Revision Guide

AQA GSCE Triple Physics Paper 1 Higher

Name: Class:

@SinclairEducation

10 Minutes on....

Energy Stores and Systems

Key Term	Definition
System	An object or group of objects.

Energy Store	Description
Magnetic	The energy stored when attracting poles are pulled apart or when repelling poles are pushed together.
Internal	The total kinetic and potential energy of the particles in an object.
Chemical	The energy stored in chemical bonds.
Kinetic	Energy of a moving object.
Electrostatic	The energy stored when repelling charges have been moved closer together or when attracting charges have been pulled further apart.
Elastic Potential	The energy stored when an object is stretched or compressed.
Gravitational Potential	The energy stored in an object a height.
Nuclear	The energy stored in the nucleus of an atom.

10 Minutes on....

Kinetic Energy 1

Key Term	Definition
Kinetic Energy	Energy of a moving object.

Quantity	Symbol	Unit
Kinetic Energy	E_k	J
Mass	m	kg
Speed	v	m/s

Equation that links kinetic energy, mass and speed.

Kinetic Energy = 0.5 x mass x (speed)^2

Calculate kinetic energy when...	Mass is 67kg and speed is 5m/s	Mass is 1.2kg and speed is 25m/s	Mass is 57g and speed is 2.5m/s	Mass is 850g and speed is 5m/s
Convert Units	-	-	57g = 0.057kg	850g = 0.85kg
Write down the formula to be used.	E_k= 0.5 x m x v^2	E_k= 0.5 x m x v^2	E_k= 0.5 x m x v^2	E_k= 0.5 x m x v^2
Substitute Values	E_k= 0.5 x 67 x 5^2	E_k= 0.5 x 1.2 x 25^2	E_k= 0.5 x 0.057 x 2.5^2	E_k= 0.5 x 0.85 x 5^2
Do the Maths	E_k= 837.5	E_k= 375	E_k= 0.178125	E_k= 10.625
Round and add units.	E_k= 837.5J	E_k= 375J	E_k= 0.19J	E_k= 10.6J

10 Minutes on....

Kinetic Energy 2

Calculate mass when...	Speed is 5m/s and K.E is 82J	Speed is 5m/s and K.E is 2.5KJ	Speed is 8m/s and K.E is 7.1KJ	Speed is 12.5m/s and K.E is 17KJ
Convert Units	-	2.5kJ = 2500J	7.1kJ = 7100J	17kJ = 17,000J
Write down the formula to be used.	E_k= 0.5 x m x v^2	E_k= 0.5 x m x v^2	E_k= 0.5 x m x v^2	E_k= 0.5 x m x v^2
Substitute Values	82 = 0.5 x m x 5^2	2500 = 0.5xmx5^2	7100 = 0.5 x m x 8^2	17000= 0.5 x m x 12.5^2
Rearrange	82 = 12.5m 82/12.5 = m	2500 = 12.5m 2500 / 12.5 = m	7100 = 32m 7100/32 = m	17000 = 78.125m 17000/78.125 = m
Answer	6.56	200	221.875	217.6
Round and add units.	m= 6.56kg	m = 200kg	m = 221.9kg	m = 217.6kg

Calculate speed when...	K.E is 82J and mass is 1.2kg	K.E is 2.5KJ and mass is 3kg	K.E is 8.1kJ and mass is 18kg	K.E is 90J and mass is 541g
Convert Units	-	2.5kJ = 2500J	8.1kJ = 8100J	541g = 0.541kg
Write down the formula to be used.	E_k= 0.5 x m x v^2	E_k= 0.5 x m x v^2	E_k= 0.5 x m x v^2	E_k= 0.5 x m x v^2
Substitute Values	82 = 0.5 x 1.2 x v^2	2500 = 0.5 x 3 x v^2	8100 = 0.5 x 18 x v^2	90= 0.5 x 0.541 x v^2
Rearrange	82 = 0.6v^2 82/0.6 = v^2	2500 = 1.5v^2 2500 / 1.5 = v^2	8100 = 9v^2 8100/9 = v^2	90 = 0.2705v^2 90/0.2705 = v^2
Answer	136.6667= v^2 v =11.6904519	1,666.6667= v^2 v =40.824829	900 = v^2 v =30	332.7171904= v^2 v =18.240537
Round and add units.	v = 11.7m/s	v = 40.8m/s	v = 30 m/s	v = 18.2m/s

10 Minutes on....

Elastic Potential Energy 1

Key Term	Definition
Elastic Potential	The energy stored when an object is stretched or compressed.

Quantity	Symbol	Unit
Elastic Potential Energy	E_e	J
Spring Constant	k	N/m
Extension	e	m

Equation that links elastic potential, extension and spring constant.

Elastic Potential Energy = 0.5 x spring constant x (extension)^2

Calculate elastic potential energy when...	Spring constant is 2N/m and extension is 3.2m	Spring constant is 7.8N/m and extension is 4.2m	Spring constant is 2N/m and extension is 38cm	Spring constant is 122N/m and extension is 98mm
Convert Units	-	-	38cm = 0.38m	98mm = 0.098m
Write down the formula to be used.	E_e= 0.5 x k x e^2	E_e= 0.5 x k x e^2	E_e= 0.5 x k x e^2	E_e= 0.5 x k x e^2
Substitute Values	E_e= 0.5 x 2 x 3.2^2	E_e= 0.5 x 7.8 x 4.2^2	E_e= 0.5 x 2 x 0.38^2	E_e= 0.5 x 122 x 0.098^2
Do the Maths	E_e= 10.24	E_e= 68.796	E_e= 0.1444	E_e= 0.585844
Round and add units.	E_e= 10.2J	E_e= 68.8J	E_e= 0.14J	E_e=0.585J

10 Minutes on....

Elastic Potential Energy 2

Calculate spring constant when...	E.P.E is 100J and extension is 1.2m	E.P.E is 100J and extension is 32cm	E.P.E is 1.8kJ and extension is 2.8m	E.P.E is 1.9KJ and extension is 92cm
Convert Units	-	32cm = 0.32m	1.8kJ = 1800J	1.9kJ = 1900 92cm = 0.92m
Write down the formula.	E_e= 0.5 x k x e^2	E_e= 0.5 x k x e^2	E_e= 0.5 x k x e^2	E_e= 0.5 x k x e^2
Substitute Values	100 = 0.5 x k x 1.2^2	100 = 0.5 x k x 0.32^2	1800 = 0.5 x k x 2.8^2	1900= 0.5 x k x 0.92^2
Rearrange	100 = 0.72k 100 / 0.72 = k	100 = 0.0512k 100 / 0.0512 = k	1800 = 3.92k 1800 / 3.92 = k	1900 = 0.4232k 1900 / 0.4232 = k
Answer	138.8888888889	1,953.125	459.1836734694	4,489.603025
Round and add units.	k= 139N/m	k = 1953N/m	k = 459N/m	k = 4490N/m

Calculate extension when...	E.P.E is 100J and spring constant is 2N/m	E.P.E is 1.02kJ and spring constant is 8N/m	E.P.E is 2.8kJ and spring constant is 3.1N/m	E.P.E is 0.72kJ and spring constant is 2N/m
Convert Units	-	1.02kJ = 1020J	2.8kJ = 2800J	0.72kJ = 720J
Write down the formula.	E_e= 0.5 x k x e^2	E_e= 0.5 x k x e^2	E_e= 0.5 x k x e^2	E_e= 0.5 x k x e^2
Substitute Values	100 = 0.5 x 2 x e^2	1020 = 0.5 x 8 x e^2	2800 = 0.5 x 3.1 x e^2	720= 0.5 x 2 x e^2
Rearrange	100 = 1e^2 100/1 = e^2	1020 = 4e^2 1020 / 4 = e^2	2800 = 1.55e^2 2800 / 1.55 = e^2	720 = 1e^2 720/1 = e^2
Answer	100 = e^2 e = 10	255= e^2 e =15.9687194	1,806.451613 = e^2 e = 42.5023719	720 = e^2 e = 26.8328157
Round and add units.	e = 10m	e = 16.0m	e = 42.5m	e = 26.8m

10 Minutes on....

Gravitational Potential Energy 1

Key Term	Definition
Gravitational Potential	The energy stored in an object a height.

Quantity	Symbol	Unit
Gravitational Potential Energy	E_p	J
Mass	m	kg
Gravitational Field Strength	g	N/kg
Height	h	m

Equation that links gravitational potential energy, gravitational field strength and height.

Gravitational Potential Energy = mass x gravitational field strength x height

Calculate g.p.e when...	Mass is 67kg, gravitational field strength is 9.8 and height is 2.8m.	Mass is 15kg, gravitational field strength is 9.8 and height is 56cm.	Mass is 525g, gravitational field strength is 9.8 and height is 71m.	Mass is 871g, gravitational field strength is 9.8 and height is 121cm.
Convert Units	-	56cm = 0.56	525g = 0.525kg	871g = 0.871kg 121cm = 1.21m
Write down the formula to be used.	E_p= m x g x h	E_p= m x g x h	E_p= m x g x h	E_p= m x g x h
Substitute Values	E_p= 67 x 9.8 x 2.8	E_p= 15 x 9.8 x 0.56	E_p= 0.525 x 9.8 x 71	E_p= 0.871 x 9.8 x 1.21
Do the Maths	E_p= 2,085.44	E_p= 82.32	E_p= 365.295	E_p= 10.328318
Round and add units.	E_p= 2085J	E_p= 82J	E_p= 365J	E_p=10.3J

10 Minutes on….

Gravitational Potential Energy 2

For each of the questions below gravitational field strength is 9.81N/kg

Calculate mass when...	G.P.E is 100J and height is 1.2m	G.P.E is 100J and height is 32cm	G.P.E is 1.8kJ and height is 14cm	G.P.E is 0.19KJ and extension is 12cm
Convert Units	-	32cm = 0.32m	1.8kJ = 1800J 14cm = 0.14m	0.19kJ = 190J 12cm = 0.12m
Write down the formula.	E_p= m x g x h	E_p= m x g x h	E_p= m x g x h	E_p= m x g x h
Substitute Values	100 = m x 9.81 x 1.2	100 = m x 9.81 x 0.32	1800 = m x 9.81 x 0.14	190= m x 9.81 x 0.12
Rearrange	100 = 11.772m 100 / 11.772 = m	100 = 3.1392m 100 / 3.1392 = m	1800 = 1.3734m 1800/1.3734 = m	190 = 1.1772m 190 / 1.1772= m
Answer	8.4947332654	31.8552497452	1,310.61598951	161.3999320421
Round and add units.	m = 8.5kg	m = 31.9kg	m = 1,311kg	m = 162.4kg

Calculate height when...	GPE is 800J and mass is 67kg	GPE is 2.1kJ and mass is 93kg	GPE is 123J and mass is 12g	GPE is 0.91kJ and mass is 850g
Convert Units	-	2.1kJ = 2100J	12g = 0.012kg	0.91kJ = 910J 850g = 0.85kg
Write down the formula.	E_p= m x g x h	E_p= m x g x h	E_p= m x g x h	E_p= m x g x h
Substitute Values	800 = 67 x 9.81x h	2100 =93 x9.81x h	123 = 0.012 x 9.81 x h	910 = 0.85 x 9.81 x h
Rearrange	800 = 657.27h 800/657.27 = h	2100 = 912.33h 2100 /912.33 = h	123 = 0.11772h 123/0.11772 = h	910 = 8.3385h 910/8.3385 = h
Answer	1.2171558112	2.3017986913	1,044.852191641	109.1323379505
Round and add units.	h = 1.2m	h = 2.3m	h = 1045m	h = 109m

10 Minutes on....

Energy Changes in Systems 1

Key Term	Definition
Specific Heat Capacity	The amount of energy needed to raise the temperature of one kilogram of the substance by one degree Celsius.

