

ECET 102/CPET101

Lab 3 Ohm's Law Lab By Dr. Hal Broberg

Required Devices & Equipment:

Resistors: 1k Ω
Power Supply
Digital Multimeter (DMM)

Objectives:

1. Learn to use the variable power supply.
2. Learn to measure Voltage
3. Learn to measure Current
4. Learn to measure the effect of resistors in series
5. Verify Ohm's Law using your measurements

General Information:

Ohm's law is the most used rule in electronics. It states that the Voltage ACROSS a resistor is the product of the Current THROUGH the resistor times the value of the resistance. Ohm's law can be written as:

$$V_{\text{across a resistor}} = I_{\text{through a resistor}} * R$$

The voltage is in Volts, the current is in Amperes and the resistance is in Ohms (Ω).

To measure Ohm's law, you can use the DMM to measure resistance, voltage and current, but you must use different settings for each measurement.

Procedure:

Part 1: Learning to measure voltage and use the variable power supply.

a. Connect leads to the constant 5 volt output of the DC power supply at the bench. Red is positive and Black is negative on the power supply output. Set your DMM to volts and connect the power supply to the DMM (now set up as a voltmeter) and measure the voltage as accurately as possible. Note that you may have to change the DMM measurement value settings to obtain the most significant figures. Measure to three significant figures and place your measurement result in the table below.

Nominal Value (to 3 significant figures)	Measured Value (Use 3 significant figures)
5.00 volts	

b. Connect the same leads to one of the variable outputs of the DC power supply and to the DMM. Set the power supply to 2 volts, 5 volts, 10 volts, 15 volts, and 20 volts using the meter that is on the face of the power supply and measure the actual voltage at each point using your DMM. Place these results in the table below.

Power Supply value (using meter on front)	Value measured using DMM
2	
5	
10	
15	
20	

Comment on the accuracy of the meter on the front of the power supply.

Does your power supply really supply 20 volts? Circle one

Yes

No

Explain:

Part 2: A Circuit with One Resistor

- Measure the resistance of the $1k\Omega$ resistor using the DMM and mark this actual value on the circuit below next to the resistor.
- Set 10.0 volts on the power supply using the DMM for accuracy.
- Set up the circuit shown in Figure 1:
- Measure the voltage across the resistor using the DMM as shown and place the result in the table below.
- Measure the current through the resistor using the DMM as shown in Figure 2.:

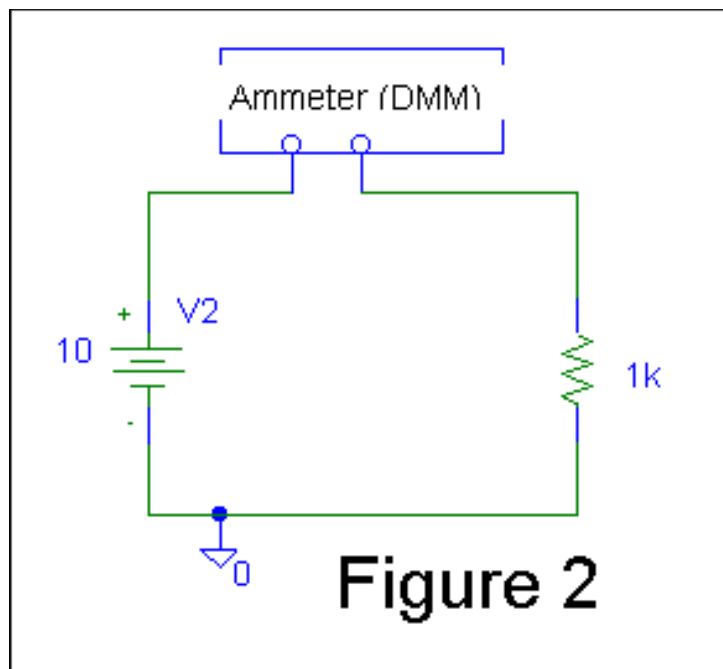
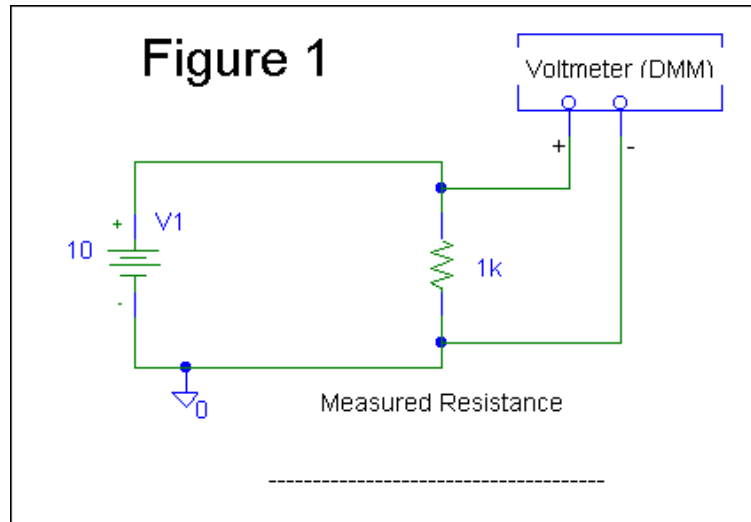
Note that:

