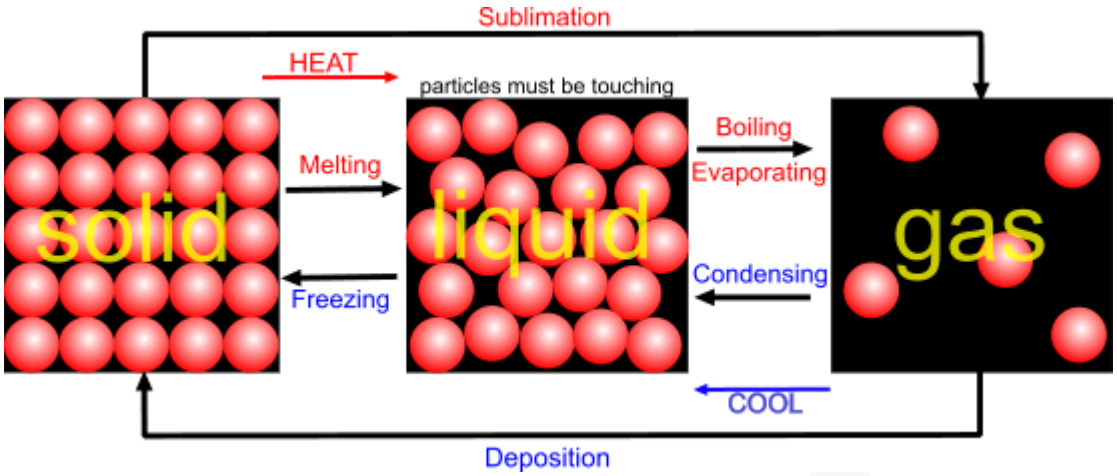
States of Matter

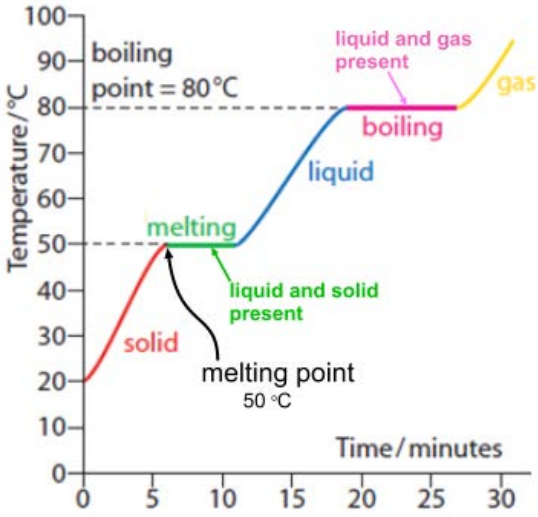
The three states of matter are solid, liquid, gas.

Boiling only occurs at the boiling point **Evaporation** can occur at any temperature



	Solids	Liquids	Gases
Distance between particles	close together	close but further apart than in solids	particles far apart
Arrangement of particles	regular	random	random
Movement of particles	vibrate	move around each other	move around in all directions
speed of movement	slowest	faster	fastest
Energy of particles	lowest	higher	highest
Forces of attraction between particles	strongest	weaker	weakest

When a substance undergoes a change of state there is no temperature change. The energy supplied is used to overcome the forces of attraction between the particles.



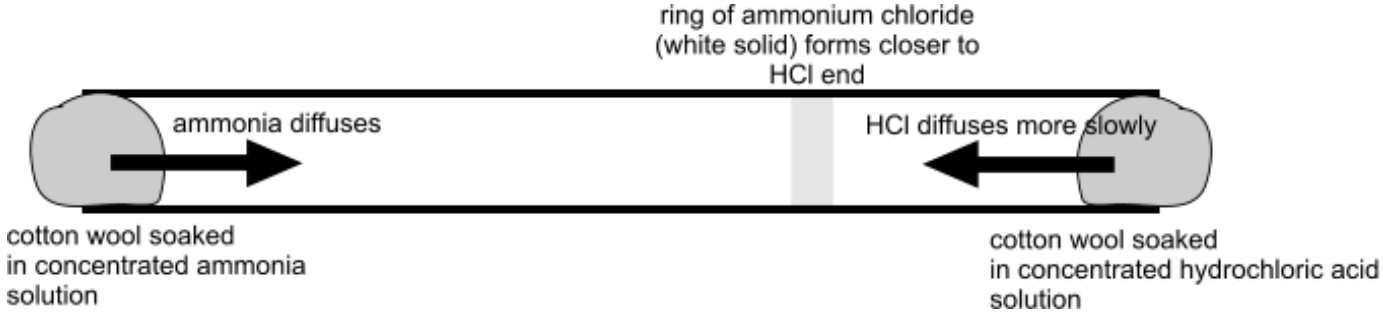
Diffusion is the random movement of particles that allows them to spread from where they are present in high concentration to where they are in lower concentration. Diffusion provides evidence for the movement of particles.

