AQA GCSE Physics | 8463

SPECIFICATION POINT 4.2.1.2

Electrical charge and current

Past-paper questions

Tier	**Foundation**
Question groups	**23**
Available paper years	**2003–2025**

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:** _____

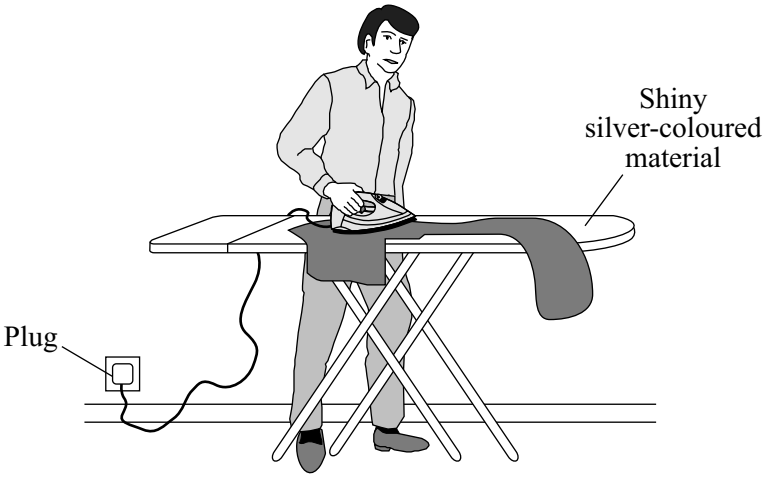
Whole questions are retained for context, so some parts assess other specification points. Current and legacy sources are labelled. Continue on extra paper if needed.

4.2.1.2 Electrical charge and current

Question 01

June 2003 | 3451F | Original Q13 | Legacy

13 The drawing shows someone ironing a shirt. The top of the ironing board is covered in a shiny silver-coloured material.



(a) Explain why the shiny silver-coloured material helps to make ironing easier.

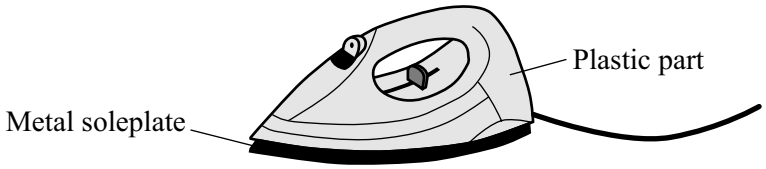
.....

.....

.....

(2 marks)

(b) The iron must be earthed to make it safe. Which part of the iron is connected to the earth pin of the plug?



.....

(1 mark)

(c) Name a material that could be used to make the outside case of the plug.

.....

Give a reason for your choice.

.....

.....

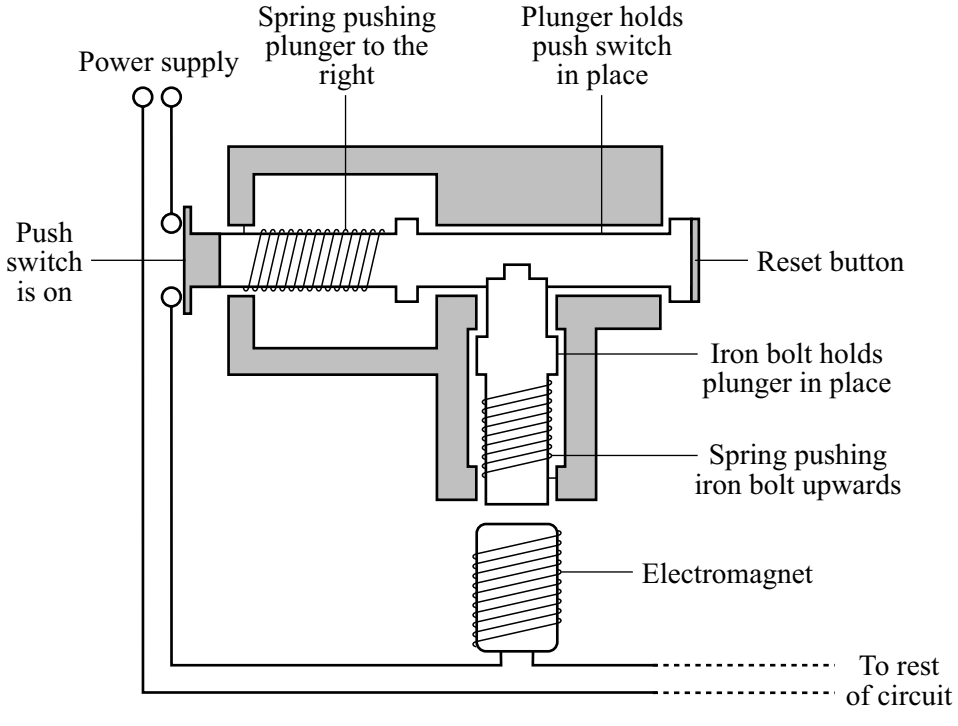
(2 marks)

Question 01 · continued

MARGIN BLANK

(d) *To gain full marks in this question you should write your ideas in good English. Put them into a sensible order and use the correct scientific words.*

Some electrical circuits are protected by a circuit breaker. These switch the circuit off if a fault causes a larger than normal current to flow. The diagram shows one type of circuit breaker. A normal current (15 A) is flowing.



Source: adapted from V. PRUDEN and K. HIRST, *AQA GCSE Science*
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Explain what happens when a current larger than 15 A flows. The answer has been started for you.

When the current goes above 15 A, the electromagnet becomes stronger and.....

.....

.....

.....

.....

.....

.....

(3 marks)

8

4.2.1.2 Electrical charge and current

Question 02

June 2006 | 3451 | Original Q10 | Legacy

10 (a) The diagram shows an electronic system.



Use a word from the box to fill in each space. Each word should be used only once.

buzzers	LDRs	LEDs	motors	switches	thermistors

Input sensors include:

- ..... which respond to changes in temperature;
- ..... which respond to changes in light;
- ..... which respond to changes in pressure.

Processors can be made using logic gates.

Output devices include:

- ..... which produce light;
- ..... which produce sound;
- ..... which produce movement.

(6 marks)

Question 02 · continued

BLANK

(b) Complete the truth tables by writing **1** or **0** in each space in the output column.

(i) AND gate

1st input	2nd input	Output
0	0	.....
1	0	.....
0	1	.....
1	1	1

(1 mark)

(ii) NOT gate

Input	Output
0	.....
1	.....

(1 mark)

(iii) OR gate

1st input	2nd input	Output
0	0	0
1	0	.....
0	1	.....
1	0	.....

(1 mark)

(c) Capacitors can be used as simple timers in electronic circuits.

(i) Draw a circuit symbol for a capacitor.

(1 mark)

(ii) Complete the sentence.

When a current flows to an uncharged capacitor, ... is stored and the potential difference across the capacitor ..... .

(2 marks)

12

4.2.1.2 Electrical charge and current

Question 03

January 2008 | PHY2F | Original Q7 | Legacy

7 During car journeys, the driver will often become electrostatically charged. This is more noticeable on dry days than on damp, humid days.

(a) Explain what happens to cause the driver to become charged.

.....

.....

.....

.....

(2 marks)

(b) Scientists were asked to find out whether the build-up of charge on the driver depends on the type of material used to make the driver's clothes. The results of the investigation are given in the table.

Material	Humidity	Temperature in °C	Charge on the driver in millicoulombs
Nylon	48%	18	3.0 to 3.2
Wool	48%	18	2.4 to 2.5
Cotton	48%	18	1.4 to 1.7

Humidity is a measure of how much water vapour the air can hold.

(i) Why was it important that the scientists controlled the humidity?

.....

.....

(1 mark)

(ii) Does the data in the table show that the charge on the driver would always be less if they were to wear cotton clothing?

Give a reason for your answer.

.....

.....

(1 mark)

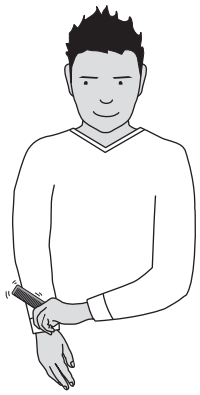
4

4.2.1.2 Electrical charge and current

Question 04

June 2008 | PHY2F | Original Q2 | Legacy

2 (a) A student rubs a nylon comb on the sleeve of his jumper.



2 (a) (i) Use words from the box to complete the following sentence.

electrons	**hand**	**jumper**	**protons**

The comb becomes negatively charged because ..... move

from the student's ..... to the comb.

(2 marks)

2 (a) (ii) What type of charge is left on the jumper?

.....

(1 mark)

2 (a) (iii) The negatively charged comb is placed close to a charged plastic ruler. The comb and the ruler attract each other.

Complete the following sentence by drawing a ring around the correct line in the box.

The ruler is

negatively charged
positively charged
uncharged

.

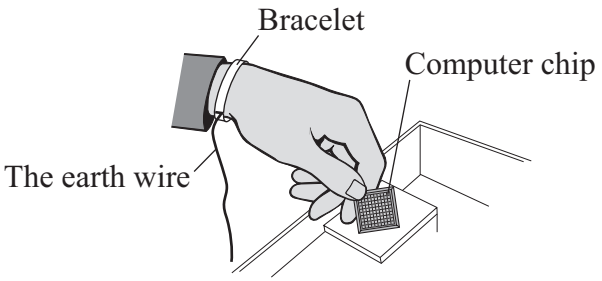
(1 mark)

4.2.1.2 Electrical charge and current

Question 04 · continued

for mark

2 (b) Electrostatic charge can damage computer chips. People working with computer chips may wear a special bracelet, with a wire joining the bracelet to earth (the earth wire). Any negative charge on the person will flow through the wire to earth.



