AQA GCSE Combined Science - Trilogy | 8464

SPECIFICATION POINT 6.2.2

Series and parallel circuits

Past-paper questions

Tier	**Higher**
Question groups	**5**
Available paper years	**2019–2025**

Using this booklet

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

Name: _____ **Date:** _____

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

6.2.2 Series and parallel circuits

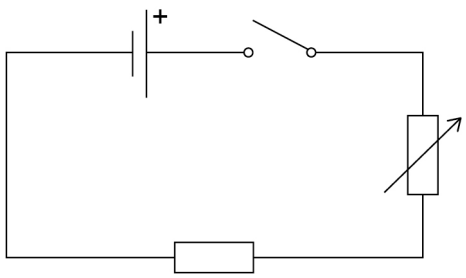
Question 01

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

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

Figure 1 shows part of the circuit used.

Figure 1



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

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

[1 mark]

Tick (✓) **one** box.

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

0 1 . 2 The student increased the resistance of the variable resistor.

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

[1 mark]

6.2.2 Series and parallel circuits

Question 01 · continued

0 1 . 3 How should the student change the circuit to give negative values for current and potential difference?

[1 mark]

0 1 . 4 Name the type of relationship between current and potential difference for a resistor at constant temperature.

[1 mark]

0 1 . 5 Write the equation which links current, potential difference and resistance.

[1 mark]

0 1 . 6 The current in the resistor was 0.12 A when the potential difference across the resistor was 3.0 V

Calculate the resistance of the resistor.

[3 marks]

Resistance = _____ Ω

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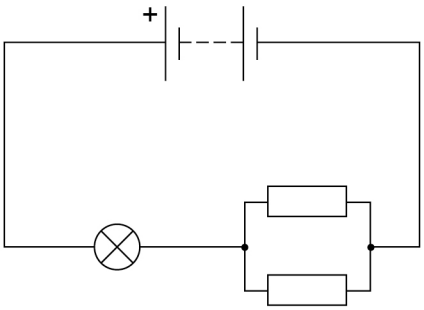
6.2.2 Series and parallel circuits

Question 02

June 2019 | 8464/P/1H | Original Q4

0 4 **Figure 2** shows a circuit that a student built.

Figure 2



0 4 . 1 The lamp has a resistance of 10 Ω

Each resistor has a resistance of 10 Ω

What is the total resistance of the circuit?

[1 mark]

Tick (✓) **one** box.

- Between 20 and 30 Ω ☐
- Exactly 20 Ω ☐
- Exactly 30 Ω ☐
- Less than 20 Ω ☐

0 4 . 2 Explain your answer to Question **04.1**

[2 marks]

6.2.2 Series and parallel circuits

Question 02 · continued

The student replaced one of the resistors with a thermistor.

0 4 . 3 Draw the circuit symbol for a thermistor in the box below.

[1 mark]

0 4 . 4 The student increased the temperature of the thermistor.

Explain how the current in the thermistor changed.

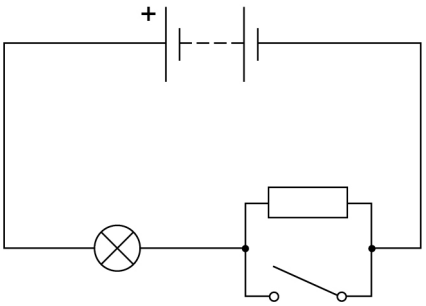
[2 marks]

6.2.2 Series and parallel circuits

Question 02 · continued

0 4 . 5 **Figure 3** shows another circuit the student built.

Figure 3



Explain how the potential difference across the resistor and the lamp will change when the switch is closed.

[4 marks]

The resistor _____

_____

_____

_____

The lamp _____

_____

_____

_____

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6.2.2 Series and parallel circuits

