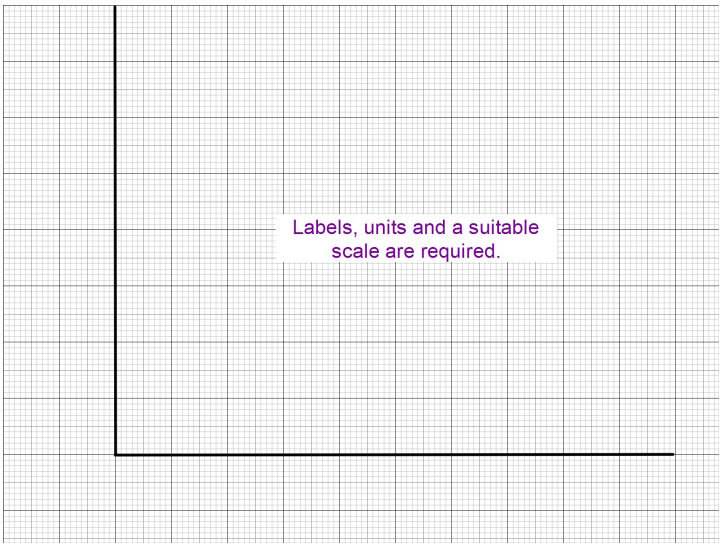

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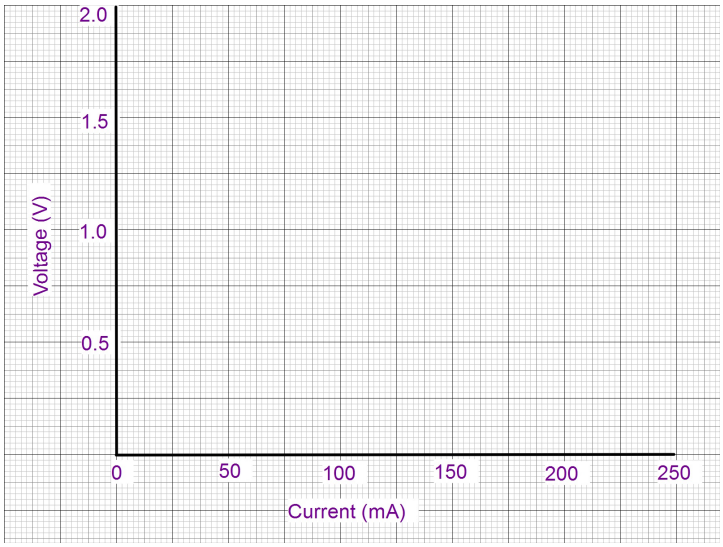

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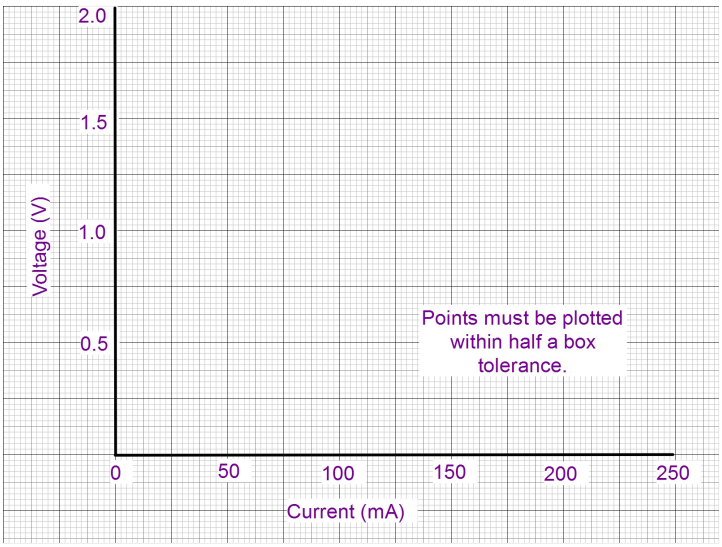

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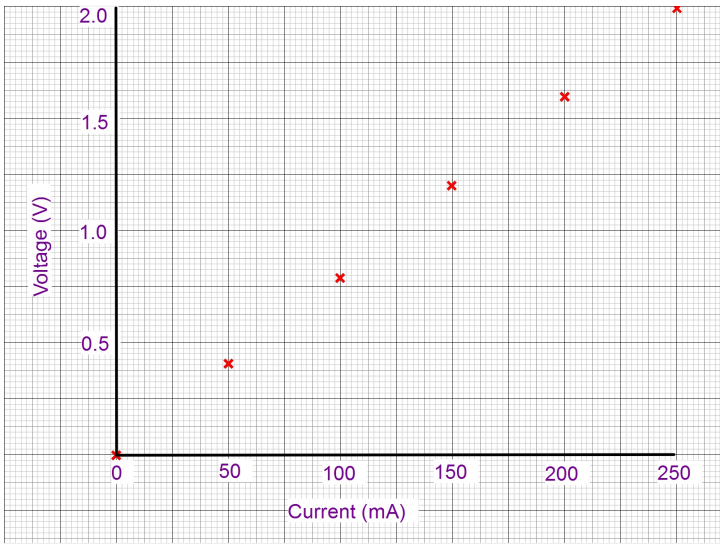

