AQA GCSE Combined Science - Trilogy | 8464

SPECIFICATION POINT 6.2.1.1

# Standard circuit diagram symbols

## Past-paper questions

| | |
|---|---|
| Tier | **Foundation** |
| Question groups | **8** |
| Available paper years | **2018–2025** |

## Using this booklet

1. Answer the questions in order and show your working.
2. Original question numbers and marks are retained.
3. Print at actual size (100%) for measuring questions.
4. Use the companion answer booklet to check your work.

**Name:** _____ **Date:** _____

Whole questions are retained for context, so some parts assess other specification points. Current and legacy sources are labelled. Continue on extra paper if needed.

### 6.2.1.1 Standard circuit diagram symbols

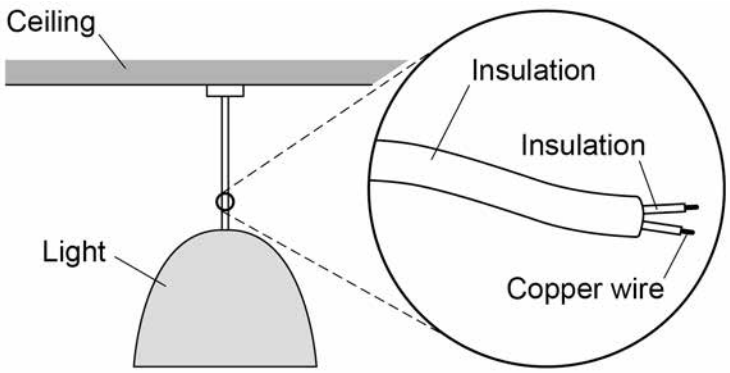
**Question 01**

June 2018 | 8464/P/1F | Original Q4

**0 4** Some ceiling lights in the home are connected to the mains by a two-core cable.

**Figure 6** shows a ceiling light.

**Figure 6**




**0 4 . 1** Suggest why some ceiling lights do **not** have an earth wire.

**[2 marks]**

**0 4 . 2** Write down the equation that links charge flow, current and time.

**[1 mark]**

**0 4 . 3** There is a current of 2.95 A in one of the copper wires for 60 seconds.

Calculate the charge flow through the wire.

Use your equation from question **04.2**

**[2 marks]**

Charge flow = _____ C

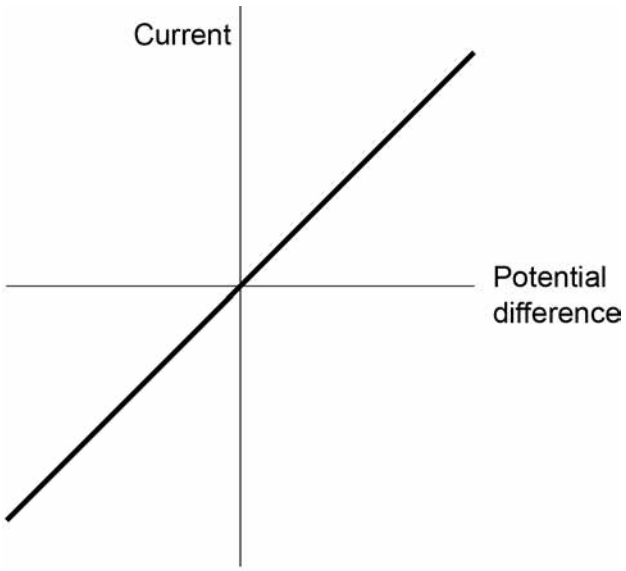
6.2.1.1 Standard circuit diagram symbols

Question 01 · continued



**0 4 . 4** **Figure 7** shows a current potential difference graph for a piece of copper wire.

**Figure 7**




Draw another line on **Figure 7** for a wire with a different resistance.

**[2 marks]**

**Question 4 continues on the next page**

6.2.1.1 Standard circuit diagram symbols

Question 01 · continued



Some fuses have a thin piece of copper that melts if the current is too large.