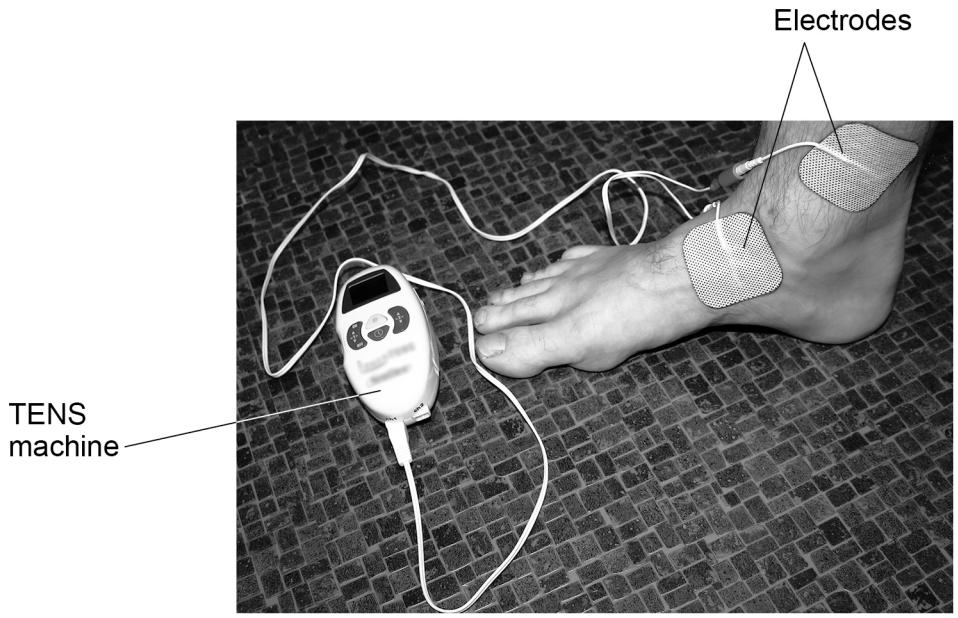
Question 03

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

0 5 A TENS machine uses an electrical current to relieve pain.

Figure 8 shows the electrodes of a TENS machine connected across an ankle.

Figure 8



0 5 . 1 The maximum power of the TENS machine is 240 mW.

The potential difference across the battery in the TENS machine is 2.5 V.

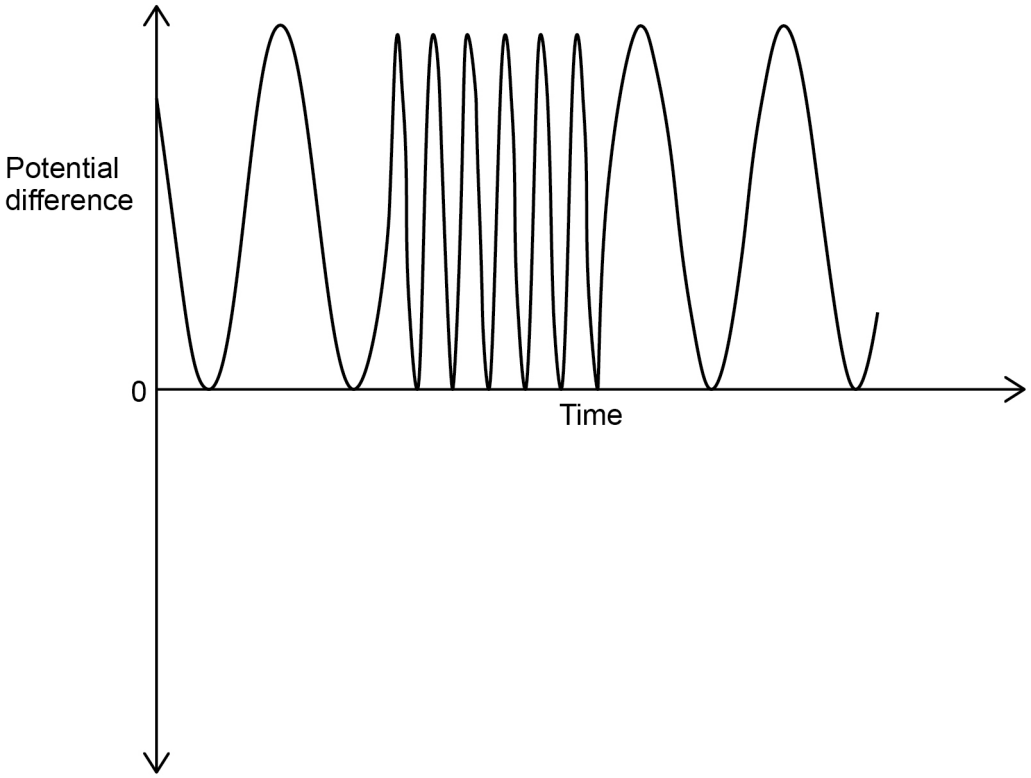
Calculate the maximum current from the battery.

