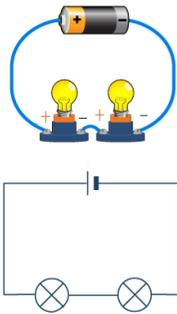


## Knowledge organiser – 7.4 Potential difference and resistance

- The cell/ battery provides the push to make charges move. This push is called potential difference.
- The current is the amount of charge flowing per second.
- A battery with a larger potential difference transfers *more* energy, making bulbs brighter.
- Components have a potential difference they are designed to work at (rating).
- A voltmeter is always connected in parallel and an ammeter is connected in series.

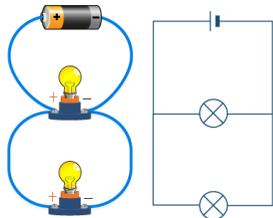
### SERIES CIRCUIT

- The **current is the same** in all parts of a series circuit.
- If you add components, the current will get smaller because the resistance is bigger.
- In a series circuit, the **potential difference** (voltage) from the battery is **shared** by the components.
- If a bulb breaks, the rest will go out.



### PARALLEL CIRCUIT

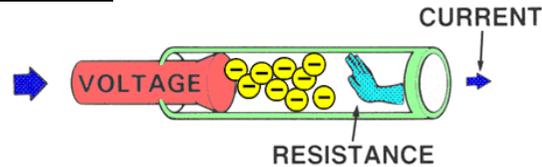
- The **current is shared** between the components (when it reaches the branches) and then adds again where the branches meet.
- The **potential difference** across each component is the **same as the potential difference across the battery**.
- If one bulb breaks, the other lights will stay on.



### MODELLING ELECTRIC CIRCUITS – ROPE MODEL

- The rope represents the charges
- The person pulling the rope is like the battery
- A bigger potential difference across the cell is like the 'battery' person pulling harder.
- **SERIES:** the rope moves at the same speed everywhere. As more people hold the rope, the rope moves more slowly.
- **PARALLEL:** there are more loops of rope. All the loops are driven by the same 'battery' person.

### RESISTANCE



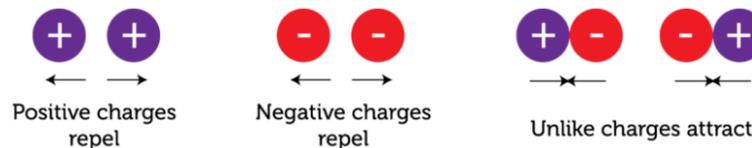
- Each component has a different resistance; this tells you how easy or difficult it is for charges (electrons) to pass through wires or components.
- Resistance is measured in ohms ( $\Omega$ ).
- Adding more components, increases the resistance, so the current is less.
- $resistance (\Omega) = \frac{potential\ difference\ (V)}{current\ (A)}$

**Resistance in wires** is caused by electrons colliding with metal atoms and transferring energy to them.

The following affects resistance;

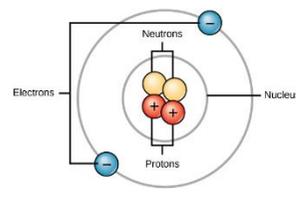
- Length  $\rightarrow$  longer wire = more resistance
- Thickness  $\rightarrow$  thicker wire = less resistance
- Material of wire  $\rightarrow$  good conductor = less resistance

There are two types of electrical charge: **positive charge (+)** and **negative charge (-)**. Charged particles (or charges) **attract or repel** each other. There is an electrostatic force between the charges.

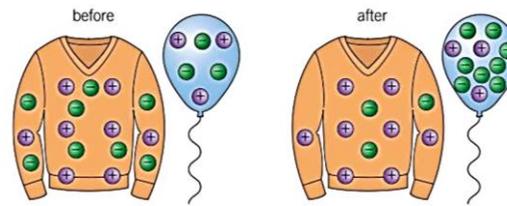


Everything is made up of **atoms**. Atoms are neutral overall. They are made of three types of even smaller particles.

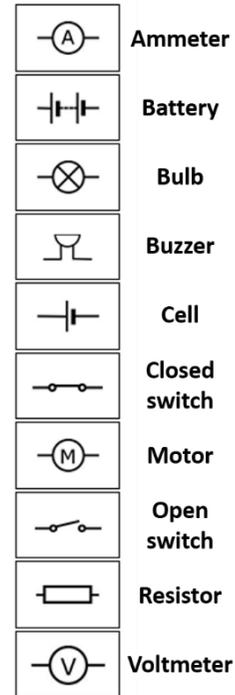
- (1) Protons (positive charge)
- (2) Electrons (negative charge)
- (3) Neutrons (no charge)



Electrons are transferred from the jumper to the balloon. The balloon is charged up. It has more electrons than protons, so it is negatively charged. The jumper is positively charged. They will attract.



### CIRCUIT SYMBOLS



KEYWORD	DEFINITION
<b>Ammeter</b>	A device for measuring electric current in a circuit.
<b>Amps</b>	Units of measurement of electric current, symbol A.
<b>Attract</b>	Be pulled together.
<b>Battery</b>	Two or more electrical cells joined together.
<b>Cell</b>	A chemical store of energy, which provides the push that moves charges around a circuit.
<b>Charged up</b>	When materials are rubbed together, electrons move from one surface to another.
<b>Current</b>	Flow of electric charge, usually electrons, in amperes (A).
<b>Electric field</b>	A region where a charged material or particle experiences a force.
<b>Electrical conductor</b>	A material that allows current to flow through it easily, and has a low resistance.
<b>Electrical insulator</b>	A material that does not allow current to flow easily, and has a high resistance.
<b>Electron</b>	Tiny particles that are part of atoms and carry a negative charge,
<b>Electrostatic force</b>	Non-contact force between two charged objects.
<b>Negatively charged</b>	An object that has gained electrons.
<b>Neutral</b>	Describes an object or particle that has no charge, or in which positive and negative charges cancel out, giving no overall charge.
<b>Ohms</b>	The unit of resistance, symbol $\Omega$ .
<b>Parallel</b>	If some components are in separate loops in an electric circuits.
<b>Positively charged</b>	An object that has lost electrons.
<b>Potential difference (voltage)</b>	The amount of energy shifted from the battery to the moving charge, or from the charge to circuit components, in volts.
<b>Rating</b>	The value of potential difference at which a cell or bulb operates.
<b>Repel</b>	Be pushed away from each other.
<b>Resistance</b>	A property of a component, making it difficult for charge to pass through, in ohms ( $\Omega$ ).
<b>Series</b>	If components in an electric circuit are in the same loop.
<b>Voltmeter</b>	A device for measuring potential difference (voltage).
<b>Volts</b>	Unit of measurement of potential difference (voltage), symbol V.