PHYSICS IN MOTION
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Unit 5F
Ohm's Law
Ohm's Law Lab

Name:

Date:

Imagine you have traveled back in time to the year 1827 to the lab of German physicist Georg Ohm. As one of Dr. Ohm's new assistants, you want to demonstrate the progress made in the lab connecting voltage, current, and resistance. The trouble is, almost nobody believes Dr. Ohm's claims. Desperate to confirm these great discoveries, you invite members of the press to witness an experiment that you hope will settle the matter once and for all.

As your guests arrive, you get them into the spirit of the visit by challenging them to a friendly competition over who can illuminate a light bulb first. Fortunately, you brought the materials back in time with you!

Part One: Connecting an Electrical Circuit

Materials:

- wire
- AA battery
- small lightbulb

Procedure:

Use a stopwatch to measure how long it takes to make the bulb light up.

1. What is the main difference between the setups that light the bulb and those that do not?

_____

_____

_____

Part Two: Demonstrating Ohm's Law

Now you turn to the main event: supporting the claims Dr. Ohm has made relating voltage, current, and resistance. Again suppose you brought the necessary materials with you into the past.

Materials:

- 3 resistors: 50 Ω, 100 Ω, 1000 Ω
- variable power supply that can provide at least 10 V
- ammeter to measure current
- voltmeter to measure voltage
- wire connections

questions continued on next page

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gpb.org/physics-motion

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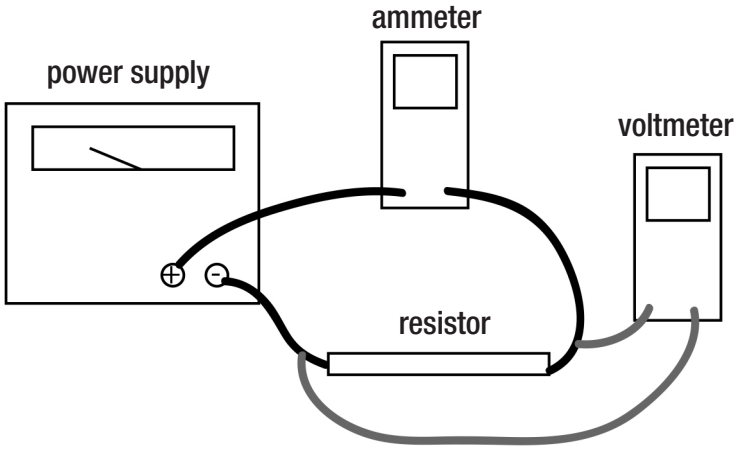
Name:

Date:

Procedure:

a. Choose one of the resistors and connect the circuit as shown below. Make sure the power supply, voltmeter, and ammeter are powered off.



b. After the components are wired up, have your lab teacher check the circuit before turning on the power supply.

1. Why is the ammeter part of the main circuit loop but the voltmeter is not?

_____

_____

The voltmeter is set to have very high internal resistance. That way it can measure voltage without disrupting the original circuit by drawing lots of current.

c. Turn on the voltmeter and set it to read 20 V DC.
d. Turn on the ammeter and set it to read 10 A.
e. Turn on the power supply and adjust it until the voltmeter reads 0.5 V.
f. Read the current displayed on the ammeter and enter the value into the table below:

Resistance = _____ Ω																		
V	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	9	10
I																		

questions continued on next page

Unit 5F
Ohm's Law
Ohm's Law Lab

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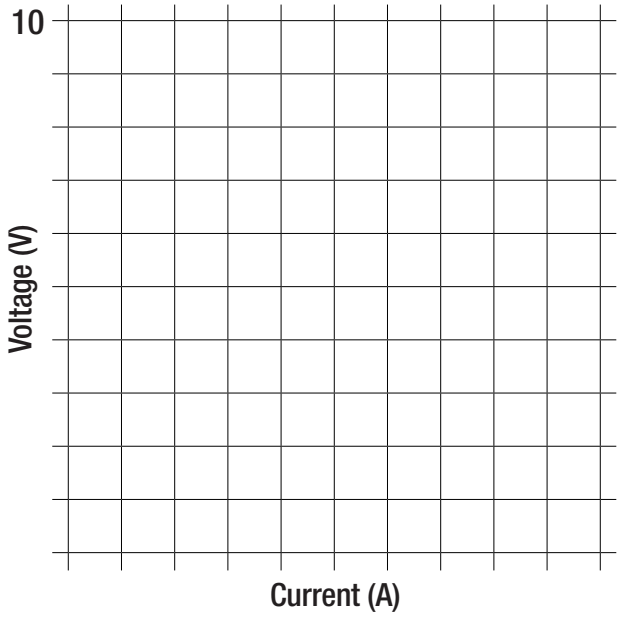
Date:

g. Adjust the power supply until the voltmeter registers the prescribed voltage in the table, and enter the associated ammeter reading.

