Edward Peake Church of England Middle School		
Topic: Electromagnets .Voltage and resistance and current	**Year: 7**	**Strand: Physics**

What should I already know?

Components in a circuit
All metals are good electrical conductors. Materials that do not allow electricity to pass through them are called insulators. Examples are wood, plastic, rubber, cloth and air.
A simple electric circuit consists of components such as cells, wires, bulbs, switches and buzzers.
Recognised symbols can be used to represent a simple circuit in a diagram.

Making current flow
Components only work if the circuit is complete and contains a power supply. Then an electric current can flow.
When the switch is open (off), the circuit is not complete and none of the components will work

Changing the voltage
The brightness of a lamp or the loudness of a buzzer is related to the number and voltage of cells used in the circuit.
If more cells are added to a circuit, the brightness of bulbs or the loudness of buzzers in the circuit will increase

What will I know by the end of the unit?

Explaining electric circuits
Components in an electric circuit provide opposition to the current, known as resistance, and transfer energy to the surroundings.
Components in circuits can be arranged in series or in parallel. These arrangements have different effects on the voltage and current, and provide different applications.
The current, voltage and resistance are related to each other.
Models are a good way of explaining what happens in a circuit

Current
Current is a movement of electrons and is the same everywhere in a series circuit.
Current depends on the 'push' given by the battery, known as the voltage.
Current divides between loops in a parallel circuit and combines when loops meet

Potential difference
Voltage, or 'potential difference', is the amount of energy per unit of charge transferred through the electrical pathway.In a series circuit, voltage is shared between each component. In a parallel circuit, voltage is the same across each loop.

Electrostatic force
Around a charged object, the electric field affects other charged objects, causing them to be attracted or repelled.
The field strength decreases with distance

Useful websites

Positive, negative charges and static electricity. ttps://www.bbc.co.uk/bitesize/guides/zthyvcw/revision/1
Electric charges and potential difference https://www.bbc.co.uk/bitesize/guides/zsfgr82/revision/1
Ohms law https://www.ducksters.com/science/physics/ohms_law.php
Fuses https://youtu.be/ObvPXRxQ98Q
Mains electricity https://youtu.be/1LxVdfX18g0
How to use an ammeter **https://youtu.be/2tCLLPnGnPg**
Revision Monkey
Electric circuits **https://www.youtube.com/watch?v=dCx-OVUn7Cw**
Energy and power
https://www.youtube.com/results?search_query=revision+monkey+ks3+science++energy+in++electric+circuits
Resistance **https://www.youtube.com/watch?v=HNPow41uibw&t=10s**
Series and parallel circuits **https://www.youtube.com/watch?v=dCx-OVUn7Cw&t=239s**
Drawing circuits **https://www.youtube.com/watch?v=7JnqnExpQU4**
Static charge **https://www.youtube.com/watch?v=Kqm26J0-j0Y**

Edward Peake Church of England Middle School		
Topic: Electromagnets .Voltage and resistance and current	**Year: 7**	**Strand: Physics**

Vocabulary	
ammeter	Equipment used to measure the current flowing in a circuit
Amp (A)	short for ampere, is a unit of electrical current
attract	to pull towards. For example, a magnet will attract any magnetic material that is close enough to be in its magnetic field
battery	2 or more cells used together in series.
cell	An electric cell or electrochemical cell. Ia made up of 2 different metals separated by an electrolyte which produce a potential difference. Or a device, that is capable of changing some form of energy, such as chemical energy or radiant energy, into electricity. In common usage we often call a cell a battery. This is incorrect as more than one cell makes a **battery**.
charge	**Negatively charged**: An object that has gained electrons as a result of the charging process. **Positively charged:** An object that has lost electrons as a result of the charging process. Fact: Two similarly charged objects repel, two differently charged objects attract. We say that an object is **charged up**
circuits	In **a series circuit**, voltage is shared between each component. In a **parallel circuit,** voltage is the same across each loop
circuit breaker	device that breaks a circuit when the current is too high
component	Components with resistance reduce the current flowing and shift energy to the surroundings.
contact forces	**contact forces**: a force that acts only if there is direct contact between objects. **non-contact forces:** a force that acts without direct contact between objects.
conductor	a conductor is an object or type of material that allows the flow of charge (electrical current) in one or more directions.
current	Current is a movement of electrons and is the same everywhere in a series circuit. Current divides between loops in a parallel circuit, combines when loops meet, lights up bulbs and makes components work. Electrical current is a measure of the amount of electrical charge transferred per unit of time.
electrons	stable subatomic particles with a charge of negative electricity.
electric field	around a charged object, the electric field affects other charged objects, causing them to be attracted or repelled. The field strength decreases with distance.
electrical conductor	a material that allows current to flow through it easily, and has a low resistance.
electrical insulator	a material that does not allow current to flow easily, and has a high resistance.
free electron	negatively charged particle that moves freely within a metal
field	force field is an area where an object feels a force, e.g. area around a charged object where another object feels an electrostatic force
non -contact force	a force that arises although objects are not touching, Non-contact force between two charged objects.
mains supply	household alternating current electric power supply
ohms	units of electrical resistance
potential difference	potential difference (voltage): The amount of energy shifted from the battery to the moving charge, or from the charge to circuit components, in volts (V).
protons	positively charged particle in the nucleus of an atom
repel	to push away. In this topic it is where, the north pole of a magnet will repel the north pole of another magnet

