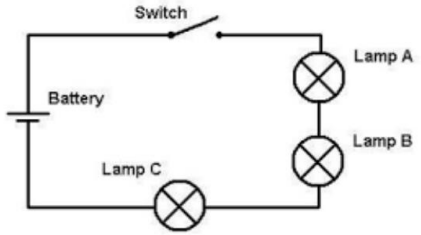
Knowledge organiser – 2. Electromagnets

Series circuit:

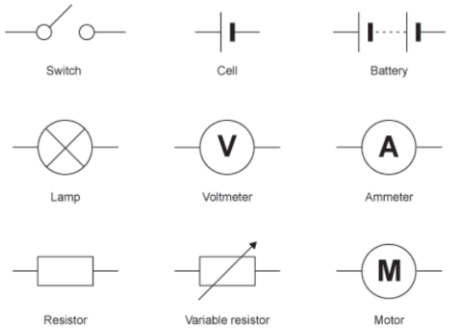
The current in a series circuit remains constant

The voltage in a series circuit is shared. The highest voltage will be across the power supply



Electrical circuit symbols:

When constructing diagrams of circuits we use symbols. These are the common symbols you will use in this topic:



Current: This is the flow of electrons (charge) in a circuit. Current is measured in amperes (Amps) with an ammeter in series.

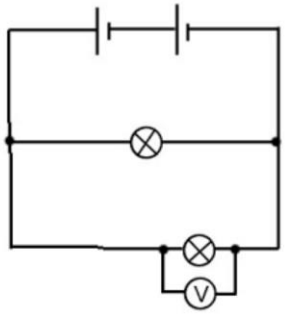
Adding cells or increasing the voltage in a series circuit will increase the current flow.

Adding components (e.g. bulbs will decrease the current flow in a circuit).

Parallel Circuits:

The current in a parallel circuit is shared evenly. The sum of the current in each branch of a circuit will be equal to the current leaving and returning to the battery.

The voltage in a parallel circuit remains the same.



Potential difference:

Voltage: (PD)
This is the 'push' provided to make the electricity flow. This is measured using a voltmeter in parallel.
1 volt means 1 joule of energy is provided per coulomb of charge.

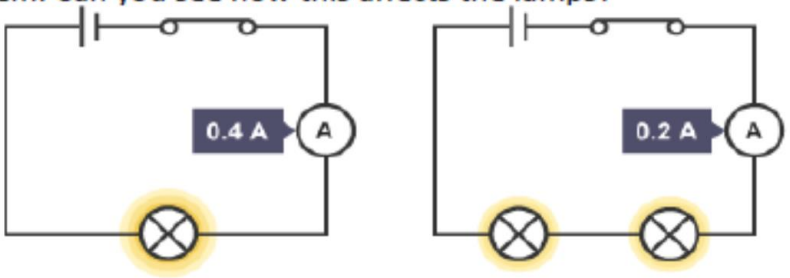
Series and parallel circuit rules:

Type of circuit	Rule for current	Rule for PD
Series	Same everywhere	Shared
Parallel	Shared	Same everywhere

Resistance

The wires and the other components in a circuit reduces the flow of charge through them. This is called resistance.
The unit of resistance is the ohm, and it has the symbol Ω (an uppercase Greek letter omega).

The resistance increases when you add more components in series. For example, the resistance of two lamps is greater than the resistance of one lamp, so less current will flow through them. Can you see how this affects the lamps?



Conductors and insulators of electricity

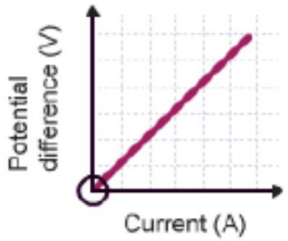
Different materials have different resistances:

- an electrical conductor has a low resistance
- an electrical insulator has a high resistance

You can easily find out which materials are conductors and which are insulators using a simple circuit. You set up a series circuit with a cell, lamp and wires. Leave a gap in the circuit between two of the wires. Then connect the two wires using pieces of each material and see if the lamp lights up:

- it will light up if the material is a conductor
- it will not light up if the material is an insulator

Resistance represents the ratio of potential difference to current. Therefore, if you plot a graph of current against potential difference for a wire, you get a straight line.



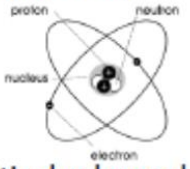
Calculating resistance

To find the resistance of a component, you need to measure:
the potential difference across it
the current flowing through it
The resistance is the ratio of potential difference to current. We use this equation to calculate resistance:

resistance = potential difference ÷ current

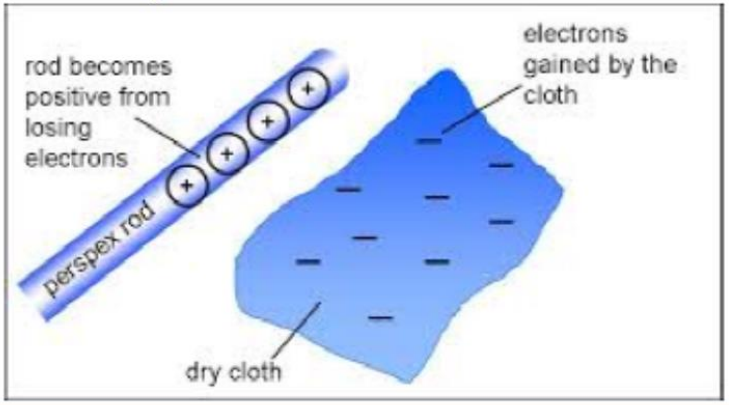
E.g. 3A flows through a 240 V lamp. What is the resistance of the lamp? resistance = 240 ÷ 3 = 80 Ω

All substances are made of atoms. These are often called particles. An atom is electrically neutral - has no overall electrical charge. However, each atom contains even smaller particles called electrons. (remember, these are negatively charged)



- If an atom gains an electron, it becomes negatively charged.
- If an atom loses an electron, it becomes positively charged.

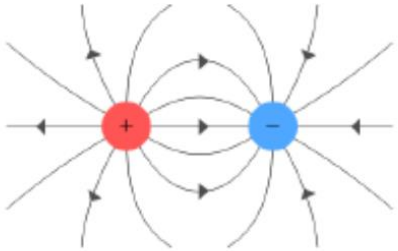
Electrons can move from one substance to another when objects are rubbed together. You may have done this with a party balloon: if you rub a balloon on your sweater, you can get the balloon to stick to the wall or to your hair. This is because of static electricity.



Electric fields

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. A second charged object placed in the field experiences a force. The force gets stronger as the distance between the objects decreases. Students should be able to:

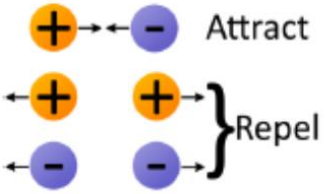
A charged object creates an electric field. You cannot see an electric field, but it surrounds the charged object. If another charged object is moved into the electric field, a force acts on it. The force is a non-contact force because the charged objects do not have to touch for the force to be exerted.



These lines show the electric field that we can't see. Can you tell from the lines whether these charged objects are attracting or repelling?

Two charged objects will:

- repel each other if they have like charges (they are both positive or both negative)
- attract each other if they have opposite charges (one is positive and the other is negative)



Charged objects will also attract small, uncharged objects. This is why a charged plastic comb or ruler, or a party balloon, can pick up small pieces of paper.
The only way to tell if an object is charged is to see if it repels another charged object.