AQA GCSE Physics | 8463

SPECIFICATION POINT 4.2.1.1

Standard circuit diagram symbols

Past-paper questions

Tier	**Foundation**
Question groups	**24**
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:** _____

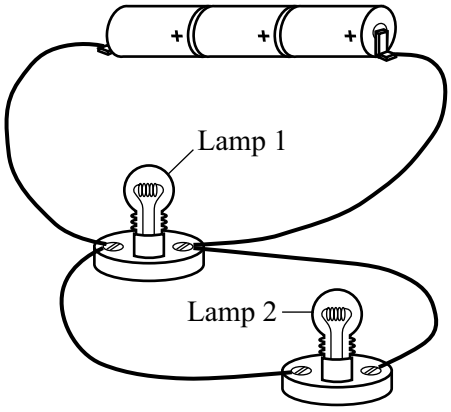
Whole questions are retained for context, so some parts assess other specification points. Current and legacy sources are labelled. Continue on extra paper if needed.

4.2.1.1 Standard circuit diagram symbols

Question 01

June 2003 | 3451F | Original Q1 | Legacy

1 The drawing shows three identical cells and two identical lamps joined in a circuit.



(a) Use the correct symbols to draw a circuit diagram for this circuit.

(3 marks)

(b) Each of the cells provides a potential difference (voltage) of 1.5 volts. What is the total potential difference (voltage) provided by all three cells?

.....volts

(1 mark)

(c) Complete this sentence by crossing out the **two** lines in the box that are wrong.

The current through lamp 2 will be

smaller than
the same as
bigger than

the current through lamp 1.

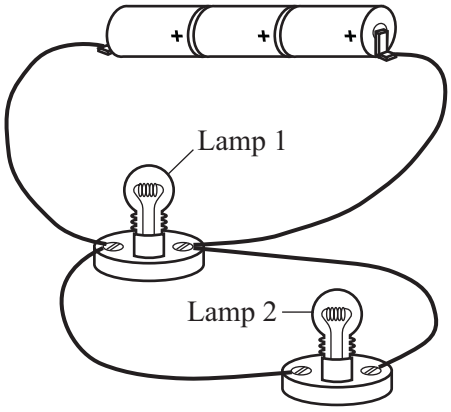
(1 mark)

4.2.1.1 Standard circuit diagram symbols

Question 02

June 2003 | 3462F3 | Original Q1 | Legacy

1 The drawing shows three identical cells and two identical lamps joined in a circuit.



(a) Use the correct symbols to draw a circuit diagram for this circuit.

(3 marks)

(b) Each of the cells provides a potential difference (voltage) of 1.5 volts. What is the total potential difference (voltage) provided by all three cells?

.....volts

(1 mark)

(c) Complete this sentence by crossing out the **two** lines in the box that are wrong.

The current through lamp 2 will be | smaller than
the same as
bigger than | the current through lamp 1.

(1 mark)

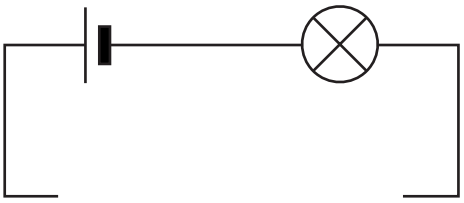
4.2.1.1 Standard circuit diagram symbols

Question 03

June 2004 | 3451F | Original Q7 | Legacy

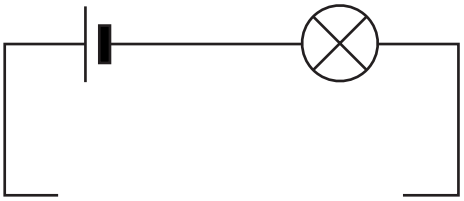
7 (a) Each diagram shows a cell connected to a lamp.

(i) Add **two** switches and connecting wires to the diagram below so that the lamp will light **only** when **both** switches are closed.



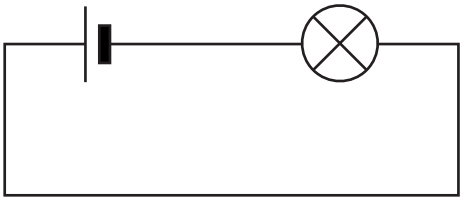
(1 mark)

(ii) Add **two** switches and connecting wires to the diagram below so that the lamp will light when either **one** or **both** switches are closed.



(1 mark)

(iii) Add **one** switch and connecting wires to the diagram below so that the lamp is **on** when the switch is **open** and the lamp is **off** when the switch is **closed**.



(1 mark)

(iv) Complete the table to name the type of logic gate represented by each circuit in parts (i), (ii) and (iii) above.

Circuit	Name of the logic gate
(a)(i)	.....
(a)(ii)	.....
(a)(iii)	.....

(3 marks)

4.2.1.1 Standard circuit diagram symbols

Question 03 · continued

MARGIN
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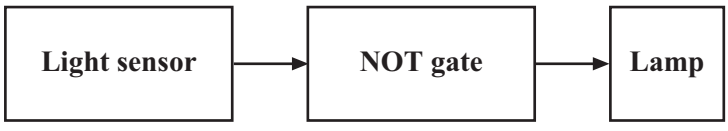
(b) The block diagram represents an electronic system.



(i) Describe how the system works.

.....

.....

.....

(2 marks)

(ii) Suggest a practical use for this system.

.....

.....

(1 mark)

(c) (i) Draw the symbol used in electronic circuits for a NOT gate.

(1 mark)

(ii) Use **0** and **1** to complete the table for a NOT gate.

Input	Output
.....	.....
.....	.....

(1 mark)

(iii) What is the name of the sort of table shown in part (c)(ii)?

.....

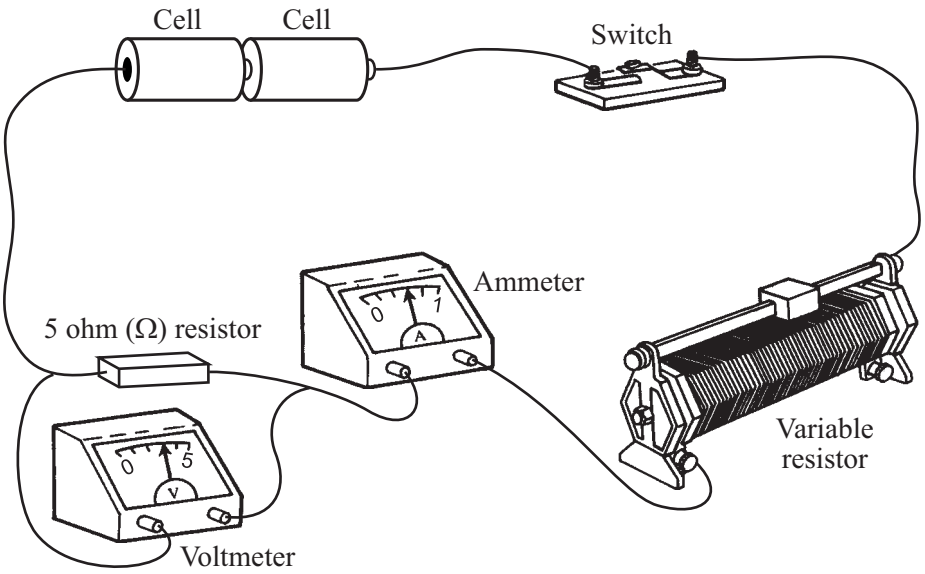
(1 mark)

4.2.1.1 Standard circuit diagram symbols

Question 04

June 2004 | 3451F | Original Q10 | Legacy

10 The drawing shows the circuit used to investigate how the current through a 5 ohm (Ω) resistor changes as the potential difference (voltage) across the resistor changes.



(a) Draw, in the space below, a circuit diagram of this circuit. Use the correct symbols for each part of the circuit.

(2 marks)

4.2.1.1 Standard circuit diagram symbols

Question 04 · continued

MARGIN BLANK

(b) (i) Write down the equation that links current, potential difference and resistance.

.....

(1 mark)

(ii) Calculate the potential difference across the 5 ohm (Ω) resistor when the current through the resistor equals 0.4 A. Show clearly how you work out your final answer.

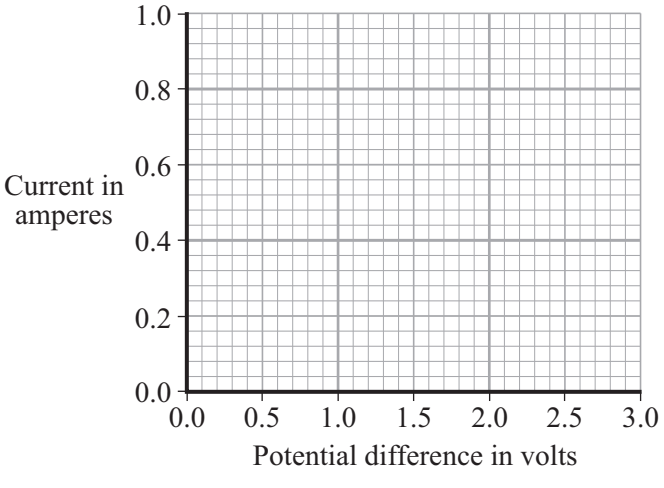
.....

