WJEC (Eduqas) Physics GCSE

7.4: Domestic Electricity and Safety

Detailed Notes

(Content in **bold** is for higher tier **only**)

Types of Current

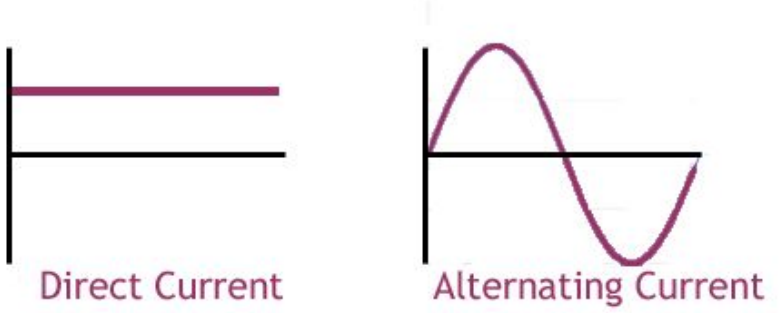
There are **two main types** of current that can be used in electrical circuits, alternating and direct.

Direct Current

Known as **DC**, this current flows in a **single direction** around a circuit. It is the type of current typically supplied by batteries and solar cells. On an oscilloscope, the trace of the voltage will also be direct, showing as a **single, straight line**.

Alternating Current

Known as **AC**, the direction of this current is **constantly changing** around the circuit. UK mains supply is an alternating current at a voltage of **230 V** and a frequency of **50 Hz**, meaning it changes direction around the circuit 50 times every second. On an oscilloscope, the trace of the voltage will also be **alternating**, showing as a wave.



Oscilloscope traces for AC and DC voltage (scienceaid.net).

Plugs

There are **three** types of wire that run through all mains circuits and devices in the UK. These have different purposes and can be identified by their different colored windings.

Live Wire

The **brown** wire that carries **mains supply voltage** around the circuit. This wire remains dangerous even when the circuit is turned off as it still may be carrying a current.

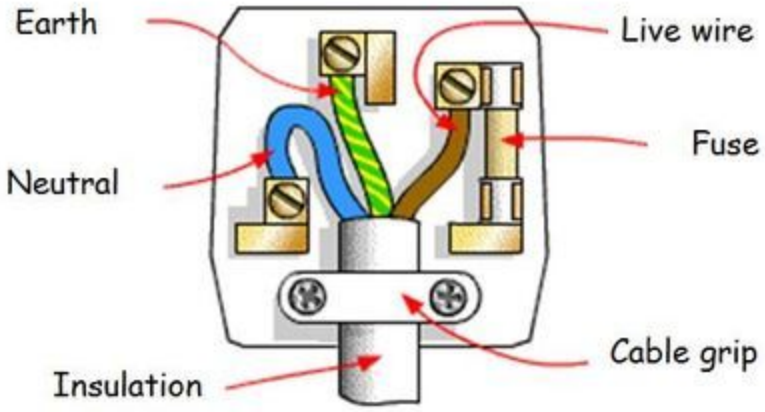
Neutral Wire

The **blue** wire that **completes** the electrical circuit.

Earth Wire

The **green and yellow striped** wire that acts as a **safety wire**, preventing the appliance from becoming live. It is connected to **'earth'** and to the casing of an appliance so that if the live wire touches the casing making it 'live', the earth wire will carry off the dangerous current keeping the appliance safe.

All three of these wires are visible within the plug head of a device.



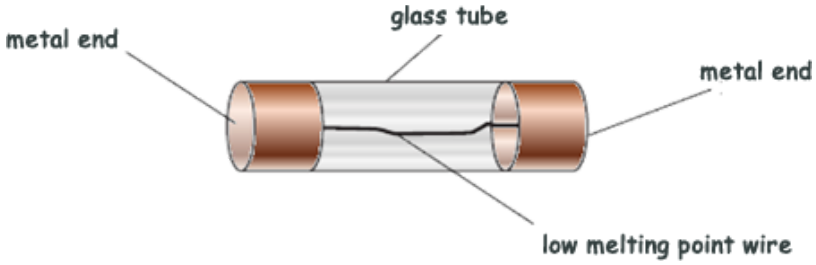
Inside structure of a plug (gcsesciencedictionary.co.uk).

Fuses & Circuit Breakers

Fuses and circuit breakers are **safety mechanisms** that protect electrical circuits and devices, by preventing too large a current flowing.

Fuses

A fuse is a **small piece of wire** within a glass tube that sits inside the plug of an appliance. They have **specific melting points** so that if a current too large for that device flows through it, the piece of wire will heat up and **melt**, breaking the circuit.



Structure of a fuse (cyberphysics.co.uk).

Fuses come in **standard ratings**, the most common being **3A, 5A** and **13A**. Devices requiring a higher current will require a larger fuse. If a 5A current flows through a 3A fuse, it will melt and break the circuit, showing how the correct fuse must be selected for a device. Once a fuse has melted, it must be replaced for the device to rework again.

Circuit Breakers

These are **automatic switches** that act in a similar way to fuses, **breaking a circuit** when there is a fault. There are two main types of circuit breaker used for different sizes of device and circuit.

Miniature Circuit Breakers (MCB)

When a fault is detected, an **electromagnetic switch** opens to stop the flow of current around a circuit. MCBs stop a dangerous current much **faster** than a regular fuse and can be **reset** more easily once the fault is found without having to be replaced.

Residual Current Circuit Breakers (RCCB)

These monitor the current in both the **live and neutral wires** of a device. If there is a **difference** detected in the current flowing in these wires, the RCCB will 'trip' and switch off the current in the circuit. RCCBs are **very sensitive** and act automatically.