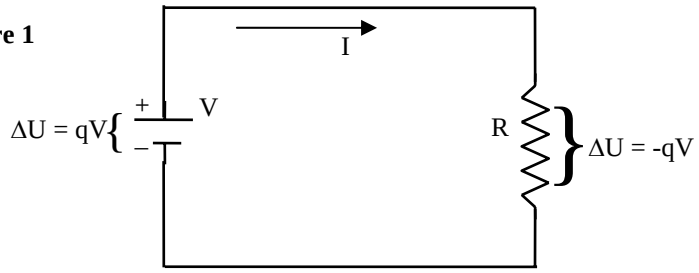
Ohm's Law

Purpose: 1. To verify Ohm's law by plotting voltage versus current for several know resistances.
2. To plot the current vs voltage curve for a non-ohmic device.
3. To determine an approximate value for the resistance of the human body.

Equipment: milliammeter, voltmeter, computer, printer, connecting wires and jumper leads, 6 v light bulb, DC power supply, three resistances between 45Ω and 100Ω

Introduction: An electrical resistance can be defined as any material that causes electrical charge to lose potential energy as the charge flows through it. The change in potential across a resistance is the electrical potential energy per unit charge that a charge loses as it flows through the resistance. On the other hand, a power supply or battery delivers potential energy to charge as it passes through that device. The circuit that is shown in Figure 1 illustrates this fact and also the fact that as an electrical charge flows around the path shown it gains and lose equal amounts of electrical energy.

Figure 1

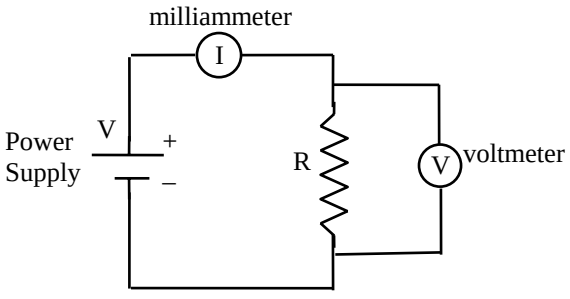


Ohm's law gives us a simple equation that relates the change in potential (often called voltage drop), V, across a resistance, R, to the electrical current, I, that flows through the resistance. It is written as

$$V = IR$$

where V is measured in volts, I in amperes (amps) and R in ohms (Ω).

Figure 2



Note: *The voltages to be used in this experiment are completely harmless to people. However, the equipment can be damaged by improper use. Therefore, do not turn on the power supply until you have completely wired the circuit and have had your instructor check the circuit.*

Procedure:

1. Check both the milliammeter and voltmeter to see that they are properly zeroed. Wire the circuit as shown in Figure 2 using one of the resistances, R, given to you by your instructor. After obtaining your instructor's approval, adjust the voltage of the power supply to obtain 6.0 volts across R. Record the current and voltage. Change the voltage by 0.5 v steps (6.0 , 5.5, 5.0, etc.) and record both I and V for each voltage down to 0.5 volts.

2. Make a plot of current versus voltage for the data obtained in part 1 using the **Graphical Analysis** program. Put the current (in amps!) on the vertical axis (Y) and voltage on the horizontal axis (X). Double click anywhere within the graph to obtain the Graph Options window. Deselect **Connecting Lines** so that just the data points are shown in the graph. Hopefully, the data has a linear appearance which means that your resistance obeys Ohm's Law. Select **Analyze/Curve Fit** and attempt to fit your data to a linear curve. Find the slope of the line. What physical meaning does the slope have? Find the percent difference between the values of the resistance marked on the resistor and the value obtained from your graph.

3. Choose two other resistances and repeat steps 1 and 2 above. Use the same graph for all three sets of data by choosing **Data/New Data Set** and using different names for each set of data as well as different symbols for the point protectors. Put a legend on your graph and label the axes with appropriate units. Move the boxes that display the fit data so that they don't cover your data. Print out the graph for your lab report.

4. Repeat part 1 and 2 for a 6 volt light bulb. Does the light bulb obey Ohm's Law? Try to obtain a fit to this data and discuss the results. Print out the graph for your lab report.

5. If time permits, replace the resistance, R, in Figure 2 with your lab partner. Set the power supply voltage at 5.0 volts and remove the voltmeter from the circuit before taking a current measurement. Calculate his/her resistance from this single measurement. What variables influence the result?