**0 4 . 5** Draw the circuit symbol for a fuse.

**[1 mark]**

**0 4 . 6** Describe how the movement of the copper particles in the wire changes when copper melts.

**[2 marks]**

**0 4 . 7** Old copper wires are melted when they are recycled.

Calculate the energy needed to melt 500 kg of copper at its melting point.

Specific latent heat of fusion of copper = 200 kJ/kg

Use the Physics Equations Sheet.

**[3 marks]**

Energy = _____ J

13

### 6.2.1.1 Standard circuit diagram symbols

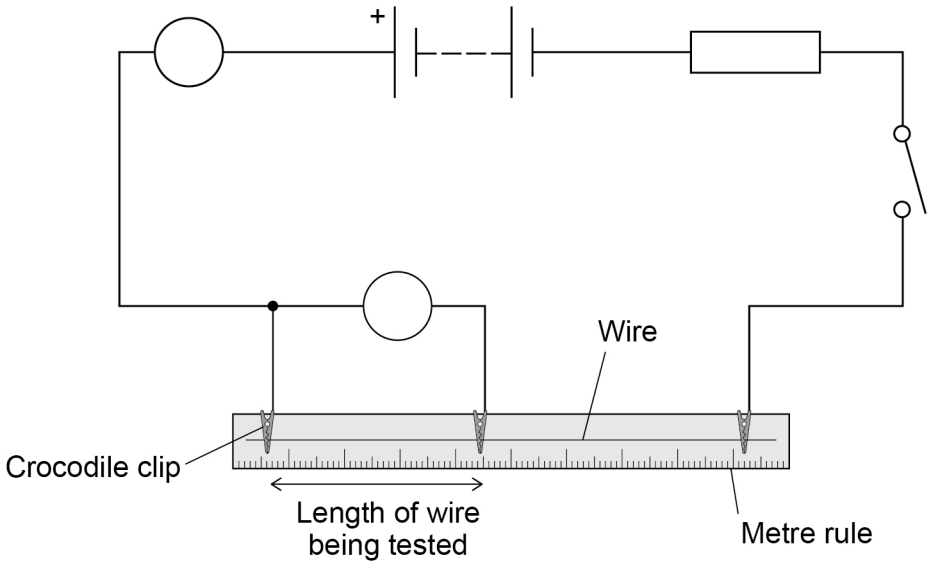
**Question 02**

November 2020 | 8464/P/1F | Original Q1

**0 1** A student investigated how the resistance of a wire varies with the length of the wire.

**Figure 1** shows the circuit used.

**Figure 1**




**0 1 . 1** The symbols for the voltmeter and ammeter in **Figure 1** are **not** complete.

Complete the symbols for the voltmeter and ammeter in **Figure 1**.

**[1 mark]**

**0 1 . 2** Which variable is the independent variable?

**[1 mark]**

Tick (✓) **one** box.

- The current in the wire ☐
- The length of the wire being tested ☐
- The resistance of the wire ☐
- The thickness of the wire ☐

6.2.1.1 Standard circuit diagram symbols

Question 02 · continued



**0 1 . 3** Which variable is the dependent variable?

**[1 mark]**

Tick (✓) **one** box.

- The current in the wire ☐
- The length of the wire being tested ☐
- The resistance of the wire ☐
- The thickness of the wire ☐

**0 1 . 4** The student took repeat readings of potential difference for a 30 cm length of the wire.

The readings were:

0.16 V 0.17 V 0.15 V

Calculate the mean potential difference.

