Circuits

Equipment

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

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 the power used by the load resistor, R_L.
- Outline a method to find the value of the load resistor to maximize the power used by the load resistor.

In a prior experiment you connected a resistor and capacitor in series and experimentally determined the voltage as a function of time across a capacitor. For both charging and discharging the capacitor you found a characteristic curve.

- What was the time constant for your circuit? Compare theoretical and experimental values.

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.

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

- Graph V(t) for two different circuits with time constants that vary by at least 10.

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)