.....

potential difference =.....volts

(2 marks)

(iii) Complete the graph to show how the current through the resistor changes as the potential difference across the resistor increases from 0 V to 3 V. Assume the resistor stays at a constant temperature.



(2 marks)

(c) The resistor is replaced by a 3 V filament lamp. The resistance of the lamp increases as the potential difference across it increases. Why?

.....

.....

(1 mark)

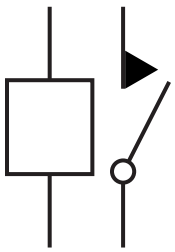
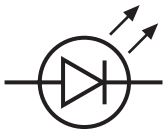
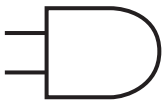
8

4.2.1.1 Standard circuit diagram symbols

Question 05

June 2004 | 3451F | Original Q15 | Legacy

15 (a) In circuit diagrams, symbols are used for the different components. Complete the table by identifying each of these components and finish each sentence which says what the component does.

Symbol	Name of component	What the component does
	.....	It allows a small current to ....
	.....	It lights if a current flows through it ....
	.....	It switches on if ....

(6 marks)

4.2.1.1 Standard circuit diagram symbols

Question 05 · continued

2 1

MARGIN BLANK

(b) We now make use of many electronic systems. Two of these systems are mobile phones and the Internet.

Apart from their costs, explain **one** benefit and **one** drawback of each of these.

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

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(4 marks)

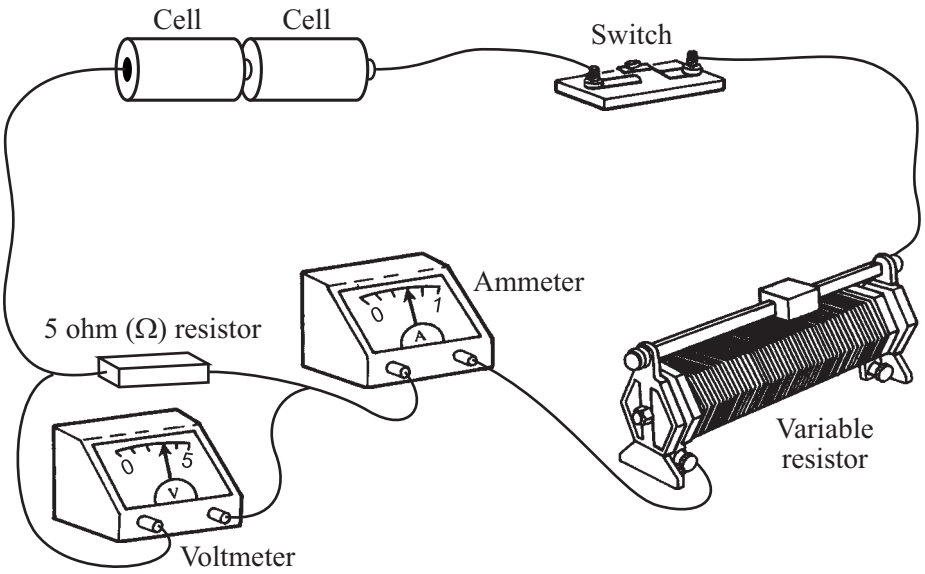
10

4.2.1.1 Standard circuit diagram symbols

Question 06

June 2004 | 3462F3 | Original Q8 | Legacy

8 The drawing shows the circuit used to investigate how the current through a 5 ohm (Ω) resistor changes as the potential difference (voltage) across the resistor changes.



(a) Draw, in the space below, a circuit diagram of this circuit. Use the correct symbols for each part of the circuit.

(2 marks)

4.2.1.1 Standard circuit diagram symbols

Question 06 · continued

MARGIN BLANK

(b) (i) Write down the equation that links current, potential difference and resistance.

.....

(1 mark)

(ii) Calculate the potential difference across the 5 ohm (Ω) resistor when the current through the resistor equals 0.4 A. Show clearly how you work out your final answer.

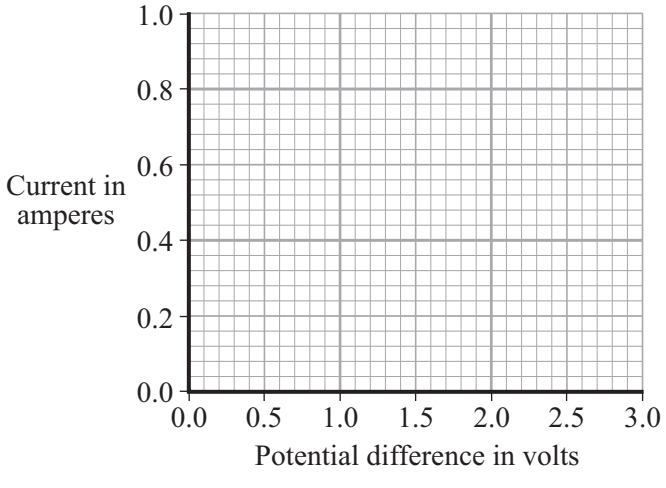
.....

.....

potential difference =.....volts

(2 marks)

(iii) Complete the graph to show how the current through the resistor changes as the potential difference across the resistor increases from 0 V to 3 V. Assume the resistor stays at a constant temperature.



(2 marks)

(c) The resistor is replaced by a 3 V filament lamp. The resistance of the lamp increases as the potential difference across it increases. Why?

.....

.....

(1 mark)

8

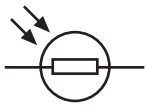
4.2.1.1 Standard circuit diagram symbols

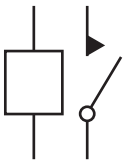
Question 07

June 2005 | 3451 | Original Q9 | Legacy

9 (a) Name each of the following circuit symbols.



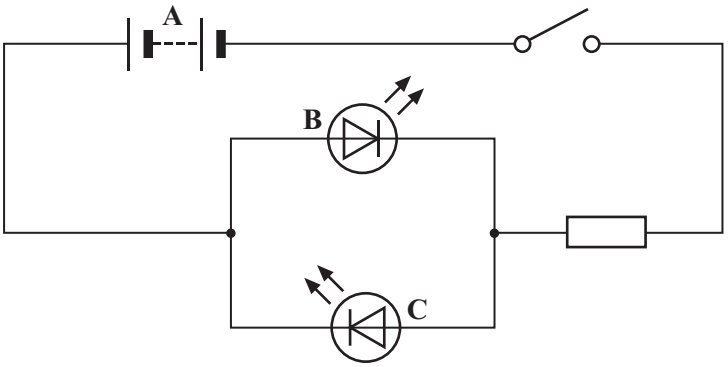




....

(3 marks)

(b) The diagram shows a circuit.



(i) Name part **A**.

.....

(1 mark)

(ii) Name part **B**.

.....

(1 mark)

(iii) What will you see happen when the switch is closed?

.....

.....

(1 mark)

(iv) Explain your answer to part (b)(iii).

.....

.....

(1 mark)

4.2.1.1 Standard circuit diagram symbols

Question 07 · continued

1 /

MARGIN BLANK

(c) (i) Complete the table for an AND gate.

First input	Second input	Output
0	0	.....
1	0	.....
0	1	.....
1	1	.....

(1 mark)

(ii) What is this sort of table called?

.....

(1 mark)

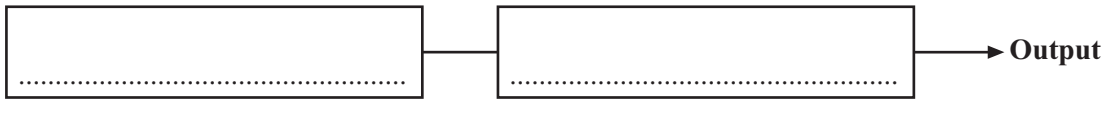
(iii) Draw the circuit symbol for an AND gate.

(1 mark)

(d) In another circuit, two electronic components are connected in series. The table shows the output from them when it is dark and when it is light.

Condition	Output
Dark	1
Light	0

Complete the boxes by adding the names of **two** suitable components in their correct order.



(2 marks)

12

4.2.1.1 Standard circuit diagram symbols

Question 08

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)

4.2.1.1 Standard circuit diagram symbols

Question 08 · continued

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(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)

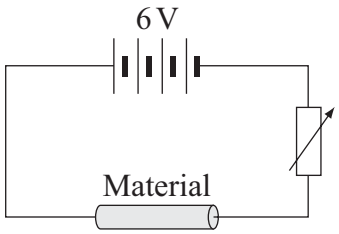
12

4.2.1.1 Standard circuit diagram symbols

Question 09

January 2008 | PHY2F | Original Q6 | Legacy

6 (a) The diagram shows the circuit used to investigate the resistance of a material.
The diagram is incomplete; the ammeter and voltmeter are missing.



(i) Draw the symbols for the ammeter and voltmeter on the diagram in the correct places. *(2 marks)*

(ii) How can the current through the material be changed?

.....

