varying oxidation number? (No = 16, Yes = Read below) (The transition metals are likely variable)
    Write the name of the first element followed by its oxidation number in parentheses, for example Iron (II)
        To determine oxidation number, determine the oxidation number of the negative ion. Then divide that number by the quantity of positive ions. OR, if you know the lower and higher oxidation states, end the lower one with -ous and the higher with -ic. This gives you the first half. Continue to #17 for the second half.
16. Write the name of the metal for the first half, and continue on to #17.
17. Is the negative ion in the compound a single element? No = 18.
    Yes = for the second part of the compound name, write the name of the element, changing the ending to "-ide". Example: Chlorine becomes chloride
    STOP – Add your first and last parts of the name, and you're done.
18. Is the first element of the negative ion an H? Yes = 19, No = 21
19. Is the oxidation number equal to -2? No = 20
    Yes = add the prefix bi- to the name of this ion and write it down. OR write the word "hydrogen" followed by the name of that ion. This is the second part of your name. Example: HSO_4^{1-} is both bisulfate or hydrogen sulfate.
    STOP – Add your first to the second name, and you're done.
20. Add the Greek prefix for the number of hydrogens, then follow it with the word hydrogen. Follow this by the name of the negative ion. Example: Na_2HPO_4 is sodium monohydrogen phosphate.
    STOP – Add the first and last names together and you're done.
21. Write the name of the negative ion, added to the first name.
    STOP – You have it.

CHECK – Is the compound a hydrate? In other words, is there a number and H_2O after the main compound name? If so, you add the Greek prefix and "hydrate" at the end. So, $CuSO_4 \cdot 5\ H_2O$ is copper (II) sulfate pentahydrate

IF YOU DIDN'T FIND THE ANSWER, CHECK AGAIN OR LOOK IT UP.

(http://chemistry.about.com/od/nomenclature/a/nomenclature-ionic-compounds.htm)
(http://www.woodrow.org/teachers/chemistry/links/chem1/namingcomp.html)