Quantity	Symbol	Unit
Change in Thermal Energy	ΔE	J
Mass	m	kg
Specific Heat Capacity	c	J/kg°C
Temperature Change	$\Delta\theta$	°C

Equation that links change in thermal energy, mass, specific heat capacity and temperature change.

Change in Thermal Energy = Mass x Specific Heat Capacity

Calculate change in thermal energy when…	Mass is 67kg, SHC is 2J/kg°C and $\Delta\theta$ is 3.1°C	Mass is 15kg, SHC is 7.1J/kg°C and $\Delta\theta$ is 2.9°C	Mass is 525g, SHC is 2J/kg°C and $\Delta\theta$ is 17°C	Mass is 871g, SHC is 2J/kg°C and the temperature raises by 11°C
Convert Units	-	-	525g = 0.525kg	871g = 0.871kg
Write down the formula.	$\Delta E = m\ c\ \Delta\theta$	$\Delta E = m\ c\ \Delta\theta$	$\Delta E = m\ c\ \Delta\theta$	$\Delta E = m\ c\ \Delta\theta$
Substitute Values	ΔE = 67 x 2 x 3.1	ΔE = 15 x 7.1 x 2.9	ΔE = 0.525 x 2 x 17	ΔE = 0.871 x 2 x 11
Do the Maths	415.4	308.85	17.85	19.162
Round and add units.	ΔE = 415.4J	ΔE = 309J	ΔE = 17.9J	ΔE = 19.2J

10 Minutes on….

Energy Changes in Systems 2

For each of the questions below the substance is water with a specific heat capacity of 4182J/kg°C.

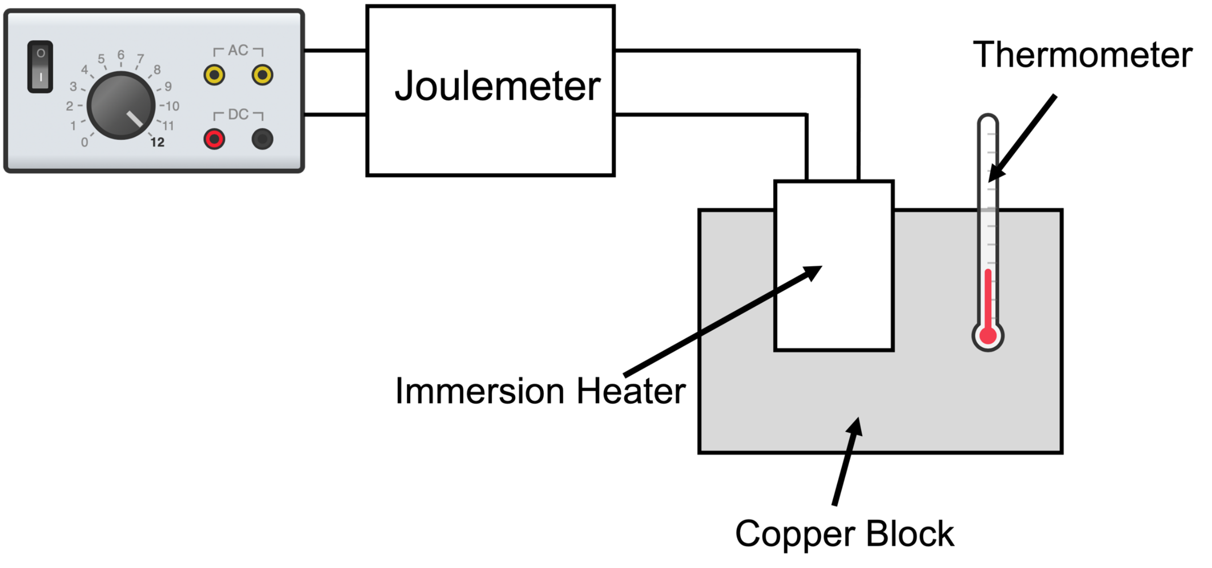
Calculate mass when…	ΔE is 100J and Δθ is 12°C	ΔE is 1.2kJ and Δθ is 9°C	ΔE is 0.91kJ and Δθ is 12°C	ΔE is 1.50kJ and Δθ is 17.8°C
Convert Units	-	1.2kJ = 1200J	0.91kJ = 910J	1.5kJ = 1500J
Write down the formula.	*ΔE = m c Δθ*	*ΔE = m c Δθ*	*ΔE = m c Δθ*	*ΔE = m c Δθ*
Substitute Values	100 = m x 4182 x 12	1200 = m x 4182 x 9	910 = m x 4182 x 12	1500 = m x 4182 x 17.8
Rearrange	100 = 50,184m 100/50184 = m	1200 = 37,638m 1200/37638 = m	1800 = 50,184m 1800/50184 = m	1500 =74439.6m 1500/74439.6 = m
Answer	0.001992666985	0.03188267177	0.03586800574	0.02015056502
Round and add units.	m = 0.00199kg	m = 0.0319kg	m = 0.0359kg	m = 0.0202kg

Calculate temp change when…	ΔE is 100J and mass is 67kg.	ΔE is 120J and mass is 31kg.	ΔE is 1.2kJ and mass is 2kg.	ΔE is 1.8kJ and mass is 51g.
Convert Units	-	-	1.2kJ = 1200J	1.8kJ = 1800J 51g = 0.051kg
Write down the formula.	*ΔE = m c Δθ*	*ΔE = m c Δθ*	*ΔE = m c Δθ*	*ΔE = m c Δθ*
Substitute Values	100 = 67 x 4182 x Δθ	120 = 31 x 4182 x Δθ	1200 = 2 x 4182 x Δθ	1800 = 0.051 x 4182 x Δθ
Rearrange	100 = 280,194Δθ 100/280194 =Δθ	120 = 129,642Δθ 120/129642 = Δθ	1200 = 8,364Δθ 1200/ 8364 = Δθ	1800 = 213.282Δθ 1800/213.282=Δθ
Answer	0.0003568955795	0.0009256259546	0.143472023	8.4395307621
Round and add units.	Δθ = 0.00036°C	Δθ = 0.00093°C	Δθ = 0.14°C	Δθ = 8.44°C

10 Minutes on....

Specific Heat Capacity RP

A method to determine the specific heat capacity of a material.



1. Measure the mass of the material by using a balance.
2. Add a heater to the block and connect this to a powerpack that is connected to a joulemeter.
3. Add a thermometer and record the start temperature.
4. Turn the powerpack on.
5. After 10 minutes turn the powerpack off, record the energy transferred and the temperature.
6. Calculate specific heat capacity of the block using formula change in thermal energy = mass × specific heat capacity × temperature change
7. Control the material and thickness of the insulation wrapped around the block.

10 Minutes on....

Power 1

Key Term	Definition
Power	The rate at which energy is transferred or the rate at which work is done.

Quantity	Symbol	Unit
Power	*P*	W
Energy Transferred	*E*	J
Time	*t*	s
Work Done	*W*	J

Equation that links energy transferred, power and time.

Power = Energy Transferred / Time

Equation that links power, time and work done.

Power = Work Done/ Time

Calculate the power when...	120J of energy is transferred in 30s	1kJ of work is done in 300s	351J of energy is transferred in 1 minute	2.5kJ of work is done in 10 minutes
Convert Units	-	1kJ = 1000	1 minute = 60s	2.5kJ = 2500J 10min = 600s
Write down the formula.	P = E / t	P = W / t	P = E / t	P = W / t
Substitute Values	P = 120 / 30	P = 1000 / 300	P = 351/60	P = 2500 / 600
Do the Maths	4	3.3333333333	5.85	4.1666666667
Round and add units.	4W	3.3W	5.85W	4.17W

10 Minutes on....

Power 2

Calculate work done when...	Power is 100W and time is 30s	Power is 250W and time is 1min	Power is 1.2kW and the time is 45s	Power is 1.4kW and the time is 3mins
Convert Units	-	1min = 60s	1.2kW = 1200W	1.4kW = 1400W 3mins = 180s
Write down the formula.	P = W / t	P = W / t	P = W / t	P = W / t
Substitute Values	100 = W / 30	250 = W / 60	1200 = W / 45	1400 = W / 180
Rearrange	W = 100 x 30	W = 250 x 60	W = 1200 x 45	W = 1400 x 180
Answer	3000	15,000	54,000	252,000
Round and add units.	3000J	15,000J	54,000J	252,000J

Calculate time when...	Power is 55W and work done is 30J.	Power is 120W and energy transferred is 2.1kJ	Power is 85W and energy transferred is 1.2kJ	Power is 1.2kW and energy transferred is 1kJ
Convert Units	-	2.1kJ = 2100J	1.2kJ = 1200	1.2kW = 1200W 1kJ = 1000J
Write down the formula.	P = W / t	P = E / t	P = E / t	P = W / t
Substitute Values	55 = 30/t	120 = 2100/t	85 = 1200/t	1200 = 1000/t
Rearrange	t = 30 / 55	t = 2100 / 120	t = 1200 / 85	t = 1000 / 1200
Answer	0.5454545455	17.5	14.1176470588	0.8333333333
Round and add units.	0.55s	17.5s	14s	0.83s

10 Minutes on....

Energy Transfers in A System

Key Term	Definition
Wasted Energy	Energy that dissipates and is stored in a less useful way.

Law for the conservation of energy.
The law of conservation of energy states that energy can be transferred usefully, stored or dissipated, but cannot be created or destroyed.

Method Of Reducing Unwanted Energy Transfers	Description
Lubrication	Friction causes surfaces to heat up which causes unwanted energy transfers. Reducing friction through the use of lubrication reduces the unwanted energy transfer as the surfaces will slide over each other more smoothly.
Thermal Insulation	Examples of insulation in the home include curtains, carpets, cavity wall insulation and draught excluders. The insulation reduces the transfer of energy.

Relationship between thermal conductivity and the rate of conduction.
The higher the thermal conductivity of a material the higher the rate of energy transfer by conduction across the material.

How the rate of cooling of a building is affected by the thickness and thermal conductivity of its walls.
The thicker the insulation within a building the slower the rate of cooling. The lower the thermal conductivity of the walls the slower the rate of cooling also. Adding cavity wall insultation reduces the conductivity of the walls.

