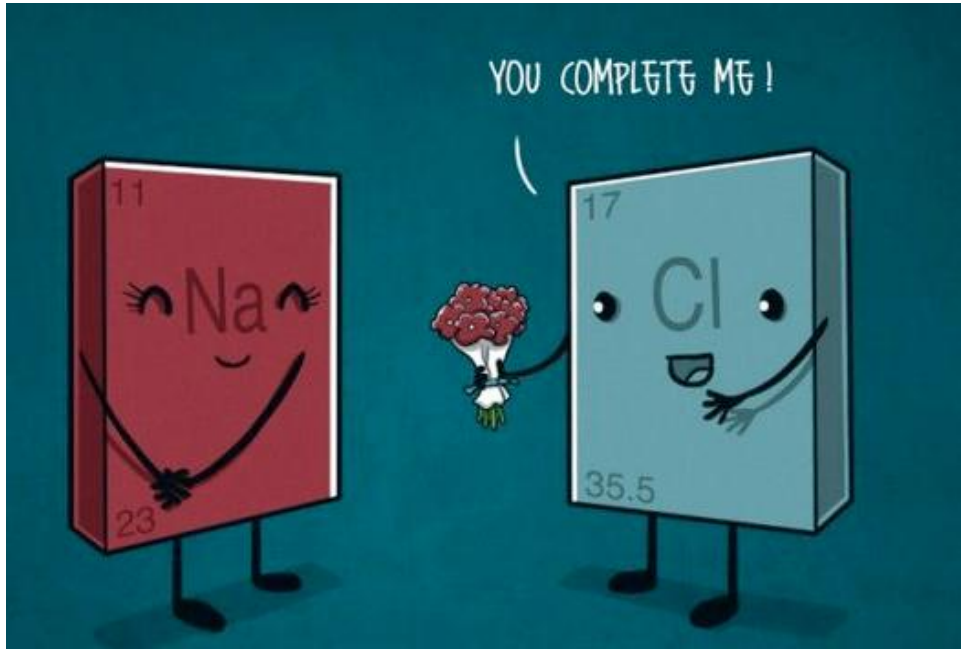
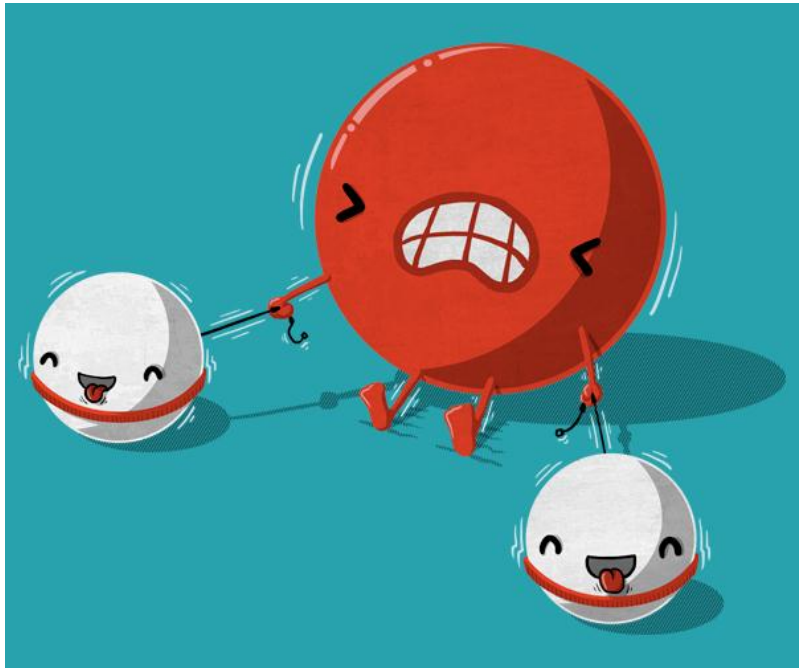
Ionic Compounds

