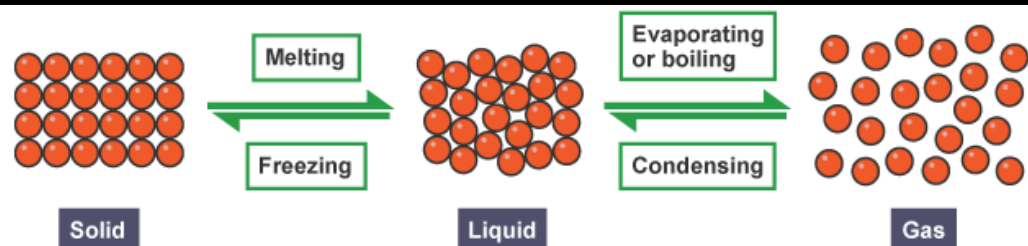


P3 Changes of state and the particle model

Section 1: Equations

Equation	Symbol equation	Units
Density = $\frac{\text{mass}}{\text{volume}}$	$\rho = \frac{m}{V}$	Density, ρ , kilograms per metre cubed, kg/m^3 Mass, m , kilograms, kg Volume, V , metre cubed, m^3
Change in thermal energy = mass x specific heat capacity x temperature change	$\Delta E = m c \Delta \theta$ The specific heat capacity of a substance is the amount of energy required to raise the temperature of one kilogram of the substance by one degree Celsius.	Change in thermal energy, ΔE , joules, J Mass, m , kilograms, kg Specific heat capacity, c , joules per kilogram per degree Celsius, $\text{J/kg } ^\circ\text{C}$ Temperature change, $\Delta \theta$, degrees Celsius, $^\circ\text{C}$
Energy for a change of state = mass x specific latent heat	$E = m L$	Energy, E , joules, J Mass, m , kilograms, kg Specific latent heat, L , joules per kilogram, J/kg Specific latent heat of fusion—change of state from solid to liquid Specific latent heat of vaporisation—change of state from liquid to vapour.

Section 2: States of matter



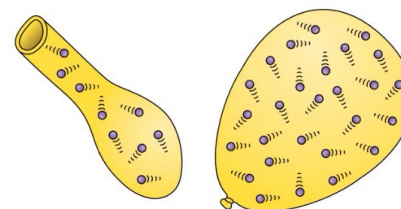
Changes of state are physical changes; the change does not produce a new substance. If the change is reversed the substance recovers its original properties.

Energy is stored inside a system by the particles (atoms and molecules) that make up the system. This is called internal energy. Internal energy is the total kinetic energy and potential energy of all the particles (atoms and molecules) that make up a system. Heating changes the energy stored within the system by increasing the energy of the particles that make up the system, either the temperature of the system increases or changes of state happen.

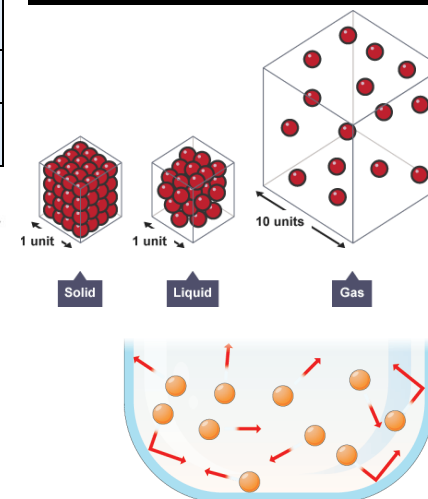
Gas laws

Pressure	↑	Temperature	↑
Pressure	↑	Volume	↓
Volume	↑	Temperature	↑

Why do balloons get bigger as you blow them up? When you blow up a balloon, you are filling it with air particles. The more air particles you add, the bigger the balloon.



Section 3: Gas laws, pressure and density



▲ The more particles you blow into a balloon, the bigger the balloon.