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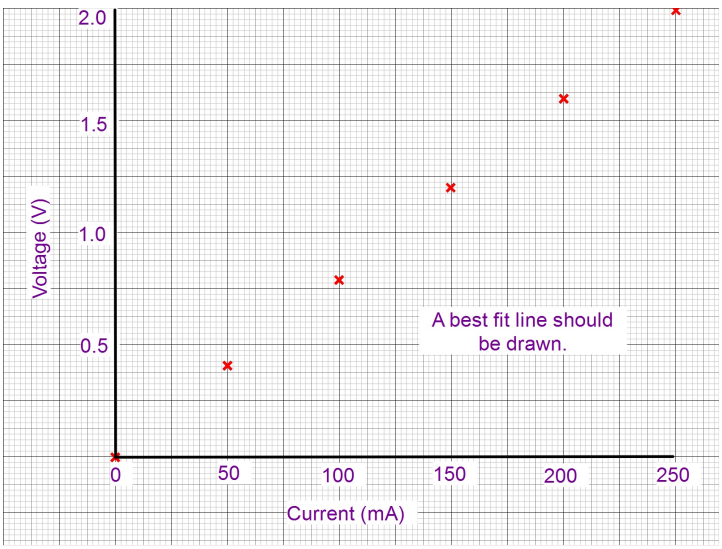

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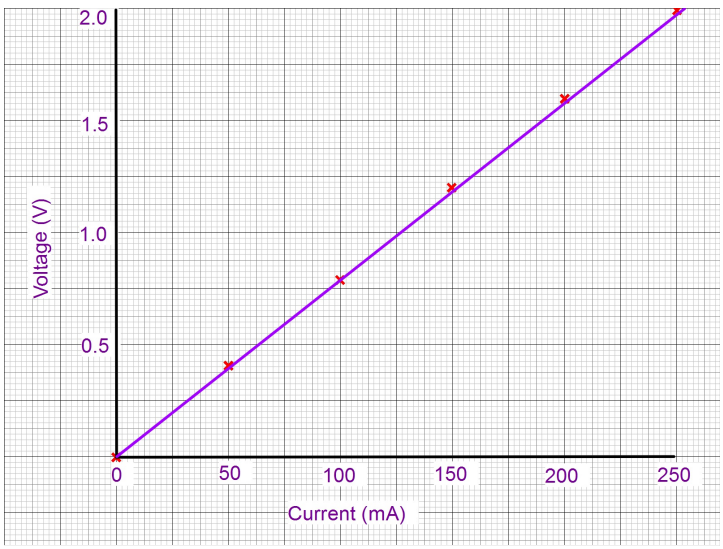

Page 6

Uncertainties

- You must include scale reading uncertainties for all the measurements you have made in your experiment, and calculate the random uncertainty in your repeated measurements.
- If you carried out two experiments, you should include the uncertainties in the measurements from both experiments. Both sets of uncertainties will be marked, and you will be awarded the mark for the better set.

Page 7

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Scale Reading Uncertainties

Page 8

Uncertainties

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Scale Reading Uncertainties

All currents were measured with a digital ammeter so all current measurements have a scale reading uncertainty of **± 1 mA**.

Page 9

Uncertainties

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All voltages were measured with a digital voltmeter so all voltage measurements have a scale reading uncertainty of **± 0.01 V**.

Page 10

Uncertainties

- You must include scale reading uncertainties for all the measurements you have made in your experiment, and calculate the random uncertainty in your repeated measurements.
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Scale Reading Uncertainties

All currents were measured with a digital ammeter so all current measurements have a scale reading uncertainty of **± 1 mA**.

All voltages were measured with a digital voltmeter so all voltage measurements have a scale reading uncertainty of **± 0.01 V**.

Make sure that your scale reading uncertainties make sense when compared to the numbers in your data!

Page 11

Uncertainties

- You must include scale reading uncertainties for all the measurements you have made in your experiment, and calculate the random uncertainty in your repeated measurements.
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Random Uncertainties

Page 12

Uncertainties

- You must include scale reading uncertainties for all the measurements you have made in your experiment, and calculate the random uncertainty in your repeated measurements.
- If you carried out two experiments, you should include the uncertainties in the measurements from both experiments. Both sets of uncertainties will be marked, and you will be awarded the mark for the better set.