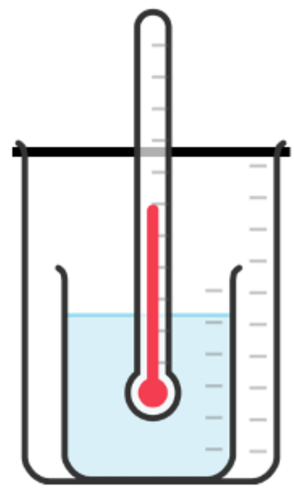
10 Minutes on....

Thermal Insulators 1 RP

A method to investigate the effectiveness of different materials as thermal insulators.

1
Boil water in a kettle and add 80cm^3 of this water to a 100cm^3 beaker.

2
Place this beaker into a larger beaker with a lid Place a thermometer through the lid.

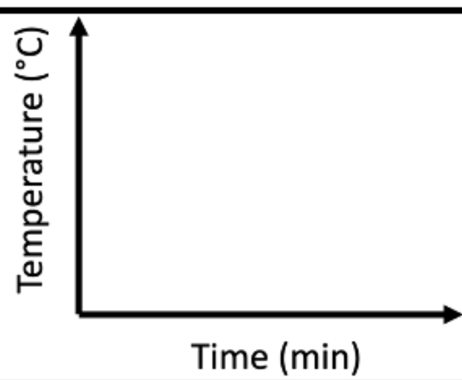


3
Record the start temperature.

4
Start the timer and record the temperature at 5, 10 , 15 and 20 minutes.

5
Repeat steps **1-4** with different materials placed in the gap between the smaller and larger beaker.

6
Plot a cooling curve of temperature against time.



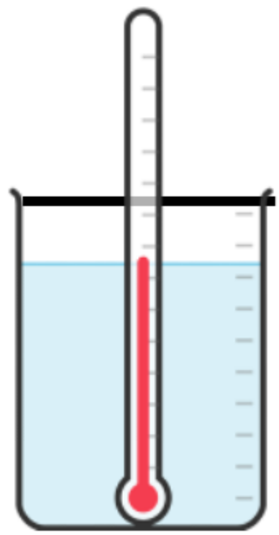
10 Minutes on….

Thermal Insulators 2 RP

A method to investigate the different factors that may affect the thermal insulation properties of a material.

1
Boil water in a kettle and add 200cm³ of this water to a 250cm³ beaker.

2
Place a thermometer through a cardboard lid.

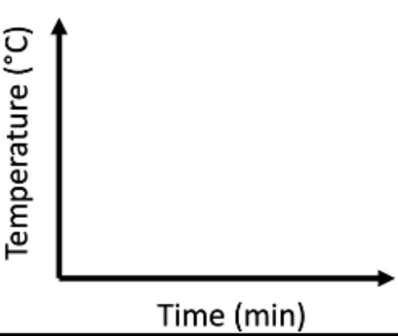


3
Record the start temperature.

4
Start the timer and record the temperature at 5, 10 , 15 and 20 minutes.

5
Repeat steps **1-4** with different number of layers of insulation held in place with elastic bands.

6
Plot a cooling curve of temperature against time.



10 Minutes on.... Efficiency

Key Term	Definition
Efficiency	The fraction of the energy supplied which is transferred in a useful form.

How to calculate efficiency.

Efficiency = Useful Energy Transferred / Total Energy Supplied

Or

Efficiency = Useful Power Transferred / Total Power Supplied

Calculate the efficiency when...	A TV transfers 58W of the 75W supplied.	1kJ of energy is supplied and 200J of energy is transferred usefully.	1.2kJ of energy is supplied and 250J of energy is transferred usefully.	A hairdryer transfers 71W of the 211W supplied.
Convert Units	-	1kJ = 1000J	1.2kJ = 1200J	-
Write down the formula.	Efficiency = Useful/Total	Efficiency = Useful/Total	Efficiency = Useful/Total	Efficiency = Useful/Total
Substitute Values	Eff = 58 / 75	Eff = 200 / 1000	Eff = 250 / 1200	Eff = 71/211
Do the Maths	0.7733333333	0.2	0.2083333333	0.336492891
Round and add units.	0.77	0.2	0.21	0.34

10 Minutes on....

Energy Resources

Key Term	Definition
Renewable	This is a resource that is replenished at the same rate as it is used.
Non-Renewable	This is a resource that is replenished slower than the rate as which is used.
Fossil Fuel	Coal, oil and natural gas that are extracted from the Earth and burned.
Nuclear Fuel	Energy from atoms. Uranium is a nuclear fuel and transfers energy when the nucleus splits in two.
Biofuel	A fuel taken from living or recently living things. An example of a biofuel is animal waste.
Hydroelectricity	Can be generated when rainwater collects behind a reservoir and flows downhill. This turns a turbine.
Geothermal	Water is pumped under the Earth and turns to steam. This turns a turbine to turn a generator.

Renewable Energy Resource	Non-Renewable Energy Resources
Biofuel Wind Hydroelectricity Geothermal Tidal The Sun Water Waves	Coal Oil Gas Nuclear

Uses that we have for energy resource.
Humans have lots of uses for our energy resources. Examples of uses include transport, generating electricity and heating.

10 Minutes on....

Non-Renewable Energy Resources

Key Term	Definition
Non-Renewable	This is a resource that is replenished slower than the rate as which is used.
Fossil Fuel	Coal, oil and natural gas that are extracted from the Earth and burned.
Nuclear Fuel	Energy from atoms. Uranium is a nuclear fuel and transfers energy when the nucleus splits in two.

Energy Resource	Advantages	Disadvantages
Fossil Fuels	Very reliable.	Produce greenhouse gases which contribute towards global warming.
Nuclear Fuel	Very reliable. Does not produce greenhouse gases and so does not contribute towards global warming. Nuclear fuel released a large amount of energy per kg of fuel.	Produce radioactive waste which will need to be disposed of safely and correctly. Long start up time. Higher decommissioning costs.

10 Minutes on….

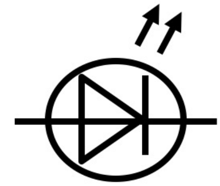
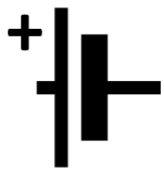
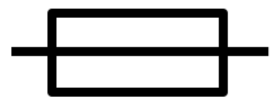
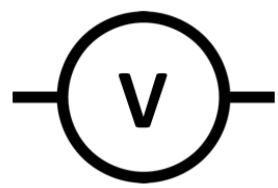
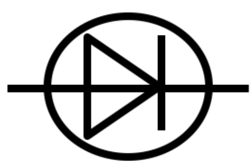
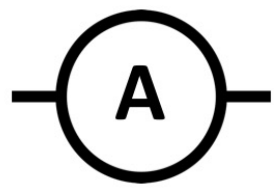
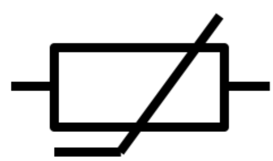
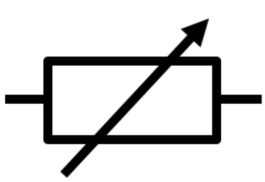
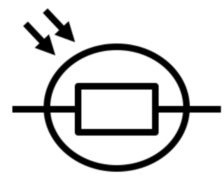
Renewable Energy Resources

Key Term	Definition
Renewable	This is a resource that is replenished at the same rate as it is used.

Energy Resource	Advantages	Disadvantages
Biofuel	Reliable It is carbon neutral.	Uses land that would be used for other purposes.
Wind	Don't produce greenhouse gases and so do not contribute towards global warming.	Unreliable as when there is no wind they don't work. Visual pollution.
Hydroelectricity	Don't produce greenhouse gases and so do not contribute towards global warming.	Affected by droughts. Large reservoirs of water needed, and habitats can be flooded to do this.
Geothermal	Reliable Don't produce greenhouse gases and so do not contribute towards global warming.	Expensive Only work in certain locations.
Tidal	Reliable Don't produce greenhouse gases and so do not contribute towards global warming.	Affect river estuaries and the habitats of animals.
Solar	Don't produce greenhouse gases and so do not contribute towards global warming.	Need to cover large areas to generate adequate electricity. Do not work at night. Generate less electricity depending on the weather and season.
Water Waves	Don't produce greenhouse gases and so do not contribute towards global warming.	Can spoil the coastline and affect habitats. Affected by storms. Don't make a constant supply of electricity.

10 Minutes on....

Standard Circuit Diagram Symbols

Component	Symbol	Component	Symbol
Open Switch		LED	
Closed Switch		Lamp	
Cell		Fuse	
Battery		Voltmeter	
Diode		Ammeter	
Resistor		Thermistor	
Variable Resistor		LDR	

10 Minutes on....

Electrical Charge 1

Key Term	Definition
Electric Current	The flow of electrical charge.

Quantity	Symbol	Unit
Charge Flow	*Q*	C
Current	*I*	A
Time	*t*	s

Equation that links charge flow, current and time.

Charge Flow = Current x Time

Calculate charge flow when ...	There is a 3A current for 30s	There is a 1.5A current for 2mins	There is a 500mA current for 30s	There is a 5A current for 1 minute
Convert Units	-	2mins = 120s	500mA = 0.5A	1 minute = 60s
Write down the formula.	Q = I x t	Q = I x t	Q = I x t	Q = I x t
Substitute Values	Q = 3 x 30	Q = 1.5 x 120	Q = 0.5 x 30	Q = 5 x 60
Do the Maths	90	180	15	300
Round and add units.	90C	180C	15C	300C

10 Minutes on....

Electrical Charge 2

Calculate current when...	Charge flow is 125C for 12s	Charge flow is 0.2C for 3mins	Charge flow is 0.5C for 25s	Charge flow is 0.2C for 10mins
Convert Units	-	3min = 180s	-	10mins = 600s
Write down the formula.	Q = I x t	Q = I x t	Q = I x t	Q = I x t
Substitute Values	125 = I / 12	0.2 = I / 180	0.5 = I / 25	0.2 = I / 60
Rearrange	I = 125 x 12	I = 0.2 x 180	I = 0.5 x 25	I = 0.2 x 60
Answer	1500	36	12.5	12
Round and add units.	1500A	36A	12.5A	12A

Calculate time when...	Charge flow is 125C and current is 2A	Charge flow is 80C and current is 4A	Charge flow is 900C and current is 900mA	Charge flow is 450C and current is 500mA
Convert Units	-	-	900mA = 0.9A	500mA = 0.5A
Write down the formula.	Q = I x t	Q = I x t	Q = I x t	Q = I x t
Substitute Values	125 = 2 x t	80 = 4 x t	900 = 0.9 x t	450 = 0.5 x t
Rearrange	t = 125/2	t = 80/4	t = 900/0.9	t = 450 / 0.5
Answer	62.5	20	1000	900
Round and add units.	62.5s	20s	1000s	900s

10 Minutes on....

Current, Resistance and Potential Difference 1

Key Term	Definition
Electric Current	The flow of electrical charge.

