Investigating resistance

Power Smart for Schools

Name: _____ Date: _____

Challenge

To construct series and parallel circuits with resistors, measure their respective voltages and current, and use Ohm's law to calculate resistance.

Critical question

How does resistance vary in series vs. parallel circuits? Why?

_____

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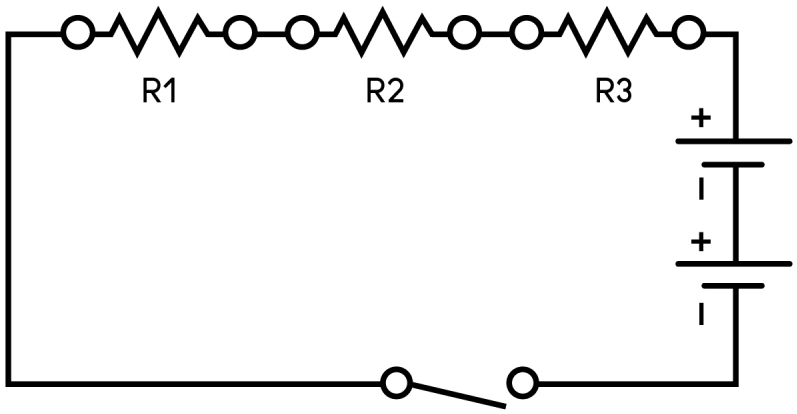
Materials

- 2 dry cell holders
- 2 dry cells
- conducting wires
- 3 resistors of different sizes (100 to 1,000 ohms)
- switch
- voltmeter
- ammeter

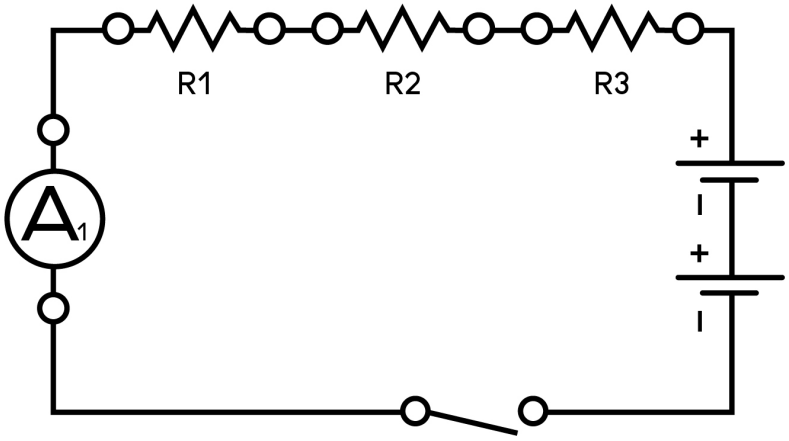
Instructions

PART A

1. Construct a series circuit as shown below. Record the value of the resistors used in Table A.



2. Close the switch and measure the current with an ammeter at position A1. Record this measurement in Table A.
Note: Be sure to convert milliamperes (mA) to amperes (A).



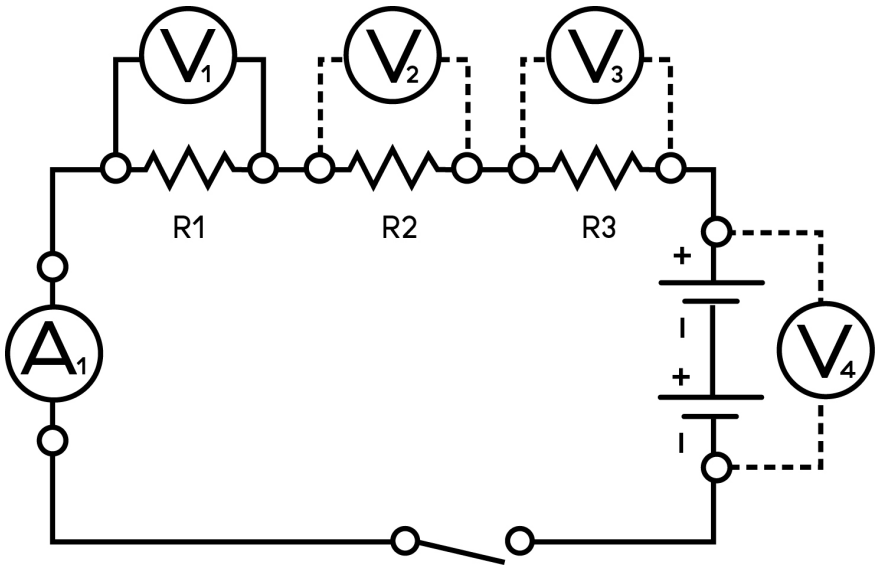
3. Using a voltmeter:

a. Measure and record the voltage across resistor 1 (at V1).

b. Remove the voltmeter and measure the voltage across resistors 2 and 3 (at V2 and V3).

c. Remove the voltmeter and connect it across the two dry cells (at V4).

