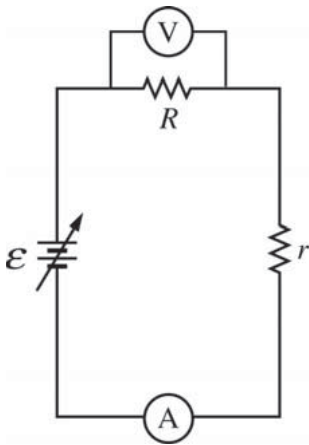




E&M.2.

The circuit shown above consists of a source of variable emf $\mathcal{E}$, an ideal ammeter A, an ideal voltmeter V, a resistor of resistance R , and a sample of wire with resistance r .

(a) How does the current through the wire sample compare with the current through the resistor R ?

- ☐ It is greater through R .
- ☐ It is greater through the sample.
- ☐ It is the same through both.
- ☐ It depends on the resistance of the sample.

Justify your answer.

(b) How does the potential difference across the wire sample compare with the potential difference across the resistor R ?

- ☐ It is greater across R .
- ☐ It is greater across the sample.
- ☐ It is the same across both.
- ☐ It depends on the resistance of the sample.

Justify your answer.

With the sample of wire in place, the emf of the source is set to a given value. The current through and potential difference across the resistor R are measured. This is repeated for several values of emf, and the data are recorded in the table below.

$\mathcal{E}$ (V)	V_R (V)	I_R (A)		
0.250	0.179	0.162		
0.500	0.335	0.327		
0.750	0.520	0.490		
1.000	0.670	0.687		

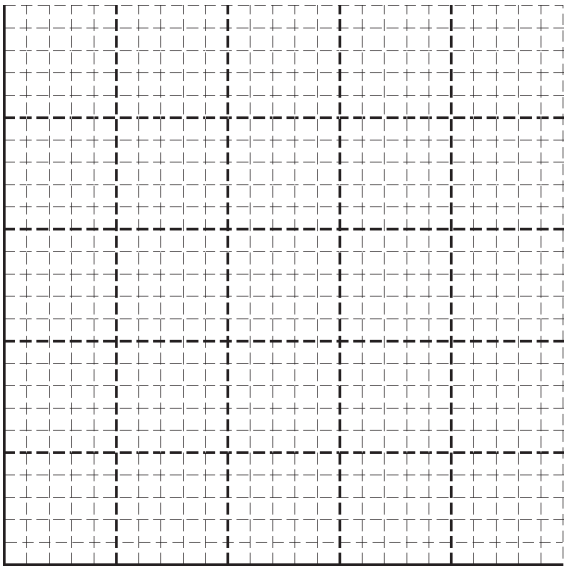
(c) Indicate below which quantities should be graphed to yield a straight line that could be used to calculate a numerical value for the resistance of the wire sample.

Horizontal axis: _____

Vertical axis: _____

You may use the remaining columns in the table above, as needed, to record any quantities that you indicated that are not given.

(d) On the grid below, plot the straight line data points from part (c). Clearly scale and label all axes, including units if appropriate. Draw a straight line that best represents the data.



(e) Use your straight line to calculate the value of the resistance of the wire sample.

(f) The wire sample has a length of 3.00 m and a radius of 1.00×10^{-3} m . Calculate the resistivity of the material from which the wire sample is made.

(g)

i. Suppose the ammeter used to collect these data was not ideal. Would the actual value of the resistance of the wire sample be greater than, less than, or equal to that calculated in part (e) ?

- ☐ Greater than
- ☐ Less than
- ☐ Equal to

Justify your answer.

ii. If the ideal voltmeter is replaced by a voltmeter that is not ideal and the experiment is repeated, would the readings of the ideal ammeter be greater than, less than, or equal to those in the data chart before part (c) ?

- ☐ Greater than
- ☐ Less than
- ☐ Equal to

Justify your answer.