Question 2

12 points total

Distribution of points

(a)

i. 5 points

For drawing a circuit with the battery, rod, and ammeter in series (rods can be drawn to look like rods, or schematically as resistors) — 1 point

For drawing the voltmeter parallel to the rod, or indicating that the setting on the power supply will be used — 1 point

For measuring potential difference and current for a rod — 1 point

For measuring the length and diameter of a rod — 1 point

For including multiple trials with appropriate controls — 1 point

Examples: 1) Use one rod and apply different potential differences
2) Use different rods

ii. 2 points

For graphing appropriate quantities whose slope can be used to calculate resistance directly or indirectly — 1 point

For correctly stating how the slope relates to the resistivity — 1 point

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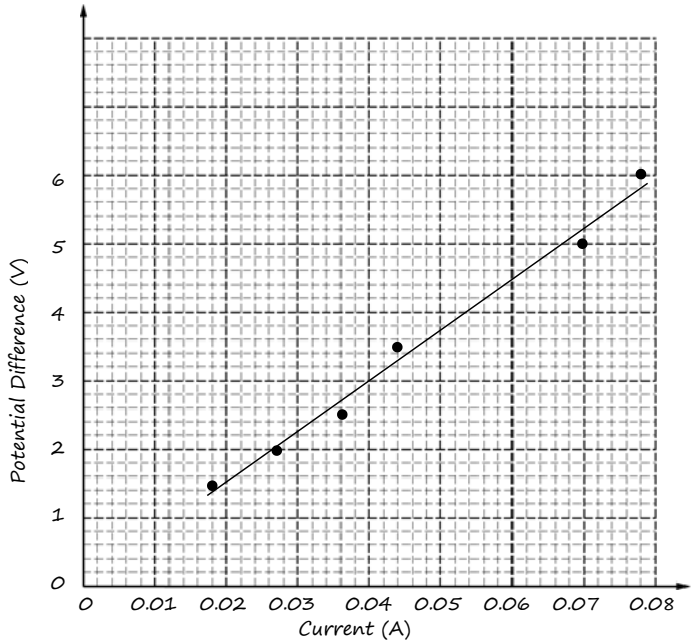
Question 2 (continued)

Distribution of points

(b) 3 points



For plotting the data on the graph with potential difference on one axis and current on the other, labeled with units, using a reasonable scale — 1 point

For a clearly shown calculation of slope from a reasonable best-fit line — 1 point

For a correct answer with units — 1 point

Acceptable range is $70 - 79\ \Omega$.

For a graph of I as a function of V, the slope should end up near $0.013\ \Omega^{-1}$ and the resistance is the inverse

For a graph of V as a function of I, the slope should end up near $74\ \Omega$ and equals the resistance

For the example shown above

$$\text{slope} = \frac{(5.8 - 2.4)\ \text{V}}{(0.078 - 0.032)\ \text{A}} = 73.9\ \Omega$$

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Question 2 (continued)

Distribution of points

(c)

i. 1 point

For indicating that the internal resistance of the power supply will not affect the data acquired, with correct reasoning — 1 point

Example: Because potential difference is measured across each rod, $\Delta V/I$ is not affected by the internal resistance of the battery.

ii. 1 point

For indicating either: — 1 point

The students should be concerned because a change in temperature causes a change in the resistance or resistivity.

OR

The students should not be concerned because any change in resistivity as the temperature increases is small compared to measurement error.