

Alternate CBL Instructions

Charging of Capacitors

Safety Precautions



- Use caution when plugging in, using, or unplugging the CBL 2 unit's power supply.

Materials

9-V battery

9-V battery clip

hook-up wires

switch

47-k Ω resistor

capacitors: 1000- μ F, 500- μ F, 240- μ F

CBL 2

link cable

voltage probe or differential voltage probe

TI graphing calculator

DataMate program

Procedure

1. Before you begin, leave the switch open (off). Do not attach the battery at this time. **CAUTION: Be careful to avoid a short circuit, especially by permitting the leads from the battery clip to touch each other.** Connect the circuit, as illustrated in the textbook. Do this by connecting either end of the resistor to one side of the switch. The resistor is used to reduce the charging of the capacitor to a measurable rate. Connect the other end of the resistor to the negative side of the 9-V battery clip. Inspect your 1000- μ F capacitor to determine whether either end is marked with a negative sign, or an arrow with negative signs on it, that point to the lead that is to be connected to the negative side of the battery. Connect this negative lead to the other side of the switch. Attach the unconnected (positive) lead of the capacitor to the positive lead from the battery clip.
2. Attach the voltage probe to the capacitor. Attach the red positive voltage probe lead to the "+" of the capacitor and the black negative voltage probe lead to the "-" of the capacitor.
3. Connect the CBL 2 unit to the TI graphing calculator using a link cable. Firmly press the ends of the link cable into each unit. Connect the voltage probe to Channel 1 of the CBL 2 unit.
4. Turn on the calculator and start the DataMate program. Press CLEAR to reset the program. The calculator should identify the voltage probe.
5. Select SETUP from the Main screen. Use the arrow keys to scroll to MODE. Select TIME GRAPH. On the TIME GRAPH SETTINGS screen, select CHANGE TIME SETTINGS. Enter "1" for the time between samples, in

- seconds. Enter “120” for the number of samples. Select OK to return to the SETUP screen.
6. Before applying power to the electric circuit, the voltage probe must be zeroed. To do this, discharge the capacitor by using a short piece of wire and placing it across both ends of the capacitor. Select ZERO from the SETUP screen. From the SELECT CHANNEL screen, select ALL CHANNELS. Press ENTER to zero the sensor. You will return to the Main screen.
 7. Press START to begin data collection. Quickly close the switch in your electric circuit to begin charging the capacitor. At the conclusion of the data collection the CBL 2 unit will beep and then display a graph of capacitor voltage v. time.
 8. Use the arrow keys to scroll through the graph and record the voltage and time data in your data table. The data table should be set up like the one in the textbook.
 9. (optional) Press ENTER to return to the Main screen, and then select QUIT to exit the Datamate program. At the direction of your teacher, use TI Connect to transfer the voltage v. time graph to a computer for printing.
 10. Replace the 1000- μF capacitor with a 500- μF capacitor. Repeat steps 7–8 and enter data into the appropriate column of your data table for the 500- μF capacitor.
 11. Replace the 500- μF capacitor with a 240- μF capacitor. Repeat steps 7–8 and enter data into the appropriate column of your data table for this last capacitor.

Alternate lab procedure, using a CBL unit

1. Before you begin, leave the switch open (off). Do not attach the battery at this time. **CAUTION: Be careful to avoid a short circuit, especially by permitting the leads from the battery clip to touch each other.** Connect the circuit, as illustrated in the textbook. Do this by connecting either end of the resistor to one side of the switch. The resistor is used to reduce the charging of the capacitor to a measurable rate. Connect the other end of the resistor to the negative side of the 9-V battery clip. Inspect your 1000- μF capacitor to determine whether either end is marked with a negative sign, or an arrow with negative signs on it, that point to the lead that is to be connected to the negative side of the battery. Connect this negative lead to the other side of the switch. Attach the unconnected (positive) lead of the capacitor to the positive lead from the battery clip.
2. Attach the voltage probe to the capacitor. Attach the red positive voltage probe lead to the “+” of the capacitor and the black negative voltage probe lead to the “-” of the capacitor.
3. Connect the voltage probe to Channel 1 of the CBL unit. Connect the CBL unit to the graphing calculator using a link cable. Turn on the graphing calculator and the CBL unit. Start the PHYSICS program and go to the MAIN MENU.
4. From the MAIN MENU, select SETUP PROBES. Select ONE as the number of probes. Select MORE twice, and then select VOLTAGE, for the voltage probe, or CV VOLTAGE, if you are using the differential voltage probe, from the SELECT

- PROBE menu. Check to be sure that the probe is properly connected and then press ENTER. You will return to the MAIN MENU.
5. Select COLLECT DATA from the MAIN MENU. Select TIME GRAPH. Enter “1” for the time between samples, in seconds. Enter “120” for the number of samples. Press ENTER. Select USE TIME SETUP. Select NON-LIVE DISPLAY.
 6. Press ENTER to begin data collection. Quickly close the switch in your electric circuit to begin charging the capacitor. After the data collection has stopped, press ENTER and observe the graph of capacitor voltage v. time.
 7. Use the arrow keys, scroll through the graph, and record the voltage and time data in your data table. The data table should be set up like the one in the textbook.
 8. (optional) Press ENTER, and then select NO at the REPEAT? prompt. Select QUIT on the MAIN MENU. As your teacher directs, print your graph using a TI Connect.
 9. Replace the 1000- μF capacitor with a 500- μF capacitor. Repeat the necessary steps and enter data into the appropriate column of your data table for the 500- μF capacitor.
 10. Replace the 500- μF capacitor with a 240- μF capacitor. Repeat the necessary steps and enter data into the appropriate column of your data table for this last capacitor.