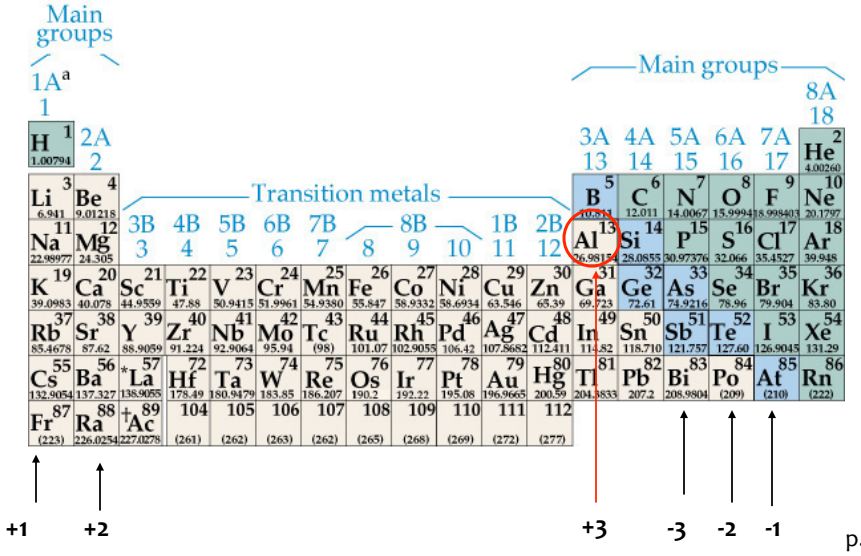
CHE1031 Lab Exercise:
Naming Chemical Compounds

Predicting Ionic Charge:

Use group numbers to predict ionic charge as shown below.
Transition metals have varying charges & cannot be predicted this way.



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Naming Chemical Compounds:

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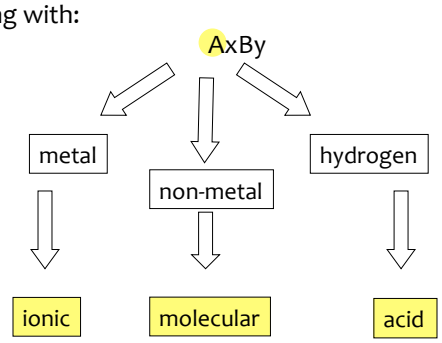
There are three distinct naming systems, so your first task is determining what type of compound you're dealing with:

Ionic

Acid

Molecular



Naming tutorial on the web @
www.towson.edu/~yau/NomenclatureTutorial.htm

Are these examples ionic, acid or molecular?

$Fe(OH)_2$	$HBrO_3$
XeO_3	$Fe_2(CO_3)_3$
$Cu(NO_3)_2$	SO_3
H_3PO_4	CO_2
SF_6	$Cd(II)(ClO_4)_2$
$CaHCO_3$	N_2O_4
$Sn(II)F_2$	HBr
P_4S_6	IF_5
HF	$HClO_3$
HCN	$(NH_4)_2SO_4$

Naming Cations:

Cations are positively charged ions - most often **metals**.
With one exception, cations are monoatomic.

Cations are named for the element they are derived from.
Transition metals (the Midwest) must include charge as (Roman numerals).

Na^{+1}
Mg^{+2}
Fe^{+2}
Al^{+3}
Cu^{+1}
Sr^{+2}
Mn^{+2}
Cs^{+1}
Ca^{+2}
Sn^{+2}
Cr^{+3}

NH_4^{+1}

Naming MONOATOMIC Anions:

Anions are negatively charged ions formed from non-metals.

Anions can be either mono- or polyatomic.

Monoatomic anions consist of a single element (can have multiple copies).
Anions get the root name of their element + -ide suffix.

_____-ide

F^{-1}
P^{-3}
O^{-2}
Cl^{-1}
N^{-3}
I^{-1}
Br^{-1}
S^{-2}

Element names can be found in the table below the periodic table on the front cover of your text.

Naming POLYATOMIC Anions:

Polyatomic anions are combinations of a more than one non-metal atom.
Generally, a non-metal & one or more **oxygen** atom(s).

