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: CaO = **ionic** 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: PO_4^{3-}  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 = Fe^{+2} or Iron III = 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:

Magnesium Chloride = $[Mg]^{2+}$ with $[Cl]^{-1}$ → $MgCl_2$

Lithium Bromide = Li^{+1} Br^{-1}

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: **CaF_2** = Ca = Calcium; F = Fluorine so the name is Calcium Fluoride

   Na_2O = Na = Sodium; O = 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: **CuI_2** = Cu = 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

   Fe_2O_3 = Fe = 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: $MgSO_3$ = Mg = Magnesium...SO3 = Sulfate so the name is Magnesium Sulfate

   $(NH_4)_2CO_3$ = Ammonium Carbonate

Try These:

$NaCl$= Sodium Chloride

K_2O= Potassium Oxide

H_2SO_4 = Hydrogen Sulfate or Sulfuric Acid

$PbPO_4$ = 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