**[2 marks]**

Mean potential difference = _____ V

**Question 1 continues on the next page**

6.2.1.1 Standard circuit diagram symbols



The length of the wire was increased to 60 cm

The current in the wire was 0.50 A

The mean potential difference across the wire was 0.32 V

**0 1 . 5** Calculate the resistance of the 60 cm length of wire.

Use the equation:

$$\text{resistance} = \frac{\text{potential difference}}{\text{current}}$$

**[2 marks]**

Resistance = _____ Ω

**0 1 . 6** Calculate the power dissipated in the 60 cm length of wire.

Use the equation:

$$\text{power} = \text{potential difference} \times \text{current}$$

**[2 marks]**

Power = _____ W

6.2.1.1 Standard circuit diagram symbols

Question 02 · continued



**0 1 . 7** Calculate the charge flow when there is a current of 0.50 A in the wire for 17 s

Use the equation:

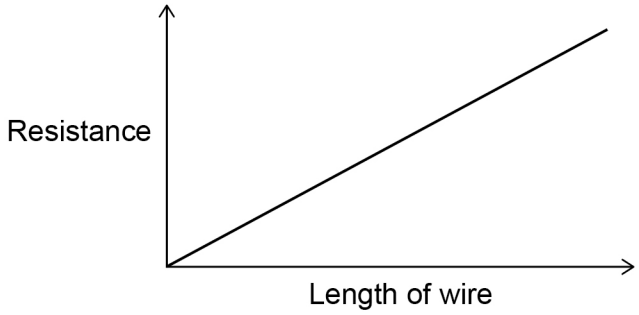
charge flow = current × time

**[2 marks]**

Charge flow = _____ C

**0 1 . 8** **Figure 2** is a sketch graph of the results.

**Figure 2**




The student repeated the investigation using a thicker wire made from the same metal. For the same length, the thicker wire has a lower resistance.

Draw a line on **Figure 2** to show how the resistance of the thicker wire varies with length.

**[1 mark]**

12

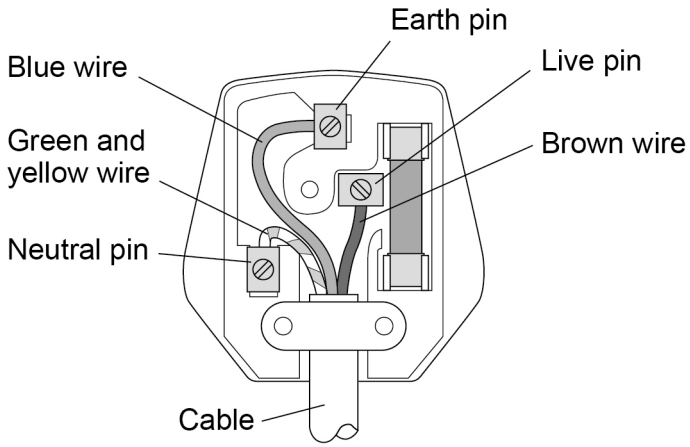
### 6.2.1.1 Standard circuit diagram symbols

Question 03

November 2020 | 8464/P/1F | Original Q5

**0 5** **Figure 5** shows the inside of a plug.

**Figure 5**




**0 5 . 1** The plug is **not** wired correctly.

What should be done to connect the wires in the plug correctly?

**[1 mark]**

6.2.1.1 Standard circuit diagram symbols

Question 03 · continued



The correctly wired plug and cable connects a washing machine to the mains electricity supply.

**0 5 . 2** Give the potential difference and frequency of the mains electricity supply in the UK.

**[2 marks]**

The potential difference is _____ V

The frequency is _____ Hz

**0 5 . 3** The washing machine is switched on.

What is the potential difference between the neutral wire and the earth wire?

**[1 mark]**

Potential difference = _____ V

**0 5 . 4** The plug has a fuse.

Draw the circuit symbol for a fuse in the space below.

**[1 mark]**

**Question 5 continues on the next page**

6.2.1.1 Standard circuit diagram symbols

Question 03 · continued



The washing machine has a metal case.

A fault causes the live wire to make an electrical connection with the metal case of the washing machine.

**0 5 . 5** The earth wire is **not** connected to the metal case of the washing machine.

Explain why it would not be safe for a person to touch the metal case.

**[2 marks]**

**0 5 . 6** The earth wire is now connected to the metal case of the washing machine.

Explain why it would now be safe for a person to touch the metal case, even if the live wire touches the metal case.

