

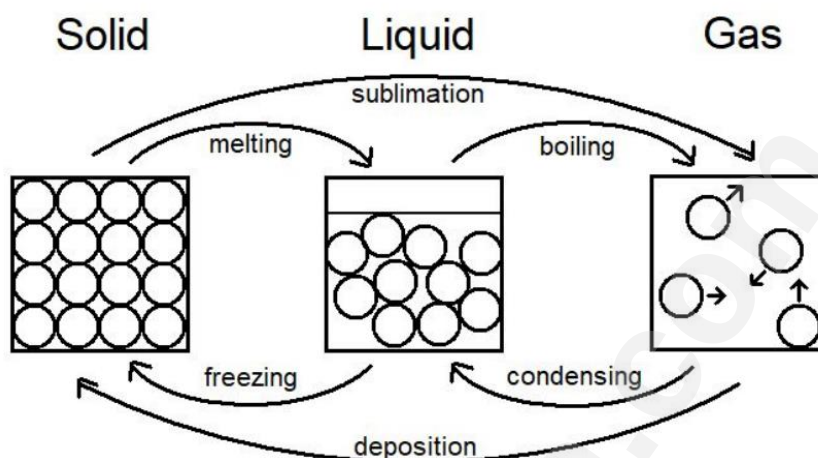


eduresourceza.com

P9 The kinetic model of matter

P9.01 States of matter

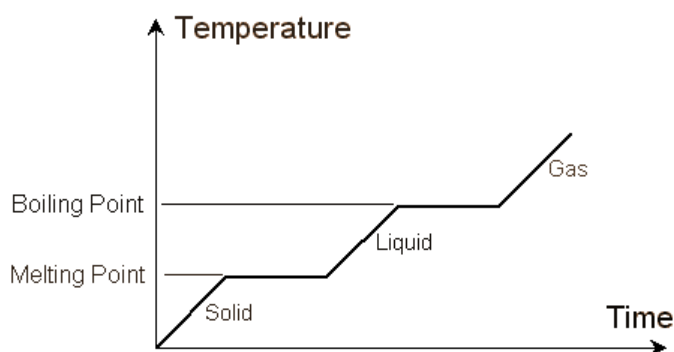
1. The three states



Solid	Liquid	Gas
Physical properties		
- Particles can vibrate about a fixed point - forces of attraction is very strong and keeps them in a fixed place.	- Particles are free to flow over each other - but the force of attraction between the particles is strong enough to keep them together	- Particles are completely free to move around wherever they want - force of attraction between particle is negligible
Cannot be compressed (there are no spaces between the particles)	Cannot be compressed (they actually can be just a little bit because of the small spaces between the particles)	Can be compressed (there are lots of spaces between particles)
Cannot be poured (unless they are in large lumps, like sand or beads, they can act to "pour")	Can be poured (because the particles can flow over each other)	Can be poured (e.g. carbon dioxide can be poured in air, because it is dense than air)
Fixed volume	Fixed volume	No fixed volume (they expand to take the volume of the container)
Shape depends on solid (Some shapes have fixed shapes (rocks) some solids have no fixed shapes (clay))	Takes the shape of the container (Liquids fill the shape of the container, and always finds horizontal level at the surface)	Takes the shape of the container (gases expand and fill the shape of the container)
Particle theory		
Forces of attraction (intermolecular bonds) are much stronger than the energy of the particles . Therefore the particles do not possess enough energy to break away from the bonds holding each other in fixed points.	Energy of the particles is greater than the forces of attraction (intermolecular bonds), so they can move around. However they do not possess enough energy to completely break away from the bonds, so they are still together.	Energy of the particles is much greater than the forces of attraction (intermolecular bonds), so the particles are completely free to move around wherever they can.
Forces of attraction >>> Energy of particles	Energy of particles > Forces of attraction	Energy of particles >>> Forces of attraction

State	Size	shape
solid	Occupies a fixed volume	Has a fixed shape
liquid	Occupies a fixed volume	Takes the shape of container
gas	Expands to fill container	Takes the shape of container