Random Uncertainties

Sample calculation for average voltage = 0.41 V:

Page 13

Uncertainties

- You must include scale reading uncertainties for all the measurements you have made in your experiment, and calculate the random uncertainty in your repeated measurements.
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Random Uncertainties

Sample calculation for average voltage = 0.41 V:

$$\Delta V_{random} = \frac{\text{max - min}}{\text{no of readings}} = \frac{0.43 - 0.39}{5} = \mathbf{0.008\ V}$$

Page 14

Uncertainties

- You must include scale reading uncertainties for all the measurements you have made in your experiment, and calculate the random uncertainty in your repeated measurements.
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Average Voltage (V)	Random Uncertainty (V)
0.00	0.00
0.41	0.008
0.79	0.006
1.21	0.004
1.60	0.004
2.00	0.008

Page 15

Uncertainties

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Average Voltage (V)	Random Uncertainty (V)
0.00	0.00
0.41	0.008
0.79	0.006
1.21	0.004
1.60	0.004
2.00	0.008

That is all that is required.

One mark for scale reading uncertainties and one mark for random uncertainties!

Page 16

Data from an internet/literature source or second experiment

- If you carried out a single experiment, you must include data from an internet/literature source that is relevant to your experimental data.
- If you carried out two experiments, you must include the data from your second experiment.

Page 17

Data from an internet/literature source or second experiment

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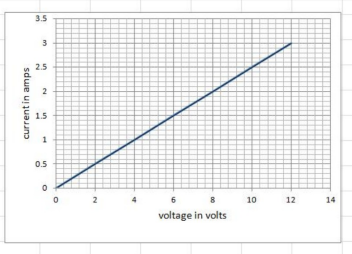
- If you carried out two experiments, you must include the data from your second experiment.

Internet Data (1):

voltage across	current through
V	A
0	0
2	0.5
4	1
6	1.5
8	2
10	2.5
12	3



Page 18

Citation and reference for a source of data/information from the internet/literature

- You must include a reference to a source of data/information.
  - If you carried out a single experiment, your reference must be to the source of data obtained from the internet/literature which is relevant to your experimental data.
  - If you carried out two experiments, your reference must be to a source of information gathered to support your description of the underlying physics.
- You must cite the internet/literature source within the body of the report, near to the relevant data/information, with the reference listed later in the report.
  - If you carried out a single experiment and have included data from an internet/literature source in your report, you must cite this source next to the data.
  - If you carried out two experiments, you must cite your source(s) of the information that supports your description of the underlying physics. This must be cited next to the information.
  - You can cite a source in many ways. One way is to put a number, for example (1), next to the data/information and the same number beside the reference included later in the report.
- You must include the following information in the reference:

Source	Reference
Website	full URL for the page or pages, with date accessed
Journal	title, author, journal title, volume and page number
Book	title, author, page number and either edition or ISBN

Page 19

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References

(1) https://johnvagabondscience.wordpress.com/2010/09/28/resistance-and-ohms-law/ (19th February 2019)

Page 20

Analysis

You must include a discussion of the data from your experiment. In physics this usually involves the calculation of a gradient, the calculation of a constant and/or the calculation of an absolute uncertainty in a final value. If you carried out two experiments, you should include an analysis of both experiments. Both analyses will be marked, and you will be awarded the mark for the better analysis.

Page 21

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$$\text{gradient} = \frac{0.79 - 0}{0.1 - 0} = \mathbf{7.9}$$

Page 22

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$$\text{gradient} = \frac{0.79 - 0}{0.1 - 0} = \mathbf{7.9}$$

The resistance of the resistor is 7.9 Ω.

Page 23

Conclusion

You must state a conclusion that relates to your aim and is supported by all the data included in your report.

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Be careful - make sure that the conclusion fully answers the aim!

Page 25

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Aim: to find out the current affects the voltage across a resistor, and use this relationship to find the resistance.

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Aim: to find out the current affects the voltage across a resistor, and use this relationship to find the resistance.

Conclusion: The resistance of the resistor is 7.9 Ω.

Page 27

Conclusion

You must state a conclusion that relates to your aim and is supported by all the data included in your report.

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Aim: to find out the current affects the voltage across a resistor, and use this relationship to find the resistance.

Conclusion: The resistance of the resistor is 7.9 Ω.

Doesn't fully answer the aim.

Page 28

Conclusion

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Be careful - make sure that the conclusion fully answers the aim!