ROSEDALE ACADEMY

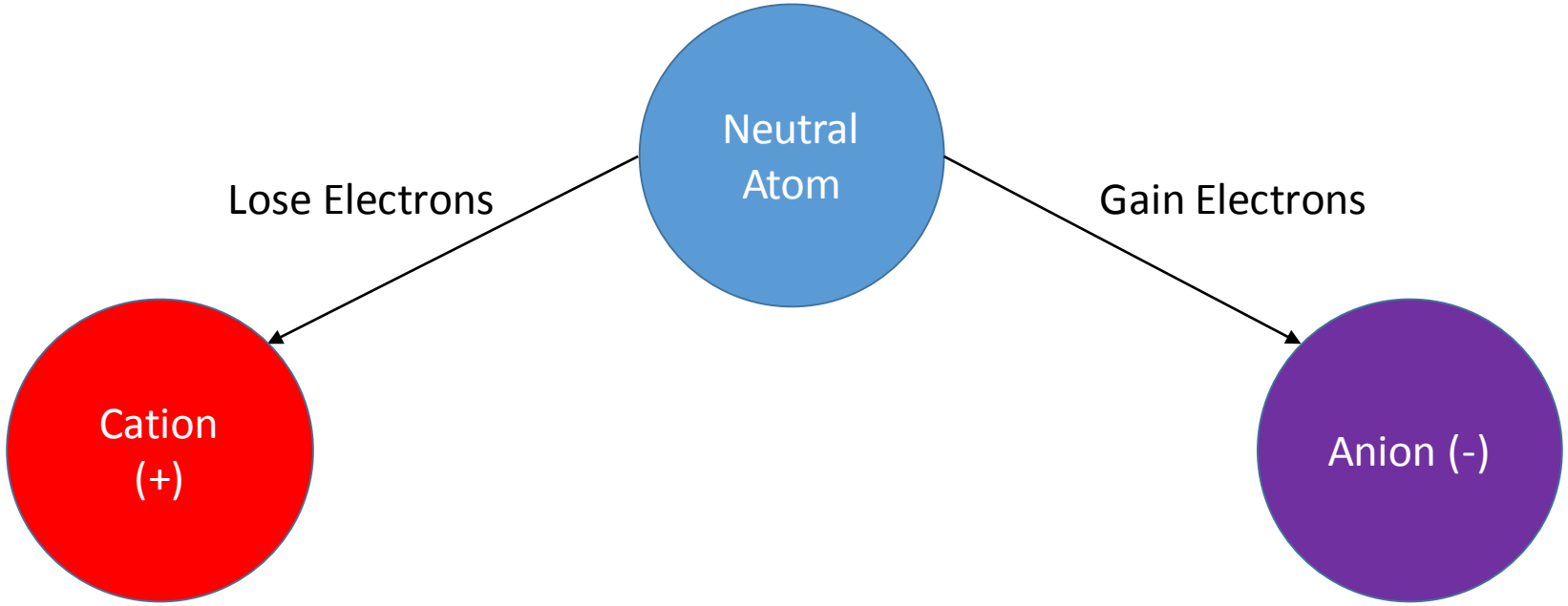
- Chemical compounds are all around us, and exist in incredible abundance. Over 10 million chemical compounds have already been identified and more are discovered or created each and every day. There are two main types of chemical compounds, molecular compounds In this activity you will learn about how one type: Ionic Compounds are formed.

A chemical compound is a chemical substance made up of two or more different elements chemically bonded to each other. This chemical bond describes the force of attraction between two atoms or ions that holds them together. A chemical bond is an invisible force that acts as a sort of glue, holding atoms together in a compound in two different ways: as ionic bonds or as covalent bonds.

