

# DC Circuits

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# Introduction

- Graphite is a conductor
- Used in batteries, solar panels, and most commonly pencil lead
- **Determine whether the PHET simulation accurately measures the resistance of a circuit in the presence of a graphite pencil**
- IV: Voltage, DV: Current



# Equations

$$I = V/R \text{ (current)}$$

$$V = IR \text{ (voltage)}$$

$$R = V/I \text{ (resistance)}$$

$$R = \frac{\rho L}{A}$$

$\rho$  = resistivity

$L$  = length

$A$  = cross sectional area



# Hypothesis

**If we test the resistivity of a graphite pencil in theory, this will match the total resistance of a graphite pencil in a series circuit on the PHET simulation.**



# Methods

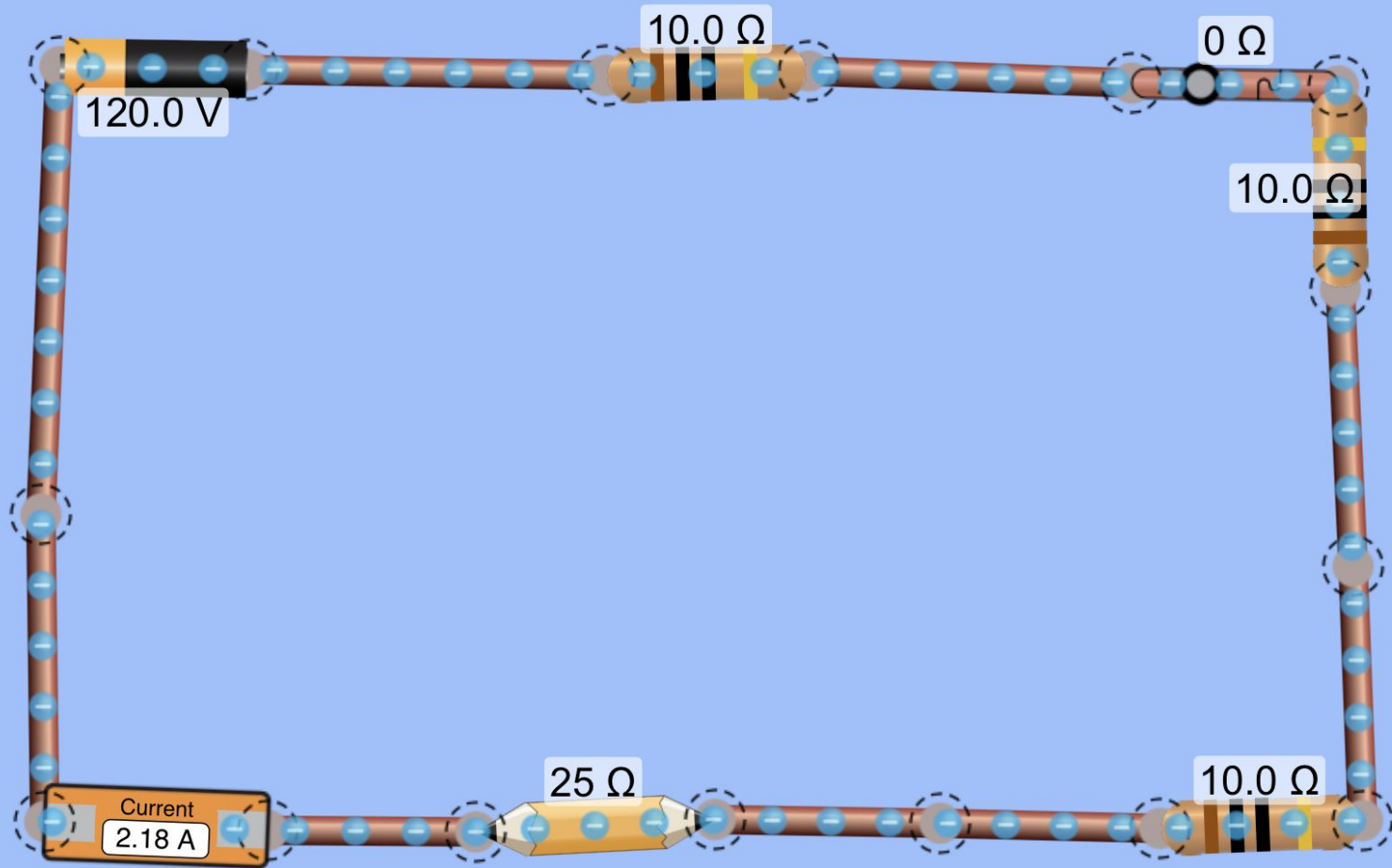
## Virtual DC Circuit

- Construct a virtual DC Circuit using three 10 ohm resistors, a battery with voltages ranging from 120-70 volts, copper wiring, and a graphite pencil
- Arrange resistors in parallel with the graphite pencil placed after the third resistor
- Use a voltmeter to calculate the voltage going into the Pencil
- Use an Ammeter to calculate the current going through the pencil
- Calculate resistance using seven different points to ensure accuracy

