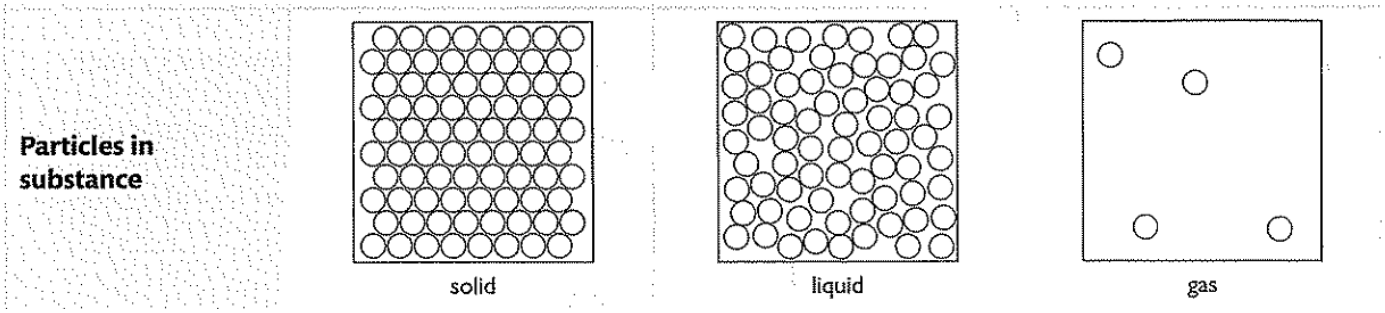
States of matter

1.1 understand the three states of matter in terms of the arrangement, movement and energy of the particles

The three states of matter

Features	Solid	Liquid	Gas
Arrangement	Regular	Irregular	Random
Movement	Cannot move, vibrate only	Particles can move throughout the liquid slight past each other	Particles can move freely
Energy of Particles	Particles have least kinetic energy	Particles have more kinetic energy than solid	The particles have the most kinetic energy
Distance between particles	Closely packed	Not closely paced	Far apart
Shape	3D structure	Takes the shape of the container	No fixed shape



Fill in the gaps to describe what happens to the particles when a substance changes state by melting and boiling.

liquid energy heated move positions vibrate boiling melting strong weak high bubbles low surface air evaporation

Melting

When a solid is …… its particles gain …….. and ……. faster. Eventually they gain enough …….

to move away their …….. and begin to …….. around each other. The solid melts to form a …….. . The

temperature at which s solid melts is the …….. point. The temperature at which a solid melts tells us how strongly its particles are held

together. Substances with high melting points have ……. forces of attraction between their particles. Substances with …… melting points have

weak forces between their particles.

Boiling

When a liquid is heated the particles gain ……. and …….. around faster and faster. Some particles near the …….. of

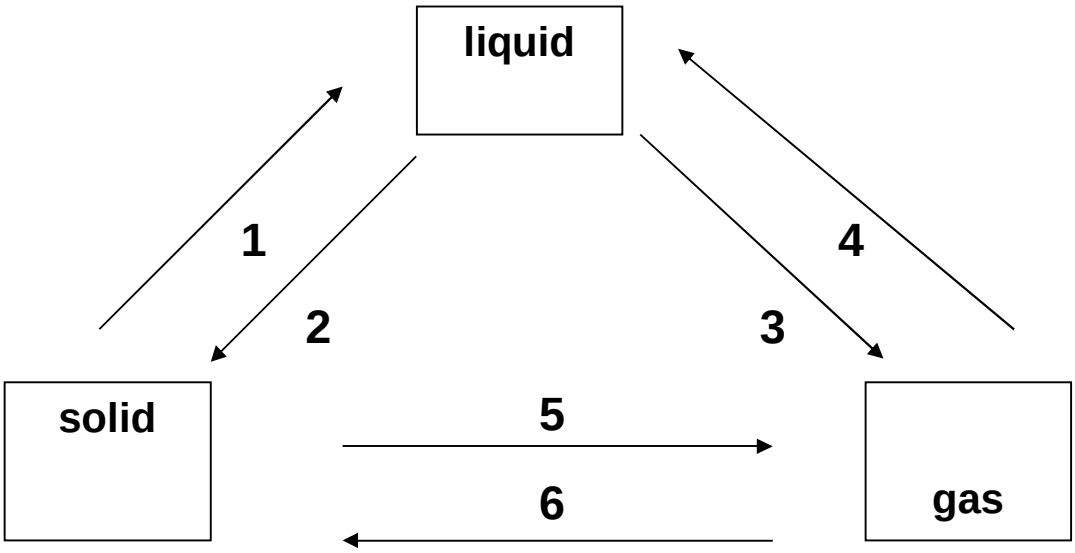
the liquid have enough …….. to escape into the …….. and form vapour. This process is called ……

