AQA GCSE Combined Science - Trilogy | 8464

SPECIFICATION POINT 6.2.1.2

Electrical charge and current

Past-paper questions

Tier	**Foundation**
Question groups	**7**
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.

6.2.1.2 Electrical charge and current

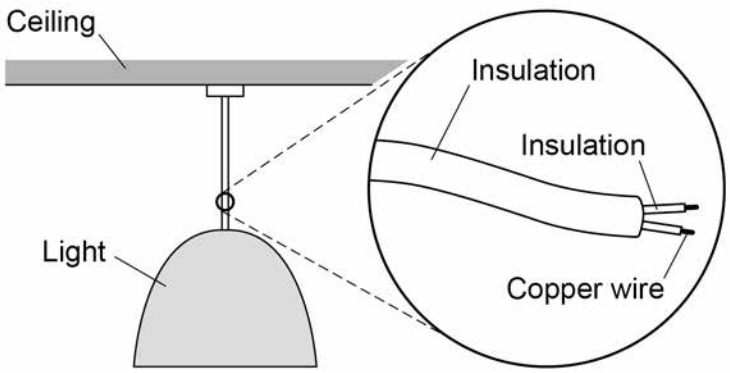
Question 01

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]

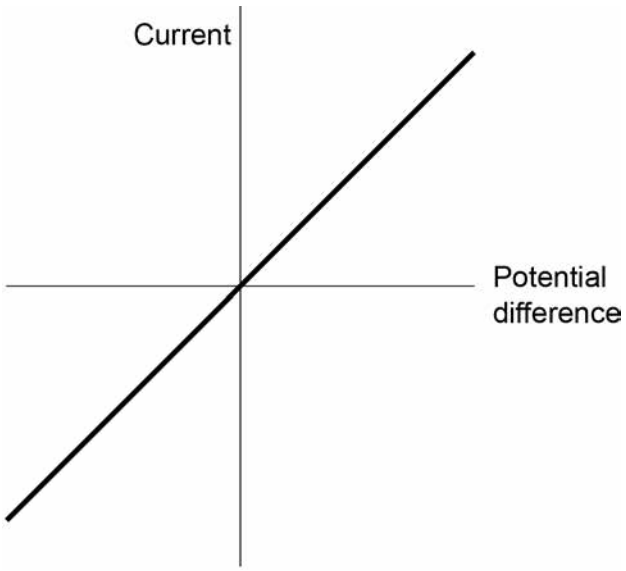
Charge flow = _____ C

6.2.1.2 Electrical charge and current

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

6.2.1.2 Electrical charge and current

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

6.2.1.2 Electrical charge and current

Question 02

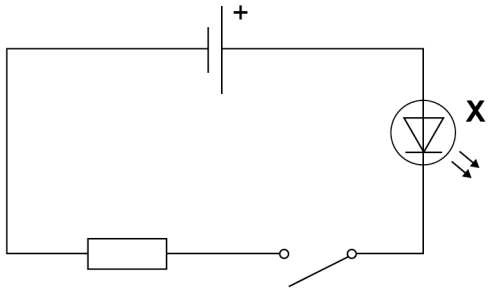
June 2019 | 8464/P/1F | Original Q1

0 1 A designer made some shoes that have lights in them.

Each shoe has a switch which closes when a person puts their foot on the floor.

Figure 1 shows the circuit.

Figure 1



0 1 . 1 What is component **X**?

[1 mark]

Tick (✓) **one** box.

Lamp ☐

LDR ☐

LED ☐

0 1 . 2 Complete the sentence.

Choose the answer from the box.

