AQA GCSE Combined Science - Trilogy | 8464

SPECIFICATION POINT 6.2.2

# Series and parallel circuits

## Mark schemes and examiner comments

| | |
|---|---|
| Tier | **Foundation** |
| Question groups | **2** |
| Available paper years | **2019–2023** |

## 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.

## 6.2.2 Series and parallel circuits

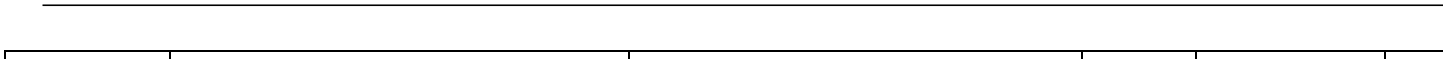
**Answer 01 · Mark scheme** June 2019 | 8464/P/1F | Original Q6

| | | | | | |
|---|---|---|---|---|---|
| **06.1** | ammeter in series with the resistor, voltmeter in parallel with the resistor | | 1 | AO1/1<br><br>6.2.1.4<br>RP 16<br>WS 2.4 | A |
| **06.2** | current decreased | ignore slows down | 1 | AO1/1<br><br>6.2.1.3<br>RP 16<br>WS 3.6 | E |
| **06.3** | reverse the connections to the cell | allow battery for cell<br><br>allow reverse the cell | 1 | AO1/2<br><br>6.2.1.3<br>RP 16<br>WS 2.2 | E |
| **06.4** | (directly) proportional | do not allow inversely proportional<br><br>do not allow indirectly proportional | 1 | AO1/2<br><br>6.2.1.3<br>RP 16<br>WS 3.5 | G |
| **06.5** | potential difference = current × resistance<br><br>**or**<br><br>V=IR | allow voltage for potential difference<br><br>allow any correct re-arrangement | 1 | AO1/1<br><br>6.2.1.3<br>RP 16<br>WS 3.3 | E |
| **06.6** | <br><br>3.0 = 0.12 × R<br><br>$R = \frac{3.0}{0.12}$<br><br>R = 25 (Ω) | an answer of 25 (Ω) scores **3** marks | <br><br>1<br><br>1<br><br>1 | AO2/1<br><br>6.2.1.3<br>RP 16<br>WS 3.3 | E |
| **Total** | | | **8** | | |

## 6.2.2 Series and parallel circuits

**Answer 01 · Mark scheme**

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Answer 02 · Mark scheme

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## Question 6

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **06.1** | voltmeter symbol correct and connected across the resistors | | 1 | AO1<br>6.2.1.3<br>6.2.1.1<br>6.2.1.4<br>RPA15 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **06.2** | the total resistance must be less than 20 Ω | allow the total resistance cannot be more than 20 Ω | 1 | AO2 |
| | because the total resistance of the resistors (in parallel) is less than the resistance of the smallest resistor | allow the total resistance of the resistors (in parallel) is less than either resistor | 1 | AO1<br>6.2.2<br>6.2.1.3<br>RPA15 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **06.3** | potential difference = current × resistance<br>**or**<br>$V = IR$ | | 1 | AO1<br>6.2.1.3<br>RPA15 |

Answer 02 · Mark scheme

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| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **06.4** | 480 mA = 0.48 A | | 1 | AO2 6.2.1.3 RPA15 |
| | $V = 0.48 \times 7.5$ | allow a correct substitution of an incorrectly / not converted value for current | 1 | |
| | $V = 3.6$ (V) | allow an answer consistent with their incorrectly / not converted value for current | 1 | |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **06.5** | x-axis labelled resistance of R in Ω **and** y-axis labelled Total resistance (of resistors) in Ω | | 1 | AO2 6.2.1.3 RPA15 |
| | both points plotted correctly | points must be plotted within ½ small square | 1 | |
| | curved line of best fit drawn | allow a line of best fit which ignores an outlier | 1 | |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **06.6** | reading from graph consistent with their line of best fit | allow an answer within ½ small square | 1 | AO3 6.2.1.3 RPA15 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **06.7** | random | | 1 | AO3 6.2.1.3 |