Eventually a temperature is reached at which the particles are escaping from the liquid surface so rapidly that …….. of vapour (liquid

particles turned into gas particles) start to form inside the liquid. This process is called ……

What are the changes of state called?

Complete the key to the right by writing the correct process next to each number.



1.

2.

3.

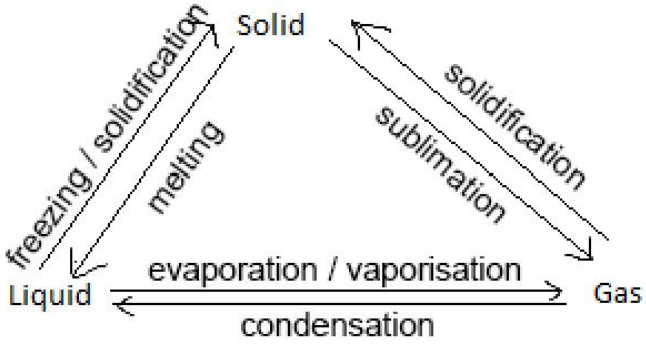
4.

5.

6.

1.2 understand the interconversions between the three states of matter in terms of:

- the names of the interconversions
- how they are achieved
- the changes in arrangement, movement and energy of the particles.



All types of INTERCONVERSIONS:

- Melting: The process of converting from solid to liquid due to increase of temperature.
- Melting point: The temperature at which a solid starts to melt. Ice melts at 0 degree C.
- Boiling: The process of converting from liquid to gas due to increase of temperature.
- Boiling point: The temperature at which liquid starts to boil. Water boils at 100 degree C.
- Condensation: The process by which a gas turns to a liquid, this process is called condensation.
- Sublimation: The process by which a solid directly turns into a gas without melting.
- Solidification: The process at which gas directly turns to solid.
- Vaporisation: A process by which liquid turns to a gas at its boiling point. (same as boiling)
- Evaporation: A process by which a liquid turns to a gas below its boiling point.
- Volatile: The liquids which evaporates at room temperature that liquids are called volatile.

- Solid to liquid: When a solid is heated the particles absorb energy and starts to vibrate faster about their fixed position. When the temperature is high enough, the vibration of the particles become sufficient to overcome the attraction between them. The particles begin to break away from their fixed position. The particles can now move slight past each other. The solid is formed liquid.
- Liquid to solid: When a liquid is cooled, the energy is given out by the particles and begins to move slowly. When the temperature is low enough, the particles no longer have the energy to slide over each other. The particles start to settle into a fixed position. When all the particles are settled, the substance's state is solid.
- Liquid to Gas: When a liquid is heated, the particles move fast which break all the forces of attraction in liquid. Bubbles of gaseous particles are formed throughout the whole liquid.
- Gas to liquid: When a gas is cooled the particles eventually move slowly enough that attraction between them hold the particles as liquids. The gas is now condensed to liquid.