2 (b) (i) Which **one** of the following materials should the bracelet be made from?

Draw a ring around your answer.

copper **plastic** **rubber**

Give a reason for your answer.

.....

.....

(2 marks)

2 (b) (ii) Which **one** of the following words is used to describe the rate of flow of charge through a wire?

Draw a ring around your answer.

current **resistance** **voltage**

(1 mark)

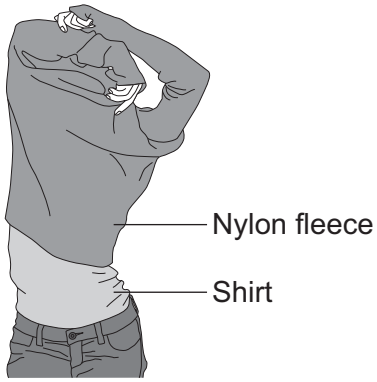
7

4.2.1.2 Electrical charge and current

Question 05

June 2011 | PHY2F | Original Q4 | Legacy

4 (a) A student takes off his nylon fleece and feels a small electric shock.
He realises that this happens because his fleece becomes charged.



Explain why the fleece becomes charged.

.....

.....

.....

.....

.....

(2 marks)

4 (b) Only **two** of the following statements are correct.

Put a tick (✓) in the boxes next to the **two** correct statements.

Positively charged objects repel negatively charged objects. ☐

Electrical charges move easily through metals. ☐

Static electricity is safe; it never causes any danger. ☐

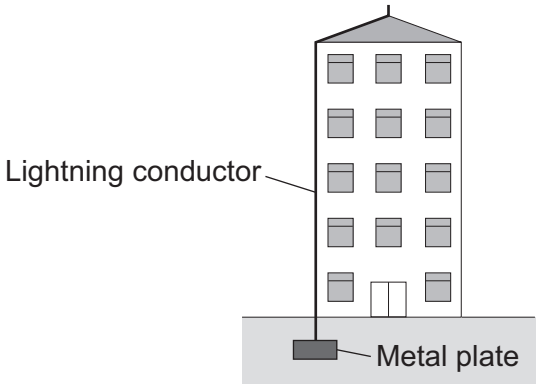
An electric current is a flow of electrical charge. ☐

(2 marks)

4.2.1.2 Electrical charge and current

Question 05 · continued

4 (c) The diagram shows a lightning conductor attached to the side of a tall building.



If the building is struck by lightning, charge flows to earth through the lightning conductor.

4 (c) (i) Which of the materials in the list is used to make the lightning conductor?

Draw a ring around your answer.

copper **glass** **plastic**

Give a reason for your answer.

.....

.....

.....

(2 marks)

4 (c) (ii) Complete the sentence by drawing a ring around the correct line in the box.

The resistance of the lightning conductor is

higher than
the same as
lower than

the resistance of the building.

(1 mark)

4 (c) (iii) It is almost impossible to test different designs of lightning conductor in controlled experiments during a lightning storm.

Suggest a reason why.

.....

.....

(1 mark)

8

4.2.1.2 Electrical charge and current

Question 06

January 2013 | PH2FP | Original Q4 | Legacy

4 (a) The diagram shows the information plate on an electric kettle. The kettle is plugged into the a.c. mains electricity supply.

230 V	**2760 W**
50 Hz	

Use the information from the plate to answer the following questions.

4 (a) (i) What is the frequency of the a.c. mains electricity supply?

.....

(1 mark)

4 (a) (ii) What is the power of the electric kettle?

.....

(1 mark)

4 (b) To boil the water in the kettle, 2400 coulombs of charge pass through the heating element in 200 seconds.

Calculate the current flowing through the heating element and give the unit.

Use the correct equation from the Physics Equations Sheet.

Choose the unit from the list below.

amps **volts** **watts**

.....

.....

.....

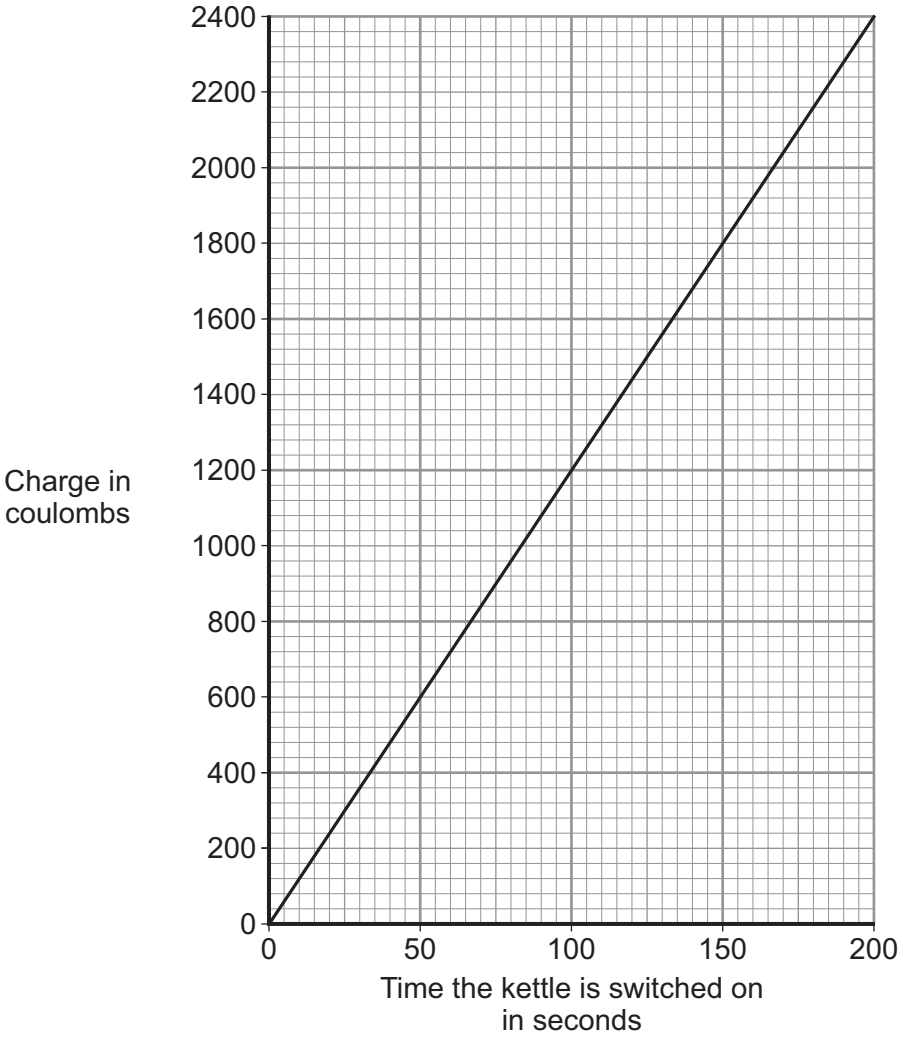
Current = ...

(3 marks)

4.2.1.2 Electrical charge and current

Question 06 · continued

4 (c) The amount of charge passing through the heating element of an electric kettle depends on the time the kettle is switched on.



What pattern links the amount of charge passing through the heating element and the time the kettle is switched on?

.....

.....

(2 marks)

7

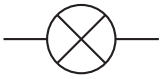
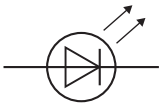
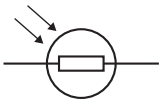
4.2.1.2 Electrical charge and current

Question 07

June 2014 | PH2FP | Original Q3 | Legacy

3 (a) Draw **one** line from each circuit symbol to its correct name.

[3 marks]

Circuit symbol	Name
	Diode
	Light-dependent resistor (LDR)
	Lamp
	Light-emitting diode (LED)

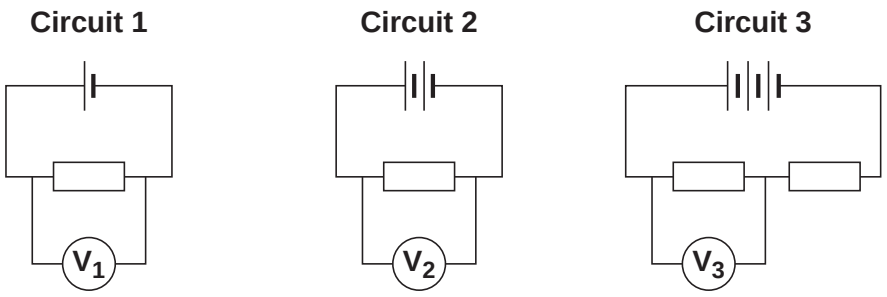
Question 07 · continued

3 (b) **Figure 5** shows three circuits.

The resistors in the circuits are identical.

Each of the cells has a potential difference of 1.5 volts.

Figure 5



3 (b) (i) Use the correct answer from the box to complete the sentence.

[1 mark]

half	twice	the same as

The resistance of **circuit 1** is ..... the resistance of **circuit 3**.

3 (b) (ii) Calculate the reading on voltmeter V_2.

[1 mark]

.....

Voltmeter reading V_2 = ... V

3 (b) (iii) Which voltmeter, V_1, V_2 or V_3, will give the lowest reading?

Draw a ring around the correct answer.

