Density:

Mass per unit volume (a measure of the 'compactness' of a substance)

$$\text{density } (\text{g/cm}^3) = \frac{\text{mass (g)}}{\text{volume } (\text{cm}^3)}$$

Density depends on: material & particle arrangement

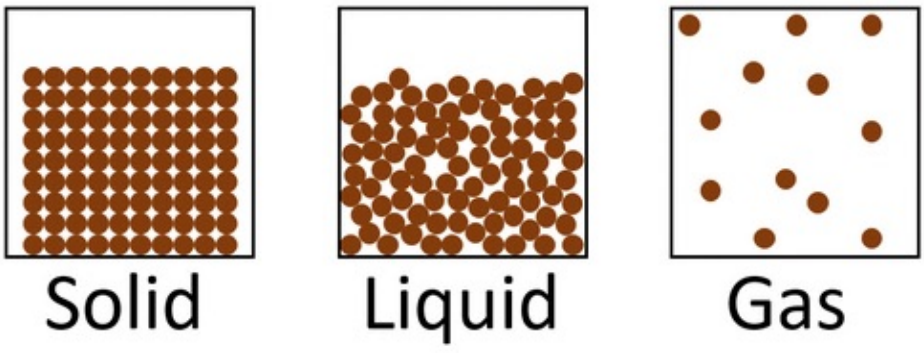
3 states of matter:

Solids: particles vibrate, have strong intermolecular forces = rigid structure, highest density (particles are compressed)

Liquids: move randomly, weak intermolecular forces = irregular structure, less dense

Gases: random movement, no intermolecular forces = move rapidly in all directions, low density

Material is compressed = particles are close together = high density



Internal energy:

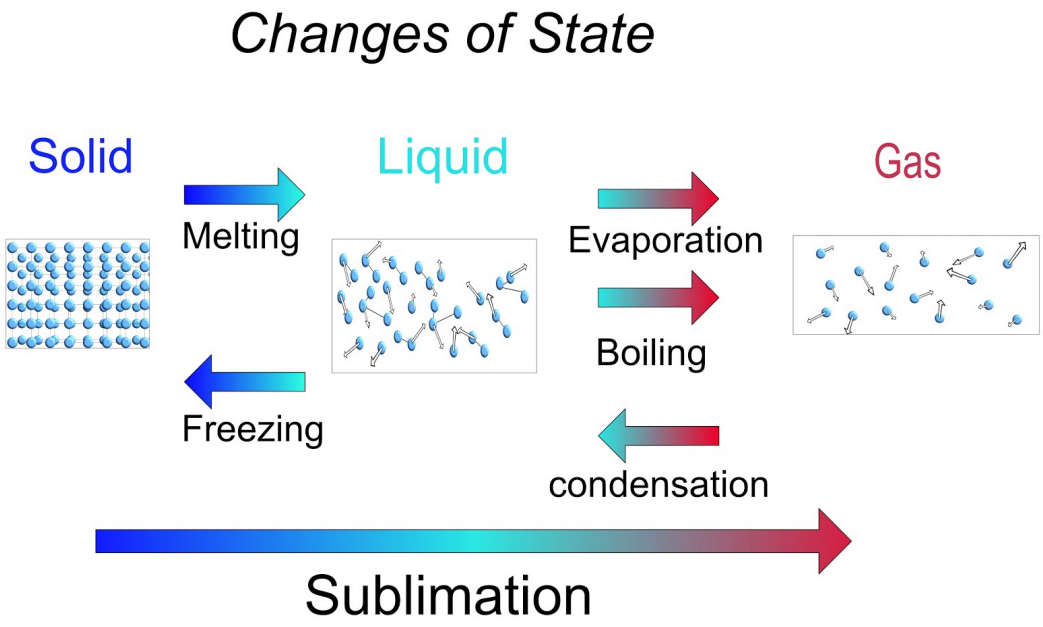
The total energy of potential & kinetic energy stores of particles

Heating a system = particles gain kinetic energy = particles have higher potential energy = change in temp or state

Changes of state:

Physical (so reversible) reactions = can revert to original properties
Number of particles doesn't change = mass is conserved

When changes of state occur, energy isn't used to raise the temp anymore, but rather to break the bonds of the substance!