Quantity	Symbol	Unit
Potential Diff	*V*	V
Current	*I*	A
Resistance	*R*	Ω

Equation that links current, potential difference and resistance.

Potential Difference = Current x Resistance

Calculate potential difference when ...	Current is 3A and the resistance is 2Ω	Current is 1.5A and resistance is 10Ω	Current is 10A and the resistance is 2Ω	Current is 500mA and the resistance is 12Ω
Convert Units	-	-	-	500mA = 0.5A
Write down the formula.	V = I x R	V = I x R	V = I x R	V = I x R
Substitute Values	V = 3 x 2	V = 1.5 x 10	V = 10 x 2	V = 0.5 x 12
Do the Maths	6	15	15	300
Round and add units.	6V	15V	20V	6V

10 Minutes on....

Current, Resistance and Potential Difference 1

Calculate current when...	Potential difference is 7V and resistance is 2Ω	Potential difference is 17V and resistance is 12Ω	Potential difference is 3.5V and resistance is 17Ω	Potential difference is 2V and resistance is 2Ω
Convert Units	-	-	-	-
Write down the formula.	V = I x R	V = I x R	V = I x R	V = I x R
Substitute Values	7 = I x 2	17 = I x 12	3.5 = I x 17	2 = I x 2
Rearrange	I = 7/2	I = 17/12	I = 3.5/17	I = 2/2
Answer	3.5	1.4166666667	0.2058823529	1
Round and add units.	3.5A	1.4A	0.21A	1A

Calculate resistance when	Potential difference is 7V and current is 2A	Potential difference is 17V and current is 3.5A	Potential difference is 12V and current is 750mA	Potential difference is 7V and current is 200mA
Convert Units	-	-	750mA = 0.75A	200mA = 0.2A
Write down the formula.	V = I x R	V = I x R	V = I x R	V = I x R
Substitute Values	7 = 2 x R	17 = 3.5 x R	12 = 0.75 x R	7 = 0.2 x R
Rearrange	R = 7/2	R = 17 / 3.5	R = 12 / 0.75	R = 7 / 0.2
Answer	3.5	4.8571428571	16	35
Round and add units.	3.5Ω	4.86Ω	16Ω	35Ω

10 Minutes on….

Resistance of a Wire RP

A method to investigate the relationship between the length of a wire and its resistance.

1
Set up equipment as shown in the diagram.

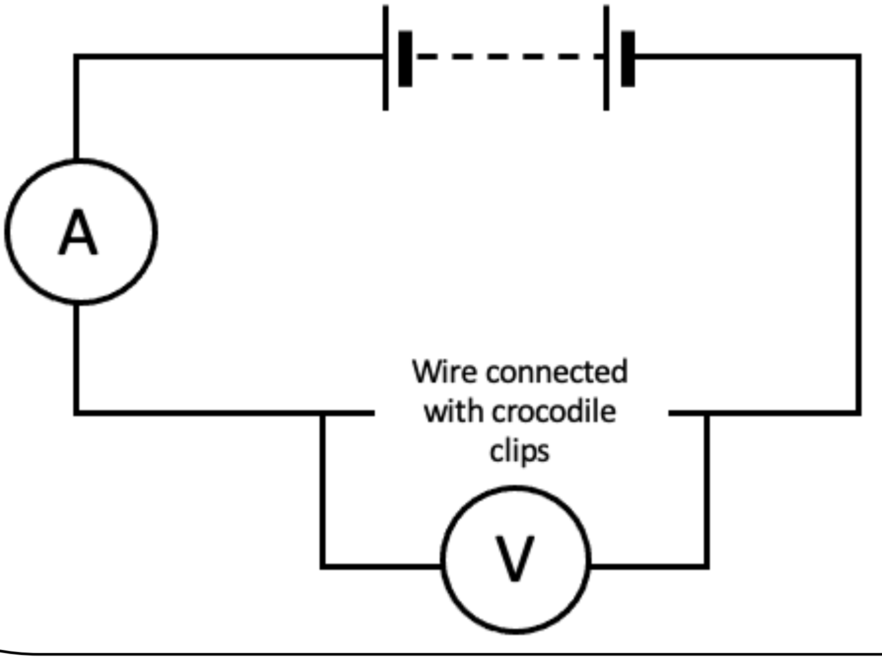
2
Place the crocodile clips 10cm apart on the length of wire.

3.
Record the current and voltage.

4.
Calculate resistance using the formula:
Resistance = Potential Different / Current

5.
Repeat for different lengths of wire at 10cm intervals.

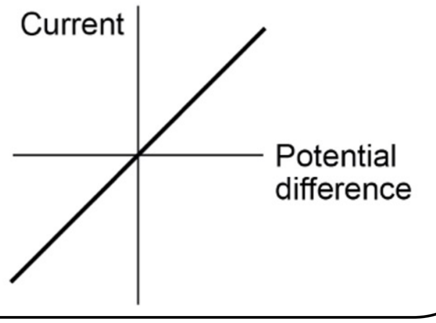
6.
Plot a graph of resistance against length.



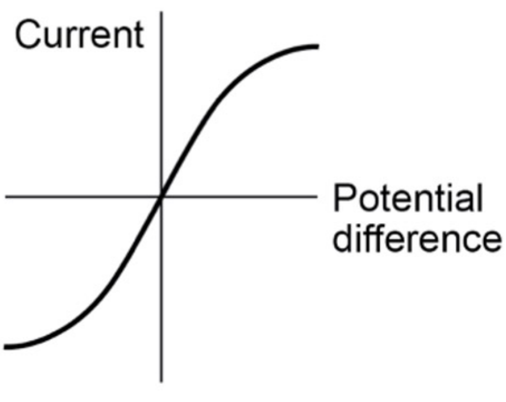
10 Minutes on.... Resistors

Relationship between current and potential difference through an ohmic conductor. Construct an I-V graph to model this.

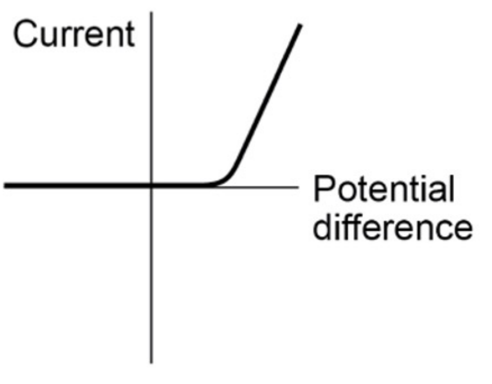
The current through an ohmic conductor (at a constant temperature) is directly proportional to the potential difference across the resistor. This means that the resistance remains constant as the current changes.



I-V graph for a filament lamp.



I-V graph for a diode.



Component	Description of when Resistance Changes	Use
Thermistor	The resistance of a thermistor decreases as the temperature increases.	Thermostats
LDR	The resistance of an LDR decreases as light intensity increases	Switching lights on when it gets dark.

10 Minutes on....

I-V Characteristics
1 RP

A method to investigate the IV Characteristics of a resistor.

1
Set up equipment as shown in the diagram.

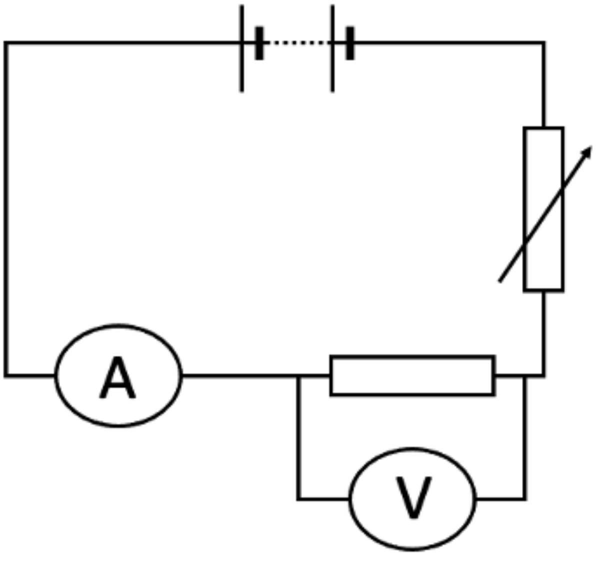
2
Record the current and voltage.

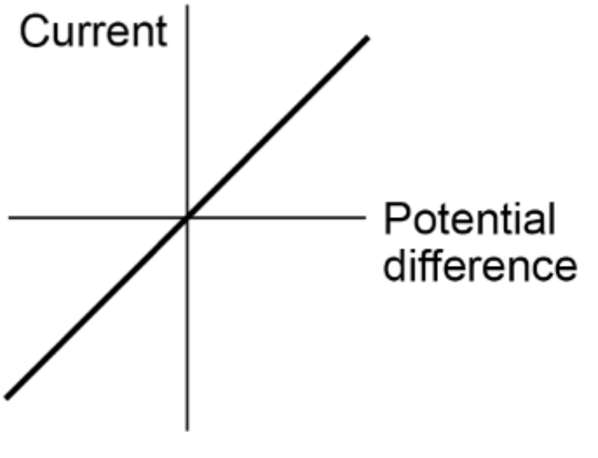
3
Adjust the variable resistor 4 more times recording the new current and voltage each time.

4
Swap the leads on the battery so that the reading on the ammeter and voltmeter is negative.

5
Record the current and voltage 5 times adjusting the variable resistor between each reading.

6
Plot a graph of current against potential difference.





10 Minutes on….

I-V Characteristics
2 RP

A method to investigate the IV Characteristics of a filament lamp.

1
Set up equipment as shown in the diagram.

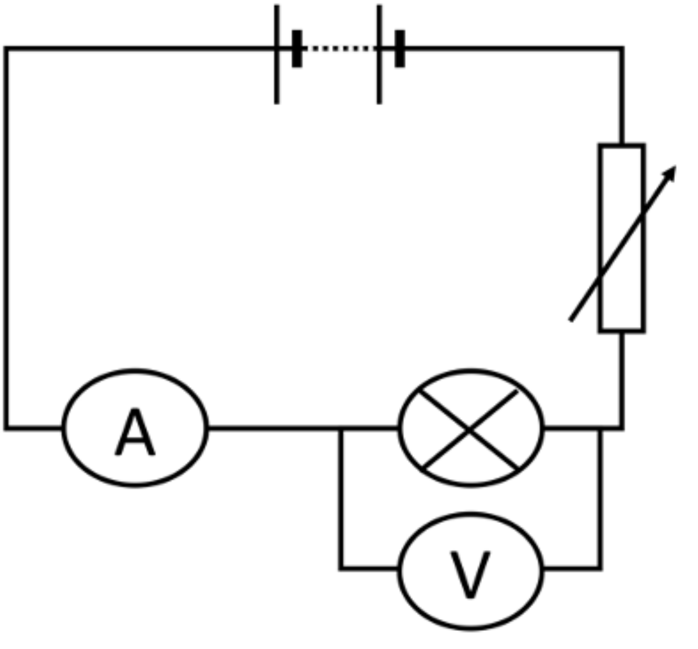
2
Record the current and voltage.

