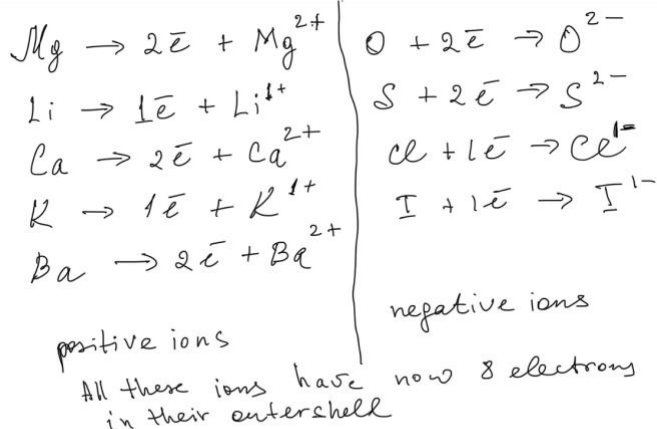


**HW 8, November 12.** Ionic bond. Ionic compounds. Generally, when metal and non-metal elements form a bond, they form ionic compounds. When a metal transfers one or more electrons to a nonmetal, they form an ionic bond.

Natural ion examples (on the left metal elements lose electrons, on the right nonmetals gain electrons):



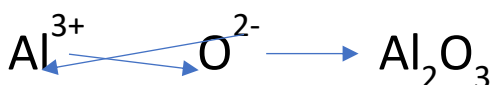
**This is how we can work out the formulas of ionic compounds:**

We can figure out the number of electrons lost and gained by atoms, based on their electron configuration.

Or we should consider that the overall charge on the compound is zero, so

the ion charges should cancel each other,  $\text{Na}^+ \text{Cl}^-$  (NaCl, sodium chloride),  $\text{Ca}^{2+} (\text{Cl}^-)_2$  ( $\text{CaCl}_2$ , sodium chloride)

Or we can "switch" over the charges on the ions



In other words:

1. Write the natural ions. For example, magnesium's natural ion is  $\text{Mg}^{2+}$  and oxygen natural ion is  $\text{O}^{2-}$
2. Next, swap the superscripts to make subscripts. If there are any ones (1), do not write them. For example,  $\text{Mg}^{2+}$  and  $\text{Cl}^-$  combine to form  $\text{MgCl}_2$ , the superscript 2+ from magnesium ion became the subscript 2 for  $\text{Cl}_2$ , while the superscript "-" from  $\text{Cl}^-$  became the subscript 1 for Mg (remember we do not write 1 in the chemical formulas).
3. Finally, check if your answer can be reduced. For example, we do not write  $\text{Ca}_2\text{O}_2$ , instead we write  $\text{CaO}$  (calcium oxide).

Remember, the number of valence electrons is the number of electrons in the atom outer shell (highest energy level).

### Question 1

Determine the total number of electrons in each of the following: Cu, H<sup>+</sup>, He, Mg, Ca<sup>2+</sup>, O<sup>2-</sup>, S<sup>2-</sup>

### Question 2

Determine the number of valence electrons in each of the following: Na, Mg, Al, Cl, K<sup>+</sup>, Mg<sup>2+</sup>, P<sup>3-</sup>, Cl<sup>-</sup>.

### Question 3

Indicate whether each of the following bonds is covalent or ionic: H<sub>2</sub>O, F<sub>2</sub>, Na<sub>2</sub>O, CO<sub>2</sub>.

### Question 4

Write down electron configuration of the element where the total number of **s** electrons is equal to the total number of **d** electrons.

