AQA GCSE Combined Science - Trilogy | 8464

SPECIFICATION POINT 6.2.1.1

Standard circuit diagram symbols

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.

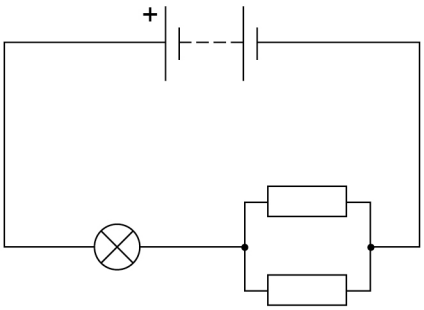
6.2.1.1 Standard circuit diagram symbols

Question 01

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]

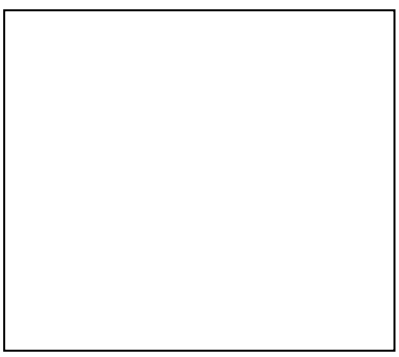
6.2.1.1 Standard circuit diagram symbols

Question 01 · 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.

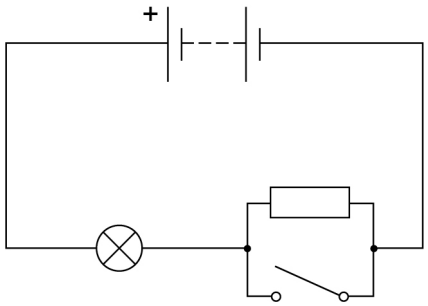
[2 marks]

6.2.1.1 Standard circuit diagram symbols

Question 01 · 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 _____

_____

_____

_____

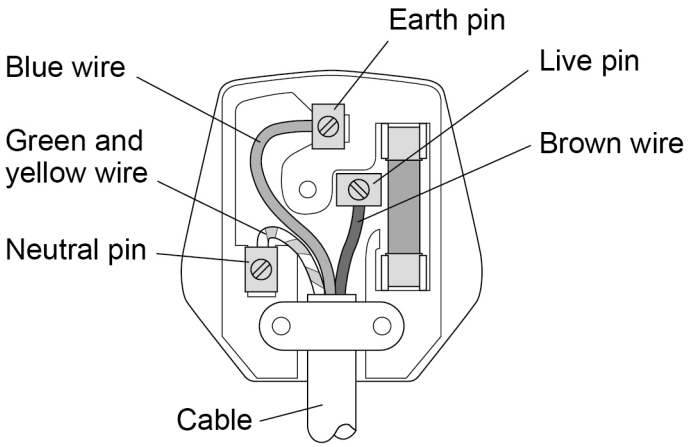
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6.2.1.1 Standard circuit diagram symbols

Question 02

0 1 **Figure 1** shows the inside of a plug.

Figure 1



0 1 . 1 The plug is **not** wired correctly.

What should be done to connect the wires in the plug correctly?

[1 mark]

6.2.1.1 Standard circuit diagram symbols

Question 02 · continued

The correctly wired plug and cable connects a washing machine to the mains electricity supply.

0 1 . 2 Give the potential difference and frequency of the mains electricity supply in the UK.

[2 marks]

The potential difference is _____ V

The frequency is _____ Hz

0 1 . 3 The washing machine is switched on.

What is the potential difference between the neutral wire and the earth wire?

[1 mark]

Potential difference = _____ V

0 1 . 4 The plug has a fuse.

Draw the circuit symbol for a fuse in the space below.

[1 mark]

Question 1 continues on the next page

6.2.1.1 Standard circuit diagram symbols

Question 02 · continued

The washing machine has a metal case.

A fault causes the live wire to make an electrical connection with the metal case of the washing machine.

0 1 . 5 The earth wire is **not** connected to the metal case of the washing machine.

Explain why it would not be safe for a person to touch the metal case.

[2 marks]

0 1 . 6 The earth wire is now connected to the metal case of the washing machine.

Explain why it would now be safe for a person to touch the metal case, even if the live wire touches the metal case.

[2 marks]

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6.2.1.1 Standard circuit diagram symbols

Question 03

0 1 **Figure 1** shows a mobile phone with its battery removed.

Figure 1



A student measured the potential difference across the battery and then put the battery into the phone.

0 1 . 1 What is the equation linking current (I), potential difference (V) and resistance (R)?

[1 mark]

Tick (✓) **one** box.

- $I = V R$ ☐
- $R = I V$ ☐
- $V = I R$ ☐
- $V = I^2 R$ ☐

Question 1 continues on the next page

6.2.1.1 Standard circuit diagram symbols

Question 03 · continued

0 1 . 2 The current in the electronic circuit in the mobile phone was 0.12 A.

The potential difference across the battery was 3.9 V.

Calculate the resistance of the electronic circuit in the mobile phone.