## Resistance of Graphite in reality

- Use scientific articles to find data on the resistance of graphite in pencils
- Use formula of resistivity to find theoretical resistance

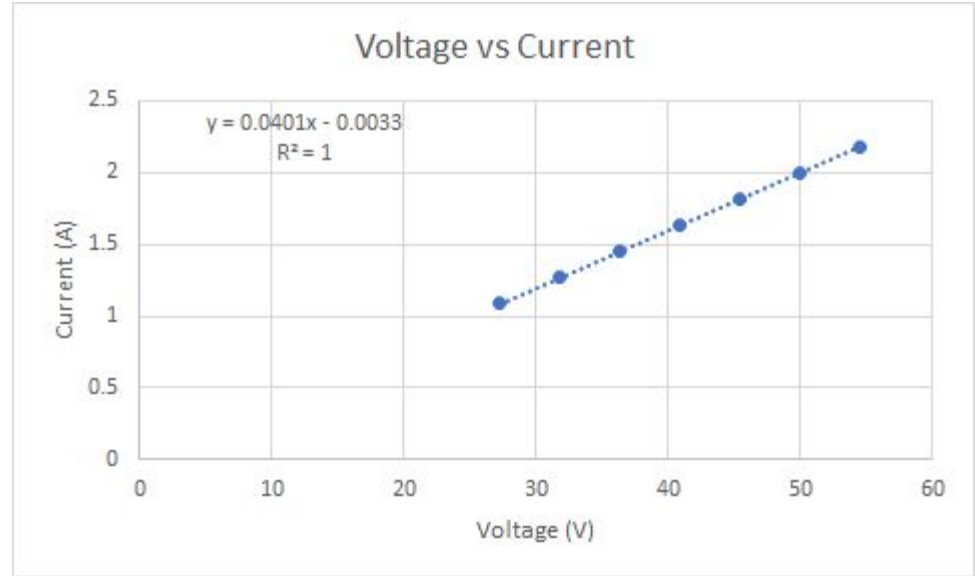




# Results

Voltage (V)	Current (A)
54.55	2.18
50	2
45.45	1.82
40.91	1.64
36.36	1.45
31.82	1.27
27.27	1.09

**Table 1.** The table above displays the raw collected data of 7 different voltages



**Figure 1.** The graph above shows the relationship between Voltage (V) and Current (A)

$$R=V/I$$

Ex.  $50/2= 25$  ohms

-Theoretical range for resistance of a graphite is 6-25 Ohms





# Discussion

- **If we test the resistivity of a graphite pencil in theory, this will match the total resistance of a graphite pencil in a series circuit on the PHET simulation- correct**
- The resistance from the circuit fell within the range of resistances from graphite in reality
- Results give implications for further research and experiments with virtual circuits
- These results can be used to improve and test circuits in practical settings and give opportunity for those in non-research environments to have realistic research experience



# Limitation

- Can not quantify cross sectional area and length in online simulation tool.

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