

Topic: Electricity A: Circuits

Duration:

Composite:
Unit test

Key vocabulary:

- Circuit
- Potential difference
- Voltage
- Current
- Resistance
- Ohm
- Amp
- Volt
- Series
- Parallel
- Branch
- Junction
- Component
- Voltmeter
- Ammeter
- Power
- Charge
- Equation
- Resistor
- Filament
- Lamp
- LDR
- Thermistor
- Variable resistor
- Cell
- Battery

Core knowledge Components

Powerful knowledge components crucial to commit to long term memory - Questions in bold, (C)

Electricity A: Circuits

What are atoms made of? (C)

Around the outside of an atom are **electrons**, which have a **negative charge**.

The nucleus at the centre of an atom contains **protons**, which have a **positive charge**.

What are the properties of the sub-atomic particles? (C)

Subatomic particle	Relative mass	Relative charge
Proton	1	+1
Neutron	1	0
electron, e ⁻	1/2000	-1

How is a voltmeter connected to measure potential difference across a component? **In parallel!**

How is an ammeter connected to measure the current flowing through a component? **In series!**

How do we define potential difference?
PD is the energy transferred per unit charge passed and hence that the volt is a joule per coulomb

How do we define an electrical current?
An electric current is the rate of flow of charge

What are the key differences between series and parallel circuits? (C)

In a series circuit the current flowing is the same in every part of that circuit.

In a parallel circuit, the current is split between branches.

In a series circuit the potential difference from the power supply is shared across the components.

In a parallel circuit each branch has the same potential difference across it.

What equation links potential difference, current and resistance?

$$V = I \times R$$

What equation links charge, current and time?

$$I = \frac{Q}{t}$$

I = Current
Q = Total charge
t = time taken

What equation links power, energy transferred and time? (C)

$$P = \frac{E}{t}$$

power = $\frac{\text{energy transferred}}{\text{time taken}}$

What equation links energy transferred to potential difference, current and time?

$$E = VIt$$

What equation links power to potential difference and current? (C)

$$P = I \times V$$

What equation links power to current and resistance?

$$P = I^2 \times R$$

How does changing resistance in a circuit affect current? (C) Increasing the resistance will decrease the current. Decreasing the resistance will increase the current.

What does a variable resistor do?
It changes the current within a circuit

How can unwanted energy transfer in wires be reduced?
By using wires with lower resistance

What are the benefits and disadvantages of the heating effect of a current?
Benefits:
Can be used in a variety of appliance to transfer energy as heating e.g. toaster, heater, kettle
Disadvantages:
Causes appliances to be inefficient, energy is dissipated to the surroundings

What properties do LDRs and Thermistors have?
LDR: Resistance increases with lower light intensity.
Thermistor: Resistance increases as temperature gets lower

What circuit symbols do I need to know?

Year 7 Electricity
Year 7 Energy
Year 9 Energy
Year 10 Conservation of Energy
Year 11 Electricity
B: Using Electricity in the Home
Year 11 Magnetism

Impressive reading

Impressive speaking

Impressive writing

Resilience

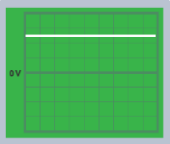
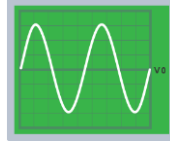
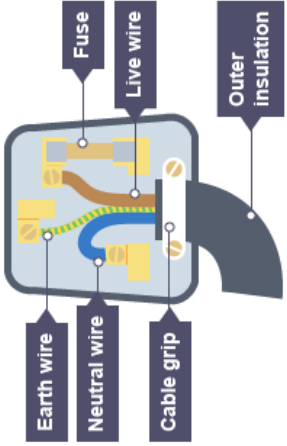
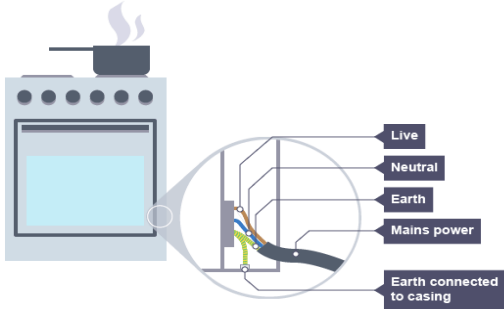
Employability via:

Students will need to be taught how to test circuits themselves and to problem solve circuits.

Many electrical and engineering career paths available with this knowledge.

