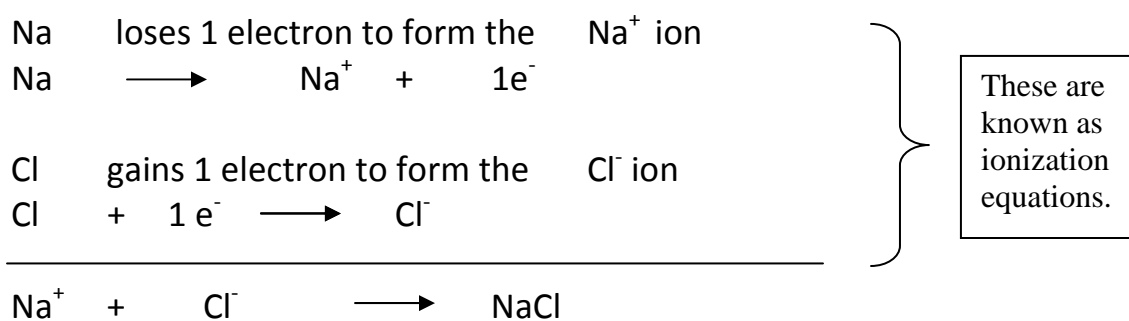


## IONIC COMPOUNDS

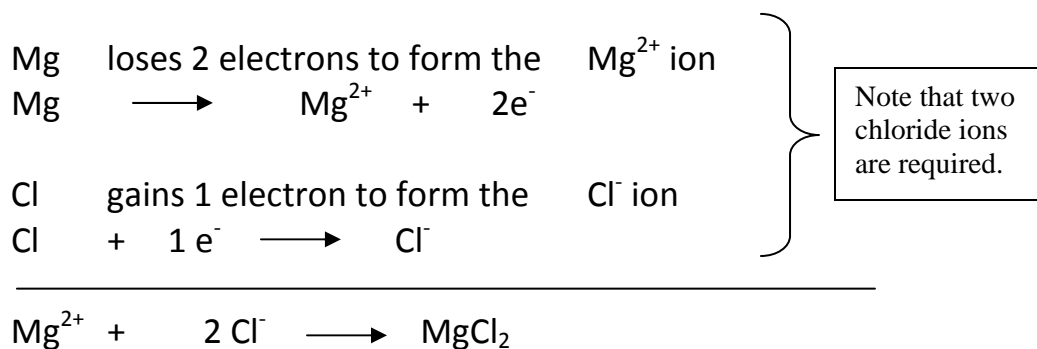
**Ionic compounds** are formed when METAL and NON-METAL elements combine to form a neutral compound.

Since electrons are transferred from metals to non-metals, the opposite charges produce an attraction between the ions.

e.g. 1 What is the formula of sodium chloride?



e.g. 2 What is the formula of magnesium chloride?



In this case, 2 chloride ions are required to create a neutral compound.

## RULES FOR NAMING IONIC COMPOUNDS

1. The METAL ion is written first.
2. The NON-METAL ion is written with the suffix “-ide”.

e.g. NaCl is called *sodium chloride*

Al<sub>2</sub>O<sub>3</sub> is called *aluminum oxide*

3. Some transition metals have more than one ionic charge (see Table 1 below). For these, a Roman numeral (I, II, III or IV) is used to indicate the charge.

e.g. CuCl<sub>2</sub> is called copper (II) chloride

PbF<sub>4</sub> is called lead (IV) fluoride

Other transition metals have only one common charge. Silver (Ag) ions are always +1 and zinc (Zn) ions are always +2.

**Table 1:** Multiple Ionic Charges of Some Metals

Element	Symbol	Ionic Charges	Roman Numeral
copper	Cu	1+, 2+	I, II
iron	Fe	2+, 3+	II, III
lead	Pb	2+, 4+	II, IV
tin	Sn	2+, 4+	II, IV

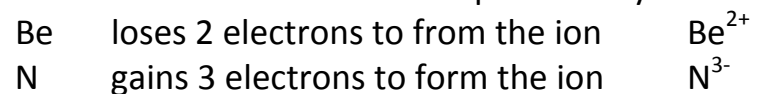
### The Crisscross Rule

This rule can be used to easily determine the number of atoms of each element in an ionic compound. By crisscrossing the ionic charge, the number of each atom in the compound is found.

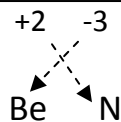
\* Note that the ionic charges DO NOT appear in the formula! \*

e.g. 1

What is the formula of the ionic compound beryllium nitride?



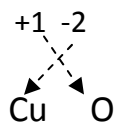
Using the crisscross rule:



∴ Chemical Formula:                      Be<sub>3</sub>N<sub>2</sub>

e.g. 2

What is the formula of the ionic compound copper (I) oxide?

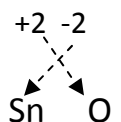


Using the crisscross rule:

∴ Chemical Formula:                      Cu<sub>2</sub>O

e.g.3

What is the formula of tin (II) oxide?



Using the crisscross rule:

∴ Chemical Formula:                      Sn<sub>2</sub>O<sub>2</sub>

However, when writing the formula for an ionic compound, always simplify the formula to the lowest common denominator.

Therefore the formula is simply SnO since this creates a neutral compound.

**Examples:**

BeF<sub>2</sub> \_\_\_\_\_

Fe<sub>3</sub>P<sub>2</sub> \_\_\_\_\_

sodium phosphide \_\_\_\_\_

tin (IV) hydride \_\_\_\_\_

iron (II) sulfide \_\_\_\_\_

aluminum sulfide \_\_\_\_\_

### Questions:

1. Draw Bohr-Rutherford diagrams to show how potassium atoms and sulfur atoms combine to form a binary ionic compound. Clearly show the movement of electrons and the proper ratio of K and S atoms.

2. Write the name for each binary compound.

- |                                  |                                  |
|----------------------------------|----------------------------------|
| a) $\text{Na}_2\text{S}$ _____   | i) $\text{SnO}_2$ _____          |
| b) $\text{KBr}$ _____            | j) $\text{FeS}$ _____            |
| c) $\text{Li}_3\text{N}$ _____   | k) $\text{CuCl}_2$ _____         |
| d) $\text{CaO}$ _____            | l) $\text{BaS}$ _____            |
| e) $\text{RbH}$ _____            | m) $\text{SnH}_2$ _____          |
| f) $\text{Fe}_2\text{O}_3$ _____ | n) $\text{MgF}_2$ _____          |
| g) $\text{BeCl}_2$ _____         | o) $\text{Al}_2\text{N}_3$ _____ |
| h) $\text{PbO}$ _____            | p) $\text{Li}_2\text{O}$ _____   |

3. Write the chemical formula for each binary compound.

- |                             |                              |
|-----------------------------|------------------------------|
| a) aluminum sulfide _____   | i) calcium oxide _____       |
| b) copper (II) oxide _____  | j) cesium hydride _____      |
| c) potassium chloride _____ | k) zinc chloride _____       |
| d) strontium chloride _____ | l) sodium fluoride _____     |
| e) magnesium bromide _____  | m) lithium phosphide _____   |
| f) copper (I) nitride _____ | n) iron (III) chloride _____ |
| g) iron (II) iodide _____   | o) lead (IV) oxide _____     |
| h) tin (IV) phosphide _____ | p) calcium nitride _____     |

4. The diagram to the right represents the ionic crystal sodium chloride. Why would a model show so many sodium and chloride ions instead of just 2, as in the formula  $\text{NaCl}$ ?

