AQA GCSE Combined Science - Trilogy | 8464

SPECIFICATION POINT 6.2.1.1

Standard circuit diagram symbols

Mark schemes and examiner comments

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

Using this booklet

1. Booklet answer numbers match the question booklet.
2. Use the original question number within marking tables.
3. Examiner comments are included where available.

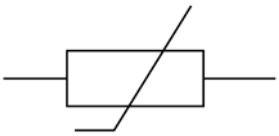
Name: _____ **Date:** _____

Where a precise marking extract is unavailable, the full source document is included in an appendix. Any missing mark scheme is explicitly identified.

6.2.1.1 Standard circuit diagram symbols

Answer 01 · Mark scheme

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

Question	Answers	Extra information	Mark	AO / Spec. Ref.	ID
04.1	less than 20 Ω		1	AO2/1 6.2.2	A
04.2	the resistance of the lamp is added to the total resistance of the resistors in parallel	allow resistors in series add up	1	AO3/1a 6.2.2	E
	the resistors in parallel have a total resistance of less than 10 ohms	allow resistors in parallel have a smaller resistance than the lowest value resistor	1		E
04.3			1	AO1.1 AO1 in isolation 6.2.1.1	E
04.4	the current increased (because) the resistance (of the thermistor) decreased	 allow because the resistance of the circuit decreased	1 1	AO1.1 AO1 in isolation 6.2.1.4 6.2.1.3	E

6.2.1.1 Standard circuit diagram symbols

Answer 01 · Mark scheme

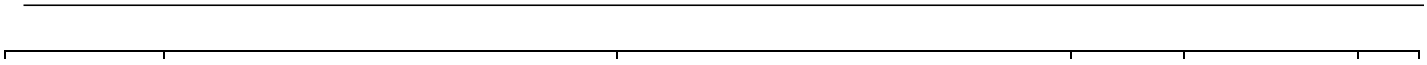
June 2019 | 8464/P/1H | Original Q4

04.5	**the resistor** the potential difference across the resistor becomes 0V because there is a short circuit across the resistor **the lamp** the potential difference across the lamp increases because the current increases	 allow because there is no current in the resistor allow switch has no resistance If neither of the first two marking points awarded, allow **1** mark for p.d. decreases because there is less current in the resistor **or** p.d. decreases because components in parallel have less resistance **or** p.d. decreases because there is an alternative route for the current allow the potential difference across the lamp will be the same as the battery allow because the resistance of the circuit decreases allow because there is less p.d. across the resistor	 1 1 1 1	AO2.2 6.2.2 6.2.1.1 6.2.1.3 WS 3.6	E
Total			**10**		

6.2.1.1 Standard circuit diagram symbols

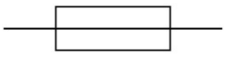
Answer 01 · Mark scheme

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



6.2.1.1 Standard circuit diagram symbols

Answer 02 · Mark scheme November 2020 | 8464/P/1H | Original Q1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	swap the blue wire and the green and yellow wire	allow connect the blue wire to the neutral pin and the yellow and green wire to the earth pin. allow swap the earth and neutral wires ignore the earth wire and neutral wire are wrongly connected	1	AO2 6.2.3.2
01.2	230 (V) 50 (Hz)		1 1	AO1 6.2.3.1 6.2.3.2
01.3	0 (V)		1	AO1 6.2.3.2
01.4			1	AO1 6.2.1.1
01.5	the person could get an electric shock because there is a current in the person	allow so the person could be electrocuted allow because the person provides a connection (from the washing machine) to earth allow because there is a potential difference across the person	1 1	AO3 6.2.3.2

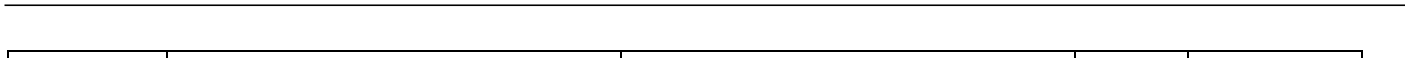
6.2.1.1 Standard circuit diagram symbols

01.6	the charge flows through the earth wire (instead of the person) because the resistance of the earth wire is much less than that of a person	 allow so the case does not become live allow so the fuse will break / melt / blow	1 1	AO3 6.2.3.2
Total			**9**	