[1 mark]

greater than	**less than**	**the same as**

When the switch was closed, the current in component **X** was

_____ the current in the resistor.

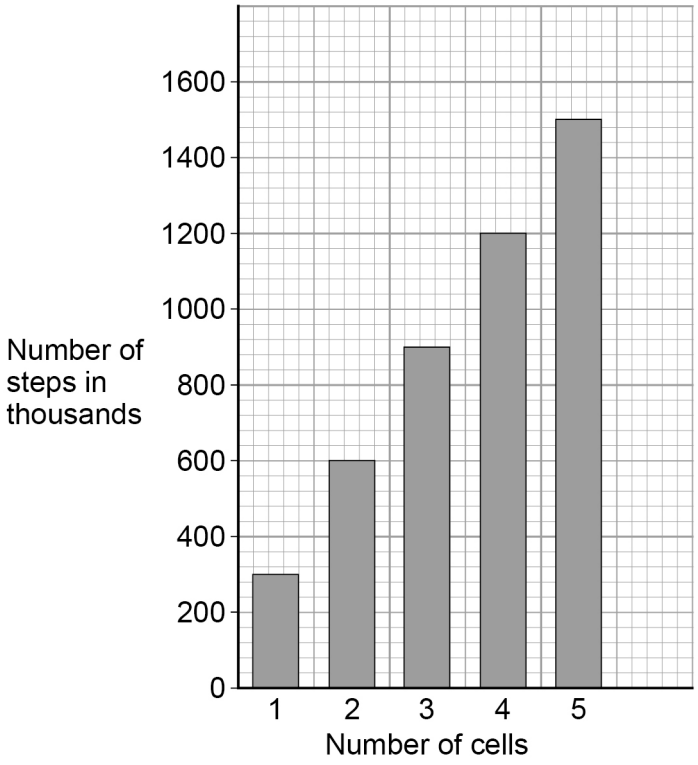
6.2.1.2 Electrical charge and current

Question 02 · continued

The designer tested how the number of cells affected the number of steps that could be taken before the lights stopped working.

Figure 2 shows the results.

Figure 2



0 1 . 3 Determine how many more steps could be taken when the number of cells was increased from 3 to 5

[2 marks]

Number of steps = _____ thousand

Question 1 continues on the next page

Question 02 · continued

0 1 . 4 How could the designer check the repeatability of the results?

[1 mark]

Tick (✓) **one** box.

Repeat the experiment with a different resistor in the circuit. ☐

Repeat the experiment using exactly the same method. ☐

Repeat the experiment with different types of shoe. ☐

0 1 . 5 When the potential difference across the resistor was 0.80 V, the current in the resistor was 0.020 A

Calculate the power dissipated by the resistor.

Use the equation:

power = potential difference × current

[2 marks]

Power = _____ W

0 1 . 6 Which other equation can be used to calculate the power dissipated by a resistor?

[1 mark]

Tick (✓) **one** box.

Power = $(\text{current})^2 \times \text{resistance}$ ☐

Power = $\frac{\text{current}}{(\text{resistance})^2}$ ☐

Power = $\text{current} \times (\text{resistance})^2$ ☐

6.2.1.2 Electrical charge and current

Question 02 · continued

0 1 . 7 What happens to the temperature of the resistor when there is a current in it?

[1 mark]

0 1 . 8 There was a current of 0.020 A in the resistor for 180 seconds.

Calculate the charge flow through the resistor.

Use the equation:

charge flow = current × time

[2 marks]

Charge flow = _____ C

11

6.2.1.2 Electrical charge and current

Question 03

June 2019 | 8464/P/1F | Original Q2

0 2 A student investigated how the area of a solar panel affected the output potential difference of the solar panel.

The student placed different sized solar panels under a lamp.

Figure 3 shows a solar panel under a lamp.

Figure 3



0 2 . 1 Which variable should be controlled?

[1 mark]

Tick (✓) **one** box.

The area of the solar panels ☐

The brightness of the lamp ☐

The output potential difference of the solar panels ☐

6.2.1.2 Electrical charge and current

Question 03 · continued

June 2019 | 8464/P/1F | Original Q2

0 2 . 2 The student measured the output potential difference using a voltmeter.

When the voltmeter was **not** connected, the reading on the voltmeter was 0.7 V

What name is given to this type of error?

[1 mark]

Tick (✓) **one** box.

Zero error ☐

Random error ☐

Measurement error ☐

Question 2 continues on the next page

Question 03 · continued

Table 1 shows the results of the investigation.