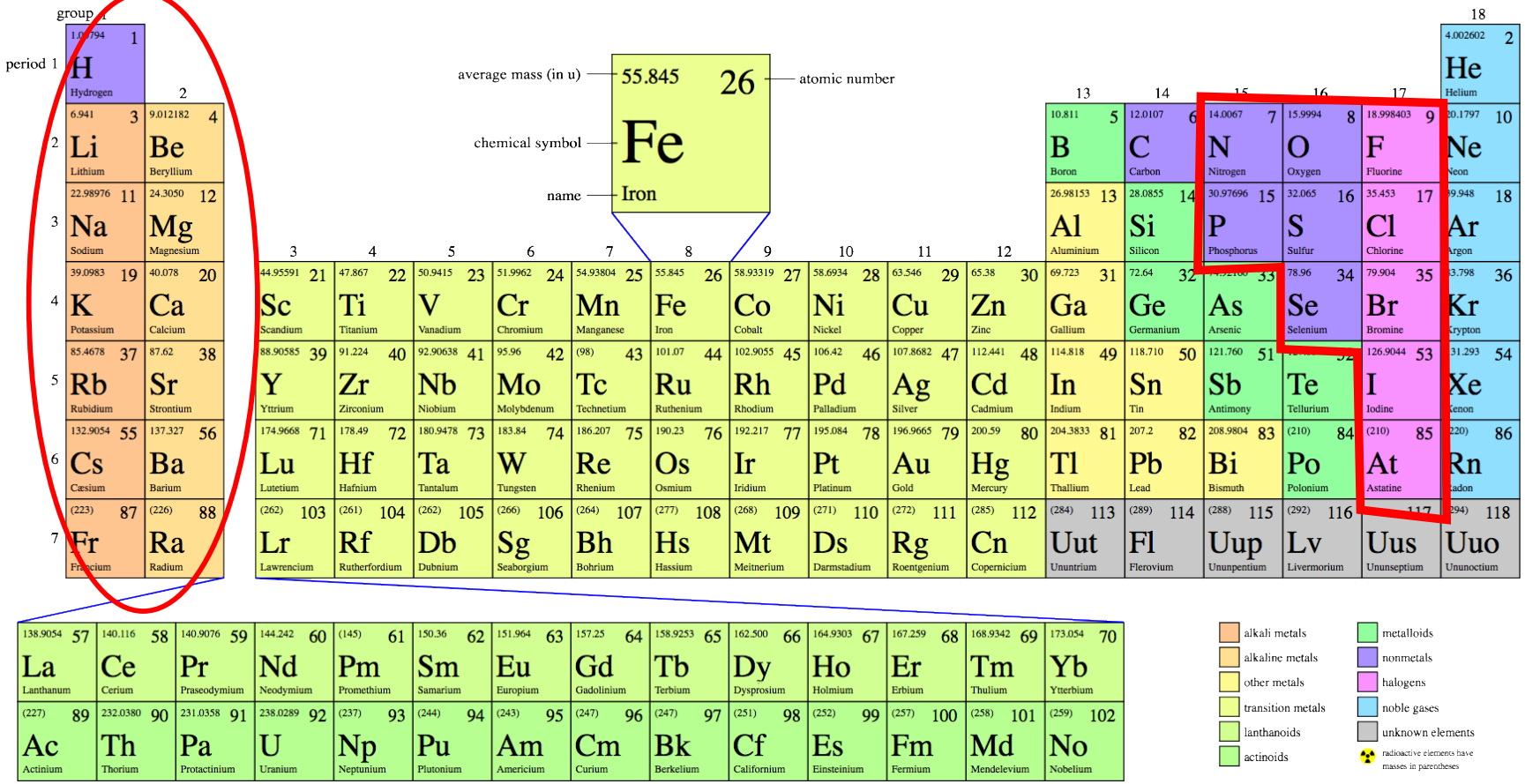




Ionic compounds form as a result of ionic bonds formed between ions. Recall that ions form when neutral atoms gain or lose electrons and certain elements are more likely to either gain or lose electrons depending on their valence electron arrangement.



Metals in the first 2 groups of the periodic table, such as sodium and potassium are more likely to lose electrons to form positively charged cations. While other elements, such as the **non-metals,** like oxygen and chlorine, in groups 15-17 are likely to gain electrons, forming negatively charged anions.



- One of the most common ionic compounds is called sodium chloride (NaCl), otherwise known as table salt. Sodium chloride is formed between postivie ions of sodium (Na^+) and negatively charged ions Chloride (Cl^-). The formation of these ions can be represented using Lewis symbols:

Click to See Formation of Na^+ ion

Sodium is a metal that tends to lose electrons, forming an Cation:

Chlorine is a non-metal that tends to gain electrons, forming an anion.

