

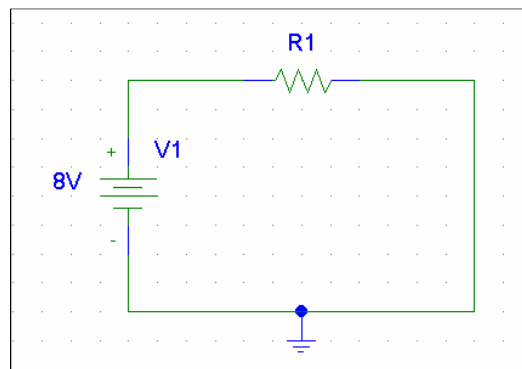
**LAB #5: Ohm's Law Pt. 2**

In this lab Ohm's Law will be explored in more depth. It will be demonstrated that when any one variable is fixed (a value is selected),  $V = I \times R$  can be used to solve for the other two. For example, given a current of 1 mA, there are many combinations of voltage and resistance that produce 1 mA (i.e. 1V and 1k $\Omega$ , 2V and 2k $\Omega$ , etc.). When one variable is fixed, values that satisfy Ohm's law will be found both mathematically and experimentally. These results will be plotted and the plots will be further analyzed.

NOTE: Include units when writing values. Please answer questions in complete sentences.

**Part I**

In this section, the relationship between resistance and current will be explored further by measuring current for various resistors. Ohm's Law will be used to validate the findings.



- 1) Complete the following table given R1 and a fixed voltage of 8V for V1. For the resistor R1, substitute it for each of the following resistors and measure the current for each.

TABLE 1 (12 pts.)

V1 (Volts)	R1 (Ohms)	I Measured (Amps)
8	470	
8	1 k	
8	2.2 k	
8	3.3 k	

- 2) Using the measured values for current, plot a curve on the logarithmic graph paper provided. (5 pts.) *The resistance values are x-axis, and the current measurements are the y-axis.* This trend represents all the possible current values for every resistor at 8V. From this plot, the current for any resistor at 8V can be determined.

- 3) When the values of current and resistance are plotted on the logarithmic scale, what kind of function results? (Polynomial, linear, exponential) (3 pts.)
- 4) Using the graph, estimate what resistor value is required to obtain a current of 20 mA? (3 pts.)
- 5) Using the graph, what resistor value is required to obtain a current of 2 mA? (3 pts.)
- 6) Using the graph, if a resistor of  $400\Omega$  is used, what would the current be? (3 pts.)
- 7) What law could be used to verify the answers from questions 2, 3 and 4? (3 pts.)
- 8) Calculate the currents using Ohm's Law to fill in the table. Then plot the points on your graph using an "X". *The plotted points should fall on or near the line.*

TABLE 2 (8 pts.)

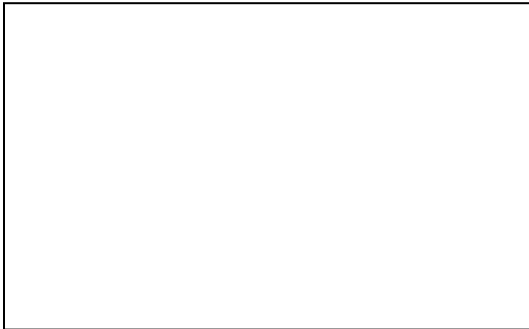
V1	R1 (Ohms)	Current (I)
8V	100	
8V	800	
8V	1.1 k	
8V	4.0 k	

**PART II**

Design a circuit using one Resistor and one Power Supply (NOT TO EXCEED 10V) that will produce a current of 2.5 mA. The resistor used should be one that is available in lab. *The maximum resistance will be 10V/2.5mA*

**CALCULATIONS**

- 1) What resistor was selected (include tolerance)? (3 pts.) \_\_\_\_\_
- 2) What are the maximum and minimum resistance values? (2 pts. each)  
MIN: \_\_\_\_\_ MAX: \_\_\_\_\_
- 3) What voltage will be used? (3 pts.) \_\_\_\_\_
- 4) Using Ohm's Law, what is the calculated current? (3 pts.) \_\_\_\_\_
- 5) Using the tolerance of the resistor selected, what is the **maximum current** expected?  
(To find maximum current use the minimum resistance) (3 pts.) \_\_\_\_\_
- 6) What is the **minimum current** expected? (3 pts.) \_\_\_\_\_
- 7) Draw the circuit and write measurements in the spaces provided. Be sure to label the values of the circuit drawing. (10 pts.)