Table 1

Solar panel	Area of solar panel in cm^2	Output potential difference in volts			
		Test 1	Test 2	Test 3	Mean
A	10	2.5	2.4	2.6	2.5
B	20	5.0	5.0	4.9	5.0
C	30	7.5	11.9	7.5	7.5
D	50	12.4	12.6	12.5	12.5

0 2 . 3 The readings for which solar panel show an anomalous result?

[1 mark]

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐

0 2 . 4 The student did **not** have a solar panel with an area of 40 cm^2

Determine the most likely value for the mean output potential difference of a 40 cm^2 solar cell.

[1 mark]

Mean output potential difference = _____ V

6.2.1.2 Electrical charge and current

Question 03 · continued

0 2 . 5 The total input energy transfer to one of the solar panels was 8.0 joules.

The useful output energy transfer was 0.96 joules.

Calculate the efficiency of the solar panel.

Use the equation:

$$\text{efficiency} = \frac{\text{useful output energy transfer}}{\text{total input energy transfer}}$$

[2 marks]

Efficiency = _____

0 2 . 6 Solar power is a renewable energy resource.

Complete the sentence.

Choose the answer from the box.

[1 mark]

burned	**replenished**	**consumed**

A renewable energy resource is one that is _____ as it is used.

Question 2 continues on the next page

6.2.1.2 Electrical charge and current

Question 03 · continued

0 2 . 7 Some homes have solar panels which generate electricity.

On a sunny day the potential difference across a solar panel is 31 volts.

A charge of 490 coulombs flows through the solar panel.

Calculate the energy transferred by the solar panel.

Use the equation:

energy transferred = charge flow × potential difference

Give your answer to 2 significant figures.

[3 marks]

Energy transferred = _____ J

0 2 . 8 Why do solar panels on homes help reduce the environmental impact of using electrical devices?

[1 mark]

Tick (✓) **one** box.

Less electricity is used in the home. ☐

Less fossil fuel is burned. ☐

The electricity from the solar panels is cheaper. ☐

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6.2.1.2 Electrical charge and current

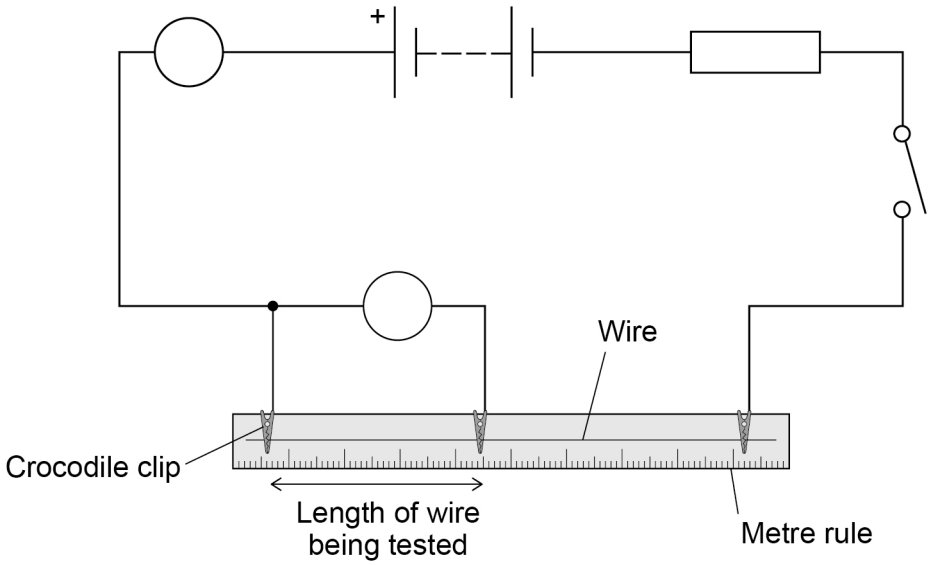
Question 04

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 ☐

6.2.1.2 Electrical charge and current

Question 04 · 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

Question 04 · continued

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

6.2.1.2 Electrical charge and current

Question 04 · 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:

