KS3 SCIENCE · CHEMISTRY

# Elements, atoms and compounds

Name _____



## 1. Atoms and elements

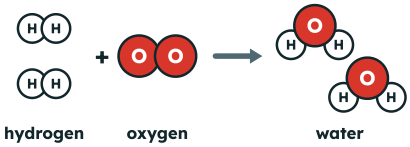
- Everything is made of tiny particles called **atoms**.
- An **element** is a substance made of only one type of atom. Gold, copper, sulfur and oxygen are elements. There are 118 elements.
- **Dalton's model:** atoms are like tiny solid balls. All matter is made of atoms. An atom cannot be broken down into anything simpler. All the atoms of one element are identical. Atoms of different elements are different.
- In some elements the atoms are joined in **molecules**. Oxygen gas is made of pairs of oxygen atoms.

## 2. Chemical symbols

| | | | | | |
|---|---|---|---|---|---|
| **H** hydrogen | **He** helium | **C** carbon | **N** nitrogen | **O** oxygen | **Na** sodium |
| **Mg** magnesium | **Al** aluminium | **S** sulfur | **Cl** chlorine | **K** potassium | **Ca** calcium |
| **Fe** iron | **Cu** copper | **Zn** zinc | **Br** bromine | **I** iodine | |

- Every element has its own **chemical symbol** of one or two letters. The first letter is a capital. A second letter is small: Mg, not MG.
- Some symbols come from Latin names: iron is Fe (ferrum), sodium is Na (natrium), potassium is K (kalium), copper is Cu (cuprum).
- Symbols are quick to write, and scientists everywhere use the same ones, whatever language they speak.

## 3. Compounds




- A **compound** is a substance made of two or more elements, chemically joined together.
- A compound is made in a **chemical reaction**. No atoms are made or lost. They are rearranged and joined in a new way.
- A compound has **different properties** from the elements in it.

| SODIUM (ELEMENT) | CHLORINE (ELEMENT) | SODIUM CHLORIDE (COMPOUND) |
|---|---|---|
| A soft, shiny metal. It fizzes violently in water. | A poisonous, pale green gas. | White crystals. It is table salt, the salt put on food. |

| | IRON AND SULFUR STIRRED TOGETHER (MIXTURE) | IRON SULFIDE (COMPOUND) |
|---|---|---|
| **Atoms** | The iron and the sulfur are not joined | Iron atoms are joined to sulfur atoms |
| **Properties** | Each keeps its own: the iron is still magnetic | New ones: a black solid that is not magnetic |
| **To separate** | Easy: a magnet pulls the iron out | Only by another chemical reaction |

## 4. Chemical formulae

**$H_2O$**



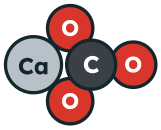

**Water**
2 hydrogen atoms, 1 oxygen atom

**$CO_2$**




**Carbon dioxide**
1 carbon atom, 2 oxygen atoms

**$CaCO_3$**

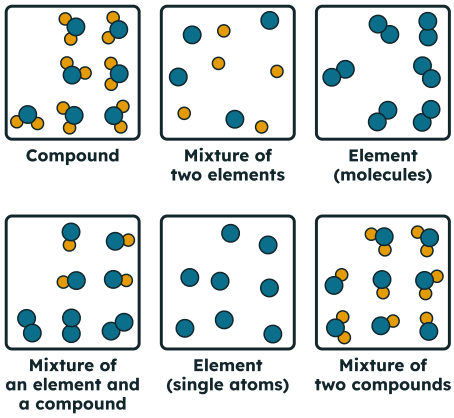



**Calcium carbonate**
1 calcium atom, 1 carbon atom, 3 oxygen atoms

- A **chemical formula** shows which elements are in a substance and how many atoms of each: the number in one molecule, or the ratio the atoms are joined in. Each capital letter starts a new symbol.
- A small number counts the atoms of the element just before it. No number means one atom.
- The numbers give a ratio that never changes: in $CO_2$ there are always two oxygen atoms for every carbon atom.

| IN THE NAME | WHAT IT TELLS YOU | EXAMPLE |
|---|---|---|
| **-ide** | Usually just two elements. A metal is named first. | Sodium chloride, NaCl. Magnesium oxide, MgO. Iron sulfide, FeS. |
| **-ate** | There is oxygen in it as well. | Calcium carbonate, $CaCO_3$. |
| **di-** | Two atoms of that element. | Carbon dioxide, $CO_2$. |

## 5. Elements, compounds and mixtures




- In these **particle diagrams** each circle is an atom. Circles that match are atoms of the same element. Circles that overlap are atoms joined together.
- **Element:** only one type of atom. The atoms may be single, or joined in molecules.
- **Compound:** atoms of different elements joined together. Every particle of the compound is the same.
- **Mixture:** two or more kinds of particle, not joined to each other. A mixture can hold elements, compounds or both.
- An element or a compound on its own is a **pure substance**. A mixture is not.

## Key words

**Atom:** the smallest particle of an element that can exist

**Molecule:** a group of two or more atoms joined together

**Chemical formula:** symbols and numbers that show the elements in a substance and the ratio of their atoms

**Property:** what a substance is like, such as its colour or whether it is magnetic

**Oxide:** a compound of an element with oxygen

**Iron sulfide:** the compound made when iron and sulfur react

**Element:** a substance made of only one type of atom

**Mixture:** two or more substances mixed together, not joined

**Dalton's model:** the idea that atoms are tiny solid balls that cannot be broken down

**Chemical reaction:** a change that rearranges atoms to make new substances

**Chloride:** a compound of an element with chlorine

**Carbon dioxide:** a compound with one carbon atom joined to two oxygen atoms

**Compound:** two or more elements chemically joined together

**Chemical symbol:** one or two letters that stand for an element

**Particle diagram:** a drawing that shows each atom as a circle

**Periodic table:** the chart that lists all the elements

**Sodium chloride:** the compound in table salt

**Pure substance:** a single element or a single compound, with nothing mixed in

Pictures are illustrations made for this sheet, not real photographs.