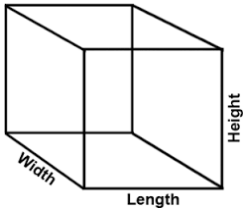
SCIENCE KNOWLEDGE ORGANISER
Year 9 Density and Changes of state

Key term	Definition
Density	Mass per unit volume
Melting	Change of state from solid to liquid
Freezing	Change of state from liquid to solid
Boiling	Change of state from liquid to gas
Evaporating	Change of state from liquid to gas not at the boiling point
Condensing	Change of state from gas to liquid
Sublimating	Change of state from solid to gas or gas to solid
Internal Energy	Sum of kinetic and potential energy or particles
Specific Heat Capacity	The energy required to raise the temperature of 1kg of a substance by 1°C
Specific Latent Heat of Fusion	The energy required to change the state of 1kg of a material from solid to liquid with no change in temperature
Specific	The energy required to

Density

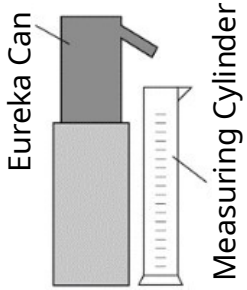
$$Density = \frac{mass}{volume}$$

Measured in kg/m^3
Or g/cm^3



Measuring density of a regular object

1. Measure the mass of the object using a mass balance
2. Measure the length, width and height of the object using a ruler
3. Volume = length x width x height
4. Density = mass / volume

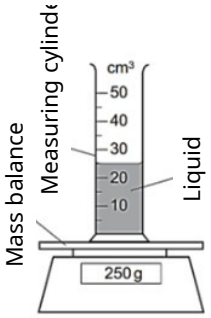


Measuring density of an irregular object

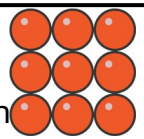
1. Measure the mass of the object using a mass balance
2. Fill a eureka can with water to the top then place a measuring cylinder under the spout
3. Place the object into the water without splashing
4. Measure the volume displaced using the measuring cylinder
5. Volume displaced = volume of object
6. Density = mass / volume

Measuring density of a liquid

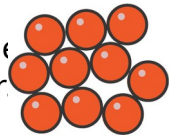
1. Measure the mass of a measuring cylinder using a mass balance
2. Measure out 100cm^3 of liquid using the measuring cylinder
3. Measure the mass of the measuring cylinder containing the liquid
4. The difference in mass is the mass of the liquid
5. Density = mass / volume



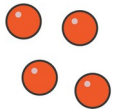
Solids
Particles are regularly arranged.
Particles vibrate around fixed position



Liquids
Particles are irregularly arrange
Particles move over each other



Gases
Particles are randomly arranged.
Particles move in random directions with a range of speeds

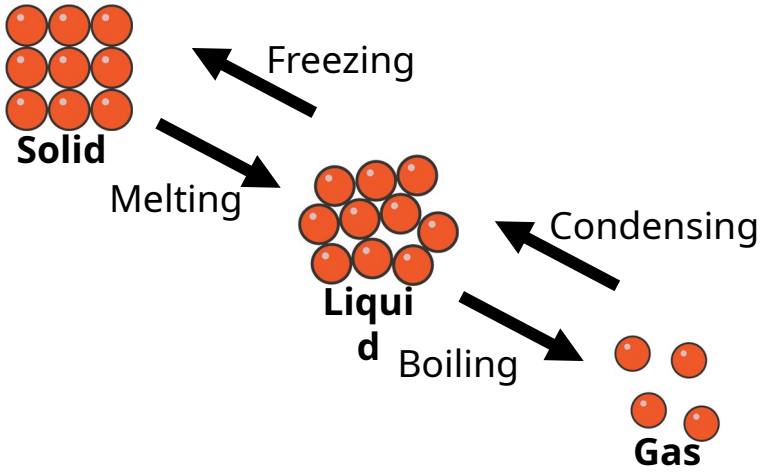


Solids – very strong forces of attraction between particles.

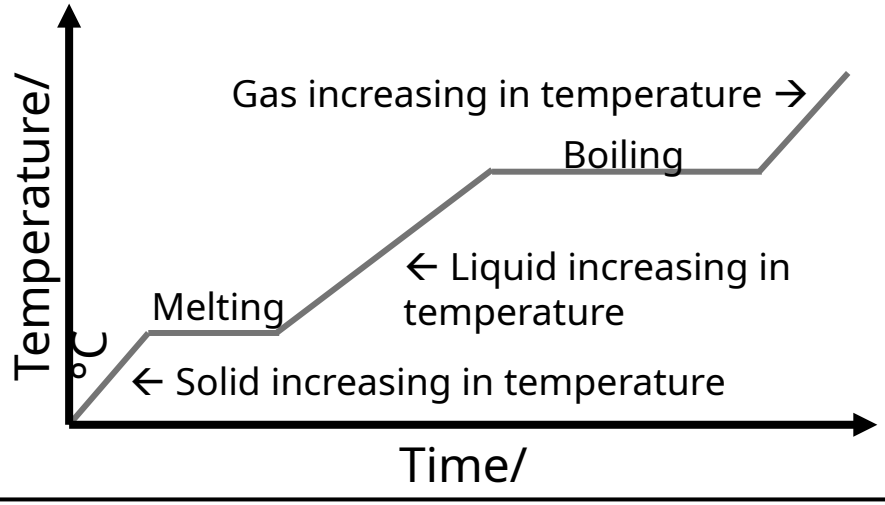
Liquids – strong forces of attraction between particles

Gas – weak forces of attraction between particles

Changing state



Changing state graph



Internal energy

$$Internal\ energy = kinetic\ energy + potential\ energy\ of\ all\ particles$$

Kinetic energy links with temperature

- The higher the temperature, the higher the kinetic energy of the particles.

Potential energy links with state

- Particles in gases have the highest potential energy. Particles in solids have the lowest potential energy.

Internal energy and heating

Increasing in temperature

- Internal energy increases because the temperature is increasing so kinetic energy increases

Changing state by heating

- Internal energy increases because the state changes so the potential energy increases

Specific heat capacity – changing temperature

$$Change\ in\ thermal\ energy = mass \times specific\ heat\ capacity \times temperature\ change$$

Specific latent heat – changing state

$$Thermal\ energy\ for\ a\ change\ of\ state = mass \times specific\ latent\ heat$$

Fusion – changing from solid to liquid

Vaporisation – changing from liquid to gas