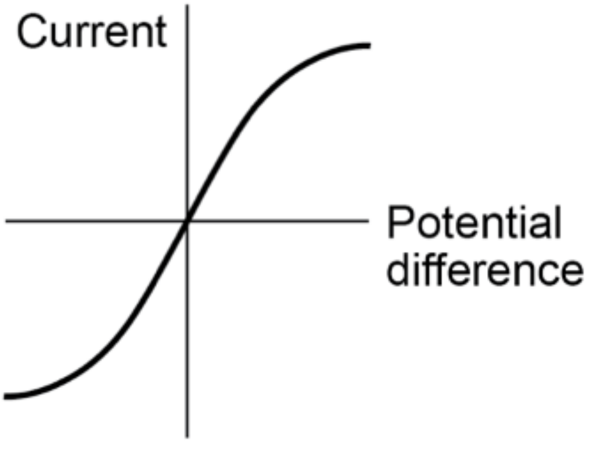
3
Adjust the variable resistor 4 more times recording the new current and voltage each time.

4
Swap the leads on the battery so that the reading on the ammeter and voltmeter is negative.

5
Record the current and voltage 5 times adjusting the variable resistor between each reading.

6
Plot a graph of current against potential difference.





10 Minutes on....

I-V Characteristics
3 RP

A method to investigate the IV Characteristics of a diode.

1
Set up equipment as shown in the diagram with a battery no higher than 5V.

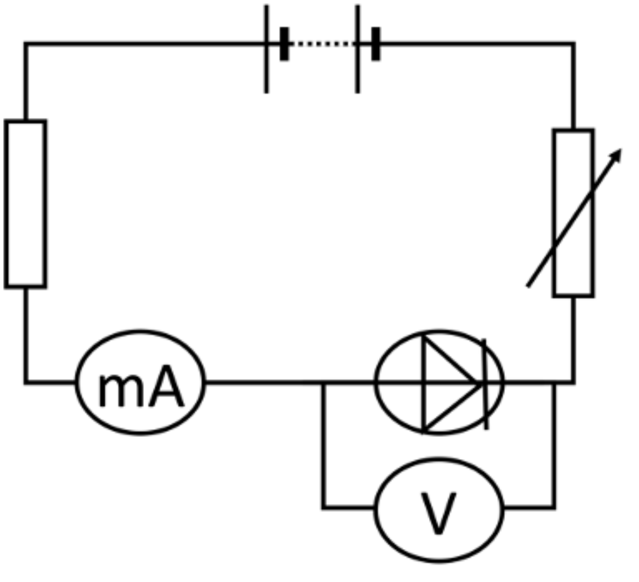
2
Record the current and voltage.

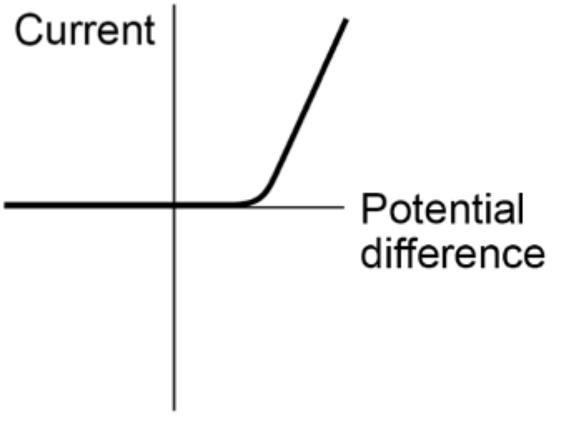
3
Adjust the variable resistor 4 more times recording the new current and voltage each time.

4
Swap the leads on the battery so that the reading on the ammeter and voltmeter is negative.

5
Record the current and voltage 5 times adjusting the variable resistor between each reading.

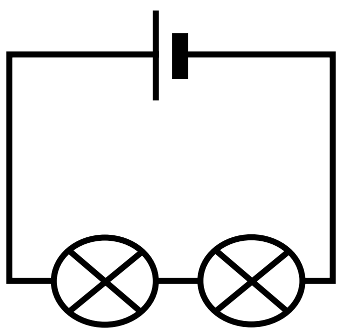
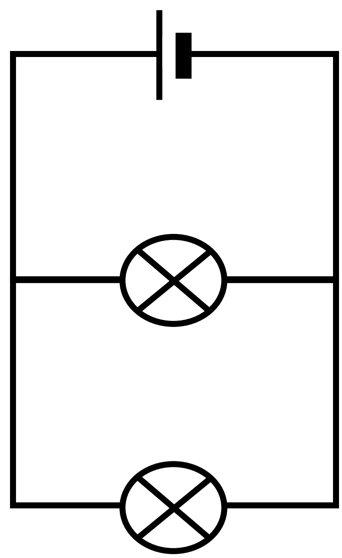
6
Plot a graph of current against potential difference.





10 Minutes on….

Series and Parallel Circuits

Circuit	Series	Parallel
Description	A circuit where one component follows directly from another	A circuit with branches so that the current divides and only part of it flows through any branch.
Diagram		
Current Through The Component	The current through each component is the same.	The total current supplied is split between the components on different loops.
Potential Difference and Components	The total potential difference of the power supply is shared between the components.	The potential difference of each component is the same.
Resistance and Components	The total resistance of the circuit is the sum of the resistance of the components. $R_{total} = R_1 + R_2$	The total resistance of two resistors is less than the resistance of the smallest individual resistor. The total resistance of the circuit is reduced as the current can follow multiple paths

10 Minutes on....

Direct and Alternating Current

Key Term	Definition	Example of Source
Direct Current	A current that passes in the same direction	Current produced by cells and batteries.
Alternating Current	A current that changes direction.	Current in the national grid.

Frequency and voltage of mains electricity.

Within the UK the domestic electricity supply has a frequency of 50Hz and a voltage of 230V.

Difference between direct and alternating potential difference.

A direct potential difference travels in the same direction, while an alternating potential difference is constantly changing direction. Within the Uk's domestic electricity supply the current changes 50 times every second.

10 Minutes on….

Mains Electricity

Wire	Colour	Description	Potential Difference
Live Wire	Brown	Carries the alternating potential difference from the supply.	230V
Neutral Wire	Blue	Completes the circuit.	0V (or close to)
Earth Wire	Green and Yellow Stripes	Safety wire to stop the appliance becoming live.	0V

Why a live wire may be dangerous even when a switch is open.

A live wire may be dangerous even when a switch is open. This is because if the circuit were to be accidently complete then there would be a large potential difference. This large potential difference could then cause electrocution.

Why it is dangerous if a live wire and earth wire are connected.

A live wire and earth wire should not be connected together. This is because if they were to touch there would be a complete circuit from the live circuit to the ground. This can cause shocks or fires.

10 Minutes on....

Power 3

Key Term	Definition
Power	The rate at which energy is transferred or the rate at which work is done.

Quantity	Symbol	Unit
Potential Diff	*V*	V
Current	*I*	A
Resistance	*R*	Ω
Power	*P*	W

Equation that links current, potential difference and power

Power = Potential Difference x Current

Equation that links current, power and resistance.

Power = Current^2 x Resistance

Calculate power when ...	Current is 3A and the P.D is 2V	Current is 1.5A and resistance is 10Ω	Current is 100mA and the P.D is 12V	Current is 500mA and the resistance is 12Ω
Convert Units	-	-	100mA = 0.1A	500mA = 0.5A
Write down the formula.	P=V x I	P = I^2 x R	P=V x I	P = I^2 x R
Substitute Values	P = 2 x 3	P = 1.5^2 x 10	P = 12 x 0.1	P = 0.5^2 x 12
Do the Maths	6	P = 2.25 x 10 = 22.5	1.2	P = 0.25 x 12 = 3
Round and add units.	6W	22.5W	1.2W	3W

10 Minutes on....

Power 4

Calculate P.D when...	Power is 25W and current is 5A	Power is 0.25kW and current is 40A	Power is 2W and current is 750mA	Power is 0.75kW and current is 10A
Convert Units	-	0.25kW = 250W	750mA = 0.75A	0.75kW = 750W
Write down the formula.	P = V x I	P = V x I	P = V x I	P = V x I
Substitute Values	25 = 5V	250 = 40V	2 = 0.75V	750 = 10V
Rearrange	V = 25/5	V = 250 / 40	V = 2 / 0.75	V = 750/10
Answer	5	6.25	2.6666666667	75
Round and add units.	5V	6.25V	2.7V	75V

Calculate current when...	Potential difference is 7V and power is 75W	Power is 100W and resistance is 5Ω	Power is 2.8KW and resistance is 10Ω	Power is 3.2KW and resistance is 25Ω
Convert Units	-	-	2.8KW = 2800W	3.2KW = 3200W
Write down the formula.	P = V x I	$P = I^2 \times R$	$P = I^2 \times R$	$P = I^2 \times R$
Substitute Values	75 = 7 I	$100 = I^2 \times 5$	$2800 = I^2 \times 10$	$3200 = I^2 \times 25$
Rearrange	I = 75/7	$I^2 = 100/5$ $I^2 = 20$	$I^2 = 2800 / 10$ $I^2 = 280$	$I^2 = 3200/25$ $I^2 = 128$
Answer	10.7142857143	4.47213596	16.7332005	11.3137085
Round and add units.	10.7A	4.5A	16.7A	11.3A

10 Minutes on....

Energy Transfers in Appliances 1

Key Term	Definition
Electrical Appliance	A device that is designed to bring about energy transfers.

Quantity	Symbol	Unit
Potential Diff	*V*	V
Energy Transferred	*E*	J
Time	*t*	s
Power	*P*	W
Charge Flow	*Q*	C

Equation that links energy transferred, power and time.