Aim: to find out the current affects the voltage across a resistor, and use this relationship to find the resistance.

Conclusion: As the current flowing through a resistor increases, the voltage increases. The resistance of the resistor is 7.9 Ω.

Page 29

Conclusion

You must state a conclusion that relates to your aim and is supported by all the data included in your report.

Be careful - make sure that the conclusion fully answers the aim!

Aim: to find out the current affects the voltage across a resistor, and use this relationship to find the resistance.

Conclusion: As the current flowing through a resistor increases, the voltage increases. The resistance of the resistor is 7.9 Ω.

This is almost a good conclusion but a bit more detail is required.

Page 30

Conclusion

You must state a conclusion that relates to your aim and is supported by all the data included in your report.

Be careful - make sure that the conclusion fully answers the aim!

Aim: to find out the current affects the voltage across a resistor, and use this relationship to find the resistance.

Conclusion: The current flowing through and the voltage across a resistor are directly proportional. The resistance of the resistor is 7.9 Ω.

Page 31

Conclusion

You must state a conclusion that relates to your aim and is supported by all the data included in your report.

Be careful - make sure that the conclusion fully answers the aim!

Aim: to find out the current affects the voltage across a resistor, and use this relationship to find the resistance.

Conclusion: The current flowing through and the voltage across a resistor are directly proportional. The resistance of the resistor is 7.9 Ω.

This is a good conclusion!

Page 32

Conclusion

You must state a conclusion that relates to your aim and is supported by all the data included in your report.

Be careful - make sure that the conclusion fully answers the aim!

Aim: to find out the current affects the voltage across a resistor, and use this relationship to find the resistance.

Conclusion: The current flowing through and the voltage across a resistor are directly proportional. The resistance of the resistor is 7.9 Ω.

This is a good conclusion!

(If you say two variables are directly proportional, make sure that your graph is a straight line through the origin).

Page 33

Evaluation

You must make three statements, supported by justification, which evaluate the data/information you have included.

The statements can relate to

- your experimental procedures
- your results
- your uncertainties
- data from your internet/literature source

Two or three of the statements can evaluate your experiment(s). No more than one of your statements can evaluate data from your internet/literature source.

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This can be positive, negative or comparative.

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For example:

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This can be positive, negative or comparative.

For example:

The resistance of the resistor was measured with an ohmmeter and found to be 8.1 Ω so the experiment can be considered a success because it gave an accurate value of resistance.

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Evaluation

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This can be positive, negative or comparative.

For example:

The resistance of the resistor was measured with an ohmmeter and found to be 8.1 Ω so the experiment can be considered a success because it gave an accurate value of resistance.

The random uncertainties were kept low by repeating the experiment five times.

Page 39

Evaluation

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The statements can relate to

- your experimental procedures
- your results
- your uncertainties
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Two or three of the statements can evaluate your experiment(s). No more than one of your statements can evaluate data from your internet/literature source.

This can be positive, negative or comparative.

For example:

A more precise value of resistance could be found by using a voltmeter and ammeter that give numbers to more decimal places. This would reduce the scale reading uncertainty.

Page 40

Evaluation

You must make three statements, supported by justification, which evaluate the data/information you have included.

The statements can relate to

- your experimental procedures
- your results
- your uncertainties
- data from your internet/literature source

Two or three of the statements can evaluate your experiment(s). No more than one of your statements can evaluate data from your internet/literature source.

This can be positive, negative or comparative.

For example:

The experimental and internet data both agree that current through and voltage across a resistor are directly proportional.

Page 41

Section	Description	Marks
Title and structure	An informative title and a structure that can easily be followed.	1
Aim	A description of the purpose of your investigation.	1
Underlying physics	A description of the physics relevant to your aim, which shows your understanding.	3
Data collection and handling	A brief description of an approach used to collect experimental data.	1
	Sufficient raw data from your experiment.	1
	Data from your experiment, including any mean and/or other derived values, presented in a table with headings and units.	1
	Numerical or graphical data relevant to your experiment obtained from an internet/literature source, or raw data relevant to your aim obtained from your second experiment.	1
	A citation for an internet/literature source and the reference listed later in the report.	1
Graphical presentation	The axes have suitable scales.	1
	Suitable labels and units on the axes.	1
	All data points plotted accurately and, where appropriate, line or curve of best fit drawn.	1
Uncertainties	Scale reading uncertainties shown for all measurements and random uncertainty in measurements calculated.	2
Analysis	Discussion of experimental data.	1
Conclusion	A conclusion relating to your aim based on all the data in your report.	1
Evaluation	Three evaluative statements supported by justifications.	3
Total		**20**

Page 42

Page 43

Page 44