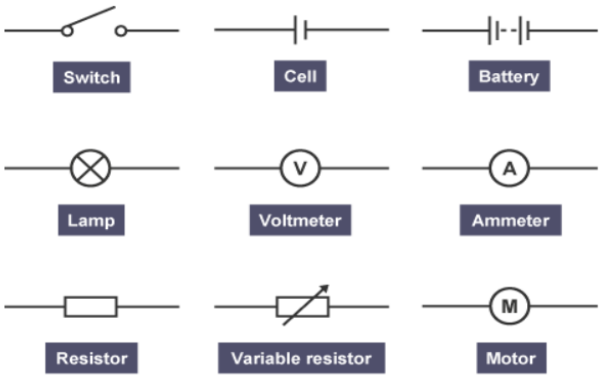
Edward Peake Church of England Middle School		
Topic: Electromagnets .Voltage and resistance and current	**Year: 7**	**Strand: Physics**

resistance	a property of a component, making it difficult for charge to pass through. The electrical resistance of an object is a measure of its opposition to the flow of electric current. Measured in ohms (Ω).
ring main	how the electricity supply in a house is connected
static electricity	an imbalance of electric charges on the surface of a material
volt	the unit for potential difference.
voltage	the measure of the size of 'push' that causes a current to flow around a circuit; it is the amount of energy shifted (from battery to charge, or from charge to component) per unit charge
voltmeter	device used to measure the voltage across a component in an electric circuit

Key information

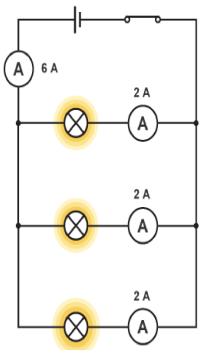
Circuit symbols

We use **circuit symbols** to draw diagrams of electrical circuits, with straight lines to show the wires. The diagram shows some common circuit symbols.

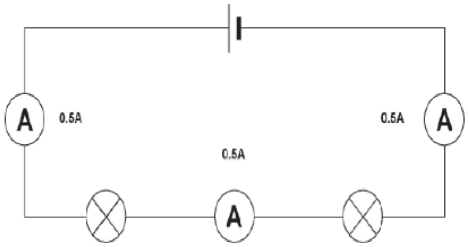


Some common circuit symbols

Current in parallel



Current in series



Key information

Insulators	Conductors
Can become charged (+ or -), but DO NOT let the charges flow	DO let charges flow (e.g. electrons)
Examples: almost any non-metal materials, like rubber, fabrics, paper, plastics, wood	Examples: all metals, and graphite (in your pencil!)
CANNOT be used in a circuit	To make a circuit, you MUST use conductors, joined in a complete loop
Insulators have extremely HIGH resistance, which is why current can't flow through them	Conductors have LOW resistance, which is why they let charges flow through them

Current in series and parallel

In a circuit with only one loop, so all components are in series the current is the same through every part of the circuit. In other words, the electrons flow at the same rate everywhere in the circuit. The diagram shows some example readings.

