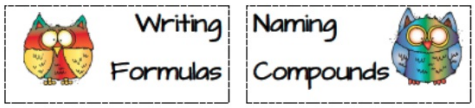
# Writing Formulas and Naming Compounds

*Please cut out along the dotted lines. DO NOT glue until I tell you the order.*

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Practice Problems:

1. $Na^{+}$, $Cl^{-}$ _____
2. $Zn^{+2}$, $S^{-2}$ _____
3. $Zn^{+2}$, $OH^{-}$ _____
4. $Al^{+3}$, $Cl^{-}$ _____
5. $K^{+}$, $PO_4^{-3}$ _____
6. $Pb^{+4}$, $O^{-2}$ _____
7. $Mn^{+4}$, $Br^{-}$ _____
8. $H^{+}$, $Cl^{-}$ _____

Paste your "Writing Formulas" Foldable Here

Practice Problems:

1. $SCl_6$ _____
2. $SO_3$ _____
3. $CaCO_3$ _____
4. $SO_2$ _____
5. $PBr_3$ _____
6. $Mg(NO_3)_2$ _____
7. $P_2O_5$ _____
8. $CCl_4$ _____

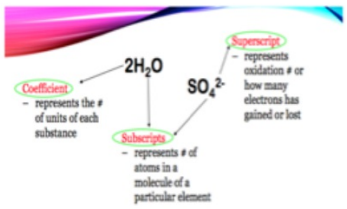
Paste your "Naming Compounds" Foldable Here

Covalent compounds

- can form more than one compound with each other. Scientist use Greek prefixes to indicate # of atoms of each element in binary compound.

**Prefixes For Binary Covalent Compounds**

| #atoms | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| prefix | Mono- | di- | tri- | tetra | penta | hexa | hepta | octa |