Topic: Electricity B: Using Electricity in the Home	Duration: 3 lessons	Composite: Unit test
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Key vocabulary:	Core knowledge Components Powerful knowledge components crucial to commit to long term memory - Questions in bold, (P)	Links to previous and future topics
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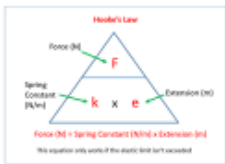
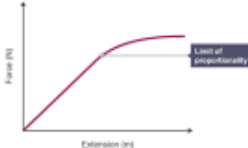
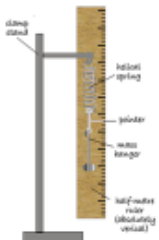
<ul style="list-style-type: none"> • Alternating • Direct • Current • Potential Difference • Mains • Frequency • Live • Neutral • Earth • Terminal • Circuit breaker • Power rating • Fuse 	<p>What is the</p>  <p>difference between direct and alternating current? (P)</p> <p><u>A direct current flows in one direction only</u></p> <p><u>In an alternating current the direction of charge movement regularly changes</u></p> 	<p>What type of current do cells and batteries supply? <u>Cells, batteries and solar cells all supply direct current</u></p> <p>What is the frequency and voltage of mains domestic electricity supply in the UK? <u>50Hz, a.c. 240V</u></p> <p>What are the functions of the live, neutral and earth wires? (P) What are the potential differences between the live, neutral and earth wires?</p> <table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th style="width:15%;">Wire</th> <th>Function</th> </tr> </thead> <tbody> <tr> <td>Live wire</td> <td>Copper wire coated with brown plastic - this wire connects to the alternating potential difference pushing the current in the circuit</td> </tr> <tr> <td>Neutral wire</td> <td>Copper wire coated with blue plastic - this wire is connected to a voltage close to zero, to ensure the live voltage always has a difference in potential to make the push for the current</td> </tr> <tr> <td>Earth wire</td> <td>Copper wire coated in striped plastic that provides a path for current to flow from the case of the device to the ground (also a zero-voltage connection) if there is a fault</td> </tr> </tbody> </table>	Wire	Function	Live wire	Copper wire coated with brown plastic - this wire connects to the alternating potential difference pushing the current in the circuit	Neutral wire	Copper wire coated with blue plastic - this wire is connected to a voltage close to zero, to ensure the live voltage always has a difference in potential to make the push for the current	Earth wire	Copper wire coated in striped plastic that provides a path for current to flow from the case of the device to the ground (also a zero-voltage connection) if there is a fault		<p>Year 7 Electricity</p> <p>Year 7 Energy</p> <p>Year 9 Energy</p> <p>Year 10 Conservation of Energy</p> <p>Year 11 Electricity A: Circuits</p> <p>Year 11 Magnetism</p>
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<p>How does earthing work? <u>The earth wire is connected to the case and is attached to a metal plate. The earth wire provides a low resistance path to the ground. In the event of a fault, the live current passing through the case will follow this path to the ground instead of passing through a person. Once the fuse has melted, the circuit is broken and no more current flows through the device. This means the case of the device is no longer live and there is no more risk of electrocution.</u></p>			<p>How does a circuit breaker work? <u>A circuit breaker can serve the same function as a fuse but can be reset without the need for replacement if it trips. The fuse or circuit breaker must be connected in the live wire side of a domestic circuit to ensure that it keeps high voltage from reaching the user, or surroundings, if a fault develops.</u></p>									

Impressive reading	Impressive speaking	Impressive writing	Resilience	Employability via:
				Many electrical and engineering career paths available with this knowledge.

CULTURAL CAPITAL:

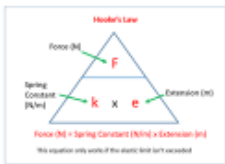
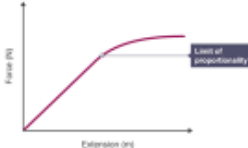

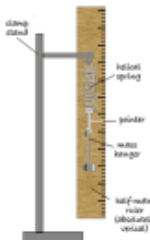
SEND

- Opening activity/theme is ... to ensure learner buy in
- Opportunities for retrieval practice and building on prior knowledge via Knowledge Recall slide
- Multi-sensory approach using video, practical work, teacher explanation/modelling, paired work
- Technology: video used to support accessibility
- Repetition of key vocabulary in every lesson
- Curriculum time allocated for the explicit teaching of key vocabulary
- Skills ordered logically and sequenced with an increase in complexity
- Links to prior learning explicitly highlighted to support non-verbal reasoning