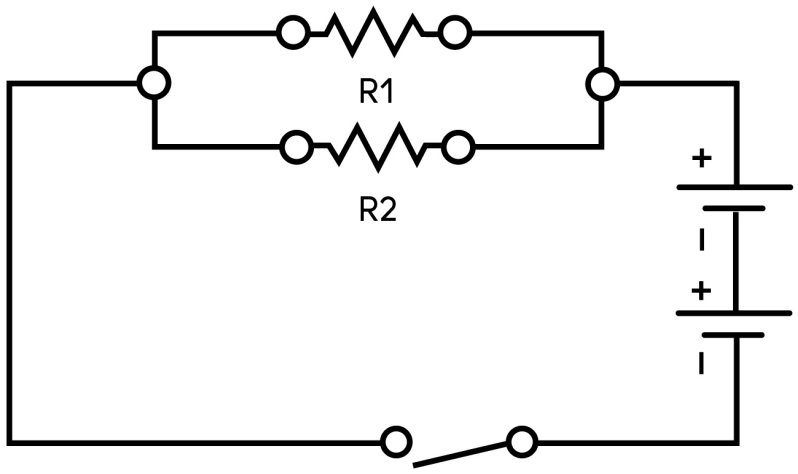
d. Record all measurements in Table A.



4. Open the switch and disassemble your series circuit.

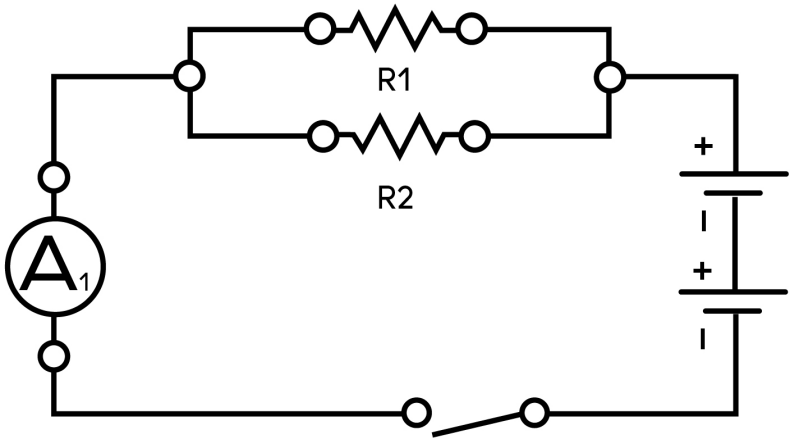
PART B

1. Construct a parallel circuit as shown below using any two of your three resistors. Record the value of these resistors in Table B.

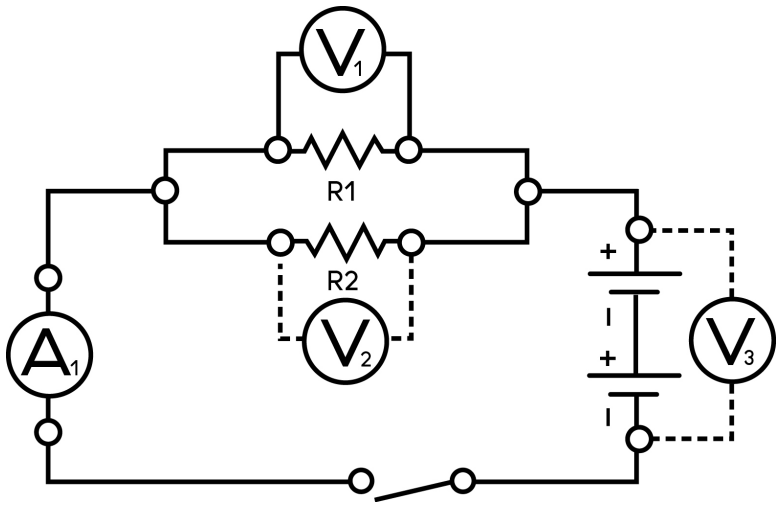


2. Close the switch and measure the current with an ammeter at A1. Record this in Table B.

3. Using a voltmeter, measure and record the voltage across each of the resistors (at V1 and V2) and the dry cells (at V3) in turn. Record these measurements in Table B.



4. Open the switch and disassemble the parallel circuit. Clean up and return your materials as directed by your teacher.



5. Complete your analysis and conclusions.

Observations

TABLE A — SERIES CIRCUIT MEASUREMENTS

Resistance (Ω)	Voltage (V)	Current (A)
Resistor 1 =	Voltage across R_1 =	Total current leaving the dry cells =
Resistor 2 =	Voltage across R_2 =	
Resistor 3 =	Voltage across R_3 =	
	Voltage across dry cells =	

TABLE B — PARALLEL CIRCUIT MEASUREMENTS

Resistance (Ω)	Voltage (V)	Current (A)
Resistor 1 =	Voltage across R_1 =	Total current leaving the dry cells =
Resistor 2 =	Voltage across R_2 =	
	Voltage across dry cells =	

Analysis

1. Calculate the total resistance of your series circuit using Ohm's law (R = V / I). Be sure to use the voltage across the dry cells. Show your work.

R = _____

2. How does the resistance calculated above compare to that of the individual resistors used in the circuit?

3. How does the voltage compare across each resistor in a series circuit?

4. Add the voltages from across each of the resistors. How does this total compare to the voltage of the dry cells?

5. Using Ohm's law, calculate the total resistance of your parallel circuit. Be sure to use the voltage across the dry cells as V in your calculation.

R = _____

6. How does the resistance calculated above compare to that of the individual resistors used in the parallel circuit?

7. How does the voltage compare across each resistor in a parallel circuit?