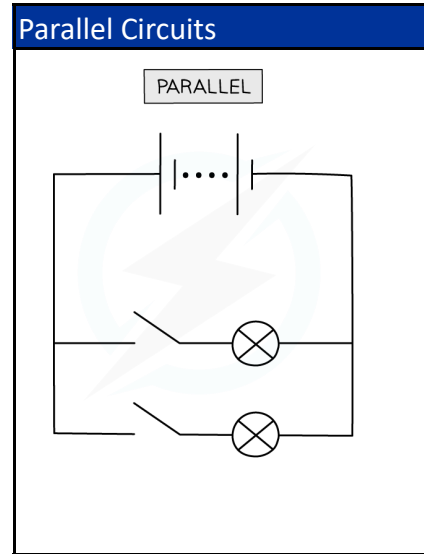
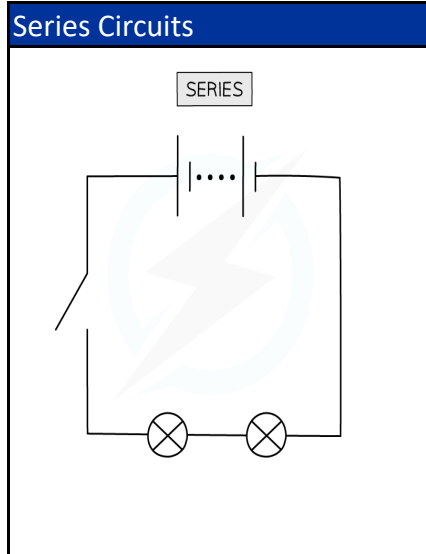


Circuits

Circuit diagrams use standard symbols.

	switch (open)		lamp
	switch (closed)		fuse
	cell		voltmeter
	battery		ammeter
	diode		thermistor
	resistor		LDR
	variable resistor		LED



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**

KEY
 = METAL ATOM
 = FREE ELECTRON

FREE ELECTRONS COLLIDING WITH METAL ATOMS AS THEY FLOW TO THE RIGHT

20°C

IT IS HARDER FOR THE ELECTRONS TO FLOW (INCREASE IN RESISTANCE)

70°C

AS THE TEMPERATURE INCREASES THE ATOMS VIBRATE

Power

- 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:
- power = potential difference \times current
- $(P = V I)$
- power = current $^2 \times$ resistance
- $(P = I^2 R)$

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

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.

Magnetic fields

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

Magnets

- Magnets**
 - Magnets have a **north** and **south** pole.

Opposite poles **attract**
 - The magnetic field is strongest at the poles
 Permanent – Always magnetic
 Induced magnet – Can be turned on or off
- Electromagnets** can be turned on and off and are created by wrapping a coil of wire (solenoid) around an iron core.
- Electromagnets** can be strengthened by the 3Cs (larger CIRCUMFERENCE, more COILS, more CURRENT)

Currents and Magnetism

- An **alternating magnetic** field can induce a **current**
- An **alternating current** can induce a **magnetic field**