**[2 marks]**

9

### 6.2.1.1 Standard circuit diagram symbols

**Question 04**

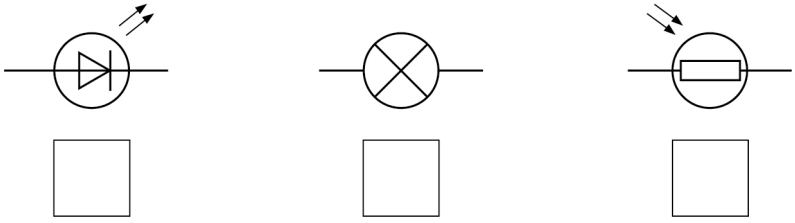
November 2021 | 8464/P/1F | Original Q3

**0 3** A filament lamp breaks if the electric current in the filament becomes too big.

**0 3 . 1** What is the correct symbol for a filament lamp?

**[1 mark]**

Tick (✓) **one** box.



**0 3 . 2** What is meant by an electric current?

**[1 mark]**

Tick (✓) **one** box.

- The energy carried by each unit of charge ☐
- The flow of electrical charge ☐
- The number of electrons in a circuit ☐
- The speed at which charge moves ☐

6.2.1.1 Standard circuit diagram symbols

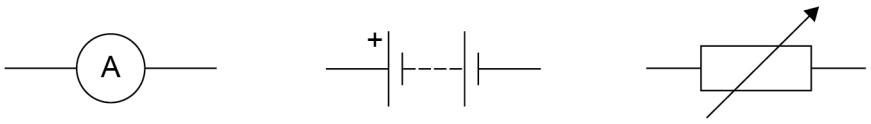
Question 04 · continued



A manufacturer investigated the maximum current value of some filament lamps.

**0 3 . 3** **Figure 6** shows the symbols for an ammeter, a battery and a variable resistor.

**Figure 6**




Ammeter Battery Variable resistor

The manufacturer connected an ammeter, battery, filament lamp and variable resistor in series.

Draw a circuit diagram to show the manufacturer's circuit.

Include the symbol for a filament lamp from Question **03.1**

**[1 mark]**

**0 3 . 4** How could the manufacturer increase the current in the filament lamp?

**[1 mark]**

Tick (✓) **one** box.

Add an extra ammeter to the circuit. ☐

Decrease the resistance of the variable resistor. ☐

Use a battery with a smaller potential difference. ☐

6.2.1.1 Standard circuit diagram symbols

Question 04 · continued



**0 3 . 5** When the potential difference across a filament lamp was 0.75 V, the current in the filament lamp was 0.16 A.

Calculate the power of the filament lamp.

Use the equation:

power = potential difference × current

**[2 marks]**

Power = _____ W

**0 3 . 6** Write down the equation which links charge flow ($Q$), current ($I$) and time ($t$).

**[1 mark]**

**0 3 . 7** The manufacturer increased the current in the filament lamp to 200 mA.

Calculate the charge flow through the filament lamp in 15 s.

**[3 marks]**

Charge flow = _____ C

6.2.1.1 Standard circuit diagram symbols

Question 04 · continued



**0 3 . 8** The manufacturer increased the current in the filament lamp from 200 mA.

The filament in the lamp broke when the current reached 320 mA.

How many times greater than 200 mA was the current at which the filament broke?

**[1 mark]**

_____

_____

_____ times greater

**0 3 . 9** The manufacturer tested lots of filament lamps.

The current at which the filament lamps broke was 320 ± 60 mA.

What is the range of currents at which the filament lamps broke?

**[1 mark]**

Tick (✓) **one** box.

60 mA to 320 mA ☐

260 mA to 320 mA ☐

320 mA to 380 mA ☐

260 mA to 380 mA ☐

**12**

### 6.2.1.1 Standard circuit diagram symbols

**Question 05**

November 2021 | 8464/P/1F | Original Q5

**0 5** **Figure 9** shows a mobile phone with its battery removed.

**Figure 9**




A student measured the potential difference across the battery and then put the battery into the phone.

