AQA GCSE Combined Science - Trilogy | 8464

SPECIFICATION POINT 6.2.1.3

Current, resistance and potential difference

Past-paper questions

Tier	**Foundation**
Question groups	**18**
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.

6.2.1.3 Current, resistance and potential difference

Question 01

June 2018 | 8464/P/1F | Original Q2

0 2 **Figure 3** shows a mobile phone being recharged by a portable power source.

Figure 3



0 2 . 1 Why does the battery in the phone need recharging?

[1 mark]

Tick **one** box.

- The store of chemical energy in the battery has reduced. ☐
- The store of thermal energy in the battery has reduced. ☐
- The store of kinetic energy in the battery has reduced. ☐
- The store of gravitational energy in the battery has reduced. ☐

Question 2 continues on the next page

6.2.1.3 Current, resistance and potential difference

Question 01 · continued

0 2 . 2 The power source provides a current of 1.86 A at a potential difference of 3.90 V

Calculate the power of the power source.

Use the equation:

power = potential difference × current

Choose the correct unit from the box.

[3 marks]

C	**J**	**W**

Power = _____

Unit _____

Question 01 · continued

0 2 . 3 A student needs a new power source.

Figure 4 shows three different sized power sources.

Figure 4

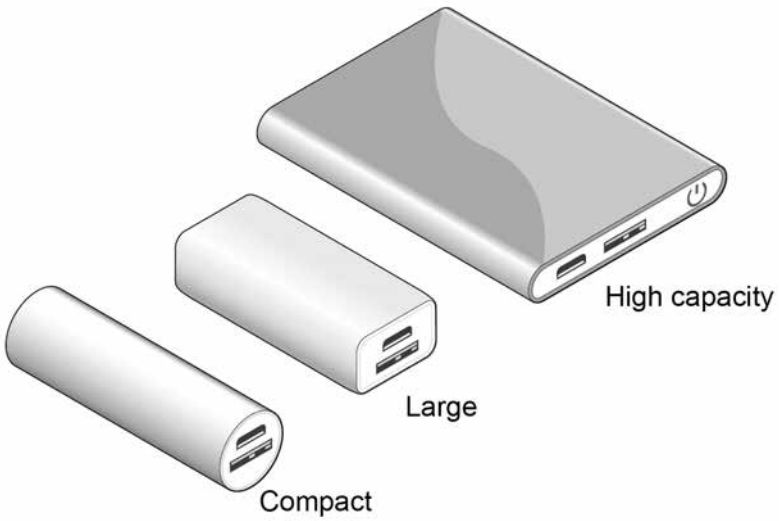


Table 1 gives data about the different power sources.

Table 1

Power source	Number of charges	Mass in grams
Compact	1	100
Large	5	200
High capacity	10	600

The student chose the large power source.

Suggest why the student chose the large power source.

[4 marks]

8

6.2.1.3 Current, resistance and potential difference

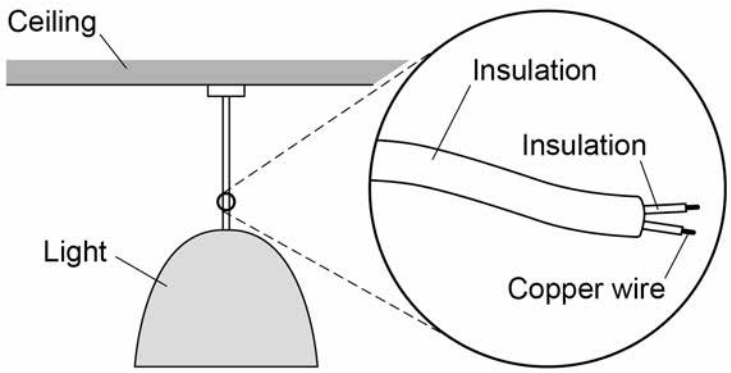
Question 02

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]

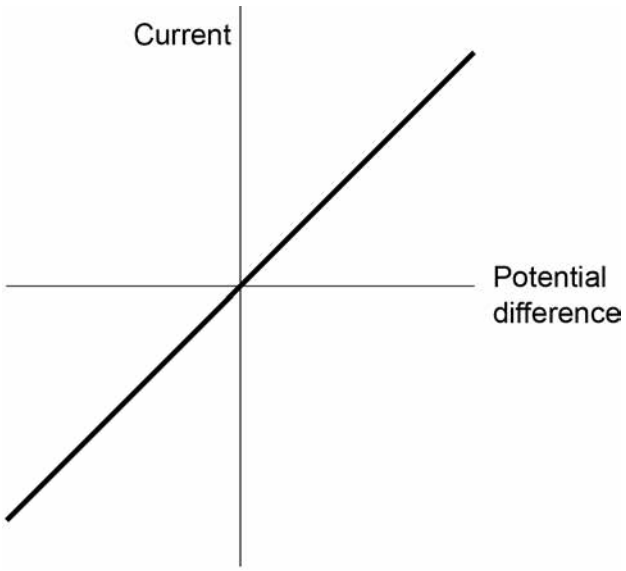
Charge flow = _____ C

6.2.1.3 Current, resistance and potential difference

Question 02 · 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

6.2.1.3 Current, resistance and potential difference

Question 02 · 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

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6.2.1.3 Current, resistance and potential difference