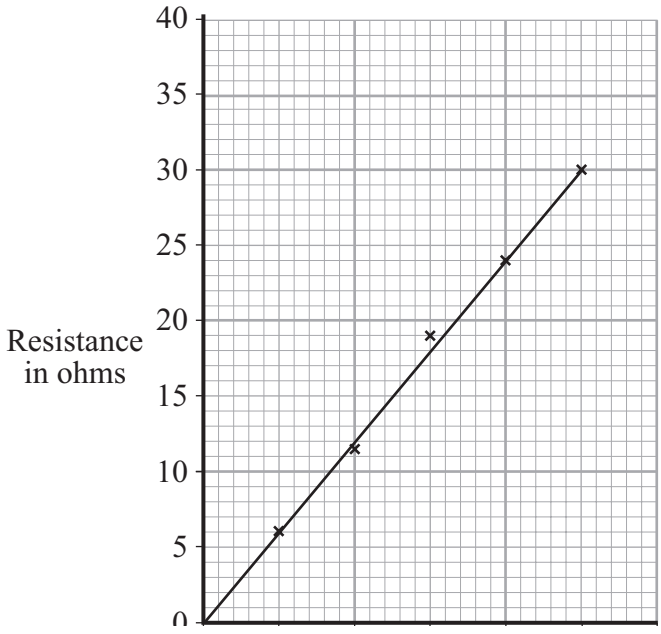
.....

(1 mark)

(b) The material, called conducting putty, is rolled into cylinders of different lengths but with equal thicknesses.

Graph 1 shows how the resistance changes with length.

Graph 1



4.2.1.1 Standard circuit diagram symbols

Question 09 · continued

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(i) Why has the data been shown as a line graph rather than a bar chart?

.....

.....

(1 mark)

(ii) The current through a 30 cm length of conducting putty was 0.15 A.

Use **Graph 1** to find the resistance of a 30 cm length of conducting putty.

Resistance = ... ohms

(1 mark)

(iii) Use your answer to (b)(ii) and the equation in the box to calculate the potential difference across a 30 cm length of conducting putty.

potential difference = current × resistance

Show clearly how you work out your answer.

.....

.....

.....

Potential difference = ... volts

(2 marks)

Question 6 continues on the next page

4.2.1.1 Standard circuit diagram symbols

Question 09 · continued

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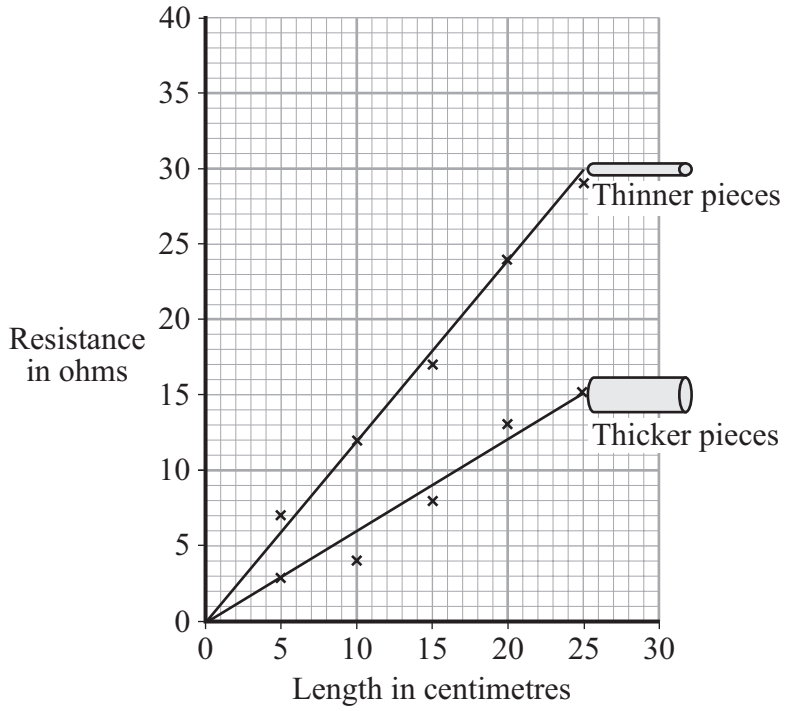
(c) A second set of data was obtained using thicker pieces of conducting putty. Both sets of results are shown in **Graph 2**.

Graph 2



(i) What is the relationship between the resistance and the thickness of the conducting putty?

.....

.....

(1 mark)

(ii) Name **one** error that may have reduced the accuracy of the results.

.....

(1 mark)

(iii) How could the reliability of the data have been improved?

.....

.....

(1 mark)

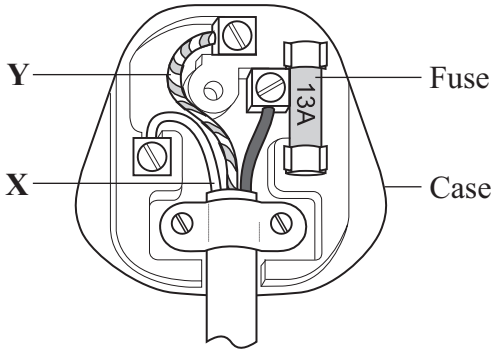
10

4.2.1.1 Standard circuit diagram symbols

Question 10

June 2008 | PHY2F | Original Q3 | Legacy

3 (a) The diagram shows the inside of a correctly wired three-pin plug.



3 (a) (i) What colour is the insulation on the wire labelled **X**?

Draw a ring around your answer.

blue **brown** **green/yellow**

(1 mark)

3 (a) (ii) What name is given to the wire labelled **Y**?

Draw a ring around your answer.

earth **live** **neutral**

(1 mark)

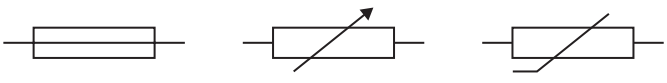
3 (a) (iii) What material would be suitable for the case of the plug?

.....

(1 mark)

3 (a) (iv) Which **one** of the following is the correct circuit symbol for a fuse?

Draw a ring around your answer.



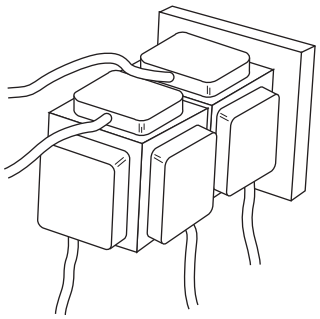
(1 mark)

4.2.1.1 Standard circuit diagram symbols

Question 10 · continued

for mark

3 (b) A householder does not have enough electric sockets in the kitchen. To overcome the problem, the householder uses two adaptors to plug five appliances into a single electric socket.



Explain why this is dangerous.

.....

.....

.....

.....

(2 marks)

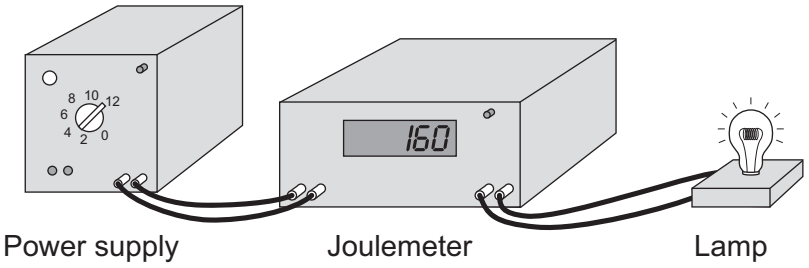
6

4.2.1.1 Standard circuit diagram symbols

Question 11

June 2010 | PHY2F | Original Q1 | Legacy

1 A student used a joulemeter to measure the energy transformed by a lamp.



The student set the joulemeter to zero, and then switched on the power supply.
After 120 seconds (2 minutes), the reading on the joulemeter had increased to 2880.

1 (a) In the space below, draw the circuit symbol used to represent a lamp.

(1 mark)

1 (b) (i) Use the equation in the box to calculate the power of the lamp.

$$\text{power} = \frac{\text{energy transformed}}{\text{time}}$$

Show clearly how you work out your answer.

.....

.....

Power = ...

(2 marks)

4.2.1.1 Standard circuit diagram symbols

Question 11 · continued

1 (b) (ii) Which **one** of the following is the unit of power?

Draw a ring around your answer.

joule **newton** **watt**

(1 mark)

1 (c) Complete the following sentence using one of the phrases from the box.

larger than	the same as	smaller than

If the lamp was left switched on for 10 minutes, the amount of energy transformed would be ..... the amount of energy transformed in 2 minutes.

(1 mark)

5

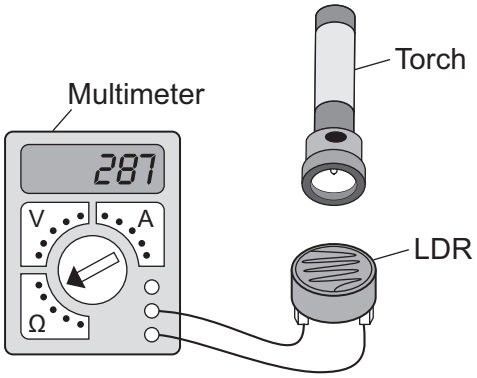
Turn over for the next question

4.2.1.1 Standard circuit diagram symbols

Question 12

June 2012 | PH2FP | Original Q4 | Legacy

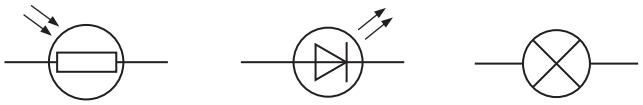
4 A student used the apparatus below to find out how the resistance of a light-dependent resistor (LDR) depends on light intensity.



The resistance of the LDR was measured directly using a multimeter.

4 (a) (i) Which **one** of the following is the correct circuit symbol for a LDR?

Draw a ring around your answer.