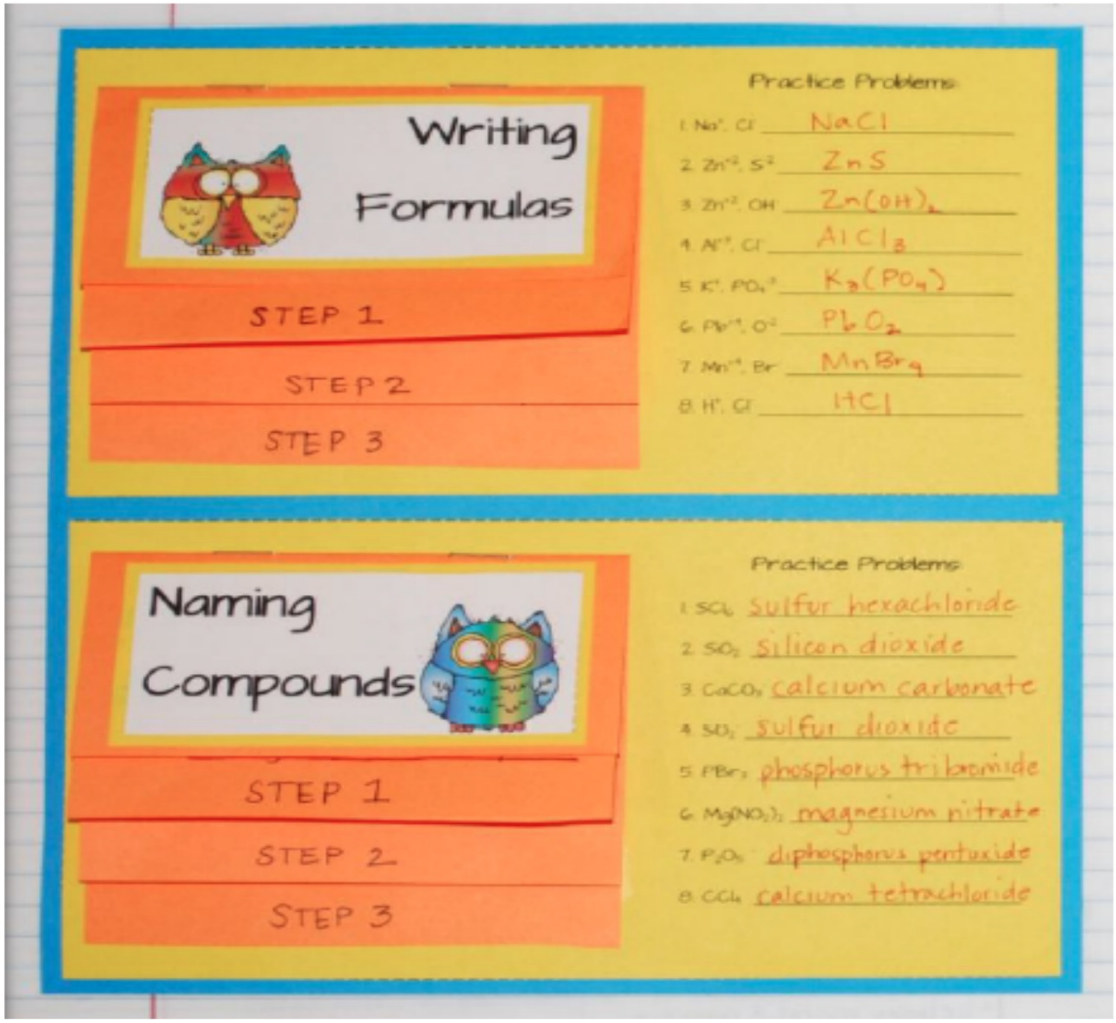

**POLYATOMIC IONS**

| Charged | Name | Formula |
|---|---|---|
| 1+ | Ammonium | $NH^{4+}$ |
| 1- | Acetate | $C_2H_3O_2^-$ |
| 1- | Chlorate | $ClO_3^-$ |
| 1- | Hydroxide | $OH^-$ |
| 1- | Nitrate | $NO_3^-$ |
| 2- | Carbonate | $CO_3^{2-}$ |
| 2- | Sulfate | $SO_4^{2-}$ |
| 3- | Phosphate | $PO_4^{3-}$ |

**Special Ions**

| Name | Oxidation Number |
|---|---|
| Copper (I) | 1+ |
| Cooper (II) | 2+ |
| Copper (III) | 3+ |
| Iron (II) | 2+ |
| Iron (III) | 3+ |
| Chromium (II) | 2+ |
| Chromium (III) | 3+ |
| Lead (II) | 2+ |
| Lead (IV) | 4+ |

*Please cut out these four tables DO NOT glue until I tell you the order.*


Writing Formulas
STEP 1
STEP 2
STEP 3
Practice Problems:
1. $Na^+$, $Cl^-$ NaCl
2. $Zn^{+2}$, $S^{-2}$ ZnS
3. $Zn^{+2}$, $OH^-$ $Zn(OH)_2$
4. $Al^{+3}$, $Cl^-$ $AlCl_3$
5. $K^+$, $PO_4^{-3}$ $K_3(PO_4)$
6. $Pb^{+4}$, $O^{-2}$ $PbO_2$
7. $Mn^{+4}$, $Br^-$ $MnBr_4$
8. $H^+$, $Cl^-$ HCl
Naming Compounds
STEP 1
STEP 2
STEP 3
Practice Problems:
1. $SCl_6$ sulfur hexachloride
2. $SiO_2$ silicon dioxide
3. $CaCO_3$ calcium carbonate
4. $SO_2$ sulfur dioxide
5. $PBr_3$ phosphorus tribromide
6. $Mg(NO_3)_2$ magnesium nitrate
7. $P_2O_5$ diphosphorus pentoxide
8. $CCl_4$ calcium tetrachloride

*Writing Formulas*

STEP 1: Write the symbol of the element or polyatomic ion (ions with more than one atom), with the positive oxidation number 1st.

STEP 2: Write the symbol of the element or polyatomic ion, with the negative oxidation number 2nd.

STEP 3: Add subscripts so that the sum of the oxidation numbers of all atoms in the formula is zero. Using the criss-cross method: the charge (without the sign) of one ion becomes the subscript of the other ion.

