

Name: _____ Date: _____ Period: **B**

Partner #1: _____

Partner #2: _____

Overview

Students will work in teams of 2 or three to build circuits, measure values for voltage, current, and resistance, and compare the measured values to values that they calculate using Ohm's Law.

Objectives

- Students will gain a better understanding of how power, voltage, current, and resistance relate to each other in both series and parallel circuits.

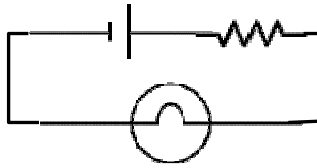
Materials

Each team will need access to (sharing components or tools is encouraged):

- Multi-meter
- Wires
- Dry cell batteries (any voltage is ok, up to 9 V)
- Resistors (should be 5 Ω or greater resistance)
- Small bulbs (and cradles for them)

Procedures

1) Build the following circuit:



2) Using the multi meter, measure the following:

Resistance of resistor	Resistance of bulb	Voltage of battery
Ω	Ω	V

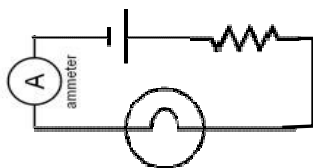
3) Calculate the total resistance of the circuit. To find the total resistance of a series circuit, add the resistances of the devices together: $R_{total} = R_{resistor} + R_{bulb}$:

Calculated total resistance of series circuit:	Ω
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4) Calculate the current that should be in the circuit. For a series circuit: $I = \frac{V}{R_{total}}$.

Calculated total current in series circuit:	A
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5) Modify your circuit by adding an ammeter to it. (Your multi-meter can be used to measure current.) Measure the actual current flowing in the circuit.



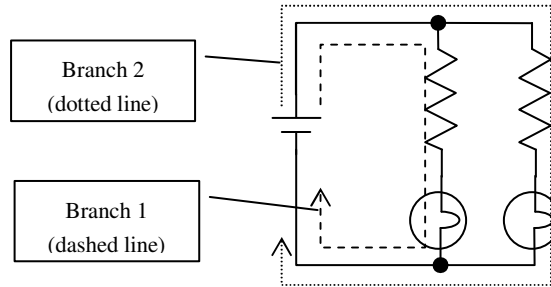
Measured current:	A
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6) Calculate the experimental error of your current. The formula to use is:

$$experimental\ error\ (in\ \%) = 100 \times \frac{actual\ value - calculated\ value}{calculated\ value}$$

Experimental error of Total Current:	%
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7) Build the following circuit:



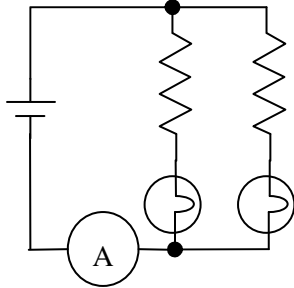
8) Using the multi-meter, measure the following:

Battery Voltage	Branch 1 resistor	Branch 1 bulb	Branch 2 resistor	Branch 2 bulb
V	Ω	Ω	Ω	Ω

9) Calculate the expected current in each branch and the total current in the circuit.

$I_{branch1} = \frac{V}{R_{resistor1} + R_{bulb1}}$	$I_{branch2} = \frac{V}{R_{resistor2} + R_{bulb2}}$	$I_{total} = I_{branch1} + I_{branch2}$
A +	A =	A

10) Modify your circuit by inserting an ammeter next to the battery. Measure the actual total current in the circuit.



Measured total current in parallel circuit:	A
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11) Calculate the experimental error of your total current. Use the formula:

$$experimental\ error\ (in\ \%) = 100 \times \frac{actual\ value - calculated\ value}{calculated\ value}$$

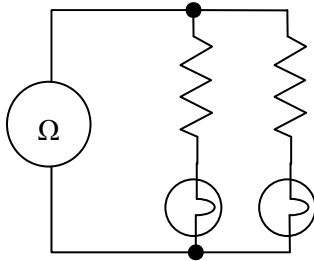
Experimental error of Total Current:	%
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12) Calculate the total resistance of the circuit built in step 7). There are two ways to calculate the total resistance. They should be equal, or nearly so (within rounding errors).

Method #1: $R_{total} = \frac{V_{circuit}}{I_{total}}$	Ω
Method #2: $\frac{1}{R_{total}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \dots$	Ω

13) If there is any difference between the values for total resistance between method #1 and method #2, what do you think the sources of the differences might be?

14) Modify your circuit by replacing the battery with an ohmmeter. Measure the actual total resistance of the circuit.



Measured total resistance of parallel circuit:	Ω
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15) Calculate the experimental error of your total resistance. Do this for both calculated values
Use the formula:

$$\text{experimental error (in \%)} = 100 \times \frac{\text{actual value} - \text{calculated value}}{\text{calculated value}}$$

Experimental error of Total Resistance: (using method #1 calculated value of R_{total} .)	%
Experimental error of Total Resistance: (using method #2 calculated value of R_{total} .)	%