[4 marks]

Maximum current = _____ A

0 5 . 2 **Figure 9** is a sketch graph showing how the potential difference across the electrodes varies with time.

Figure 9



A student concluded that there was an alternating potential difference across the electrodes.

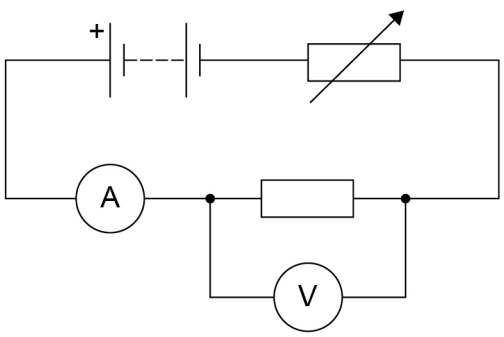
How does **Figure 9** show that the student was **not** correct?

[1 mark]

Question 5 continues on the next page

Figure 10 shows a circuit the student built using the battery from the TENS machine.

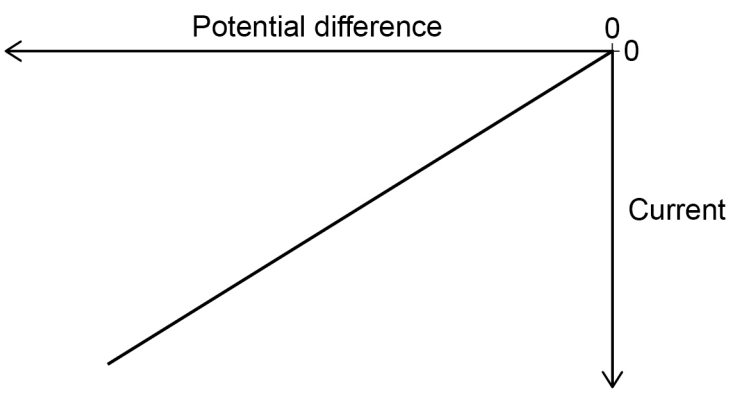
Figure 10



The student recorded how the current in the resistor varied with the potential difference across the resistor.

Figure 11 shows a sketch graph of the results.

Figure 11



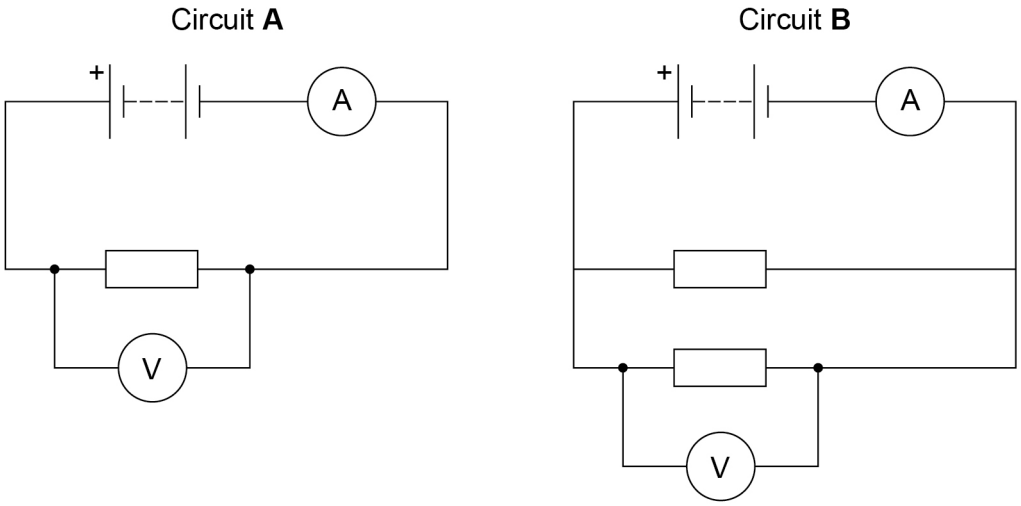
0 5 . 3 What relationship does **Figure 11** show?

[1 mark]

Question 03 · continued

0 5 . 4 **Figure 12** shows two more circuits that the student built using the battery from the TENS machine.

Figure 12



The resistors all have the same resistance.

Compare the readings on the voltmeter and ammeter in circuit **A** and circuit **B**.

[3 marks]

Voltmeter _____

_____

_____

Ammeter _____

_____

_____

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6.2.2 Series and parallel circuits

Question 04

0 2 Body analysis scales use the electrical resistance of a person's legs to estimate the percentage of water in the person's body.