1.3 understand how the results of experiments involving the dilution of coloured solutions and diffusion of gases can be explained

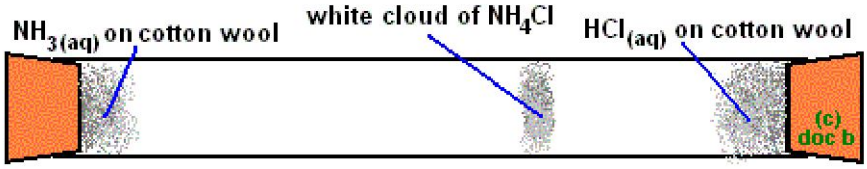
Experiment on dilution

In a beaker of water, a deeply colored substance (Potassium mangnete) is kept. After 10-20 min, the whole solution turned purple. That's because Potassium Mangnete is made of small particles which spread out through the solution. If it was replaced with heavier or bigger particles, it will take long time to diffuse and often it wont.

Diffusion experiment-1

When the glass lid is removed, the brome rises to the top because bromine is made up of small particles which occupies spaces inside both jars by diffusion.

Diffusion experiment-2



From the cotton wool which is soaked in aqueous ammonia, ammonia gas is produced. And from the cotton wool which is soaked in hydrochloric acid, hydrogen chloride gas is produced. Both gases move to each other inside the glass and meet near the cotton wool which is soaked in hydrochloric acid. The gases forms a white smoke of ammonium chloride.

$$NH_3(g) + HCl(g) \rightarrow NH_4Cl(s)$$

This shows that ammonia gas move faster than hydrogen chloride gas in the same length of time. Because ammonia is lighter than hydrogen chloride gas. So ammonia diffuses faster.

The factors that affects the diffusion process are:-
(i) Molecular Mass(Mr)
(ii) Temperature

The molecules with low molecular mass diffuse faster than the higher molecular masses.
Increase in temperature increases the diffusion rate.

1.4 know what is meant by the terms:

- solvent
- solute
- solution
- saturated solution.

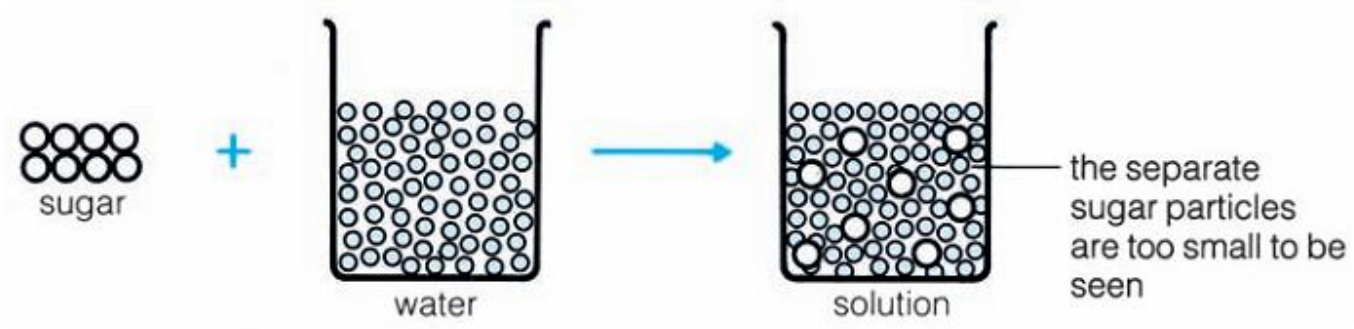
Solvent: A substance that allows solutes to dissolve in
Example: Water, Ethanol

Solute: A solid that dissolves into a solvent

Solution: It is when a solute and a solvent mix. The solute dissolves in the solvent making a solution.
Example: sugar (solute) dissolves in water (solvent) making a solution of sugar and water.

Solutions

When you mix sugar with water, the sugar seems to disappear. That is because its particles spread all through the water particles, like this:



The sugar has **dissolved** in the water, giving a mixture called a **solution**. Sugar is the **solute**, and water is the **solvent**:

solute + solvent = solution

You can't get the sugar out again by filtering.

Saturated Solution:

If you add excess amount of sugar in a small amount of water...it won't dissolve as there is no space for it. The solution becomes saturated.

A solution is called *saturated* when it can dissolve no more solute, at that temperature.

1.5C know what is meant by the term solubility in the units g per 100 g of solvent

1.6C understand how to plot and interpret solubility curves

1.7C *practical: investigate the solubility of a solid in water at a specific temperature*