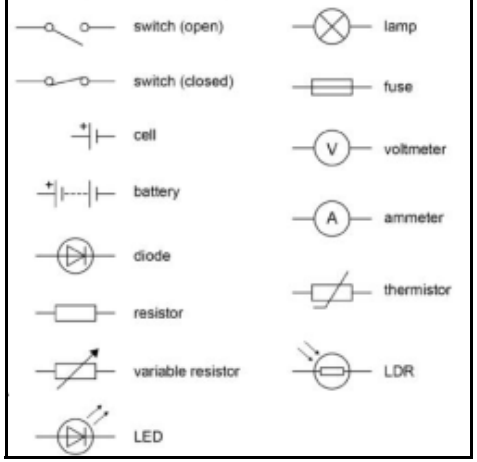
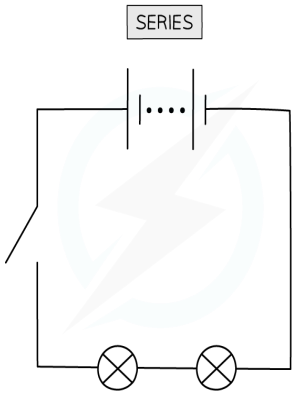
Physics: Electricity and Magnets

Circuits

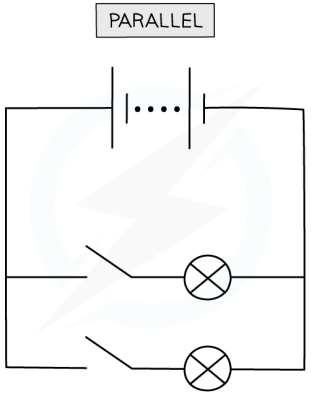
Circuit diagrams use standard symbols.



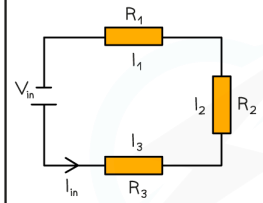
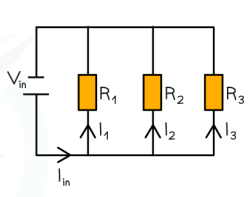
Series Circuits



Parallel Circuits

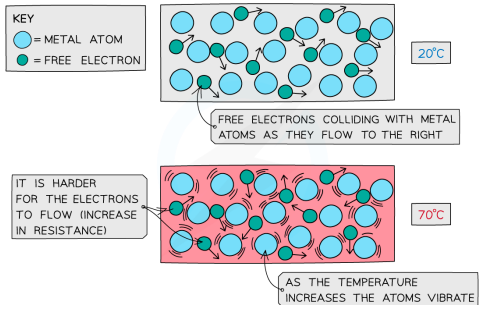


Series and Parallel Circuits

	Series	Parallel
Circuit		
Voltage	$V_{in} = V_1 + V_2 + V_3$	$V_{in} = V_1 = V_2 = V_3$
Current	$I_{in} = I_1 = I_2 = I_3$	$I_{in} = I_1 + I_2 + I_3$
Resistance	$R_{total} = R_1 + R_2 + R_3$	$R_{total} < R_1 + R_2 + R_3$

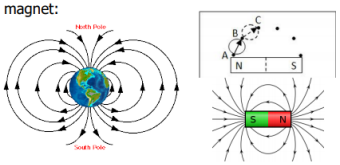
Resistance

Resistance is **the opposition to current**



Magnetic fields

Use a compass to plot a magnetic field:
Magnetic field of the Earth and a magnet:



Power

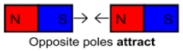
1. The **power transfer** in any circuit device is related to the potential difference across it and the **current** through it, and to the energy changes over **time**:
2. power = potential difference × current
3. **(P = V I)**
4. power = current 2 × resistance
5. **(P = I² R)**

Power (P): **in watts (W)**
potential difference (V): **in volts (V)**
Current (I): **in amperes (A)**
Resistance (R): **in ohms (Ω)**

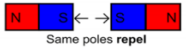
Magnets

1. Magnets

(a) Magnets have a **north** and **south** pole.



Opposite poles **attract**



Same poles **repel**

(b) The magnetic field is strongest at the poles
Permanent – Always magnetic
Induced magnet – Can be turned on or off

(c) **Electromagnets** can be turned on and off and are created by wrapping a coil of wire (solenoid) around an iron core.
(d) **Electromagnets** can be strengthened by the 3Cs (larger CIRCUMFERENCE, more COILS, more CURRENT)

Currents and Magnetism
a) An **alternating magnetic** field can induce a **current**
b) An **alternating current** can induce a **magnetic field**

Electricity in the Home

Most electrical **appliances** are connected to the **mains** using **three-core cable**.
The insulation covering each wire is colour coded for easy identification:
live wire – brown
neutral wire – blue
earth wire – green and yellow stripes.
The **live wire** carries the **alternating potential difference** from the supply. The **neutral wire** **completes** the circuit. **The earth** wire is a **safety wire** to stop the appliance becoming live.

The **potential difference** between the **live wire** and **earth** (0 V) is about **230 V**. The **neutral wire** is at, or close to, earth potential **(0 V)**. The earth wire is at 0 V, it only carries a current if there is a **fault**. A live wire may be **dangerous** even when a switch in the mains circuit is open.

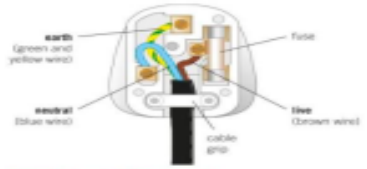


Figure 2 *Inside a three-pin plug*

Mains electricity is an ac supply.
In the United Kingdom the domestic electricity supply has a frequency of 50 Hz and is about 230 V.
Direct current flows in one direction only.
Alternating current constantly changes direction.