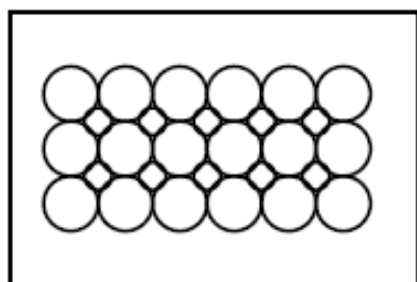
2. Changes of state



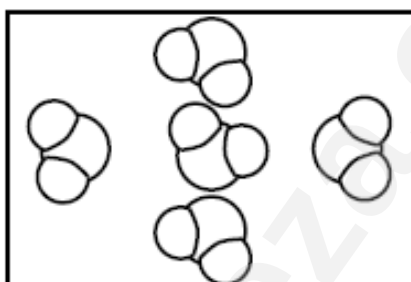
- Melting point - solid to liquid
- Boiling point - liquid to gas
- They are constant in **pure substances**

P9.02 the kinetic model of matter

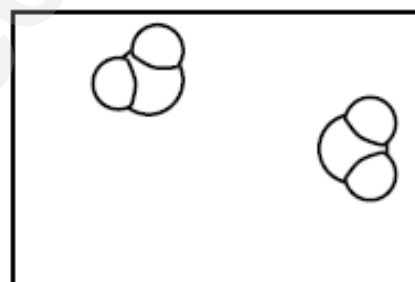
Kinetic model of matter



solid



liquid

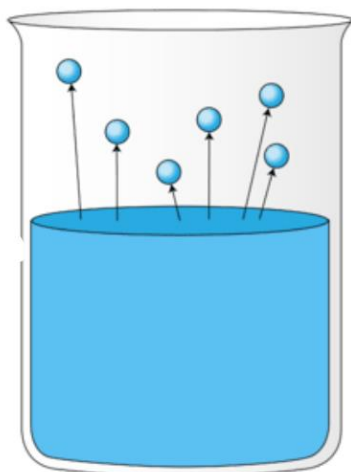


gas

State	Arrangement of particles	Movement of particles
solid	Particles are packed closely together	Particles can't move around → retain their position They move a bit - vibrate in fixed position Hotter the solid, the more they vibrate
Liquid	Particles are packed slightly less closely More disorderly	Particles can move around within the liquid Particles can vibrate Move from place to place → Take up the shape of container
Gas	Particles are widely separated No longer in contact, unless collision	bounce off another and the wall of the container Particles move freely → Take up the shape of container They can diffuse from place to place → perfume

- Most solids expand when they melt - particles are slightly further apart
- Liquids expand a lot when they boil - particles are much further apart

1. Evaporation



- More higher temperature, more quickly evaporates
- At top - some particles move faster enough to escape
- They vapour
- Continues, evaporates at all
- Only particles with high energy evaporate, water is cooler

2. Evidence for kinetic model

Brownian motion

- moving particles are constantly buffeted by the fast-moving particles of the air

P9.03 Forces and the kinetic theory

Attractive force: force which holds the particles together

- Bonds between the particles
- The power of bonding gets weaker from solid to gas

1. Kinetic theory and change of state

Why temperature remains during b.p and m.p

- More vibrate and vibrate
- Energy should be used to **break the bonds**

2. More about evaporation

Observation	Explanation
A liquid evaporates more rapidly when hotter	Higher temperature, more liquid particles moves fast enough to escape from the surface
A liquid evaporates more quickly when it's spread out	Have greater surface area, more particles are close to the surface, so escape more easily
A liquid evaporates more quickly when wind blows	When particles escape, they are blown away so that they can't fall back into the water

P9.04 Gases and the kinetic theory

More **mass** → more pressure

- More mass - more density because volume is constant
 - Volume of the gas = volume of box
- Particles are more colliding with the walls

High **temperature** - more faster particles moves - more pressure

- High temperature = more kinetic energy

1. Compressing a gas

Volume of box decreases- pressure increases

- Particles collide with the walls more frequently

- Halved volume → doubled pressure

2. High-speed collisions

- High-speed molecule collides with walls, everything
- Bounce off every surface, change direction
- Each molecule exerts tiny force
- Tiny force exerts large force - air pressure

eduresourceza.com