[1 mark]

V_1 V_2 V_3

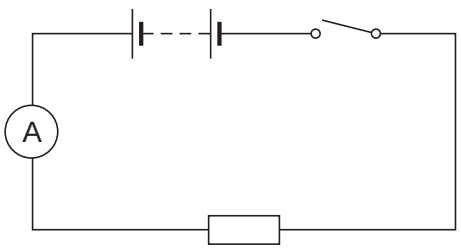
Question 3 continues on the next page

Question 07 · continued

3 (c) A student wanted to find out how the number of resistors affects the current in a series circuit.

Figure 6 shows the circuit used by the student.

Figure 6



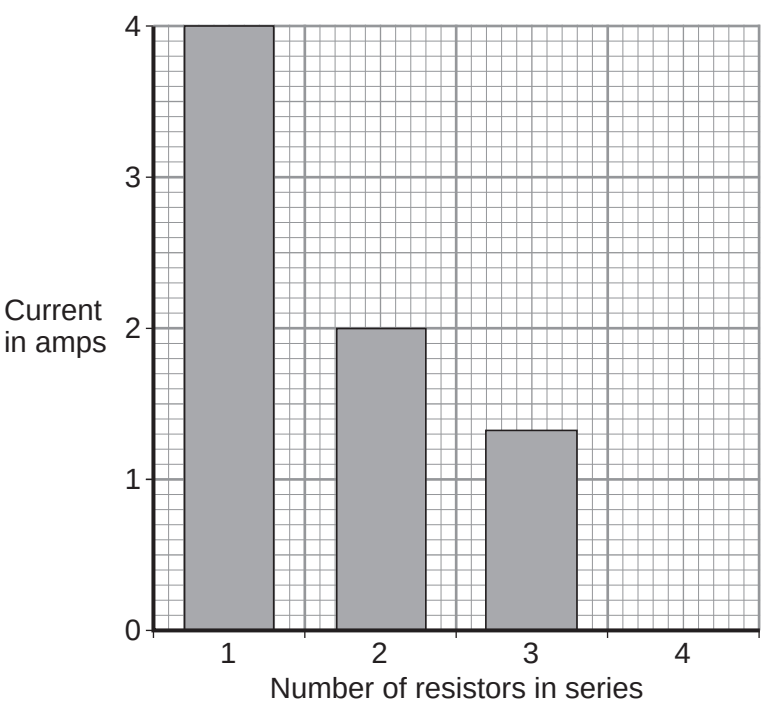
The student started with one resistor and then added more identical resistors to the circuit.

Each time a resistor was added, the student closed the switch and took the ammeter reading.

The student used a total of 4 resistors.

Figure 7 shows three of the results obtained by the student.

Figure 7



4.2.1.2 Electrical charge and current

Question 07 · continued

3 (c) (i) To get valid results, the student kept one variable the same throughout the experiment.

Which variable did the student keep the same?

[1 mark]

.....

3 (c) (ii) The bar chart in **Figure 7** is not complete. The result using 4 resistors is not shown.

Complete the bar chart to show the current in the circuit when 4 resistors were used.

[2 marks]

3 (c) (iii) What conclusion should the student make from the bar chart?

[1 mark]

.....

.....

10

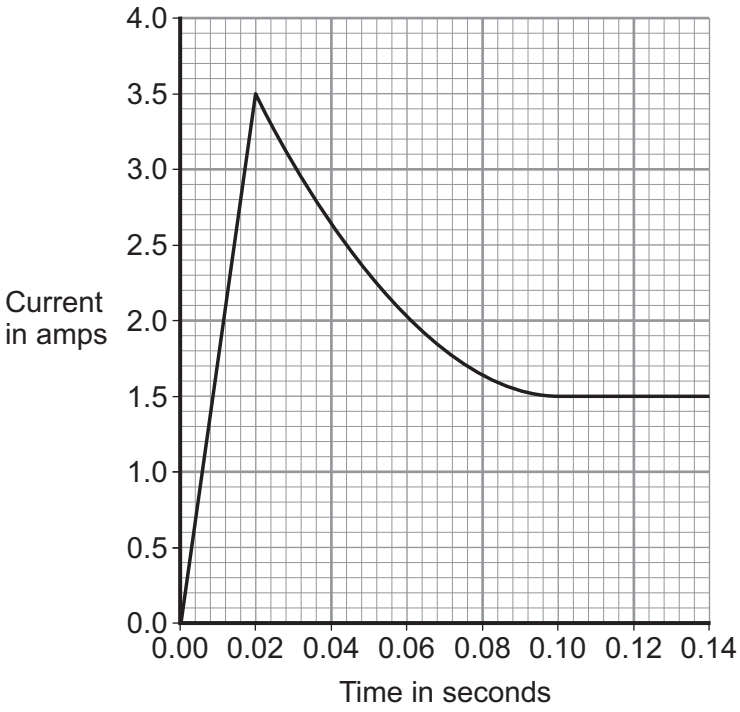
4.2.1.2 Electrical charge and current

Question 08

June 2015 | PH2FP | Original Q1 | Legacy

1 **Figure 1** shows how the current through a filament bulb changes after the bulb is switched on.

Figure 1



1 (a) What happens to the current through the bulb in the first 0.02 seconds after the bulb is switched on?

[1 mark]

.....

1 (b) Between 0.02 seconds and 0.08 seconds the current through the bulb decreases.

1 (b) (i) What, if anything, happens to the **resistance** of the bulb between 0.02 seconds and 0.08 seconds?

[1 mark]

Draw a ring around the correct answer.

decreases **does not change** **increases**

4.2.1.2 Electrical charge and current

Question 08 · continued

1 (b) (ii) What, if anything, happens to the **temperature** of the bulb between 0.02 seconds and 0.08 seconds?

[1 mark]

Draw a ring around the correct answer.

decreases **does not change** **increases**

1 (c) The bulb is connected to a 12 V power supply.

Calculate the power of the bulb when the current through the bulb is 1.5 A.

Use the correct equation from the Physics Equations Sheet.

[3 marks]

Choose the unit from the list below.

coulomb **joule** **watt**

.....

.....

Power = ... unit .....

6

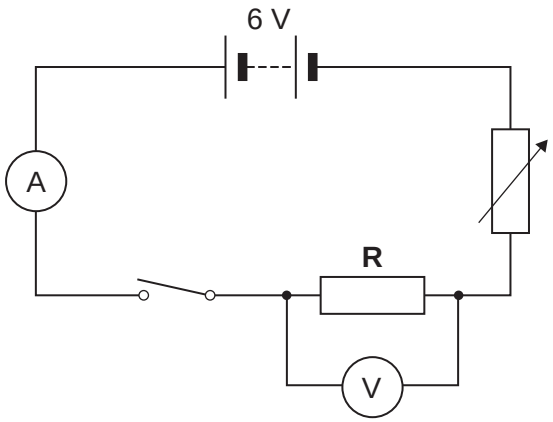
4.2.1.2 Electrical charge and current

Question 09

June 2016 | PH2FP | Original Q5 | Legacy

5 **Figure 8** shows an electrical circuit.

Figure 8



5 (a) The 6 V battery shown in **Figure 8** is made up of a number of identical 1.5 V cells.

Calculate the minimum number of cells needed to make the battery.

[1 mark]

Number of cells = _____

5 (b) The switch in **Figure 8** is shown in the open position. Closing the switch completes the circuit.
Charge flows through the completed circuit and a reading is shown on both the ammeter and the voltmeter.

5 (b) (i) In 10 seconds, 20 coulombs of charge flows through the circuit.

Calculate the current reading shown on the ammeter.

Use the correct equation from the Physics Equations Sheet.

[2 marks]

Current = _____ A

4.2.1.2 Electrical charge and current

Question 09 · continued

5 (b) (ii) For 20 coulombs of charge to flow through the resistor **R**, 100 joules of work must be done.

Calculate the potential difference reading given by the voltmeter.

Use the correct equation from the Physics Equations Sheet.

[2 marks]

_____

_____

Potential difference = _____ V

5

Turn over for the next question

4.2.1.2 Electrical charge and current

Question 10

June 2017 | PH2FP | Original Q1 | Legacy

1 (a) A student rubs a rubber balloon against the sleeve of her woollen jumper. The balloon becomes negatively charged.

1 (a) (i) Use the correct answer from the box to complete the sentence.

[1 mark]

electrons	neutrons	protons

The balloon becomes negatively charged because it gains _____ from the jumper.

1 (a) (ii) After charging the balloon, what is the overall charge left on the jumper?

[1 mark]

Tick (✓) **one** box.

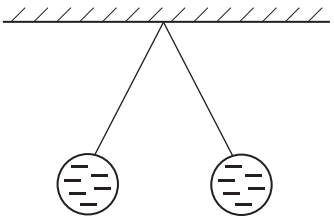
negative ☐

neutral ☐

positive ☐

1 (b) **Figure 1** shows two identically charged balloons hanging close together.

Figure 1



1 (b) (i) Complete the following sentence.

[1 mark]

The balloons carry the same type of charge and so _____ each other.

1 (b) (ii) From **Figure 1**, what can you conclude about the sizes of the **forces** acting on the balloons?

[1 mark]

_____

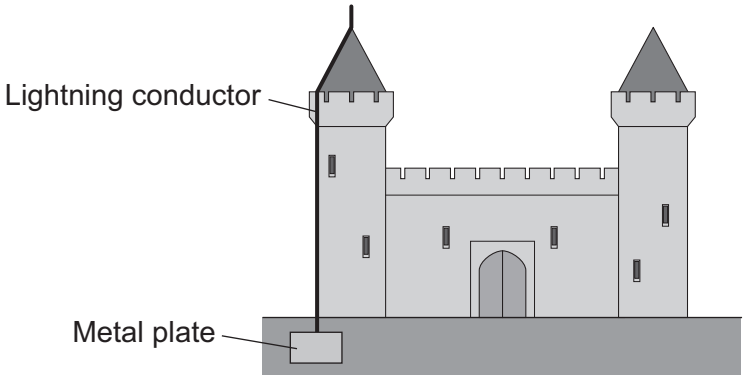
_____

4.2.1.2 Electrical charge and current

Question 10 · continued

1 (c) A lightning conductor attached to the outside of a building reduces the risk of damage being caused to the building by a lightning strike.

