Particles and density

State	Particle arrangement	Movement	Properties
Solid	***Packed in a regular structure. Strong forces of attraction hold in place so cannot move.***	Particles don't have a lot of energy in KE store and vibrate around a fixed position.	Difficult to change shape.
Liquid	***Close together, weak forces of attraction keep contact and form irregular arrangements.***	Particles have more energy in KE store and move in random directions at low speeds.	Can change shape but difficult to compress.
Gas	***Almost no forces of attraction so separated by large distances, free to move***	Particles have more energy in KE store and move in random directions at high speeds.	Can expand to fill a space, easy to compress.

Solids	***High density***	Particles very close together – a lot of mass in a given volume.
Liquids	***Less dense***	Fewer particles - less mass in a given volume.
Gases	***Low density***	Even fewer particles – even less mass in a given volume.

$P = m \div V$

Density = mass ÷ volume.

Density	***Mass of a substance in a given volume***

Core Practical	***Investigate density of solids and liquids***	Regular solid shapes – measure dimensions with a rule and work out volume.
		Irregular solid shapes – use a Eureka can to measure the volume of displaced water.
		Liquids - use a measuring cylinder on a balance and measure the mass of a certain volume.

EDEXCEL Topic 14 PARTICLE MODEL

PHYSICS ONLY

Temperature, pressure and Volume

Calculate pressure of volume of gases of a fixed mass at a constant temperature.

$P_1V_1 = P_2V_2$

PHYSICS HIGHER ONLY

Doing work on a gas, increases the temperature

Pump air quickly into a ball, the air gets hot because as the piston in the pump moves the particles bounce off increasing kinetic energy, which causes a temperature rise.

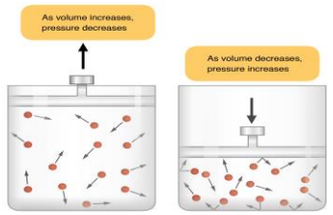
Reducing the volume of a fixed mass of gas increases the pressure.

Halving the volume doubles the pressure.

Reducing the volume of a gas at a fixed temperature, increases pressure. (Less space so particles collisions occur more frequently and with more force).

Decrease pressure, gases are expanded.

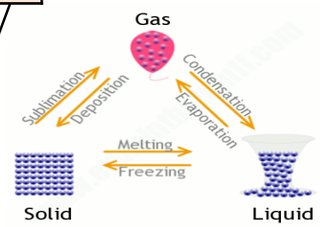
Increase pressure, gases are compressed.



Pressure is a net force per unit area, when particles collide a pressure is exerted.

When particles collide with a surface, a force is exerted. This is a resultant force at right angles to the surface.

Gas particles are in a constant state of random motion.



Freezing	Liquid turns to a solid. Internal energy decreases.
Melting	Solid turns to a liquid. Internal energy increases.
Boiling / Evaporating	Liquid turns to a gas. Internal energy increases.
Condensation	Gas turns to a liquid. Internal energy decreases.
Sublimation	Solid turns directly into a gas. Internal energy increases.

Energy and Changes of state

Absolute zero	***-273K***	Very little energy in kinetic energy store. Particles do not move.

Convert between kelvin and Celsius +273.

Convert between Celsius and kelvin -273.

Internal energy	***Energy stored inside a system by particles***	The more energy particles have in their kinetic energy store, the faster the particles move.
		Particles also have energy in their potential energy store due to their positions. The more energy they have the further the particles are away from each other.

Adding thermal energy	***Heating and, increases the thermal energy store of the system. The more energy in this store, the hotter it is.***	Heating causes a change in state. As particles separate, potential energy stored increases. Heating increases the temperature of a system. Particles move faster so kinetic energy of particles increases.

To reduce thermal transfer, (make more accurate) use insulation.

$\Delta E = m \times c \times \Delta\theta$

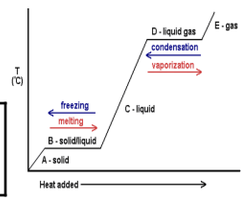
Change in thermal energy = mass **X** specific heat capacity **X** temperature change.

