Alternate CBL Instructions
Forces in an Elevator

Safety Precautions

- Use caution when working around elevator doors.
- Do not interfere with normal elevator traffic.
- Make sure that the mass on the force sensor does not fall and hit someone's feet or toes.
- Use caution when plugging in, using, or unplugging the CBL 2 unit's power supply.

Materials
elevator
500-g mass
CBL 2 unit
TI graphing calculator
link cable
DataMate program
dual range force sensor
masking tape, 30 cm

Procedure

1. Construct a data table, as shown in the textbook. Record the weight of the 500-g mass in the data table.
2. When you have assembled your materials and have your teacher's permission, proceed to an elevator on the ground floor. Secure your dual range force sensor to the wall of the elevator with masking tape.
3. Make a trial run with the elevator to the desired floor to determine if 100 s will be enough time to start the CBL 2 unit and have the elevator begin its trip and arrive at the desired floor.
4. Connect the force sensor to Channel 1 of the CBL 2 unit. Connect the CBL 2 unit to the TI graphing calculator with a link cable. Turn on the graphing calculator. Start the DataMate program. Press CLEAR to reset the application program. The CBL 2 unit should auto ID the force sensor and a default time interval of 5 s should be displayed.
5. From the Main screen select SETUP. Using the arrow keys, scroll to MODE and press ENTER.
6. Select TIME GRAPH from the SELECT MODE menu.
7. Choose CHANGE TIME SETTINGS from the TIME GRAPH SETTINGS menu. Enter "0.5" as the time between samples (in seconds). Enter "200" as the number of samples allowing data collection to run for 100 s. If 100 s was not enough time to run your experiment as determined in step 3, adjust the time value above to

allow more time, such as by increasing the number of samples. Select OK to return to the setup menu.

8. Before beginning data collection, the sensor needs to be calibrated to zero. Select ZERO from the SETUP menu. With no force applied to the sensor (i.e. no mass hung on the sensor), press ENTER to calibrate the force sensor to zero. Then hang the 500-g mass on the sensor. You will return to the Main screen.
9. To begin data collection, press START. Select the floor your want the elevator to go to and allow the doors to close. After data collection stops, a graph of force *vs.* time will be displayed. Use the arrow keys to trace along the graph. The first maximum value of weight you encounter will be during the upward acceleration of the elevator. Record the highest reading in your data table.
10. When the velocity of the elevator became constant, the force should have dropped back nearly to or to the stationary weight of the mass. Record this value in your data table.
11. As the elevator began to decelerate, the lowest value of force should be obtained. Record this value in your data table.

Alternate lab procedure, using a CBL unit

1. Construct a data table as shown in the text. Record the weight of the 500-g mass in the data table.
2. When you have assembled your materials and have your teacher's permission, proceed to an elevator on the ground floor. Secure your dual range force sensor to the wall of the elevator with masking tape.
3. Make a trial run with the elevator to the desired floor to determine if 99 s will be enough time to start the CBL unit and have the elevator begin its trip and arrive at the desired floor.
4. Connect the force sensor to Channel 1 of the CBL unit. Connect the CBL unit to the graphing calculator with a link cable. Turn on the CBL unit and the graphing calculator.
5. Start the PHYSICS program and go to the MAIN MENU. Select SET UP PROBES from the MAIN MENU. Select ONE as the number of probes.
6. Select FORCE from the SELECT PROBE menu. Select the type of force sensor that you are using and press ENTER.
7. From the CALIBRATION menu, select USE STORED. Return to the MAIN MENU.
8. Select ZERO PROBES and CHANNEL 1 from the SELECT CHANNEL menu. With no force applied to the sensor, press TRIGGER on the CBL unit. Now hang the 500-g mass from the sensor.
9. Select COLLECT DATA from the MAIN MENU. Select TIME GRAPH from the DATA COLLECTION menu. Enter "1" as the time between samples (in

seconds). Enter “99” as the number of samples so the CBL will collect data for about 99 s. If 99 s was not enough time to run your experiment as determined in step 3, adjust the time value above to allow more time, but do not exceed 99 samples. Press ENTER.

10. Select USE TIME SETUP. Press ENTER to begin collecting data. Select the floor your want the elevator to go to and allow the doors to close.
11. When the data collection is complete, press ENTER to view your graph. Use the arrow keys to trace along the graph. The first maximum value of weight you encounter will be during the upward acceleration of the elevator. Record the highest reading in your data table.
12. When the velocity of the elevator became constant, the force should have dropped back nearly to or to the stationary weight of the mass. Record this value in your data table.
13. As the elevator began to decelerate, the lowest value of force should be obtained. Record this value in your data table.