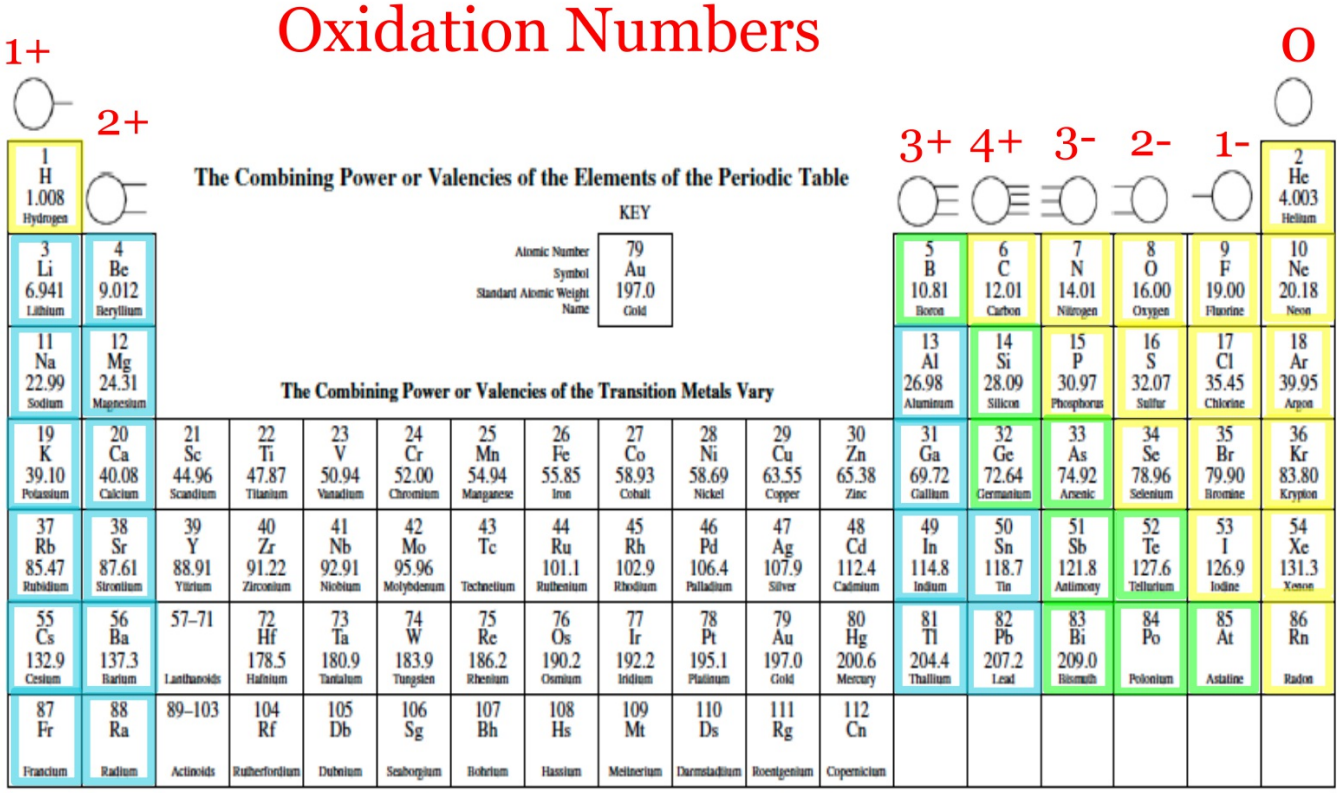
*Naming Compounds*

STEP 1: Write the name of the positive ion 1st. For special ions, use roman numerals in parentheses after the ions name to balance the overall charge.
Ex: $Fe^{2+}$ Iron (II), $Pb^{4+}$ is Lead (IV).

STEP 2: Write the root name of the negative ion with part of the element's name 2nd, such as Chlorine is chloro- or Oxygen is ox-.

STEP 3: Add the ending -ide or -ate to the root depending on the type of compound.
Example: CO is named carbon monoxide
$Ba(ClO_3)_2$ is barium chlorate