(1 mark)

4 (a) (ii) Name **one** factor that will affect the intensity of the light hitting the LDR.

.....

.....

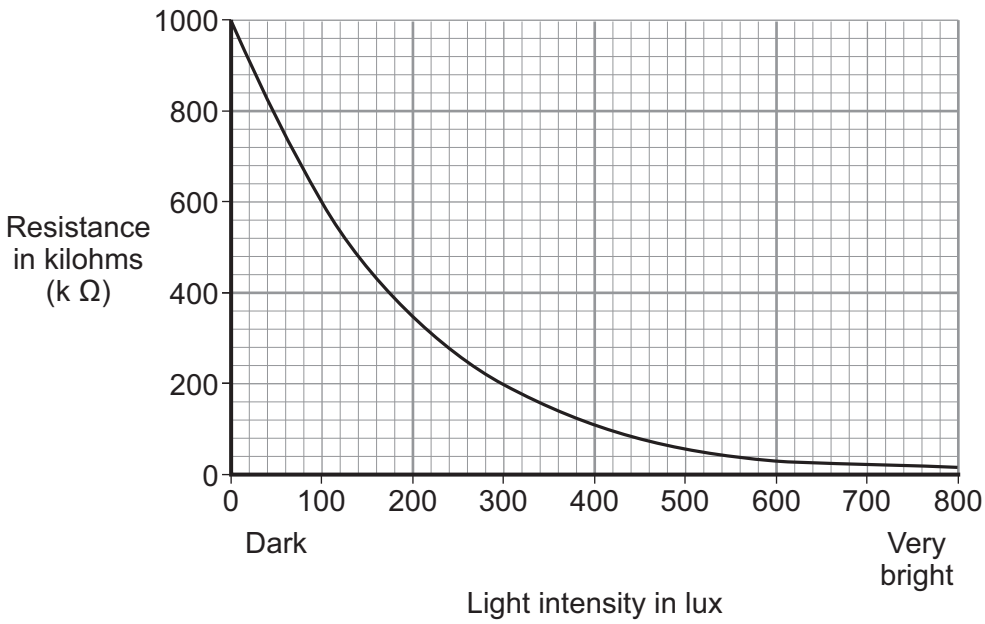
(1 mark)

Question 4 continues on the next page

4.2.1.1 Standard circuit diagram symbols

Question 12 · continued

4 (b) The manufacturer of the LDR provides data for the LDR in the form of a graph.



Describe how the resistance of the LDR changes when the light intensity increases from 100 lux to 300 lux.

.....

.....

.....

(2 marks)

4.2.1.1 Standard circuit diagram symbols

Question 12 · continued

4 (c) The student only obtained three results. These are given in the table.

Light intensity	Resistance in kilohms
Dark	750
Bright	100
Very bright	1

4 (c) (i) The student could **not** use the results to draw a line graph.
Why not?

.....

.....

(1 mark)

4 (c) (ii) Do the student's results agree with the data the manufacturer provided?

Draw a ring around your answer. YES NO

Give a reason for your answer.

.....

.....

.....

(1 mark)

4 (d) Which **one** of the following circuits probably includes a LDR?

Tick (✓) **one** box.

A circuit that automatically switches outside lights on when it gets dark. ☐

A circuit that automatically switches central heating on and off. ☐

A circuit that automatically turns lights off when no one is in the room. ☐

(1 mark)

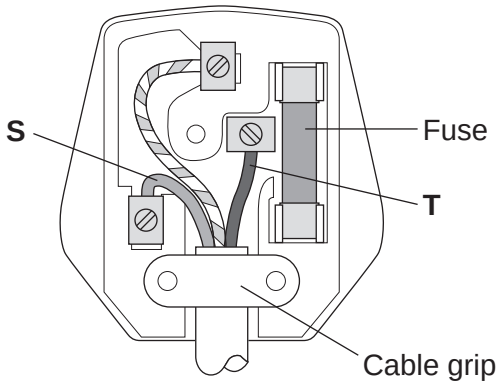
7

4.2.1.1 Standard circuit diagram symbols

Question 13

June 2013 | PH2FP | Original Q3 | Legacy

3 (a) The diagram shows the inside of a three-pin plug.



3 (a) (i) What name is given to the wire labelled **S**?

Draw a ring around the correct answer.

earth **live** **neutral**

(1 mark)

3 (a) (ii) What is the colour of the insulation around the wire labelled **T**?

Draw a ring around the correct answer.

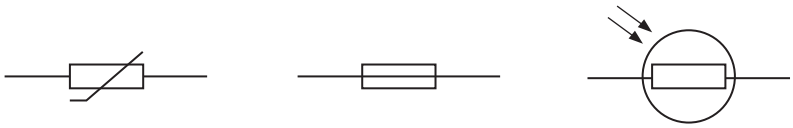
blue **brown** **green and yellow**

(1 mark)

3 (b) The plug contains a 13 amp fuse.

3 (b) (i) Which **one** of the following is the correct circuit symbol for a fuse?

Draw a ring around the correct answer.



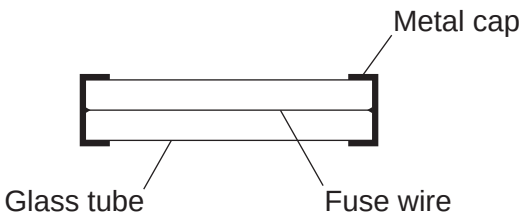
(1 mark)

Question 3 continues on the next page

4.2.1.1 Standard circuit diagram symbols

Question 13 · continued

3 (b) (ii) The diagram shows the parts of the fuse.



What would happen if a current of 20 amps passed through the 13 amp fuse?

.....

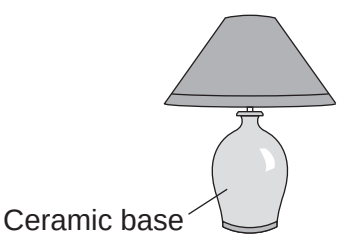
.....

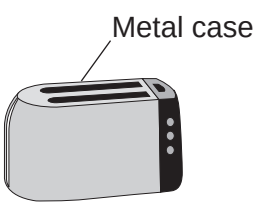
(1 mark)

3 (c) Not all electrical appliances are earthed.

3 (c) (i) Which **one** of the following appliances must be earthed?

Tick (✓) **one** box.





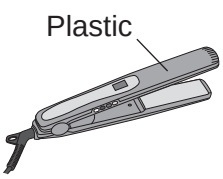


Table lamp ☐ Toaster ☐ Hair straighteners ☐

Give a reason for your answer.

.....

.....

(2 marks)

3 (c) (ii) Earthing an appliance helps to protect a person against a possible risk.

What is the risk?

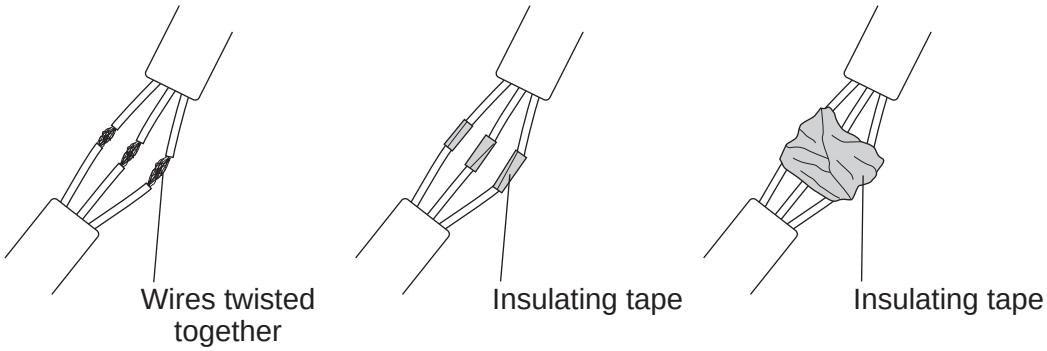
.....

(1 mark)

4.2.1.1 Standard circuit diagram symbols

Question 13 · continued

3 (d) The diagrams show how two lengths of mains electrical cable were joined. The individual wires have been twisted together and covered with insulating tape. This is not a safe way to join the cables.



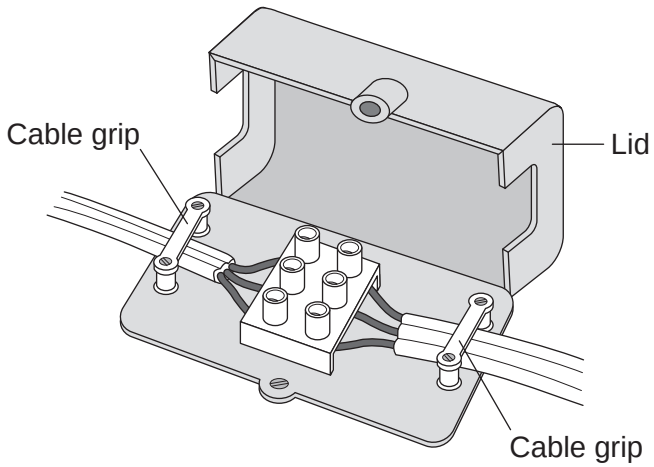
What is the possible risk from joining the two lengths of mains electrical cable in this way?

.....

.....

(1 mark)

3 (e) The diagram below shows a connecting box being used to join two lengths of electrical cable. This is a safe way to join the cables.



