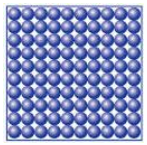
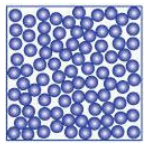
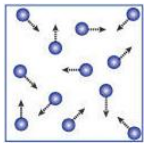
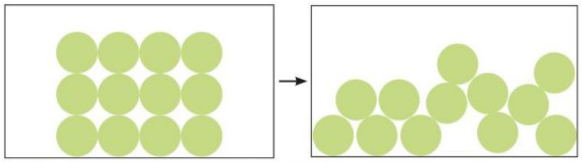
Knowledge organiser - 7.3 States of Matter

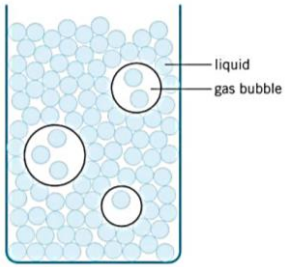
Solid	Liquid	Gas
Fixed shape	No fixed shape	No fixed shape
Fixed volume	Fixed volume	No fixed volume
Do not flow easily	Flow quite easily	Flow very easily
Very dense	Less dense	Not dense at all
Cannot be squashed	Very difficult to squash	Easy to squash
Particles very close together	Particles fairly close together	Particles are very far apart

MELTING: As a substance melts, its particles vibrate faster. The particles start moving around (away from their places in the pattern). The substance is now in the liquid state.



If you know the melting point and boiling point … you can predict the state at any temperature!

Above boiling point >> gas
Middle of melting and boiling >> liquid
Below melting point >> solid



What is the difference between boiling and evaporation?

Boiling → Occurs when bubbles of steam form all through the liquid (see diagram). The particles in the bubble are spread out. As it boils, the steam bubbles rise to the surface of the liquid and escape into the air. It happens only at the boiling point. Different substances will boil at different temperatures.

Evaporation → Occurs when particles (with the most energy) leave the surface of the liquid. They move away from the liquid, spread out and form a gas. It can happen at any temperature.

- Materials are made of particles. Many materials are mixtures. Some are made up of only one substance.
- Every substance has its own properties. The properties of a mixture are different to the properties of the individual substances that make it up.
- The particle model helps us explain these properties.
- Properties of a substance depends on three things: what the particles are like, how they are arranged and how they move.

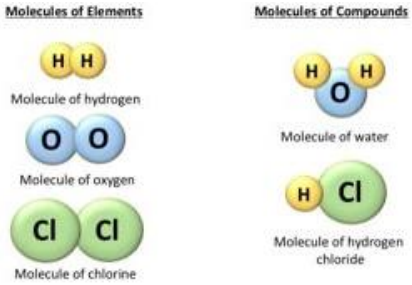
DIFFUSION

Three factors affect the speed of diffusion:

1. **Temperature →** Occurs more quickly at higher temperatures as the particles are moving faster.
2. **Particle size →** Big, heavy particles diffuse more slowly than small, light ones.
3. **State of the diffusing substance →** Occurs quicker in gases than liquids (as the particles in a gas are very far apart). Diffusion does not occur in solids (as particles cannot move).

What is the evidence for particles?

Brownian motion → The random movement of particles in a fluid (gas or liquid) due to collisions with other particles surrounding them.



- Elements consists of **atoms** (the smallest particle that can exist).
- A molecule is a group of two or more atoms, strongly joined together (e.g. hydrogen / water)
- A compound is a substance made up of atoms of two or more elements, chemically bonded (e.g. water).

GAS PRESSURE

- Gas particle collide with the walls of their container.
- Colliding gas particles exert pressure on the inside of their container.

Factors that affect pressure:

- **Number of particles →** The more particles in a container, the higher the pressure (this is because there are more frequent collisions)
- **Temperature →** The higher the temperature, the higher the pressure (this is because the particles have more energy, they move faster and collide with the container more frequently).

When is evaporation useful?

- Sweating cools, you down by evaporation.
- Drying hair with hairdryer – speeds up evaporation.

KEYWORD	DEFINITION
Boiling	The change of state from liquid to gas.
Boiling point	The temperature at which a substance boils.
Change of state	The process by which a substance changes from one state to another.
Condensation	The change of state from gas to liquid. It can happen at any temperature below boiling point.
Density	The mass of a material in a certain volume.
Diffusion	The process by which particles in liquids or gases spread out through random movement from a region where there are many particles or one where there are fewer.
Element	A substance that cannot be broken down into other substances and contains only one type of atom.
Evaporation	The change of state from liquid to gas.
Freeze	The change of state from liquid to solid at the melting point of a substance.
Gas	A substance that can flow and can also be compressed.
Gas pressure	The force exerted per unit area on the walls of a container. It is caused by collisions of particles with the walls.
Liquid	A substance that can flow but cannot be compressed.
Material	The different types of stuff that things are made from.
Melt/ melting	The change of state from a solid to liquid at the melting point of a substance.
Melting point	The temperature at which a substance melts.
Mixture	Made up of two or more pure substances that are mixed (not chemically joined) together.
Particle	A very tiny object (atom or molecule) that materials are made from. They are too small to be seen with a microscope.
Particle model	A way to think about how substances behave in terms of small, moving particles.
Properties	A quality of a substance or material that describes its appearance or how it behaves.
Solid	A substance that cannot be compressed and cannot flow.
States of matter	The three forms in which a substance can exist – solid, liquid and gas.
Sublimation	The change of state from solid directly to gas.
Substance	A material that is not a mixture. It has the same properties all the way through.