# Oxidation Numbers



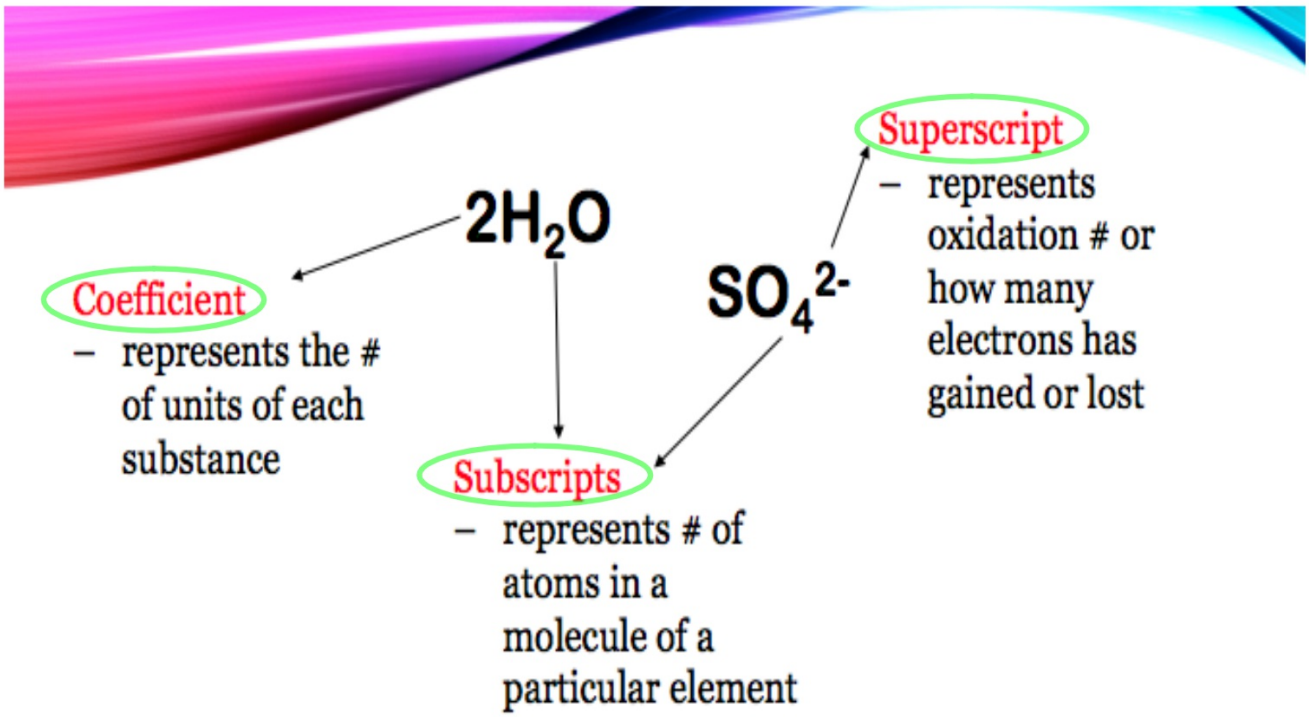

ION

–positive (cation) or negatively (anion) charged atom

# Transition Metals

| Special Ions | |
|---|---|
| Name | Oxidation Number |
| Copper (I) | 1+ |
| Cooper (II) | 2+ |
| Copper (III) | 3+ |
| Iron (II) | 2+ |
| Iron (III) | 3+ |
| Chromium (II) | 2+ |
| Chromium (III) | 3+ |
| Lead (II) | 2+ |
| Lead (IV) | 4+ |

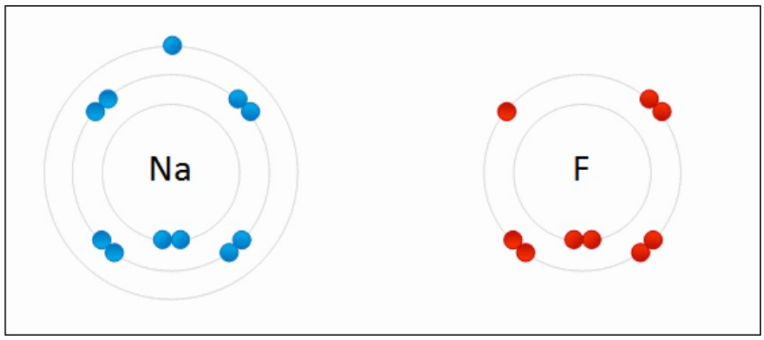
When naming these compounds, the oxidation number is expressed in the name with a Roman Numeral. It represents the Charge.


2H2O
SO4 2-
Coefficient
– represents the # of units of each substance
Subscripts
– represents # of atoms in a molecule of a particular element
Superscript
– represents oxidation # or how many electrons has gained or lost

# Formulas of Binary Ionic Compounds

*NaF*

*Sodium Fluoride*




*The cations and anions are combined in a way that produces a electrically neutral compound.

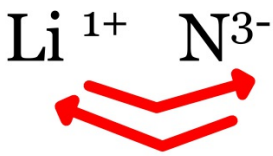
*Metal is named first, Non-metal  is named second.

*Use -ide to write the name of the compound.

Criss-Cross Method

Lithium → $Li^{1+}$

Nitrogen → $N^{3-}$




The charge (without the sign) of one ion becomes the subscript of the other.

$$Li_3N_1 \longrightarrow Li_3N$$

*Practice*

Lead (IV) phosphide

Iron (III) Oxide

Now write the names of these formulas in your journal.

