AQA GCSE Combined Science - Trilogy | 8464

SPECIFICATION POINT 6.2.1.2

# Electrical charge and current

## Mark schemes and examiner comments

| | |
|---|---|
| Tier | **Foundation** |
| Question groups | **7** |
| Available paper years | **2018–2025** |

## 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.

### 6.2.1.2 Electrical charge and current

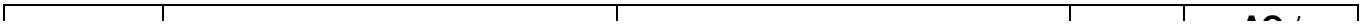
**Answer 01 · Mark scheme** June 2018 | 8464/P/1F | Original Q4

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **04.1** | (casing is) not made of metal<br><br>little / no chance of electric shock | allow (casing is) made of plastic<br>allow they are double insulated | 1<br><br>1 | AO3<br>6.2.3.2 |
| **04.2** | charge flow = current × time | allow the equation given in symbols | 1 | AO1<br>6.2.1.2 |
| **04.3** | Q = 2.95 × 60<br><br>Q = 177 (C) | an answer of 177 scores **2** marks<br><br>allow 180 (C) | 1<br><br>1 | AO2<br>6.2.1.2 |
| **04.4** | straight line with a different positive gradient<br><br>straight line with positive gradient through the origin | must go through the first and third quadrant | 1<br><br>1 | AO1<br>6.2.1.4 |
| **04.5** |  | | 1 | AO1<br>6.2.1.1 |
| **04.6** | the particles vibrate about a fixed position regular arrangement<br><br>(the particles change) to being free to move around | allow the particles are in a regular arrangement<br><br>allow correct description of translational kinetic energy | 1<br><br>1 | AO1<br>6.3.1.1 |
| **04.7** | <br><br>L = 200 000 (J/kg)<br><br>E = 500 × 200 000<br><br>E = 100 000 000 (J) | an answer of 100 000 000 scores **3** marks<br><br><br>allow $1 \times 10^8$ (J)<br><br>allow correct calculation for incorrect conversion or no conversion of L for **2** marks | <br><br>1<br><br>1<br><br>1 | AO2<br>6.3.2.3 |
| **Total** | | | **13** | |

### 6.2.1.2 Electrical charge and current

**Answer 01 · Mark scheme**

June 2018 | 8464/P/1F | Original Q4



## 6.2.1.2 Electrical charge and current

**Answer 02 · Mark scheme** June 2019 | 8464/P/1F | Original Q1

| Question | Answers | Extra information | Mark | AO / Spec. Ref. | ID |
|---|---|---|---|---|---|
| **01.1** | LED | | 1 | AO1.1<br>AO1 in isolation<br>6.2.1.1 | A |
| **01.2** | the same as | | 1 | AO1.1<br>6.2.1.2 | G |
| **01.3** | <br><br><br><br>1500 – 900<br><br>600 (thousand) | an answer of 600 (thousand) or 600 000 scores **2** marks<br><br>two correct readings from the graph scores **1** mark<br><br>allow a range of 1480 to 1520 and a range of 880 to 920<br><br>allow an answer in the range of 560 (thousand) to 640 (thousand) consistent with their allowed readings | <br><br>1<br><br>1 | AO2.2<br>6.2.1.2<br>WS 3.2 | G |
| **01.4** | repeat the experiment using exactly the same method | | 1 | AO3.3a<br>6.2.1.2 | A |
| **01.5** | <br><br>power = 0.80 × 0.020<br><br>power = 0.016 (W) | an answer of 0.016 (W) scores **2** marks | <br><br>1<br><br>1 | AO2.1<br>6.2.4.1<br>WS 3.3 | E |
| **01.6** | power = (current)$^2$ × resistance | | 1 | AO1.1<br>AO1 in isolation<br>6.2.4.1 | A |
| **01.7** | temperature increases | | 1 | AO1.1<br>6.1.1.1 | E |