Diffusion is fastest in gases because the particles are far apart and moving very quickly. Particles are moving randomly.

Diffusion is slower between liquids because the particles are much closer together and moving more slowly.

Diffusion is very slow in solids.

Diffusion is fastest with particles of low molecular mass - e.g. ammonia molecules (M_r= 17) diffuse more quickly than hydrogen chloride molecules (M_r= 36.5).



Dilution of solutions of coloured substances provides evidence for the small size/mass of particles.

Solubility

- Solute a substance that dissolves to make a solution
- Solvent – a liquid that a solute dissolves in to make a solution
- Solution – what is formed when a solute dissolves in a solvent
- Saturated solution – contains the maximum amount of dissolved solute at a certain temperature (there must be some undissolved solid present)

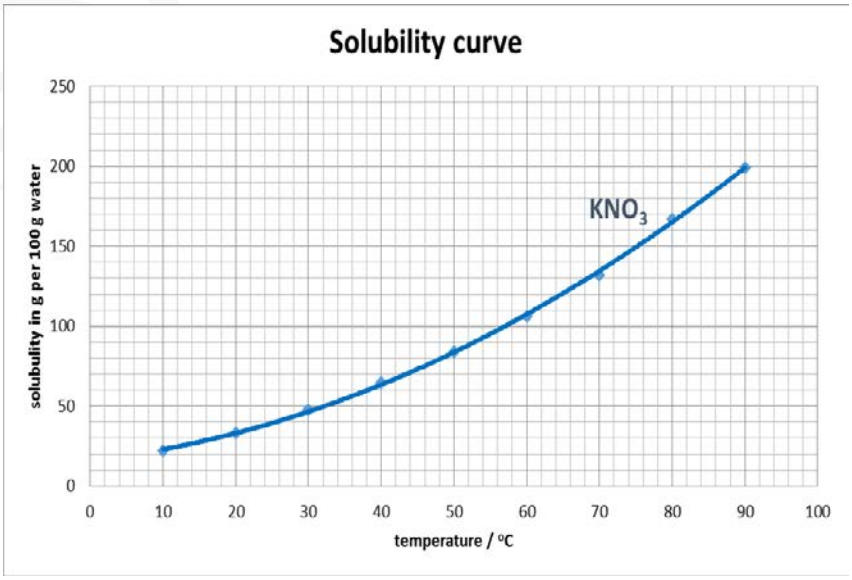
Solubility is usually quoted as the mass of solute that dissolves in 100 g water (to make a saturated solution)

To measure the solubility of a salt in water at xx °C

- Heat some water to just above xx °C.
- Add the salt to the water and stir rapidly until no more will dissolve and there is undissolved solid left over.
- Allow the solution to cool to exactly xx °C.
- Pour off some of the solution into a pre-weighed evaporating basin (e.g. 45.2 g)
- Weigh the evaporating basin and contents (e.g. 63.3 g)
- Heat the evaporating basin and contents gently to evaporate off **all** the water (heat to constant mass to ensure all the water has been given off)
- Weigh the evaporating basin and contents. (e.g. 47.9 g)

Mass of water = 63.3 – 47.9 = 15.4 g
Mass of salt = 47.9 – 45.2 = 2.7 g
Solubility of salt at xx ^{o}C = 2.7/15.4 x 100 = 17.5 g per 100 g of water

Solubility curve gives the maximum amount that dissolves at a particular temperature to form a saturated solution e.g. a saturated solution of KNO_3 at 70 ^{o}C contains 130 g of KNO_3 per 100 g of water.



If a solution is prepared containing 80 g of KNO_3 in 100 g of water at 70 ^{o}C all the solid will dissolve as this is below the solubility at this temperature. As this is cooled crystals will start to appear at 48 ^{o}C (when maximum solubility is 80 g per 100 g of water). If it is further cooled to 40 ^{o}C (solubility 65 g per 100 g water), 80-65 = 15 g of KNO_3 crystals will precipitate out of the solution.