6.2.1.1 Standard circuit diagram symbols

Answer 02 · Mark scheme

November 2020 | 8464/P/1H | Original Q1



6.2.1.1 Standard circuit diagram symbols

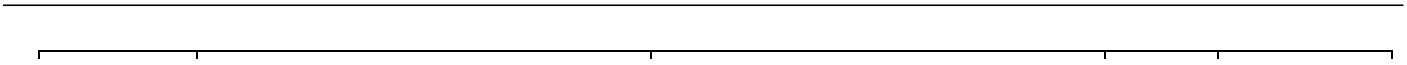
Answer 03 · Mark scheme November 2021 | 8464/P/1H | Original Q1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	$V = I R$		1	AO1 6.2.1.3
01.2	$3.9 = 0.12 \times R$ $R = \frac{3.9}{0.12}$ R = 32.5 (Ω)	 allow R = 33 (Ω)	1 1 1	AO2 6.2.1.3
01.3	energy = power × time **or** E = P t		1	AO1 6.2.4.2
01.4	time = 150 000s energy = 0.46 × 150 000 energy = 69 000 (J)	 allow a substitution using an incorrectly/not converted value of time allow a correct calculation using an incorrectly/not converted value of time	1 1 1	AO2 6.2.4.2
01.5	thermistor		1	AO1 6.2.1.1
01.6	the current will increase (because) the resistance decreases		1 1	AO1 6.2.1.4
Total			**11**	

6.2.1.1 Standard circuit diagram symbols

Answer 03 · Mark scheme

November 2021 | 8464/P/1H | Original Q1



6.2.1.1 Standard circuit diagram symbols

Answer 04 · Mark scheme

June 2024 | 8464/P/1H | Original Q3

Question 3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	correct symbol for voltmeter connected across LED correct symbol for ammeter in series with LED		1 1	AO1 6.2.1.4 6.2.1.1 RPA16

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.2	change the number of cells in the battery	allow use batteries with different potential differences allow adjust the variable resistor allow adjust the potential difference across the power supply	1	AO1 6.2.1.4 RPA16
	reverse the connections to the LED / battery	allow reverse the connections to the power supply	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.3	4 points plotted correctly	allow a tolerance of ± ½ small square allow **1** mark for 3 points plotted correctly	2	AO2 6.2.1.4 RPA16
	line of best fit	ignore line before 1.8 V	1	

6.2.1.1 Standard circuit diagram symbols

Answer 04 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.4	the current is zero because the LED / diode has a very high resistance (in the reverse direction)	allow the current stops allow because the LED / diode only allows current in one direction	1 1	AO1 6.2.1.4 RPA16

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.5	the investigation is reproducible		1	AO3 6.2.1.4 RPA16

Question	Answers	Extra information	Mark	AO / Spec. Ref.
3.6	resistor at constant temperature		1	AO1 6.2.1.4

Total Question 3	**11**

6.2.1.1 Standard circuit diagram symbols

Answer 05 · Mark scheme

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

Question 3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	circuit with a cell, (switch) and resistor in series	allow battery for cell	1	AO2
	ammeter in series (with the resistor and the cell)		1	AO1
	voltmeter in parallel with resistor		1	AO1 6.2.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.2	I = 0.45 (A)	subsequent marks may be awarded if an incorrectly / not converted value of I is used	1	AO2 6.2.1.3
	$2.7 = 0.45 \times R$		1	
	$R = \frac{2.7}{0.45}$		1	
	R = 6 (Ω)	allow 6.0 (Ω)	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.3	straight line through the origin in **both** 1st and 3rd quadrant		1	AO1 6.2.1.4

6.2.1.1 Standard circuit diagram symbols

Answer 05 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.4	R = 2200 (Ω)	subsequent marks may be awarded if an incorrectly / not converted value of R is used	1	AO2
	$P = 0.012^2 \times 2200$		1	AO2
	P = 0.3168 (W)	allow P = 0.32 allow P = 0.317	1	AO2
	resistors **A**, **B** and **C**	dependent on MP1 **and** MP3	1	AO3
	OR			6.2.4.1
		the first three marks may be awarded for calculating I_{max} for any of the resistors		
	R = 2200 (Ω) (1)	subsequent marks may be awarded if an incorrectly / not converted value of R is used		
	$2.0 = I^2 \times 2200$ (1)			
	I = 0.030…(1)			
	resistors **A**, **B** and **C** (1)	dependent on MP1 **and** MP3		

