

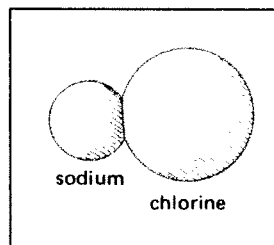
# AIM | What is a formula?

13

Each element has its chemical symbol. Each compound has its chemical *formula*. The formula tells us two important things about the compound. It tells us which elements there are in a molecule. A formula also tells us how many atoms there are of each element.

The formula for table salt is NaCl.

Na is the symbol for sodium.  
Cl is the symbol for chlorine.



One molecule of NaCl has a total of two atoms. One of the atoms is sodium (Na). The other atom is chlorine (Cl).

Chart I page 75 has more examples.

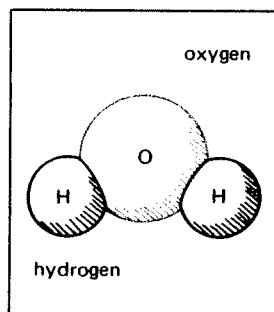
Sometimes a symbol has a small number written next to it. This number tells us the number of atoms there are of that element.

The formula for water is H<sub>2</sub>O.

H is the symbol for hydrogen.  
O is the symbol for oxygen.

H<sub>2</sub> means two atoms of hydrogen.

O means one atom of oxygen.



One molecule of H<sub>2</sub>O, then, has a total of three atoms. Two of the atoms are hydrogen. One atom is oxygen.

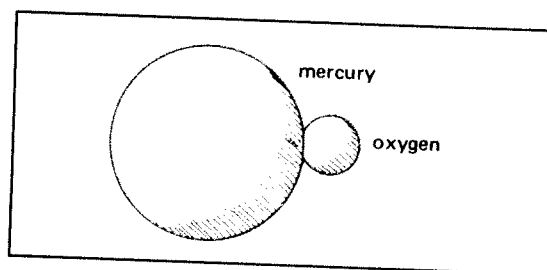
Chart II has more examples.

The formula for a compound is always the same. A change in the formula means that a new substance was formed.

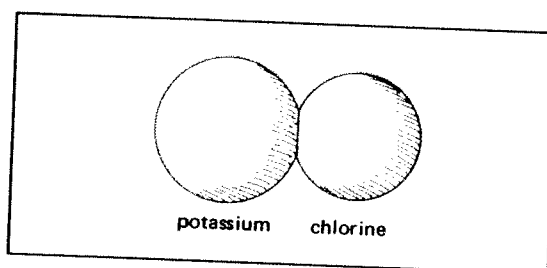
It is helpful to learn to recognize some chemical symbols. But if you see one you don't know, you can always look it up in a dictionary, an encyclopedia, or a chemistry book.

# I. SOME COMMON MOLECULES

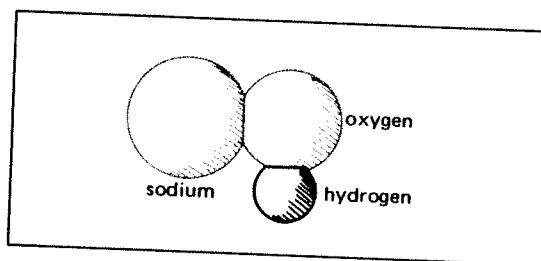
Formula	Name	Elements	Number of Atoms of Each Element	Total Number of Atoms in One Molecule
HgO	mercuric oxide	mercury (Hg) oxygen (O)	1 } 1 }	2



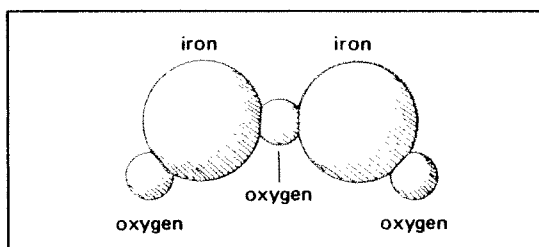
KCl	potassium chloride	potassium (K) chlorine (Cl)	1 } 1 }	2
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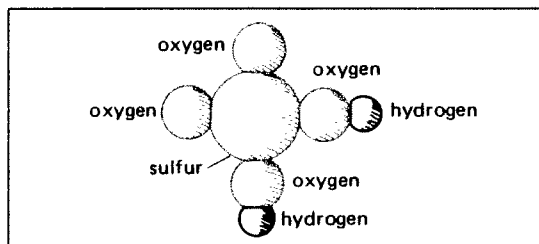
NaOH	sodium hydroxide (lye)	sodium (Na) oxygen (O) hydrogen (H)	1 } 1 } 1 }	3
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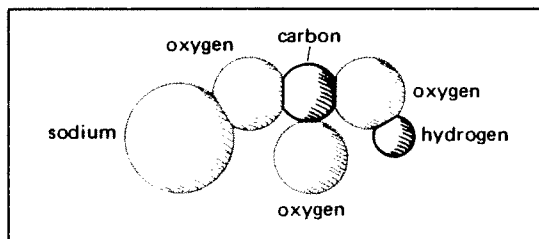
Formula	Name	Elements	Number of Atoms of Each Element	Total Number of Atoms in One Molecule
$\text{Fe}_2\text{O}_3$	iron oxide (rust)	iron (Fe) oxygen (O)	2 } 3 }	5



