Exercise walk-through

2.5
Domestic uses and safety (4.2.3)

AQA · GCSE · Physics

Circuit symbols, charge and current

- Circuit diagrams use standard **circuit symbols** .
- Learn the symbols for a cell, battery, open and closed switch, lamp, fuse, resistor, variable resistor, ammeter, voltmeter, **diode**, LED, **thermistor** and **LDR**.
- An ammeter is always connected **in series** with a component, and a voltmeter **in parallel** across it.
- For charge to flow, there must be a closed circuit with a source of potential difference, such as a cell. **Electric current** is the rate of flow of electrical **charge** :

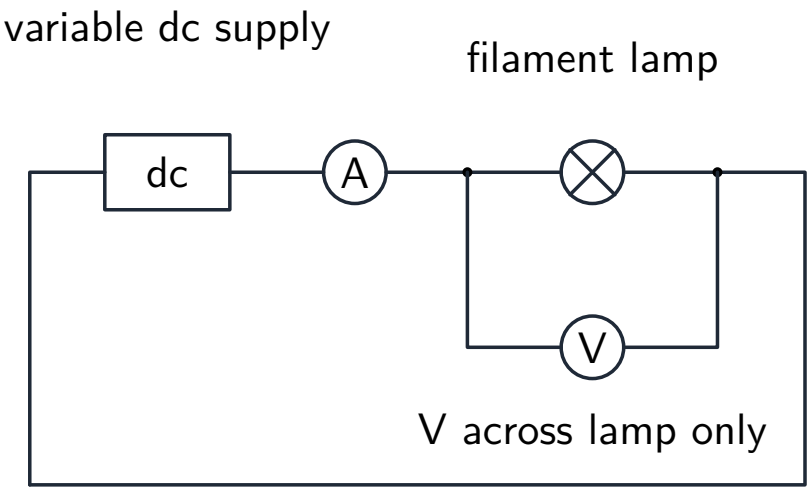
$$Q = It$$

Current, resistance and potential difference

- The current through a component depends on the potential difference across it and on its **resistance** :
- V is potential difference in volts (V), I is current in amperes and R is resistance in ohms (Ω).
- For the same potential difference, a bigger resistance gives a smaller current.
- **Worked example 4.** A potential difference of 0.45 V drives a current of 0.0075 A through a coin.

$$V = IR$$

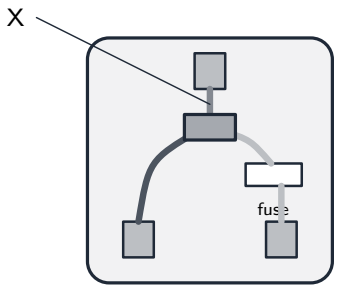
Figure: Resistors and I–V characteristics



- Required practical 4: the ammeter is **in series** with the lamp, and the voltmeter is across it.
- Match each part of the diagram to the text.

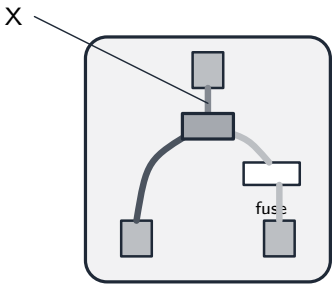
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2.1 Name wire X in the plug, and give its colour. [2]



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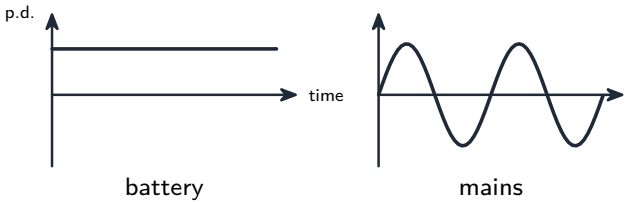


2.1

- earth wire; green and yellow

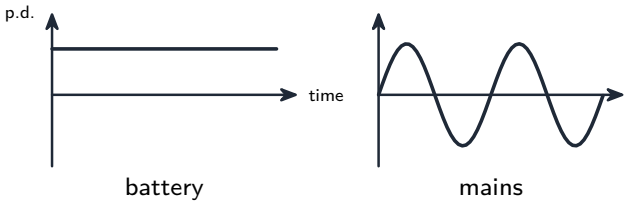
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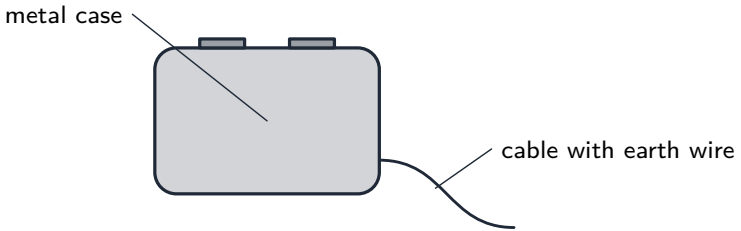


2.2

- the battery gives a direct potential difference, which stays in one direction and is constant; the mains gives an alternating potential difference, which keeps changing direction