Question 03

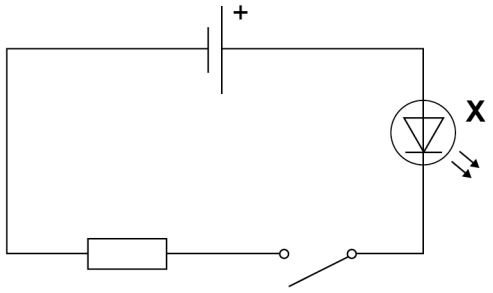
June 2019 | 8464/P/1F | Original Q1

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

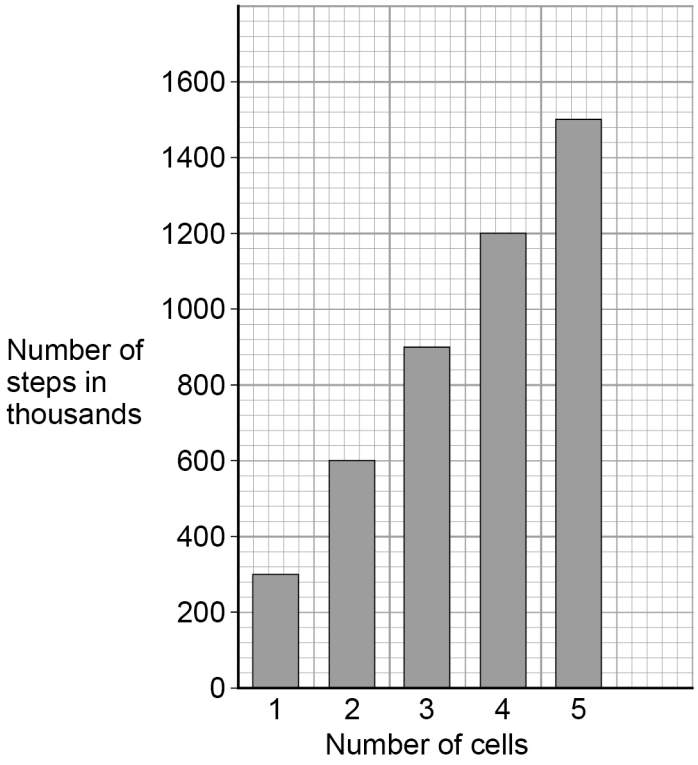
_____ the current in the resistor.

Question 03 · 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 03 · 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 = $\text{current} \times (\text{resistance})^2$ ☐

6.2.1.3 Current, resistance and potential difference

Question 03 · 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

6.2.1.3 Current, resistance and potential difference

Question 04

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 ☐

6.2.1.3 Current, resistance and potential difference

Question 04 · continued

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 04 · 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

Question 04 · 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

6.2.1.3 Current, resistance and potential difference

Question 04 · 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. ☐

11

6.2.1.3 Current, resistance and potential difference

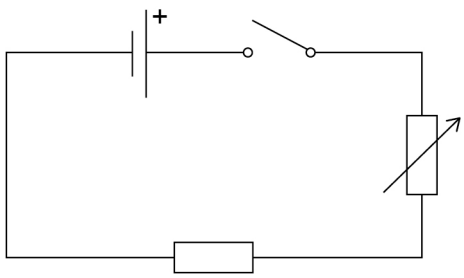
Question 05

June 2019 | 8464/P/1F | Original Q6

0 6 A student investigated how the current in a resistor varies with the potential difference across the resistor.

Figure 8 shows part of the circuit used.

Figure 8



0 6 . 1 The student connected an ammeter and a voltmeter into the circuit.

What is the correct way to connect the ammeter and the voltmeter into the circuit?

[1 mark]

Tick (✓) **one** box.

Ammeter	Voltmeter	
In parallel with the resistor	In series with the resistor	☐
In parallel with the cell	In series with the resistor	☐
In series with the resistor	In parallel with the resistor	☐
In series with the resistor	In parallel with the cell	☐

0 6 . 2 The student increased the resistance of the variable resistor.

How did increasing the resistance affect the current in the circuit?

[1 mark]

6.2.1.3 Current, resistance and potential difference

Question 05 · continued

0 6 . 3 How should the student change the circuit to give negative values for current and potential difference?

[1 mark]

0 6 . 4 Name the type of relationship between current and potential difference for a resistor at constant temperature.

[1 mark]

0 6 . 5 Write the equation which links current, potential difference and resistance.

[1 mark]

0 6 . 6 The current in the resistor was 0.12 A when the potential difference across the resistor was 3.0 V

Calculate the resistance of the resistor.

[3 marks]

Resistance = _____ Ω

8

6.2.1.3 Current, resistance and potential difference

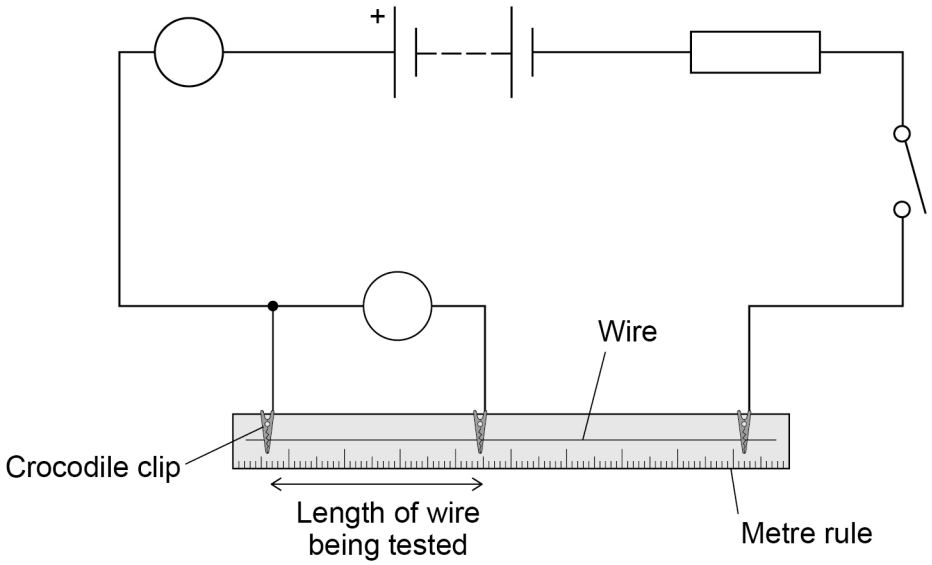
Question 06

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 ☐

6.2.1.3 Current, resistance and potential difference

Question 06 · 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

6.2.1.3 Current, resistance and potential difference

Question 06 · 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

6.2.1.3 Current, resistance and potential difference

Question 06 · 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:

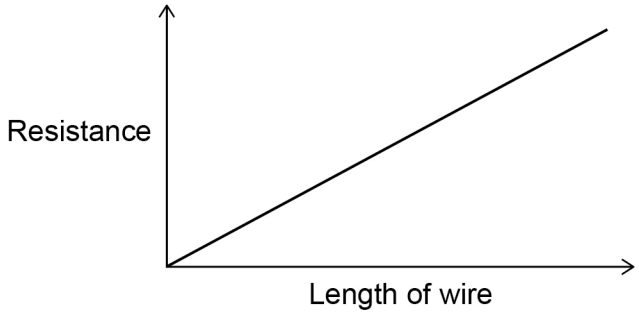
charge flow = current × time

[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

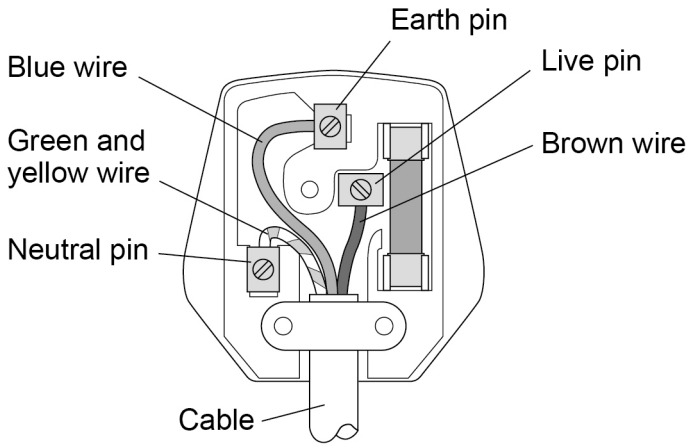
6.2.1.3 Current, resistance and potential difference

Question 07

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]

Question 07 · 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

Question 07 · 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

6.2.1.3 Current, resistance and potential difference

Question 08

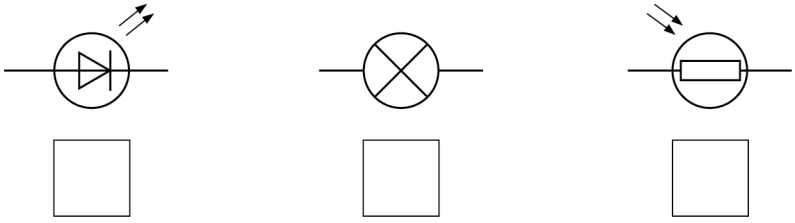
November 2021 | 8464/P/1F | Original Q3

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 ☐

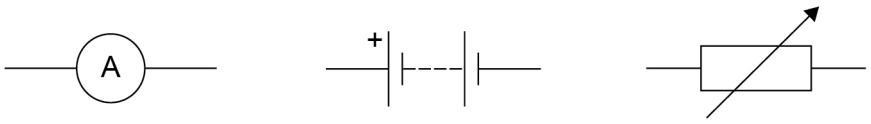
The speed at which charge moves ☐

Question 08 · 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. ☐

6.2.1.3 Current, resistance and potential difference

Question 08 · 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

6.2.1.3 Current, resistance and potential difference

Question 08 · 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

6.2.1.3 Current, resistance and potential difference

Question 09

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

6.2.1.3 Current, resistance and potential difference

Question 09 · 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

6.2.1.3 Current, resistance and potential difference

Question 09 · 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

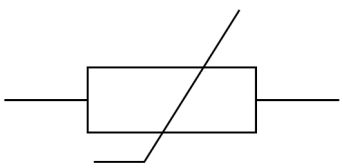
6.2.1.3 Current, resistance and potential difference

Question 09 · 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

6.2.1.3 Current, resistance and potential difference

Question 10

November 2021 | 8464/P/1F | Original Q6

0 6 A radioactive source emits alpha, beta and gamma radiation.

0 6 . 1 An alpha particle is the same as a helium nucleus.

How many times bigger is the radius of a helium atom than the radius of an alpha particle?

[1 mark]

Tick (✓) **one** box.

- Less than 100 times bigger ☐
- Exactly 5000 times bigger ☐
- More than 10 000 times bigger ☐

0 6 . 2 Alpha particles can ionise atoms in the air.

What happens to an atom when it is ionised by an alpha particle?

[2 marks]

Tick (✓) **two** boxes.

- A neutron in the atom becomes a proton. ☐
- The atom becomes a positive ion. ☐
- The atom gains a neutron. ☐
- The atom gains a proton. ☐
- The atom loses an electron. ☐

Question 6 continues on the next page

6.2.1.3 Current, resistance and potential difference

Question 10 · continued

November 2021 | 8464/P/1F | Original Q6

0 6 . 3 A spark detector is a device that can be used to detect alpha radiation.

A spark detector works by alpha particles ionising atoms in the air near a wire mesh.

A large potential difference creates a spark when the air near the wire mesh is ionised.

Suggest why a spark detector **cannot** detect beta radiation.

[1 mark]

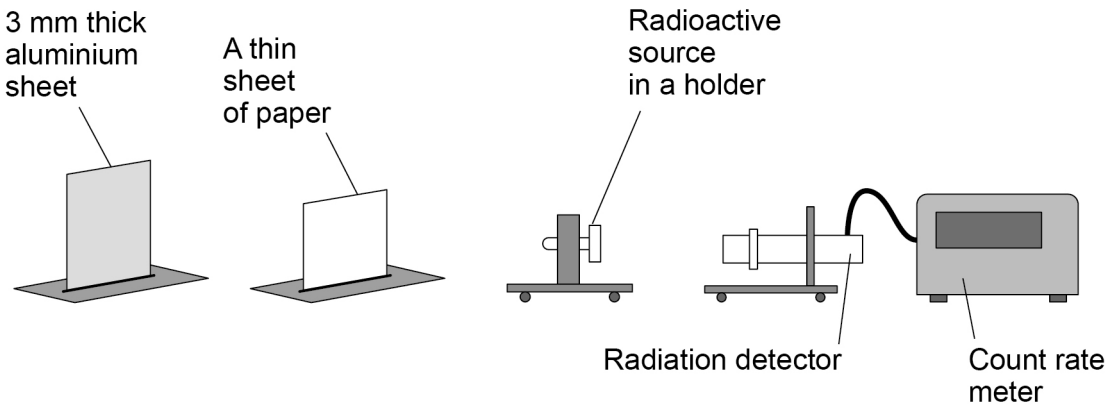
6.2.1.3 Current, resistance and potential difference

Question 10 · continued

0 6 . 4 A teacher wants to demonstrate that the radioactive source emits alpha, beta and gamma radiation.

Figure 11 shows the equipment the teacher has.

Figure 11



Describe a method the teacher could use.