Figure 3 shows body analysis scales.

Figure 3



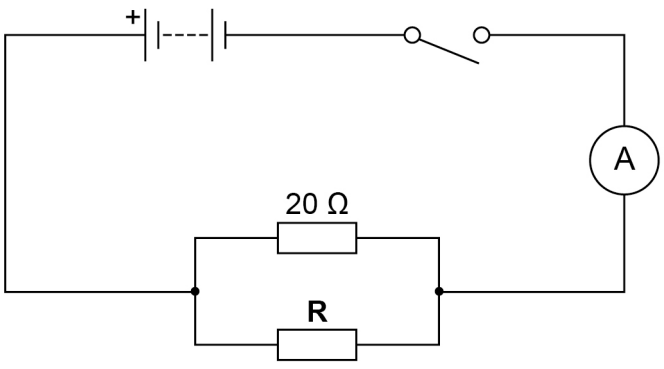
The person's legs contain both solid tissue and water.

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

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

Figure 4 shows the circuit diagram.

Figure 4



0 2 . 1 To determine the total resistance of both resistors, a voltmeter must be connected into the circuit.

Complete **Figure 4** to show where the voltmeter should be connected.

[1 mark]

Question 04 · continued

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

The student's answer was 26 Ω.

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

[2 marks]

Use the Physics Equations Sheet to answer questions **02.3** and **02.4**.

0 2 . 3 Write down the equation that links current (*I*), resistance (*R*) and potential difference (*V*).

[1 mark]

0 2 . 4 When the total resistance of the resistors was 7.5 Ω the current in the circuit was 480 mA.

Calculate the potential difference across the two resistors.

[3 marks]

Potential difference = _____ V

6.2.2 Series and parallel circuits

Question 04 · continued

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

Table 1 shows the results.

Table 1

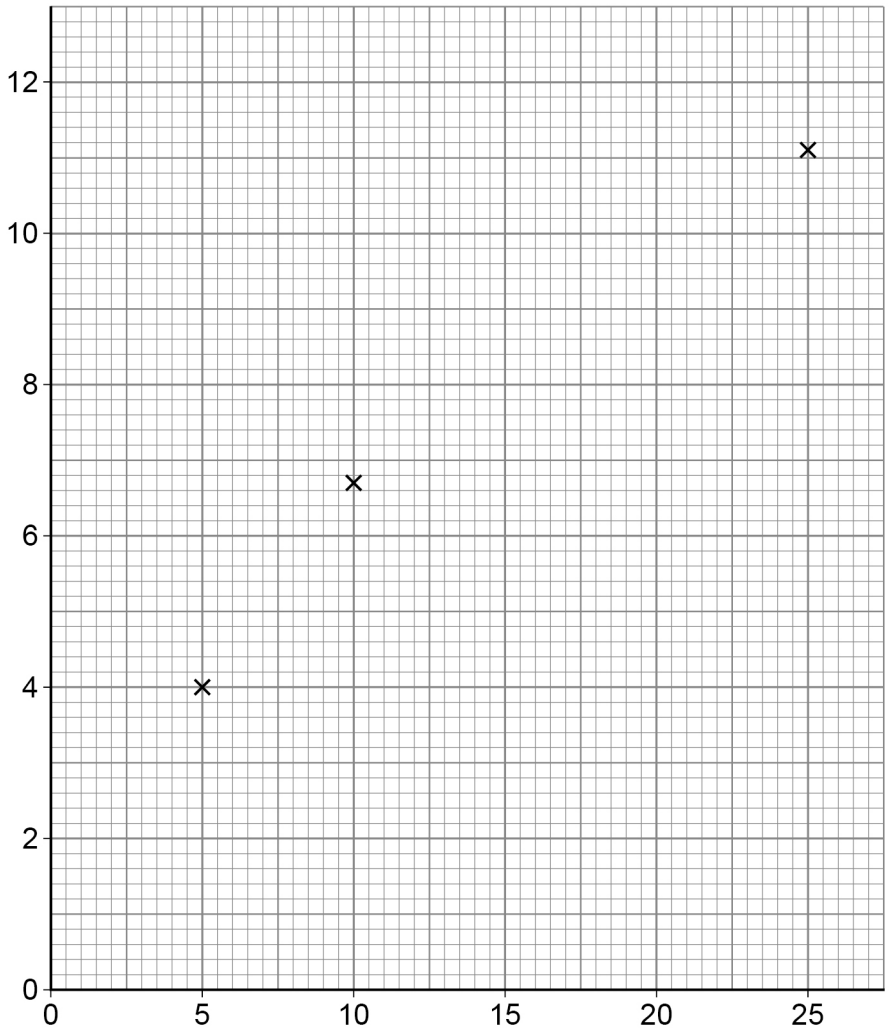
Resistance of R in ohms	Total resistance of the circuit in ohms
5.0	4.0
10.0	6.7
15.0	8.6
20.0	10.0
25.0	11.1