1. Copper (I) Oxide
2. Aluminum Chloride
3. Barium Fluoride
4. Calcium Chloride
5. Chromium (III) Oxide
6. Iron (II) sulfide
7. Magnesium Chloride

Answers:

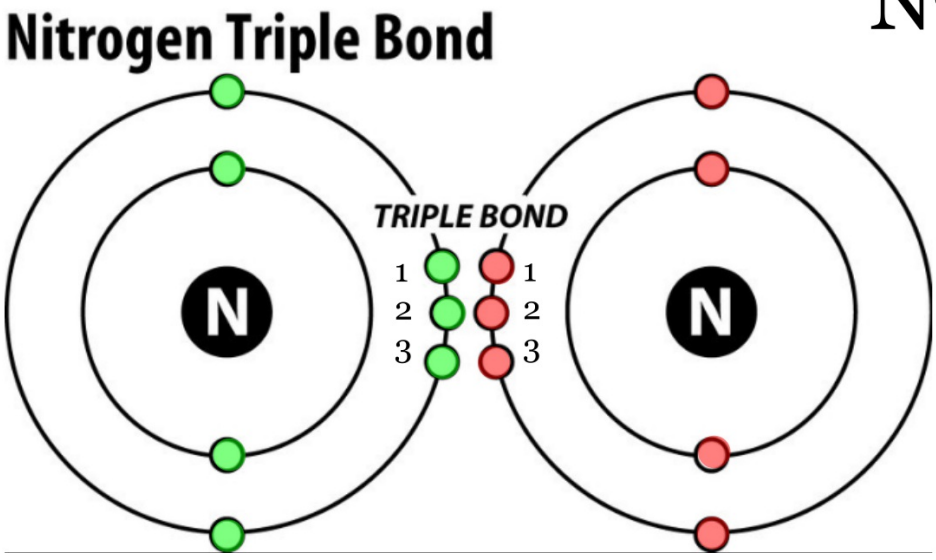
1. $CuO_2$
2. $AlCl_3$
3. $BaF_2$
4. $CaCl_2$
5. $Cr_2O_3$
6. $FeS$
7. $MgCl_2$

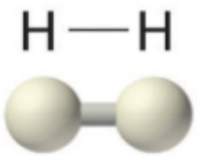
*Diatomic Molecules*

$H_2$, $O_2$, $F_2$, $Cl_2$, $Br_2$, $I_2$, $N_2$

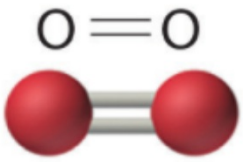
Bond Types (single, double or triple) depends on the charge of the ion.

$N^{3-}$

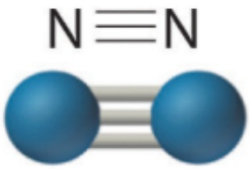





Single bond




Double bond




Triple bond

*More bonds make the diatomic molecule more stable the atom alone.*

## Polyatomic Ions

a positively or group of atoms negatively charged covalently bonded

- The prefix poly means "many", so the term polyatomic means "having many atoms"

| POLYATOMIC IONS | | |
|---|---|---|
| Charged | Name | Formula |
| 1+ | Ammonium | $NH^{4+}$ |
| 1- | Acetate | $C_2H_3O_2^-$ |
| 1- | Chlorate | $ClO_3^-$ |
| 1- | Hydroxide | $OH^-$ |
| 1- | Nitrate | $NO_3^-$ |
| 2- | Carbonate | $CO_3^{2-}$ |
| 2- | Sulfate | $SO_4^{2-}$ |
| 3- | Phosphate | $PO_4^{3-}$ |

When more than one is needed to balance the formula, parentheses are used to indicate that a polyatomic ion and comes as a "package deal."

*Practice*

Ammonium Phosphate

Aluminum Carbonate

Now write the names of these formulas in your journal.

1. Potassium Nitrate
2. Magnesium Hydroxide
3. Aluminum Sulfate
4. Copper (II) Sulfate
5. Lead (IV) Acetate
6. Zinc Nitrate
7. Potassium Chlorate

Answers

1. $KNO_3$
2. $Mg(OH)_2$
3. $Al_2(SO_4)_3$
4. $CuSO_4$
5. $Pb(C_2H_3O_2)_4$
6. $Zn(NO_3)_2$
7. $KClO_3$

Hydrate

–a compound that has water chemically attached to its ions and written into chemical formula.

$CaSO_4 \cdot 2\ H_2O$ Calcium Sulfate dihydrate

$CoCl_2 \cdot 6\ H_2O$ Cobalt Chloride hexahydrate

## Covalent compounds

– can form more than one compound with each other. Scientist use Greek prefixes to indicate # of atoms of each element in binary compound.

| **Prefixes For Binary Covalent Compounds** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| #atoms | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| prefix | Mono- | di- | tri- | tetra | penta | hexa | hepta | octa |

## *Using Prefixes*

$N_2O$ dinitrogen oxide

NO nitrogen oxide (mono prefix not needed)

$NO_2$ nitrogen dioxide

$N_2O_5$ dinitrogen pentoxide