[6 marks]

10

6.2.1.3 Current, resistance and potential difference

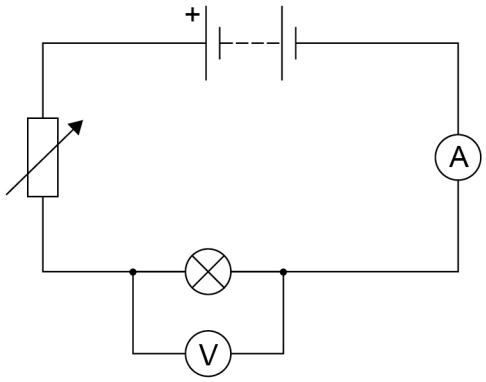
Question 11

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.

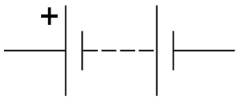
Figure 1 shows the circuit the student used.

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 ☐

6.2.1.3 Current, resistance and potential difference

Question 11 · 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

Question 11 · continued

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

6.2.1.3 Current, resistance and potential difference

Question 11 · 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

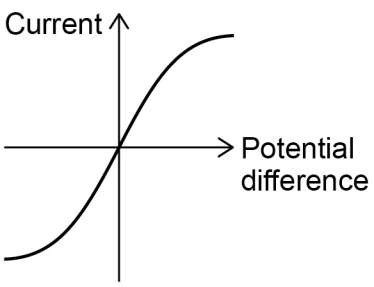
6.2.1.3 Current, resistance and potential difference

Question 11 · continued

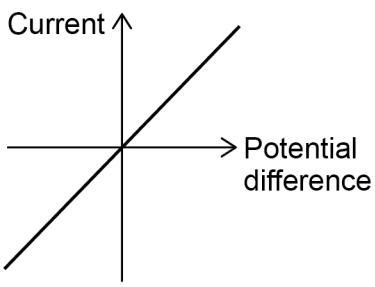
0 1 . 8 Which graph shows the relationship between potential difference and current for a filament lamp?

[1 mark]

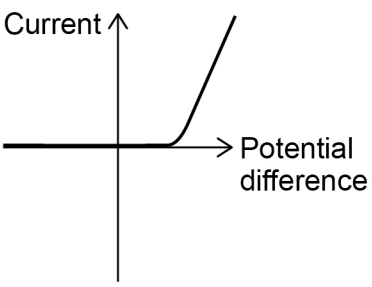
Tick (✓) **one** box.



☐



☐



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12

6.2.1.3 Current, resistance and potential difference

Question 12

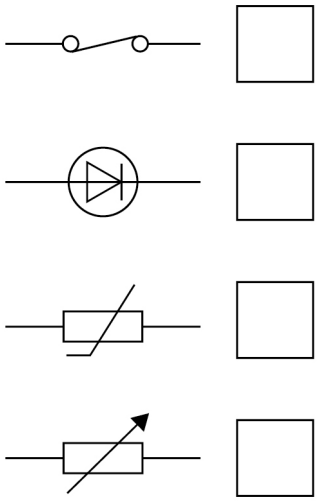
June 2023 | 8464/P/1F | Original Q4

0 4 A gardener wanted to build an electrical circuit to monitor the temperature in a greenhouse.

0 4 . 1 Which symbol represents an electrical component with a resistance that decreases as its temperature increases?

[1 mark]

Tick (✓) **one** box.



0 4 . 2 When the resistance of an electrical circuit decreases, the current in the circuit increases.

Complete the sentence.

Choose the answer from the box.

[1 mark]

charge	**energy**	**potential difference**	**power**

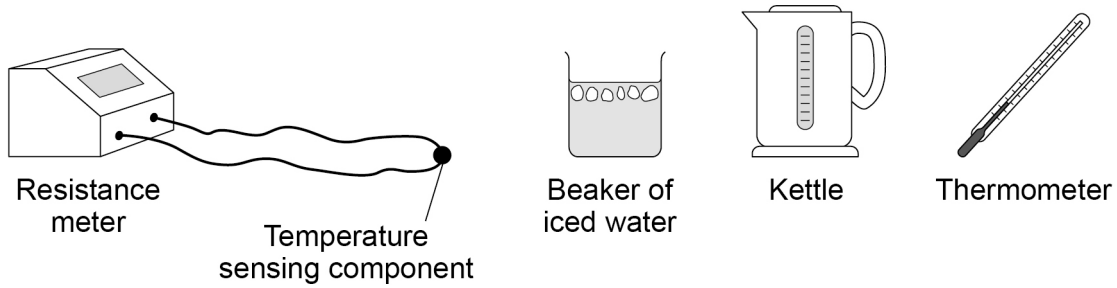
Electrical current is a flow of _____ .

Question 12 · continued

0 4 . 3 The gardener wanted to find how the resistance of the component varies with temperature.

Figure 4 shows the equipment used by the gardener.

Figure 4



The resistance meter displays the resistance of the component.

Plan a method the gardener could use to find how the resistance of the component varies with temperature.

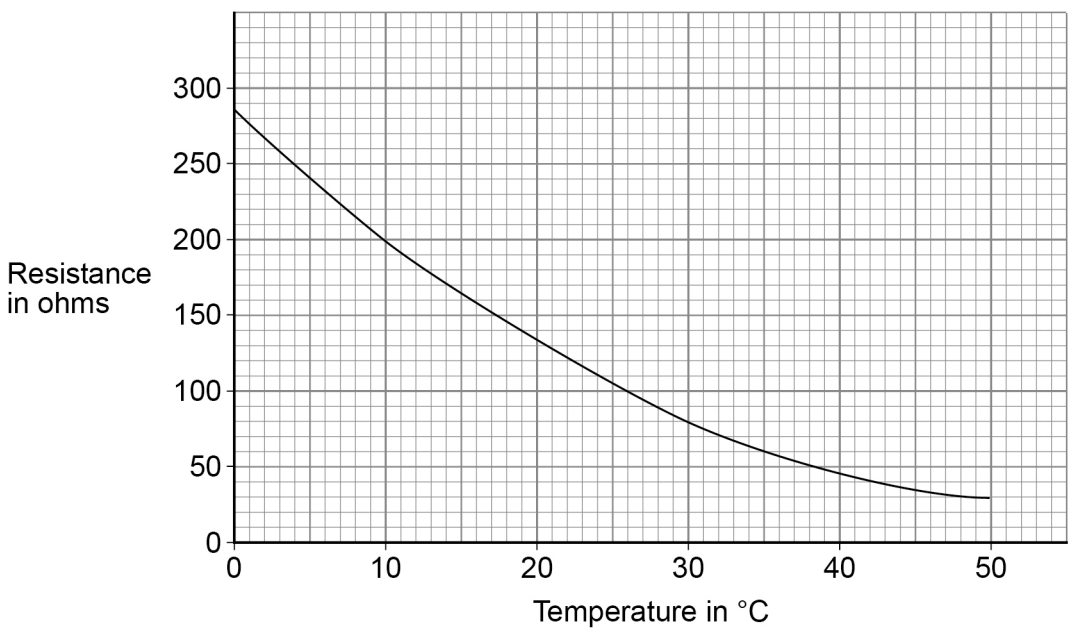
[4 marks]