[3 marks]

Resistance = _____ Ω

6.2.1.1 Standard circuit diagram symbols

Question 03 · continued

0 1 . 3 Write down the equation which links energy (E), power (P) and time (t).

[1 mark]

0 1 . 4 The battery was fully charged when it was put into the mobile phone.

The battery discharged when the mobile phone was switched on.

The average power output of the battery as it discharged was 0.46 watts.

The time taken to fully discharge the battery was 2500 minutes.

Calculate the energy transferred by the battery.

[3 marks]

Energy transferred = _____ J

Question 1 continues on the next page

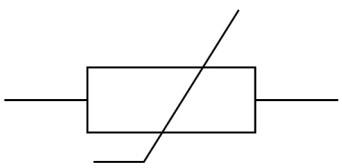
6.2.1.1 Standard circuit diagram symbols

Question 03 · continued

The mobile phone includes a sensor to monitor the temperature of the battery.

Figure 2 shows the circuit symbol for a component used in the sensor.

Figure 2



0 1 . 5 What component does the circuit symbol shown in **Figure 2** represent?

[1 mark]

0 1 . 6 The temperature of the component in **Figure 2** increases.

The potential difference across the component remains constant.

Explain what happens to the current in the component.

[2 marks]

11

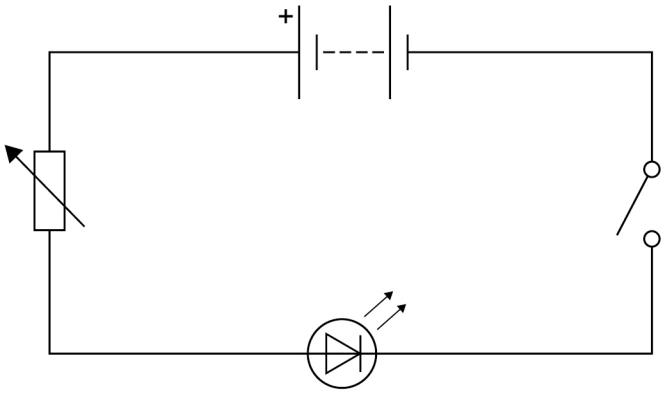
6.2.1.1 Standard circuit diagram symbols

Question 04

0 3 A student investigated how the current in a red LED varies with the potential difference across the LED.

Figure 3 shows an incomplete diagram of the circuit used.

Figure 3



0 3 . 1 Complete **Figure 3** to show how the student should have connected a voltmeter and an ammeter into the circuit.

Use the correct circuit symbols.

[2 marks]

6.2.1.1 Standard circuit diagram symbols

Question 04 · continued

0 3 . 2 The potential difference across the battery was +2.6 V.

The student varied the potential difference across the LED between –2.6 V and +2.6 V.

Describe how the student should have adjusted the circuit to vary the potential difference across this range.

[2 marks]

Question 3 continues on the next page

0 3 . 3 **Table 1** shows the results when the potential difference across the LED had positive values.

Table 1

Potential difference in volts	0.0	1.0	1.8	2.0	2.2	2.4	2.6
Current in milliamps	0	0	0	5	19	41	69

Figure 4 shows a graph of current against potential difference.

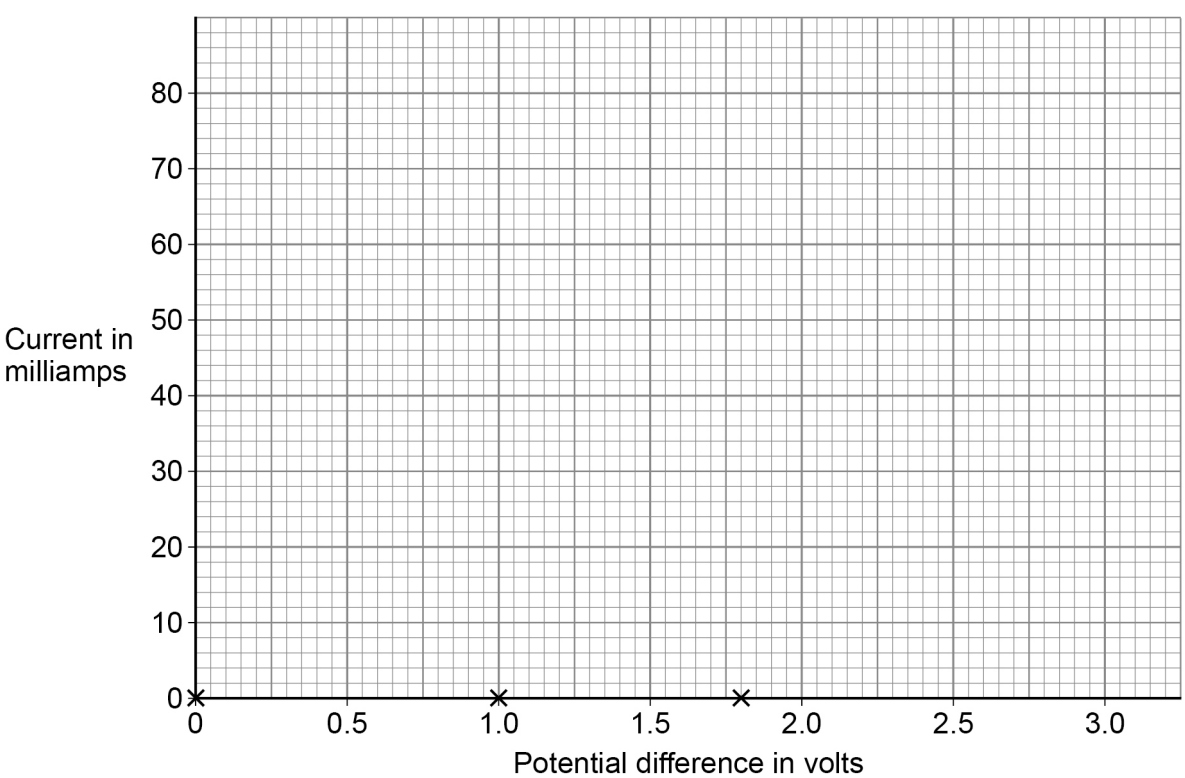
Complete **Figure 4**.