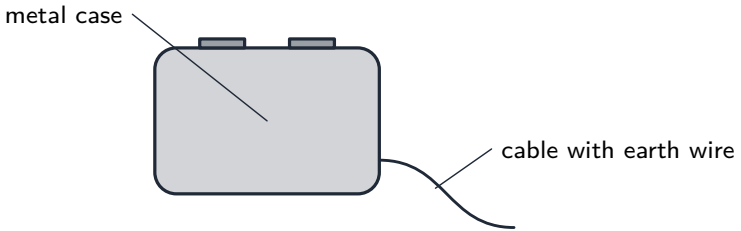
Exercise 3.1

3.1 A toaster has a metal case connected to the earth wire. A fault makes the live wire touch the case. Explain how the earth wire protects the user. [3]



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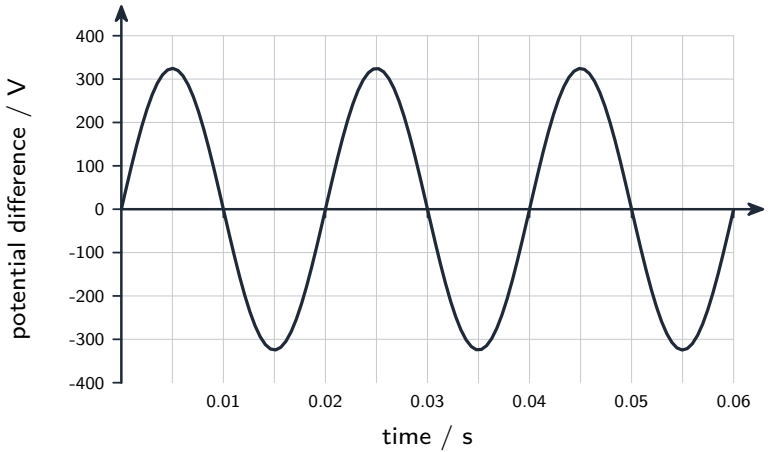
3.1

- a current flows from the live wire through the case to earth
- this current is large, so the fuse melts and breaks the circuit
- so the case does not stay live and the user does not get a shock

Exercise 3.2 (a)

3.2 The graph shows the potential difference of the mains supply against time.

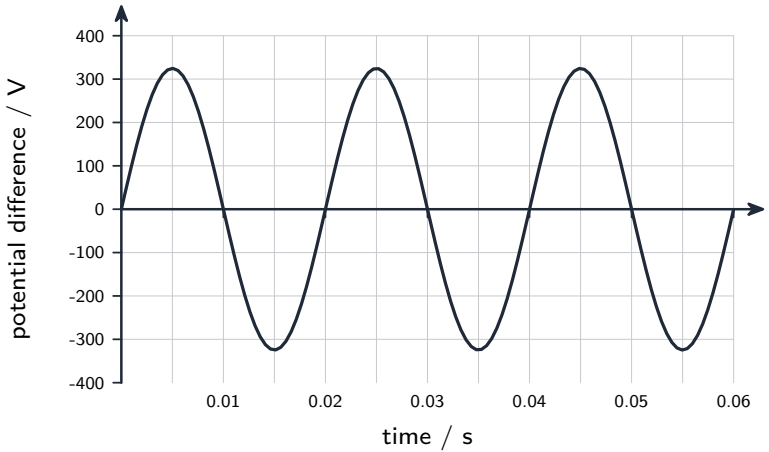
(a) Use the graph to find the period, and calculate the frequency. [2]



Exercise 3.2 (a)

3.2 The graph shows the potential difference of the mains supply against time.

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(a) period $= 0.02$ s; $1 \div 0.02 =$ **50** Hz

Exercise 3.2 (b)

3.2 The graph shows the potential difference of the mains supply against time.

(b) Explain why a person who touches the live wire can get an electric shock, even if the appliance is switched off. [3]

Exercise 3.2 (b)

3.2 The graph shows the potential difference of the mains supply against time.

(b) Explain why a person who touches the live wire can get an electric shock, even if the appliance is switched off. [3]

(b) the live wire is still at about 230 V when the switch is off; the person's body is at about 0 V; so there is a large potential difference, which drives a current through the body

Exercise 3.2 (c)

3.2 The graph shows the potential difference of the mains supply against time.

(c) Describe the job of each wire in a three-core cable, and explain why the earth wire makes an appliance with a metal case safe. [6]

Exercise 3.2 (c)

3.2 The graph shows the potential difference of the mains supply against time.

(c) Describe the job of each wire in a three-core cable, and explain why the earth wire makes an appliance with a metal case safe. [6]

(c) points to include:

- the live wire (brown) carries the alternating potential difference from the supply
- the neutral wire (blue) completes the circuit and is at about 0 V
- the earth wire (green and yellow) is a safety wire at 0 V
- it is connected to the metal case; normally no current flows in it
- if the live wire touches the case, a large current flows to earth and the fuse melts
- this disconnects the live wire, so the case cannot give a shock

Levels: **5–6** a full, logical answer with correct physics and correct terms; **3–4** several correct points, partly linked; **1–2** one or two relevant points.