Question 4 continues on the next page

Question 12 · continued

Figure 5 shows how the resistance of the component varies with temperature.

Figure 5



0 4 . 4 Complete the sentence.

Choose the answer from the box.

[1 mark]

linear	**non-linear**	**directly proportional**

The relationship between the temperature and the resistance of the component is _____ .

Question 12 · continued

0 4 . 5 The temperature in the greenhouse changed from 10 °C to 30 °C.

Determine the change in resistance of the component between these temperatures.

Use **Figure 5**.

[2 marks]

Change in resistance = _____ Ω

Question 4 continues on the next page

6.2.1.3 Current, resistance and potential difference

Question 12 · continued

The gardener builds a circuit that switches a heater on when the greenhouse gets too cold.

Use the Physics Equations Sheet to answer questions **04.6** and **04.7**.

0 4 . 6 Write down the equation that links current (I), potential difference (V) and power (P).

[1 mark]

0 4 . 7 The power of the heater is 2900 W.

The potential difference across the heater is 230 V.

Calculate the current in the heater.

[3 marks]

Current = _____ A

13

6.2.1.3 Current, resistance and potential difference

Question 13

June 2023 | 8464/P/1F | Original Q6

0 6 Body analysis scales use the electrical resistance of a person's legs to estimate the percentage of water in the person's body.

Figure 8 shows body analysis scales.

Figure 8



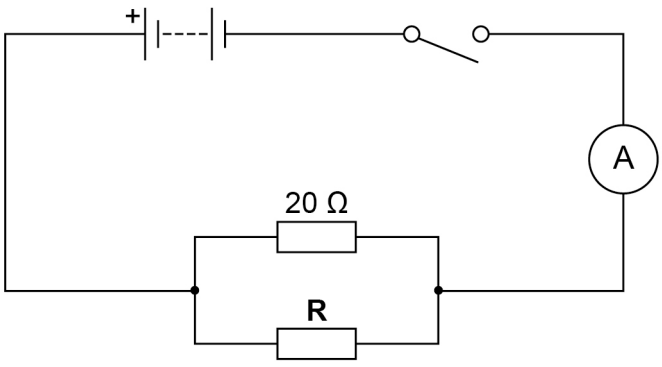
The person's legs contain both solid tissue and water.

A student used resistors to model the solid tissue and water.

The student connected a 20 Ω resistor in parallel with a resistor, **R**.

Figure 9 shows the circuit diagram.

Figure 9



0 6 . 1 To determine the total resistance of both resistors, a voltmeter must be connected into the circuit.

Complete **Figure 9** to show where the voltmeter should be connected.

[1 mark]

6.2.1.3 Current, resistance and potential difference

Question 13 · continued

0 6 . 2 The student calculated the total resistance of the two resistors.

The student's answer was 26 Ω.

Explain why the student's answer **cannot** be correct.

[2 marks]

0 6 . 3 Write down the equation that links current (I), resistance (R) and potential difference (V).

[1 mark]

0 6 . 4 When the total resistance of the resistors was 7.5 Ω the current in the circuit was 480 mA.

Calculate the potential difference across the two resistors.

[3 marks]

Potential difference = _____ V

6.2.1.3 Current, resistance and potential difference

Question 13 · continued

The student investigated how the resistance of **R** affected the total resistance of the circuit.

Table 2 shows the results.

Table 2

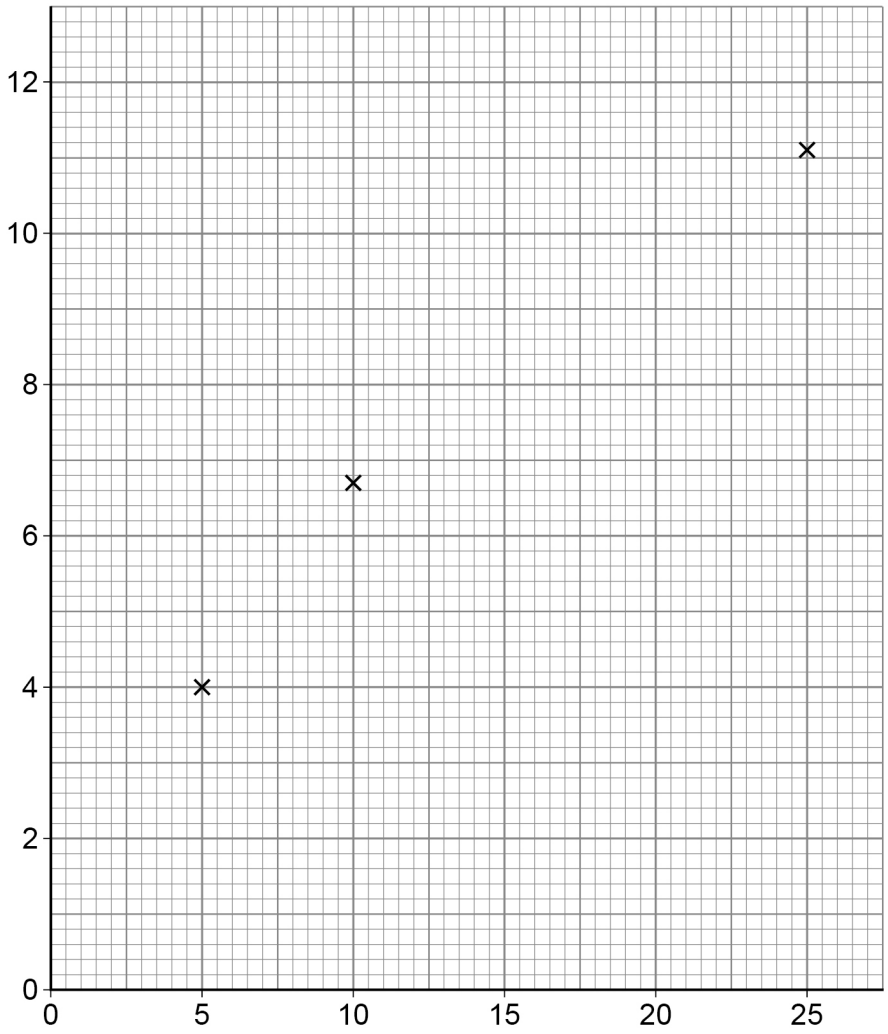
Resistance of R in ohms	Total resistance of the circuit in ohms
5.0	4.0
10.0	6.7
15.0	8.6
20.0	10.0
25.0	11.1

