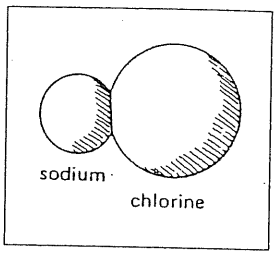
# LESSON 18 | What is a chemical formula?

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

The formula for table salt is NaCl.

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

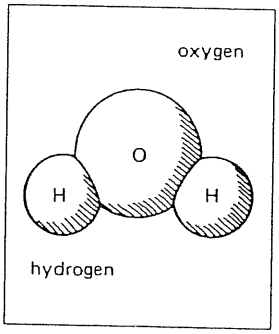



One molecule of NaCl has a total of two atoms. One of the atoms is sodium (Na). The other atom is chlorine (Cl).

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 $H_2O$.

- H is the symbol for hydrogen.
- O is the symbol for oxygen.
- $H_2$ means two atoms of hydrogen.
- O means one atom of oxygen.




One molecule of $H_2O$, then, has a total of three atoms. Two of the atoms are hydrogen. One atom is oxygen.

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. However, if you see one you do not know, you can always look it up in a dictionary, an encyclopedia, or a chemistry book.

## SOME COMMON MOLECULES

**Formula:** HgO

**Name:** mercuric oxide

**Elements:** mercury (Hg) and oxygen (O)

**Number of atoms in each element:**
1 atom of mercury (Hg)
1 atom of oxygen (O)

**Total number of atoms in one molecule:**
2 atoms total

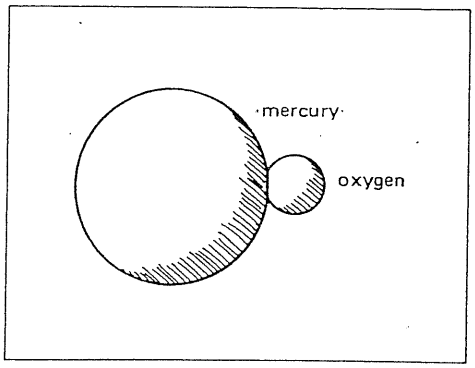



Figure A

**Formula:** KCl

**Name:** potassium chloride

**Elements:** potassium (K) and chlorine (Cl)

**Number of atoms in each element:**
1 atom of potassium (K)
1 atom of Chlorine (Cl)

**Total number of atoms in one molecule:**
2 atoms total

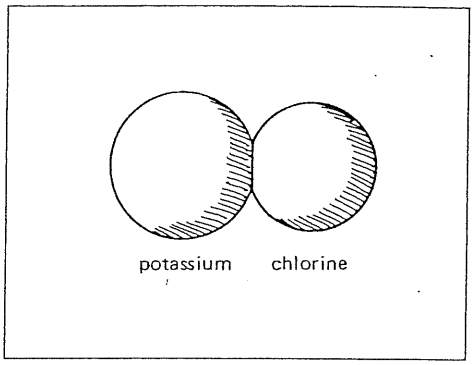



Figure B

**Formula:** NaOH

**Name:** sodium hydroxide (lye)

**Elements:** sodium (Na), oxygen (O), and hydrogen (H)

**Number of atoms in each element:**
1 atom of sodium (Na)
1 atom of oxygen (O)
1 atom of hydrogen (H)

**Total number of atoms in one molecule:**
3 atoms total

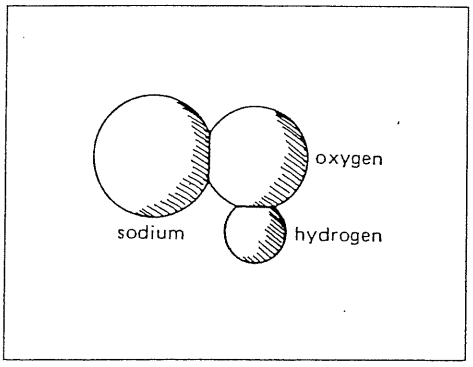



Figure C

**Formula:** $Fe_2O_3$

**Name:** iron oxide (rust)

**Elements:** iron (Fe) and oxygen (O)

**Number of atoms in each element:**
2 atoms of iron (Fe)
3 atoms of oxygen (O)

**Total number of atoms in one formula unit:**
5 atoms total

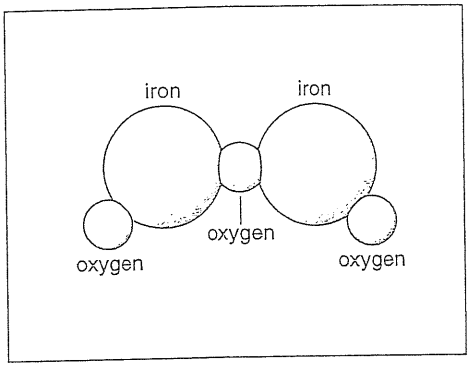



Figure D

**Formula:** $H_2SO_4$

**Name:** sulfuric acid

**Elements:** hydrogen (H), sulfur (S), and oxygen (O)

**Number of atoms in each element:**
2 atoms of hydrogen (H)
1 atom of sulfur (S)
4 atoms of oxygen (O)

**Total number of atoms in one formula unit:**
7 atoms total

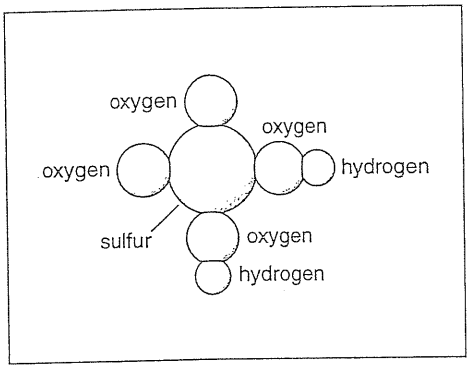



Figure E