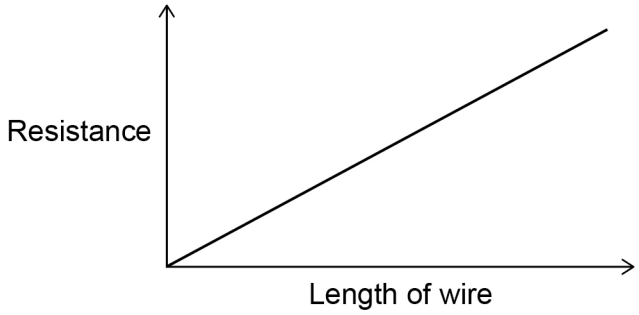
charge flow = current × time

[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

6.2.1.2 Electrical charge and current

Question 05

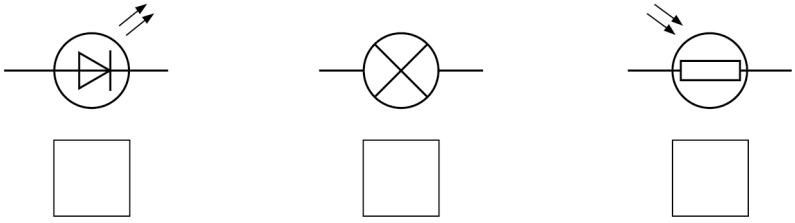
November 2021 | 8464/P/1F | Original Q3

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 ☐

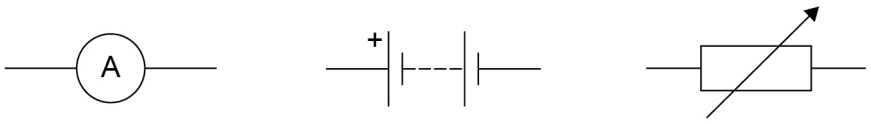
6.2.1.2 Electrical charge and current

Question 05 · 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. ☐

6.2.1.2 Electrical charge and current

Question 05 · 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

6.2.1.2 Electrical charge and current

Question 05 · 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

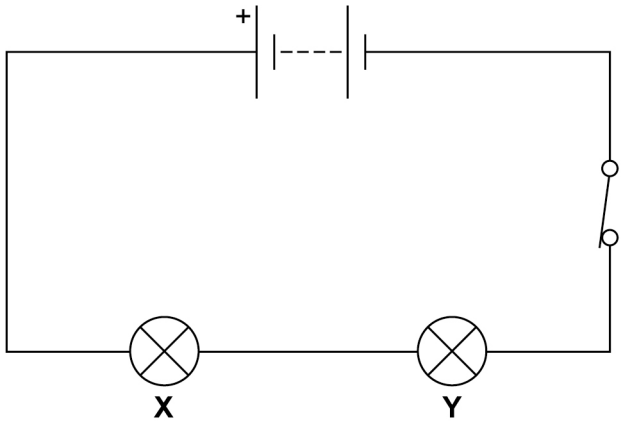
6.2.1.2 Electrical charge and current

Question 06

June 2024 | 8464/P/1F | Original Q1

0 1 **Figure 1** shows a circuit diagram. The circuit contains a battery and two lamps, **X** and **Y**.

Figure 1



0 1 . 1 How does the current in lamp **X** compare with the current in lamp **Y**?

[1 mark]

Tick (✓) **one** box.

The current in lamp **X** is smaller. ☐

The current in both lamps is the same. ☐

The current in lamp **X** is greater. ☐

0 1 . 2 Lamp **X** and lamp **Y** are **not** identical.

The potential difference across the battery is 4.5 V.

The potential difference across lamp **X** is 1.5 V.

Calculate the potential difference across lamp **Y**.

[1 mark]

Potential difference across lamp **Y** = _____ V

6.2.1.2 Electrical charge and current

Question 06 · continued

The current in lamp **X** is 1.2 A.

The potential difference across lamp **X** is 1.5 V.

