MOLECULAR COMPOUNDS

- There are several kinds of molecular compound. We will learn to name two simple but important classes

1 BINARY MOLECULAR COMPOUNDS

- molecular compounds containing only two elements

2 ACIDS

- molecular compounds that dissolve in water to release H^+ ions
- corrosive to metals (react with many to produce hydrogen gas)
- contact hazard: can cause chemical burns to eyes and skin
- sour taste
- turn litmus indicator RED
- two kinds of acids:

Usually from Group VIIA

1 BINARY ACIDS

- contain hydrogen and one other element

2 OXYACIDS

- contain hydrogen, OXYGEN, and another element

BINARY MOLECULAR COMPOUNDS

- Named based on the elements they contain, plus prefixes to indicate the number of atoms of each element in each molecule

1 FIRST ELEMENT

- Add a GREEK PREFIX to the name of the element.
- Omit the "MONO-" (1) prefix if there is only one atom of the first element

2 SECOND ELEMENT

- Add a GREEK PREFIX to the STEM NAME of the element
- Add the suffix "-ide" (as if you were naming an anion)
- DO NOT omit the "mono-" prefix if there is only one atom of the second element

SEE COURSE WEB SITE FOR A LIST OF GREEK PREFIXES!
THESE ARE THE SAME PREFIXES USED FOR THE HYDRATES!

BINARY MOLECULAR COMPOUNDS

Examples:

BF_3	Cl_2O_7	CO	CO_2
boron triflouride	dichlorine heptoxide	carbon monoxide	carbon dioxide

*Note: metalloids like boron behave chemically like nonmetals do.

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carbon tetrachloride

CCl_4

dihydrogen monoxide

H_2O

dinitrogen tetrafluoride

N_2F_4

$MgCl_2$: This is MAGNESIUM CHLORIDE, not magnesium DICHLORIDE. Remember that the prefix system we discussed here is only for the binary molecules, and not for ionic compounds like magnesium chloride. How to tell? A quick way is to look at the first element. Compounds that have a metal as their first element are almost always ionic!

ACIDS

1 BINARY ACIDS

- named after the element (other than hydrogen) they contain
- common binary acids include a Group VIIA element
- named: "Hydro-" + STEM NAME OF ELEMENT+ "-ic acid"

Four common binary acids

- HF : hydrofluoric acid * dissolves glass!
- HCl : hydrochloric acid * most common binary acid!
- HBr : hydrobromic acid
- HI : hydroiodic acid

ACIDS

2 OXYACIDS

- Easy to think about as HYDROGEN IONS combined with POLYATOMIC IONS

- These acids are not true ionic compounds, but they interact with water to PRODUCE ions!

- named based on the polyatomic ion they contain, with an ending change:

1 - ions ending in -ATE form acids ending in -IC

2 - ions ending in -ITE form acids ending in -OUS

sulfATE

H_2SO_4

sulfuric acid

phosphATE

H_3PO_4

phosphoric acid

sulfITE

H_2SO_3

sulfurous acid

nitrate

HNO_3

nitric acid

OXYACID EXAMPLES

acetic acid

based on ACETATE ion

$H^+ \quad C_2H_3O_2^-$

$HC_2H_3O_2$

nitrous acid

based on NITRITE ion

$H^+ \quad NO_2^-$

HNO_2

carbonic acid

based on CARBONATE ion!

$H^+ \quad CO_3^{2-}$

H^+

H_2CO_3

The number of hydrogen atoms at the beginning of the formula equals the charge of the anion the acid is based on!

SUMMING UP CHEMICAL NOMENCLATURE

- You need to be able to tell, by looking at a name OR a formula, what kind of compound you are working with!

DON'T GET THE NAMING SYSTEMS MIXED UP! EACH KIND OF COMPOUND IS NAMED WITH ITS OWN SYSTEM!

FROM A CHEMICAL NAME

- If the name has a Roman numeral, the name of a metal, or "ammonium", the compound is likely IONIC

- If the name has a Greek prefix AND the prefix is NOT in front of the word "hydrate", the compound is BINARY MOLECULAR

- If the name contains the word "acid":

... and starts with "hydro-", then the compound is a BINARY ACID

... and does not start with "hydro-", the compound is an OXYACID

FROM A CHEMICAL FORMULA

- if the formula contains a metal or the NH_4^+ ion, it is likely IONIC

H_2O H_2O_2

- If the formula starts with H and is not either water or hydrogen peroxide, the compound is likely an ACID. Which kind?

  - BINARY ACIDS contain only two elements

  - OXYACIDS contains oxygen

- If the formula contains only nonmetals (and is not an ammonium compound or an acid), the compound is likely MOLECULAR

Examples:

PCl_3: BINARY MOLECULAR
Name: phosphorus trichloride

NH_4Cl: IONIC (ammonium ion)
Name: ammonium chloride

H_3PO_4: OXYACID (hydrogen, phosphate)
Name: phosphoric acid

$Fe(OH)_2$: IONIC (starts with a metal)
Name: iron(II) hydroxide