Circuits

Equipment

- DMM (optional: computer with voltage and current probes)
- Assorted resistors, 1-Farad capacitor, battery eliminator, light bulb and holder, alligator clips

Objective

Physics Concepts

- Power
- $\Sigma I=0$ into a node, $\Sigma V=0$ around a closed loop

Experimental analysis

- Graph time varying functions, combine measurements to graph new quantities
- Fit curves to data to determine mathematical relationships
- Recognizing the uncertainty in measurements

Conceptual (C-Level)

You can simplify any circuit as a voltage source, V_S, in series with a source resistance, R_S, that is providing power (voltage and current) to a load resistance, R_L that is connected in series with R_S and V_S. [This general concept is referred to as finding the Thévenin equivalent circuit]

- Draw a schematic diagram of this general circuit.
- Determine a theoretical function for the power used by the load resistor, P_L, as a function of V_S, R_S, and R_L.
- Outline a method to find the value of the load resistor to maximize the power used by the load resistor.

Basic Lab (B-Level)

Hook a battery eliminator, resistor and variable resistor (the load) in series.

- Graph the power used by the load resister as a function of the load resistor.
- Fit your theoretical function, $P_L(R_L)$ to your dataset. Comment.

Hook a battery eliminator, a resistor and two 1-Farad capacitors in series. NOTE: Do not exceed 5 volts on the capacitors.

- Graph V(t) and determine the effective capacitance. Compare with theory.
- Using the same materials increase the time constant. Graph V(t) and compare to theory.

Advanced/Extended Lab Ideas (A-Level)

- Determine the internal resistance for a battery.
- Explore complex circuits – both experimentally and theoretically.
- Use a Wheatstone bridge to determine an unknown resistance. (We have setups if you want to use one)
- Explore something that you are curious to investigate.