Figure 2



If the building is struck by lightning the electrical charge flows through the lightning conductor to earth.

1 (c) (i) Through which one of the following materials can electrical charge flow easily?

Draw a ring around the correct answer.

[1 mark]

copper **plastic** **rubber**

1 (c) (ii) What happens to the temperature of a lightning conductor when electrical charge flows through it?

[1 mark]

Tick (✓) **one** box.

the temperature decreases ☐

the temperature does not change ☐

the temperature increases ☐

1 (c) (iii) During a lightning strike, 4 coulombs of charge flow through a lightning conductor in 0.002 seconds.

Calculate the current in the lightning conductor.

Use the correct equation from the Physics Equations Sheet.

[2 marks]

_____

_____

Current = _____ A

8

4.2.1.2 Electrical charge and current

Question 11

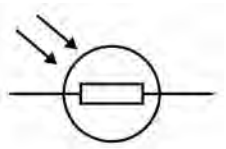
June 2018 | 8463/1F | Original Q7

0 7 The plug of an electrical appliance contains a fuse.

0 7 . 1 What is the correct circuit symbol for a fuse?

Tick **one** box.

[1 mark]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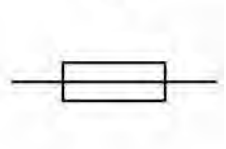
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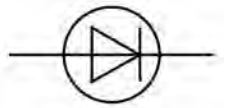
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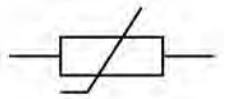

☐

0 7 . 2 The appliance is connected to the mains electrical supply. The mains potential difference is 230 V.

Calculate the energy transferred when 13 C of charge flows through the appliance.

Use the equation:

energy transferred = charge flow × potential difference

[2 marks]

Energy transferred = _____ J

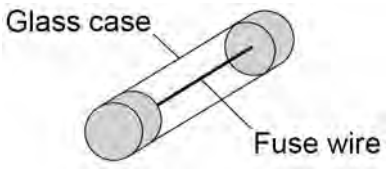
4.2.1.2 Electrical charge and current

Question 11 · continued

June 2018 | 8463/1F | Original Q7

Figure 9 shows the structure of a fuse.

Figure 9



0 7 . 3 Write down the equation that links charge flow, current and time.

[1 mark]

0 7 . 4 The fuse wire melts when 1.52 coulombs of charge flows through the fuse in 0.40 seconds.

Calculate the current at which the fuse wire melts.

[3 marks]

Current = _____ A

0 7 . 5 The mass of the fuse wire is 0.00175 kg. The specific latent heat of fusion of the fuse wire is 205 000 J/kg.

Calculate the energy needed to melt the fuse wire.

Use the Physics Equations Sheet.

[2 marks]

Energy = _____ J

9

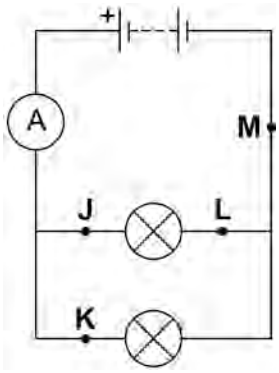
4.2.1.2 Electrical charge and current

Question 12

June 2019 | 8463/1F | Original Q7

0 7 **Figure 9** shows a circuit diagram.

Figure 9



0 7 . 1 In which position could a switch be placed so that both lamps can be switched on or off at the same time?

[1 mark]

Tick (✓) **one** box.

J ☐ **K** ☐ **L** ☐ **M** ☐

0 7 . 2 Draw the circuit symbol for a switch in the box below.

[1 mark]

4.2.1.2 Electrical charge and current

Question 12 · continued

0 7 . 3 In 30 seconds, 24 coulombs of charge flow through the battery.

Calculate the current in the battery.

Use the equation:

$$\text{current} = \frac{\text{charge flow}}{\text{time}}$$

[2 marks]

Current = _____ A

0 7 . 4 There is a potential difference of 3.6 V across the battery.

Calculate the energy transferred by the battery when 60 coulombs of charge flows through the battery.

Use the equation:

energy transferred = charge flow × potential difference

[2 marks]

Energy transferred = _____ J

Question 7 continues on the next page

4.2.1.2 Electrical charge and current

Question 12 · continued

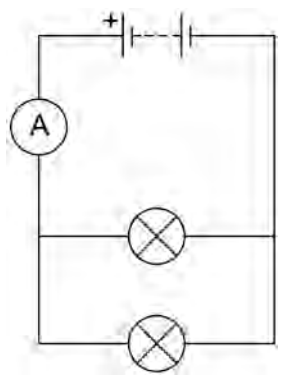
June 2019 | 8463/1F | Original Q7

A student built **Circuit X** and **Circuit Y** shown in **Figure 10**.

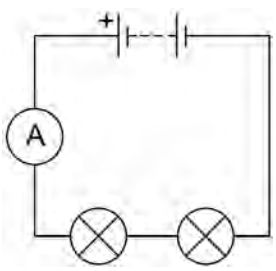
The components used in each circuit were identical.

Figure 10

Circuit X



Circuit Y



0 7 . 5 How would the reading on the ammeter in **Circuit Y** compare to the reading on the ammeter in **Circuit X**?

[1 mark]

Tick (✓) **one** box.

The reading in **Y** would be higher. ☐

The reading in **Y** would be lower. ☐

The readings would be the same. ☐

0 7 . 6 How does the total resistance of **Circuit Y** compare with the total resistance of **Circuit X**?

[1 mark]

Tick (✓) **one** box.

The total resistance of **Y** is greater. ☐

The total resistance of **Y** is less. ☐

The total resistance is the same. ☐

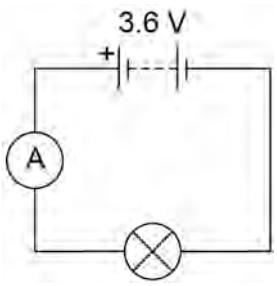
4.2.1.2 Electrical charge and current

Question 12 · continued

June 2019 | 8463/1F | Original Q7

The student built another circuit which is shown in **Figure 11**.

Figure 11



0 7 . 7 Write down the equation which links current, potential difference and resistance.

[1 mark]

0 7 . 8 There is a potential difference of 3.6 V across the lamp in **Figure 11**.

The current through the lamp is 0.80 A

Calculate the resistance of the lamp.

[3 marks]

Resistance = _____ Ω

12

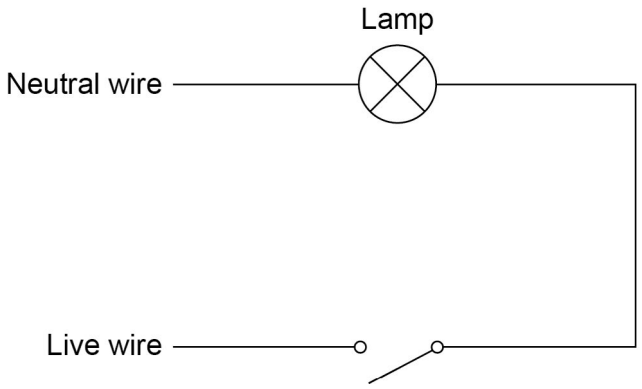
4.2.1.2 Electrical charge and current

Question 13

November 2020 | 8463/1F | Original Q3

0 3 **Figure 5** shows part of a lighting circuit in a house.

Figure 5



0 3 . 1 What is the frequency of the ac mains electricity supply in the UK?

[1 mark]

Tick (✓) **one** box.

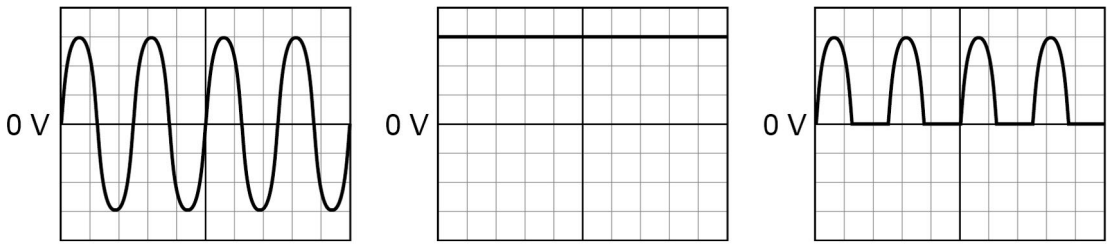
20 Hz ☐ 50 Hz ☐ 60 Hz ☐ 100 Hz ☐

0 3 . 2 The mains electricity supply has an alternating potential difference.

Which diagram shows an alternating potential difference?

[1 mark]

Tick (✓) **one** box.



☐ ☐ ☐

4.2.1.2 Electrical charge and current

Question 13 · continued

0 3 . 3 The potential difference across the lamp is 230 V.

The current in the lamp is 0.020 A.

Calculate the power output of the lamp.

Use the equation:

power = potential difference × current

[2 marks]

Power = _____ W

0 3 . 4 The potential difference across the lamp is 230 V.

Calculate the energy transferred by the lamp when 180 C of charge flows through the lamp.

