

# P3 Knowledge Organiser – 4.3.1 – Particle model

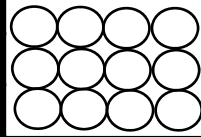


Quantity	Symbol	Unit
Density	$\rho$	kg/m <sup>3</sup>
Mass	$m$	kg
Volume	$V$	m <sup>3</sup>
Change in Thermal Energy	$\Delta E$	J
Specific Heat Capacity	$c$	J/kg°C
Temperature Change	$\Delta\theta$	°C
Energy	$E$	J
Specific Latent Heat	$L$	J/kg
Pressure	$p$	Pa
Volume	$V$	m <sup>3</sup>
Constant	<i>constant</i>	

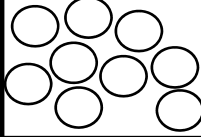
## Internal Energy

- Is the energy that is **stored inside a system**.
- Internal energy is the **total kinetic and potential energy** of all the particles
- When heated, the energy stored by the particles increases.
- This will **raise the temperature of the system or will cause a change in state**.

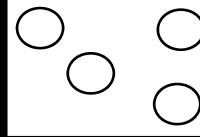
## Solids



## Liquids



## Gases



## Particle Motion in Gases

- The **temperature of the gas is related to the average kinetic energy** of the molecules.
- Changing the temperature of a gas, changes the pressure exerted by the gas.
- The **pressure of a gas on a solid surface is caused by the impact** of the gas particles with the surface.
- When a **gas is heated the particles gain kinetic energy** and so pressure increases.

## Particles in a Liquid

- **Weaker forces of attraction** between the particles
- Not held together in a regular structure,
- **When heated**, particles obtain enough energy to **break forces of attraction and become a gas**.

## Particles in a Solid

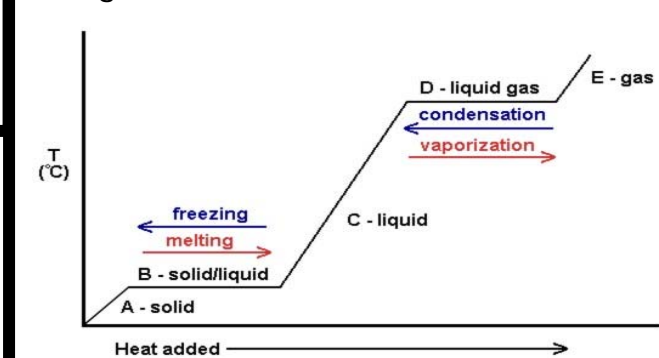
- Particles are arranged in a **regular structure**.
- There are **strong forces of attraction** between the particles and they **vibrate about fixed positions**.
- When heated, **particles energy increases and vibrate more**.
- If the solid is heated up enough, it will melt.

## Temperature Change

The specific heat capacity of a substance is the amount of energy required to raise the temperature of 1kg of the substance by 1°C

$$\text{Change in Thermal Energy} = \text{Mass} \times \text{Specific Heat Capacity} \times \text{Temperature Change}$$

## Changes in State



## Pressure in gases (TRIPLE)

Increasing the volume of a gas, at a constant temperature, leads to a decrease in pressure

$$\text{Constant} = \text{Pressure} \times \text{Volume}$$

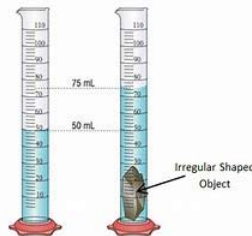
## Density

Density is the measure of the mass per unit volume of a substance.

$$\text{Density} = \text{Mass/Volume}$$

## Measuring the Density of a Solid Object

For an irregular shaped object lower it into a measuring cylinder partly filled with water and record the displacement. This is the volume.



## Changes of Heat and Specific Latent Heat

- The specific latent heat of a substance is the amount of **energy required to change the state of one kilogram of the substance with no change in temperature**
- **energy for a change of state = mass × specific latent heat**
- **Specific latent heat of fusion is the change of state from solid to liquid**
- **Specific latent heat of vaporisation is the change of state from liquid to vapour.**

## Increasing the Pressure of Gases (TRIPLE)

Doing work on a gas increases internal energy of the gas and causes an increase in temperature. E.G. if a tyre is inflated with a pump there would be work done so the internal energy of the gas increases which causes an increase of the temperature of the gas.