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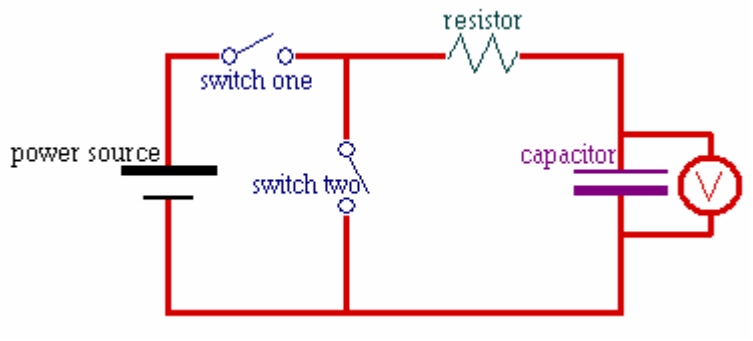
Physics – A

Capacitors Lab

27 April 2007

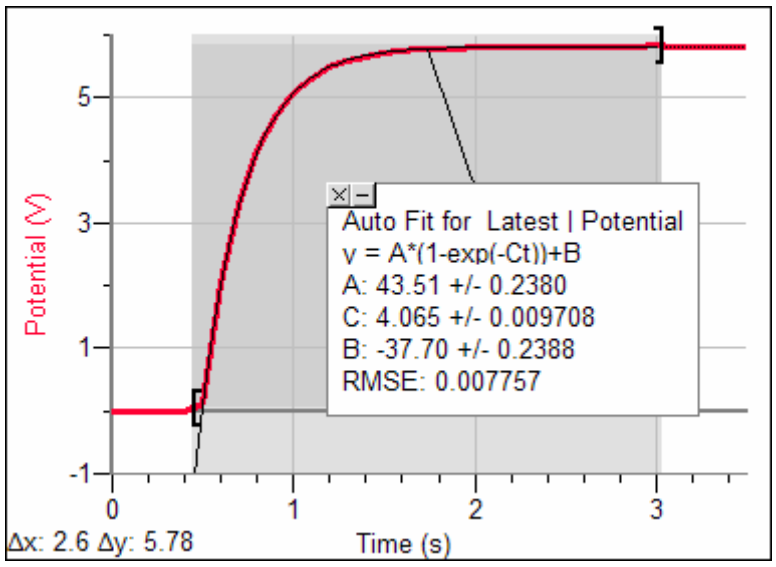
In this lab we created the following circuit and used LoggerPro as a volt meter to study how capacitors charge and discharge. The capacitor we used had a value of 4.7 μF at 50 volts.



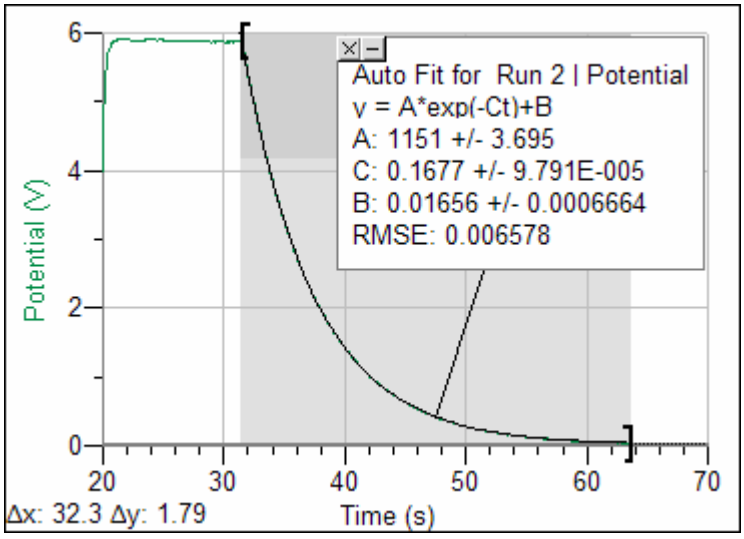
We started with both switches open. To charge the battery, we closed switch one. This allowed the current to flow from the power source through the resistor into the capacitor. When the volt meter showed a constant rate, the capacitor was charged. Next, to discharge the battery, we closed switch two and opened switch one. We collected and saved the data in LoggerPro. To model to charge of the capacitor we