Use the equation:

energy transferred = charge flow × potential difference

[2 marks]

Energy transferred = _____ J

0 3 . 5 An electrician needs to replace the light switch in **Figure 5**.

Describe the possible hazard and the risk to the electrician of changing the light switch.

[2 marks]

Hazard _____

Risk _____

8

4.2.1.2 Electrical charge and current

Question 14

November 2020 | 8463/1F | Original Q9

0 9 **Figure 13** shows an LED torch.

Figure 13

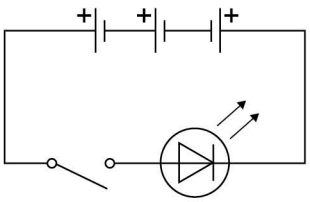


0 9 . 1 The torch contains one LED, one switch and three cells.

Which diagram shows the correct circuit for the torch?

[1 mark]

Tick (✓) **one** box.



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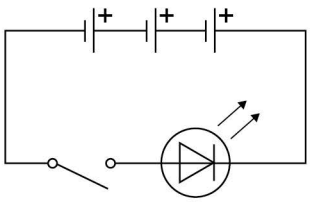
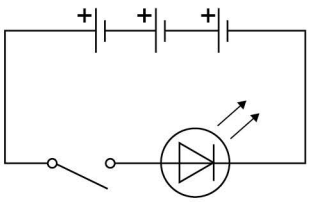


☐



☐

Question 14 · continued

0 9 . 2 Write down the equation which links charge flow (Q), current (I) and time (t).

[1 mark]

0 9 . 3 The torch worked for 14 400 seconds before the cells needed replacing.

The current in the LED was 50 mA.

Calculate the total charge flow through the cells.

[3 marks]

Total charge flow = _____ C

0 9 . 4 When replaced, the cells were put into the torch the wrong way around.

Explain why the torch did not work.

[2 marks]

Question 9 continues on the next page

4.2.1.2 Electrical charge and current

Question 14 · continued

0 9 . 5 Write down the equation which links efficiency, total power input and useful power output.

[1 mark]

0 9 . 6 The total power input to the LED was 0.24 W.

The efficiency of the LED was 0.75

Calculate the useful power output of the LED.

[3 marks]

Useful power output = _____ W

11

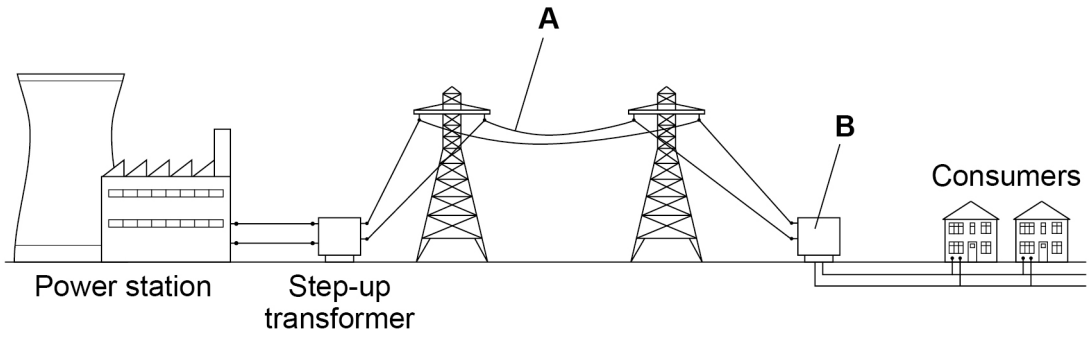
4.2.1.2 Electrical charge and current

Question 15

November 2021 | 8463/1F | Original Q2

0 2 **Figure 2** shows part of the National Grid linking a power station to consumers.

Figure 2



0 2 . 1 Name the parts of **Figure 2** labelled **A** and **B**.

[2 marks]

A _____

B _____

0 2 . 2 Electricity is transmitted through **A** at a very high potential difference.

What is the advantage of transmitting electricity at a very high potential difference?

[1 mark]

Tick (✓) **one** box.

A high potential difference is safer for consumers. ☐

Less thermal energy is transferred to the surroundings. ☐

Power transmission is faster. ☐

4.2.1.2 Electrical charge and current

Question 15 · continued

0 2 . 3 The power station generates electricity at a potential difference of 25 000 V.

The energy transferred by the power station in one second is 500 000 000 J.

Calculate the charge flow from the power station in one second.

Use the equation:

$$\text{charge flow} = \frac{\text{energy}}{\text{potential difference}}$$

[2 marks]

Charge flow in one second = _____ C

Question 2 continues on the next page

Question 15 · continued

The electricity supply to a house has a potential difference of 230 V.

Table 1 shows the current in some appliances in the house.

Table 1

Appliance	Current in amps
Dishwasher	6.50
DVD player	0.10
Lamp	0.40
TV	0.20

0 2 . 4 Calculate the total power of all the appliances in **Table 1**.

Use the equation:

power = potential difference × current

[3 marks]

Total power = _____ W

4.2.1.2 Electrical charge and current

Question 15 · continued

0 2 . 5 Each appliance in **Table 1** is switched on for 2 hours.

Which appliance will transfer the most energy?

Give a reason for your answer.

[2 marks]

Appliance _____

Reason _____

_____

_____

0 2 . 6 The average energy transferred from the National Grid every second for each person in the UK is 600 J.

There are 32 000 000 seconds in one year.

Calculate the average energy transferred each year from the National Grid for each person in the UK.

[2 marks]

_____

_____

_____

Average energy transferred = _____ J

12

4.2.1.2 Electrical charge and current

Question 16

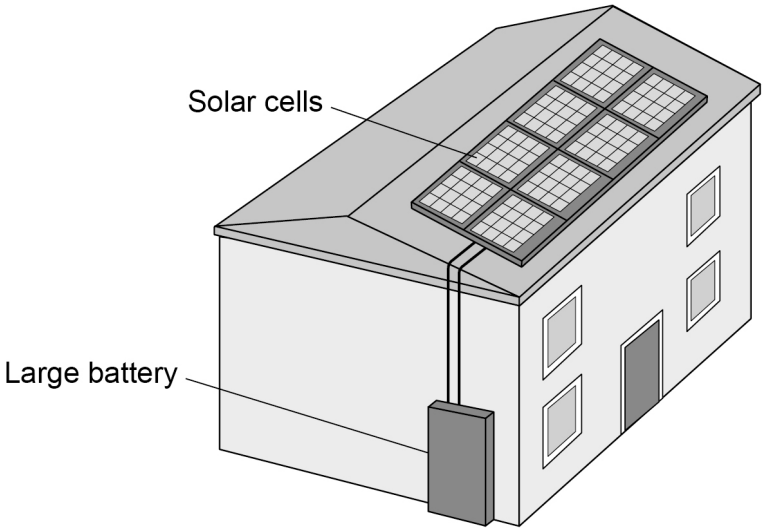
November 2021 | 8463/1F | Original Q6

0 6 **Figure 10** shows a house with a solar power system.

The solar cells generate electricity.

When the electricity generated by the solar cells is not needed, the energy is stored in a large battery.

Figure 10



0 6 . 1 The solar cells on the roof of the house always face in the same direction.

Explain **one** disadvantage caused by the solar cells only facing in one direction.

[2 marks]

4.2.1.2 Electrical charge and current

Question 16 · continued

0 6 . 2 The mean current from the solar cells to the battery is 3.5 A.

Calculate the charge flow from the solar cells to the battery in 3600 seconds.

Use the equation:

charge flow = current × time

[2 marks]

Charge flow = _____ C

0 6 . 3 Write down the equation which links efficiency, total power input and useful power output.

[1 mark]

0 6 . 4 At one time in the day, the total power input to the solar cells was 7500 W.

The efficiency of the solar cells was 0.16

Calculate the useful power output of the solar cells.

[3 marks]

Useful power output = _____ W

Question 6 continues on the next page

4.2.1.2 Electrical charge and current

Question 16 · continued

0 6 . 5 The wasted energy that is **not** usefully transferred by the solar cells is dissipated.

What happens to energy that has been dissipated?

[1 mark]

Tick (✓) **one** box.

- The energy becomes less useful. ☐
- The energy is destroyed. ☐
- The energy is used to generate electricity. ☐

0 6 . 6 Why is it unlikely that all the UK's electricity needs could be met by solar power systems?

[1 mark]

Tick (✓) **one** box.

