Resistors

Equipment

- DMM and battery eliminator
- 56Ω resistor, light bulb and holder, appropriate cables
- Optional: Computer with voltage and current probes, hand generator

Objective

Physics Concepts

- Ohm's Observation, V=IR
- Power, P=IV

Experimental technique

- Correctly connecting an ammeter (and voltmeter) in a circuit

Experimental analysis

- Fit curves to data to determine mathematical relationships
- Recognizing the uncertainty in measurements

Conceptual (C-Level)

Draw a schematic wiring diagram for a circuit containing a DC voltage source (battery) and a resistive load (either a light bulb or resistor).

- Show how to connect an ammeter and voltmeter to this circuit.
- What happens if you connect a voltmeter and an ammeter incorrectly in your circuit?

EXPLORATIONS:

- Use the on-line circuit simulation to wire the simple circuit you just drew. Confirm current flows (light turns on). Explore other circuit configurations for different resistors etc.
- Measure the resistance of the light bulb using the "Resistance/Ohm/Ω" setting on the DMM. Calculate the theoretical power used by the light bulb when operated at 3V.
- Determine the resistance of the resistor (using color code and DMM). Calculate the theoretical power used by the resistor when operated at 3V.
- Try connecting the voltmeter in series and observe any changes to your circuit.
  NOTE: **Do not** connect the ammeter incorrectly.

NOTE: A voltmeter is connected in parallel with an object to measure the voltage drop across the object. An *ideal* voltmeter has infinite resistance. An ammeter is connected in series to measure the current through an object. An *ideal* ammeter has zero resistance. A fuse protects good ammeters from too much current. Your DMM can be configured to read either current or voltage.

Basic Lab (B-Level)

- Graph the voltage as a function of current for a resistor and a light bulb. What does your data tell you? Please try to avoid burning out the light bulb!
- Explain any discrepancies with theory and note any observations.

Advanced/Extended Lab Ideas (A-Level)

- Measure the current and voltage as a function of time for a light bulb as it is turned on for the first few 100 milliseconds. This requires setting up a trigger for your data collection.
- Use a battery and measure the voltage and current as you decrease the resistance in a circuit. (This is hard to do for the battery eliminator)
- Explore something else that you are curious to investigate.