Energy Transferred = Power x Time

Equation that links charge flow, energy transferred and potential difference

Energy Transferred = Charge Flow x P.D

Calculate energy transferr-ed when..	Power is 60W and times is 3s.	Charge flow is 12C and potential difference is 3V	Power is 12W and the time is 1 minute.	Charge flow is 25C and potential difference is 1.5V
Convert Units	-	-	1min = 60s	-
Write down the formula.	E = P x t	E = Q x V	E = P x t	E = Q x V
Substitute Values	E = 60 x 3	E = 12 x 3	E = 12 x 60	E = 25 x 1.5
Do the Maths	180	36	84	37.5
Round and add units.	180J	36J	84J	37.5J

10 Minutes on….

Energy Transfers in Appliances 2

Calculate power when…	120J of energy is transferred in 30s	225J of energy is transferred in 2 mins	1.8kJ of energy is transferred in 45s	2.5kJ of energy is transferred in 10min
Convert Units	-	2mins = 120s	1.8kJ = 1800J	2.5kJ = 2500J 10min = 600s
Write down the formula.	E = P x t	E = P x t	E = P x t	E = P x t
Substitute Values	120 = 30 P	225 = 120 P	1800 = 45 P	2500 = 600 P
Rearrange	P = 120/30	P = 225/120	P = 1800 / 45	P = 2500 / 600
Answer	4	1.875	40	4.1666666667
Round and add units.	4W	1.88W	40W	4.2W

Calculate P.D when…	Charge flow is 30C and 120J of energy is transferred.	Charge flow is 44C and 1.95kJ of energy is transferred.	Charge flow is 12C and 44J of energy is transferred.	Charge flow is 120C and 2.5kJ of energy is transferred.
Convert Units	-	1.95kJ = 1950J	-	2.5kJ = 2500
Write down the formula.	E = Q x V	E = Q x V	E = Q x V	E = Q x V
Substitute Values	120 = 30 V	1950 = 44 V	44 = 12 V	2500 = 120 V
Rearrange	V = 120/30	V = 1950/44	V = 44 / 12	V = 2500 / 120
Answer	4	44.3181818182	3.6666666667	20.8333333333
Round and add units.	4V	44.3V	3.7V	20.8V

10 Minutes on....

National Grid

Key Term	Definition
National Grid	A system of cables and transformers linking power stations to consumers.
Step-Up Transformer	A transformer that increases the voltage of the ac supply.
Step-Down Transformer	A transformer that decreases the voltage of the ac supply.

How transfers are used in the National Grid.

Step-up transformers are used to increase the potential difference from the power station to the transmission cables. This decreases the current and reduces the thermal transfer to the surroundings from the transmission cables. Then step-down transformers are used to decrease the potential difference. This lowers the potential different to a much lower safer value so that it can be used domestically.

10 Minutes on….

Static Charge

Key Term	Definition
Non-Contact Force	A force exerted between two objects, even when they are not touching.
Repel	Objects that will push apart because of a force between them.
Attract	Objects that will come together because of a force between them.

How insulating materials become electrically charged.
When certain insulating materials are rubbed against each other they become electrically charged. Negatively charged electrons are rubbed off one material and on to the other. The material that gains electrons becomes negatively charged. The material that loses electrons is left with an equal positive charge.

What happens when two electrically charged objects are brought close together.
When two electrically charged objects are brought close together, they exert a force on each other. Two objects that carry the same type of charge repel. Two objects that carry different types of charge attract. Attraction and repulsion between two charged objects are examples of non-contact force.

Evidence that charged objects exert forces on when another when not in contact.
Examples of evidence include using a charged balloon to pick up pieces of paper. Another example is hanging two rods of plastic ,that have been rubbed with a cloth, with a piece of string and suspending them close to each other.

10 Minutes on….

Electric Field

Key Term	Definition
Electric Field	An area surrounding an electric charge that may influence other charged particles.
Van de Graaf Generator	A machine that causes friction between a rubber belt and plastic rollers in order to build up electrical charge on a metal dome.

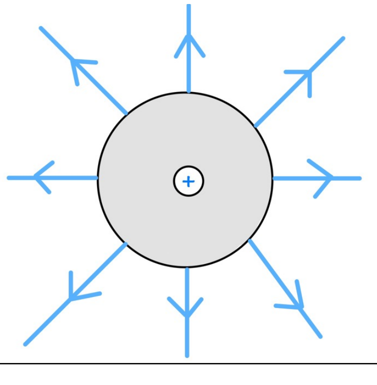
What happens to the strength of an electric field when you move away from the object.

A charged object creates an electric field around itself. The electric field is strongest close to the charged object. The further away from the charged object, the weaker the field.

What happens when you place a charged object inside of an electric field.

When you place a charged object within a field the object experiences a force. The closer the object is to the object that has created the electric field the stronger the force is.

A diagram to show the electric field pattern for an isolated charged sphere.



Why someone may receive an electric shock when they touch a metal tap.

There is a potential difference between the person and the object they have touched. This causes electrons to transfer from the person, the charge is earthed, and the person experiences a shock.

10 Minutes on….

Density of Materials 1

Key Term	Definition
Density	How closely packed the particles are in a material.

Quantity	Symbol	Unit
Density	ρ	kg/m^3
Mass	m	kg
Volume	V	m^3

Equation that links density, mass and volume.

Density = Mass / Volume

Calculate density when..	Mass is 2kg and volume is $3m^3$	Mass is 150g and volume is $0.1m^3$	Mass is 1kg and volume is $0.2m^3$	Mass is 1500g and volume is $0.12m^3$
Convert Units	-	150g = 0.15kg	-	1500g = 1.5kg
Write down the formula.	$\rho = m / V$	$\rho = m / V$	$\rho = m / V$	$\rho = m / V$
Substitute Values	$\rho = 2 / 3$	$\rho = 0.15 / 0.1$	$\rho = 1 / 0.2$	$\rho = 1.5 / 0.12$
Do the Maths	0.6666666667	1.5	5	12.5
Round and add units.	$0.67kg/m^3$	$1.5kg/m^3$	$5kg/m^3$	$12.5kg/m^3$

10 Minutes on....

Density of Materials 2

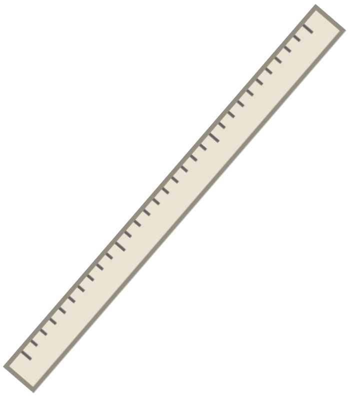
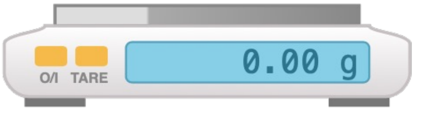
Calculate mass when...	There is $0.1m^3$ of a material with a density of $1.5kg/m^3$	There is $0.2m^3$ of a material with a density of $4kg/m^3$	There is $0.005m^3$ of a material with a density of $3.7kg/m^3$	There is $0.001m^3$ of a material with a density of $17kg/m^3$
Convert Units	-	-	-	-
Write down the formula.	ρ = m / V	ρ = m / V	ρ = m / V	ρ = m / V
Substitute Values	1.5 = m / 0.1	4 = m / 0.2	3.7 = m / 0.005	17 = m / 0.001
Rearrange	m = 1.5 x 0.1	m = 4 x 0.2	m = 3.7 x 0.005	m = 17 x 0.001
Answer	0.15	0.8	0.018	0.017
Round and add units.	0.15kg	0.8kg	0.018kg	0.017kg

Calculate volume when...	There is 37kg of a material with a density of $1.5kg/m^3$	There is 250g of a material with a density of $17kg/m^3$	There is 5g of a material with a density of $2.8kg/m^3$	There is 1800g of a material with a density of $0.8kg/m^3$
Convert Units	-	250g = 0.250kg	5g = 0.005kg	1800g = 1.8kg
Write down the formula.	ρ = m / V	ρ = m / V	ρ = m / V	ρ = m / V
Substitute Values	37 = 1.5 / V	17 = 0.25 / V	2.8 = 0.005 / V	0.8 = 1.8 / V
Rearrange	V = 1.5 / 37	V = 0.25 / 17	V = 0.005 / 2.8	V = 1.8 / 0.8
Answer	0.04054054054	0.01470588235	0.001785714286	2.25
Round and add units.	$0.041m^3$	$0.015m^3$	$0.0018m^3$	$2.25m^3$

10 Minutes on….

Determining Density 1 RP

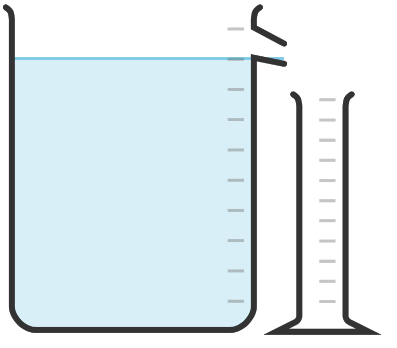
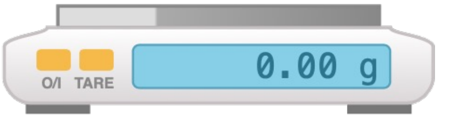
A method to determine the density of a regular shaped object.

Finding Volume	Measure the length height and width of the object. Multiply these values together to calculate volume	
Finding Mass	Measure the mass of the object using a balance.	
Determining Density	Divide the mass by the volume to calculate density.	**Density = Mass / Volume**

10 Minutes on....

Determining Density 2 RP

A method to determine the density of an irregular shaped object.

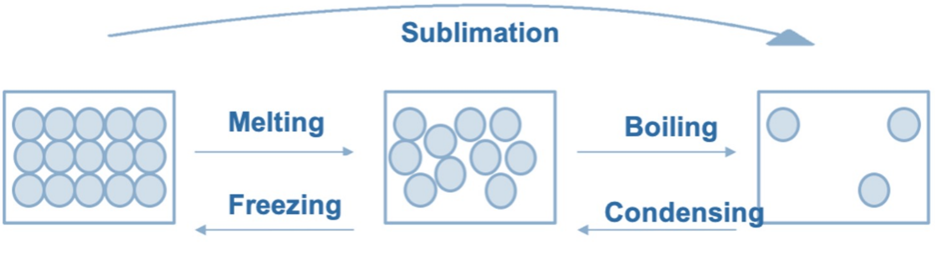
Finding Volume	Fill a displacement can with water. Place an empty measuring cylinder under the spout. Add the object to the can. Measure and record the volume displaced into the measuring cylinder.	
Finding Mass	Measure the mass of the object using a balance.	
Determining Density	Divide the mass by the volume to calculate density.	**Density = Mass / Volume**

10 Minutes on….

Changes of State

Key Term	Definition
Melt	A change in state in which a solid becomes a liquid.
Freeze	A change in state in which a liquid becomes a solid.
Boil	A change in state in which a liquid becomes a gas.
Evaporate	When particles on the surface of a liquid turn into a gas.
Condense	A change in state in which a gas becomes a liquid.
Sublimate	A change in state in which a solid becomes a gas.

A diagram to model state changes.



What happens to mass when an object changes state.
When an object changes state mass is conserved. This means the object/material will have the same mass before and after the change of state.

Comparing state changes and chemical changes.
During a physical change there is nothing new made, while there is in a chemical change. A physical change can be reversed, and the material will recover its original properties. This is not possible for a chemical change.

10 Minutes on....

Internal Energy

Key Term	Definition
Internal Energy	The energy stored inside a system by the particles that make up the system.

Internal energy of a system.

The total internal energy that makes up a system is all the total kinetic energy and potential of all the particles that make up that system.

What happens when a system is heated.

When a system is heated the energy stored within the system increases because the particles in the system have more energy. This will cause the temperature of the system to increase. If the temperature reaches the melting or boiling point, then there will be a change in state.

