

# Capacitors

## Equipment

- DMM
- 1 Farad capacitor, battery eliminator, light bulb and holder, hand generator, alligator clips
- Optional: Computer with voltage and current probes

## Objective

Physics Concepts

- Capacitance

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. You must connect the positive terminals and negative terminals.
- 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, 1-Farad 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.
- Determine a mathematical relationship (i.e. fit a curve to your data).
- Explain the behavior of the light bulb in this circuit.

## 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.