

## Chemical reactions

In a **chemical reaction** a new substance is always formed. Most chemical changes are not easily reversed: they are **irreversible**. In a **physical change** no new substance is formed. Melting and evaporation are examples of physical changes. Physical changes are usually **reversible**.

You can tell that a reaction has occurred if there is a **colour change** or when a **gas** is given off. Most chemical reactions also involve an **energy change**. This is usually in the form of heat, but can also involve light or sound being given off (for example, when something burns).

Some chemical reactions involve **decomposition** (chemicals being split up). This needs a source of **energy** (usually **heat** or **electricity**).

## Reactions of acids

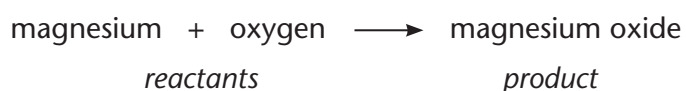
Some metals react with acids, and hydrogen gas is produced. When acids react with limestone, carbon dioxide gas is given off.

You can test the gas made in a reaction to find out what it is:

- **hydrogen** burns with a squeaky pop if a lighted splint is held near the test tube
- **carbon dioxide** will put out a lighted splint, and it makes limewater turn milky
- **oxygen** makes flames burn more brightly, and will relight a glowing splint.

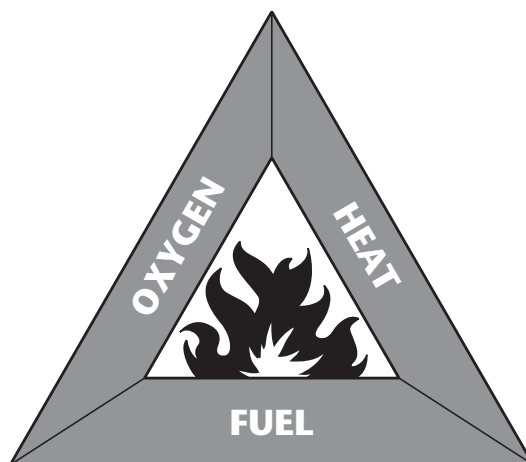
## Burning

When a metal burns in air, the metal combines with oxygen from the air to form a chemical called an oxide. We can show this using a **word equation**. The chemicals that you start with are called the **reactants**. The chemicals at the end are called the **products**. Here is an example:



Burning is also known as **combustion**. In a combustion reaction, some energy has to be supplied at the beginning to start the reaction. Once the reaction has started, it will produce its own heat.

A fire needs three things to keep burning: fuel, oxygen and heat. We show these three things on the **fire triangle**.

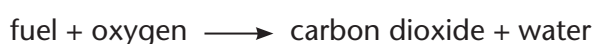


If any one of these three things is taken away, the fire will go out.

**Fire extinguishers** are used for putting out fires. There are different types of fire extinguisher, and it is important always to use the correct sort for a particular fire. Sand or fire blankets can also be used to put out fires.

Water is often used to put out fires, because it takes away the heat. However, water should never be used on oil or petrol fires, because it makes the burning fuel spread out. Fire blankets and foam, powder or carbon dioxide (CO<sub>2</sub>) extinguishers work by stopping oxygen getting to the flames.

Fossil fuels contain a lot of carbon and hydrogen. When they burn, they use up oxygen from the air and produce water and carbon dioxide. We can show the reaction using a word equation. Energy is not in this equation because it is not a chemical substance.



**Pollution** can occur if there is not enough oxygen for complete combustion. **Carbon monoxide** is a poisonous gas, and soot (**carbon**) can also be formed if the oxygen supply is restricted further. Smoke is made up of soot and any other solid particles, such as metal oxides.

## Explosions

**Explosions** are very fast reactions that give out a lot of heat and produce lots of gases. Fuels such as natural gas can produce an explosive mixture with oxygen. This is a combustion explosion.

**Explosives** are chemicals that often contain all the oxygen they need to react inside the chemical. They can react by decomposition as they do not need any oxygen from the air.

Some explosives, such as nitroglycerine, are very **unstable** and will react with only a tiny amount of added energy. A safer explosive, such as dynamite, will not react until a **detonator** is used.

Explosives are used for weapons, quarrying rock, building roads and demolishing old buildings.