h. To illustrate the relationships visually on a graph for your audience, plot voltage on the vertical axis versus current on the horizontal axis below:



2. What is the functional shape of the plot: linear, quadratic, sine curve, or logarithmic?

3. Based on your answer, what mathematical equation describes the curve? Which measured values go with each of the variables within the equation?

questions continued on next page

Unit 5F
Ohm's Law
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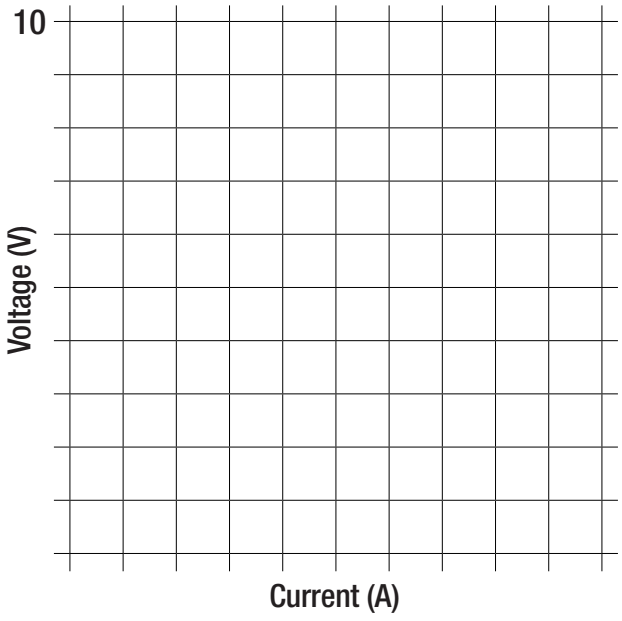
Date:

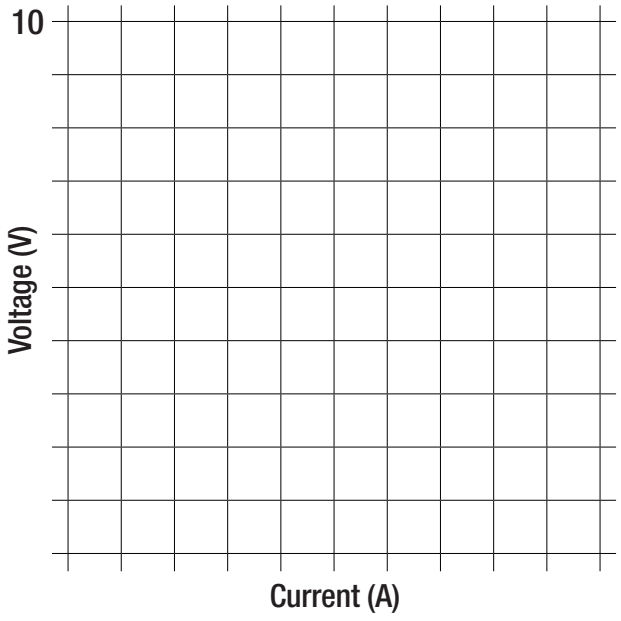
i. Now, turn off the power supply, remove the current resistor and put one of the other two resistors in its place, then turn the power supply back on. Repeat the previous process for each of the two additional resistors and enter the ammeter readings in the table below:

Resistance = _____ Ω																		
V	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	9	10
I																		

Resistance = _____ Ω																		
V	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	9	10
I																		

j. Plot voltage versus current curves for these resistors below. Be sure to label each plot with the corresponding resistor value used.





questions continued on next page

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gpb.org/physics-motion

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Your visitors are starting to get restless for results. It's now time to show them what Dr. Ohm discovered.

4. **On each graph, write a formula that relates voltage (V) to current (I). If they are connected by a constant include the units of that constant as well.**

   For the first resistor, the constant is: _____

   For the second resistor, the constant is: _____

   For the third resistor, the constant is: _____

5. **Compare the three constants to the corresponding resistor values. What is the percent error for each resistor?**

_____

6. **Write a general equation that relates voltage (V), current (I), and resistance (R).**

7. **That concludes your demonstration to the press! To help them create tomorrow's news, write a brief article on your findings. Include the five Ws (who, what, where, why, how) and an explanation of both the experimental process and the summary equation you derived.**

_____

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