# States of Matter

Most matter exists in one of three states: solid, liquid or gas. Each state of matter has its own properties.

## Properties of solids

- Solids can be held.
- They keep their shape and do not flow.
- They always take up the same amount of space.
- They cannot be compressed.

**Examples**

metal

wood

plastic

## Properties of liquids

- Liquids cannot be held easily.
- They flow and can be poured.
- They take the shape of the container they are in.
- They cannot be compressed.

**Examples**

water

oil

milk

## Properties of gases

- Gases cannot be held.
- They have no fixed shape and fill the available space in the container.
- They can be compressed.
- They are normally invisible.

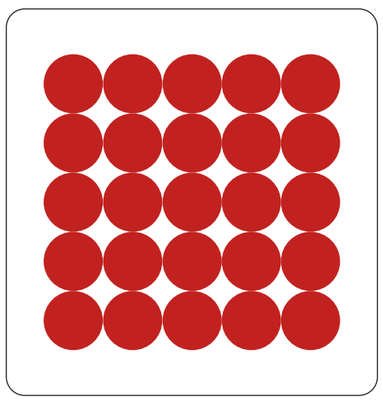
**Examples**

air

helium

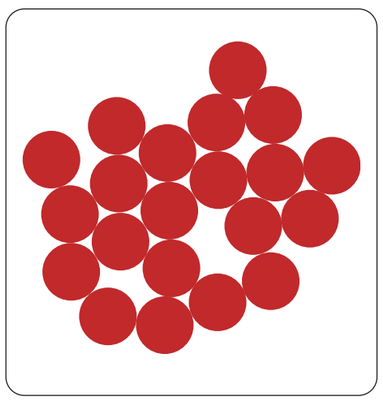
## Particle theory

All matter is made from tiny particles. Particles are single pieces of matter that are too small to be seen. The arrangement of particles in solids, liquids and gases explains their different properties.



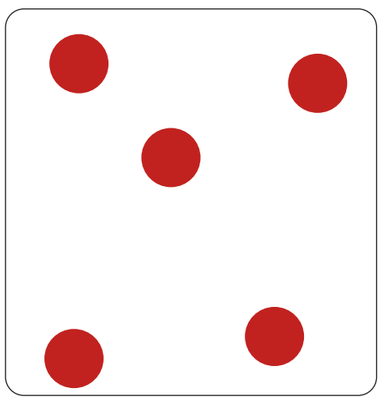
In a **solid**, the particles are close together, arranged in a regular pattern and cannot move around each other.

This arrangement means that solids keep their shape, always take up the same amount of space and cannot be compressed.



In a **liquid**, the particles are close together but arranged randomly, which means they can move around each other.

This arrangement means that liquids can flow, take the shape of the container and cannot be compressed.



In a **gas**, the particles are far apart, randomly arranged and can freely move.

This arrangement means that gases have no fixed shape, fill any container and can be compressed.



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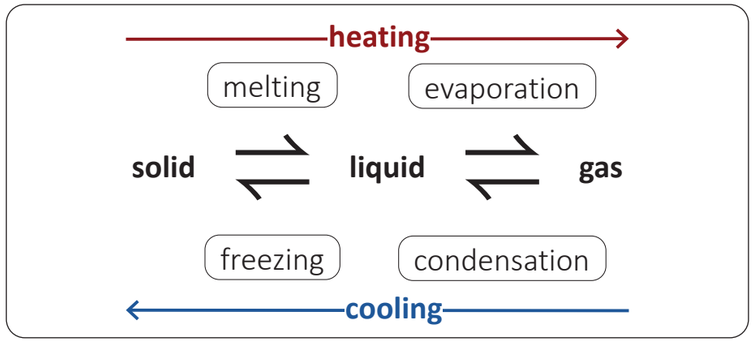
## Changing state

Materials can exist as solids, liquids or gases. However, some materials change state when heat is added or removed. The processes involved in changing state are melting, freezing, evaporation and condensation. These changes are reversible.




When a solid is heated, it melts into a liquid.

When a liquid is heated, it evaporates into a gas.

When a gas is cooled, it condenses into a liquid.

When a liquid is cooled, it freezes into a solid.

## States of water

Water exists in three states on Earth: solid ice, liquid water or gaseous water vapour.

**solid**

**liquid**

**gas**

## Melting and boiling points

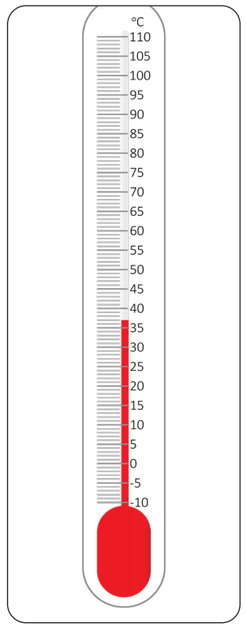
When solid water (ice) is heated to 0°C, it begins to melt. This is called its melting point.

When liquid water is heated to 100°C, it begins to evaporate. This is called its boiling point.

Different materials have different melting and boiling points. For example, solid gold melts at 1063°C and liquid argon evaporates at -189°C.

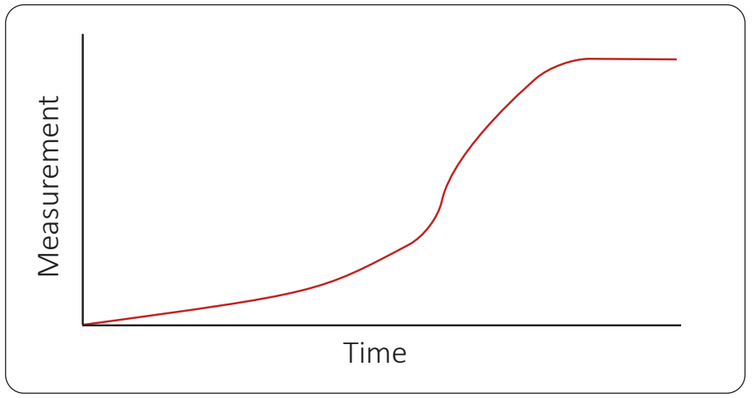
## Measuring temperature

Temperature is a measure of how hot or cold something is. It is measured in degrees (°) using a thermometer. The Celsius scale, which was invented by Anders Celsius in 1742, is used in the United Kingdom to measure temperature. In a liquid thermometer, the liquid rises and falls in the tube as the temperature rises and falls. The scale on a thermometer has marked and unmarked divisions. This thermometer reads 37°C.




## Line graphs

A line graph is a way of displaying data that shows a relationship between two things, or variables. Many line graphs show changes over time. The line can be straight or curved and have flat sections or slopes that are shallow or steep. Flat lines mean there is no change over time. The steeper the line, the faster the change.




## Glossary

| | |
|---|---|
| **arrangement** | The way in which things are placed. |
| **compress** | To squash. |
| **gaseous** | In the form of a gas. |
| **matter** | What all things are made from. |
| **process** | A series of actions taken to achieve a result. |
| **reversible** | Capable of being reversed so that the previous state is restored. |
| **variable** | A factor, such as an object or condition, that changes during an investigation. |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