

Commentary on candidate 2 evidence (Batteries)

The evidence for this candidate has achieved the following marks for each section of this course assessment component.

Section	Expected response	Maximum mark	Mark awarded	Commentary
1 Aim	An aim that describes clearly the purpose of the investigation.	1	1	The candidate has carried out two related experiments and so has cited the source of their background physics. This source has been cited (1) and referenced at the end of the report. The date of access has not been included and so the reference is incomplete.
2 Underlying physics	An account of physics relevant to the aim of the investigation.	3	3	The candidate's description of the source of internal resistance, the modelling of a battery, and the relationships used to determine the internal resistance of the battery are at the appropriate level, and mostly correct. Despite the linking of the relationships to the gradient and intercept of the graphs missing intermediate steps, a good understanding is being demonstrated.
3a Brief summary	A brief summary of the approach(es) used to collect experimental data.	1	1	The candidate has briefly summarised what they are measuring in both experiments and has indicated the measuring instruments used. Either summary would be sufficient to be awarded the mark in this section.

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3b Sufficient raw data	Sufficient raw data from the candidate's experiment.	1	0	In each experiment, the candidate's data has six values for the independent variable. The number and range of values is acceptable. The candidate, however, has not repeated measurements and so the data is not sufficient.
3c Data table	Data, including any mean and/or derived values, presented in correctly produced table(s).	1	1	<p>Experiment 1: The candidate has presented the data in a table with correct headings.</p> <p>Experiment 2: The candidate has entered readings and calculated derived values correctly, but has used an incorrect unit in the 'ohm-meter reading' column.</p> <p>The table of data from the first experiment is acceptable, and the mark for this section can be awarded.</p>
3d Relevant data	Data relevant to the experiment from an internet/literature source or data relevant to the aim of the investigation from a second experiment.	1	0	<p>The candidate has included data from a second experiment which is relevant to the aim of the investigation.</p> <p>Again, in this experiment repeated readings have not been taken and so the data is not sufficient.</p>

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3e Citation and reference	A citation and reference for a source of internet/literature data or information.	1	0	The candidate has carried out two related experiments and so has cited the source of their background physics. The source of the internet data has been cited (1) and referenced at the end of the report. The date of access has not been included and so the reference is incomplete.
4a Axes scaled	The axes of the graph have suitable scales.	1	1	The axes of both of the candidate's graphs have suitable linear scales.
4b Axes labels	The axes of the graph have suitable labels and units.	1	1	The axes of both of the candidate's graphs have suitable labels and units.
4c Accurately plotted data points and line of best fit	Accurately plotted data points and, where appropriate, a line of best fit.	1	0	<p>Experiment 1: The candidate's data points are excessively large, in some cases covering more than $\frac{1}{2}$ of the smallest division. It is therefore not possible to check the accuracy of plotting. The line of best fit is not acceptable, the candidate has ignored one data point but has not identified this as a 'rogue' point.</p> <p>Experiment 2: The candidate has incorrectly plotted the second data point on the graph. The line of best fit would be acceptable.</p>

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				In section 4 the candidate is awarded the mark associated with the better graph (experiment 1: 2 marks; experiment 2: 2 marks).
5 Uncertainties	Scale reading uncertainties and random uncertainties.	2	1	<p>The candidate has stated the scale reading uncertainty in each instrument used, presumably \pm the least significant digit for the multimeter in its various operations.</p> <p>The candidate has not repeated measurements and so is unable to calculate random uncertainties in either experiment.</p>
6 Analysis	Analysis of experimental data.	1	0	<p>Experiment 1: The candidate has stated a positive value for the gradient of the graph and not indicated that the gradient of the line of best fit gives $-r$.</p> <p>Experiment 2: The candidate has identified the intercept on the y-axis, but again the candidate has not indicated that the intercept gives $-r$. In addition the candidate's value of 0.45 is incorrect.</p> <p>Neither of the analyses can be awarded marks.</p>

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7 Conclusion	A valid conclusion that relates to the aim and is supported by all the data in the report.	1	0	The candidate has made a statement of the values for internal resistance obtained. The averaging of these values, however, is invalid, and so the stated value 0.5025Ω is not a valid conclusion.
8 Evaluation	Evaluation of the investigation.	3	1	<p>The candidate has made three evaluative statements.</p> <p>The first refers to the precision of measurements made by the meters. Given the scales used in the graphs, it is unlikely that increased precision of measurement would have an effect on the experimental results. In addition, the candidate confuses <i>accuracy</i> with <i>precision</i>.</p> <p>The second suggests taking repeated measurements to allow a random uncertainty to be considered, and comments on the small scale reading uncertainties. Despite the effect that repeated readings could have on the internal resistance of the battery, this is a valid evaluative statement.</p> <p>The third statement suggests experimenting with a second battery to obtain comparative data. This would not lead to an improvement in either of the candidate's</p>

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				experiments, and so is not a valid evaluative statement.
9 Structure	A clear and concise report with an informative title.	1	0	The candidate's report is clear and concise, but the title is not sufficiently informative.
Total		20	10	