Voltage, Current, Resistance and Ohm's Law

Goals of Experiment:

To gain familiarity with the ideas of voltage, current and resistance and to become familiar with the tools and equipment used in simple electrical measurements.

Necessary Equipment

1. Resistors of various sizes
2. Digital Multimeter (DMM)
3. Protoboard
4. Voltage Supply
5. Potentiometer
6. Helipot

Procedure

1. Use a DMM to read the voltage of a power supply.
2. Use the resistor color code to find a 33 kΩ and a 1 kΩ miniature carbon film resistors. Check these values with a DMM. Are the DMM readings consistent with the tolerance rating marked on the resistor?
3. The power rating of a resistor depends on its size. Using the vernier calipers measure the length and diameter of one of your resistors. Compare your measurements with the data on Panasonic 5% Miniature Carbon Film Resistors as given on the data sheet to determine its power rating. What is it?
4. Fit the DMM with alligator clips and wire leads to make a continuity checker. Use it to discover the arrangement of connections on a *protoboard*. Which holes are connected?
5. Use a DMM to measure the resistance of a 1 MΩ resistor while holding one resistor lead in the fingers of your left hand and the other resistor lead in the fingers of your right hand. Repeat the measurement in a way that gets your body out of the circuit. Do you find a difference? Would you expect to find a difference if the resistance to be measured was 10 kΩ? Try it.
6. Predict and measure the combined resistance of:
   A) 82 kΩ and 100 kΩ in series.
   B) 82 kΩ and 100 kΩ in parallel.
7. The circuit in Figure 1 is known as a voltage divider. You can build it on a protoboard.
   A) Predict and measure the voltages V_1 and V_2. Compare with the supply voltage.
   B) Predict the battery current. Use the DMM to measure it.

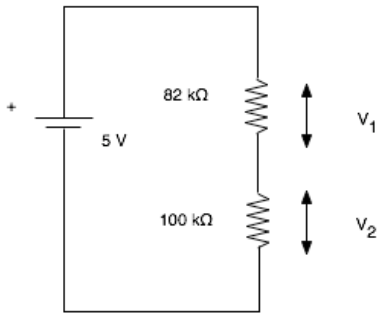

Figure 1: Resistors in Series.

C) Suppose the 82 kΩ resistor is shorted. Predict the battery current and the current through the 100 kΩ resistor. Use the DMM to measure these.

8. Figure 2 shows an open circuit. What is the current through the ammeter? What is the voltage at point P?
9. Figure 3 shows a voltage divider that is loaded by a load resistor R_L. Predict how the voltage V_2 changes if R_L = 1 MΩ. Measure it. Predict how the voltage V_2 changes if R_L = 330 kΩ and measure it.
10. A potentiometer (pot) has three terminals. Use a DMM to identify the terminal for the moveable tap on a standard rotary pot. Which terminals are connected together for maximum clockwise rotation? For maximum CCW rotation?
11. Adjust the pot so that the resistances of the two sides are equal. Show by

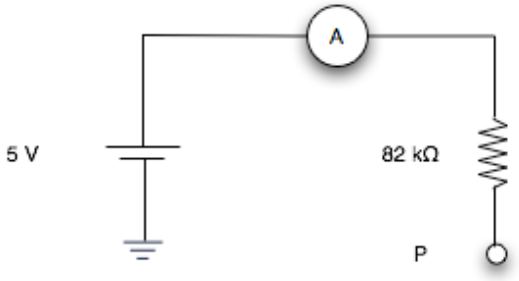

Figure 2: Open Circuit.

measurements that this pot is now a voltage divider that divides the voltage by two. Does it matter what the resistance of the pot is?

12. Use a DMM to identify the moveable tap on a Helipot.

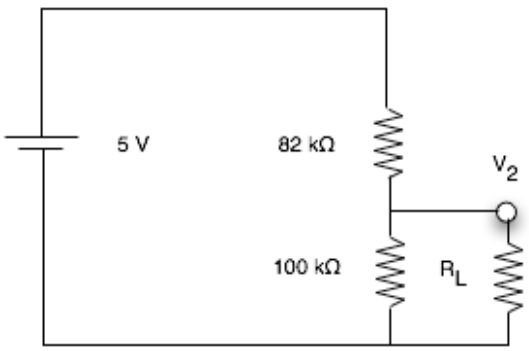

Figure 3: Voltage Divider.