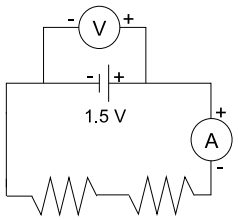
15 Electrical Circuits

Name_____

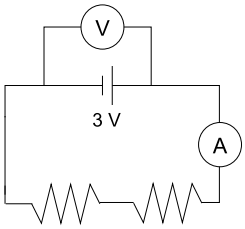
Lab B: OHM'S LAW

AP Physics B

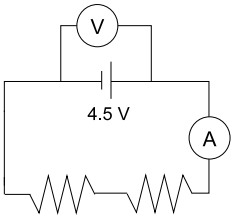
In this lab, you will experiment to discover the relationship between voltage, current, and resistance. We will begin by examining how voltage affects current when resistance is held constant. Connect circuits 1, 2, and 3. Set the power supply as indicated. Measure and record in Table I the voltage (V) and the current (I) for each. (Measure the voltage - do not assume it is what you set on the supply.)



Circuit #1: Voltage Set at 1.5V



Circuit #2: Voltage Set at 3V



Circuit #3: Voltage Set at 4.5V

Table I - Voltage and Current Data

READ THE METERS TO THE LIMIT OF THEIR PRECISION

Circuit	Voltage (V)	Current (A)	Resistance (Ω)
1			
2			
3			

1. What was the independent variable in this experiment? EXPRESS VERBAL ANSWERS IN COMPLETE SENTENCES

2. What was the dependent variable?

Use the computer to construct a graph of your data. Place the independent and dependent variables on the appropriate axes. Have Mr. M check your results before printing any graphs. Save your data as "H#G#L15B", replacing # with the correct numbers.

3. The shape of your graph indicates the relationship between voltage and current. What is that relationship?

4. Use the program's regression line capability to fit a line to your graph. Write out the complete linear equation relating voltage (V) and current (I), inserting the slope and y-intercept numbers rounded to the proper precision.

5. The slope of the graph is related to what was held constant in the experiment. Identify the proper relationship and use it to re-write your equation in purely symbolic form.

6. We will consider your graph's slope to be a "measured" value. The supposed value of the resistors, modified according to your answer to question 5, can provide a theoretical value for what the slope should have been. Compute the percentage error between those values. Express your final answer with the appropriate precision.

SHOW YOUR WORK

$$\%\ \text{error} = \frac{|\text{measured} - \text{theoretical}|}{\text{theoretical}} \times 100$$

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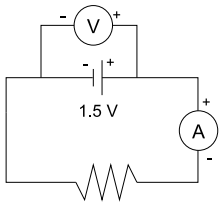
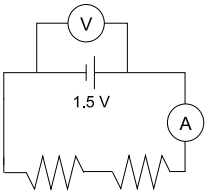
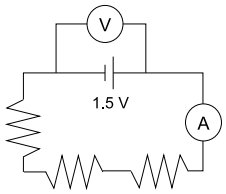
Next we will examine how resistance affects current when voltage is held constant. Connect circuits 4, 5, 6, and 7. **BE SURE TO SET THE VOLTAGE AT 1.5V.** Record all data in Table II, reading the meters to the limits of their precision.



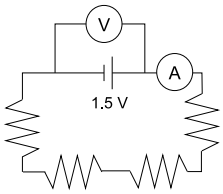
Circuit #4



Circuit #5



Circuit #6



Circuit #7

EXPRESS VERBAL ANSWERS USING SENTENCES

Table II - Resistance and Current Data

Circuit	Voltage (V)	Current (A)	Resistance (Ω)
4			
5			
6			
7			

7. Now what was the independent variable?

8. Now what was the dependent variable?

Again construct an appropriate graph on the computer. Have Mr. M check your results before printing any graphs. Save your data as "H#G#L15C", replacing # with the correct numbers.

9. The shape of your graph indicates the relationship between resistance and current. What is that relationship?

10. You cannot perform a linear fit to a curve. Select your data points and then use the "Analyze" menu's "Automatic Curve Fit" option to fit the appropriate type of curve to your data. What type of fit did you select?

11. The computer will provide the necessary constant(s) for your curve. Write out the complete equation relating resistance (R) and current (I), inserting the appropriate rounded constants.

12. The constant in your equation is related to what was held constant in the experiment. Identify the relationship and re-write your equation in purely symbolic form.

Your answers to questions to 5 and 12 should be mathematically equivalent. If they are not, ask Mr. M for assistance.

13. Use the constant for your new graph and its average theoretical value from Table II to calculate a percentage error.
SHOW YOUR WORK

14. You have discovered a relationship known as Ohm's Law. It states that the current in a circuit is

_____ to the _____

and _____ to the _____.

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