- A very large area would need to be covered with solar cells. ☐
- Solar power is a non-renewable energy resource. ☐
- The efficiency of solar cells is too high. ☐

10

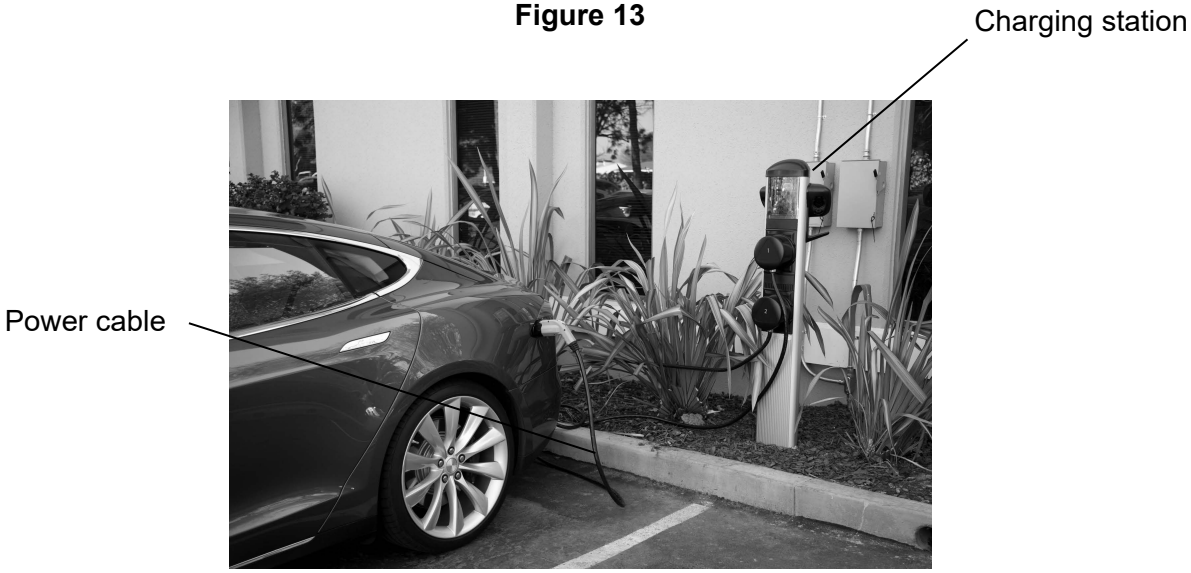
4.2.1.2 Electrical charge and current

Question 17

November 2021 | 8463/1F | Original Q9

0 9 **Figure 13** shows an electric car being recharged.

Figure 13



0 9 . 1 The charging station applies a direct potential difference across the battery of the car.

What does 'direct potential difference' mean?

[1 mark]

Question 9 continues on the next page

4.2.1.2 Electrical charge and current

Question 17 · continued

0 9 . 2 Which equation links energy transferred (*E*), power (*P*) and time (*t*)?

[1 mark]

Tick (✓) **one** box.

energy transferred = $\frac{\text{power}}{\text{time}}$ ☐

energy transferred = $\frac{\text{time}}{\text{power}}$ ☐

energy transferred = power × time ☐

energy transferred = power^2 × time ☐

0 9 . 3 The battery in the electric car can store 162 000 000 J of energy.

The charging station has a power output of 7200 W.

Calculate the time taken to fully recharge the battery from zero.

[3 marks]

Time taken = _____ s

4.2.1.2 Electrical charge and current

Question 17 · continued

0 9 . 4 Which equation links current (I), potential difference (V) and resistance (R)?

[1 mark]

Tick (✓) **one** box.

$I = V \times R$ ☐

$I = V^2 \times R$ ☐

$R = I \times V$ ☐

$V = I \times R$ ☐

0 9 . 5 The potential difference across the battery is 480 V.

There is a current of 15 A in the circuit connecting the battery to the motor of the electric car.

Calculate the resistance of the motor.

[3 marks]

Resistance = _____ Ω

Question 9 continues on the next page

4.2.1.2 Electrical charge and current

Question 17 · continued

0 9 . 6 Different charging systems use different electrical currents.

- Charging system **A** has a current of 13 A.
- Charging system **B** has a current of 26 A.
- The potential difference of both charging systems is 230 V.

How does the time taken to recharge a battery using charging system **A** compare with the time taken using charging system **B**?

[1 mark]

Tick (✓) **one** box.

Time taken using system **A** is half the time of system **B** ☐

Time taken using system **A** is the same as system **B** ☐

Time taken using system **A** is double the time of system **B** ☐

10

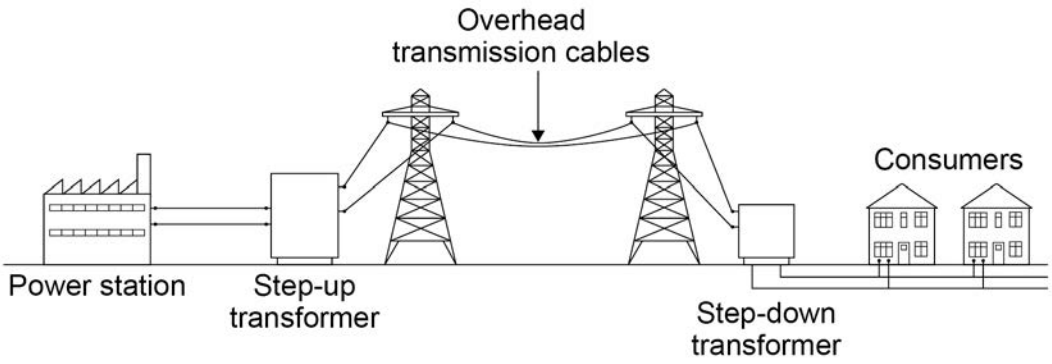
4.2.1.2 Electrical charge and current

Question 18

June 2022 | 8463/1F | Original Q7

0 7 **Figure 8** shows how electricity is supplied to consumers.

Figure 8



0 7 . 1 Electricity from the power station can be generated using renewable or non-renewable energy resources.

Complete **Table 2** to show which energy resources are renewable and which are non-renewable.

[2 marks]

Tick (✓) **one** box in **each** row.

Table 2

Energy resource	Renewable	Non-renewable
biofuel		
coal		
nuclear		
tides		

Question 7 continues on the next page

4.2.1.2 Electrical charge and current

Question 18 · continued

0 7 . 2 Transformers are used to make power transmission an efficient process.

Complete the sentences.

Choose answers from the box.

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

[4 marks]

charge	**current**	**energy**
potential difference	**resistance**	

The step-up transformer increases the _____ and decreases the _____ .

Using the transformers decreases the _____ transfer from the overhead transmission cables to the surroundings.

The step-down transformer decreases the _____ .

4.2.1.2 Electrical charge and current

Question 18 · continued

Use the Physics Equations Sheet to answer questions **07.3** and **07.4**.

0 7 . 3 Write down the equation which links charge flow (Q), current (I) and time (t).

[1 mark]

0 7 . 4 The town of Hornsdale in Australia has electricity supplied by a huge battery.

The battery supplies a current of 130 000 A.

Calculate the charge flow from the battery in 5 minutes.

Choose the unit from the box.

[4 marks]

coulombs	newtons	watts

Charge flow = _____ Unit _____

11

4.2.1.2 Electrical charge and current

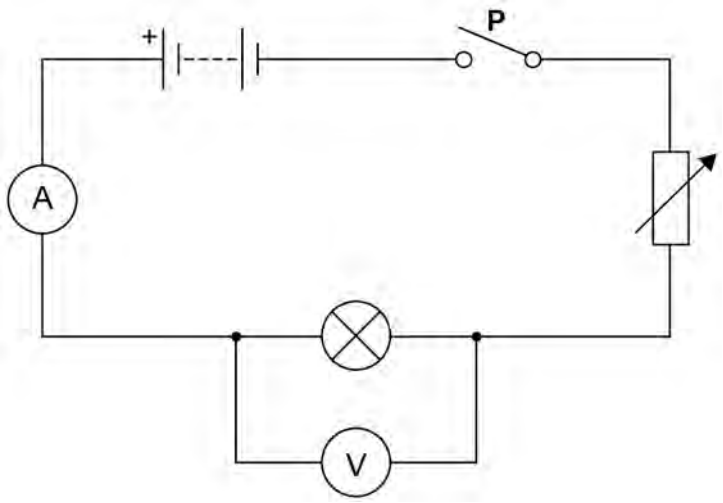
Question 19

June 2023 | 8463/1F | Original Q1

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

Figure 1 shows the circuit used.

Figure 1



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

[1 mark]

_____

0 1 . 2 Complete the sentences.

Choose answers from the box.

[2 marks]

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

The ammeter in the circuit measures _____ .

The voltmeter in the circuit measures _____ .

Question 19 · continued

0 1 . 3 How will **increasing** the resistance of the variable resistor in **Figure 1** affect each of the following quantities?

[3 marks]

Tick (✓) **one** box in **each** row.

Quantity	Decreases	Stays the same	Increases
Current in the circuit			
Potential difference across the lamp			
Total resistance of the circuit			

0 1 . 4 A charge flow of 15 coulombs passed through the filament lamp in a time of 60 seconds.

Calculate the current in the lamp.

Use the equation:

$$\text{current} = \frac{\text{charge flow}}{\text{time}}$$

[2 marks]

Current = _____ A

Question 1 continues on the next page

4.2.1.2 Electrical charge and current

Question 19 · continued

0 1 . 5 When the current in the filament lamp is 0.12 A, the potential difference across the lamp is 6.0 V.

Calculate the resistance of the filament lamp.

Use the equation:

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

[2 marks]

Resistance = _____ Ω

4.2.1.2 Electrical charge and current

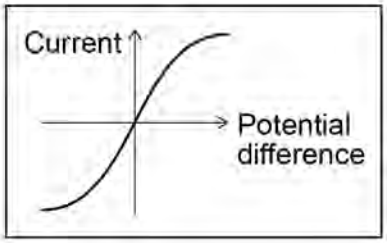
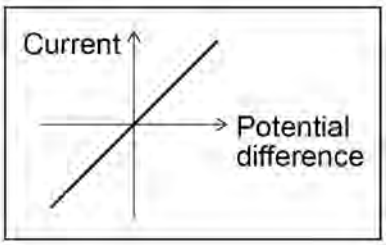
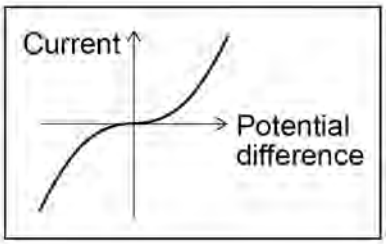
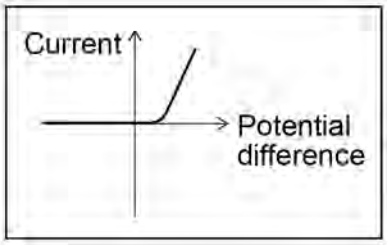
Question 19 · continued

0 1 . 6 The student repeated the investigation after replacing the lamp with a resistor at constant temperature and then a diode.