### 6.2.1.2 Electrical charge and current

**Answer 02 · Mark scheme**

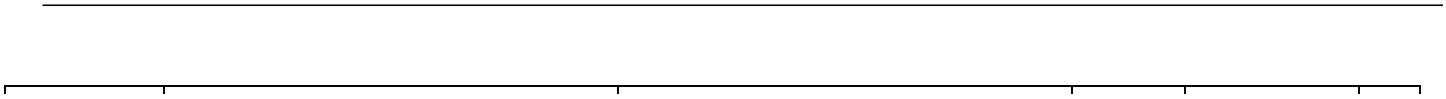
June 2019 | 8464/P/1F | Original Q1

| | | | | | |
|---|---|---|---|---|---|
| **01.8** | Q = 0.020 × 180<br><br>Q = 3.6 (C) | an answer of 3.6 (C) scores **2** marks | 1<br><br>1 | AO2.1<br><br>6.2.1.2<br>WS 3.3 | E |
| **Total** | | | **11** | | |

### 6.2.1.2 Electrical charge and current

**Answer 02 · Mark scheme**

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



### 6.2.1.2 Electrical charge and current

**Answer 03 · Mark scheme** June 2019 | 8464/P/1F | Original Q2

| Question | Answers | Extra information | Mark | AO / Spec. Ref. | ID |
|---|---|---|---|---|---|
| **02.1** | the brightness of the lamp | | 1 | AO3/3a<br>6.1.3c<br>WS 2.2 | A |
| **02.2** | zero error | | 1 | AO3/3b<br>6.1.3c<br>WS 3.7 | A |
| **02.3** | C | | 1 | AO3/1b<br>6.1.3c<br>WS 3.7 | A |
| **02.4** | 10.0 | allow 10 | 1 | AO3/1a<br>6.1.3c<br>WS 3.5 | G |
| **02.5** | $\frac{0.96}{8.0}$<br>= 0.12 | an answer of 0.12 or 12% scores **2** marks<br>allow 12% | 1<br>1 | AO2.1<br>6.1.2.2 | E |
| **02.6** | replenished | | 1 | AO1.1<br>in isolation<br>6.1.3b | G |
| **02.7** | E = 490 × 31<br>E = 15 190<br>E = 15 000 (J) | an answer of 15 000 (J) scores **3** marks<br>allow 15 200 if correct substitution is seen<br>allow an answer to 2 s.f. consistent with their calculated value of E using E=QV | 1<br>1<br>1 | AO2.1<br>6.2.4.2 | E |

### 6.2.1.2 Electrical charge and current

**Answer 03 · Mark scheme**

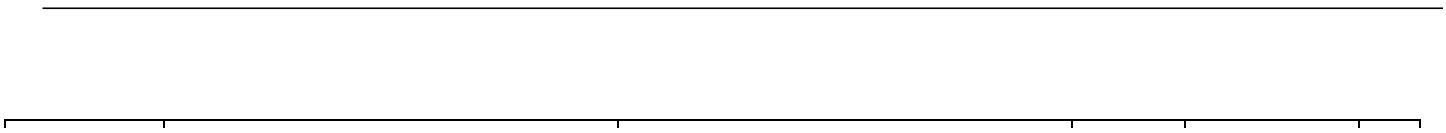


| | | | | | |
|---|---|---|---|---|---|
| **02.8** | less fossil fuel is burned | | 1 | AO3.2a<br>6.1.3e | A |
| **Total** | | | **11** | | |