Some of the results are plotted in **Figure 10**.

6.2.1.3 Current, resistance and potential difference

Question 13 · continued

Figure 10



0 6 . 5 Complete **Figure 10**.

You should:

- label both axes
- plot the two remaining values from **Table 2**
- draw the line of best fit.

[3 marks]

0 6 . 6 What resistance of **R** would give a total resistance of 4.4 Ω?

Use **Figure 10**.

[1 mark]

Resistance of **R** = _____ Ω

Question 13 · continued

The body analysis scales initially show a reading of 0.0 kg.

When the student steps onto the scales the reading is 64.8 kg.

The student steps off the scales and then immediately steps back on.

The scales now show a reading of 64.1 kg.

0 6 . 7 Complete the sentence.

[1 mark]

The difference between the two values given by the scales is due

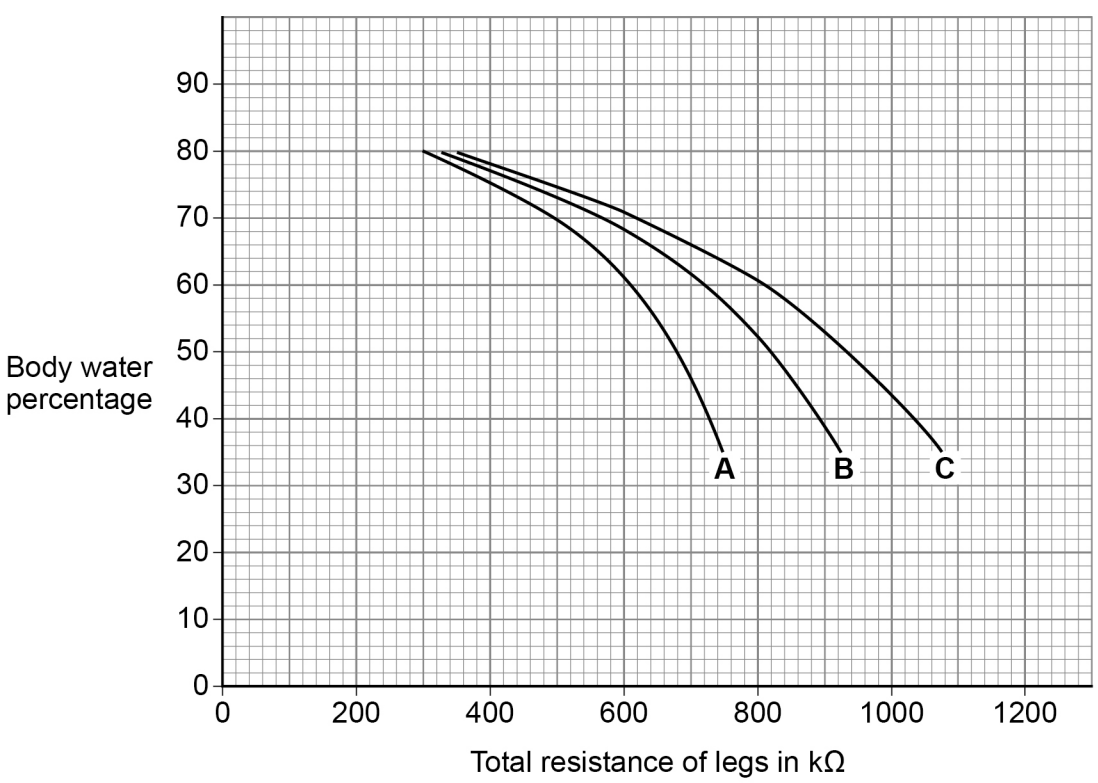
to a _____ error.

0 6 . 8 The height of the student is programmed into the scales.

The scales place the student into a category, **A**, **B** or **C**, based on height and mass.

Figure 11 shows how the scales use the category and the total resistance of the legs to determine the body water percentage.

Figure 11



6.2.1.3 Current, resistance and potential difference

Question 13 · continued

The total resistance of the student's legs is 600 kΩ. A healthy body water percentage is between 45% and 65%.

The different measurements of the mass of the student mean that the student could be in either category **A** or category **B**.

Evaluate if the student has a healthy body water percentage.

[3 marks]

15

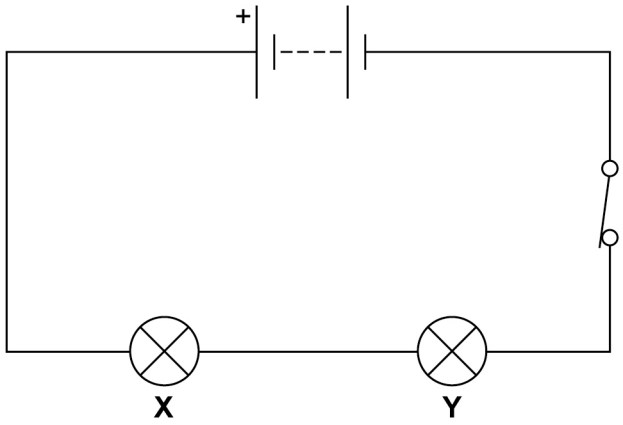
6.2.1.3 Current, resistance and potential difference