Topic: KS4 FORCES AND MATTER				Duration: 4 Lessons	Composite: Unit test
Key vocabulary:	Core knowledge Components Powerful knowledge components crucial to commit to long term memory (IN RED BOX)				Links to previous and future topics
Force Stretch Compress Elastic Inelastic Plastic Deformation Linear Non linear Hooke Proportionality Energy Work done Potential	<p>KS4 FORCES AND MATTER</p> <p>SPRINGS:</p> <p>Stretching, Bending and Compressing:-</p> <ul style="list-style-type: none"> More than one force has to be applied <p>o If a single force is applied, the object will just move in the force's direction</p> <p>o If forced inwards from opposite sides, the object (e.g. a spring) will compress</p> <p>o If fixed at one end of the spring and a force is applied at the other, more than one force is still being applied to the spring (a reaction force from the fixed point)</p> <p>Deformation:-</p> <ul style="list-style-type: none"> This means changing shape Elastic Deformation <ul style="list-style-type: none"> The object returns to its original shape when the load/force has been removed Eg. An elastic band Plastic Deformation (distortions) <ul style="list-style-type: none"> The object does not return to its original shape when the load has been removed Eg. A spring when pulled too far 	<p>Linear Elastic Distortions, Hooke's Law</p> <ul style="list-style-type: none"> Spring constant k = Force required to extend a spring by one metre Hooke's Law: The extension of a spring is directly proportional to the force applied. Directly proportional means e.g. that if force doubles, extension doubles. It will be a linear (straight line) graph starting at the origin.  <p>Limit of Proportionality/Elastic Limit:-</p> <ul style="list-style-type: none"> Spring constant is a measure of the stiffness of a spring up to its limit of proportionality or elastic limit. The limit of proportionality is the point beyond which Hooke's law is no longer true when stretching a material. The elastic limit of a material is the furthest point it can be stretched or deformed while being able to return to its previous shape. Once a material has gone past its elastic limit, its deformation is said to be inelastic. The graph curves at this point. The material will not return to its original length. 	<p>Energy stored in a spring:-</p> <ul style="list-style-type: none"> Work is done when a spring is extended or compressed. Elastic potential energy is stored in the spring. Provided inelastic deformation as not occurred:- <p>Work done = Elastic Potential Energy (Both are measured in Joules, J)</p> $E_e = \frac{1}{2} k e^2$ <p>Labels: Elastic Potential Energy (J), spring constant (N/m), extension (m), E_e, $\frac{1}{2} k e^2$</p>	<p>Hooke's Law Investigation</p> <p>Variables:- Independent = mass added to spring Dependent = extension of spring Control = material of spring, original length of spring, person judging extension length</p> <p>NB: pointer; absolutely vertical ruler Consider: range (need change but not overstretch); safety</p> <p>Plot graph of F against e:</p> <ul style="list-style-type: none"> gradient = spring constant Area under line = Work done 	<p>Y7: Forces and Space</p> <p>Y9: Forces in a Newtonian World, Motion & Pressure</p> <p>KS4: Forces, Energy – Forces doing Work; Forces & their Effects, Conservation of Energy</p> <p>KS5 Physics: Forces in Action; Work, Energy and Power</p>
Impressive reading		Impressive speaking	Impressive writing	Resilience	Employability via:
<p>Linking Physics and Springs to the human body:- https://www.nhs.uk/conditions/hamstring-injury/</p> <p>What is the link between Physiotherapy and this topic? https://www.nhs.uk/conditions/physiotherapy/</p>		Identify forces acting on objects stretching, compressing, bending or none of the above	Linking topic with muscle injury and Physiotherapy	Required practical: Investigating Hooke's Law	Architect, Product design, Civil and Aeronautical Engineering, Geophysicist, Physiotherapist, Sports Scientist
CULTURAL CAPITAL: Understanding the link between Hooke's Law, hamstring injury and Physiotherapy					

SEND

- Opening activity/theme is Knowledge Recall to ensure learner buy in
- Opportunities for retrieval practice and building on prior knowledge using Knowledge Recall.
- Multi-sensory approach using reading, listening, watching, doing practicals, talking, observing demonstrations...
- Muscle injury/physiotherapy link case study chosen to support cultural capital at KS4/KS5
- Muscle injury/physiotherapy link case study chosen as it is relatable and for career opportunities/aspirations beyond school.
- Muscle injury/physiotherapy topic chosen due to cross curricular links with PE supporting non-verbal reasoning
- Repetition of key vocabulary in every lesson
- Curriculum time allocated for the explicit teaching of key vocabulary
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- Activities are scaffolded with over-learning of previous content to encourage independence

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