Name ______________________________ Date ____________ Partners__________________________

CAPACITORS

Materials:

CBL unit	TI voltage probe
TI-83 calculator with unit-to-unit link cable	Assorted capacitors (47, 100, 220 microfarads)
Resistor (about 100 kΩ)	9-volt battery
Connecting wires	Knife switch
Wavetek multimeter	

Source:
Brueningsen, Chris and Wesley Krawiec., ***Exploring Physics and Math with the CBL System***. Texas Instruments Incorporated. 1994. Modified slightly by Stephen Thornton, Department of Physics, University of Virginia.

Purpose:

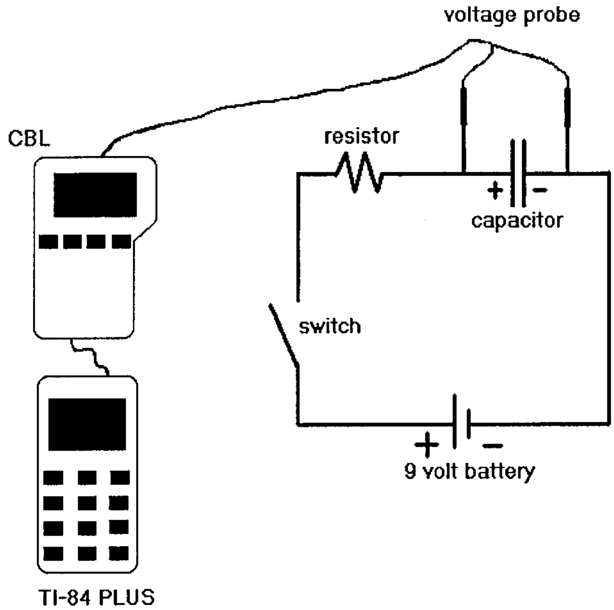
To investigate charging and discharging characteristics for a variety of capacitors and determine how capacitance influences the charging rate of a capacitor.

Setup:

1. Connect the CBL unit to the TI-83 calculator with the link cable using the I/O ports located on each unit. Press the cables ends in firmly.

2. Connect the TI voltage probe to the Channel 1 (CH1) input on the top edge of the CBL unit.

3. Turn on the CBL unit and calculator.



Procedure:

1. Connect the battery, open switch, the 47μF capacitor, and resistor in series as shown in the diagram above. Connect the voltage probe in parallel with the capacitor. Be sure that the black lead is connected to the negative side of the capacitor and to the negative terminal of the battery as shown.

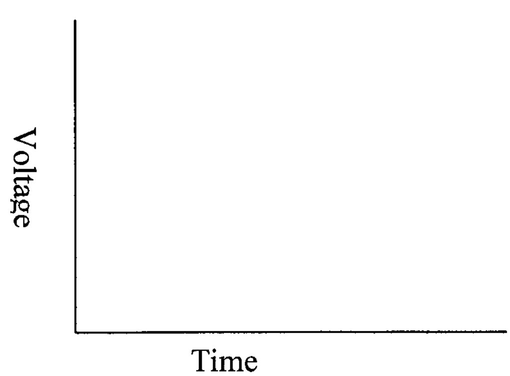
2. Measure the value of the resistor using the multimeter and record this value below as R. Measure the value of the capacitor with the multimeter and record below..

   R = ______________

   C = ______________

   Prediction 1: What do you think will happen to the voltage across the capacitor when you close the switch? Sketch your prediction below.

Charging Capacitor Prediction

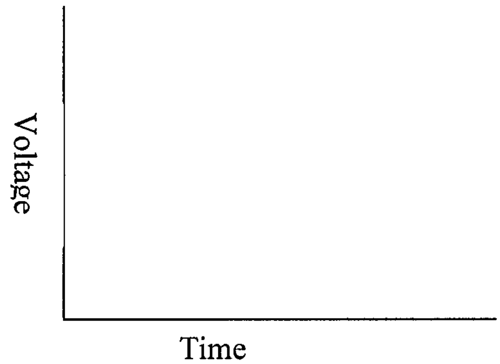


3. Make sure the CBL and TI-83 are turned on. Click on PRGM on the TI-83 and select the CAPAC program. Select AUTO SCALE from the WINDOW OPTIONS menu. Enter 1 for one point per second when prompted for the data collection rate.