### 6.2.1.2 Electrical charge and current

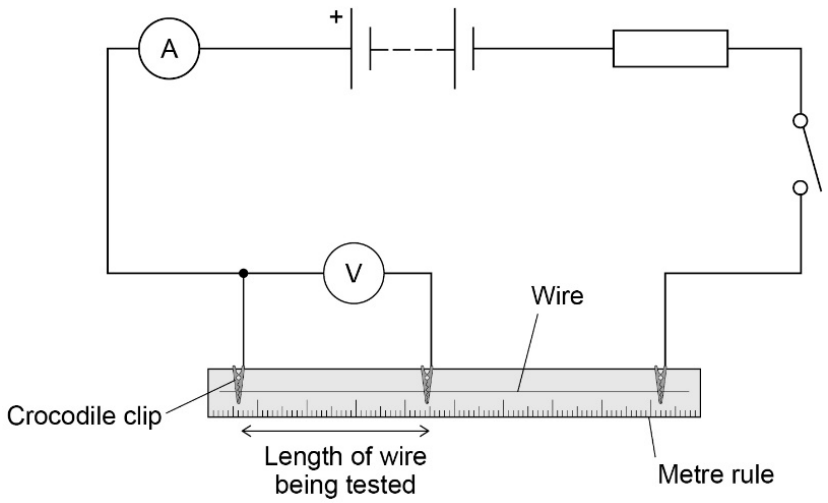
**Answer 03 · Mark scheme**

June 2019 | 8464/P/1F | Original Q2



### 6.2.1.2 Electrical charge and current

**Answer 04 · Mark scheme** November 2020 | 8464/P/1F | Original Q1

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **01.1** | both symbols correct and in the correct position   | | 1 | AO1<br>6.2.1.3<br>6.2.1.4<br>RPA 15 |
| **01.2** | the length of the wire being tested | | 1 | AO1<br>6.2.1.3<br>RPA 15 |
| **01.3** | the resistance of the wire | | 1 | AO1<br>6.2.1.3<br>RPA 15 |
| **01.4** | mean p.d. = $\frac{0.16 + 0.17 + 0.15}{3}$<br>mean p.d. = 0.16 (V) | | 1<br>1 | AO2<br>6.2.1.3<br>RPA 15 |
| **01.5** | R = 0.32/0.50<br>R = 0.64 (Ω) | | 1<br>1 | AO2/1<br>6.2.1.3<br>6.2.1.3<br>RPA 15 |

### 6.2.1.2 Electrical charge and current

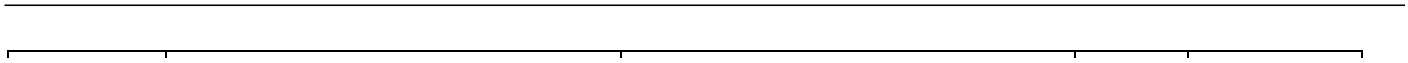


| | | | | |
|---|---|---|---|---|
| **01.6** | power = 0.32 × 0.50<br><br>power = 0.16 (W) | | 1<br><br>1 | AO2<br>6.2.4.1 |
| **01.7** | charge flow = 0.50 × 17<br><br>8.5 (C) | | 1<br><br>1 | AO2<br>6.2.1.2 |
| **01.8** | a straight line through the origin with a lower gradient | | 1 | AO1/2<br>6.2.1.3<br>RPA 15 |
| **Total** | | | **12** | |

### 6.2.1.2 Electrical charge and current

**Answer 04 · Mark scheme**

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



### 6.2.1.2 Electrical charge and current

**Answer 05 · Mark scheme** November 2021 | 8464/P/1F | Original Q3

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **03.1** |  | | 1 | AO1<br>6.2.1.1 |
| **03.2** | the flow of electrical charge | | 1 | AO1<br>6.2.1.2 |
| **03.3** | all 4 components connected in a series circuit | allow a cell instead of a battery<br><br>allow an LED or LDR symbol instead of a lamp<br><br>ignore the + sign on the battery symbol | 1 | AO3<br>6.2.1.1<br>6.2.2 |
| **03.4** | decrease the resistance of the variable resistor | | 1 | AO1<br>6.2.1.3 |
| **03.5** | P = 0.75 × 0.16<br><br>P = 0.12 (W) | | 1<br><br>1 | AO2<br>6.2.4.1 |
| **03.6** | charge flow = current × time<br><br>Q = It | | 1 | AO1<br>6.2.1.2 |

