DETERMINING THE FORMULA OF AN IONIC COMPOUND FROM THE NAME

- The name of an ionic compound is made of the names of the CATION and ANION in the compound.

- To get the FORMULA, you must figure out the SMALLEST RATIO of cation to anion that makes the charges balance out

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Examples:

iron(III) carbonate

Fe^{3+} CO_3^{2-}

Fe^{3+} CO_3^{2-}

CO_3^{2-}

$Fe_2(CO_3)_3$

potassium sulfide

K^+ S^{2-}

K^+

K_2S

calcium bromide

Ca^{2+} Br^-

$CaBr_2$

cross method

DETERMINING IONIC FORMULAS

sodium sulfate

$Na^+ \quad SO_4^{2-}$

Na^+

Na_2SO_4

strontium oxide

$Sr^{2+} \quad O^{2-}$

SrO

chromium(III) nitrate

$Cr^{3+} \quad NO_3^-$

NO_3^-

NO_3^-

$Cr(NO_3)_3$

chromium(III) nitride

$Cr^{3+} \quad N^{3-}$

CrN

tin(II) phosphate

$Sn^{2+} \quad PO_4^{3-}$

$Sn^{2+} \quad PO_4^{3-}$

Sn^{2+}

$Sn_3(PO_4)_2$

titanium(IV) chloride

$Ti^{4+} \quad Cl^-$

Cl^-

Cl^-

Cl^-

$\rightarrow TiCl_4$

titanium(IV) oxide

$Ti^{4+} \quad O^{2-}$

O^{2-}

TiO_2

barium hydroxide

$Ba^{2+} \quad OH^-$

OH^-

$Ba(OH)_2$

~~$BaOH_2$~~

Be careful with polyatomic ions that don't end in subscripts. You still need parenthesis to indicate more than one of these polyatomics. Most common: hydroxide or cyanide.

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) 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

MEMORIZE THE GREEK PREFIXES. SEE COURSE WEB SITE FOR A LIST!

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 always use "water")

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carbon tetrachloride

CCl_4

iodine trichloride

ICl_3

dinitrogen tetrafluoride

N_2F_4

$MgCl_2$ This one is magnesium CHLORIDE, not magnesium DICHLORIDE, Why not? It's IONIC ... and should be named using the ionic naming system we discussed before.
(How can we tell? Remember, ionic compounds usually contain a metal, and molecular compounds usually don't!)

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

$H^+ \quad NO_2^-$

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.