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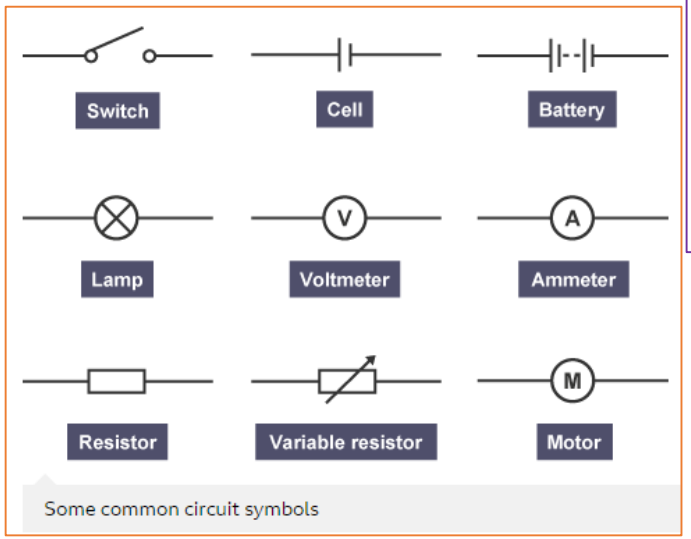
Year 8 Physics UNIT 3
Electricity and Magnetism



Some common circuit symbols

Electric **current** is the flow of electric charge (electrons) measured in amperes A (amps).

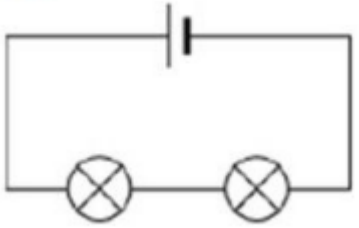
Voltage (potential difference) is the **push force** which produces a current around the circuit.

Conductor – a material that allows electrical current to pass through it.
Insulator – does not allow an electric current to flow through it.

Metals are **good electrical conductors**. They have a very low resistance because they contain **lots of electrons** that can move.

In a series circuit all the components are connected, one after the other, in a complete loop of conducting wire. There is **only one path** that the current can take. The voltage is shared between the components.

A series circuit.



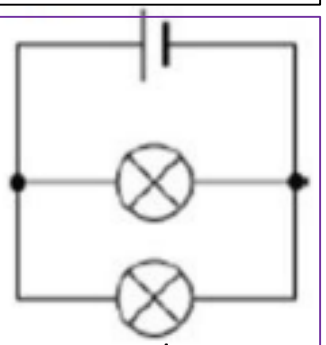
If a lamp breaks or a component is disconnected, the circuit is broken and all the components stop working.

Electrical resistance (R) tells us how easy or difficult it is for electrical charges to pass through an electrical component or wire. Resistance is measured in **ohms (Ω).**

Other materials, such as **plastics, do not have many electrons** that are free to move. The **resistance of plastic objects is very high**.

In a parallel circuit each component is connected separately in its own loop between the two terminals of a cell or battery. The full voltage is supplied to each loop. The **current** from the battery **is divided** between the loops.

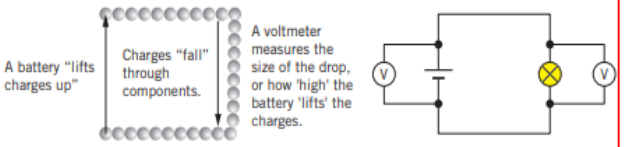
In a parallel circuit



if a lamp breaks or a component is disconnected from one parallel wire, the components on different branches keep working.

'Potential difference' or 'voltage'?

Sometimes people talk about the '**voltage**' of a cell or battery. It is better to talk about potential difference. You can think of this like a height difference.



▲ You can think of the battery 'lifting' up the charges. In the circuit above, the voltmeters would read the same.

Keyword	Definition
Ammeter	A device used to measure electric charge.
Ampere	Unit of current. E.g. The current in the bulb is 4 amps or amperes (A).
Cell	A store of internal energy that can be transferred as an electric current in a circuit.
Conductor	A material which allows charge to move easily through it.
Electron	Sub atomic particle which flows in a circuit carrying a negative charge.
Series Circuit	A circuit connected in a way that the same current flows through each component in turn.
Parallel Circuit	In a parallel circuit, the current divides into two or more paths before recombining to complete the circuit.
Insulator	A material that does not allow charge or heat to pass through it easily.
Ohms	The unit of electrical resistance. Unit is **Ω**
Resistance	The opposition in an electrical component to the movement of electrical charge through it. Resistance is measured in ohms.
Potential Difference	The potential difference (or voltage) of a supply is a measure of the energy given to the charge carries in a circuit.
Volt	Unit of voltage. E.g. the voltage across the lamp was 6 volts (V).
Voltmeter	A device used to measure potential difference or voltage.