The cable grips are important parts of the connecting box.

Explain why.

.....

.....

.....

.....

(2 marks)

10

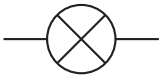
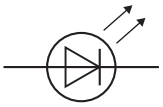
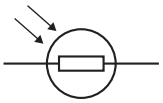
4.2.1.1 Standard circuit diagram symbols

Question 14

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)

4.2.1.1 Standard circuit diagram symbols

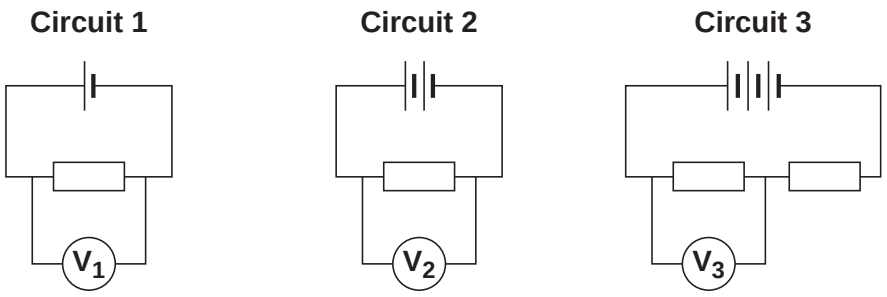
Question 14 · continued

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

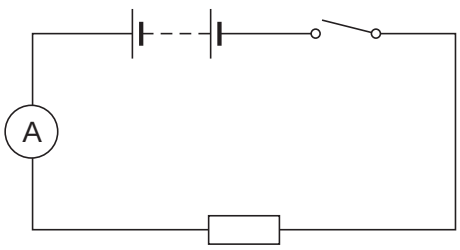
4.2.1.1 Standard circuit diagram symbols

Question 14 · 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



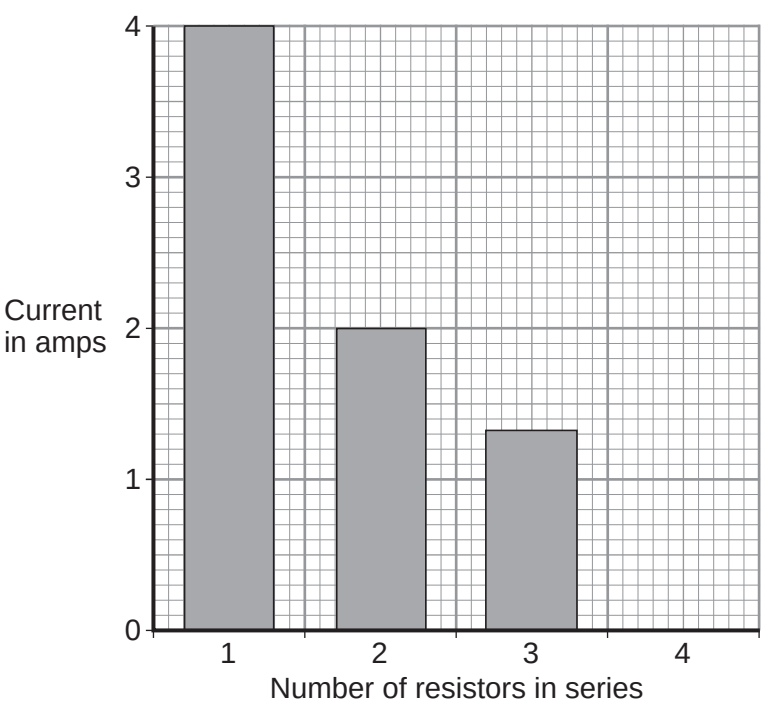
The student started with one resistor and then added more identical resistors to the circuit.

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



4.2.1.1 Standard circuit diagram symbols

Question 14 · 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

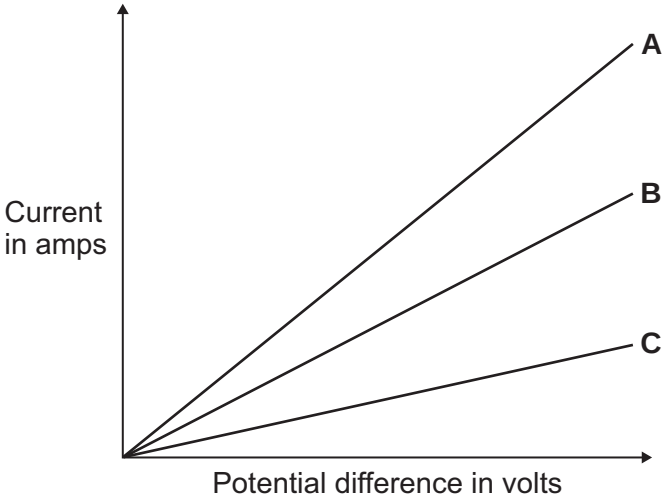
4.2.1.1 Standard circuit diagram symbols

Question 15

June 2015 | PH2FP | Original Q7 | Legacy

7 (a) **Figure 9** shows the current–potential difference graph for three wires, **A**, **B** and **C**.

Figure 9



7 (a) (i) Using **Figure 9**, how can you tell that the temperature of each wire is constant?

[1 mark]

.....

.....

7 (a) (ii) Which **one** of the wires, **A**, **B** or **C**, has the greatest resistance?

[2 marks]

Write the correct answer in the box. ☐

Give a reason for your answer.

.....

.....

.....

4.2.1.1 Standard circuit diagram symbols

Question 15 · continued

7 (b) A student measured the resistance of four wires.

Table 1 shows the resistance of, and other data about, each of the four wires, **J**, **K**, **L** and **M**.

Table 1

Wire	Type of metal	Length in cm	Diameter in mm	Resistance in …….
J	copper	50	0.17	0.36
K	copper	50	0.30	0.12
L	copper	100	0.30	0.24
M	constantan	100	0.30	7.00

7 (b) (i) The last column of **Table 1** should include the unit of resistance.

[1 mark]

What is the unit of resistance?

.....

7 (b) (ii) The resistance of a wire depends on many factors.

Look at **Table 1**. Which **two** wires from **J**, **K**, **L** and **M** show that the resistance of a wire depends on the **length** of the wire?

[2 marks]

Wire ☐ and wire ☐

Give a reason for your answer.

.....

.....

.....

Question 7 continues on the next page

4.2.1.1 Standard circuit diagram symbols

Question 15 · continued

7 (b) (iii) A student looked at the data in **Table 1** and wrote this conclusion:

'The resistance of a wire depends on the type of metal from which the wire is made.'

The student could **not** be certain that her conclusion is true for **all** types of metal.

Suggest what extra data is needed for the student to be more certain that the conclusion is correct.

[1 mark]

.....

.....

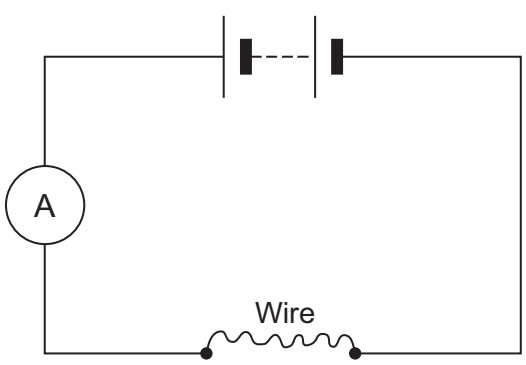
.....

7 (c) The resistance of a wire can be calculated using the readings from an ammeter and a voltmeter.

7 (c) (i) Complete **Figure 10** by drawing a voltmeter in the correct position in the circuit. Use the correct circuit symbol for a voltmeter.

[1 mark]

Figure 10



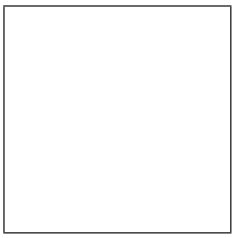
4.2.1.1 Standard circuit diagram symbols

Question 15 · continued

7 (c) (ii) In a circuit diagram, a wire can be represented by the symbol for a resistor.

In the box below, draw the circuit symbol for a resistor.

[1 mark]



9

Turn over for the next question

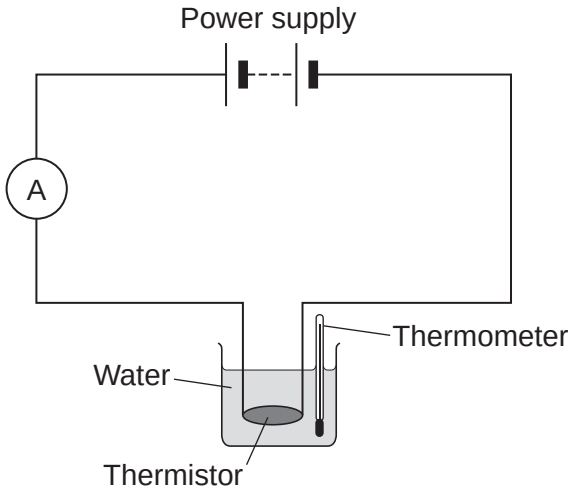
4.2.1.1 Standard circuit diagram symbols

Question 16

June 2016 | PH2FP | Original Q7 | Legacy

7 **Figure 10** shows the apparatus used to investigate how the current through a thermistor depends on the temperature of the thermistor.