### 6.2.1.2 Electrical charge and current

**Answer 05 · Mark scheme**

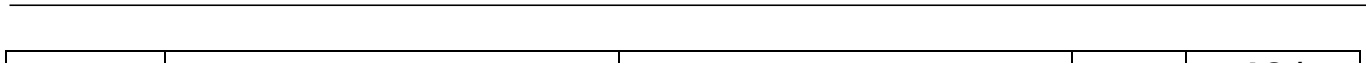


| | | | | |
|---|---|---|---|---|
| **03.7** | 200 mA = 0.2 A<br><br>charge flow = 0.2 × 15<br><br>charge flow = 3.0 (C) | <br><br>allow a correct substitution using an incorrectly/not converted value for current<br><br>allow a correct calculation using an incorrectly/not converted value for current | 1<br><br>1<br><br>1 | AO2<br>6.2.1.2 |
| **03.8** | 1.6 | | 1 | AO3<br>6.2.1.2 |
| **03.9** | 260 mA to 380 mA | | 1 | AO2<br>6.2.1.2 |
| **Total** | | | **12** | |

### 6.2.1.2 Electrical charge and current

**Answer 05 · Mark scheme**

November 2021 | 8464/P/1F | Original Q3



6.2.1.2 Electrical charge and current

Answer 06 · Mark scheme

June 2024 | 8464/P/1F | Original Q1

## Question 1

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **01.1** | the current in both lamps is the same | | 1 | AO1<br>6.2.2 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **01.2** | (4.5 – 1.5 =) 3 (V) | allow (4.5 – 1.5 =) 3.0 (V) | 1 | AO2<br>6.2.2 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **01.3** | $P$ = 1.5 × 1.2<br>1.8 (W) | | 1<br>1 | AO2<br>6.2.4.1 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **01.4** | $R = \frac{1.5}{1.2}$<br>1.25 (Ω) | allow 1.3 (Ω) | 1<br>1 | AO2<br>6.2.1.3 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **01.5** | $Q$ = 1.2 × 40<br>48 (C) | | 1<br>1 | AO2<br>6.2.1.2 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **01.6** | the temperature of each lamp increases | | 1 | AO1<br>6.2.1.4 |

### 6.2.1.2 Electrical charge and current

**Answer 06 · Mark scheme**

June 2024 | 8464/P/1F | Original Q1

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **01.7** | lamp **X** no longer emits light<br><br>because the circuit is no longer complete | <br><br>dependent on MP1<br><br>allow because there is no current | 1<br><br>1 | AO3<br>6.2.2 |

| | |
|---|---|
| **Total Question 1** | **11** |

6.2.1.2 Electrical charge and current

Answer 07 · Mark scheme

June 2025 | 8464/P/1F | Original Q2

## Question 2

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **02.1** | symbols for filament lamp, ammeter and cell used<br><br>a simple complete series circuit | allow **1** mark for 2 correct circuit symbols<br><br>MP3 dependent on scoring at least **1** other mark | 2<br><br>1 | AO1<br>6.2.1.1 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **02.2** | cell | | 1 | AO1<br>6.2.1.2 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **02.3** | $Q = 1.5 \times 30$<br><br>$Q = 45$ (C) | | 1<br><br>1 | AO2<br>6.2.1.2 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **02.4** | $R = \frac{12}{1.5}$<br><br>$R = 8$<br><br>Ω | <br><br>allow 8.0<br><br>allow ohms | 1<br><br>1<br><br>1 | AO2<br><br>AO2<br><br>AO1<br><br>6.2.1.3 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **02.5** | as potential difference increases, the current increases<br><br>non-linear relationship | <br><br>allow at a decreasing rate | 1<br><br>1 | AO3<br>6.2.1.4 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 02.6 | (resistance) increases | | 1 | AO1<br>6.2.1.4 |