**0 5 . 1** What is the equation linking current ($I$), potential difference ($V$) and resistance ($R$)?

**[1 mark]**

Tick (✓) **one** box.

$I = V R$ ☐

$R = I V$ ☐

$V = I R$ ☐

$V = I^2 R$ ☐

**Question 5 continues on the next page**

6.2.1.1 Standard circuit diagram symbols

Question 05 · continued



**0 5 . 2** The current in the electronic circuit in the mobile phone was 0.12 A.

The potential difference across the battery was 3.9 V.

Calculate the resistance of the electronic circuit in the mobile phone.

**[3 marks]**

Resistance = _____ Ω

6.2.1.1 Standard circuit diagram symbols

Question 05 · continued



**0 5 . 3** Write down the equation which links energy ($E$), power ($P$) and time ($t$).

**[1 mark]**

**0 5 . 4** The battery was fully charged when it was put into the mobile phone.

The battery discharged when the mobile phone was switched on.

The average power output of the battery as it discharged was 0.46 watts.

The time taken to fully discharge the battery was 2500 minutes.

Calculate the energy transferred by the battery.

**[3 marks]**

Energy transferred = _____ J

**Question 5 continues on the next page**

6.2.1.1 Standard circuit diagram symbols

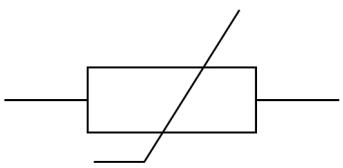
Question 05 · continued



The mobile phone includes a sensor to monitor the temperature of the battery.

**Figure 10** shows the circuit symbol for a component used in the sensor.

**Figure 10**



**0 5 . 5** What component does the circuit symbol shown in **Figure 10** represent?

**[1 mark]**

**0 5 . 6** The temperature of the component in **Figure 10** increases.

The potential difference across the component remains constant.

Explain what happens to the current in the component.

**[2 marks]**

11

### 6.2.1.1 Standard circuit diagram symbols

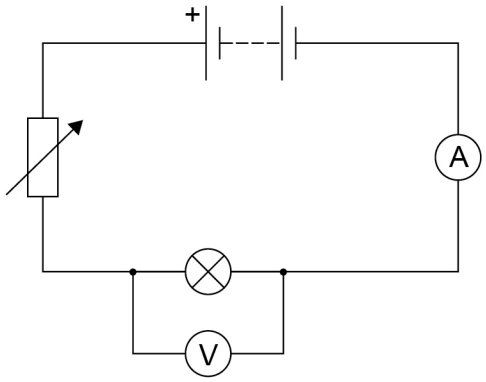
**Question 06**

June 2022 | 8464/P/1F | Original Q1

**0 1** A student investigated how the potential difference across a filament lamp affects the current in the lamp.

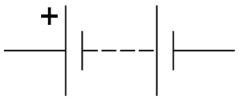
**Figure 1** shows the circuit the student used.

**Figure 1**




**0 1 . 1** **Figure 2** shows a circuit symbol.

**Figure 2**




What component does the symbol represent?

**[1 mark]**

Tick (✓) **one** box.

- Ammeter ☐
- Battery ☐
- Lamp ☐
- Variable resistor ☐

6.2.1.1 Standard circuit diagram symbols

Question 06 · continued



**0 1 . 2** Which component from **Figure 1** did the student use to adjust the potential difference across the lamp?

**[1 mark]**

**0 1 . 3** When the voltmeter was **not** connected to the circuit it gave a reading of 0.4 volts.

How can the student correct all the readings taken from the voltmeter?

**[1 mark]**

Tick (✓) **one** box.

- Add 0.4 volts to each reading ☐
- Divide each reading by 0.4 volts ☐
- Multiply each reading by 0.4 volts ☐
- Subtract 0.4 volts from each reading ☐

**Question 1 continues on the next page**

**0 1 . 4** The student recorded three values of current for each potential difference.

**Table 1** shows the results for 2.5 volts.

**Table 1**

| Potential difference in volts | Current in amps | | |
|---|---|---|---|
| | 1 | 2 | 3 |
| 2.5 | 0.54 | 0.58 | 0.53 |

Calculate the mean current in the lamp.

