

The atmosphere and air

Printable revision sheet — Galaxscia

LEVEL 1

What is air made of?

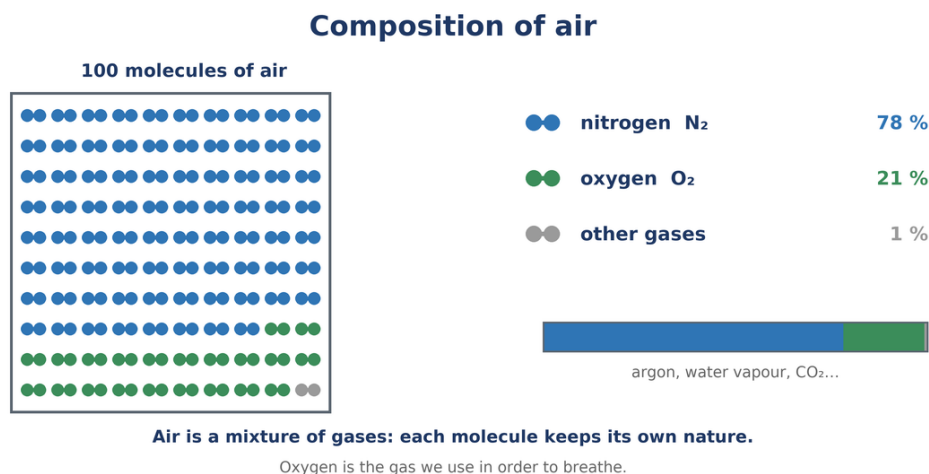
The **air** around us seems empty, but it is really **matter**: it is a **mixture of several gases**. We cannot see it, but we can feel it (the wind) and it fills all the space available.

The composition of air:

About **78 % nitrogen** (N_2)

About **21 % oxygen** (O_2), the gas we need in order to breathe

About **1 % other gases**: argon, **water vapour**, **carbon dioxide** (CO_2)...



Air and the greenhouse effect

Some gases in the air are called **greenhouse gases**. They keep part of the Sun's heat near the Earth's surface, rather like a blanket. Without them it would be far too cold to live.

The main greenhouse gases are:

Water vapour

Carbon dioxide (CO_2)

Methane

Human activities (cars, factories, heating...) release a great deal of CO₂. This excess strengthens the greenhouse effect and contributes to **global warming**. Protecting the air means protecting the planet.

Key points — revision questions

Is air matter? Why?

What are the two main gases in air and their proportions?

Which gas in the air is essential for us to breathe?

What is a greenhouse gas?

Name three greenhouse gases present in the air.

Why is the greenhouse effect both useful and dangerous?

Which human activity increases the amount of CO₂ in the air?

LEVEL 2

What is combustion?

Combustion is a **chemical transformation** in which a **fuel** (wood, methane, carbon, petrol...) reacts with an **oxidiser**: the **oxygen** (O₂) present in the air. This reaction **releases energy** as heat, and often as light (the flame).

Example: the combustion of methane (mains gas).



*Note: you learned to write the equation of this reaction ($\text{CH}_4 + 2 \text{O}_2 \rightarrow \text{CO}_2 + 2 \text{H}_2\text{O}$) in the **Reactions** lesson.*

The fire triangle

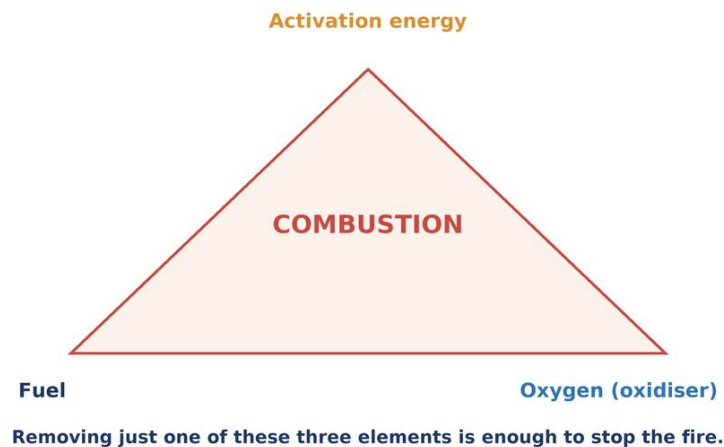
For combustion to happen, **three elements** must be present at the same time. This is the **fire triangle**:

a **fuel** (what burns);

an **oxidiser** (the oxygen in the air);

an **activation energy** (a source of heat: a spark, a flame...).

The fire triangle



Removing just one of these three elements is enough to stop the fire.

If **just one** of these three elements is **removed**, the combustion stops. This is the principle used to **put out a fire**: deprive it of oxygen (a lid, a fire blanket) or of fuel.

Key points — revision questions

- What is combustion? What are the fuel and the oxidiser?
- Where does the oxygen needed for combustion come from?
- What are the three elements of the fire triangle?
- How can a fire be put out? Explain using the fire triangle.

LEVEL 3

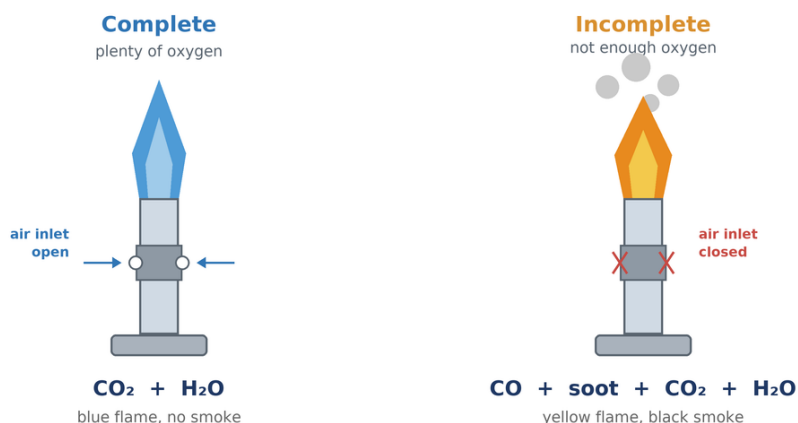
Complete or incomplete combustion

How a combustion proceeds depends on the **amount of oxygen** available:

Complete combustion (plenty of oxygen): it produces only **carbon dioxide** (CO_2) and **water**. The flame is blue and bright.

Incomplete combustion (not enough oxygen): it also produces **carbon monoxide** (CO) and **particles of soot**. The flame is yellow and smoky.

Complete or incomplete combustion



Carbon monoxide CO is a toxic, invisible and odourless gas.

Danger: carbon monoxide (CO) is a **toxic, invisible and odourless** gas. It is responsible for serious accidents in the home (badly adjusted heaters or water heaters). You must always **ventilate** and have combustion appliances serviced.

The **products** of a combustion can be **identified**: carbon dioxide turns **limewater** cloudy, and water turns **anhydrous copper sulfate** blue (see the **Characteristic tests** lesson).

Combustion and the climate

Burning **fossil fuels** (coal, oil, gas) releases large amounts of **carbon dioxide** (CO_2) into the air. But CO_2 is a **greenhouse gas**: this excess strengthens the greenhouse effect and contributes to **global warming** (see level 1 of this lesson).

Key points — revision questions

- What is the difference between complete and incomplete combustion?
- Which dangerous gas forms during incomplete combustion? Why is it dangerous?
- How can the carbon dioxide produced be shown to be present?
- What is the link between combustion and global warming?