

Electricity in the Home

- Mains electricity is the electricity generated by power stations and transported around the country through the National Grid
- Everyone connects to the mains when plugging in an appliance such as a phone charger or kettle
- Mains electricity is an **alternating current** (a.c.) supply
- In the UK, the domestic electricity supply has a **frequency** of **50 Hz** and a **potential difference** of about **230 V**
- A frequency of 50 Hz means the direction of the current changes back and forth 50 times every second.
- Mains electricity, being an alternating current, does not have positive and negative sides to the power source
- The equivalent to positive and negative are called **live** and **neutral** and these form either end of the electrical circuit.

Cables have Three Wires

- All electrical appliances are connected to the mains using at least a live wire and a neutral wire
- In the UK, most electrical appliances are connected to the mains using a three-core cable consisting of
 1. A live wire
 2. A neutral wire
 3. An Earth wire
- **Color code for easy identification** The insulation covering each wire is color coded for easy identification:
 1. Live wire – **brown**
 2. Neutral wire – **blue**
 3. Earth wire – **green and yellow stripes**

Purposes of Live, Neutral and Earth Wires

The three wires have distinct purposes

1. The Live Wire

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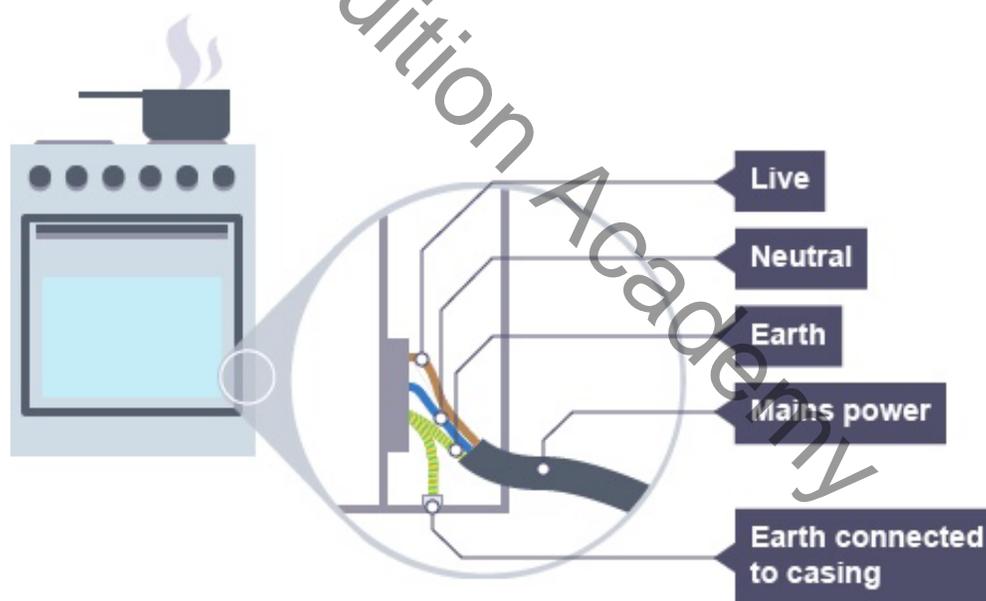
- a. The **live wire** **Carries the alternating potential difference from the mains supply to a circuit.**
- b. It is the most dangerous of the three wires
- c. If it touches the appliance without the Earth wire, it can cause electrocution
- d. It provide the alternative potential difference at about 230 V

2. The Neutral Wire

- a. The **neutral wire** **Forms the opposite end of the circuit to the live wire to complete the circuit**
- b. Because of its lower voltage, it is much less dangerous than the live wire
- c. It doesn't carry a current or around 0 V

3. The Earth Wire

- a. The **earth wire** **Acts as a safety wire to stop the appliance from becoming live**
- b. This prevents electric shocks from occurring if the appliance malfunctions or the live wire breaks off and touches the case of the plug
- c. It also doesn't carry current or around at 0 V



Danger of electricity

Electricity can be dangerous in the following situations:

1. **If an electrical wire is damaged.** This might expose the live wire meaning a person received an electrical shock if they touched it.
2. **Damp conditions.** Water that is not pure can conduct electricity. In damp conditions a current could flow outside of a live wire and cause an electrical shock.

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3. **Overloading of plug sockets or extension cables.** Excess current could flow if more than the recommended number of appliances is plugged in. This could cause a fire if the cables overheat.
4. **Overheating cables.** Hot cables could start a fire, or melt through the insulating plastic coating, exposing the live wire.
5. **Open circuits are still dangerous.** Even if the switch is open in a circuit (i.e. the circuit is not complete), the circuit may not actually be safe. There might not be a current in the **live wire**, but there will still be a potential difference in it. When touched, a current can flow from the live wire through your body and into the **earth**.

Safety of Electricity

1. **Fuses are important for safety.** Sometimes electric circuits become overheated, and the amount of electricity flowing through is very large. This can lead to the circuit becoming very hot, which can potentially cause a fire. **Fuses** are devices which shut down the circuit if the current becomes too high. Similarly **circuit breakers** break a circuit if the current is too high.
2. **Sockets and wires have insulating coating.** Sockets have a plastic **insulating coating**, which prevents you from getting in direct contact with the mains supply.
3. **Double Insulation.** Appliances with double insulation do not have an earth wire. They only have a live wire and neutral wire. The whole appliance is insulated by plastic, meaning that no live conductor can touch the outer casing. This can be seen in TVs and hairdryers.
4. **Earthing.** One safety measure is **earthing**. To prevent this, the earth wire is connected a metal casing. This means the current will pass through the earth wire instead of the other components and prevent an electric shock from happening.



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