

changes of state

particles gain energy from the surroundings → particles vibrate faster → particles lose their place in the pattern → particles gain more energy from the surroundings → particles move faster → particles pull completely away from each other

melting

boiling / evaporation

state of matter

solid

liquid

gas

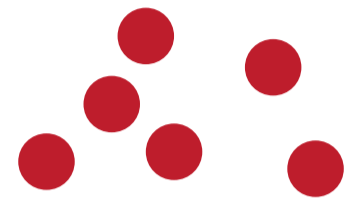
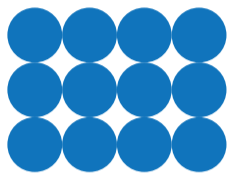
how do the particles move?

particles do not move around, but vibrate on the spot

particles are touching but can slide over each other

particles are spread out far away from each other

arrangement of particles



can it be compressed?

no, because there is no space between the particles

no, because the particles are touching their neighbours

yes, because there is space between the particles

can it flow?

no, because the particles can't move around

yes, because the particles can slide over each other and move around

yes, because the particles can move around

freezing

condensation

changes of state

particles take a fixed place in a pattern ← particles move even slower ← particles lose more energy to the surroundings

particles come close together ← particles move slower ← particles lose energy to the surroundings

Sublimation

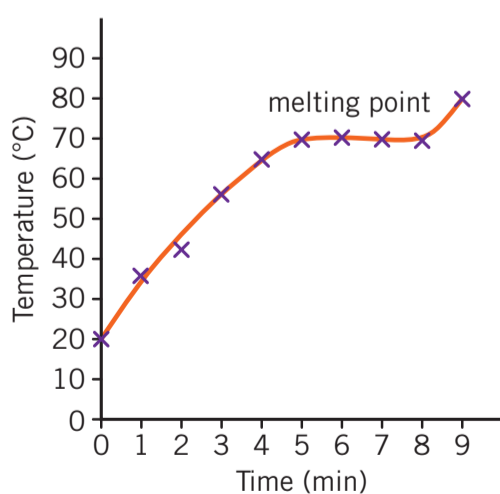
Some substances do not exist as liquids, but instead directly change state from solid to gas in a process called sublimation.

Melting and boiling points

Melting point — the temperature at which a **substance** melts

Boiling point — the temperature at which a substance boils

If you heat a **solid** and plot a graph of temperature against time the melting point will appear as a flat line if the substance is **pure** (has only one type of particle).



Diffusion

Particles move about randomly in liquids and gases and spread out through **mixtures**. This process is called diffusion. How quickly diffusion happens depends upon three variables:

Variable	Effect on diffusion
temperature	diffusion is faster at higher temperatures <i>because</i> particles move faster when hotter
particle size	diffusion is slower with larger, heavier particles
state of matter	diffusion is: <ul style="list-style-type: none"> • fast in gases • slow in liquids • doesn't happen in solids

Gas pressure

Density

Density tells us how heavy something is for its size. You can calculate density using the formula: $\text{density} = \text{mass} / \text{volume}$

Mass is the amount of 'stuff' an object is made of, measured in grams or kilograms.

Volume is the amount of space an object takes up, measured in cm^3 .

Density of a substance depends on:

- the mass of the particles
- how closely together the particles are arranged.

A substance is most dense as a solid, as the particles are closely packed together, and least dense as a gas, as the particles are spread far apart.

Particle model and properties

The properties of a substance depend on:

- 1 the shape and size of its particles
- 2 the arrangement of its particles
- 3 how its particles move
- 4 how strong the forces between its particles are.

Key words

Make sure you can write a definition for these key terms.

boiling boiling point change of state condensation diffusion evaporation freezing gas liquid melting mixture
particle solid state of matter sublimation substance