**MEASUREMENTS**

Voltage: \_\_\_\_\_ (use digital multimeter)

Resistance: \_\_\_\_\_ (use digital multimeter)

Current: \_\_\_\_\_ (use digital multimeter)

- 8) Is the measured current within the range calculated, why **or** why not? (3 pts.)
- 9) When designing the circuit is it better to select the voltage or the resistance first? Why? (3 pts.)

**PART III**

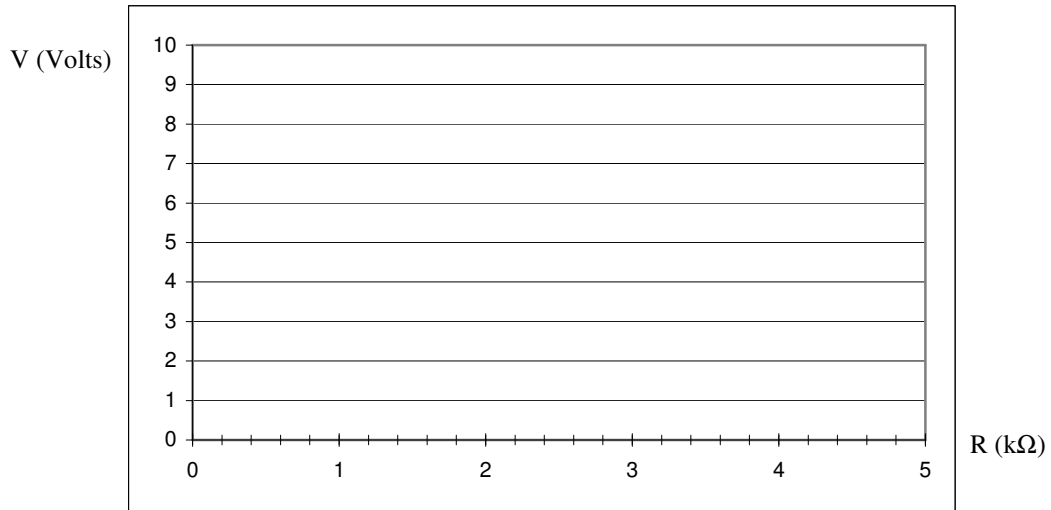
- 1) Find three other voltage and resistance values that would also create a current of 2.5 mA. Use resistances less than 3.9 kΩ and voltages less than 10 V. *Select either the voltage or resistance and then calculate the other.* (12 pts.)

1. Resistance: \_\_\_\_\_ Voltage: \_\_\_\_\_

2. Resistance: \_\_\_\_\_ Voltage: \_\_\_\_\_

3. Resistance: \_\_\_\_\_ Voltage: \_\_\_\_\_

- 2) Using the resistances and voltages above, plot them on the following graph. (5 pts.)



- 3) The plot should be a straight line, showing linear relationship between voltage and resistance. What is the slope of the line? (*Slope = Rise over Run or Rise/Run*) (3 pts.)

\_\_\_\_\_

- 4) What is the connection, if any, between the slope of the line and the current of this example? (3 pts.)

- 5) Write the equation of the line in terms of V and R? (*Recall the equation for a line is  $y=mx+b$  where  $m$  is the slope and  $b$  is the y-intercept.*) (3 pts.)

\_\_\_\_\_

- 6) In a sentence, list all of the equipment that was used in the lab today. (3 pts.)

- 7) What was the objective of this lab? (3 pts.)

NAME: \_\_\_\_\_

### LOGARITHMIC GRAPH

2 3 4 5 6 7 8 9      20 30 40 50 60 70 80 90      200 300 400 500 600 700 800 900      2000 3000 4000 5000 6000 7000 8000 9000