**[2 marks]**

Mean current = _____ A

**0 1 . 5** Calculate the power of the lamp when the potential difference across the lamp was 4.8 V

The current in the lamp was 0.75 A

Use the equation:

power = potential difference × current

**[2 marks]**

Power = _____ W

6.2.1.1 Standard circuit diagram symbols

Question 06 · continued



**0 1 . 6** Calculate the resistance of the lamp when the potential difference across the lamp was 4.8 V

The current in the lamp was 0.75 A

Use the equation:

$$\text{resistance} = \frac{\text{potential difference}}{\text{current}}$$

**[2 marks]**

Resistance = _____ Ω

**0 1 . 7** Complete the sentence.

Choose answers from the box.

Each answer may be used once, more than once or not at all.

**[2 marks]**

| | | |
|---|---|---|
| **decrease** | **increase** | **stay the same** |

Increasing the current in a filament lamp makes the temperature

of the lamp _____ and the

resistance of the lamp _____ .

**Question 1 continues on the next page**

6.2.1.1 Standard circuit diagram symbols

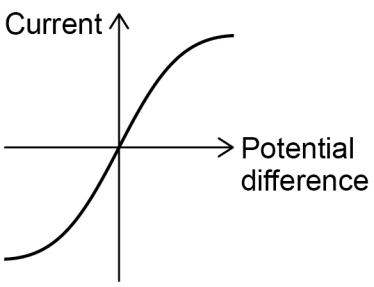
Question 06 · continued



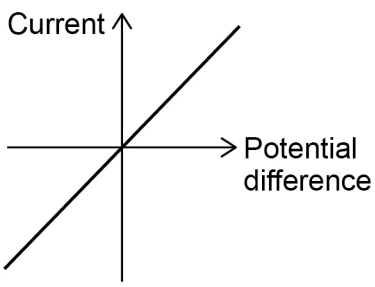
**0 1 . 8** Which graph shows the relationship between potential difference and current for a filament lamp?

**[1 mark]**

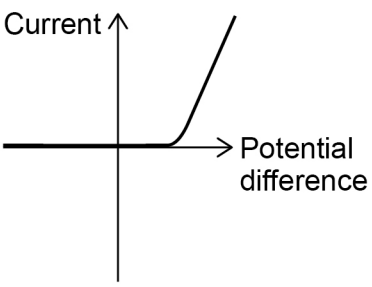
Tick (✓) **one** box.




☐




☐




☐

12

### 6.2.1.1 Standard circuit diagram symbols

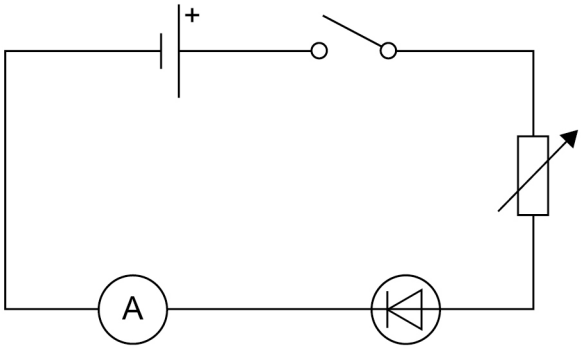
**Question 07**

June 2024 | 8464/P/1F | Original Q4

**0 4** A student investigated how the current in a diode varies with the potential difference across the diode.

**Figure 6** shows an incomplete diagram of the circuit used.

**Figure 6**




**0 4 . 1** The student measured the potential difference across the diode.

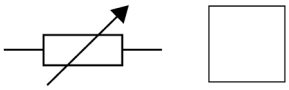
Complete **Figure 6** by adding the symbol for a voltmeter in the correct position.