Question 14

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

6.2.1.3 Current, resistance and potential difference

Question 14 · 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

6.2.1.3 Current, resistance and potential difference

Question 14 · 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. ☐

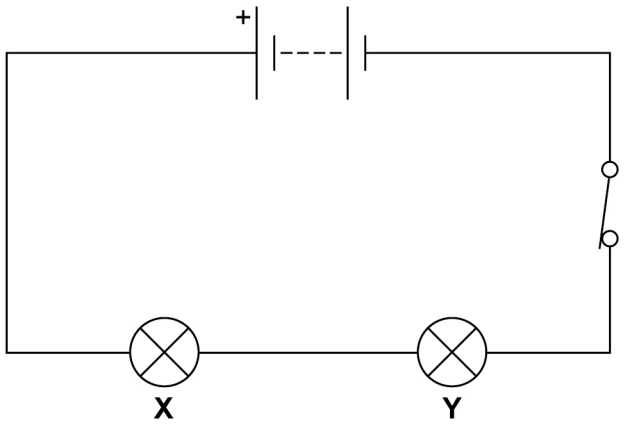
6.2.1.3 Current, resistance and potential difference

Question 14 · 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

6.2.1.3 Current, resistance and potential difference

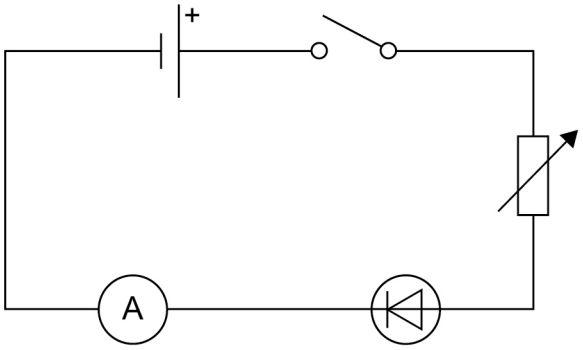
Question 15

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.

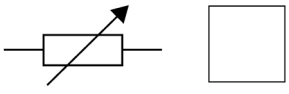
Complete **Figure 6** by adding the symbol for a voltmeter in the correct position.

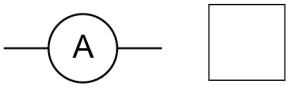
[2 marks]

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

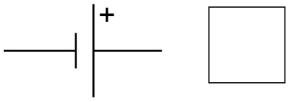
[1 mark]

Tick (✓) **one** box.


☐



☐



☐

Question 15 · continued

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]

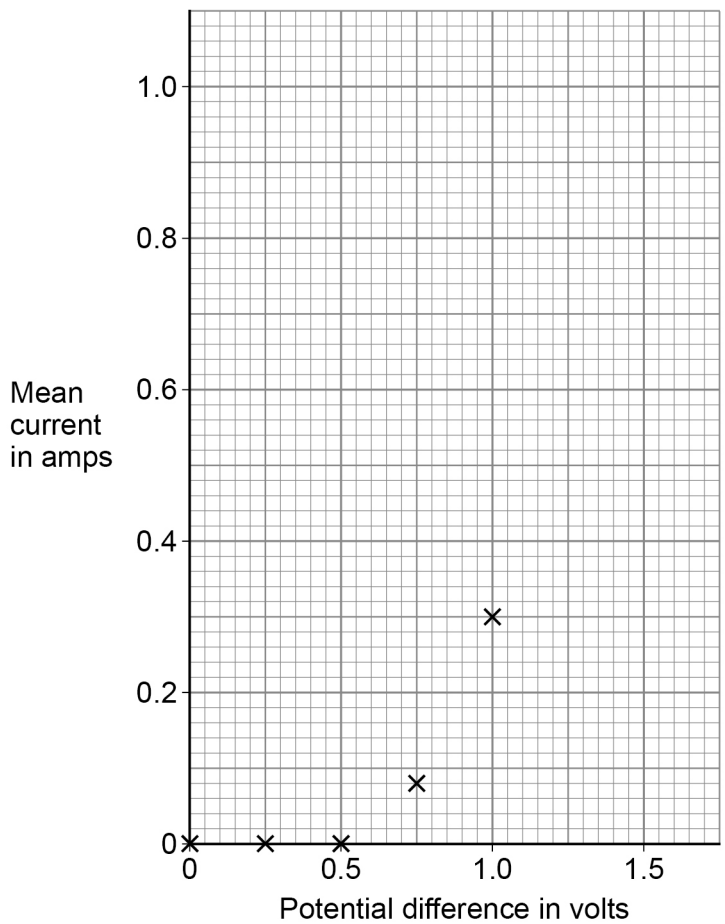
Mean current = _____ A

Question 4 continues on the next page

Question 15 · 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]

6.2.1.3 Current, resistance and potential difference

Question 15 · 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

6.2.1.3 Current, resistance and potential difference

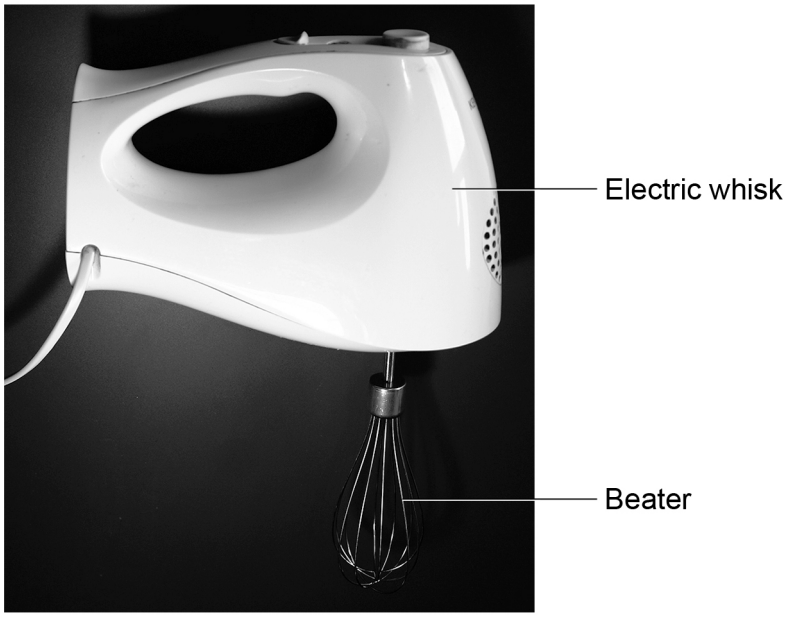
Question 16

June 2024 | 8464/P/1F | Original Q6

0 6 **Figure 10** shows an electric whisk that plugs into the mains electricity supply.

