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

- contain hydrogen and one other element

usually Group VIIA

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!

BINARY MOLECULAR COMPOUNDS

Examples:

BF_3
boron trifluoride

Cl_2O_7
dichlorine hept(a)oxide

CO
carbon monoxide

CO_2
carbon dioxide

H_2O
dihydrogen monoxide (but we call this molecule "water")

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carbon tetrachloride
CCl_4

iodine trichloride
ICl_3

dinitrogen tetrafluoride
N_2F_4

$MgCl_2$: magnesium chloride, not magnesium dichloride. Why not? Because magnesium chloride is an IONIC compound, and is named with the system we talked about before.

How can we tell? metal/nonmetal compounds 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

H_2SO_4

based on sulfATE ion

sulfuric acid

H_3PO_4

based on phosphATE ion

phosphoric acid

H_2SO_3

based on sulfITE ion

sulfurous acid

HNO_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

based on nitrite

$H^+ \quad NO_2^-$

HNO_2

carbonic acid

based on carbonate

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

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

- If the formula starts with H and is not either water (H_2O) or hydrogen peroxide (H_2O_2), 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

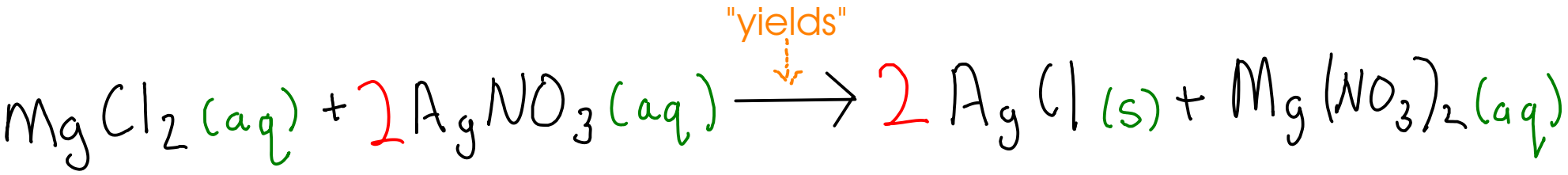
H_3PO_4 : OXYACID (hydrogen, phosphate)
Name: phosphoric acid

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

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

CHEMICAL EQUATIONS

- are the "recipes" in chemistry
- show the substances going into a reaction, substances coming out of the reaction, and give other information about the process



REACTANTS - materials that are needed for a reaction

PRODUCTS - materials that are formed in a reaction

COEFFICIENTS - give the ratio of molecules/atoms of one substance to the others

PHASE LABELS - give the physical state of a substance:
(s) -solid
(l) - liquid
(g) - gas
(aq) - aqueous. In other words, dissolved in water