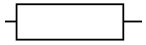
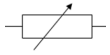
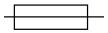
SCIENCE

Year 9: Electricity and Magnetism

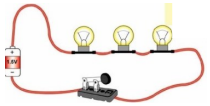
1) Electrical Components

Component	Symbol	Component	Symbol
Switch		Thermistor	
Cell		Diode	
Battery		LED	
Lamp		LDR	
Voltmeter		Resistor	
Ammeter		Variable resistor	
Motor		Fuse	

Keyword	Meaning	Keyword	Meaning
Charge	A property of an object that can be either positive, negative or neutral. Measured in **Coulombs (C)**	**Magnet**	An object that can repel another magnet and attracts magnetic materials
Current	A flow of charge. In a wire, this will be a flow of electrons Measured in **Amperes (A)** using an **ammeter**	**Magnetic Flux Density**	The strength of a magnetic field. Measured in **Tesla (T)**
Conductor	Substances that an electric charge can pass through without difficulty e.g. copper, iron	**Insulator**	Substances that an electric charge cannot pass through easily e.g. wood, plastic, rubber
Electron	Part of an atom which has a negative charge. The charge carrying particle in a circuit	**Iron Core**	A piece of iron inside the coil of wire in an electromagnet to increase the strength of the magnetic field
Electromagnet	A coil of wire connected to a power supply. When an electric current flows, a magnetic field is created around the wire	**Potential difference**	A measure of the **difference in energy per unit of charge** between two parts of a circuit. Measured in **Volts (V)** using a **voltmeter**

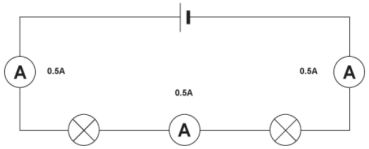
2) Series Circuits

An electrical circuit in which the wires and components are linked together in one **closed loop**

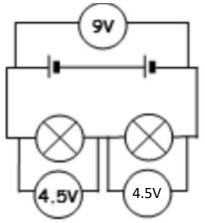


Rules

- **Current** is the **same** all around the circuit. **Ammeters are added in series** in a circuit



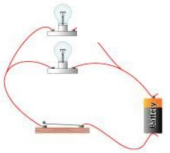
- If one component in a series circuit **breaks**, the **current stops** all round the circuit
- **Bulbs get dimmer** as more get added in series
- **Potential difference** of the cell is **shared between the components.**



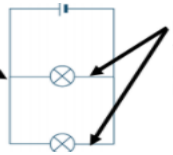
Voltmeters are added in parallel and we **ignore measuring equipment when deciding if something is a series circuit or not**

3) Parallel Circuits

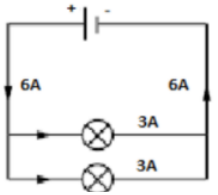
An electrical circuit in which wires and components are linked together but there are **junctions** and **branches**



Junction—here the current splits and goes down either branch

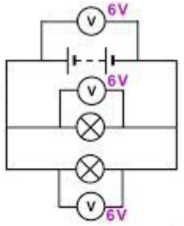


Branches—how much current flows down each branch depends on what is in each branch.



Rules

- **Current** is **not the same** all round the circuit.
- Current in **each branch adds up** to the **same as the total current before the junction**
- If one component **breaks,** components on other branches will keep working as there are other routes for **electrons** to flow
- **Potential difference** of the **cell** is the **same** as the **potential difference across each branch**
- **Bulbs** stay the **same brightness** as more get added in parallel

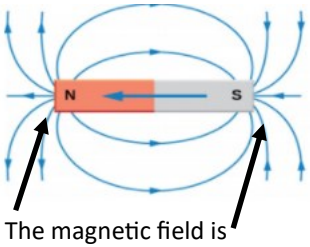


RGS BRISTOL **SCIENCE**

Year 9: Electricity and Magnetism

4) Magnetic fields

Surrounding a magnet is an area called a **magnetic field.** Inside this field, other magnets and/or magnetic objects will feel a magnetic **force**



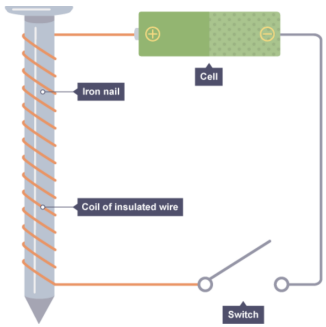
The magnetic field is stronger at the **poles.**

This diagram shows the magnetic field around a **bar magnet**

- The arrows on the lines show the direction the force will act on a compass
- The distance between the **magnetic field lines** show the **magnetic flux density.** The closer together the lines, the stronger the magnetic flux density

6) Electromagnets

- When an electric current flows in a wire, it creates a magnetic field around the wire. This effect can be used to make an **electromagnet**.
- A simple electromagnet comprises a length of wire turned into a coil and connected to a battery or power supply.
- Electromagnets are useful as they can be **turned on and off** and the **strength** of the **magnetic field can be varied**
- The **magnetic field** around an electromagnet is the same shape as the one around a bar magnet but it can be **reversed** by **reversing the current** (turn battery around)

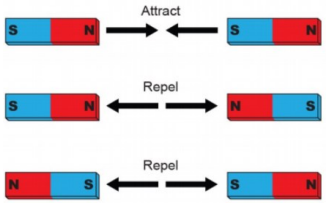


You can make an **electromagnet stronger** by doing these things:

- Wrapping the coil around a an **iron core** (such as an iron nail)
- Adding **more turns to the coil**
- **Increasing** the **current** flowing through the coil

5) Magnets

- The three **magnetic elements** are **iron, cobalt and nickel.**
- **Steel** is also a magnetic material as it contains iron and carbon
- These magnetic materials will be **attracted** to a magnet

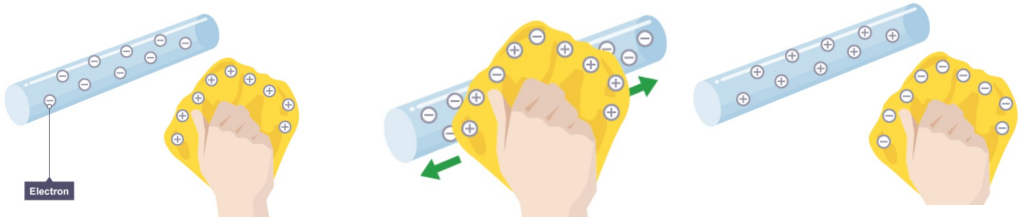


Unlike poles attract

Like poles repel

- There are 2 types of Magnet:
- **Permanent magnet**—Materials that produce their own magnetic field.
  E.g. **bar magnets** in science or fridge magnets

- **Induced magnet**—Materials that can temporarily become magnets in the magnetic field of something else.
  E.g. iron filings, paper clip or an electromagnet

7) Separating charges

- When **insulating materials** rub against each other, they may become electrically **charged**
- **Electrons**, which are negatively charged, may be 'rubbed off' one material and on to the other
- The material that **gains electrons** becomes **negatively charged**
- The material that **loses electrons** is left with a **positive charge**
- **Insulators** prevent the electrons from moving and the charge remains **static**
- A **charged object** will experience a **non contact force** from another charged object