

2. (12 points, suggested time 25 minutes)

A group of students is given several long, thick, cylindrical conducting rods of the same unknown material with various lengths and diameters and asked to experimentally determine the resistivity of the material using a graph. The available equipment includes a voltmeter, an ammeter, connecting wires, a variable-output DC power supply, and a metric ruler.

- (a)
- i. Describe a procedure the students could use to collect the data needed to create the graph, including the measurements to be taken and a labeled diagram of the circuit to be used. Include enough detail that another student could follow the procedure and obtain similar data.

Draw a labeled diagram here.

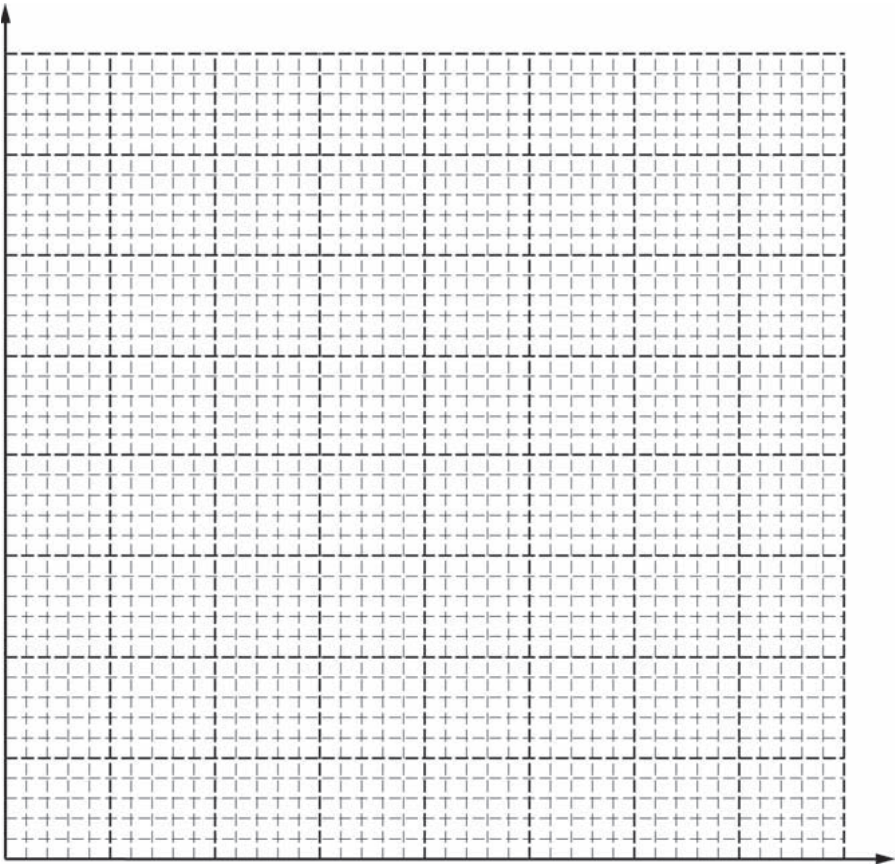
Write your procedure here.
 - ii. Describe how the data could be graphed in a way that is useful for determining the resistivity of the material. Describe how the graph could be analyzed to calculate the resistivity.

The students are now given a rectangular rod of the material, as shown below, whose dimensions are not known. The students are asked to experimentally determine the resistance of the rod. They obtain the data in the table below for the potential difference ΔV across the rod and the current I in it.



ΔV (V)	6.0	5.0	3.5	2.5	2.0	1.5
I (A)	0.078	0.070	0.044	0.036	0.027	0.018

- (b) On the axes below, plot the data so that the resistance of the rectangular rod can be determined from a best-fit line. Label and scale the axes. Use the best-fit line to determine the resistance of the rod, clearly showing your calculations.



- (c) After completing their calculations, the students begin to consider the factors that might have produced uncertainties in their results.
- i. The students realize that they did not take into account the internal resistance of the power supply. Briefly describe how this would affect their value of the resistance of the rectangular rod. Explain your reasoning.
 - ii. The students realize that they did not take into account a possible change in the temperature of the cylindrical rods. Should the students be concerned about this? Explain why or why not.