LAB 7 OHM'S LAW R.E. Tremblay

Purpose: To investigate Ohm's law

Before proceeding, you might want to view the lecture on Ohm's Law.

Materials: DC power supply , voltmeter(0-10 V dc), amp-meter(0-500milliamp), connecting wires, Rheostat (Variable resistor), Decade Resistance Box.

Discussion: In this lab, we will verify the relationship between voltage resistance and current in a simple circuit Ohm's law states that , $I = \frac{V}{R}$

where 'I' is the current measured in amps and 'R' is the resistance measured in ohms. Current, I is defined as amount of charge per unit time that moves through a conductor. Using symbols, the definition of current is as follows: $I \equiv \frac{q}{t}$.

'V' is the voltage measured in volts. Voltage is often referred to as the electrical potential difference between two places on a conductor. Voltage is defined as the amount of energy per unit charge that flows through a conductor. Using symbols, $V \equiv \frac{E}{q}$.

Ohm's law tells us how the current is effected by voltage and resistance.

$I = \frac{V}{R}$ predicts that the current through a resistor is directly proportional to the voltage across the resistor and inversely proportional to the resistance.

In the circuit below, R_1 is a variable resistor, sometimes called a rheostat. The second resistor 'R_2' , is a Decade Resistance Box used to predetermine various values for R_2.

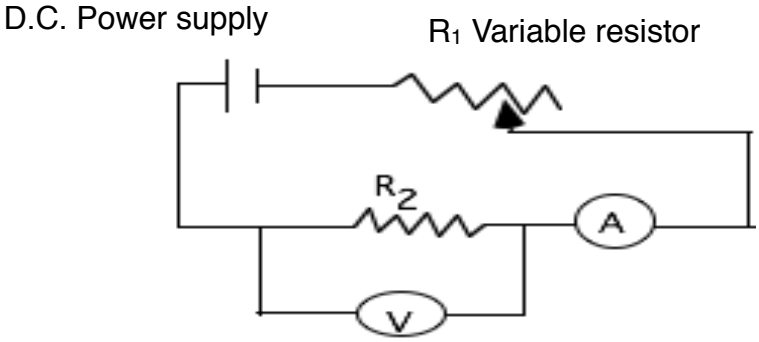


Fig. 1

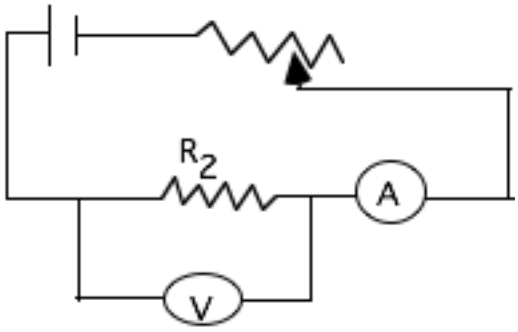
When the value of the variable resister, R_1, is altered, there will be a change in the current in the circuit. The value of the current can be read from the milliamp-meter ('A' in the diagram). The voltage across 'R_2' will also change, and we can read its value from the voltmeter 'V'.

Lab 7 preparation: **Name _____**

Hand this page in, before the beginning of the lab.

1. Write Ohm's law from memory

2. Draw the following diagram and label all of the parts



3. Write the definition of current:

4. Convert 45 mAmps to Amps: _____

5. Write the definition of voltage:

Procedure:

If we solve Ohm's law for R, we see that $R = \frac{V}{I}$

In this lab, you will alter the value of the variable resistor, R_1, several times, which will change the current in the circuit and the voltage across R_2 . You must record the corresponding current 'A' and voltage 'V' onto the data sheet for each new position of the variable resistor. You will then make a graph of voltage versus current. If all goes well, the slope of the line will be the value of the resistance of R_2 that is predicted by Ohm's law.

1. Set up the circuit that is diagrammed in figure 1. It is easiest if you connect the voltmeter last. Notice that the voltmeter is wired in parallel with the R_2 resistor.