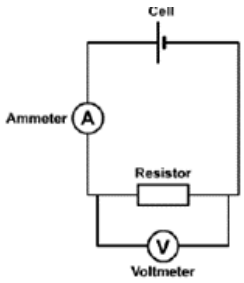
If a circuit includes components on different loops (in parallel), the current splits at the junctions in the circuit. The total current in all the separate loops adds up to the current before or after the split, as the diagram shows.

Potential difference in series and parallel

In a circuit with only one loop, so all components are in series, the potential difference from the supply is shared by all the components. If a circuit includes components on different loops (in parallel), each loop receives ALL the potential difference from the supply. The parallel components don't have to share.

Edward Peake Church of England Middle School		
Topic: Electromagnets .Voltage and resistance and current	**Year: 7**	**Strand: Physics**

Measuring current and potential difference



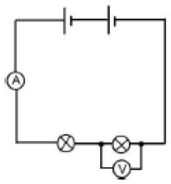
Resistance

If the reading on the ammeter is 0.2 A and the reading on the voltmeter is 5.5 V, what is the resistance of the lamp?

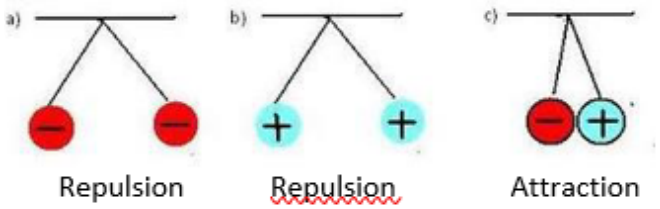
R = V/I

R = 5.5/0.2

R =27.5 Ω

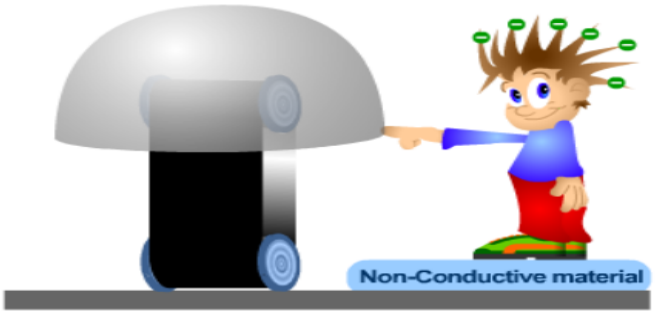


Static electricity

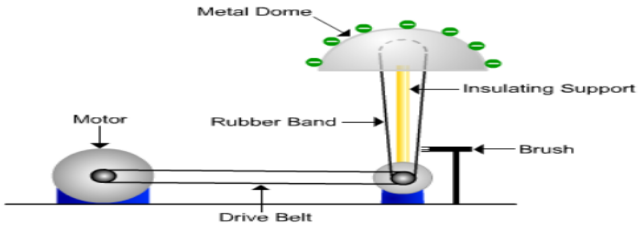


Fun Static

When you rub your hair (e.g. balloon or jumper), or hold onto a Van de Graaff generator while you are insulated yourself, your hair stands on end (unless it's full of super strength gel!). Because each of the hairs has the same charge, they try to get as far away from each other as possible.



The way you may have seen static generated at school is with a **Van de Graaff Generator (see diagram).** The motor turns the rubber band and friction between the band and the rollers starts to build up huge amounts of charge.



This charge is then deposited on the metal dome, which is a **conductor**, but is insulated from everything else (like birds sitting on a power line), so it is able to store the charge.

The charge can build up in a big way, causing voltages as high as 50,000 Volts. A shock from this doesn't kill you, as the actual amount of charged particles stored on the dome is so small.

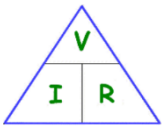
Measuring current and potential difference

•Current is measured with an ammeter. An ammeter is included in the circuit (in series with the other components).

• Potential difference (voltage) is measured with a voltmeter. Since voltmeters measure the difference in potential energy between two points, they must be added across the component whose potential difference you want to measure.

Resistance

Resistance, potential difference and current are linked in the equation V = IR. This is also known as Ohm's Law.



Static electricity

Electric charges are positive or negative. For example, electrons have a negative charge. Opposite charges attract each other (+ and --), whereas charges that are alike repel each other (+ and +, OR and --). This is because there is a force of attraction between opposite charges, but a force of repulsion between like charges.