



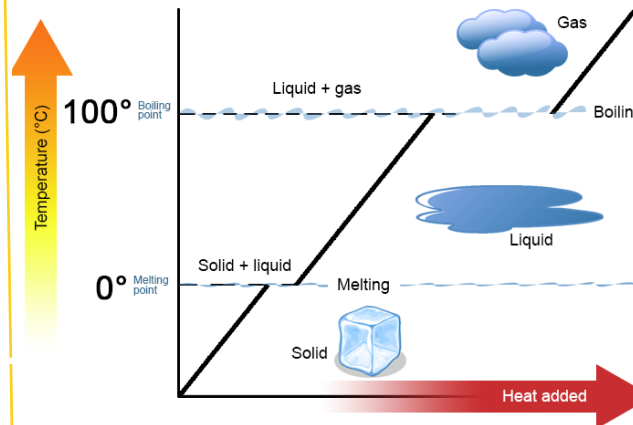
- 1 **The three states of matter are solid, liquid and gas.**
- 2 In **solids** the **forces of attraction** hold particles close together, the particles vibrate but cannot move freely. Solids have a fixed shape, do not flow and usually cannot be **compressed**.
- 3 In **liquids** the **forces of attraction** between particles is less than solids, the particles are free to move and can **flow**. Liquids take the shape of their container but usually cannot be **compressed**.
- 4 In gases the particles are far apart and moving very fast. The forces of attraction between particles is very small. Gases are **compressible** and expand to fill their container.
- 5 A **change of state** is where a substance changes the arrangement of particles e.g. solid to a liquid. Mass is **conserved**. This is **physical change** that can easily reversed.
- 6 Density (ρ) is the mass of substance (number of particles) in a given volume. Units are Kg/m^3 . Solids are usually denser than liquids.
- 7 Energy transferred to a substance is stored in the movement of the particles, called **thermal energy**.
- 8 **Temperature** is a measure of how fast particles move in a substance.
- 9 The amount of **thermal energy stored** in an object depends on its temperature, mass and the material it is made from. **Specific heat capacity (c)** is the amount of energy it takes to increase the Temperature of 1kg of the substance by 1°C .
- 10 **Heating curves** show temperature changes over time. Where the temperature stays constant the energy being given to the substance is being used to overcome the forces between particles.
- 11 Flat parts (**plateaux**) of a heating curve show a **change of state** occurring.

Specific heat capacity. The specific heat capacity of a substance is a measure of how much heat energy it can hold

$$\text{Energy} = \text{Mass} \times \text{Spec. Heat Capacity} \times \text{Temp. Change}$$

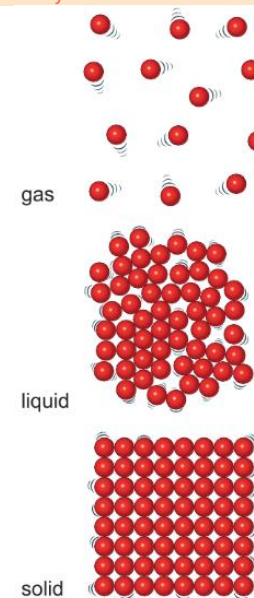
Specific Latent Heat is the energy needed for a specific substance to change state

$$\text{Energy} = \text{Mass} \times \text{Specific Latent Heat}$$



$$\rho = \frac{m}{V}$$

density = mass / volume



- 16 **Specific latent heat** is the energy taken to make 1Kg of substance change state.
- 17 **Specific latent heat of melting** is the energy taken to make 1kg of solid change into liquid.
- 18 **Specific latent heat of evaporation** is the energy taken to make 1kg of liquid change into a gas.
- 19 **Temperature** of a gas is a measure of the **average kinetic energy (KE)** of the particles of a gas



1

Pressure of a gas is due to the gas particles colliding (hitting) the sides of the container.

2

Heating a gas increases the KE of the gas particles, this increases the temperature of the gas.

3

For a fixed mass of gas in a fixed volume, pressure increases when the temperature increases. As the gas particles move faster, hitting the sides of the container more, with more force.

4

Pressure is **force** per unit **area**. Its units are **pascals (Pa)** $1\text{Pa} = 1\text{Nm}^2$

5

Gas pressure decreases as the temperature of a gas decreases. **Absolute zero** is the temperature at which a gas would not exert a pressure as the particles are no longer moving. **Absolute zero = -273°C or 0 K (kelvin)**

6

The **kelvin temperature scale** measures temperatures relative to absolute zero. Convert **Celsius (C)** to **Kelvin (K)** by subtracting 273. Convert from Kelvin to degrees Celsius add 273.

7

Average kinetic energy of particles is directly proportional to the kelvin temperature of a gas.

8

Decreasing the volume of a gas (fixed mass) at a fixed temperature will increase the pressure as there will be more collisions on the sides of the container.

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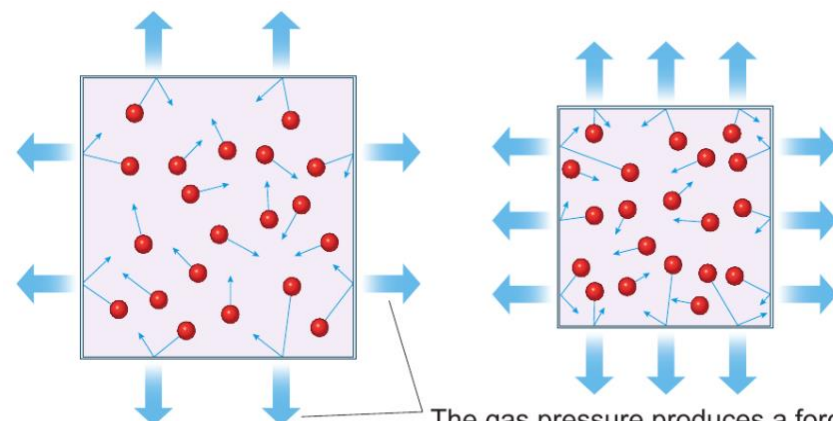
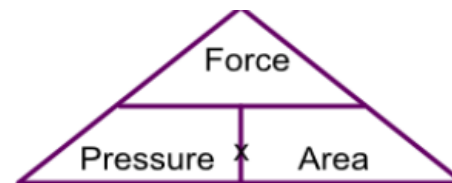
Increasing the volume of a gas (fixed mass) at a fixed temperature will decrease the pressure.

11

To calculate the pressure or volume for gases of fixed mass at constant temperature we use: $P_1 \times V_1 = P_2 \times V_2$ P =pressure V = Volume

12

When force is transferring energy to a gas e.g. using a bicycle pump, the energy is called **work done**. The energy transferred increases the energy of gas particles so increases the temperature of the gas. (the temperature of bicycle pump will go up as it is used).



The gas pressure produces a force at right angles to the sides of the container.