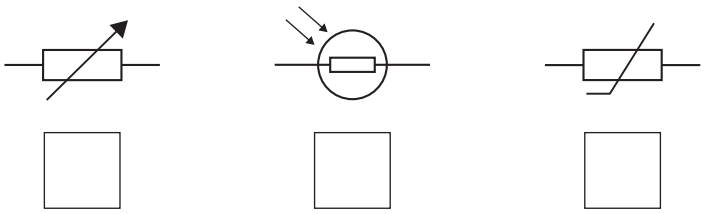
Figure 10



7 (a) Which **one** of the following is the correct circuit symbol for a thermistor?

[1 mark]

Tick (✓) **one** box.



Question 7 continues on the next page

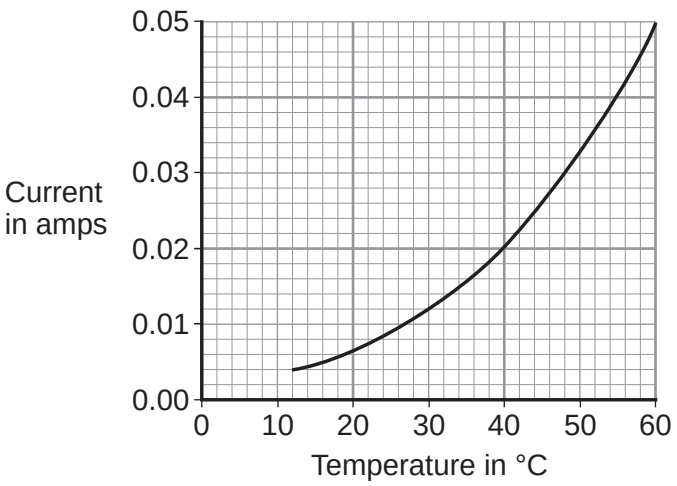
4.2.1.1 Standard circuit diagram symbols

Question 16 · continued

7 (b) To get a range of results, hot water at 60 °C was poured into the beaker.
The temperature of the water and current through the thermistor were then recorded as the water cooled.

The results of the investigation are shown in **Figure 11**.

Figure 11



7 (b) (i) Suggest **one** way the investigation could have been changed to give a wider range of temperatures.

[1 mark]

_____

_____

7 (b) (ii) Describe how the current through the thermistor depends on the temperature of the thermistor.

[1 mark]

_____

_____

7 (b) (iii) Use **Figure 11** to determine the current through the thermistor at 40 °C.

[1 mark]

Current at 40 °C = _____ A

4.2.1.1 Standard circuit diagram symbols

Question 16 · continued

7 (b) (iv) At 40 °C the thermistor has a resistance of 250 Ω.

Use your answer to part **(b)(iii)** and the resistance of the thermistor to calculate the potential difference across the thermistor.

Use the correct equation from the Physics Equations Sheet.

[2 marks]

Potential difference = _____ V

7 (b) (v) The potential difference across the thermistor stays the same all through the investigation.

What conclusion can be made from the results in **Figure 11** about the resistance of the thermistor as the temperature of the thermistor **decreases**?

[1 mark]

Tick (✓) **one** box.

- the resistance increases ☐
- the resistance does not change ☐
- the resistance decreases ☐

7

4.2.1.1 Standard circuit diagram symbols

Question 17

June 2018 | 8463/1F | Original Q3

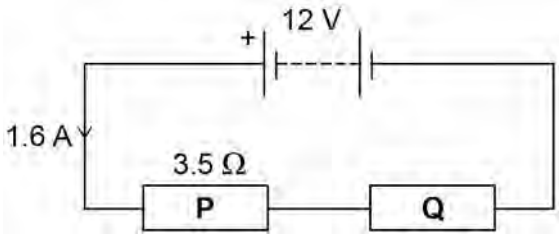
0 3 . 1 Draw a diagram to show how 1.5 V cells should be connected together to give a potential difference of 4.5 V.

Use the correct circuit symbol for a cell.

[2 marks]

A student built the circuit shown in **Figure 3**.

Figure 3



0 3 . 2 Calculate the total resistance of the circuit in **Figure 3**.

Use the equation:

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

[2 marks]

Total resistance = _____ Ω

4.2.1.1 Standard circuit diagram symbols

Question 17 · continued

0 3 . 3 The resistance of **P** is 3.5 Ω.

Calculate the resistance of **Q**.

[1 mark]

Resistance of **Q** = _____ Ω

0 3 . 4 The student connects the two resistors in **Figure 3** in parallel.

What happens to the total resistance of the circuit?

Tick **one** box.

[1 mark]

- It decreases ☐
- It increases ☐
- It does not change ☐

Give a reason for your answer.

[1 mark]

7

4.2.1.1 Standard circuit diagram symbols

Question 18

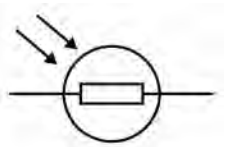
June 2018 | 8463/1F | Original Q7

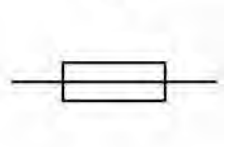
0 7 The plug of an electrical appliance contains a fuse.

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

Tick **one** box.

[1 mark]


☐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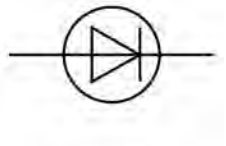
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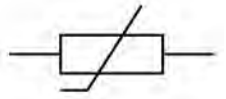

☐

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]

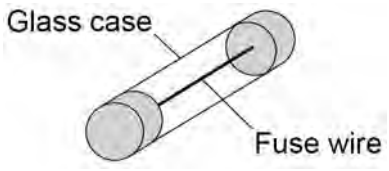
Energy transferred = _____ J

4.2.1.1 Standard circuit diagram symbols

Question 18 · continued

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

4.2.1.1 Standard circuit diagram symbols

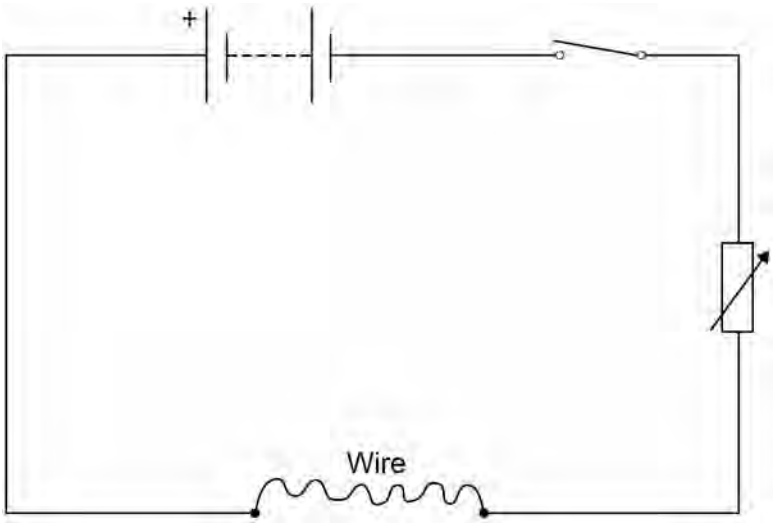
Question 19

June 2018 | 8463/1F | Original Q12

1 2 A student investigated how the resistance of a piece of nichrome wire varies with length.

Figure 17 shows part of the circuit the student used.

Figure 17



1 2 . 1 Complete **Figure 17** by adding an ammeter and a voltmeter.

Use the correct circuit symbols.

[3 marks]

4.2.1.1 Standard circuit diagram symbols

Question 19 · continued

1 2 . 2 Describe how the student would obtain the data needed for the investigation.

Your answer should include a risk assessment for **one** hazard in the investigation.

[6 marks]

1 2 . 3 Why would switching off the circuit between readings have improved the accuracy of the student's investigation?

Tick **one** box.

[1 mark]

- The charge flow through the wire would not change. ☐
- The potential difference of the battery would not increase. ☐
- The power output of the battery would not increase. ☐
- The temperature of the wire would not change. ☐

1 2 . 4 The student used crocodile clips to make connections to the wire.

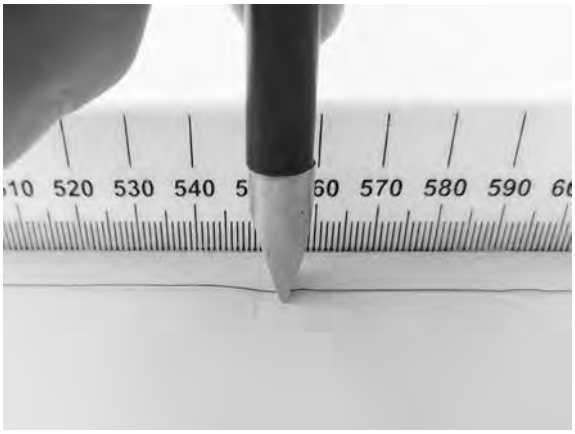
They could have used a piece of equipment called a 'jockey'.

Figure 18 shows a crocodile clip and a jockey in contact with a wire.

Figure 18



Crocodile clip



Jockey

How would using the jockey have affected the accuracy and resolution of the student's results compared to using the crocodile clip?

Tick **two** boxes.