First, we used a resistor with a resistance of 47000±5% ohms. Our data is as follows:

Charge:

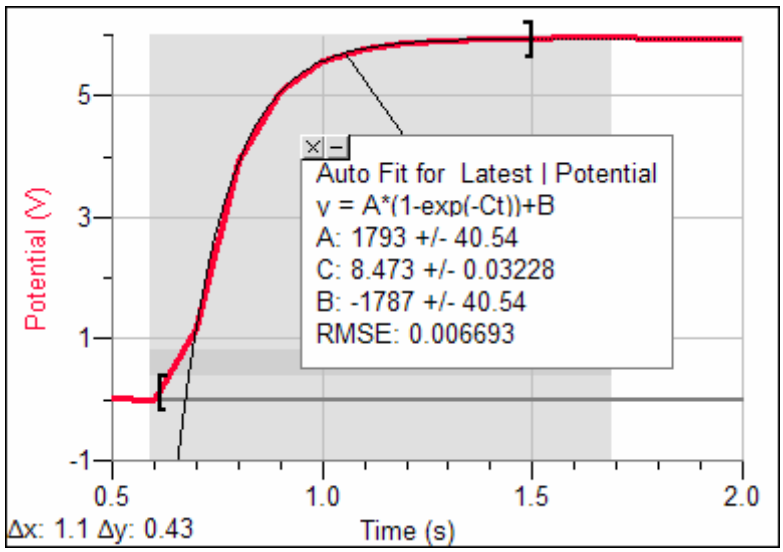


Discharge:

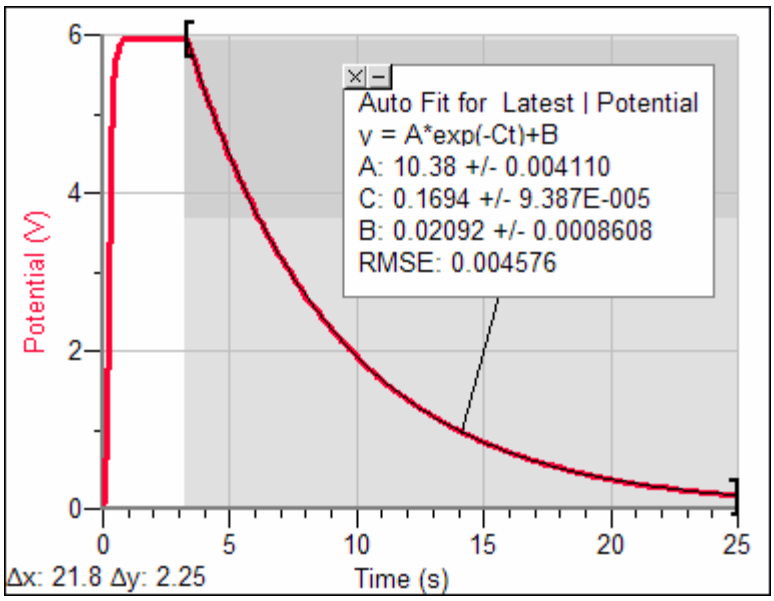


Next, we used a resistor with a resistance of 22000±5% ohms. Our data is as follows:

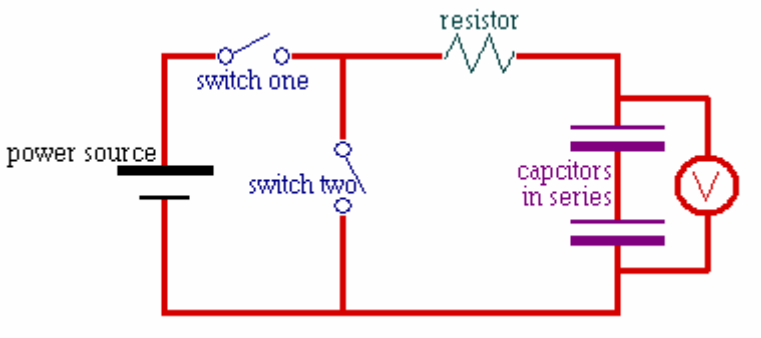
Charge:



Discharge:

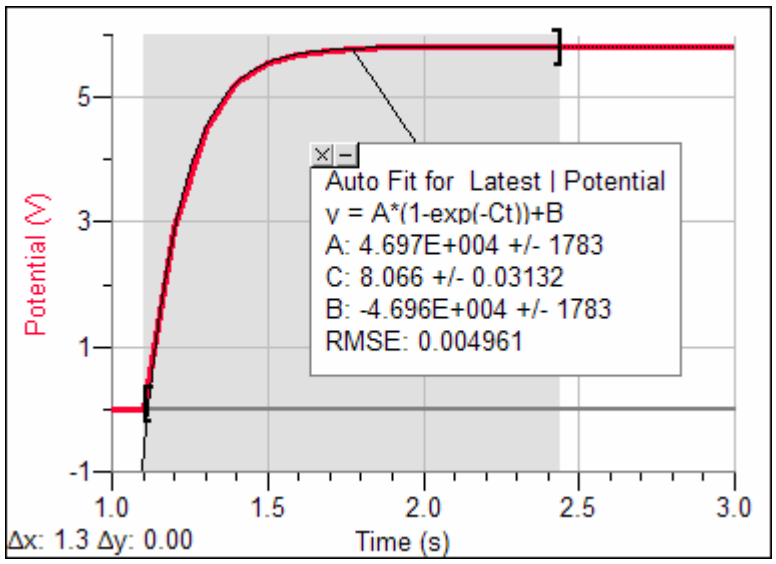


Next, we used the first resistor with a resistance of 47000±5% ohms, but added a second capacitor in series.

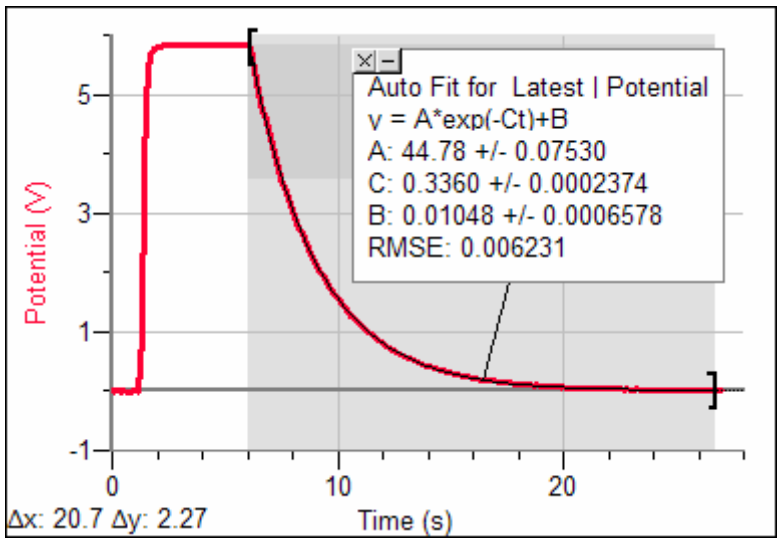


Our data is as follows:

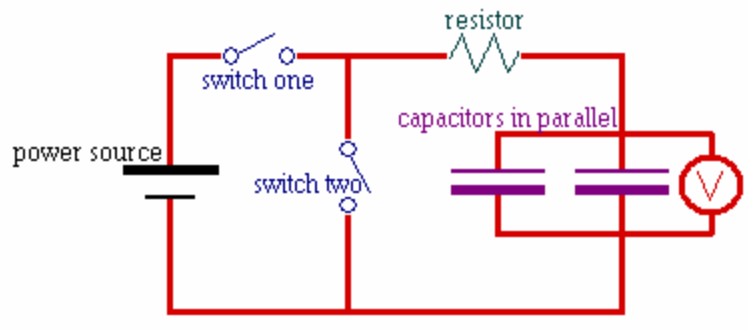
Charge:



