



# Discharging a capacitor

PHYSICS  
Electric fields

## Driving Question:

*How do capacitance and resistance values determine the time of discharging?*



## Thinking about the question

A capacitor is an electric device that can store electrical charge. A known device that uses a capacitor is the flash attachment of a camera. A battery is used to charge the capacitor, and this stored charge is then released when the shutter-release button is pressed to take a photo. In order to see how a capacitor can be used in a timing circuit, it is important to know what happens to voltage and current in a capacitor-resistor circuit as the capacitor accumulates charge and release it. In this activity you are going to investigate the process of discharging using a variety of capacitors and resistors.

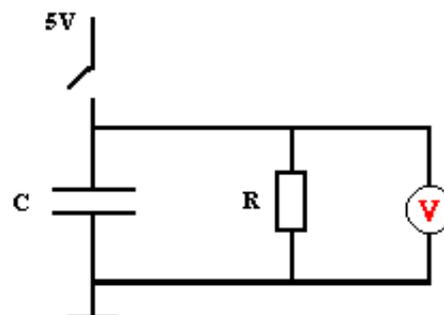
## Materials

In your investigations you will use:

- Data-logger e.g. CLAB or CoachLab II<sup>+</sup>,
- Voltage sensor or 4-mm leads (when working with CoachLab II<sup>+</sup>),
- Capacitors (e.g. 10  $\mu\text{F}$ , 100  $\mu\text{F}$  and 1000  $\mu\text{F}$  ),
- Resistors (e.g. 10  $\text{k}\Omega$ , 22  $\text{k}\Omega$ , 33  $\text{k}\Omega$ ),
- External 5 V DC power supply.

## Investigations

1. Set up the electric circuit, as shown on the drawing.
2. Connect the voltage sensor to input 1 of your interface or connect 4-mm wires directly to a 4-mm input of CoachLab II<sup>+</sup>.
3. Open Coach Activity 'Discharging a capacitor'. The recording is triggered, so after a measurement is started the program waits for the measured voltage to reach the trigger conditions. Check the trigger conditions set in the program?



4. Charge the capacitor, using an external power supply or using the 5V output CoachLab II+.
  5. Start the measurement.
  6. Disconnect the power supply or remove the charging wire to allow the capacitor to discharge through the resistor. The measurement starts automatically when the trigger conditions are reached.
  7. Determine the experimental value of RC-time of the circuit. Describe a method you are going to use.
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8. Calculate the theoretical values of RC-time based on the actual resistance and capacitance values used in your circuit.
  9. Note that resistors and capacitors are marked with approximate values with a tolerance. How can this influence your data?
  10. Compare the theoretical calculated value with your experimental found value. Is your experimental value close to the theoretical value?
  11. What is the effect of changing the capacitance of the capacitor on the discharging time?
  12. What is the effect of changing the resistance?

### **Resources:**

Coach Activity: Discharging a capacitor.cma7

Coach Activity: Discharging a capacitor (with CoachLab II+).cma7