

# Chemical Formulas and Names of Ionic Compounds

## WHY?

Going back to pre-historic times, humans have experimented with chemical processes that helped them to make better tools, pottery and weapons. In the middle-ages, alchemists combined various compounds in the search for the philosopher's stone and the elixir of life. However, as chemistry became a real science, chemists realized that all matter was made of atoms and that chemical processes were simply a rearrangement of these atoms. Chemists needed some simple, shorthand way to show this fact, and thus created chemical formulas.

## Success criteria

You should be able to write the correct formula for any ionic compound

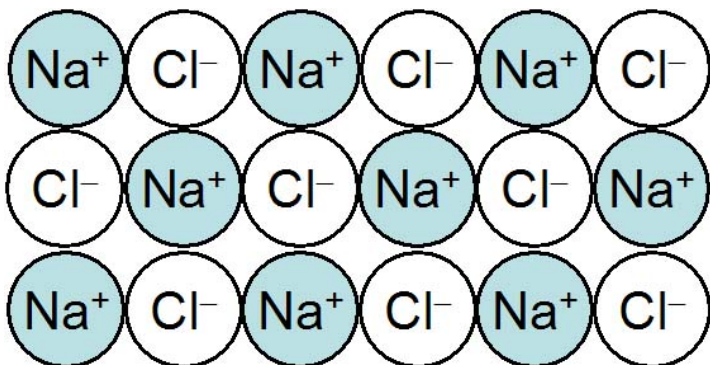
## Prerequisites

Knowledge of atoms and isotopes

## Model 1: An atomic look at three compounds

The diagrams below represent some ionic compounds at the atomic level.

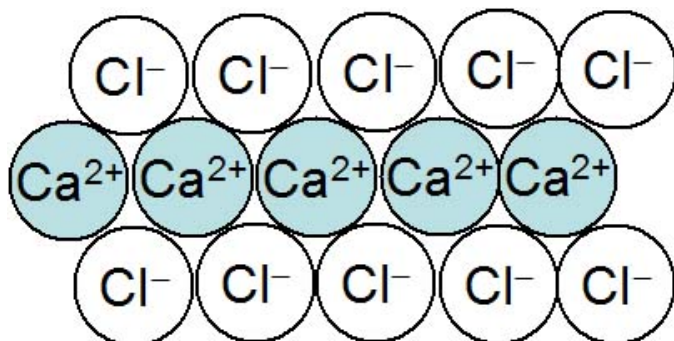
### Sodium chloride



Chemical formula:

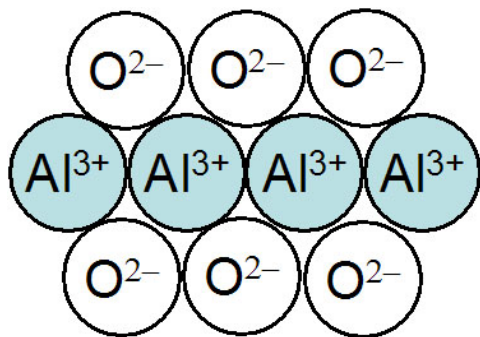


### Calcium chloride



Chemical formula:



Aluminum oxideChemical formula:**Key Questions**

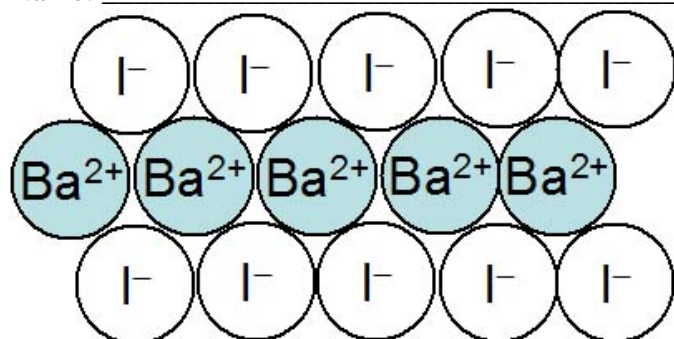
1. What are the names of the elements found in the compounds above?
2. How does the name of the elements in each compound differ from that of the free elements?
3. How many sodium ions are there in the sodium chloride sample shown above? How many chloride ions? What is the ratio between the two?
4. How many calcium ions are there in the calcium chloride sample shown above? How many chloride ions? What is the ratio between the two?
5. How many aluminum ions are there in the aluminum oxide sample shown above? How many oxide ions? What is the ratio between the two?
6. What is the relationship between the chemical formula for the compounds above and the ratio of the ions in them?
7. What is the charge of a sodium ion? What is the charge of a chloride ion?

8. What is the charge of the calcium ion? What is the charge of the chloride ion?
  
9. What is the charge of the aluminum ion? What is the charge of the oxide ion?
  
10. All samples of sodium chloride have a ratio of one sodium ion for one chloride ion.  
What must be true of the total (net) charge for any sample of sodium chloride?
  
11. All samples of calcium chloride have a ratio of one calcium ion for two chloride ions.  
What must be true of the total (net) charge for any sample of calcium chloride?
  
12. All samples of aluminum oxide have an atomic ratio of two aluminums for three oxide ions. What must be true of the total (net) charge for any sample of aluminum oxide?
  
13. From the pattern seen in the last three questions, what is the rule for the total charge for a compound?

**Exercises**

1. Write the name and the chemical formula for the compound depicted below.

Name: \_\_\_\_\_



Chemical formula:

**Model 2: Ionic Charges**

Many ions have the same charge whenever they are found in a compound. Some of these ions are listed in the table below.

<b>Group</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>15</b>	<b>16</b>	<b>17</b>
<b>Charge</b>	<b>+1</b>	<b>+2</b>	<b>+3</b>	<b>-3</b>	<b>-2</b>	<b>-1</b>
Lithium Li <sup>+</sup>				Nitride N <sup>3-</sup>	Oxide O <sup>2-</sup>	Fluoride F <sup>-</sup>
Sodium Na <sup>+</sup>	Magnesium Mg <sup>2+</sup>	Aluminum Al <sup>3+</sup>		Phosphide P <sup>3-</sup>	Sulfide S <sup>2-</sup>	Chloride Cl <sup>-</sup>
Potassium K <sup>+</sup>	Calcium Ca <sup>2+</sup>				Selenide Se <sup>2-</sup>	Bromide Br <sup>-</sup>
Rubidium Rb <sup>+</sup>	Strontium Sr <sup>2+</sup>					Iodide I <sup>-</sup>
Cesium Cs <sup>+</sup>	Barium Ba <sup>2+</sup>					

**Key Questions**

14. What patterns do you notice about the charges of the ions with respect to their positions in the periodic table (or their Group number in the periodic table).

**Exercises**

2. Following the rule you established in the last key question, write correct chemical formula for each of the following compounds

Compound	Formula
(a) Lithium chloride	
(b) Magnesium iodide	
(c) Strontium selenide	
(d) Rubidium fluoride	
(e) Lithium oxide	
(f) Sodium sulfide	
(g) Potassium chloride	
(h) Calcium phosphide	
(i) Barium oxide	
(j) Aluminum sulfide	

3. Use your answers to the Key Questions and the Exercise Questions to draw a conclusion about the ratio of ions in two compounds if the elements in the compounds are from the same groups (example: aluminum oxide and aluminum sulfide; lithium chloride and potassium chloride).