Some of the results are plotted in **Figure 5**.

6.2.2 Series and parallel circuits

Question 04 · continued

Figure 5



0 2 . 5 Complete **Figure 5**.

You should:

- label both axes
- plot the two remaining values from **Table 1**
- draw the line of best fit.

[3 marks]

0 2 . 6 What resistance of **R** would give a total resistance of 4.4 Ω?

Use **Figure 5**.

[1 mark]

Resistance of **R** = _____ Ω

Question 04 · continued

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

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

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

The scales now show a reading of 64.1 kg.

0 2 . 7 Complete the sentence.

[1 mark]

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

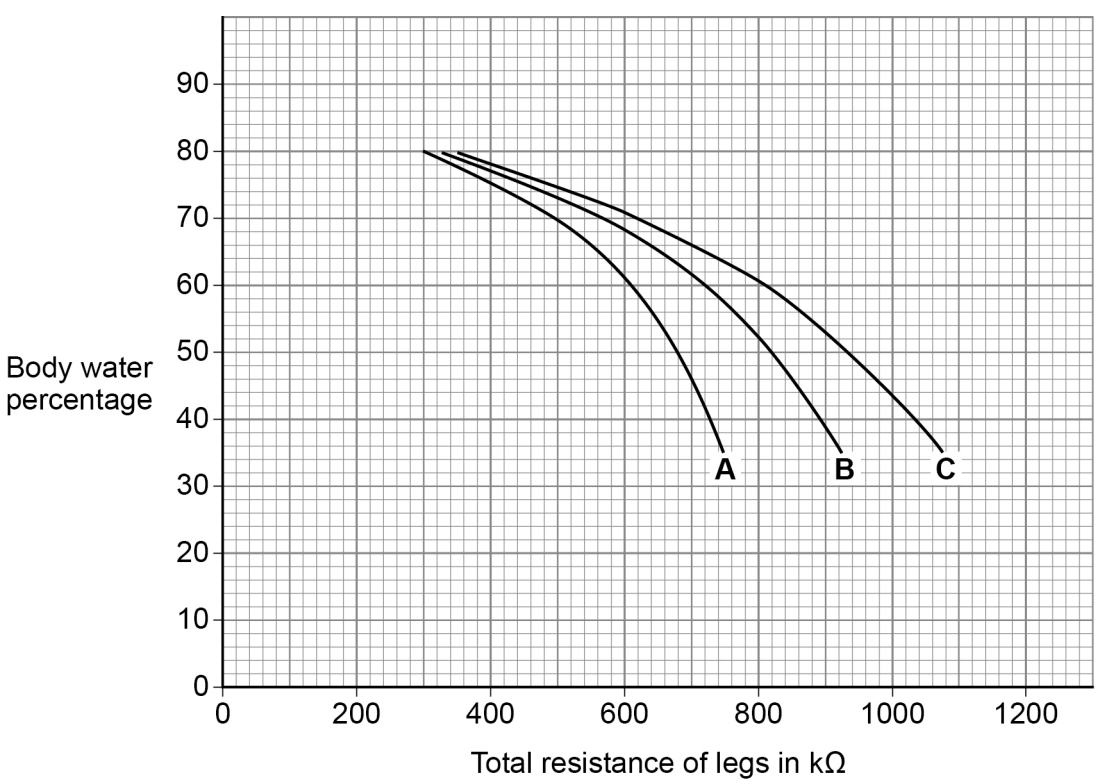
to a _____ error.

0 2 . 8 The height of the student is programmed into the scales.

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

Figure 6 shows how the scales use the category and the total resistance of the legs to determine the body water percentage.

Figure 6



6.2.2 Series and parallel circuits

Question 04 · continued

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

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

Evaluate if the student has a healthy body water percentage.