2. Set the rheostat to its maximum value.

3. Set R_2 to the value listed in the data table on the last page of this lab.

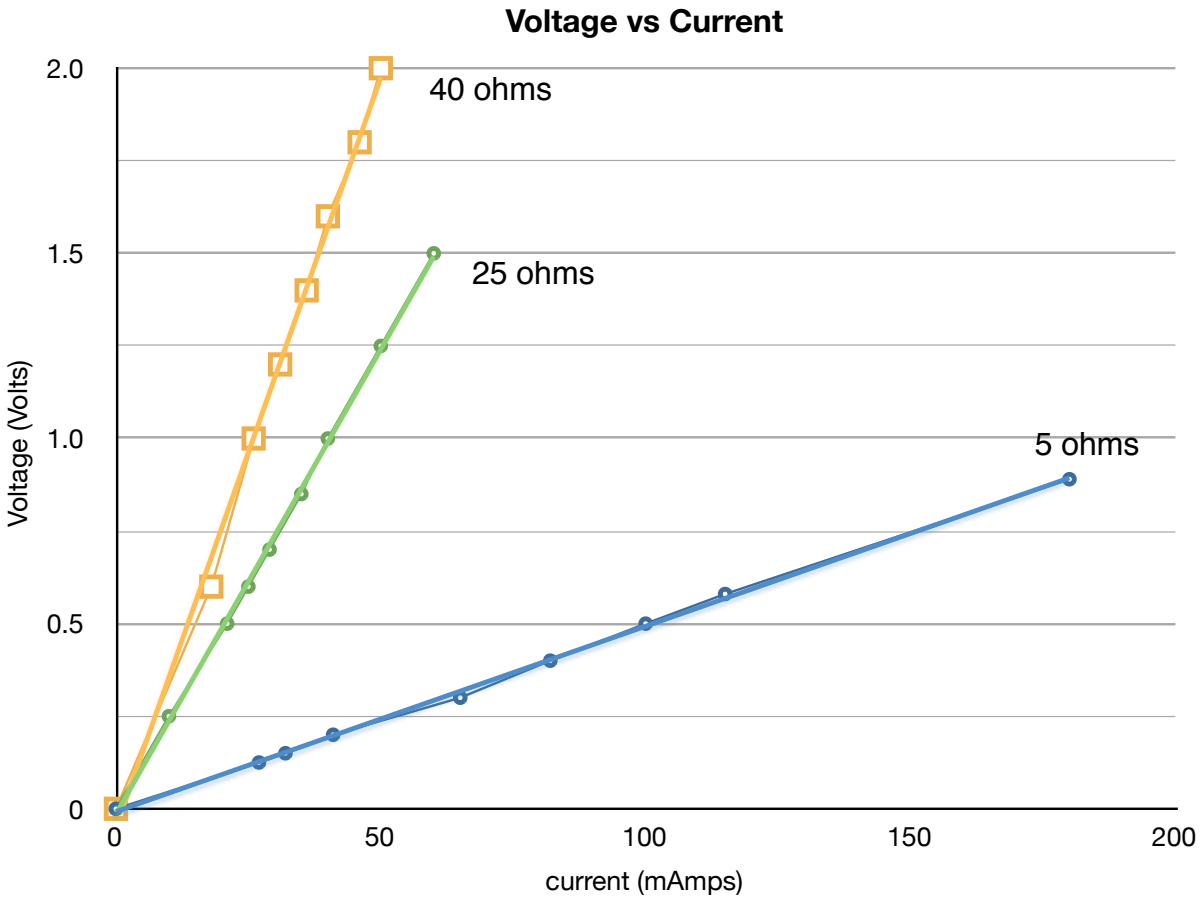
4. Have the lab instructor check the circuit **before** you turn on the power supply switch.

5. Turn on the power supply and read the current and voltage on the volt and amp. meters. Record their values in the data table. Caution- the power (P=IV) should not exceed 3 watts. Never exceed 3 watts. If you do, you might damage the decade resistance box.

6. Change the rheostat setting and repeat this procedure until you have seven (7) different current and voltage readings.
   Note: since ohm's law indicates that current and voltage are proportional, the needles on both meters should move in the same direction when you move the slide on the rheostat. If they don't move in the same direction, turn off the power and notify your laboratory instructor.

7. Repeat step 6 until you have data for the 5, 25, and 40 ohm settings for R_2.

8. Plot the results for all three resistances on a single 'V' versus 'I' graph and draw a straight line that best fits the data. See example below.



Note that 1 mAmp = 1 x10^{-3} Amps

9. Calculate the slope of each line to determine the resistance predicted by ohm's law and enter the slope values on your data sheet. Neatly show the calculations.

10. Determine the % error by comparing your slopes with the values for R_2 used in the decade resistance box. Enter percent error on your data sheet.

LAB 7: Ohm's Law NAME_____/section___

DATA SHEET

Trial# 1

R_2 (value on box)		Voltage	current	slope
a)	5Ω	_____	_____	
b)	5Ω	_____	_____	
c)	5Ω	_____	_____	
d)	5Ω	_____	_____	
e)	5Ω	_____	_____	
f)	5Ω	_____	_____	
g)	5Ω	_____	_____	_____

% error _____

Trial# 2

R_2 (value on box)		Voltage	current	slope
a)	25Ω	_____	_____	
b)	25Ω	_____	_____	
c)	25Ω	_____	_____	
d)	25Ω	_____	_____	
e)	25Ω	_____	_____	
f)	25Ω	_____	_____	
g)	25Ω	_____	_____	_____

% error _____

Trial# 3

R_2 (value on box)		Voltage	current	slope
a)	40Ω	_____	_____	
b)	40Ω	_____	_____	
c)	40Ω	_____	_____	
d)	40Ω	_____	_____	
e)	40Ω	_____	_____	
f)	40Ω	_____	_____	
g)	40Ω	_____	_____	_____

% error _____