4. Press the ENTER key and close the circuit switch at the same time, when you are ready to start collecting data. Notice that the voltage continues to increase as the capacitor charges. The capacitor is fully charged when the voltage reading levels out at about nine volts. After the capacitor has charged, open the switch.

5. Sketch your resulting graph below. Be sure to put units on the axes scales.

Charging Capacitor



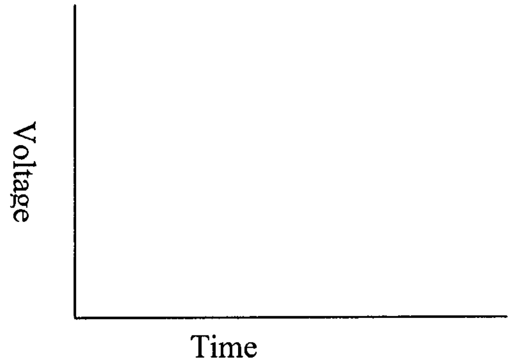
Question 1: How does your prediction compare to the graph from your experiment? Explain.

6. Disconnect the leads from the battery.

7. You need to set up the calculator for the next experiment. One of the group should hit CLEAR and go through the set-up procedure again to take data.

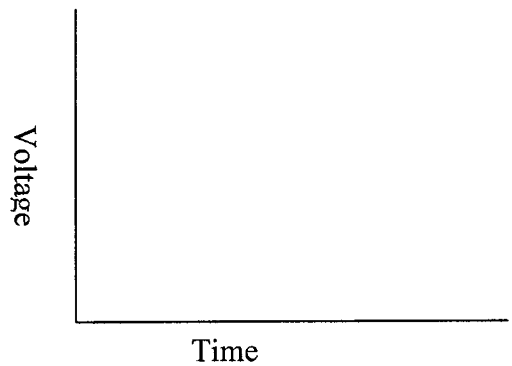
Prediction 2: What will happen to the voltage if you connect the two leads (which previously connected to the battery) to each other? **DO NOT DO IT NOW!**

Discharging Capacitor Prediction



8. Connect the two leads (formerly from the battery) to each other. Then, close the switch and start the CAPAC program again at the same time. This time you will be collecting data for a discharging capacitor. Sketch the resulting graph below. Be sure to put a scale on the axis.

Discharging Capacitor

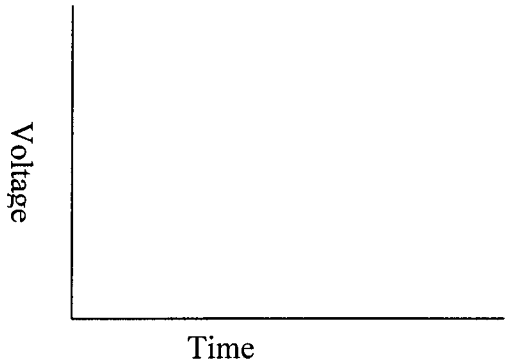


Question 2: How does the graph of the charging capacitor compare with the graph for the discharging capacitor? How are they similar or different?

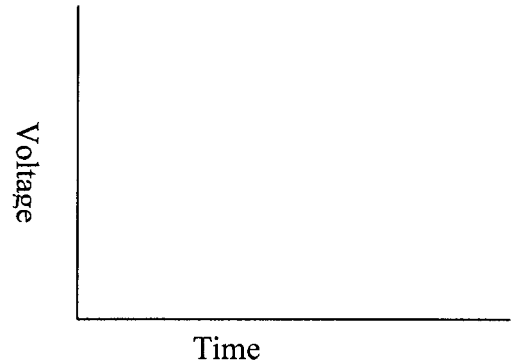
9. Repeat the above procedure for the 220 μF capacitor. Measure the value of the capacitor and record below.

C=________________

Charging Capacitor



Discharging Capacitor



Question 3: How do these graphs compare to the ones for the first capacitor?

Question 4: What does that tell you about the relationship between capacitance and the rate of charge/discharge?

10. If you have time repeat the experiment with the 100 μF capacitor.

Question 5: Does the result of the third capacitor change your answer to Question 4? Explain.