

Lab 3: Resistance and Resistors Student Handout

The Project: Resistance and Resistors

Company X is interested in characterizing the resistive behavior of several different wires for an upcoming job. You have been hired to characterize three different wire samples and provide relevant circuit information. has expressed an interest in characterizing the behavior of several complex circuits that will be used on a future project. These circuits consist of a number of capacitors, resistors and inductors to create the desired signal. As a way of introduction to these more complex circuits, we ask that you characterize the behavior of these several simpler circuits to start off with.

*You should consult your instructor for additional safety instructions before starting on **ANY** lab. You should cap the current output of your power supply at **.1 A (100 mA)**.*

Equipment Available to You:

- DC Power Supply
- Pasco CI- 6512 RLC Circuit Board
- Data Acquisition (DAQ) Unit
- BNC to Alligator Cable
- Banana to Alligator Cables
- Alligator to Alligator Cables
- Resistive Wire Board

Possible Needed Techniques:

- Measuring Voltage with a DAQ
- Basic Circuit Design
- Basic Python Commands

Pre-Lab Organizational Questions:

1. What parameters are used to determine the resistance of an object? What do you need to measure with your system to find the resistivity of each wire?
2. You are given three different wires. How can you use these wires to design a circuit with multiple different resistors?
3. Resistors can be placed in either series or parallel. What circuits can you use to test both of these cases?
4. How can you calculate the value of the resistances used for your circuits from the parameters you derived earlier in the experiment?

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The Requirements:

We ask that you characterize the behavior of several different aspects of a number of simple series and parallel circuits using resistors and a DC power supply:

1. Find the value of the resistivity for all three wires.
2. Demonstrate that these wires are ohmic materials (they obey Ohm's Law).
3. Verify the rules for adding resistors in series and in parallel using these circuits.

Presentation of the solution:

Your team must prepare a presentation that will be given to a member of Company X on the approach that your team is using to complete the project. The presentation may be given by the whole team as a group or by a single member of the team chosen by a member of Company X. The presentation must include:

- A description of the basic physics principles used in your project, including equations used to convert the outputted data into charge, current, or voltage. Be sure to how you would predict the circuit behavior for a given circuit.
- Plot the voltage through a wire as a function of the wire length for a given current
- Plot the current through, versus the voltage across your series resistor network.
- Plot the voltage through each resistor in your series resistor network as a function of current. Using your data, provide the total voltage through your circuit. Comment on how this voltage compares to the voltage from the power supply.
- Plot the voltage through each resistor in your parallel resistor network as a function of current from the power supply. Using your data, provide the sum of the current through all resistors your circuit. Comment on how this current compares to the voltage from the power supply.