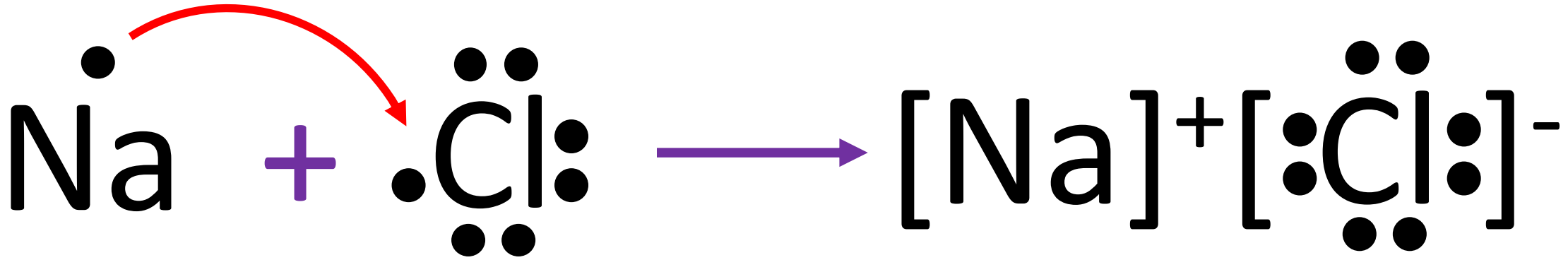
Click to See Formation of Cl^- ion

Sodium is a metal that tends to lose electrons, forming an **cation**. When cations are formed, the ion is shown in square brackets with the charge as a superscript:

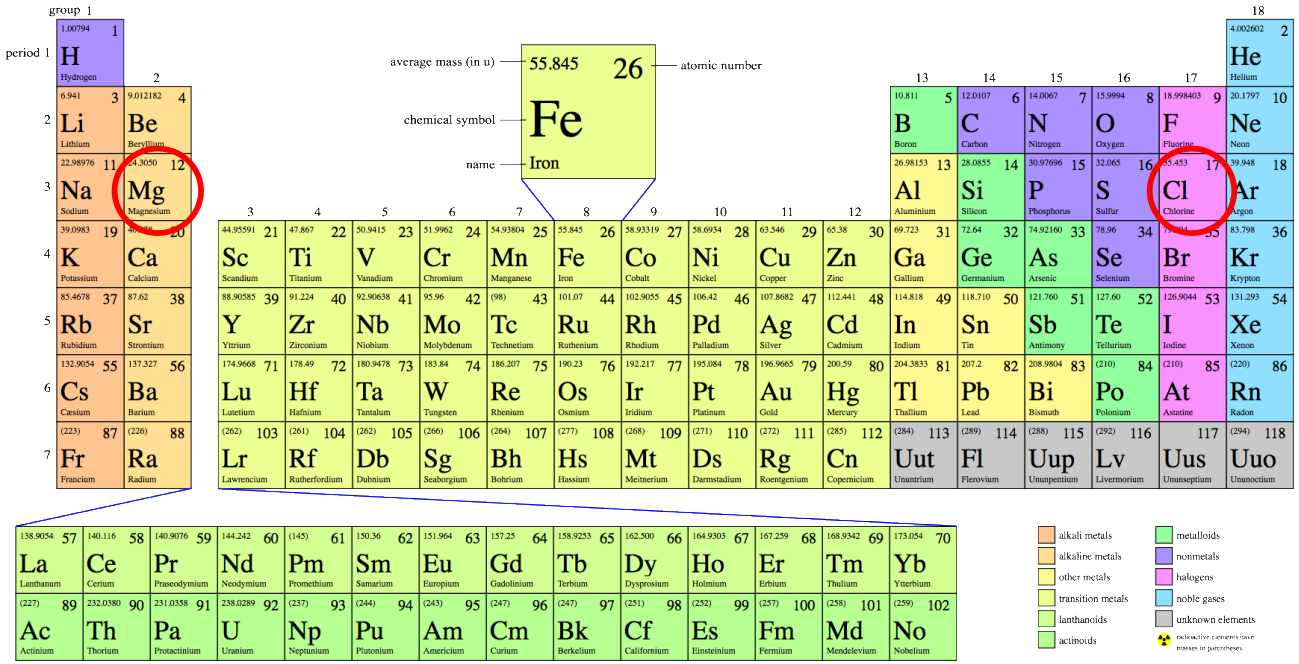
Chlorine is a non-metal that tends to gain electrons, forming an **anion**. When anions are formed, the ion is shown in square brackets with the full octetet represented and the charge written as a superscript:

Click to See Formation of an Ionic Bond Between Na and Cl

- An ionic bond forms when a non-metal atom removes an electron from a metal atom. When this transfer of electrons occurs, a cation and anion are formed, the two are then attracted to each other due to the force of attraction between positive and negatively charged atoms. The bond between a positive ion and a negative ion is called an IONIC BOND.



