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:

           (1) BINARY ACIDS

usually
Group VIIA

              - 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) <u>FIRST ELEMENT</u>

       - Add a <u>GREEK PREFIX</u> to the name of the element.

       - Omit the "MONO-" (1) prefix if there is only one atom of the first element

(2) <u>SECOND ELEMENT</u>

       - Add a <u>GREEK PREFIX</u> to the STEM NAME of the element

       - Add the suffix "<u>-ide</u>" (as if you were naming an anion)

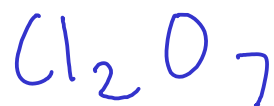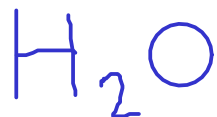   - DO NOT omit the "mono-" prefix if there is only one atom of the second element

SEE COURSE WEB SITE FOR A LIST OF GREEK PREFIXES!

BINARY MOLECULAR COMPOUNDS

Examples:

BF_3

boron trifluoride

Cl_2O_7

dichlorine heptoxide

CO

carbon monoxide

CO_2

carbon dioxide

H_2O

dihydrogen monoxide (water)

---

carbon tetrachloride

CCl_4

iodine trichloride

ICl_3

dinitrogen tetrafluoride

N_2F_4

$MgCl_2$: Magnesium chloride, not magnesium dichloride. Why not? This one is ionic and is named using the system for ionic compounds we discussed earlier.
(Remember - compounds that begin with a metal are generally 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

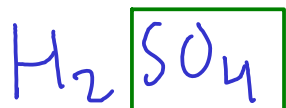HI: hydroiodic acid

ACIDS

ⓩ 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!

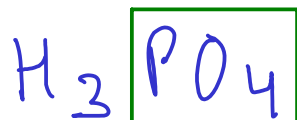- named based on the polyatomic ion they contain, with an ending change:

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

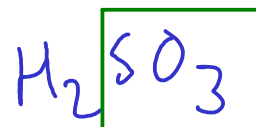② - ions ending in -ITE form acids ending in -OUS
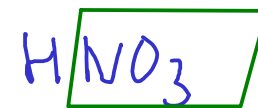
$H_2 \boxed{SO_4}$

based on sulfATE ion

sulfuric acid

$H_3 \boxed{PO_4}$

based on phosphATE

phosphoric acid

$H_2 \boxed{SO_3}$

based on sulfITE

sulfurous acid

$H \boxed{NO_3}$

based on nitrATE

nitric acid

OXYACID EXAMPLES

acetic acid

based on ACETATE ion

H^+ $\quad C_2H_3O_2^-$

$HC_2H_3O_2$

nitrous acid

H^+ $\quad NO_2^-$

HNO_2

carbonic acid

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

H^+

H_2CO_3
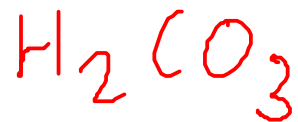
* The number of hydrogen ions to add to the polyatomic to make the acid equals the charge of the polyatomic.

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, 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

$Fe_2(SO_4)_3$: IONIC (iron - metal!)
Name: iron(III) sulfate

Fe^{3+} SO_4^{2-}
Fe^{3+} SO_4^{2-}
        SO_4^{2-}