Total Question 3	**12**

6.2.1.1 Standard circuit diagram symbols

Answer 01 · Examiner comments June 2019 | 8464/P/1H | Original Q4

Question 4 (Standard / high demand)

04.1 Around 15% of students correctly identified the total resistance.

04.2 Fewer than 5% of students gained both marks on this question, although just under a third of students scored 1 mark. The concept of parts of a circuit being in series and other parts being in parallel seemed to cause problems. Many students seemed to know that resistors in series are added together, but then proceeded to add 10 plus 10 plus 10, demonstrating that they had not appreciated that the two resistors are in parallel. Many students ignored the resistance of the lamp because it was not a resistor. Another common misconception was that resistance is shared, and to discuss resistance as if it behaves like potential difference.

04.3 Around two fifths of students could draw the correct circuit symbol for a thermistor. Many students drew the correct symbol but then added an arrow to the line through the resistor, which meant they did not gain the mark.

04.4 Slightly less than 60% of students gained at least one mark, with just less than 15% of students scoring both. It was not uncommon for students to erroneously suggest that current increases because it gains more energy from the increase in temperature.

04.5 Very few students recognised that the potential difference across the resistor would drop to zero and across the lamp the potential difference would be the same as the battery. Around 45% of students gained at least 1 mark, usually for mentioning that the potential difference across the lamp would increase. Many students stated that the switch controlled the entire circuit, turning it on or off. Many students appeared to be confused by the difference between current, potential difference and resistance, and many did not write about potential difference (or voltage) at all in their answers.

Answer 03 · Examiner comments November 2021 | 8464/P/1H | Original Q1

Question 01 (Standard demand)

01.1 Slightly over two thirds of students selected the correct equation.

01.2 Full marks were gained by over 60% of the students, with about 35% failing to gain any credit.

01.3 This equation was correctly recalled by around 70% of students.

01.4 Most students did not attempt to convert 2500 minutes into seconds. Nearly a quarter of students gained all 3 marks, with just over half of students gaining 2 marks.

01.5 Slightly less than 40% of higher tier students were able to correctly identify the symbol for a thermistor.

6.2.1.1 Standard circuit diagram symbols

Answer 03 · Examiner comments November 2021 | 8464/P/1H | Original Q1

01.6 Most students failed to recognise that the resistance of the thermistor would decrease as temperature increased, with many students stating that because the potential different across the thermistor was constant, the current in the thermistor must also be constant. Another misconception demonstrated in a number of responses was that the current would increase because the increased temperature gives the current more energy. Roughly one in ten students gained 2 marks, with just over a third gaining 1 mark.

Answer 04 · Examiner comments

June 2024 | 8464/P/1H | Original Q3

Question 3 (standard & standard/high demand)

03.1 Approximately half the students gained both marks, with roughly a quarter scoring 1 mark. The vast majority of students were able to draw the correct symbols for a voltmeter and ammeter, but positioning the voltmeter correctly caused a problem for many students.

03.2 While most students attempted to describe a way to vary the magnitude of the potential difference across the LED, the majority of students did not address how to change the potential difference to obtain negative values.

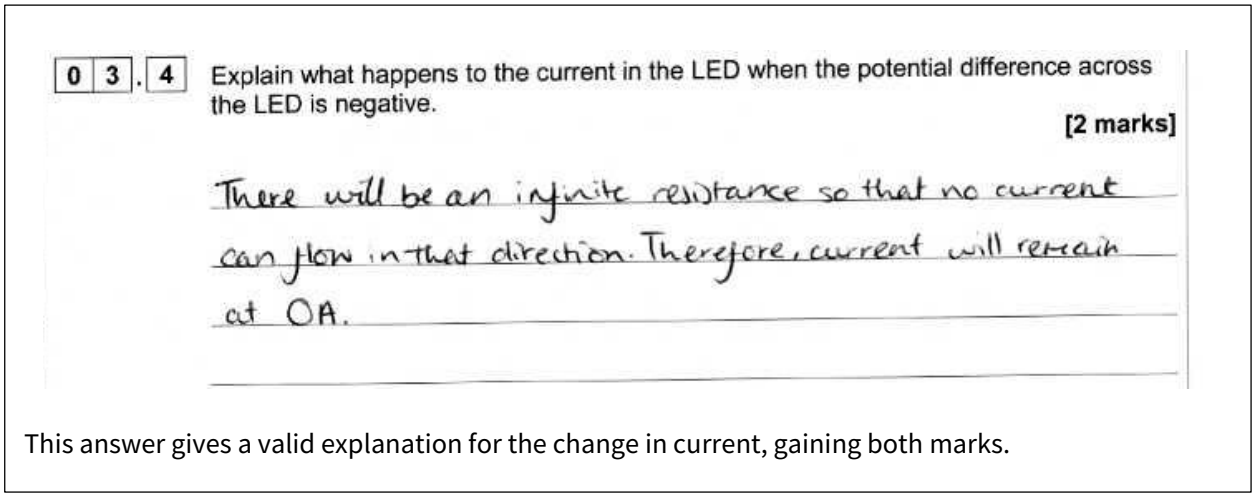
There were some misconceptions demonstrated by a number of students, with suggestions that moving the LED closer to or further from the battery would increase or decrease the potential difference being relatively common. Many students also incorrectly suggested that connecting all the components in parallel rather than in series would vary the potential difference as required.