Specific Heat Capacity	***Energy needed to raise 1kg of substance by 1°C***	Depends on: • Mass of substance • What the substance is • Energy put into the system.

Core Practical	***Investigate properties of water (SHC)***	Measure mass of water, measure initial temperature of water, turn on power and start stopwatch. After certain temperature rise , stop stopwatch.

Energy needed = mass **X** specific latent heat.

$\Delta E = m \times L$



Specific Latent Heat	***Energy needed to change 1kg of a substance's state***

Specific Latent Heat of Fusion	***Energy needed to change 1kg of solid into 1 kg of liquid at the same temperature***

Specific Latent Heat of Vaporisation	***Energy needed to change 1kg of liquid into 1 kg of gas at the same temperature***

Conservation of mass	When substances change state, mass is conserved.
Physical change	No new substance is made, process can be reversed.

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Particles and density

	Particle arrangement	Movement	Properties
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EDEXCEL Topic 14 PARTICLE MODEL

PHYSICS ONLY

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PHYSICS HIGHER ONLY

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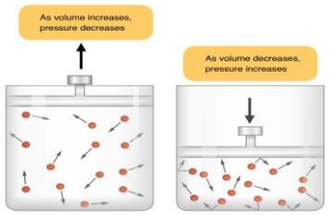

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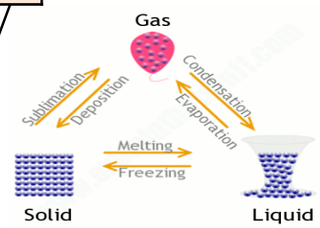
Energy and Changes of state



	-273K	Very little energy in kinetic energy store. Particles do not move.

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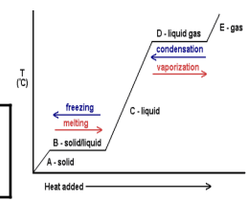


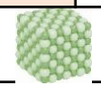
	Energy needed to change 1kg of a substance's state
	Energy needed to change 1kg of solid into 1 kg of liquid at the same temperature
	Energy needed to change 1kg of liquid into 1 kg of gas at the same temperature

EDEXCEL Topic 14 PARTICLE MODEL

Particles and density

State	*Particle arrangement*	Movement	Properties
Solid			
Liquid			
Gas			

Solids		
Liquids		
Gases		



P = m ÷ V

Density

Core Practical

PHYSICS ONLY

Temperature, pressure and Volume

Calculate pressure of volume of gases

P_1V_1

PHYSICS HIGHER ONLY

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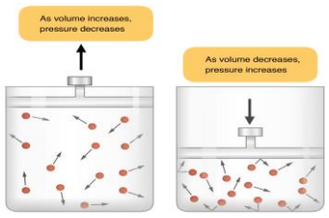

Pressure is

When particles collide

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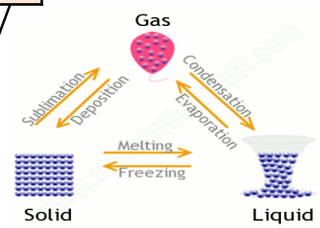
Energy and Changes of state



Freezing	
Melting	
Boiling / Evaporating	
Condensation	
Sublimation	

Absolute zero

+273.

-273.

Internal energy

The more energy particles

Adding thermal energy

Heating causes a change in state.

To reduce thermal transfer

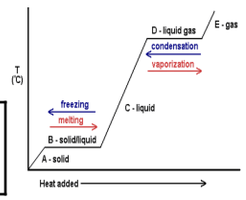
Specific Heat Capacity

Core Practical

ΔE= m **X c X** Δθ

ΔE= m X L

Specific Latent Heat



Specific Latent Heat of Fusion

Specific Latent Heat of Vaporisation

Conservation of mass	
Physical change	

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PHYSICS HIGHER ONLY

PHYSICS ONLY

PHYSICS ONLY

Particles and density

EDEXCEL Topic 14 PARTICLE MODEL

Temperature, pressure and Volume

Energy and Changes of state