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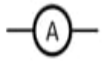
Some materials are **magnetic**. If you put **iron, steel, cobalt, or nickel** in a magnetic field they experience a magnetic force. This is a **non-contact force**. The force is **stronger the closer you are** to the magnet.

Fantastic Fact The Earth's magnetic field keeps flipping. About 500 000 years ago the magnetic north pole was actually the south pole.

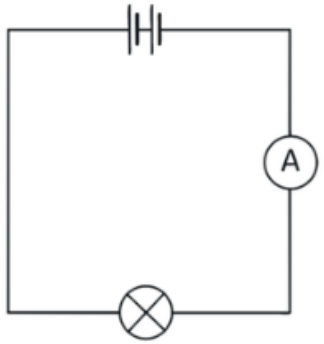
Electrical current is the **flow of electrons** around the circuit**.** Electrons are **negatively** charged**.**

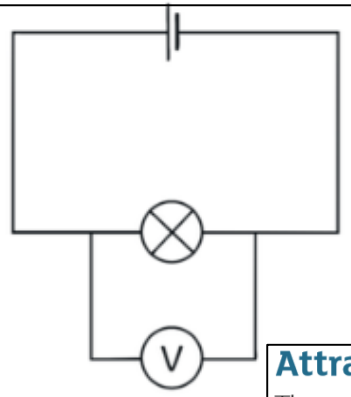
An **ammeter** 

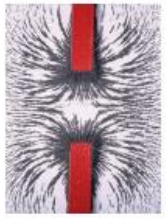
to measure electric **current.** It is connected in **series**.

A **voltmeter** 

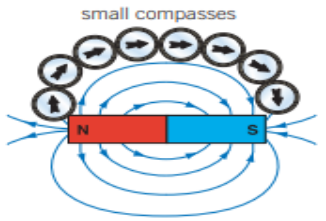
used to measure **potential difference** (also known as **voltage**). It is connected in **parallel**.







Two magnets repelling.



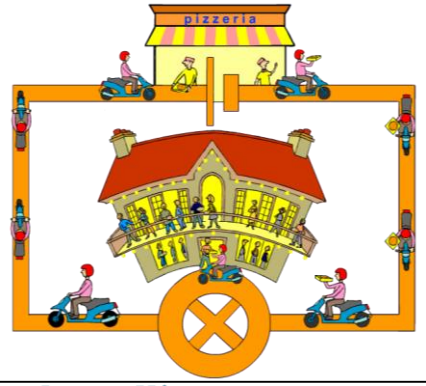
▲ The field around a bar magnet.

A magnet has two magnetic poles, a **north-seeking pole** and a south-seeking pole.

- **North**-seeking poles **repel north**-seeking poles.
- **South**-seeking poles **repel south**-seeking poles.
- **North**-seeking poles **attract south**-seeking poles

A **permanent magnet** is a magnet that has its **own** magnetic field.

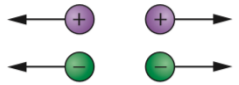
A wire with an electric current flowing through it also has a magnetic field. The magnetic field around a single loop isn't very strong.



Attracting and repelling

There are two types of **electric charge**: positive charge (+) and negative charge (–). Charged particles, or charges, **attract** or **repel** each other, like magnets do. There is an **electrostatic force** between charges.

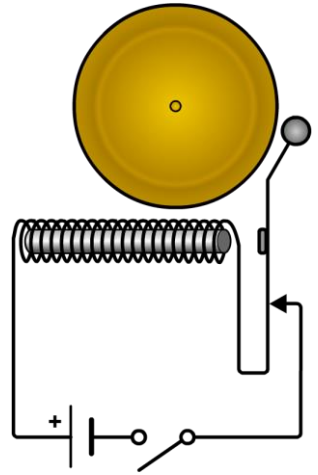
- **Positive** charges *repel* **positive** charges.
- **Negative** charges *repel* **negative** charges.
- **Positive** charges *attract* **negative** charges.

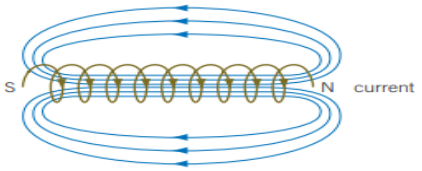


▲ Repelling.

▲ Attracting.

Using electromagnets





▲ The magnetic field around a coil of wire carrying a current.

You can wind lots of loops together to make a coil, called a **solenoid**. If a current flows through it you have an **electromagnet**. You can turn an electromagnet on and off by turning the current on and off. The magnetic field is only produced when the current is flowing in the wire.

Skills Development:

Use the formula resistance = potential difference/ current
Build series and parallel circuits and take measurements

Extend to GCSE:

All of these topics will be re-visited in GCSE Physics.

Q) Write and explain how the resistance of a filament lamp changes when the current through the filament is increased.

Q) Sketch a circuit diagram to show two resistors R and S in parallel with each other connected to a single cell.