$\text{H}_2\text{SO}_4$	sulfuric acid	hydrogen (H) sulfur (S) oxygen (O)	2 } 1 } 4 }	7
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$\text{NaHCO}_3$	sodium hydrogen carbonate [baking soda]	sodium (Na) hydrogen (H) carbon (C) oxygen (O)	1 } 1 } 1 } 3 }	6
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CHOOSE ONE Choose the word that completes each sentence best.

1. A molecule is made up of \_\_\_\_\_ atoms, oxygen.
2. A single molecule has at least \_\_\_\_\_ atoms.  
one, two
3. The atoms of a molecule come from two or more \_\_\_\_\_ elements, compounds.
4. There are \_\_\_\_\_ elements than compounds.  
more, fewer
5. Molecules are \_\_\_\_\_ than atoms.  
larger, smaller

The formula for starch is  $C_6H_{10}O_5$ .

This stands for one molecule of starch.

Answer these questions about the starch molecule.

6. Starch is made up of \_\_\_\_\_ elements.  
one, two, three
7. The number of different kinds of atoms in starch is \_\_\_\_\_.  
three, billions
8. One molecule of starch has \_\_\_\_\_ atoms of hydrogen.  
two, six, ten
9. The total number of atoms in one molecule of starch is \_\_\_\_\_.  
6, 10, 16, 21
10. The number of molecules in a teaspoon of starch is \_\_\_\_\_.  
twenty-one, billions

## COMPLETE THE CHART

The chart below asks for some information about certain molecules. The first molecule, magnesium oxide, is done as an example. Try to complete the chart by filling in the missing information. You may use the list of elements and their symbols.

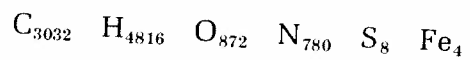
Formula	Name	Number of Elements	Names of the Elements	Number of Atoms of Each Element	Total Number of Atoms In One Molecule
1. MgO	magnesium oxide	2	magnesium oxygen	magnesium 1 oxygen 1	2
2. SO <sub>2</sub>	sulfur dioxide				
3. NH <sub>3</sub>	ammonia				
4. H <sub>2</sub> CO <sub>3</sub>	carbonic acid (soda water)				
5. C <sub>12</sub> H <sub>22</sub> O <sub>11</sub>	table sugar				
6. MgSO <sub>4</sub>	Epsom salts				
7. NaOH	sodium hydroxide (lye)				
8. H <sub>2</sub> O <sub>2</sub>	hydrogen peroxide				
9. Fe <sub>2</sub> O <sub>3</sub>	iron oxide (rust)				
10. NaHCO <sub>3</sub>	sodium bicarbonate (baking soda)				

**MATCHING** Match the two lists. Write the correct letter on the line next to each number.

- |          |                                |   |
|----------|--------------------------------|---|
| 1. _____ | CaF <sub>2</sub>               | a) two or more different kinds of atoms linked together |
| 2. _____ | HF                             | b) 7 atoms in each molecule                             |
| 3. _____ | H <sub>3</sub> PO <sub>3</sub> | c) contains one kind of atom                            |
| 4. _____ | formula                        | d) 3 atoms in each molecule                             |
| 5. _____ | compound                       | e) 2 atoms in each molecule                             |
| 6. _____ | element                        | f) short way of writing an element                      |
| 7. _____ | symbol                         | g) short way of writing a compound                      |

### A VERY SPECIAL MOLECULE

Some molecules have thousands of atoms. For example, the formula for one of the substances in blood is



Try to answer these questions about this large molecule.



1. How many atoms are there in just one molecule of this substance?

\_\_\_\_\_

2. How many atoms of each of the following elements are in one molecule?

carbon \_\_\_\_\_

nitrogen \_\_\_\_\_

hydrogen \_\_\_\_\_

sulfur \_\_\_\_\_

oxygen \_\_\_\_\_

iron \_\_\_\_\_