[2 marks]

The accuracy of the student's results would be higher. ☐

The accuracy of the student's results would be lower. ☐

The accuracy of the student's results would be the same. ☐

The resolution of the length measurement would be higher. ☐

The resolution of the length measurement would be lower. ☐

The resolution of the length measurement would be the same. ☐

12

4.2.1.1 Standard circuit diagram symbols

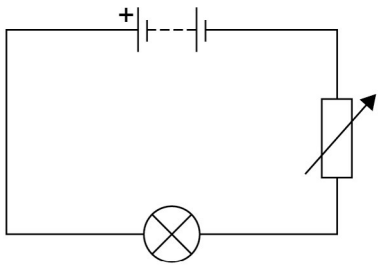
Question 20

November 2020 | 8463/1F | Original Q8

0 8 A student investigated how the current in a filament lamp varied with the potential difference across the filament lamp.

Figure 11 shows part of the circuit used.

Figure 11



0 8 . 1 Complete **Figure 11** by adding an ammeter and a voltmeter.

Use the correct circuit symbols.

[3 marks]

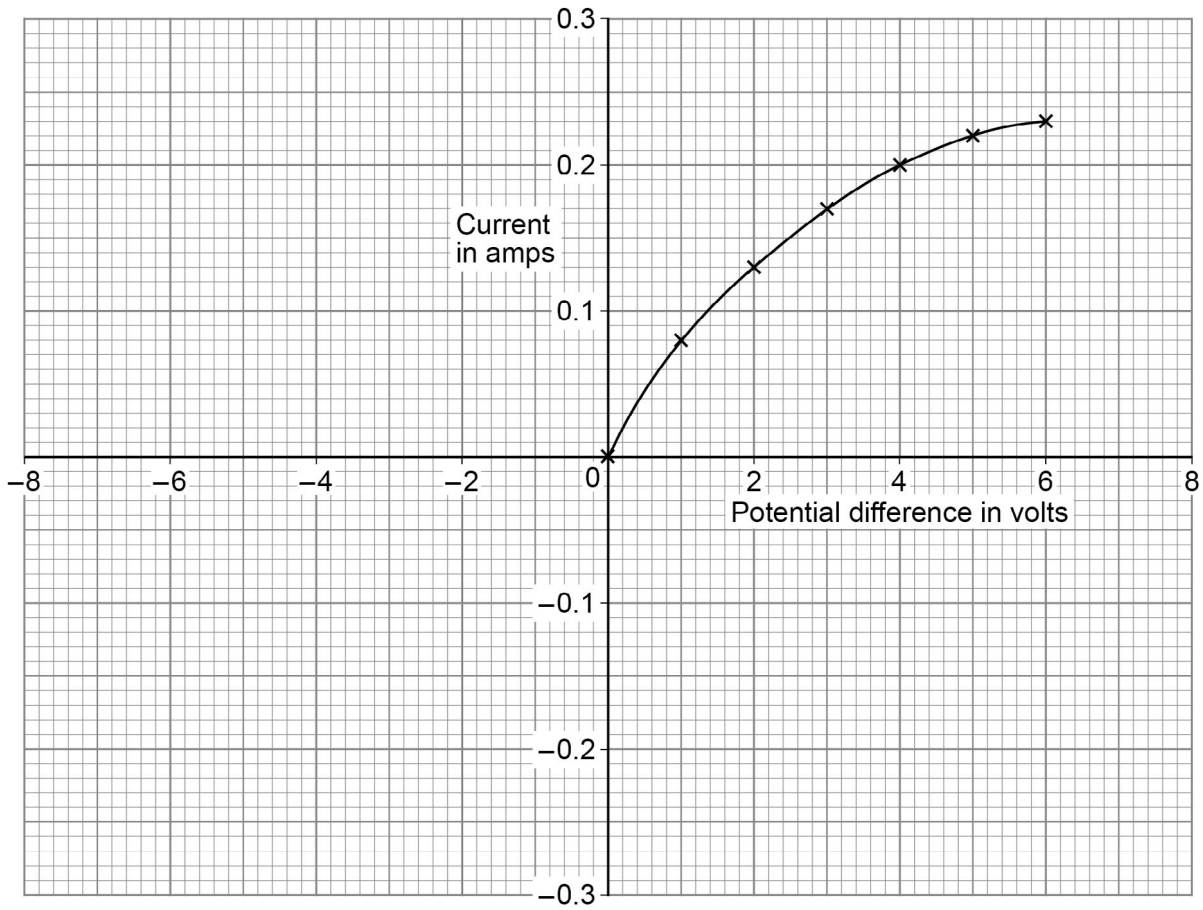
Question 8 continues on the next page

4.2.1.1 Standard circuit diagram symbols

Question 20 · continued

Figure 12 shows some of the results.

Figure 12



0 8 . 2 The student reversed the connections to the power supply and obtained negative values for the current and potential difference.

Draw a line on **Figure 12** to show the relationship between the negative values of current and potential difference.

[2 marks]

4.2.1.1 Standard circuit diagram symbols

Question 20 · continued

0 8 . 3 Write down the equation which links current (I), potential difference (V) and resistance (R).

[1 mark]

0 8 . 4 Determine the resistance of the filament lamp when the potential difference across it is 1.0 V.

Use data from **Figure 12**.

[4 marks]

Resistance = _____ Ω

0 8 . 5 A second student did the same investigation. The ammeter used had a zero error.

What is meant by a zero error?

[1 mark]

11

4.2.1.1 Standard circuit diagram symbols

Question 21

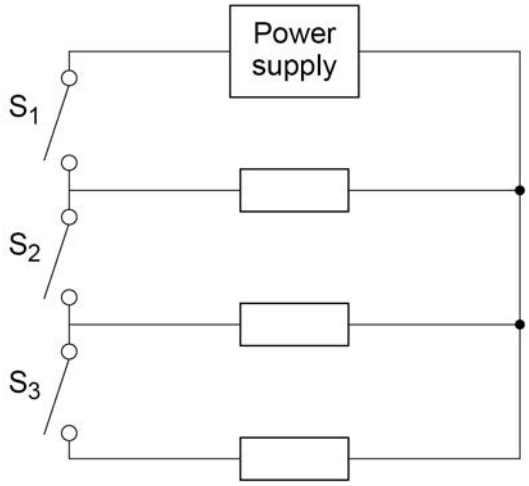
June 2022 | 8463/1F | Original Q6

0 6 A hair dryer contains three heating elements.

Figure 7 shows the circuit diagram for the heating elements in the hair dryer.

In **Figure 7** the heating elements are represented by resistor symbols.

Figure 7



0 6 . 1 Complete the sentence.

[1 mark]

The three resistors in **Figure 7** are connected in _____ with the power supply.

0 6 . 2 Which switch must always be closed for the hair dryer to work?

[1 mark]

Tick (✓) **one** box.

S_1 ☐

S_2 ☐

S_3 ☐

4.2.1.1 Standard circuit diagram symbols

Question 21 · continued

0 6 . 3 Which switches must be closed for the hair dryer to work at maximum power output?

[1 mark]

Tick (✓) **one** box.

S_1 and S_2 ☐

S_1 and S_3 ☐

S_1, S_2 and S_3 ☐

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

0 6 . 4 Write down the equation which links energy transferred (*E*), power (*P*) and time (*t*).

[1 mark]

_____

0 6 . 5 The heating elements have a maximum power output of 1200 W.

The energy transferred to the heating elements to reach normal operating temperature is 3600 J.

Calculate the time taken for the heating elements to reach normal operating temperature at maximum power output.

[3 marks]

_____

_____

_____

_____

_____

_____

Time = _____ s

4.2.1.1 Standard circuit diagram symbols

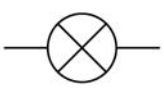
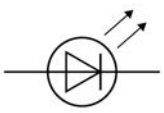
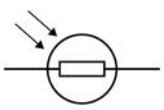
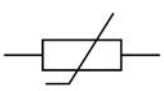
Question 21 · continued

0 6 . 6 The hair dryer has LEDs to indicate the power setting.

What is the circuit symbol for an LED?

[1 mark]

Tick (✓) **one** box.

8

4.2.1.1 Standard circuit diagram symbols

Question 22

June 2024 | 8463/1F | Original Q2

0 2 **Figure 4** shows a student putting a coin into a vending machine that sells food.

Figure 4



The vending machine is connected to the mains electricity supply.

0 2 . 1 What is the frequency of the mains electricity supply in the UK?

[1 mark]

Tick (✓) **one** box.

50 hertz ☐

60 hertz ☐

100 hertz ☐

4.2.1.1 Standard circuit diagram symbols

Question 22 · continued

0 2 . 2 What is the potential difference of the mains electricity supply in the UK?

[1 mark]

Tick (✓) **one** box.

12 volts ☐

230 volts ☐

20 000 volts ☐

The vending machine identifies the value of the coin by measuring the resistance of the coin.

0 2 . 3 The machine applies a potential difference of 0.45 V across the coin.

The current in the coin is 0.75 A.

Calculate the resistance of the coin.

