

Hypotheses and theories

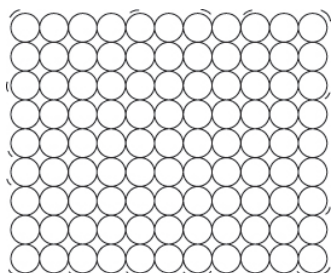
A **scientific method** describes how scientists try to explain the world around them. It starts with some observations, which generate a question. Scientists then use steps to answer the question:

- thinking up a **hypothesis** (idea) or using existing hypotheses to explain the observations
- making a **prediction** about what will happen in an experiment if the hypothesis is correct
- testing the prediction by experiment, and collecting data
- checking the **data** to see if it matches the prediction
- using the data as **evidence** to support the hypothesis (or show it is wrong).

A **theory** is a hypothesis with a lot of evidence to support it. The **particle theory** or **particle model** is an example.

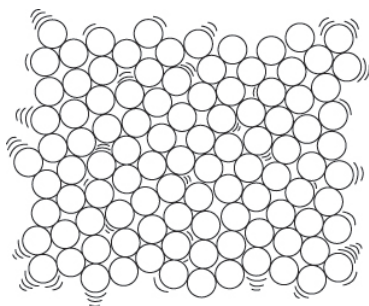
The particle theory

The different **properties** of solids, liquids and gases can be explained by the particle model. These three **states of matter** are handled and stored differently because of their different properties.



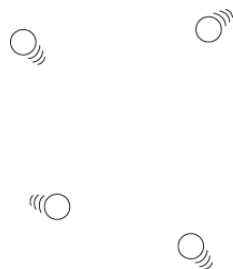
Solids

- Solids are made up of particles that are very close together (held by strong forces of attraction).
- The particles in solids vibrate in fixed positions.
- The shape and volume of solids do not change.
- Solids cannot be squashed and do not flow.



Liquids

- Liquids are made up of particles that are fairly close together (held by fairly strong forces of attraction).
- The particles in liquids can move past each other.
- Liquids have a fixed volume but their shape can change to fit the container as they flow easily.
- Liquids cannot be easily compressed (squashed).



Gases

- The particles in gases are well spread out (with only weak forces of attraction between them).
- The particles in gases move about freely in all directions.
- The shape and the volume of gases can change as they flow very easily and spread out.
- Gases can be compressed (squashed) quite easily.

Density

Density is the mass of a certain volume of material. It is measured in units such as kilograms per cubic metre (kg/m^3) or grams per cubic centimetre (g/cm^3). Iron has a density of 7.9 g/cm^3 . This means that 1 cm^3 of iron has a mass of 7.9 g .

Brownian motion

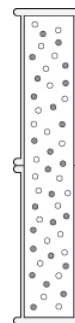
When pollen grains in water are observed through a microscope they are seen to move jerkily in different directions. This is called **Brownian motion**. It is caused by water particles, which are moving all the time, hitting the pollen grains. The pollen grains are small enough so that when many water particles hit one side of the grain, the grain is moved in that direction.

Brownian motion provides evidence to support particle theory.

Diffusion

Diffusion is said to have occurred when substances mix together without anything moving them. Diffusion is fastest in gases, and slower in liquids.

Diffusion occurs because particles in a substance are always moving around. So there is an overall movement of particles from where they are in greater **concentration** (more particles in a certain volume) to where they are in lower concentration.



Dilution and dissolving

When you add water to orange squash you dilute it. The colour becomes paler because the orange coloured squash particles are spread out more among the water particles.

When **soluble** solids **dissolve** in liquids, the tiny solid particles are separated and spread through the liquid. The **solute** particles are so spread out that you can see through the **solution**.

Pressure in gases

Pressure is caused by particles hitting the walls of the container they are in. It increases when:

- the container is squashed (the volume is smaller so particles hit the walls more often)
- the number of particles is increased (there are more particles moving around to hit the walls).

If the particles are in a flexible container, like a balloon, an increase in pressure inside the container can make the volume increase. If the pressure becomes too great, the balloon will burst.

Gas pressure is pressure caused by gases. **Air pressure** is a type of gas pressure and is caused by air particles around us. Air pressure lets us suck up liquids using straws and causes a container to collapse if air is sucked out. If there is no gas in a container, you get a **vacuum** (nothingness).