| Question | Answers | Mark | AO / Spec. Ref. |
|---|---|---|---|
| 02.7 | **Level 2:** Relevant points (reasons / causes) are identified, given in detail and logically linked to form a clear account. | 3–4 | AO3 |
| | **Level 1:** Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking. | 1–2 | AO2<br>6.2.4.2 |
| | **No relevant content** | 0 | |
| | **Indicative content**<br>• both types of bulb have equal brightness<br>• the same number of bulbs are needed<br>• LED bulbs do not need to be replaced as often<br>**power comparison**<br>• the input power of filament lamp is greater<br>• the input power of the filament lamp is 32 W greater<br>• the input power of filament lamp is 5 times greater<br>• the brightness per watt for the LED bulb is 100 arbitrary units<br>• the brightness per watt for the filament lamp is 20 arbitrary units<br>**consequence**<br>• LED bulb transfers less energy<br>• (number of units of) electricity used is lower for LED bulb<br>• LED bulb wastes less energy<br>• LED bulb running costs are lower<br>• the LED bulb is more efficient<br>• the LED bulb is 5 times more efficient<br>for **Level 2** answers must include a valid calculation | | |

| Total Question 2 | 16 |
|---|---|

6.2.1.2 Electrical charge and current

Answer 02 · Examiner comments

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

**Question 1 (Low demand)**

**01.1** Slightly below 60% of students recognised the LED in this question.

**01.2** Around 33% of students knew that the circuit in the diagram is series circuit, so the current is the same through both components.

**01.3** More than half of all students gained both marks. Many who did not score appeared to have read the scale of the graph incorrectly, for example reading 850 thousand and 1450 thousand steps when they should have read 900 thousand and 1500 thousand steps.

**01.4** Almost 70% of students knew that checking repeatability requires repeating with the same method.

**01.5** A simple calculation using a given formula was well answered with slightly less than 90% of students showing clear working and gaining both marks.

**01.6** Fewer than 30% of students knew the formula relating power, current and resistance.

**01.7** Almost 90% of students knew that a current would increase the temperature of the resistor.

**01.8** This straightforward calculation using a given equation was done well, with clear working shown. Over 90% scored both marks. Some students, however, converted 180 seconds to minutes before calculating the answer.

### 6.2.1.2 Electrical charge and current

**Answer 03 · Examiner comments** June 2019 | 8464/P/1F | Original Q2

**Question 2**

**02.1** Nearly 70% of students correctly chose the brightness of the lamp as the control variable.

**02.2** This question was correctly answered by just over 30% of students.

**02.3** The anomalous result was recognised by about 70% of students.

**02.4** Slightly less than half of the students identified the pattern in the data, and used this to predict the most likely value using the information in the table. Many students who didn't score a mark tried to calculate a mean using some data from the table.

**02.5** This calculation was answered well, with around four fifths of students dividing the two values correctly and expressing their answer as either a decimal or a percentage.

**02.6** Understanding that renewable resources are replenished was shown by three quarters of students.

**02.7** Just over 5% of students gained only 1 mark on this question, for correctly substituting the numbers into an equation. Another 80% or so of students completed the calculation, but the ability to express it to two significant figures was shown by only approximately 30% of students. Some students did not try, some rounded incorrectly, but many reduced 15190 to just 15.

**02.8** Just over 70% of students knew that using solar panels would reduce the need to burn fossil fuels.

**Answer 05 · Examiner comments** November 2021 | 8464/P/1F | Original Q3

**Question 3 (Low/standard demand)**

**03.1** Slightly over half the students knew the symbol for a filament lamp.

**03.2** Nearly three quarters of all students answered this correctly.

### 6.2.1.2 Electrical charge and current

**Answer 05 · Examiner comments** November 2021 | 8464/P/1F | Original Q3

**03.3** This question was testing whether students were able to draw four components in series. A complete circuit was needed, with no gaps around the components. Many students drew the components at right angles to the wires, and therefore not connected into the circuit. Students were given the symbols in the question, and were expected to draw them correctly, so those who drew a line through the middle of the ammeter, for example, did not gain the mark. Roughly 45% of students gained this mark, with almost 10% not attempting the question at all.

**03.4** Just over 40% of students answered correctly, with more than a third opting to place an additional ammeter in the circuit.

**03.5** Over 90% gained both marks.

**03.6** Just under half the students correctly recalled the equation, but almost 1 student in 8 did not attempt to answer.

**03.7** A fair proportion of students attempted to convert 15 seconds into minutes, and then multiplied this by 200, gaining no marks. It was uncommon for students to attempt to convert milliamps into amps. Just over half of all students gained at least 2 marks.