The student plotted a graph for each component.

Draw **one** line from each component to its graph.

[2 marks]

Component	Graph
Diode	
Filament lamp	
Resistor	
	

4.2.1.2 Electrical charge and current

Question 19 · continued

0 1 . 7 **Figure 2** shows an ammeter.

The ammeter is **not** connected to a circuit.

Figure 2



What type of error does the ammeter display?

[1 mark]

Tick (✓) **one** box.

A positive error ☐

A random error ☐

A zero error ☐

13

4.2.1.2 Electrical charge and current

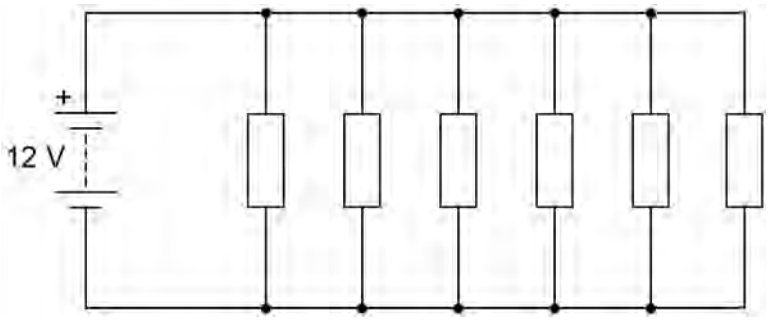
Question 20

June 2023 | 8463/1F | Original Q10

1 0 **Figure 14** shows an electrical circuit used to heat the windscreen of a car.

Each resistor in the circuit represents a heating element.

Figure 14



1 0 . 1 The 12 V battery supplies direct potential difference.

What is meant by 'direct potential difference'?

[1 mark]

Use the Physics Equations Sheet to answer questions **10.2** and **10.3**.

1 0 . 2 Which equation links charge flow (Q), energy (E) and potential difference (V)?

[1 mark]

Tick (✓) **one** box.

$E = \frac{V}{Q}$ ☐

$E = QV$ ☐

$E = \frac{Q}{V}$ ☐

$E = \frac{V^2}{Q}$ ☐

4.2.1.2 Electrical charge and current

Question 20 · continued

1 0 . 3 Calculate the charge flow through the 12 V battery when the battery transfers 5010 J of energy.

[3 marks]

Charge flow = _____ C

1 0 . 4 Ice forms on the windscreen at a temperature of 0 °C.

The electrical circuit transfers 5010 J of energy to the ice.

A mass of 0.015 kg of ice melts.

Calculate the specific latent heat of fusion of water.

Use the Physics Equations Sheet.

[3 marks]

Specific latent heat of fusion of water = _____ J/kg

4.2.1.2 Electrical charge and current

Question 20 · continued

10.5 The electrical circuit was left switched on while the ice changed from a solid to a liquid and increased in temperature to 5 °C.

Explain the changes in the arrangement **and** movement of the particles as the ice melted and the temperature increased to 5 °C.

[6 marks]

14

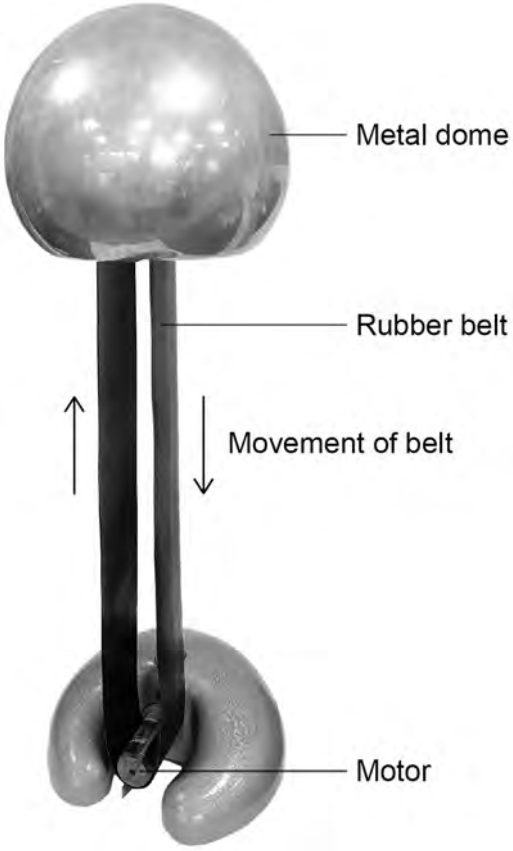
4.2.1.2 Electrical charge and current

Question 21

June 2024 | 8463/1F | Original Q1

0 1 **Figure 1** shows a static electricity generator.

Figure 1



The rubber belt is turned by a motor.

As the rubber belt moves, charge is transferred from the rubber belt to the metal dome.

Question 21 · continued

Figure 2 shows a student touching the metal dome of the static electricity generator.

The dome is negatively charged.

Figure 2



0 1 . 1 Complete the sentence.

Choose the answer from the box.

[1 mark]

negative	**neutral**	**positive**

When the student touches the negatively charged metal dome the student's hair gains a _____ charge.

Question 1 continues on the next page

Question 21 · continued

0 1 . 2 Complete the sentence.

Choose the answer from the box.

[1 mark]

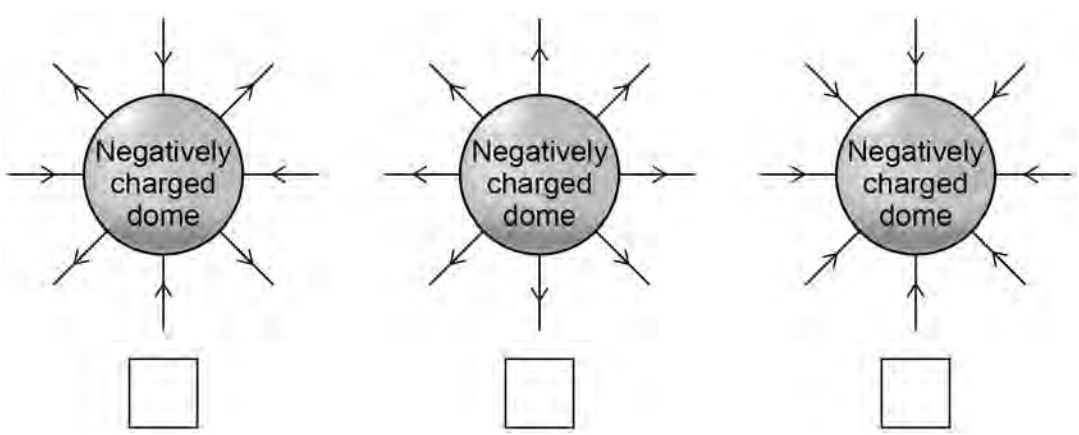
attraction	**gravity**	**repulsion**

The hair on the student's head stands up because the strands of hair experience forces of _____.

0 1 . 3 Which of the following diagrams shows the electric field pattern around the negatively charged metal dome?

[1 mark]

Tick (✓) **one** box.

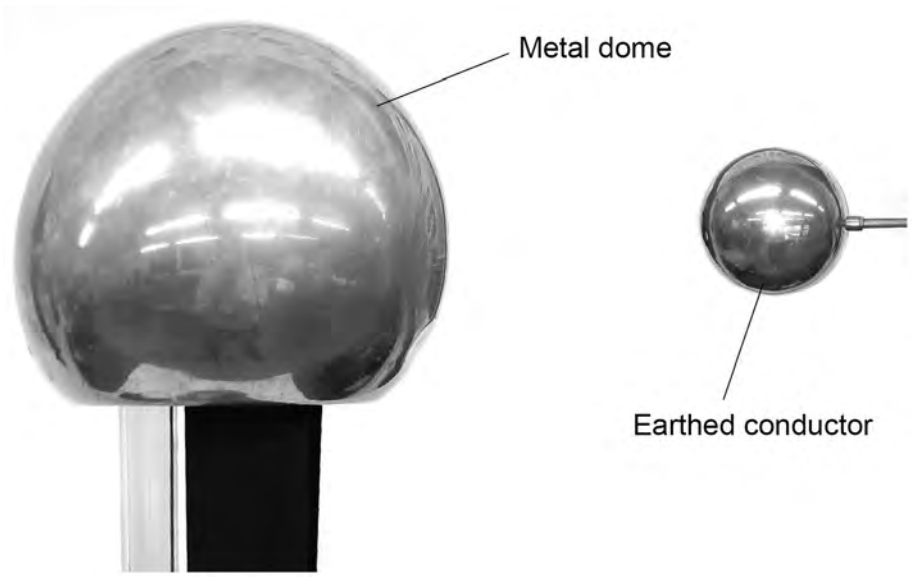


4.2.1.2 Electrical charge and current

Question 21 · continued

Figure 3 shows the negatively charged metal dome and an earthed conductor.

Figure 3



0 1 . 4 The air between the dome and the earthed conductor is an insulator.

Complete the sentence.

Choose the answer from the box.

[1 mark]

efficiency	**resistance**	**temperature**

The air between the dome and the earthed conductor has

a high _____.

Question 1 continues on the next page

4.2.1.2 Electrical charge and current

Question 21 · continued

The earthed conductor is moved closer to the metal dome.

A spark jumps from the dome to the earthed conductor.