The current must go through the ammeter in order to measure the current and that the leads must be

One of the leads on the DMM must be inserted into a different plug.

The DMM must be switched to a different setting so that it measures current (amperes).

- Fill in the table below with your measured results.



Volts	Amps	Ohms
Ideal = 10.0	Ideal = .01	Ideal = 1000
Measured =	Measured =	Measured =

- Explain how the table verifies Ohm's Law.

Part 3: Plotting Ohm's Law

Ohm's law is:

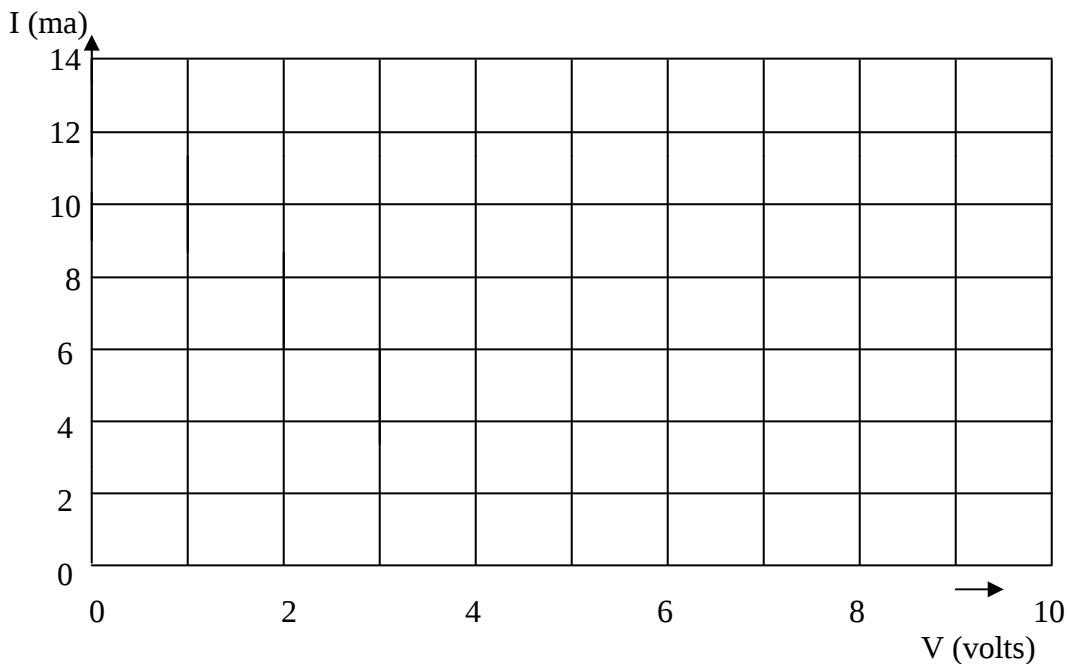
$$V = I * R$$

There is a linear relationship between voltage, current and resistance. For instance, if we plot voltage vs. current, and change the value of resistance, The V vs. I curve is a straight line and therefore linear.

Fill in the following table of values using Ohm's law:

Voltage (volts)	Current for a 2k Ω Resistor (in ma)	Current for a 1k Ω Resistor (in ma)	Current for a 500 Ω Resistor (in ma)
0			
2			
4			
6			
8			
10			

Plot Ohm's law for the three resistors on the graph below (only plot values that are on the graph). Note that this is the normal format for plotting Voltage versus Current characteristics of a device, such as a diode or transistor.



Notice that each of the relationships is linear, e.g. produces a straight line. Also, notice that the inverse of the slope of each line is the resistance. Slope is defined as Rise/Run or, more specifically as $\Delta\text{Rise}/\Delta\text{Run}$. Since Ohm's law is $V = I * R$, then $R = V / I$ which is the inverse of the slope.