What happens when ionic bonds form between atoms that lose or gain more than one electron? For example, consider an ionic compound forming between magnesium and chlorine. Magnesium tends to lose 2 electrons, forming $[Mg]^{2+}$ while chlorine only tends to gain 1 electron, forming $[Cl]^{-}$. What type of ionic compound will these ions form?

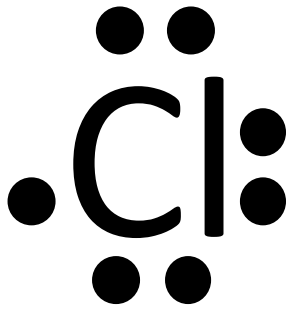


Click for the Step-by-Step Solution

Step 1. Wrote the Lewis structure for each atom of the combining elements.

Next

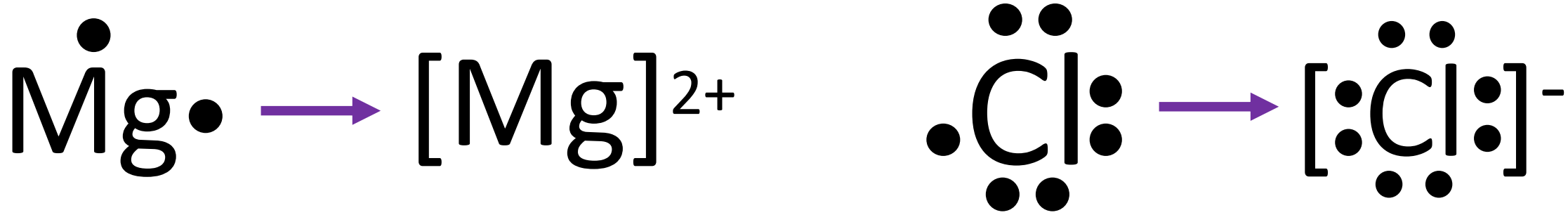
Step 1. Wrote the Lewis structure for each **atom** of the combining elements.



Step 2. Determine how many electrons each atom is likely to gain or lose to form a full valence shell.

Next

Step 2. Determine how many electrons each atom is likely to gain or lose to form a full valence shell: Magnesium is likely to lose 2 electrons and chlorine is likely to gain 1 electron to form full valence shells.



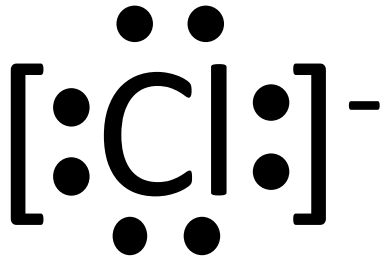
Step 3. Determine the ratio of each ion needed to produce a neutral molecule.

Next

Step 3. Determine the ratio of each ion needed to produce a neutral molecule:

$[Mg]^{2+}$

Charge = +2

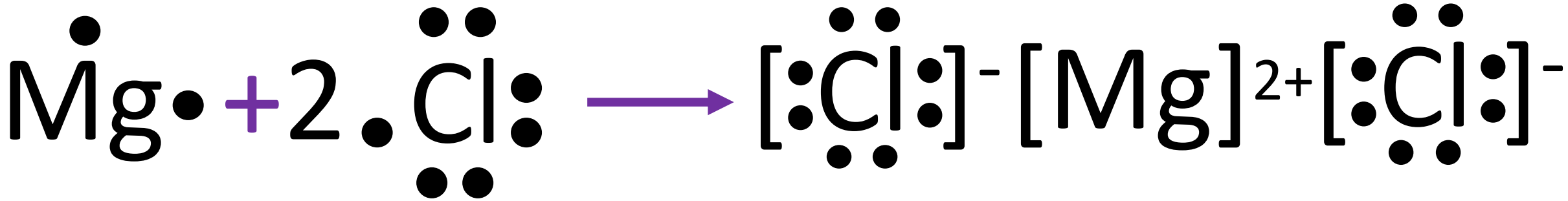


Charge = -1

Since each magnesium ion has a charge of +2 and each chloride ion has a charge of -1, 2 chloride ions are required for every 1 magnesium ion to produce a neutral molecule.