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Answer 02 · Mark scheme

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| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **06.8** | in category A the body water percentage is 61% | allow a value for A between 60% and 62% | 1 | AO3 6.2.1.3 |
| | in category B the body water percentage is 68% | | 1 | |
| | if in category A they have a healthy body water percentage **and** if in category B they have an unhealthy body water percentage | | 1 | |

| **Total Question 6** | **15** |
|---|---|

6.2.2 Series and parallel circuits

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## Question 6

**06.1** Slightly over 35% of students made the correct choice in this question. Some students who used a computer to type their answer did not gain the mark because they typed answers such as 'the ammeter is in series and the voltmeter in parallel' which could have meant either the third or fourth options in the table.

**06.2** Just under one in four students knew that increasing the resistance would cause the current to decrease. Current slowing down was not an acceptable alternative but a reduced rate of flow of charge was accepted. Almost 10% did not attempt the question.

**06.3** Although this question is based on a Required Practical Activity, fewer than 5% of students could suggest how to give negative readings on both of the meters. Many students suggested making changes to the other components in the circuit that would not have the desired effect, such as swapping the positions of the meters, adjusting the variable resistor, or adding more resistors. Others suggested using a 'negative battery'. Around 20% of students made no attempt. A small proportion stated that the direction of the current needed to be reversed but did not describe how the circuit should have been changed to achieve this.

**06.4** This question required the *type* of relationship; around 5% of students could describe the relationship as proportional or directly proportional; about 15% made no attempt.

**06.5** The equation linking current, potential difference and resistance was correctly described by around 35% of students in words or symbols. Many students used lower case letters i, v and r to represent current, potential difference and resistance, which was allowed. Also acceptable was a correct combination of symbols and words. Of those who did not gain the mark, many appeared to be making up their own symbols to represent each of the quantities

**06.6** Full marks were scored by just under a quarter of students, but almost 10% of students made no attempt to calculate the resistance.

6.2.2 Series and parallel circuits

Answer 02 · Examiner comments

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**Question 06 (Standard demand)**

**06.1** Less than 10% of students scored this mark, with over 20% of students not attempting this question. It was very common for those who did attempt the question to place the voltmeter on the left side of the circuit in series with the battery.

**06.2** Only about 5% of students gained 1 mark or more on this question. It was very common for students to think that resistors in parallel have to have the same value or that the unknown resistor must also be 20 ohms. It was also common to think that the values of the resistors added in parallel. Many students thought that the value of the resistors should be multiplied, but that nothing can be multiplied by 20 to make 26. Very few realised that as resistors are combined in parallel, the total resistance decreases.

**06.3** Nearly 90% of students wrote down the correct equation.

**06.4** While nearly three quarters of students used the equation and scored 1 or 2 marks, only a very small proportion of students correctly converted milli-amps to amps and gained all 3 marks on this calculation. It was reasonably common for students to recognise that they needed to do this conversion, but to use a factor of 100 rather than 1000. Some students incorrectly decided to double their answer because there were two resistors, which unfortunately led to them gaining no marks for this question.

**06.5** About four fifths of students gained at least one mark for plotting the graph, but only about 15% gained all three marks. Some students did not label the axes, and a fair proportion labelled them X and Y. Many thought that the line of best fit should be straight rather than curved.

**06.6** Just over a quarter of students gained this mark, which was for reading the value consistent with their line of best fit – whether this was curved or straight – from question 06.5. Many students

who did not score the mark either read from the wrong axis or read values from 4.8 ohms rather than 4.4 ohms because they did not read the scale correctly.

**06.7** Very few students could identify this as a random error. The question was not attempted by about 1 in 10 students. Common wrong answers included human error and mechanical errors.

**06.8** About a fifth of students gained marks, with another fifth not attempting the question at all. It was reasonably common for students to read the percentage from the ends of the lines and base their evaluation on a reading of 80%, which gained no credit.

### Mark Ranges and Award of Grades

Grade boundaries and cumulative percentage grades are available on the Results Statistics page of the AQA Website.