Specific latent heat:

The energy needed to change the state of 1kg of substance WITHOUT changing its temperature

Cooling = energy released

Specific latent heat of fusion: melting & freezing
Specific latent heat of vaporisation: evaporating, boing & condensing

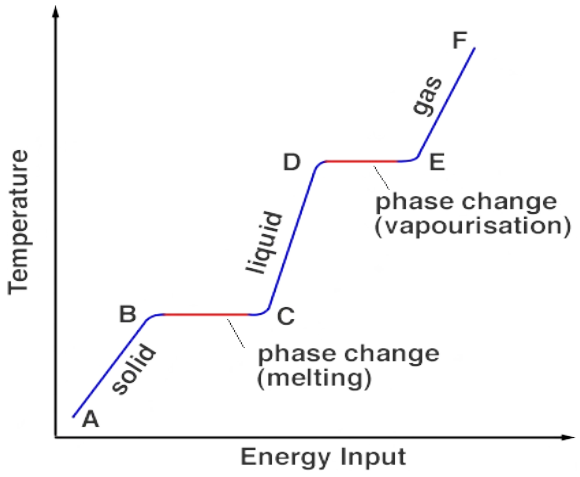
Energy = mass x specific latent heat

J kg J/kg

$$E = mL$$

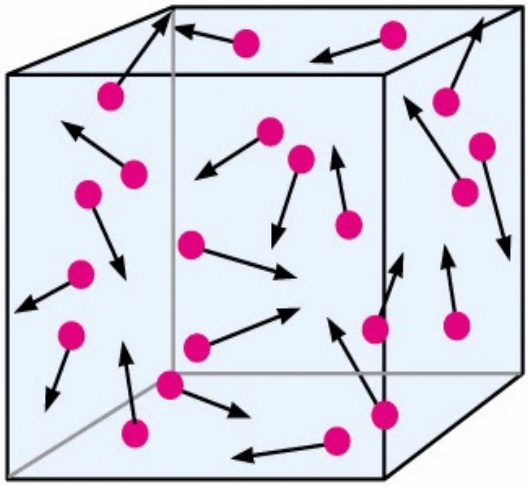
At melting/boiling point, internal energy is still increasing but energy is used to break the bonds instead of to raise the temperature

Condensing & freezing: bonds are formed = energy is released (internal energy decreases but temp doesn't decrease until all the substance has turned into a liquid/solid)



Particle motion in gases:

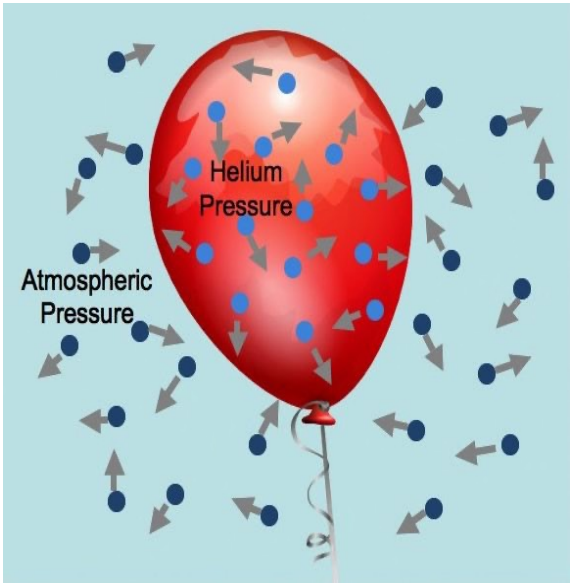
Increasing thermal energy & decreasing the volume of a sealed container = increases kinetic energy = faster particle collisions in random directions = higher pressure exerted on container's walls



Volume decreases = Pressure increases (inversely proportional for a fixed mass of gas at a constant temp)

Changes in pressure can cause changes in volume:

The pressure of a gas causes a net outwards force at right angles to the surface of its container
An outside force is caused by gas around the object
A balloon can compress/expand due to the overall force



E.g. a ballon is released -> it rises -> outwards pressure decreases (with height) -> ballon expands till the inside pressure of the ballon = the outside pressure

Transferring energy by applying a force = doing work
Causes an increase in internal energy & temperature

Bike pump: gas puts pressure on the plunger = a force is exerted mechanically (work is done against the force to push the plunger down)

Energy is transferred from the kinetic energy stores of the gas particles so temp increases