**03.8** Many students struggled to answer this question, and less than a quarter of students answered correctly.

**03.9** Around than one in ten students selected the correct answer. Roughly a third of students selected the third option, suggesting that the vast majority of these students were not familiar with the ± symbol.

Answer 06 · Examiner comments

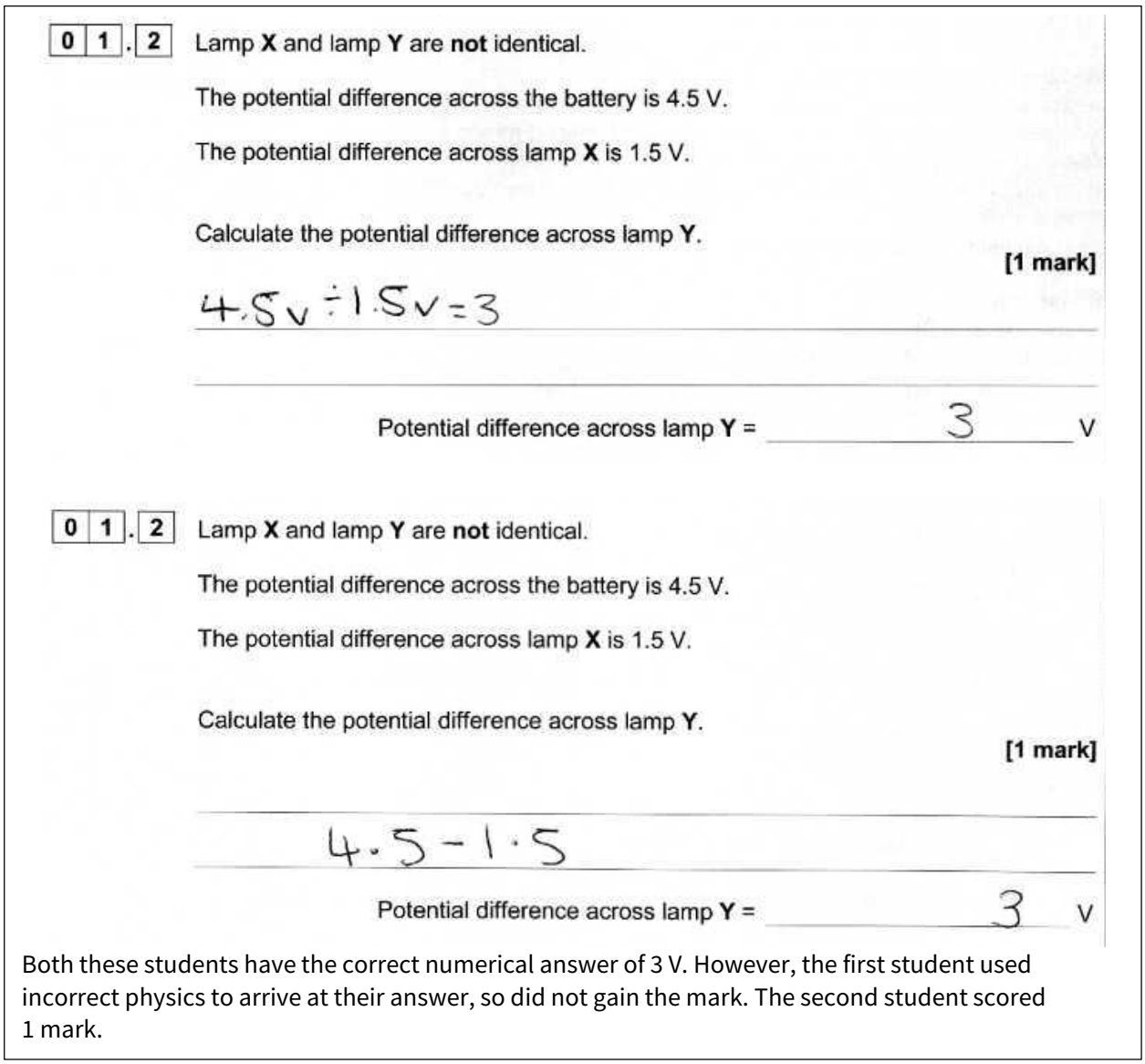
June 2024 | 8464/P/1F | Original Q1

# Question 1 (low demand)

**01.1** Roughly half of all students recognised that the current in two lamps connected in series is the same.

**01.2** Approximately 1 in 2 students answered this question correctly.

Students who demonstrated that they had arrived at the answer of 3.0 V by using incorrect physics did not score this mark. This included those who divided 4.5 V by 1.5 V, and, less commonly, those who calculated a mean of 4.5 V and 1.5 V. If a student gave the correct answer without showing their reasoning, it was assumed that they had used correct physics and the mark was awarded.



0 1 . 2 Lamp **X** and lamp **Y** are **not** identical.

The potential difference across the battery is 4.5 V.

The potential difference across lamp **X** is 1.5 V.

Calculate the potential difference across lamp **Y**.

**[1 mark]**

4.5V ÷ 1.5V = 3

Potential difference across lamp **Y** = 3 V

0 1 . 2 Lamp **X** and lamp **Y** are **not** identical.

The potential difference across the battery is 4.5 V.

The potential difference across lamp **X** is 1.5 V.

Calculate the potential difference across lamp **Y**.

**[1 mark]**

4.5 − 1.5

Potential difference across lamp **Y** = 3 V

Both these students have the correct numerical answer of 3 V. However, the first student used incorrect physics to arrive at their answer, so did not gain the mark. The second student scored 1 mark.

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### 6.2.1.2 Electrical charge and current

**Answer 06 · Examiner comments** June 2024 | 8464/P/1F | Original Q1

**01.3** This question was generally very well answered, with around 90% of students able to substitute into the equation and calculate the correct answer.

**01.4** Nearly 85% of all students calculated the correct resistance and gained both marks.

**01.5** The majority of students gained full marks on this question.

A common mistake was to divide the 40 seconds by 100, before using the time in the equation given. Students who made this error arrived at an incorrect answer but could still gain a mark if their answer was consistent with the current multiplied by their time.