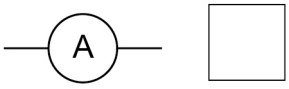
**[2 marks]**

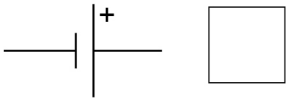
**0 4 . 2** Which component should the student adjust to change the potential difference across the diode?

**[1 mark]**

Tick (✓) **one** box.





6.2.1.1 Standard circuit diagram symbols



The student measured the current three times for each value of potential difference.

**0 4 . 3** Complete the sentence.

Choose the answer from the box.

**[1 mark]**

| | | |
|---|---|---|
| **random** | **systematic** | **zero** |

When the potential difference was 1.50 V the current measurements varied between 0.95 A and 1.08 A. This was caused by _____ errors.

**0 4 . 4** For one value of potential difference, the measurements of current were:

0.27 A 0.32 A 0.31 A

Calculate the mean current.

**[2 marks]**

_____

_____

_____

Mean current = _____ A

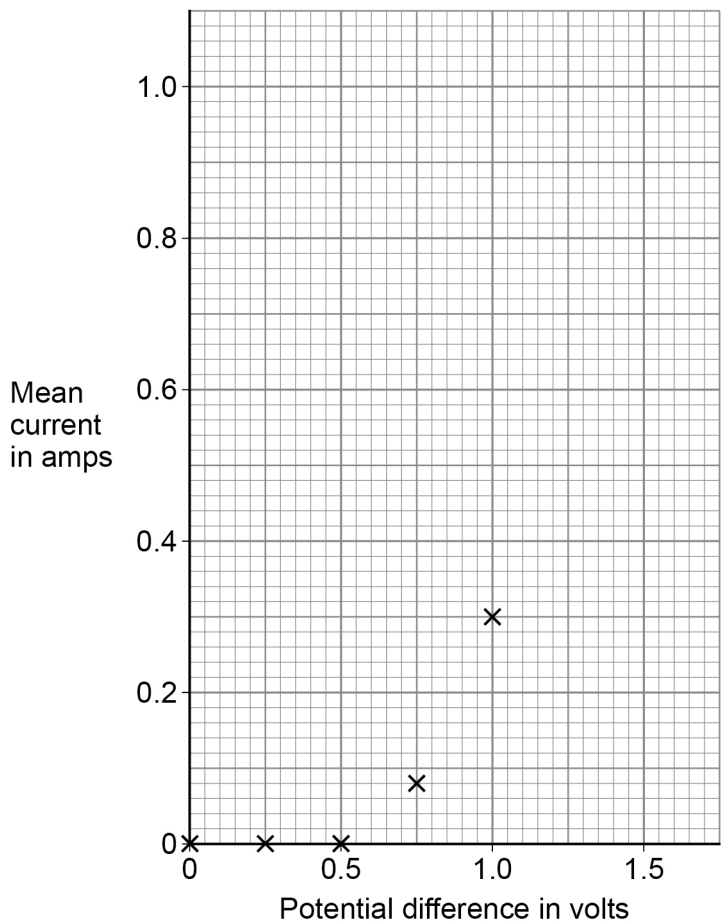
**Question 4 continues on the next page**

Question 07 · continued



**Figure 7** shows some of the results.

**Figure 7**




**0 4 . 5** **Table 2** shows the results when the potential difference was greater than 1.00 V.

**Table 2**

| Potential difference in volts | Mean current in amps |
|---|---|
| 1.25 | 0.60 |
| 1.50 | 1.00 |

Complete **Figure 7**.

You should:

- plot the results from **Table 2**
- draw a line of best fit.

**[2 marks]**

6.2.1.1 Standard circuit diagram symbols

Question 07 · continued



**0 4 . 6** Complete the sentence.

Choose the answer from the box.

**[1 mark]**

| | | |
|---|---|---|
| **directly proportional** | **inversely proportional** | **non-linear** |

**Figure 7** shows that the relationship between potential difference and current for the diode is _____.

**0 4 . 7** The student adjusted the circuit so that the current in the diode was 1.00 A.

The student then reversed the connections to the diode.

What happened to the current in the diode when the connections were reversed?

