Rules for naming ions and ionic compounds using the Stock system

Cations = positive ions = metals (name = name of element)

Anions = negative ions = non-metals (names end in –ide)

Common monoatomic (one-atomed) cations and anions

Group I	Group II	Group III	Group IV	Group V	Group VI	Group VII	Group VIII
+1	+2	+3	+4 to –4	–3	–2	–1	0
Li^+ Lithium			(*share*	N^{-3} Nitride	O^{-2} Oxide	F^- Fluoride	(*don't*
Na^+ Sodium	Mg^{+2} Magnesium	Al^{+3} Aluminum	*electrons*	P^{-3} Phosphide	S^{-2} Sulfide	Cl^- Chloride	*make*
K^+ Potassium	Ca^{+2} Calcium		*don't*		Se^{-2} Selenide	Br^- Bromide	*ions*)
Rb^+ Rubidium	Sr^{+2} Strontium		*usually*			I^- Iodide	
Cs^+ Cesium	Ba^{+2} Barium		*make ions*)				

Some common transition metal ions (Those with more than 1 charge need *Roman Numerals* to denote the charge)

Ag^+	Silver	Co^{+3}	Cobalt(III)	Hg_2^{+2}	Mercury(I)	Pb^{+4}	Lead(IV)
Cd^{+2}	Cadmium	Cr^{+2}	Chromium (II)	Hg^{+2}	Mercury(II)	Sn^{+2}	Tin(II)
Cu^+	Copper(I)	Cr^{+3}	Chromium(III)	Mn^{+2}	Manganese(II)	Sn^{+4}	Tin(IV)
Cu^{+2}	Copper(II)	Fe^{+2}	Iron(II)	Mn^{+3}	Manganese(III)	Zn^{+2}	Zinc
Co^{+2}	Cobalt(II)	Fe^{+3}	Iron(III)	Pb^{+2}	Lead(II)		

Some common polyatomic ions (-ate, ite, ide)

Polyatomic ions are covalently bonded groups of atoms that act as a unit and carry a net charge. The most common polyatomic ions are elements combined with oxygen (endings -ate and -ite). The *bi-* prefix means "hydrogen," not "two." Three other common ions are cyanide, hydroxide and ammonium (the only common + polyatomic ion).

Most common ion with oxygen = *–ate* ending, 1 more oxygen than ate = *per-* prefix
1 less oxygen than ate = *–ite* ending, 1 less oxygen than ite = *hypo-* prefix

-1 charge				-2 charge		-3 charge
$C_2H_3O_2^-$	Acetate	ClO_4^-	Perchlorate	CO_3^{-2}	Carbonate	PO_4^{-3}
CN^-	Cyanide	ClO_3^-	Chlorate	CrO_4^{-2}	Chromate	Phosphate
OH^-	Hydroxide	ClO_2^-	Chlorite	$Cr_2O_7^{-2}$	Dichromate	
NO_3^-	Nitrate	ClO^-	Hypochlorite	SO_4^{-2}	Sulfate	+1 charge
NO_2^-	Nitrite	MnO_4^-	Permanganate	SO_3^{-2}	Sulfite	NH_4^+
HCO_3^-	Hydrogen carbonate (bicarbonate)			O_2^{-2}	Peroxide	Ammonium

To Determine the **Types of Compound**

Check the **First** Element: If it is a **METAL** (or NH_4^+) then the compound is **IONIC**

If it is a **NON-METAL**, then the compound is **MOLECULAR**

Ionic compounds (start with a metal, end with non-metal or polyatomic ion)

To write the **Formula** for an **Ionic** compound: Write the formula for the Ions, then "criss-cross" to balance the charges. Always write the postive ion (metal) first!!

Potassium oxide K^+ O^{-2} ——> K_2O Sodium sulfate Na^+ SO_4^{-2} ——> Na_2SO_4

Reduce if needed to the *lowest ratio* of the subscripts. Pb^{+2} O^{-2} —> Pb_2O_2 —> PbO

To **Name** an **Ionic** compound : Name the **Cation**, then name the **Anion**. Some helpful hints:

If only 2 elements (Metal+Non-metal) : it is **Binary** ionic: Hint: The name always ends in –ide.

$NaCl$ = Sodium chloride $MgBr_2$ = Magnesium bromide

If 3 elements: It contains a **Polyatomic ion:** Hint: The name will often end in –ate or –ite.

$CaCO_3$ = Calcium carbonate $Al(NO_3)_3$ = Aluminum nitrate

- Check the **Metal** on your Periodic Table: If the Metal has *more than one common charge*, the cation name includes a Roman numeral to denote *its charge*. To determine the correct charge and Roman numeral of the metal: write the total charge of the anion and work backwards to balance the charges.

$FeSO_4 = Fe^{+2}$ and SO_4^{-2} = Iron (II) sulfate $Fe_2(SO_4)_3 = Fe^{+3}$ and SO_4^{-2} = Iron (III) sulfate

Molecular compounds: (Start with a non-metal) (Binary molecular = two non–metals)

To write the **Formula** for a **Molecular** compound: The **PREFIXES** in the name tell you how many of each element are present in the molecule. DON'T criss-cross! DON'T reduce!

To **Name** a **Molecular** compound: You must use **PREFIXES** to tell how many of each element are in the molecule. The name always ends in -ide.

mono–	1	CO	Carbon monoxide	hexa–	6	SF_6	Sulfur hexafluoride
di–	2	CO_2	Carbon dioxide	hepta–	7	Cl_2O_7	Dichlorine heptoxide
tri–	3	SO_3	Sulfur trioxide	octa–	8	Cl_2O_8	Dichlorine octoxide
tetra–	4	CCl_4	Carbon tetrachloride	nona–	9	I_4O_9	Tetraiodine nonoxide
penta–	5	PF_5	Phosphorus pentafluoride	deca–	10	P_4O_{10}	Tetraphosphorus decaoxide

(**Molecular** compounds made of **Carbon, Hydrogen and Oxygen** are usually "organic" compounds and have a complicated system of names. We will not learn these rules this year.)

Acids: (Start with H^+) : Compounds that give off hydrogen ions when dissolved in water. Their names are special to show they act as acids. The name of the acid depends on the **ending** of the name of the **anion** the hydrogen is combined with. The word "acid" is added to the name. Remember the acid naming disease: "Ate-ic Ite-ous"

1. Anion ends in *-ate*, change the ate to *-ic*

H_2SO_4 = sulf<u>ate</u> ion = sulfur<u>ic</u> acid

2. Anion ends in *-ite*, change the ite to *-ous*.

H_2SO_3 = sulf<u>ite</u> ion = sulfur<u>ous</u> acid

3. Anion ends in *-ide*, add the prefix *hydro-*, change the ide to *-ic*

HCl = chlor<u>ide</u> ion = <u>hydro</u>chlor<u>ic</u> acid