**01.6** Slightly less than a third of students recognised that the resistance of a filament lamp increases because the temperature increases. The most common incorrect answer was from students who stated that the power of the battery increases to cause the resistance of the lamp to increase.

**01.7** Approximately 35% of students identified that lamp X would no longer emit light if lamp Y breaks, with a high proportion of students selecting that lamp X would get brighter. Approximately 2 in 5 of those students who selected the correct answer were able to articulate a valid reason for this.

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6.2.1.2 Electrical charge and current

Answer 07 · Examiner comments



# Question 2 (Low demand)

**02.1** This question discriminated well and produced a good spread of marks. 35% of students gained 3 marks for selecting the correct circuit symbols and drawing a simple complete series circuit. 70% of students made one error and were awarded 2 marks. Most of the students that scored 2 marks selected an incorrect circuit symbol, but some did select them correctly but could not draw a simple complete series circuit. 10% of students gained 1 mark for 2 correct circuit symbols.

**02.2** 65% of students correctly identified the cell as the source of energy for the circuit.

**02.3** This low demand calculation was well answered with 90% of students gaining both marks. Some students did an unusual conversion of time, dividing 30 by 100.

**02.4** 85% of students correctly calculated the resistance of the filament lamp and gained both calculation marks. The unit mark was awarded independently, and 60% of students selected the correct unit.

**02.5** 65% of students gained a mark for describing the current increasing as the potential difference increases. Only a small number of students described the relationship as being non-linear.

**02.6** Only 30% of students described the resistance of the filament lamp increasing as the temperature increases.

**02.7** This question discriminated well and produced a good spread of marks. Approximately 50% of students wrote Level 2 responses and gained either 3 or 4 marks. 40% of students wrote Level 1 responses because they did not include a calculation. Only a very small number of students did not write anything creditworthy, and a very small number did not attempt the question.

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