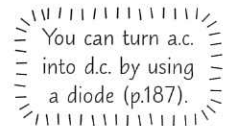


Electricity in the Home

There are two types of electricity supply — alternating and direct currents. Read on for more about both...

Mains Supply is a.c., Battery Supply is d.c.

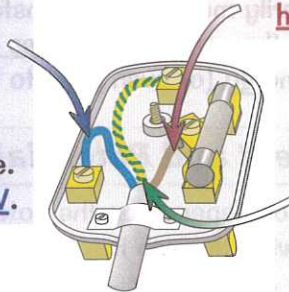
- 1) There are two types of electricity supplies — alternating current (a.c.) and direct current (d.c.).
- 2) In a.c. supplies the charges are constantly changing direction. Alternating currents are produced by alternating voltages (the positive and negative ends of the p.d. keep alternating).
- 3) The UK mains supply (the electricity in your home) is an a.c. supply at around 230 V.
- 4) The frequency of the a.c. mains supply is 50 cycles per second or 50 Hz (hertz).
- 5) By contrast, cells and batteries supply direct current (d.c.).
- 6) In a direct current the charges always move in the same direction.
D.c. is created by a direct voltage (a p.d. that is only positive or negative, not both).



Most Cables Have Three Separate Wires

- 1) Most electrical appliances are connected to the mains supply by three-core cables. This means that they have three wires inside them, each with a core of copper and a coloured plastic coating.
- 2) The colour of the insulation on each cable shows its purpose.
- 3) The colours are always the same for every appliance. This is so that it's easy to tell the different wires apart.

- 2) NEUTRAL WIRE — blue.
The neutral wire completes the circuit — electricity normally flows in through the live wire and out through the neutral wire. The neutral wire is always at 0 V.



- 1) LIVE WIRE — brown.
The live wire carries the voltage (potential difference, p.d.). It alternates between a high +ve and -ve voltage of about 230 V.

- 3) EARTH WIRE — green and yellow.
The earth wire is for safety and protecting the wiring. It carries the current away if something goes wrong and stops the appliance casing becoming live. It's also at 0 V.

- The p.d. between the live wire and the neutral wire equals the supply p.d. (230 V for the mains).
- The p.d. between the live wire and the earth wire is also 230 V for a mains-connected appliance.
- There is no p.d. between the neutral wire and the earth wire — they're both at 0 V.

- 4) Plug sockets have switches which are connected in the live wire of the circuit. This is so the circuit can be broken — the appliance becomes isolated and the risk of an electric shock is reduced.

Touching the Live Wire Gives You an Electric Shock

- 1) Your body (just like the earth) is at 0 V.
- 2) This means that if you touch the live wire, a large potential difference is produced across your body and a current flows through you.
- 3) This causes a large electric shock which could injure or even kill you.
- 4) Even if a plug socket or a light switch is turned off (i.e. the switch is open) there is still a danger of an electric shock. A current isn't flowing, but there is still a p.d. in the live wire. If you made contact with the live wire, your body would provide a link between the supply and the earth, so a current would flow through you.
- 5) Any connection between live and neutral can be dangerous. If the link creates a low resistance path to earth, a huge current will flow, which could result in a fire.



Why are earth wires green and yellow — when mud is brown..?

Electricity is very useful, but it can also be very dangerous. Make sure you know the risks.

Q1 Explain the difference between a.c. and d.c. electricity supplies.

[2 marks]

Electricity in the Home

Warm-Up

In the table below, put a tick next to each statement to show whether it applies to direct current or alternating current.

	Direct current	Alternating current
Describes the current supplied by a battery		
Produced by a voltage that constantly changes direction		
Describes the current supplied by the UK mains		
Produced by a voltage with a constant direction		

1 Most houses in the UK are connected to the mains supply.



a) State the potential difference and frequency of the UK mains electricity supply.

..... [1]

b) A kettle is plugged into the mains with a three-core cable containing a live wire, a neutral wire and an earth wire.

i) State the colours of the live, neutral, and earth wires.

Live:

Neutral:

Earth:

[2]

ii) Complete the table in **Figure 1** to show the sizes of the potential differences between the wires that make up the three-core cable.

Figure 1

Wires	Potential difference / V
Live wire and neutral wire
Neutral wire and earth wire
Earth wire and live wire

[3]

[Total 6 marks]

- 2 A radio develops a fault such that the live wire is in electrical contact with the neutral wire.



Explain whether you think the radio will work while this fault remains.

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[Total 3 marks]

- 3 The cable that connects an iron to the mains supply has become worn with use. There is no insulation covering part of the live wire. The iron is plugged in, but switched off.



- a) State **two** purposes of the insulation that covers the live wire.

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[2]

- b) A man switches on the iron and touches the exposed live wire. He receives an electric shock. Explain why he receives an electric shock. You should refer to the electrical potential of the man in your answer.

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[3]

- c) The the socket is switched off and the iron is unplugged. Explain whether there is still a danger of the man receiving an electric shock from the plug socket.

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[3]

[Total 8 marks]

Exam Practice Tip

The voltage-time graph for an alternating current has a similar shape to the wave shown on p.185. The frequency of an alternating current is how many cycles it completes per second, where one cycle is, for example, from one crest to the next crest (or from one trough to the next trough). It's measured in Hz, just like wave frequency.