The whisk can mix food by spinning a beater.

Figure 10



0 6 . 1 Give **two** energy stores that increase when the whisk is switched on.

[2 marks]

1 _____

_____

2 _____

_____

Question 16 · continued

Use the Physics Equations Sheet to answer questions **06.2** and **06.3**.

0 6 . 2 Work is done by the whisk when it is used to mix food.

Write down the equation that links power (*P*), time (*t*) and work done (*W*).

[1 mark]

0 6 . 3 The power output of the whisk is 92 W.

Calculate the time for the whisk to do 23 000 J of work.

[3 marks]

Time = _____ s

Question 6 continues on the next page

Question 16 · continued

Use the Physics Equations Sheet to answer questions **06.4** and **06.5**.

0 6 . 4 Which equation links current (I), power (P) and resistance (R)?

[1 mark]

Tick (✓) **one** box.

$P = \frac{I}{R^2}$ ☐

$P = I R^2$ ☐

$P = \frac{I^2}{R}$ ☐

$P = I^2 R$ ☐

0 6 . 5 The current in the whisk is 500 mA.

The resistance of the whisk is 640 Ω.

Calculate the power of the whisk.

[3 marks]

Power = _____ W

6.2.1.3 Current, resistance and potential difference

Question 16 · continued

The whisk has several settings that allow the beater to spin at different speeds.

A faster beater speed needs a greater power input from the mains electricity supply.

0 6 . 6 What is the potential difference between the live wire and neutral wire in the mains electricity supply?

[1 mark]

_____ V

0 6 . 7 Changing the beater speed does **not** change the potential difference between the live wire and neutral wire.

The power input to the whisk changes because the current in the whisk changes.

Complete the sentence.

[1 mark]

When the beater speed increases, the current in the whisk increases because the resistance of the whisk _____.

12

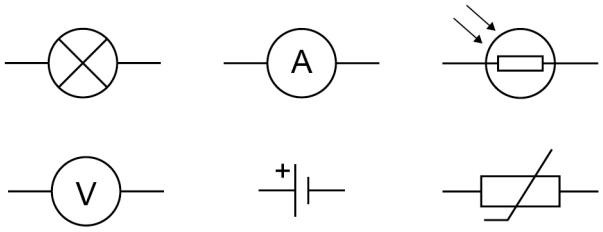
6.2.1.3 Current, resistance and potential difference

Question 17

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]

Question 17 · 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

6.2.1.3 Current, resistance and potential difference

Question 17 · 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 _____

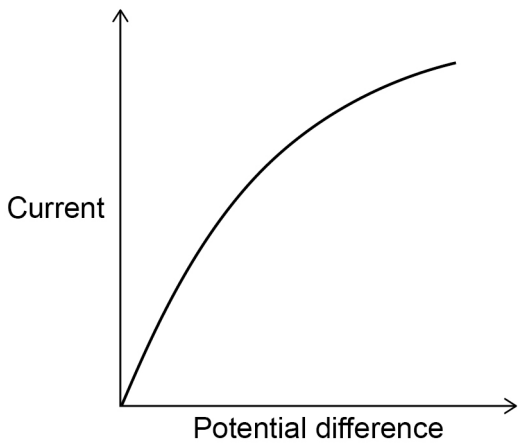
Question 2 continues on the next page

6.2.1.3 Current, resistance and potential difference

Question 17 · 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]

6.2.1.3 Current, resistance and potential difference

Question 17 · 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

6.2.1.3 Current, resistance and potential difference

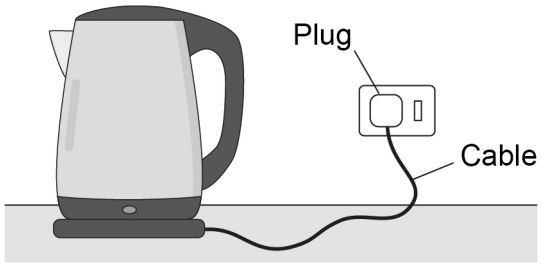
Question 18

June 2025 | 8464/P/1F | Original Q4

0 4 **Figure 5** shows a plastic kettle.

The kettle is connected to the mains electricity supply.

Figure 5



0 4 . 1 What is the frequency of the UK mains electricity supply?

[1 mark]

Tick (✓) **one** box.

25 Hz ☐

50 Hz ☐

75 Hz ☐

100 Hz ☐

Question 4 continues on the next page

6.2.1.3 Current, resistance and potential difference

Question 18 · continued

0 4 . 2 The cable that connects the kettle to the plug contains two insulated wires.

Draw **one** line from each wire to the colour of the insulation on the wire.

[2 marks]

Wire	Colour of insulation
Live	Blue
Neutral	Brown
	Green and yellow stripes

Use the Physics Equations Sheet to answer questions **04.3** and **04.4**.

0 4 . 3 Write down the equation that links current (I), potential difference (V) and power (P).

[1 mark]

6.2.1.3 Current, resistance and potential difference

Question 18 · continued

0 4 . 4 The power of the heating element in the kettle is 2100 W.

The potential difference across the heating element is 230 V.

Calculate the current in the heating element.

Give your answer to 2 significant figures.

[4 marks]

Current (2 significant figures) = _____ A

0 4 . 5 The kettle is designed to switch off when the water reaches boiling point.

Before the kettle switches off, 0.0080 kg of water changes state.

The energy transferred to change the state of the water is 18 000 J.

Calculate the specific latent heat of vaporisation of the water.

Use the Physics Equations Sheet.

[3 marks]

Specific latent heat of vaporisation = _____ J/kg

Question 18 · continued

0 4 . 6 A different kettle is used to heat some water.

The useful output energy transferred to the water is 75 600 J.

The total input energy transferred by the kettle is 84 000 J.

Calculate the efficiency of the kettle.

Use the equation:

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

[2 marks]

Efficiency = _____

0 4 . 7 Explain **one** advantage of electrical appliances having a high efficiency.

[2 marks]

15