**Formula:** $NaHCO_3$

**Name:** sodium hydroxide carbonate (baking soda)

**Elements:** sodium (Na), hydrogen (H), carbon (C), and oxygen (O)

**Number of atoms in each element:**
1 atom of sodium (Na)
1 atom of hydrogen (H)
1 atom of carbon (C)
3 atoms of oxygen (O)

**Total number of atoms in one formula unit:**
6 atoms total

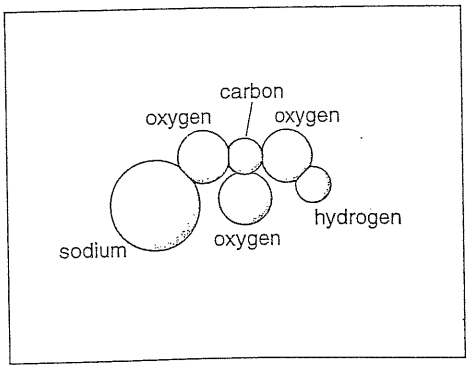



Figure F

*Choose the correct word or term for each statement. Write your choice in the spaces provided.*

1. A molecule is made up of _____ .
   atoms, oxygen

2. A single molecule has at least _____ atoms.
   one, two

3. _____ are combined to make _____ .
   Elements, Compounds — elements, compounds

4. There are _____ elements than compounds.
   more, fewer

5. Molecules are usually _____ 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 of 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 _____ .
    about one hundred, more than a billion

*Match each term in Column A with its description in Column B. Write the correct letter in the space provided.*

| | Column A | Column B |
|---|---|---|
| _____ | 1. $CaF_2$ | a) contains one kind of atom |
| _____ | 2. HF | b) 3 atoms in each formula unit |
| _____ | 3. formula | c) 2 atoms in each formula unit |
| _____ | 4. element | d) short way of writing an element |
| _____ | 5. symbol | e) short way of writing a compound |

## COMPLETE THE CHART

*Complete the chart by filling in the missing information. The first one has been done for you.*

| 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<br>oxygen | 1<br>1 | 2 |
| 2. $SO_2$ | sulfur dioxide | | | | |
| 3. $NH_3$ | ammonia | | | | |
| 4. $H_2CO_3$ | carbonic acid (soda water) | | | | |
| 5. $C_{12}H_{22}O_{11}$ | table sugar | | | | |
| 6. $MgSO_4$ | Epsom salts | | | | |
| 7. $NaOH$ | sodium hydroxide (lye) | | | | |
| 8. $H_2O_2$ | hydrogen peroxide | | | | |
| 9. $Fe_2O_3$ | iron oxide (rust) | | | | |
| 10. $NaHCO_3$ | sodium bicarbonate (baking soda) | | | | |

SLA Student Learning Activity

# Chemical Formulas

For each of the molecules in the left column, answer the questions that appear in the other columns.

| Chemical Formula | a) How many different kinds of atoms are in this molecule?<br>b) How many atoms of each kind are in this molecule?<br>c) What is the total number of all atoms in this molecule? | Element or Compound? |
|---|---|---|
| $Na_2O$ | a)<br>b)<br>c) | |
| $H_2O_2$ | a)<br>b)<br>c) | |
| Al | a)<br>b)<br>c) | |
| $CaCO_3$ | a)<br>b)<br>c) | |
| $H_3PO_4$ | a)<br>b)<br>c) | |