

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
- Power

Experimental technique

- Correctly connecting 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.

Note: A voltmeter is connected in parallel across the object you wish to measure the voltage drop. 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 an ammeter from too much current. Your DMM can easily be reconfigured to act as an ammeter and measure current.

- What happens if you connect a voltmeter and an ammeter incorrectly in your circuit?

EXPLORATIONS:

- Carry out the following explorations with the on-line circuit simulation and in the lab. Explore the resistance simulations.
- 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 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.

Basic Lab (B-Level)

- Graph the voltage as a function of current for each device. 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.
- Use a battery and measure the voltage and current as you decrease the resistance in a circuit. (You may also be able to do this for the battery eliminator)
- What are you curious to investigate?