[3 marks]

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Turn over for the next question

6.2.2 Series and parallel circuits

Question 05

June 2025 | 8464/P/1H | Original Q3

0 3 A student investigated the resistance of a resistor.

0 3 . 1 The student used:

- the resistor
- a cell
- a switch
- an ammeter
- a voltmeter.

Draw a circuit diagram for a circuit the student could use to measure the resistance of the resistor.

[3 marks]

Question 3 continues on the next page

The student:

- added a variable resistor to the circuit
- used the variable resistor to change the readings on the ammeter and the voltmeter
- recorded several different pairs of readings from the ammeter and the voltmeter.

0 3 . 2 When the reading on the ammeter was 450 mA, the reading on the voltmeter was 2.7 V.

Calculate the resistance of the resistor.

Use the Physics Equations Sheet.

[4 marks]

Resistance = _____ Ω

6.2.2 Series and parallel circuits

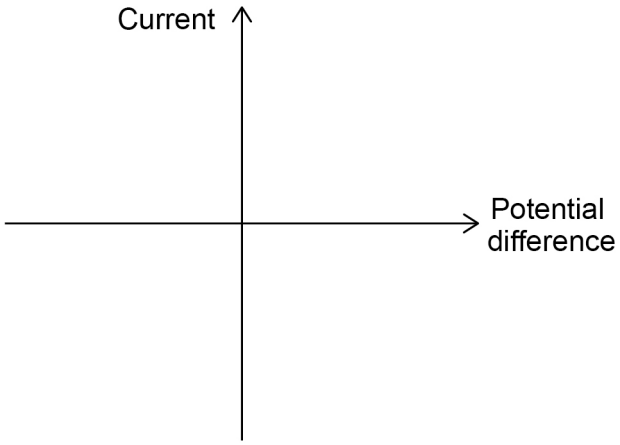
Question 05 · continued

0 3 . 3 The student plotted a graph of current against potential difference for the fixed resistor.

Complete **Figure 2** to show a sketch graph for a fixed resistor at a constant temperature.

[1 mark]

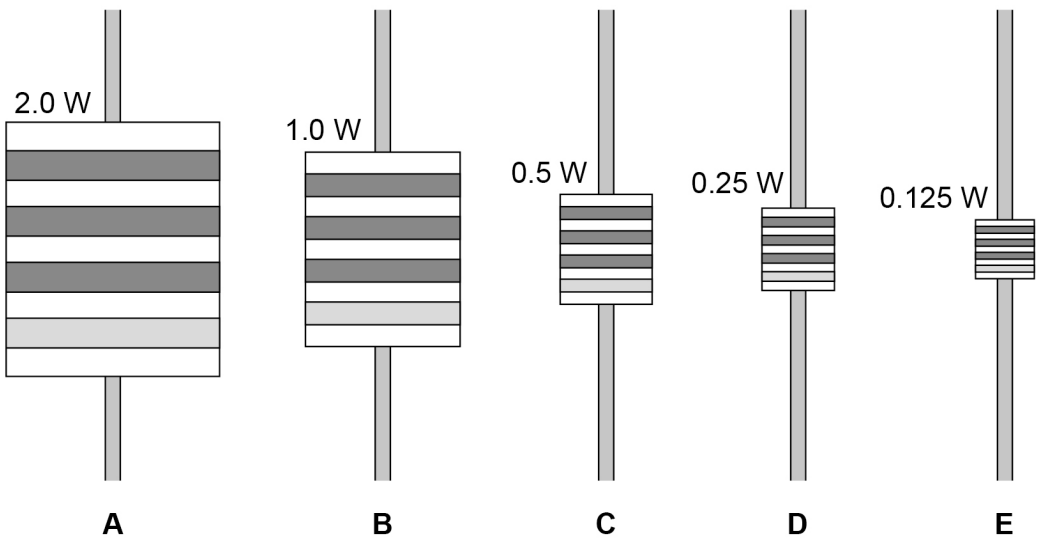
Figure 2



Question 3 continues on the next page

0 3 . 4 **Figure 3** shows five resistors with the same resistance but different power ratings.

Figure 3



The power rating of a resistor is the maximum energy the resistor can transfer each second without overheating.

Each resistor has a resistance of 2.2 kΩ.

Determine which resistors in **Figure 3** are suitable to be used in a circuit that has a maximum current of 0.012 A.

Use the Physics Equations Sheet.

[4 marks]

Suitable resistors _____

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