**[1 mark]**

Tick (✓) **one** box.

The current decreased to 0.00 A. ☐

The current remained at 1.00 A. ☐

The current increased to 2.00 A. ☐

10

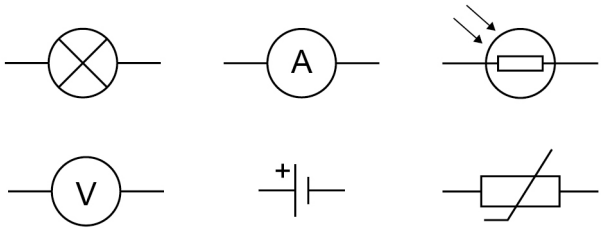
### 6.2.1.1 Standard circuit diagram symbols

**Question 08**

June 2025 | 8464/P/1F | Original Q2

**0 2** **Figure 2** shows circuit symbols for some electrical components.

**Figure 2**




A student connects a circuit to measure the current in a filament lamp.

The student uses:

- an ammeter
- a cell
- a filament lamp.

**0 2 . 1** Draw a circuit diagram for a circuit the student could use to measure the current in a filament lamp.

You should use **three** of the circuit symbols from **Figure 2**.

**[3 marks]**

6.2.1.1 Standard circuit diagram symbols

Question 08 · continued



**0 2 . 2** Which component is the source of energy for the circuit?

**[1 mark]**

Tick (✓) **one** box.

Ammeter ☐

Cell ☐

Filament lamp ☐

**0 2 . 3** There is a current of 1.5 A in the filament lamp for a time of 30 s.

Calculate the charge flow in the filament lamp.

Use the equation:

charge flow = current × time

**[2 marks]**

Charge flow = _____ C

6.2.1.1 Standard circuit diagram symbols

Question 08 · continued



**0 2 . 4** The current in the filament lamp is 1.5 A when the potential difference across the filament lamp is 12 V.

Calculate the resistance of the filament lamp.

Use the equation:

$$\text{resistance} = \frac{\text{potential difference}}{\text{current}}$$

Choose the unit from the box.

**[3 marks]**

| | | |
|---|---|---|
| **Ω** | **°C** | **W** |

Resistance = _____ Unit _____

**Question 2 continues on the next page**

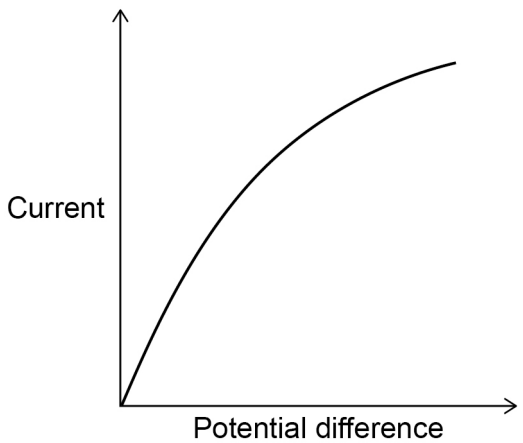
6.2.1.1 Standard circuit diagram symbols

Question 08 · continued



**Figure 3** shows how the current varies with potential difference for the filament lamp.

**Figure 3**




**0 2 . 5** Describe the relationship between potential difference and current for the filament lamp.

**[2 marks]**

**0 2 . 6** As the current in the filament lamp increases, the temperature of the filament lamp increases.

What happens to the resistance of the filament lamp as the temperature increases?

**[1 mark]**

6.2.1.1 Standard circuit diagram symbols

Question 08 · continued



**0 2 . 7** In most homes, filament lamps have been replaced with LED bulbs.

**Table 1** shows information about a filament lamp and an LED bulb.

**Table 1**

| | Input power in watts | Brightness in arbitrary units |
|---|---|---|
| **Filament lamp** | 40 | 800 |
| **LED bulb** | 8 | 800 |

Explain the advantages of using LED bulbs instead of filament lamps.

You should include a calculation in your answer.

**[4 marks]**

Extra space

16