0 1 . 5 Complete the sentence.

Choose the answer from the box.

[1 mark]

earthed	**ionised**	**neutral**

The spark jumps because the air around the charged dome has

become _____.

0 1 . 6 Which particles are transferred when the spark jumps from the negatively charged metal dome to the earthed conductor?

[1 mark]

Tick (✓) **one** box.

Electrons ☐

Neutrons ☐

Protons ☐

4.2.1.2 Electrical charge and current

Question 21 · continued

0 1 . 7 The potential difference between the metal dome and earth is 300 000 V.

When the spark jumps there is a charge flow of 0.000 002 C.

Calculate the energy transferred by the spark.

Use the equation:

energy transferred = charge flow × potential difference

[2 marks]

Energy transferred = _____ J

8

Turn over for the next question

4.2.1.2 Electrical charge and current

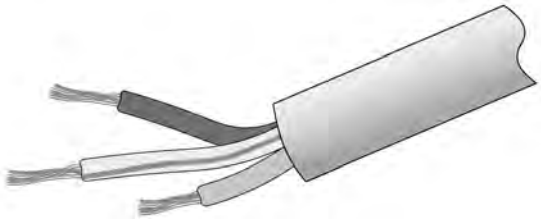
Question 22

June 2024 | 8463/1F | Original Q7

0 7 An electrical appliance is connected to the mains electricity supply using a three-core cable.

Figure 13 shows a three-core cable.

Figure 13



0 7 . 1 What colour is the insulation covering the live wire inside the cable?

[1 mark]

Tick (✓) **one** box.

- Blue ☐
- Brown ☐
- Green and yellow ☐
- Orange ☐

0 7 . 2 What colour is the insulation covering the neutral wire inside the cable?

[1 mark]

Tick (✓) **one** box.

- Blue ☐
- Brown ☐
- Green and yellow ☐
- Orange ☐

4.2.1.2 Electrical charge and current

Question 22 · continued

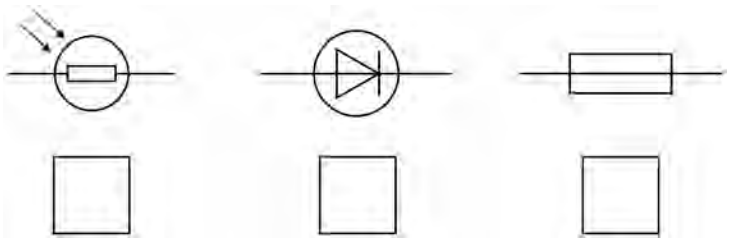
The plug connected to the cable contains a fuse.

A fuse contains a wire that is designed to melt when the current is too great.

0 7 . 3 What is the circuit symbol for a fuse?

[1 mark]

Tick (✓) **one** box.



0 7 . 4 The wire in the fuse melts when there is a charge flow of 2.0 C in a time of 0.40 s.

Calculate the current in the wire when it melts.

Use the equation:

$$\text{current} = \frac{\text{charge flow}}{\text{time}}$$

[2 marks]

Current = _____ A

Question 7 continues on the next page

Question 22 · continued

0 7 . 5 The mass of the wire is 0.016 g.

specific latent heat of fusion of the wire = 60 000 J/kg

Calculate the change in thermal energy needed to melt the wire.

Use the Physics Equations Sheet.

[3 marks]

Change in thermal energy = _____ J

0 7 . 6 The fuse transfers some energy to the surroundings as it melts.

How does transferring energy to the surroundings affect the total energy needed to melt the fuse?

[1 mark]

Tick (✓) **one** box.

- The total energy will be smaller. ☐
- The total energy will be the same. ☐
- The total energy will be greater. ☐

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4.2.1.2 Electrical charge and current

Question 23

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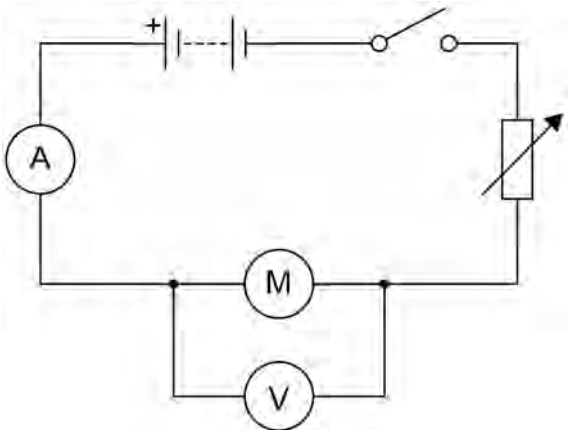
0 7 A student built a circuit to investigate how the efficiency of a motor varies with the speed of the motor.

The symbol for a motor is 

Figure 12 shows the circuit.

Figure 12



The student used the motor to lift a mass through a height of 1.0 m.

0 7 . 1 The motor took 12 seconds to lift the mass.

The charge flow through the circuit was 6.0 C.

Calculate the current in the circuit.

Use the equation:

$$\text{current} = \frac{\text{charge flow}}{\text{time}}$$

[2 marks]

Current = _____ A

4.2.1.2 Electrical charge and current

Question 23 · continued

0 7 . 2 The potential difference across the motor was 8.0 V.

The charge flow through the motor was 6.0 C.

Calculate the energy transferred to the motor.

Use the equation:

energy transferred = charge flow × potential difference

[2 marks]

Energy transferred = _____ J

Question 7 continues on the next page

4.2.1.2 Electrical charge and current

Question 23 · continued

Use the Physics Equations Sheet to answer questions **07.3** and **07.4**.

0 7 . 3 Which equation links efficiency, total input energy transfer and useful output energy transfer?

[1 mark]

Tick (✓) **one** box.

efficiency = useful output energy transfer × total input energy transfer ☐

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

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

0 7 . 4 The efficiency of the motor was 0.70

The useful output energy transfer of the motor was 1.96 J.

Calculate the total input energy transfer to the motor.

[3 marks]

Total input energy transfer = _____ J

4.2.1.2 Electrical charge and current

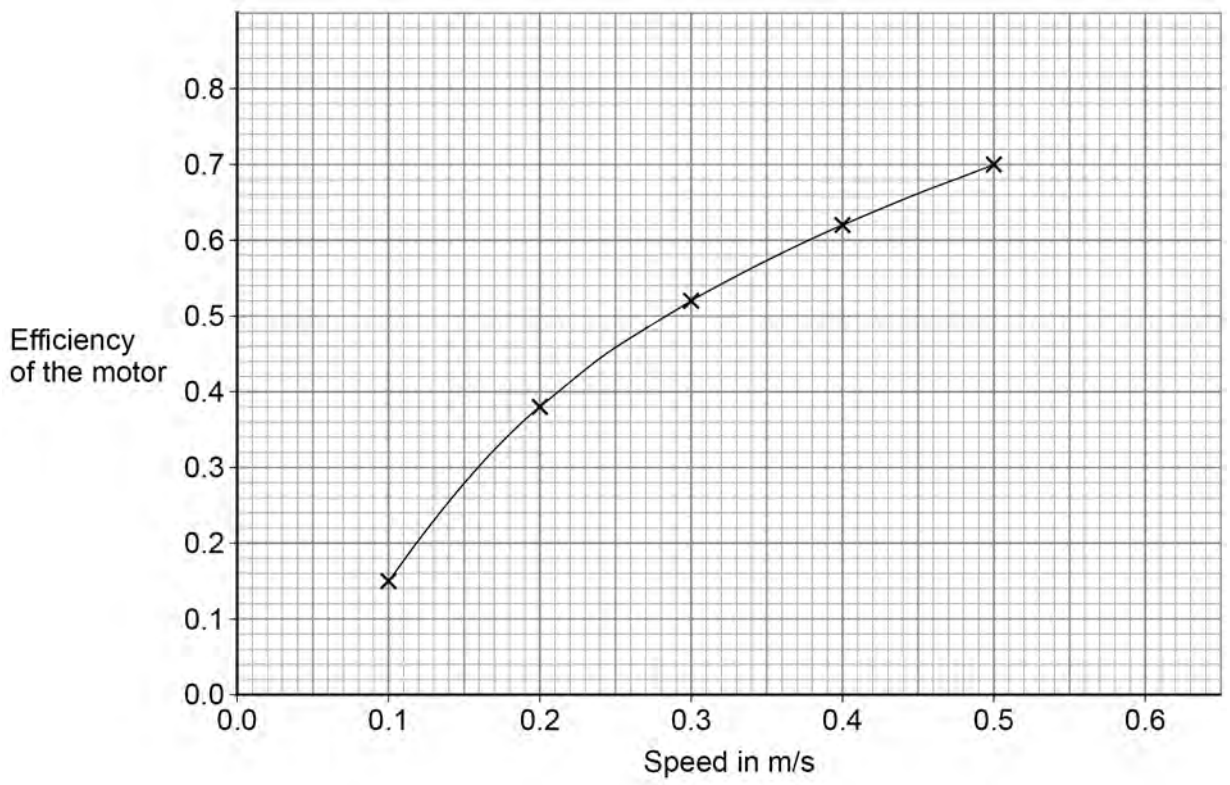
Question 23 · continued

The student adjusted the speed at which the mass was lifted.

For each speed, the student determined the efficiency of the motor.

Figure 13 shows the results.

Figure 13



0 7 . 5 Use **Figure 13** to predict the efficiency of the motor when the speed is 0.6 m/s.

[1 mark]

Efficiency = _____

0 7 . 6 How does **Figure 13** show that the efficiency of the motor is **not** directly proportional to the speed?

[1 mark]

_____

_____

_____

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