0 1 . 3 Calculate the power of lamp **X**.

Use the equation:

power = potential difference × current

[2 marks]

Power = _____ W

0 1 . 4 Calculate the resistance of lamp **X**.

Use the equation:

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

[2 marks]

Resistance = _____ Ω

Question 1 continues on the next page

6.2.1.2 Electrical charge and current

Question 06 · continued

0 1 . 5 The current in lamp **X** is 1.2 A.

Calculate the charge flow through lamp **X** in 40 seconds.

Use the equation:

charge flow = current × time

[2 marks]

Charge flow = _____ C

0 1 . 6 The switch can be used to turn the lamps on and off.

Immediately after the lamps are switched on, the resistance of each lamp increases.

Why does the resistance of each lamp increase?

[1 mark]

Tick (✓) **one** box.

- The current in the battery decreases. ☐
- The potential difference across each lamp decreases. ☐
- The power of the battery increases. ☐
- The temperature of each lamp increases. ☐

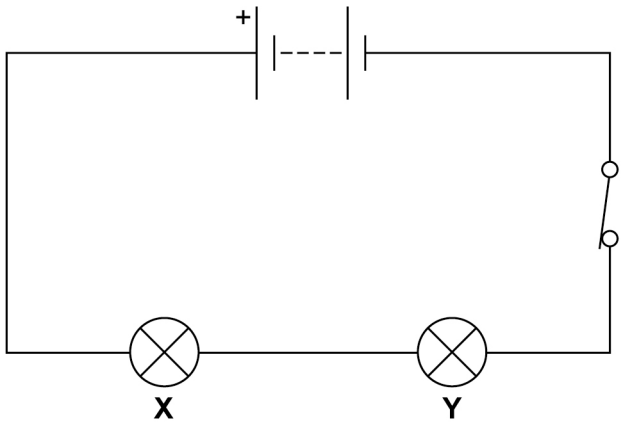
6.2.1.2 Electrical charge and current

Question 06 · continued

June 2024 | 8464/P/1F | Original Q1

Figure 1 is repeated below.

Figure 1



0 1 . 7 Lamp **Y** breaks.

What happens to lamp **X**?

Give a reason for your answer.

[2 marks]

Tick (✓) **one** box.

Lamp **X** gets brighter. ☐

Lamp **X** stays the same brightness. ☐

Lamp **X** no longer emits light. ☐

Reason _____

_____

11

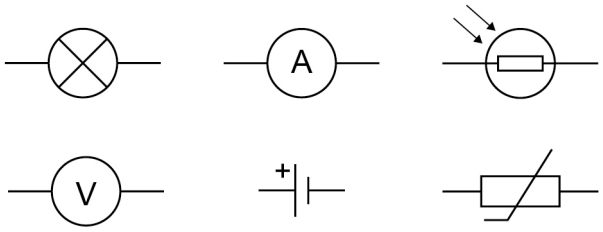
6.2.1.2 Electrical charge and current

Question 07

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]

6.2.1.2 Electrical charge and current

Question 07 · 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

6.2.1.2 Electrical charge and current

Question 07 · 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 _____

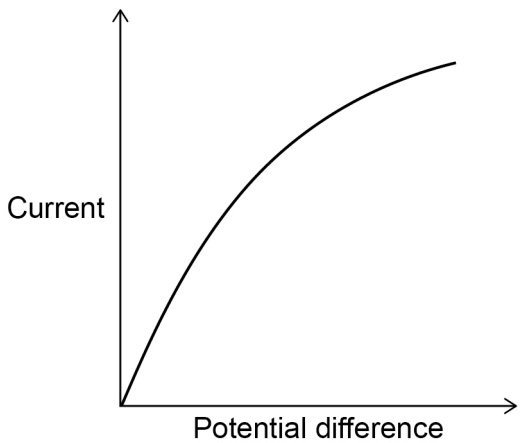
Question 2 continues on the next page

6.2.1.2 Electrical charge and current

Question 07 · 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]

6.2.1.2 Electrical charge and current

Question 07 · 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

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