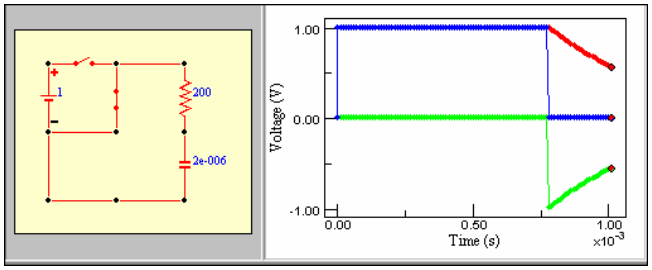
Worksheet for Exploration 30.6: RC Time Constant



In this animation, you can close and open switches to see what happens to the voltage across the capacitor **(red)**, the voltage across the resistor **(green)**, and the total voltage across the capacitor plus resistor **(blue)**. Initially, the capacitor is charged. After pushing *play*, you should throw the switches **(voltage is given in volts and time is given in seconds)**. Restart.

Set the switches so that you can get a good graph of the capacitor discharging and charging.

a. How much time (approximately) does it take the capacitor to charge and discharge?

V = ____ R = _____ C = _____

	Charge	Discharge
Time:		

b. Double the battery voltage. How much time does it take to charge and discharge?

V = ____ R = _____ C = _____

	Charge	Discharge
Time:		

c. Double the capacitance and measure the time to charge and discharge.

V = ____ R = _____ C = _____

	Charge	Discharge
Time:		

d. Double the resistance and measure the time to charge and discharge.

V = ____ R = _____ C = _____

	Charge	Discharge
Time:		

The value of RC (resistance times capacitance) is the RC time constant for the circuit and is a characteristic time. Set the battery voltage to 1 V.

e. When the time equals R*C after throwing the switch, what is the capacitor voltage when it is discharging? When it is charging?

t = RC = _____

	Charge	Discharge
Voltage (at t=RC after throwing the switch):		

f. Compare your measurements to the values found from the equations for a charging or discharging capacitor:

Charging: $V = V_0 (1 - e^{-t/RC})$ Discharging: $V = V_0 e^{-t/RC}$