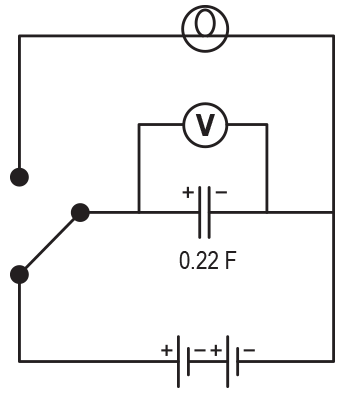
# **Investigation: Capacitors**

**Essential Question: How do capacitors work?**

In addition to the resistor, a standard component found in most electronic circuits is the capacitor. Capacitors are designed to store electric charge, which has many useful applications in circuits. In this investigation, you will explore how a capacitor stores charge and how that charge can vary based on the circuit design.

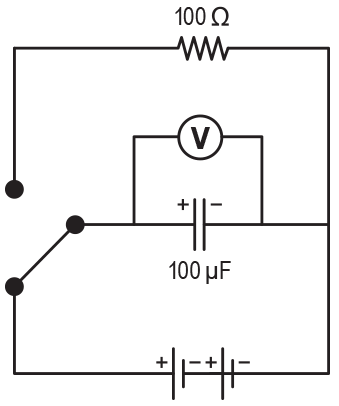
Part 1: Discharging a capacitor though an electrical device



1. Open the experiment file **Capacitors** and then connect the voltage sensor to your software.
2. Build the circuit shown in the diagram.
3. Begin recording data and close the switch toward the battery branch of the circuit to charge the capacitor. Observe the voltage.
4. Once the capacitor is charged, flip the switch to the branch containing the light bulb to discharge the capacitor. Observe the light bulb.
5. Replace bulb with a motor and repeat the experiment. Observe the motor as you discharge the capacitor.
6. Repeat the experiment using the 33 ohm and 100 ohm resistors.

Questions

1. How does the charging time compare to the discharging time? What can you account for the difference?
2. What happened to the light bulb when the capacitor was discharging?
3. What was the voltage equal to when the bulb was no longer lit? If the light bulb is not lighting up when voltage is applied, where is the energy going?
4. How does the voltage discharge rate for the 33 ohm resistor compare to the 100 ohm resistor? Why is the discharge time different for each resistor?
5. How does the voltage discharge for the motor compare to the bulb? Why is the discharge time different for the motor versus the bulb?

Part 2: Different Capacitors

1. Rebuild the circuit with a 100 ohm resistor and replace the 0.22 F capacitor with the spring clip module. Insert a 100 µF capacitor between the spring clips.
2. Repeat the experiment performed in Part 1 with the new circuit.
3. Remove the 100 µF capacitor and replace it with the 330 µF capacitor. Repeat the experiment.
4. Add a second 330 µF capacitor to the second set of spring clips so that the capacitors are in parallel. Repeat the experiment.

Questions

1. How does the discharge time for the 100 µF compare to the 330 µF capacitor? Why are the discharge times different? What does the capacitor rating tell us?
2. How does the discharge time for the two capacitors in parallel compare to the discharge time for a single capacitor? Why?
3. Is connecting capacitors in parallel more similar to connecting two resistors in parallel or connecting two batteries in parallel? Explain.
4. What do you believe would happen to the discharge time if you connected two capacitors in series? Why?