Click to See Lewis Structures of this Compound Forming

Formation of $MgCl_2$:



Step 4. Write the chemical formula for the ionic compound. The symbol for the metal (Mg) is written first followed by the symbol for the non-metal (Cl). The number of each of the ions required to produce the neutral molecule is written as a subscript. (Note: If the ratio of one of the ions is 1, no number subscript is necessary)

Click to See Chemical Formula

Step 4. Write the chemical formula for the ionic compound. Since this ionic compound requires 2 Cl^- ions for each Mg^{2+} ion, the chemical formula is:

$$MgCl_2$$

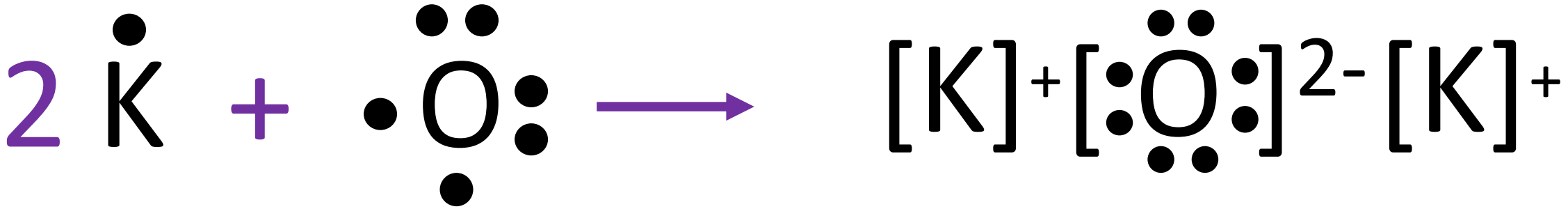
Click for a Sample Question to Test Your Understanding

Test your understanding

1. Draw Lewis symbols to show the formation of bonds within an ionic compound of potassium oxide.
2. Write the chemical formula for potassium oxide.

Click for the Solution

1. Draw Lewis symbols to show the formation of bonds within an ionic compound of potassium oxide.

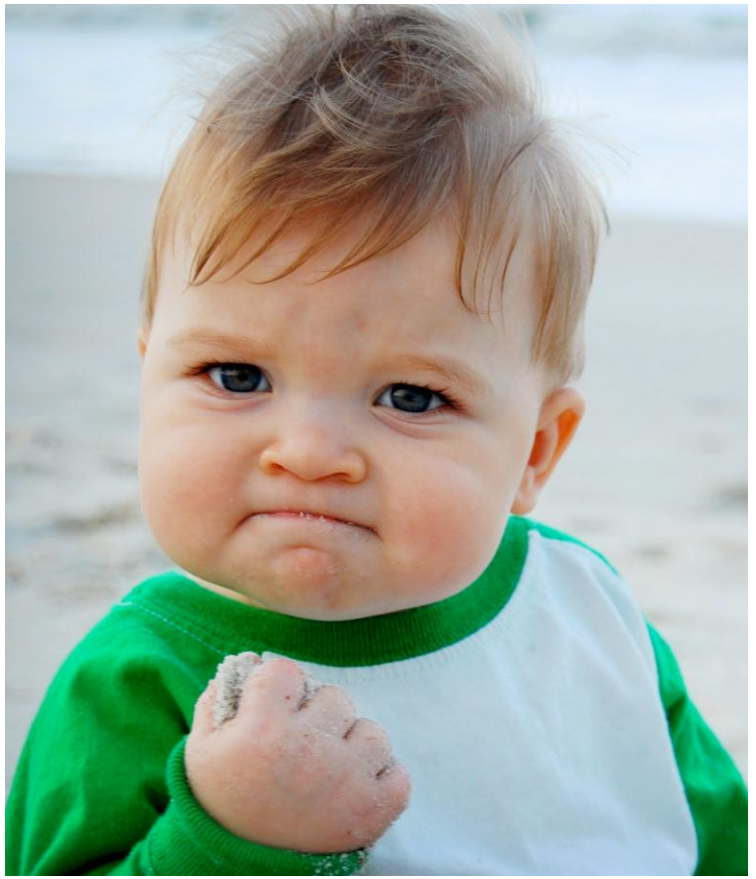


2. Write the chemical formula for potassium oxide.

K_2O

Success!

You have reached the end of this activity. You will know that you have achieved the goals for this activity when you can describe how ionic compounds form through ionic bonding. You will also be able to determine the chemical formulae for ionic compounds and draw Lewis structures representing the formation of ionic compounds.



Back to Start