A very low proportion of students scored both marks, but over 25% gained at least 1 mark.

03.3 A significant minority of students made errors in reading either the *x*-axis scale or the *y*-axis scale when plotting their points. Points plotted at 18 mA, 42 mA and 68 mA were within half a small square, so credit could still be awarded, but students who made errors on the *x*-axis scale tended to be less fortunate. Even if points were not correctly plotted, the line of best fit mark could still be scored. Slightly over half the students gained all 3 marks.

03.4 Fewer than 1 in 10 students scored both marks on this question, with about 20% scoring 1 mark.

It was common for students to incorrectly suggest that the current would reverse, or just to state that the current would decrease. Very few students gave a reason why the current would be zero.



This answer gives a valid explanation for the change in current, gaining both marks.

03.5 The difference between repeatability and reproducibility was misunderstood by many students, with nearly 50% choosing the incorrect answer that the results showed repeatability. Just over a third of students gave the correct answer.

03.6 Just under 60% of students recalled that a resistor at constant temperature shows a linear relationship between current and potential difference.

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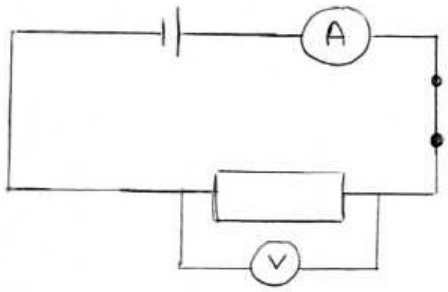
6.2.1.1 Standard circuit diagram symbols

Answer 05 · Examiner comments

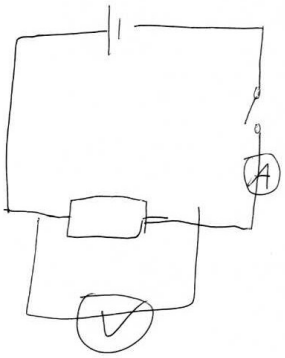
June 2025 | 8464/P/1H | Original Q3

Question 3 (Standard and standard/high demand)

03.1 Nearly 90% of students gained at least 1 mark on this question. 40% gained all three marks for using all the correct circuit symbols and drawing an ammeter in series and voltmeter in parallel with the resistor. 25% of students gained 2 marks due to having one error, which most commonly was having an incorrect circuit symbol or having the voltmeter in series.



It is expected that students draw circuit diagram accurately. This an excellent example, scoring all 3 marks.



There should be no lines through the symbols, this example shows incorrect circuit symbols and there is a significant gap in the circuit next to the cell.

03.2 This calculation was reasonably well answered. Over 70% of students gained at least 3 marks. Nearly all students that did a correct substitution were able to rearrange correctly and calculate the final answer. 45% of students did a correct conversion of the current to amps and did the calculation correctly so gained 4 marks.

03.3 75% of students draw a straight line through the origin in both 1st and 3rd quadrant so gained the mark. A number of students only drew the line in the 1st quadrant, so did not gain the mark. Some students drew the IV curve for a lamp.

03.4 There were two different valid calculations students could do to determine which resistors in figure 3 were suitable to be used. The most common method was to determine the power when a current of 0.012A was in a resistor. 10% of students gained a mark for converting the resistance in ohms but could not get any further. 45% of students completed a valid calculation so gained 3 marks. Only 15% went on to draw the correct conclusion based on their calculation and were awarded 4 marks.

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