10 Minutes on....

Energy Changes in Systems 3

Key Term	Definition
Specific Heat Capacity	The amount of energy needed to raise the temperature of one kilogram of the substance by one degree Celsius.

Quantity	Symbol	Unit
Change in Thermal Energy	ΔE	J
Mass	m	kg
Specific Heat Capacity	c	J/kg°C
Temperature Change	$\Delta\theta$	°C

Equation that links change in thermal energy, mass, specific heat capacity and temperature change.

Change in Thermal Energy = Mass x Specific Heat Capacity

Calculate change in thermal energy when...	Mass is 17kg, SHC is 3J/kg°C and $\Delta\theta$ is 2.1°C	Mass is 15kg, SHC is 7.1J/kg°C and $\Delta\theta$ is 3.8°C	Mass is 425g, SHC is 3J/kg°C and $\Delta\theta$ is 21°C	Mass is 831g, SHC is 3J/kg°C and the temperature raises by 0.1°C
Convert Units	-	-	425g = 0.425kg	831g = 0.831kg
Write down the formula.	$\Delta E = m\ c\ \Delta\theta$	$\Delta E = m\ c\ \Delta\theta$	$\Delta E = m\ c\ \Delta\theta$	$\Delta E = m\ c\ \Delta\theta$
Substitute Values	ΔE = 17 x 3 x 2.1	ΔE = 15 x 7.1 x 3.8	ΔE = 0.425 x 3 x 21	ΔE = 0.831 x 3 x 0.1
Do the Maths	107.1	404.7	26.775	0.2493
Round and add units.	ΔE = 107.1J	ΔE = 404.7J	ΔE = 26.8J	ΔE = 0.249J

10 Minutes on....

Energy Changes in Systems 4

For each of the questions below the substance is aluminium with a specific heat capacity of 900J/kg°C.

Calculate mass when...	ΔE is 100J and Δθ is 15°C	ΔE is 1.4kJ and Δθ is 9°C	ΔE is 0.72kJ and Δθ is 12°C	ΔE is 1.50kJ and Δθ is 17.8°C
Convert Units	-	1.4kJ = 1400J	0.72kJ = 720J	1.5kJ = 1500J
Write down the formula.	*ΔE = m c Δθ*	*ΔE = m c Δθ*	*ΔE = m c Δθ*	*ΔE = m c Δθ*
Substitute Values	100 = m x 900 x 15	1400 = m x 900 x 9	720 = m x 900 x 12	1500 = m x 900x 17.8
Rearrange	100 = 13,500m 100/13,500 = m	1400 = 8100m 1400/8100 = m	720 = 10,800m 720/10800 = m	1500 =16020m 1500/16020 = m
Answer	0.007407407407	0.1728395062	0.06666666667	0.0936329588
Round and add units.	m = 0.0074kg	m = 0. 17kg	m = 0.067kg	m = 0.094kg

Calculate temp change when...	ΔE is 100J and mass is 7kg.	ΔE is 1120J and mass is 3.1kg.	ΔE is 2.8kJ and mass is 2.1kg.	ΔE is 1.8kJ and mass is 51g.
Convert Units	-	-	2.8kJ = 2800J	1.8kJ = 1800J 51g = 0.051kg
Write down the formula.	*ΔE = m c Δθ*	*ΔE = m c Δθ*	*ΔE = m c Δθ*	*ΔE = m c Δθ*
Substitute Values	100 = 7 x 900 x Δθ	120 = 3.1 x 900 x Δθ	2800 = 2.1 x 900 x Δθ	1800 = 0.051 x 900 x Δθ
Rearrange	100 = 6300 Δθ 100/6300 =Δθ	1120 = 2790 Δθ 1120/2790 = Δθ	2800 = 1890Δθ 2800 / 1890 = Δθ	1800 = 45.9 Δθ 1800/45.9=Δθ
Answer	0.01587301587	0.4014336918	1.4814814815	39.2156862745
Round and add units.	Δθ = 0.016°C	Δθ = 0.401°C	Δθ = 1.48°C	Δθ = 39°C

10 Minutes on....

Change in State and SLH 1

Key Term	Definition
Latent Heat	The energy needed for a substance to change state.
Specific Latent Heat	The amount of energy needed to change the state of one kilogram of the substance with no change in temperature.
Specific Latent Heat of Fusion	The energy needed to change state from a solid to a liquid.
Specific Latent Heat of Vaporisation	The energy needed to change state from a liquid to a vapour.

Quantity	Symbol	Unit
Energy	*E*	J
Mass	*m*	kg
Specific Latent Heat	*L*	J/kg

Equation that links energy for a change in state, mass and specific latent heat.

Energy for a Change in State = Mass x Specific Latent Heat

Calculate the energy to change state when...	There is 0.5kg of a material with a specific latent heat of 2J/kg	There is 2.8kg of a material with a specific latent heat of 5J/kg	There is 500g of a material with a specific latent heat of 1021J/kg	There is 52g of a material with a specific latent heat of 980J/kg
Convert Units	-	-	500g = 0.500kg	52g = 0.0052kg
Write down the formula.	E = m x L	E = m x L	E = m x L	E = m x L
Substitute Values	E = 0.5 x 2	E = 2.8 x 5	E = 0.5 x 1021	E = 0.0052 x 980
Do the Maths	1	14	510.5	5.096
Round and add units.	E = 1J	E = 14J	E = 510.5J	E = 5.10J

10 Minutes on....

Change in State and SLH 2

For each of the questions below the substance is aluminium with a specific heat capacity of 900J/kg°C.

Calculate mass when...	Energy is 100J and SLH is 900J/kg	Energy is 1kJ and SLH is 1081J/kg	Energy is 100J and SLH is 820J/kg	Energy is 7.8kJ and SLH is 501J/kg
Convert Units	-	1kJ = 1000J	-	7.8kJ = 7800J
Write down the formula.	E = m x L	E = m x L	E = m x L	E = m x L
Substitute Values	100 = 900 m	1000 = 1081 m	100 = 820 m	7800 = 501 m
Rearrange	m = 100 / 900	m = 1000 / 1081	m = 100 / 820	m = 7800 / 501
Answer	0.1111111111	0.9250693802	0.1219512195	15.5688622754
Round and add units.	m = 0.11kg	m = 0. 925kg	m = 0.12kg	m = 15.6kg

Calculate SLH when...	The energy suppled is 1200J and the mass is 2kg.	The energy suppled is 5.5kJ and the mass is 2.2kg.	The energy suppled is 700J and the mass is 55g.	The energy suppled is 3kJ and the mass is 250g.
Convert Units	-	5.5kJ = 5500J	55g = 0.005g	3kJ = 3000J 250g = 0.25kg
Write down the formula.	E = m x L	E = m x L	E = m x L	E = m x L
Substitute Values	1200 = 2 L	5500 = 2.2 L	700 = 0.005 L	3000 = 0.25 L
Rearrange	L = 1200 / 2	L = 5500 / 2.2	L = 7 / 0.005	L = 3000 / 0.25
Answer	600	2500	140,000	12000
Round and add units.	600J/kg	2,500J/kg	140,000J/kg	12,000J/kg

10 Minutes on….

Particle Motion in Gases

How the motion of the molecules in a gas is related to its temperature and pressure.

The molecules of a gas are in constant random motion. The temperature of the gas is related to the average kinetic energy of the molecules. This means that the greater the temperature, the more kinetic energy the gas particles will have and so the particles will move faster. Under high pressure the particles are much closer together and so collisions between the particles is much more frequent.

Relationship between the temperature of a gas and its pressure at a constant volume.

If you were to change the temperature of a gas, at a constant volume, this will change the pressure exerted by the gas. At higher temperatures the gas particles will have more kinetic energy. This means that they will move faster and there will be more frequent collisions with the container walls. This causes the force on the container walls to increase and so pressure increases.

10 Minutes on....

Pressure in Gases

How increasing the volume in which a gas is contained, at a constant temperature, can lead to a decrease in pressure.

When the volume in which a gas is contained is increased there is more space between the particles. There are fewer collisions between the particles and the container. Overall there is a smaller net force at right angles to the wall of the gas container and so pressure decreases.

Quantity	Symbol	Unit
Pressure	*p*	Pa
Volume	*V*	m^3

Equation for a fixed mass of gas held at a constant temperature.

Pressure x Volume = Constant

Calculate the pressure when…	The pressure is 100,000Pa in $0.03m^3$ and volume is decreased to $0.025m^3$	The pressure is 2kPa in $0.003m^3$ and volume is increased to $0.025m^3$	The pressure is 18.8kPa in $2m^3$ and pressure is decreased to $0.5m^3$
Convert Units	-	2kPa = 2000Pa	18.8kPa = 18,800Pa
Write down the formula.	p x V = constant	p x V = constant	p x V = constant
Substitute Values to Determine Constant	Constant = 100,000 x 0.03 = 3000	Constant = 2000 x 0.003 = 6	Constant = 18,800 x 2 = 37,600
Substitute Values to Find New Pressure	p x 0.025 = 3000	p x 0.025 = 6	p x 0.5 = 37,600
Rearrange	p = 3000 / 0.025	p = 6 / 0.025	p = 37,600 / 0.5
Answer	p = 120,000	p = 240	p = 75,200
Round and add units.	p = 120,000Pa	p = 240Pa	p = 75,200Pa

10 Minutes on….

Increasing the Pressure of a Gas

Key Term	Definition
Work	The transfer of energy by a force

What happens when work is done on a gas.

When work is done on a gas there is an increase in the internal energy of the gas. This can cause an increase in the temperature of the gas.

Why when temperature is increased the pressure within a container increases

When temperature is higher particles will have more kinetic energy and so there are more collisions between the particles and the walls of the container. A greater force is also exerted in these collisions and so there is a greater force exerted in the same area. This means that the pressure increases.

Why the pressure inside a container increases when a gas is compressed.

As the gas is compressed the volume of the gas decreases. This means that there are more frequent collisions between the particles and the container wall. Each particle collision with the wall exerts a force and so there is a greater force on the walls.

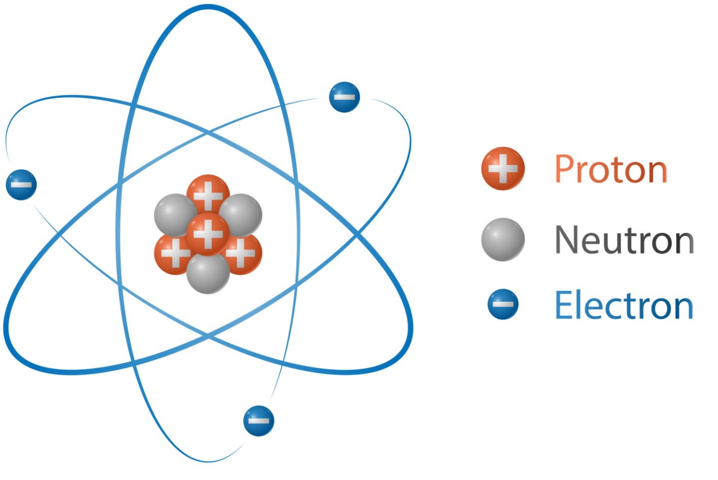
10 Minutes on….

