

Alternate CBL Instructions

The Coefficient of Friction

Safety Precautions



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

Materials

CBL 2 unit

TI graphing calculator

link cable

DataMate program

force sensor

wood block

string, 20 cm

wood surface

masking tape, 30 cm

Procedure

1. Lay the force sensor on its side on the wood surface. Attach it to the wood block using the short length of string.
2. Connect the force sensor to Channel 1 of the CBL 2 unit. Connect the TI graphing calculator to the interface with a link cable.
3. Turn on the graphing calculator. Start the DataMate program. The CBL 2 unit should automatically recognize the sensor type connected to Channel 1 and display this on the screen. Press CLEAR to reset the program application.
4. From the Main screen select SETUP. Using the arrow keys, scroll to MODE and press ENTER.
5. Select TIME GRAPH from the SELECT MODE menu.
6. Choose CHANGE TIME SETTING from the TIME GRAPH SETTINGS menu. Enter "0.05" as the time between samples (in seconds). Enter "200" as the number of samples, allowing data collection to run for 10 s. Select OK to return to the setup screen.
7. Before beginning data collection, the sensor needs to be zeroed. Select ZERO from the SETUP menu. With no force applied to the sensor, press ENTER to zero the sensor.
8. To begin data collection, press START. Slowly begin pulling on the force sensor to pull the block until it begins to move across the wood surface. Keep pulling so the wood block moves at a constant speed to the end of the wood surface.
9. After data collection stops, a graph of force v. time will appear. Use the cursor keys to trace along the graph. The maximum value of the force of static friction

occurs at the moment the block begins to slide. Record this value in your data table.

10. After the block is sliding at a constant speed, the average value of force displayed is the force of sliding friction. Record this value in your data table. Press ENTER to return to the Main screen.
11. Place the block on the end of the surface. Slowly raise one end of the surface to make an incline. Gently tap the block to cause it to move and overcome static friction. If the block stops, replace it at the top of the incline and repeat the procedure. Continue increasing the angle, θ , between the horizontal and the inclined surface, and tapping the block until it slides at a constant speed down the incline. Record the angle, θ , in Data Table 4.

Alternate lab procedure, using a CBL unit

1. Lay the force sensor on its side on the wood surface. Attach it to the wood block using the short length of string.
2. Connect the force sensor to Channel 1 of the CBL unit. Connect the graphing calculator to the CBL unit with a link cable. Turn on the CBL unit and the graphing calculator.
3. 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.
4. Select FORCE from the SELECT PROBE menu. Select the type of force sensor that you are using and press ENTER.
5. From the CALIBRATION menu, select USE STORED. You will return to the MAIN MENU.
6. Select ZERO PROBES and the CHANNEL 1 from the SELECT CHANNEL menu. With no force applied to the sensor, press TRIGGER on the CBL.
7. Select COLLECT DATA from the MAIN MENU. Select TIME GRAPH from the DATA COLLECTION menu. Enter "0.1" as the time between samples (in seconds). Enter "99" as the number of samples so the CBL will collect data for about 10 s. Press ENTER.
8. Select USE TIME SETUP. Press ENTER to begin collecting data. Slowly begin pulling on the force sensor to pull the block until it begins to move across the wood surface. Keep pulling so the wood block moves at a constant speed to the end of the wood surface.
9. When the data collection is complete, press ENTER to view your graph. Use the arrow keys to trace the curve. The maximum value of the force of static friction occurs at the moment the block begins to slide. Record this value in your data table.

10. After the block is sliding at a constant speed, the average value of force displayed is the force of sliding friction. Record this value in your data table. Press ENTER to return to the MAIN MENU.
11. Place the block on the end of the surface. Slowly raise one end of the surface to make an incline. Gently tap the block to cause it to move and overcome static friction. If the block stops, replace it at the top of the incline and repeat the procedure. Continue increasing the angle, θ , between the horizontal and the inclined surface, and tapping the block until it slides at a constant speed down the incline. Record the angle, θ , in Data Table 4.