Alternate CBL Instructions
Speed of Sound

Safety Precautions

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

Materials
meterstick
thermometer
cardboard or plastic tube with end cap or a book placed against the end (carpet tubes work well)
CBL 2 unit
link cable
TI graphing calculator
DataMate program
CBL microphone

Procedure

1. Connect the microphone to Channel 1 of the CBL 2 unit. Connect the CBL 2 unit to the graphing calculator using the link cable. Press the link cable ends firmly into each unit.
2. Lay the tube, closed at one end, horizontally on a table or a lab bench. Place the microphone at the open end so the microphone tip is positioned exactly at the opening. Measure the length of the tube and record it.
3. Turn on the graphing calculator. Start the DataMate program. The CBL 2 unit should auto ID the microphone. Press CLEAR to reset the application program.
4. Select SETUP. Use the arrow keys to scroll to MODE and press ENTER to go to the SELECT MODE menu. Select TIME GRAPH. Select ADVANCED.
5. On the ADV. TIME-GRAPH SETTINGS menu select CHANGE TRIGGERING. Select CH1-MICROPHONE, and then select INCREASING for the TRIGGER TYPE. Enter "0.001" for the TRIGGERING THRESHOLD. Next, enter "5" for PRESTORE IN PERCENT. Select OK twice to return to the SETUP screen.
6. On the SETUP screen, select ZERO, and then CH 1- MICROPHONE. When the room is quiet, press ENTER. This will zero the probe for room background noise. You will be back on the Main screen.
7. The CBL 2 unit has been programmed to begin listening and recording sound when it receives a loud trigger impulse. Make sure the room is quiet. Select START to ready the CBL 2 unit for the trigger noise. The CBL 2 unit will beep twice, indicating that it is ready. Quickly snap your fingers next to the microphone and the open end of the tube. The CBL 2 unit should beep twice to indicate that the threshold sound was loud enough to trigger it and begin data collection. If you did not hear the CBL 2 unit beep, then snap your fingers again.

8. The calculator will display “sampling.” After data collection has stopped, a graph of sound amplitude *vs.* time will be displayed.
9. Scroll to the first peak, your finger snap, and record the time. Scroll to the next peak which should be the return echo after the sound has traveled down the tube, reflected off the end, and traveled back.
10. The speed of sound may be calculated using the relationship $d = vt$, where d is the distance the sound wave traveled (twice the length of the tube), v is the velocity of sound, and t is the time measured on the graphing calculator from when the snap was heard until the echo is heard.

Alternate lab procedure, using a CBL unit

1. Connect the microphone to the Channel 1 of the CBL unit. Connect the CBL unit to the graphing calculator using the link cable. Press the link cable ends firmly into each unit.
2. Lay the tube, closed at one end, horizontal on a table or lab bench. Place the microphone at the open end so the microphone tip is positioned exactly at the opening. Measure the length of the tube and record it.
3. Turn on the CBL unit and the graphing calculator. Start the PHYSICS program and go to the MAIN MENU. Select SETUP PROBES from the MAIN MENU. Select ONE as the number of probes. Select MICROPHONE from the SELECT PROBE menu. Press ENTER. On the SELECT MICROPHONE menu, select the type of microphone you are using.
4. The COLLECTION MODE menu will appear. Select WAVEFORM/TRIGR. This will set up the CBL unit to trigger from a loud sound.
5. Press ENTER to ready the CBL unit. Snap your fingers next to the microphone and the open end of the tube. This should trigger the CBL unit into data collection mode. If you do not see a graph appear in a few moments, then snap your fingers again.
6. After data collection is complete, a graph of sound intensity *vs.* time will be displayed. Scroll to the first peak, which should identify your finger snap, and record the time. Scroll to the next peak, which should be the return echo after the sound has traveled down the tube, reflected off the end, and traveled back.
7. The speed of sound may be calculated using the relationship $d = vt$, where d is the distance the sound wave traveled (twice the length of the tube), v is the velocity of sound, and t is the time measured on the graphing calculator from when the snap was heard until the echo is heard.