Capacitance

Equipment

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

Objective

Physics Concepts

- Capacitance
- Time constant, $\tau = RC$

Experimental analysis

- Graph time varying functions
- 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), capacitor and light bulb.

- Connect the capacitor and light bulb in series.
- Connect the capacitor and light bulb in parallel.

Will the light bulb light in your circuits? Explain.

SIMULATION: Make sure to use the "AC/DC Circuit" simulation.

- Connect a light bulb to a battery. Add a capacitor to your circuit. Wire the parts in series – which means connect them one after the other to make one big path or circuit.
- Comment on what you observe in the simulation. Is this what you expected?

EXPLORATIONS:

- Connect the 1-Farad capacitor to the hand generator. Crank a bit, stop (remove your hand from the handle) and observe. NOTE: The capacitor is polarized – the negative terminal has a double line next to it. Don't exceed 5 volts on the capacitor.
- Add a light bulb in series with the capacitor and generator and observe the circuit behavior.
- After cranking for a bit, disconnect the generator from the circuit and observe.
- Does the order of the light bulb and capacitor matter?

Basic Lab (B-Level)

Hook the battery, 1F capacitor and light bulb in series. NOTE: Do not exceed 5 volts on the capacitor.

- Determine the voltage as a function of time for the capacitor to charge and discharge. You will have to disconnect the voltage source and connect the light bulb to just the capacitor to determine the discharge function. Explain the behavior of the light bulb in this circuit.
- Determine a mathematical relationship (i.e. fit a curve to your data).
- Determine the time constant using a known resistor. Compute actual capacitance.

Advanced/Extended Lab Ideas (A-Level)

- Determine the current as a function of time for the capacitor to charge and discharge.
- Determine the amount of charge and energy stored in the capacitor as a function of time.
- Explore something that you are curious to investigate.