Naming? Root name of the non-oxygen atom with a suffix:

- **hypo ____-ite**
- **-ite**
- **-ate**
- **per _____-ate**

NO_2^{-1}
NO_3^{-1}

ClO_1^{-1}
ClO_2^{-1}
ClO_3^{-1}
ClO_4^{-1}

HCO_3

Get to Know POLYATOMIC Families:

NH_4^+	ammonium
AsO_4^{-3}	arsenate
$C_2H_3O_2^{-1}$	acetate
CN^{-1}	cyanide
SCN^{-1}	thiocyanate
CO_3^{-2}	carbonate
HCO_3^{-1}	hydrogen carbonate
Cl^{-1}	chloride
ClO^{-1}	hypochlorite
ClO_2^{-1}	chlorite
ClO_3^{-1}	chlorate
ClO_4^{-1}	perchlorate
Cr ?	chromium (x)
CrO_4^{-2}	chromate
$Cr_2O_7^{-2}$	dichromate
MnO_4^{-1}	permanganate
NO_2^{-1}	nitrite
NO_3^{-1}	nitrate
O_2^{-2}	peroxide
OH^{-1}	hydroxide
PO_4^{-3}	phosphate
HPO_4^{-2}	hydrogen phosphate
$H_2PO_4^{-1}$	dihydrogen phosphate
S^{-2}	sulfide
SO_3^{-2}	sulfite
SO_4^{-2}	sulfate
HSO_3^{-1}	hydrogen sulfite
SCN^{-1}	thiocyanate

Memorize these!

What about formulas of ionic compounds?

All molecules (ionic, molecular, or acid) have a net charge of **zero**.
So total positive and negative charges must be equal - must cancel out.

How do you ensure a net zero charge?

CatxAny	
Mg Cl	Sr SO_4
Na O	Cr ClO_3
N F	Li PO_4
Ba Br	Ca NO_3
Fe S	Cs BrO_3
Ni N	Fe CO_3

Ionic formulas are always empirical formulas.

If you are given a cation and anion and are asked to give the formula, you can write ONLY the empirical formula (i.e. ratio of elements).

How?

Al and Cl ions

Al and O ions

Mg and NO_3 ions

Na and PO_4 ions

Zn and SO_4 ions

Fe and CO_3 ions

So… back to naming ionic compounds.

Naming ionic compounds is fairly straightforward.

Name the cation first, and the anion second

NEVER include the **subscript numbers** in the name.

Mg Cl	Sr SO_4
Na O	Cr ClO_3
N F	Li PO_4
Ba Br	Ca NO_3
Fe S	Cs BrO_3
Ni N	Fe CO_3

Naming MOLECULAR compounds is much easier.

Remember that a molecular compound is:

Elements are named from left to right (as found in the peroidic table):

Molecular compounds use Greek prefixes to 'name' subscript numbers.

mono
di
tri
tetra
penta
hexa
hepta
octa
nona
deca

Both elements get prefixes
EXCEPT when there is only
a single atom of the first element.

Naming MOLECULAR compounds is much easier.

Elements are named from left to right (as found in the peroidic table):
- Left-hand element gets the element name.
- Right-hand element is named for its root + **-ide** suffix.

Molecular compounds use Greek prefixes to **'include'** subscript numbers.

(Net charge of molecular compounds is still zero.)

C_2O_2
CO_2
CO

NOTE: It's difficult to predict the formula of molecular compounds.

P_4S_{10}

Cl_2O

N_2O_4

NF_3

SO_2

PCl_5

S_2Cl_2

$SiBr_4$

Names of ACIDS are based on anion names.

Remember that acids are compounds that can donate protons (H^+).
Acid formulas always **begin with H**: HCl, HBr, H_2SO_4

Since all acids have protons, names are based on the **anion name**.

MONOatomic acids: **hydro** root **-ic acid**
HCl
HBr
H_2S
HF

POLYatomic acids: change the suffix & add the word acid (no hydro-)
- -ate --> **-ic acid**
- -ite --> **-ous acid**

H_2SO_3
H_2SO_4

HClO
$HClO_2$
$HClO_3$
$HClO_4$