You should:

- plot the remaining points from **Table 1**
- draw a line of best fit.

[3 marks]

Figure 4



6.2.1.1 Standard circuit diagram symbols

Question 04 · continued

0 3 . 4 Explain what happens to the current in the LED when the potential difference across the LED is negative.

[2 marks]

0 3 . 5 A second student did the investigation using a blue LED.

The results for both the red LED and the blue LED showed the same pattern.

What conclusion can be made about the investigation?

[1 mark]

Tick (✓) **one** box.

The investigation is repeatable. ☐

The investigation is reproducible. ☐

The results were accurate. ☐

Question 3 continues on the next page

6.2.1.1 Standard circuit diagram symbols

Question 04 · continued

0 3 . 6 The relationship between current and potential difference for an LED is non-linear.

Which of the following always shows a linear relationship between current and potential difference?

[1 mark]

Tick (✓) **one** box.

Filament lamp ☐

LDR ☐

Resistor at constant temperature ☐

Thermistor ☐

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6.2.1.1 Standard circuit diagram symbols

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

6.2.1.1 Standard circuit diagram symbols

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

6.2.1.1 Standard circuit diagram symbols

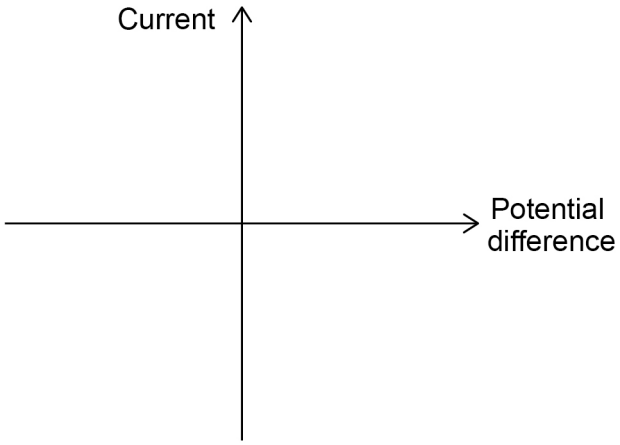
Question 05 · continued

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]

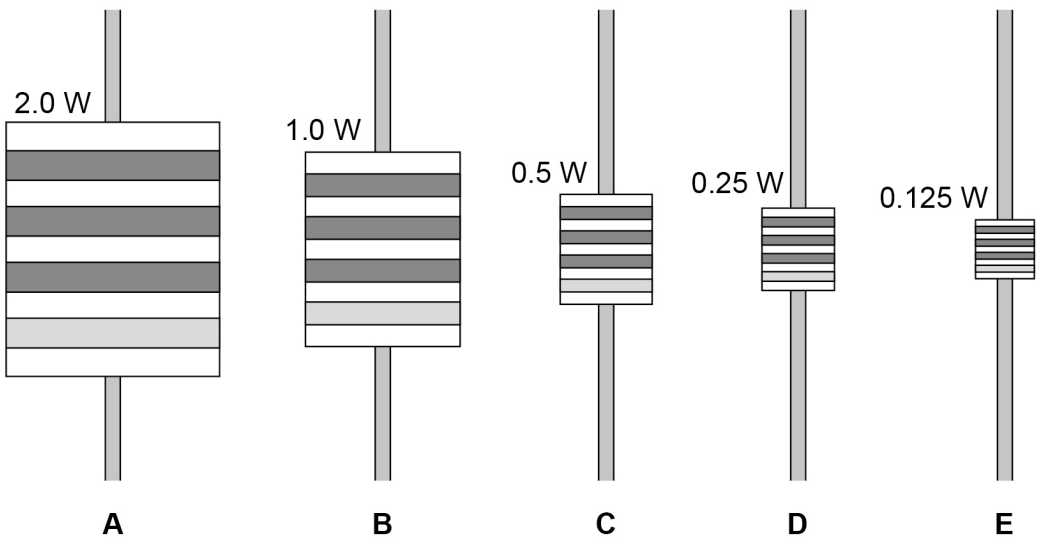
Figure 2



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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