Structure of an Atom

Radius of an Atom	0.1nm or $1x10^{-10}$m
Radius of an Atoms Nucleus	1/10,000 of the size of the atom or $1x10^{-14}$m

The basic structure of an atom and construct a diagram.

The basic structure of an atom is a positively charged nucleus composed of both protons and neutrons surrounded by negatively charged electrons.



How the electron arrangements may change when radiation is absorbed.

The electrons are arranged at different distances from the nucleus and are found in different energy levels. The electron arrangements may change with the absorption of electromagnetic radiation. When radiation is absorbed, electrons will move into a higher energy level and move further from the nucleus. Electromagnetic radiation is emitted from an atom when electrons move down to a lower energy level.

10 Minutes on….

Mass Number, Atomic Number and Isotopes

Key Term	Definition
Mass Number	The total number of protons and neutrons in an atom.
Atomic Number	The number of protons in an atom.
Isotope	Atoms with the same atomic number but different mass number due to having a different number of neutrons.

Particle	Relative Charge	Relative Mass
Proton	+1	1
Neutron	0	1
Electron	-1	Tiny

What determines the element an atom is.

The proton number determines the element that an atom is.

Why atoms are neutral.
Atoms are neutral because the number of positive protons is equal to the number of negative electrons the atom has.

How to calculate the numbers of protons neutrons and electrons when given the atomic number and mass number.

To determine the number of protons an element has identify the atomic number. The atomic number will also tell you how many electrons the atom has. To calculate the number of neutrons an atom has deduct the atomic number away from the mass number.

10 Minutes on....

Development of the Model of the Atom

Comparing the plum pudding and nuclear model of the atom.

The plum pudding model suggested that the atom is a ball of positive charge with negative electrons embedded in it. The nuclear model also had a positively charged nucleus, however the negative electrons orbit the nucleus within the nuclear model. In the plum pudding model the nucleus is very large and the atom is one solid ball of mass, however in the nuclear model the nucleus is very small and most of the atom is empty space. Neutrons are not present in either model.

Explaining how the scattering experiment led to a change in the atomic model.

In the experiment alpha particles were fired at a thin sheet of gold. Most of the alpha particles passed straight through which led to the conclusion that most of the atom was empty space. A very small amount of particles were reflected back which led to the conclusion that the mass of the atom must be concentrated at the centre. Some of the positive alpha particles were also deflected which led to the conclusion that the nucleus must also be positive.

10 Minutes on....

Radioactive Decay and Nuclear Radiation

Key Term	Definition
Radioactive Decay	The random process in which the nucleus gives out radiations as it changes to become more stable.
Activity	The rate at which a source of unstable nuclei decays. It is measured in becquerels.
Count Rate	The number of decays recorded each second by a detector.

Radiation	Symbol	Description	Range	Penetrating Power	Ionising Power
Alpha	α	A particle that consists of two neutrons and two protons. It is the same as helium nucleus.	3-5cm	Least penetrating. Absorbed by the skin and a sheet of paper.	Most ionising.
Beta	β	A high-speed electron that is ejected from the nucleus as a neutron turns into a proton.	15cm	Can penetrate air and paper. Stopped by a thin sheet of aluminium.	More ionising than gamma, less ionising than alpha.
Gamma	γ	Electromagnetic radiation from the nucleus.	Large Distances	Most penetrating. Can be stopped by thick lead or concrete.	Least ionising

10 Minutes on.... Nuclear Equations

Type of Radiation	Description	Symbol To Use In Nuclear Equations
Alpha	Helium nucleus	$^{4}_{2}He$
Beta	An electron	$^{0}_{-1}e$

Nuclear equation to model the alpha decay of radon-219.

$$^{219}_{86}\text{Radon} \rightarrow\ ^{215}_{84}\text{Polonium} +\ ^{4}_{2}\text{He}$$

Nuclear equation to model the beta decay of carbon-14

$$^{14}_{6}\text{Carbon} \rightarrow\ ^{14}_{7}\text{Nitrogen} +\ ^{0}_{-1}\text{e}$$

Comparing alpha and beta decay.
Both alpha and beta decay form a new element. However, alpha decay produces an element that has 2 fewer neutrons and protons, while beta decay forms a new element that has one more proton and one fewer neutron. This means that in alpha decay the overall mass number of the element will decrease, while in beta decay the mass number will remain the same. In alpha decay the atomic number will decrease by one, while in beta decay the atomic number will increase by one.

10 Minutes on....

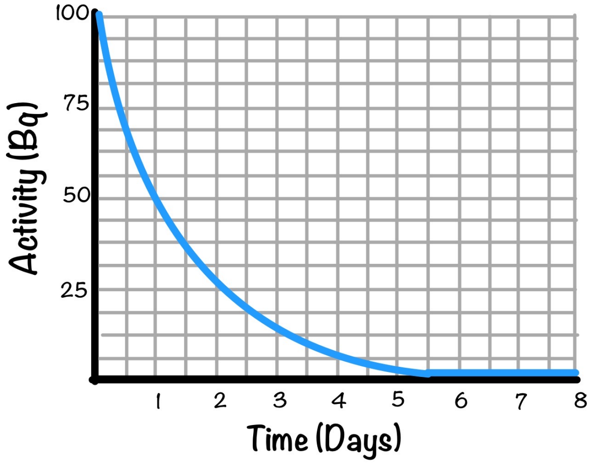
Half Life

Key Term	Definition
Radioactive Decay	The random process in which the nucleus gives out radiations as it changes to become more stable.
Half Life	The time it takes for the number of nuclei of the isotope in a sample to halve, or the time it takes for the count rate from a sample containing the isotope to fall to half its initial level.

Determining half life.

To determine the half life of a radioactive sample during its decay graph you would identify the original activity rate at day 0. You would half this activity number and draw a horizontal line to the curve. You would then draw a vertical line down from the curve and read off the the number of days.

A graph to model a substance that has a half life of 1 day with a start activity of 100 Bq



10 Minutes on….

Radioactive Contamination

Key Term	Definition
Radioactive Contamination	The unwanted presence of materials containing radioactive atoms on other materials.
Irradiation	The process of exposing an object to nuclear radiation.

Explaining the importance of peer review when studying the effects of radiation.
It is important for the the findings of studies into the effects of radiation on humans to be published and shared with other scientists so that the findings can be checked by peer review. This will prevent false claims.

	Contamination	Irradiation
When It Occurs	Occurs when the radioactive source is on or in the object.	Occurs when an object is exposed to a source of radiation outside the object.
Does It Cause The Object To Become Radioactive?	A contaminated object will be radioactive for as long as the source is on or in it.	The object will not become radioactive itself.
Stopping/Blocking Radiation.	Once an object is contaminated it can become very difficult to remove or block the radiation.	Can be protected from irradiation by moving away from the radioactive source of can be blocked with the use of a shield. As soon as the source of radiation is removed the irradiating effect stops.

10 Minutes on….

Background Radiation

Key Term	Definition
Background Radiation	Radiation this is around us all of the time. It comes from natural and man-made sources.

Source of Radiation	Example(s)
Natural Sources	Rocks and cosmic rays from space.
Man-Made Sources	Fallout from nuclear weapons testing and nuclear accidents.

What the level of background radiation and radiation dose may be affected by.

Occupation and/or location

What radiation does is measured in.

Sieverts (Sv)

How to convert between millisieverts and sieverts.

1000 millisieverts (mSv) = 1 sievert (Sv)

To convert from **millisieverts** into **sieverts** divide by 1000.
To convert from **sieverts** into **millisieverts** multiply by 1000.

10 Minutes on....

Uses of Nuclear Radiation

Use of Nuclear Radiation	Description	Properties of Radiation Used	Disadvantages
Exploration of Internal Organs	We can use radioactive sources as tracers to make soft tissues show up through medical imaging. We typically use isotopes that emit gamma rays which easily pass through the body to a detector on the outside of the body.	Radiation should be gamma rays so that they can pass through the body and be detected. They should have a short half life (of hours) so that after a few days there ill be little radioactive material left in the person. It should be low ionising so not to damage cells.	Risk that cells could be damaged which would cause cancer.
Control or Destruction of Unwanted Tissue	Beams of Gamma rays can be used to kill cancerous tumour cells. The gamma rays are aimed at the tumour from different directions.	Radiation should be gamma rays so that they can pass through the body.	Healthy cells can also be damaged.

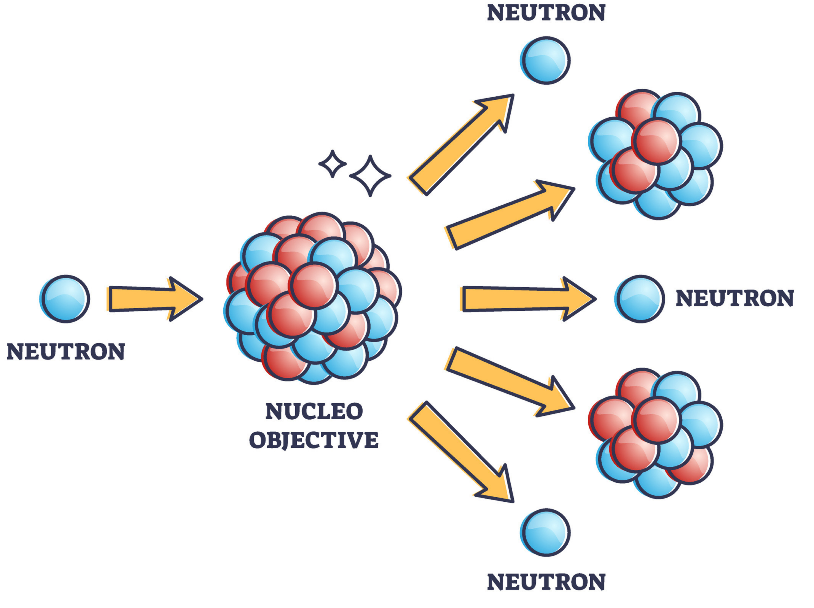
10 Minutes on....

Nuclear Fission

Key Term	Definition
Nuclear Fission	The splitting of a large and unstable nucleus

What happens during nuclear fission.
For fission to occur the unstable nucleus absorbs a neutron. The nucleus undergoing fission splits into two smaller nuclei, roughly equal in size and emits three neutrons plus gamma rays. Energy is released by the fission reaction. All of the fission products have kinetic energy. The neutrons may go on to start a chain reaction. This is controlled in a nuclear reactor, however, the explosion caused by a nuclear weapon is caused by an uncontrolled chain reaction.

A diagram to model nuclear fission



10 Minutes on....

Nuclear Fusion

Key Term	Definition
Nuclear Fusion	The joining of two light nuclei to form heavier nucleus. In the process some of the mass may be converted into the energy of radiation.

A diagram to model nuclear fusion