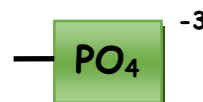


## 9. Naming Compounds & Writing Formulas

- Chemical Formula: a combination of symbols and small numbers to show what a substance is made up of and in what proportion
- Since ionic substances transfer electrons and covalent (molecular) substances share electrons they are named using different rules
  - = **FIRST CHECK** if the compound is **Ionic** or **Covalent**
  - example:  $\text{CaO}$  = ionic       $\text{CCl}_4$  = covalent

### Writing Formulas of Ionic Compounds:

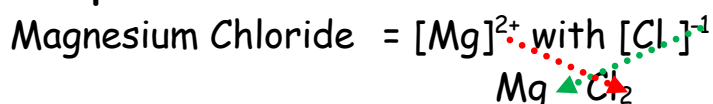
- Ionic Compounds are made up of cations joined to anions.
  - Binary ionic compounds = composed of a **metal** joined to a **nonmetal**
    - metalloids are considered nonmetals so bond covalently
  - Special Case Ions
    - see **ION CHART** on the back side of your periodic table
    - a) **Complex ions**: groups of atoms bonded so strongly they tend to stick together & act as a **single unit** having an overall charge
      - example: phosphate ion:  $\text{PO}_4^{3-}$
- b) **Polyvalent ions**: most transition metals can have more than 1 valence which is indicated in the name by a roman numeral
  - example: Iron II =  $\text{Fe}^{+2}$  or      Iron III =  $\text{Fe}^{+3}$



### Steps for Writing Formulas of Ionic Compounds

1. Identify the ions involved, writing the **ca+ion** first and the **anion** second.
2. Write valence number or **charge** of each ion above it.
3. Use **subscripts** to indicate the **NUMBER** of ions **ONLY** of each element present = do this by '**criss-crossing**' the valence numbers (**do not** write charges!)
4. In formulas involving **complex ions (radicals)**, use brackets then the subscript to describe the number used.
5. Write the formula in **lowest** terms
- \*6. Remember: the total charge of the compound must be 0.

### examples:



Aluminum iodide =

**\*\*Aluminum is not a metalloid**

Calcium Oxide:

**\*\* Lowest Terms**

Magnesium hydroxide =

**\*\*Brackets**

Zinc phosphate =

Iron III Sulfide =

**\*\*Careful, Iron is polyvalent**

### What about Hydrogen?

- Having only 1 proton and 1 electron makes hydrogen special. It can form covalent bonds **AND** ionic bonds depending on what it bonds with.
- In general Hydrogen:
  - : acts as a **nonmetal** when bonding with **nonmetals**
  - : acts as a **metal** when bonding with **complex ions**.

**example:**  $H_2O$  = **covalent**

$NH_3$  = **covalent**

$H_2SO_4$  = **ionic**

### **Try These:**

Potassium Iodide: \_\_\_\_\_

Nickel Bromide: \_\_\_\_\_

Barium Oxide: \_\_\_\_\_

Ammonium Sulfide: \_\_\_\_\_

Copper II Carbonate: \_\_\_\_\_

## Naming Ionic Substances

1. With the first element (the **metal** or the cation), you simply use its name
2. With the second element (the nonmetal or the **anion**), you use its **shortened name** (the first syllable) and add **"-ide"**

example:  $\text{CaF}_2 = \text{Ca} = \text{Calcium}; \text{F} = \text{Fluorine}$  so the name is **Calcium Fluoride**

$\text{Na}_2\text{O} = \text{Na} = \text{Sodium}; \text{O} = \text{Oxygen}$  so the name is **Sodium Oxide**

3. If the element has more than one valence (ie. Polyvalent, like Copper), then you **MUST** include a **Roman Numeral** representing the **valence** in the name.

example:  $\text{CuI}_2 = \text{Cu} = \text{Copper... Copper I or Copper II? Look at the charge of iodide! I has +1 charge \& there are 2 of them}$   
so the name is **Copper II Iodide**

$\text{Fe}_2\text{O}_3 = \text{Fe} = \text{Iron II or Iron III ...reverse the criss cross to find the charge on Fe! Fe has a charge of +3}$   
so the name is **Iron III Oxide**

4. All polyatomic ions (**complex ions**) are made of more than 1 atom &/or element = use their **full name** when you name the compound **NOT** the names of the elements that compose them.

example:  $\text{MgSO}_3 = \text{Mg} = \text{Magnesium...SO}_3 = \text{Sulfate}$  so the name is **Magnesium Sulfate**

$(\text{NH}_4)_2\text{CO}_3 = \text{Ammonium Carbonate}$

Try These:

$\text{NaCl} = \underline{\text{Sodium Chloride}}$

$\text{K}_2\text{O} = \underline{\text{Potassium Oxide}}$

$\text{H}_2\text{SO}_4 = \underline{\text{Hydrogen Sulfate or Sulfuric Acid}}$

$\text{PbPO}_4 = \underline{\text{Lead III Phosphate}}$

\*\*\* even though Lead III isn't in your ion chart, it is the lead cation necessary to balance the -3 charge of Phosphate