Use the equation:

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

[2 marks]

Resistance = _____ Ω

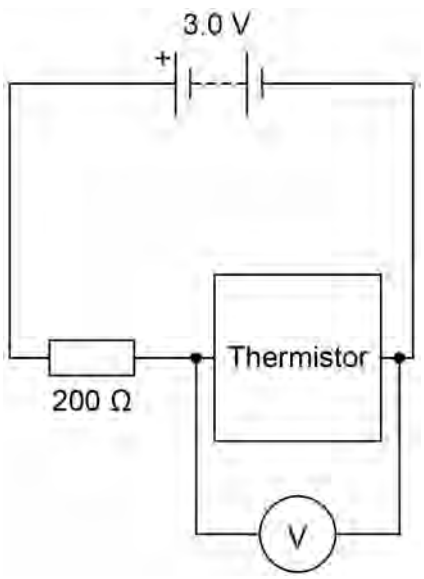
4.2.1.1 Standard circuit diagram symbols

Question 22 · continued

The temperature inside the vending machine is monitored using an electrical circuit.

Figure 5 shows part of the circuit.

Figure 5

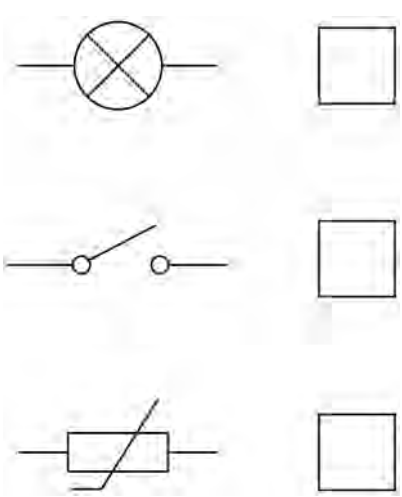


0 2 . 4 The circuit symbol for the thermistor is wrong.

What is the circuit symbol for a thermistor?

[1 mark]

Tick (✓) **one** box.



4.2.1.1 Standard circuit diagram symbols

Question 22 · continued

0 2 . 5 How could the potential difference (pd) across the resistor be calculated?

[1 mark]

Tick (✓) **one** box.

pd across battery – pd across thermistor ☐

pd across battery + pd across thermistor ☐

pd across battery × pd across thermistor ☐

pd across battery ÷ pd across thermistor ☐

0 2 . 6 At one temperature, the thermistor in **Figure 5** has a resistance of 200 Ω.

What is the potential difference across the thermistor at this temperature?

Give a reason for your answer.

[2 marks]

Tick (✓) **one** box.

0.0 V ☐

1.0 V ☐

1.5 V ☐

2.0 V ☐

Reason _____

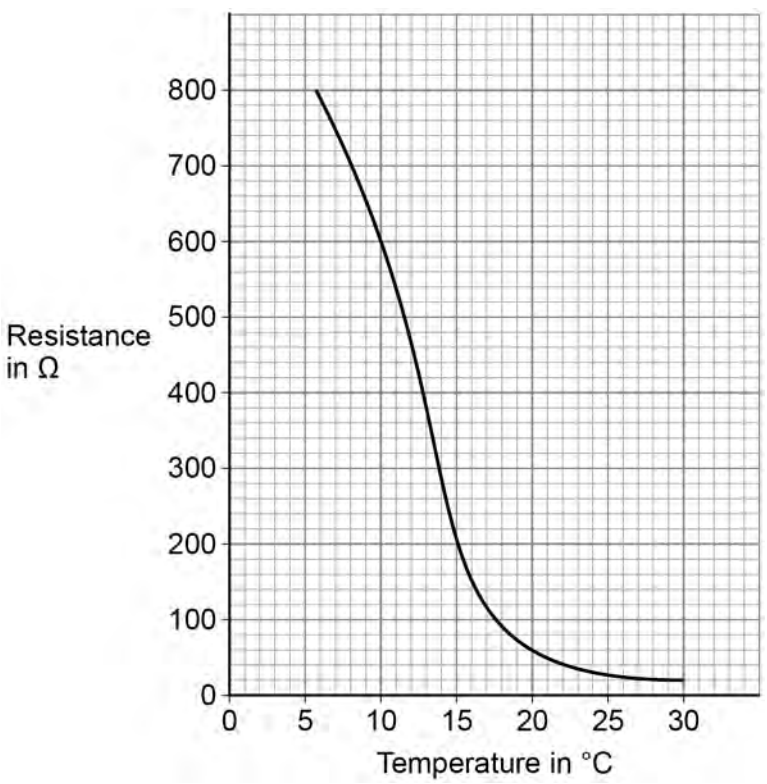
_____

4.2.1.1 Standard circuit diagram symbols

Question 22 · continued

Figure 6 shows how the resistance of the thermistor varies with temperature.

Figure 6



0 2 . 7 When the temperature of the thermistor is 10 °C, the resistance of the thermistor is 600 Ω.

Calculate the change in resistance when the temperature increased from 10 °C to 15 °C.

[2 marks]

Change in resistance = _____ Ω

10

4.2.1.1 Standard circuit diagram symbols

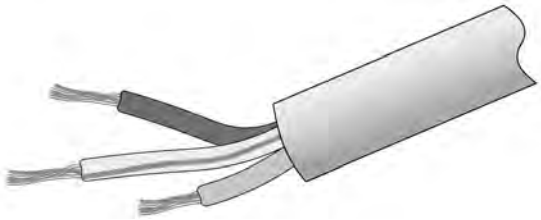
Question 23

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 ☐

4.2.1.1 Standard circuit diagram symbols

Question 23 · continued

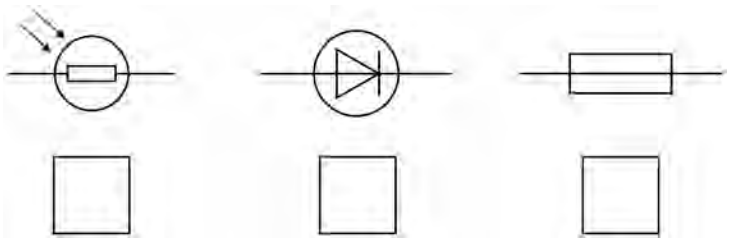
The plug connected to the cable contains a fuse.

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

4.2.1.1 Standard circuit diagram symbols

Question 23 · 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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4.2.1.1 Standard circuit diagram symbols

Question 24

June 2025 | 8463/1F | Original Q5

0 5 **Figure 8** shows an electric kettle used to boil water.

Figure 8



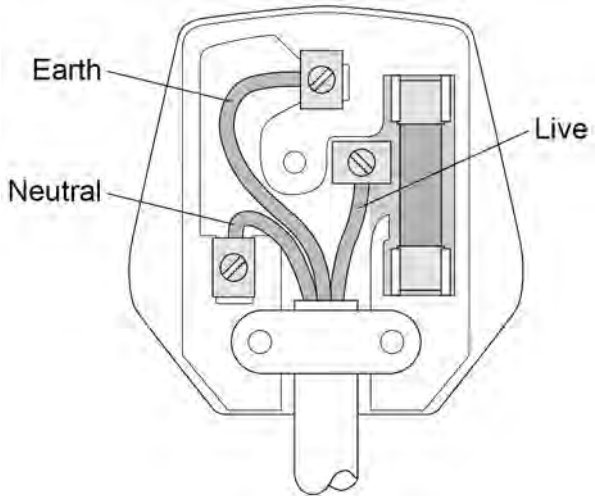
4.2.1.1 Standard circuit diagram symbols

Question 24 · continued

0 5 . 1 The kettle is connected to the mains electricity supply by a three-core cable and plug.

Figure 9 shows the inside of the plug.

Figure 9



What are the colours of the insulation around the earth, live and neutral wires inside a plug?

[3 marks]

Choose answers from the box.

blue	**brown**	**green and yellow**	**red**	**yellow and brown**

Earth wire _____

Live wire _____

Neutral wire _____

Question 5 continues on the next page

4.2.1.1 Standard circuit diagram symbols

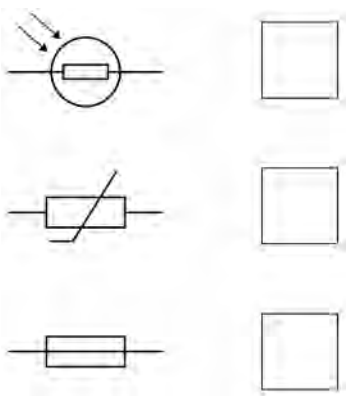
Question 24 · continued

0 5 . 2 The plug in **Figure 9** contains a fuse.

What is the circuit symbol for a fuse?

[1 mark]

Tick (✓) **one** box.



0 5 . 3 The electric kettle contains a heating element.

The power of the heating element is 2420 W.

The current in the heating element is 11.0 A.

Calculate the potential difference across the heating element.

Use the equation:

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

[2 marks]

Potential difference = _____ V

4.2.1.1 Standard circuit diagram symbols

Question 24 · continued

0 5 . 4 The power of the heating element is 2420 W.

The current in the heating element is 11.0 A.

Calculate the resistance of the heating element.

Use the equation:

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

[2 marks]

Resistance = _____ Ω

0 5 . 5 Kettle **A** and kettle **B** have the same total power input.

Kettle **A** has a greater efficiency than kettle **B**.

Which **two** of the following describe heating water in kettle **A** compared with kettle **B**?

[2 marks]

Tick (✓) **two** boxes.

- A greater percentage of energy is usefully transferred by kettle **A**. ☐
- Kettle **A** has a lower useful power output. ☐
- Kettle **A** takes less time to boil the same volume of water. ☐
- More energy is wasted by kettle **A** each second. ☐
- The temperature of the same volume of water increases more slowly in kettle **A**. ☐

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