Discharge:

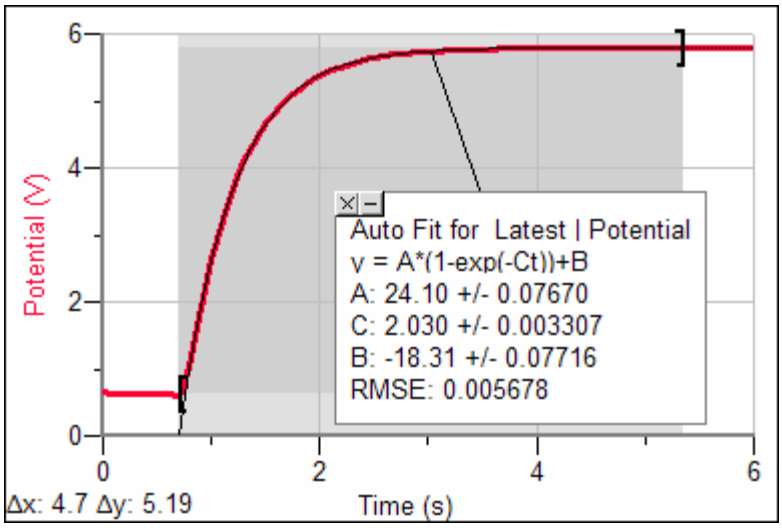


Last, we used the same resistor with a resistance of 47000±5% ohms, and had the second capacitor in parallel.

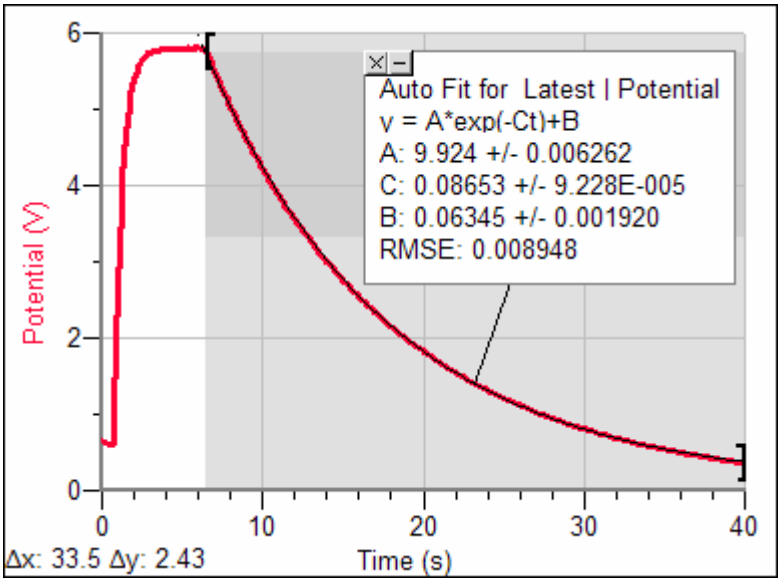


Our data is as follows:

Charge:



Discharge:



In conclusion, capacitors charge differently in different situations. With a high resistance the capacitors charge and discharge more slowly. Similarly, with a low resistance they charge and discharge faster. This seems to suggest that the capacitors lose charge based on the current through the resistor which is induced by the difference in electric potential of the two leads of the capacitor. As the charge on the capacitor decreased, the difference in potential decreased, resulting in a smaller current and rate of discharge. This resulted in the curve which is seen in all of the resulting graphs for discharge, where the slope of the line decreases as it approaches zero. The capacitors in series seemed to discharge more quickly than those in parallel. The capacitors in parallel took significantly longer to discharge completely. This is because the current remains the same at each voltage, but there is a larger reservoir of charge to draw from and it takes longer to deplete. Putting the capacitors in parallel is effectively the same as adding area to a capacitor, which would increase the capacitance of the capacitor, by increasing the amount of charge per volt that the capacitor could hold.