

Alternate CBL Instructions

Conservation of Energy

Safety Precautions



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

Materials

grooved track
marble or steel ball
block of wood
CBL 2 unit
link cable
TI graphing calculator
two Vernier photogates
electronic balance
metric ruler
DataGate program (from Vernier)
masking tape

Procedure

The DataGate program must be installed prior to beginning the lab. It is a separate program from DataMate and is designed to work with the Vernier photogates. The DataGate program comes as part of a collection of programs in the VST APPS program available from Vernier.

1. Place the two section of grooved track together, as shown in **Figure 1** in the textbook. Raise one end of the track and place the block under it, about 5 cm from the raised end. Make sure the ball can roll smoothly across the junction of the two tracks.
2. Set up a data table like the one shown in the textbook.
3. The two photogates will be used as an electronic stopwatch to measure the time it takes for the ball to roll a specific distance. Place the two photogates 20.0 cm apart, center to center, on the table at the bottom of the ramp so that a marble rolling down the ramp will pass through the middle of the gates. Record the 20.0-cm distance in your data table. Secure the photogates to the table with pieces of masking tape.
4. Cascade the photogates by plugging one photogate lead into the second photogate and then connecting the second photogate to the DIG/SONIC port of the CBL 2 unit. Connect the CBL 2 unit to the TI graphing calculator using a link cable.
5. Turn on the graphing calculator and start the VST APPS program. Then, select the DataGate program.
6. Select SETUP from the main DataGate screen. Next, on the PHOTOGATE SETUP menu select PULSE. Select ONE photogate. If you observe the graphing

- calculator screen, the value displayed for the photogate is either a “—O—“ indicating an open, or unblocked, photogate or an “—X—“ indicating a blocked photogate.
7. When you are ready to time a roll, select START to ready the CBL 2 unit. Roll the marble from the selected location. You'll be using the CBL 2 unit as your stopwatch.
 8. Place a ball on the track directly above the point supported by the block. Release the ball. Record the time required for the ball to travel the 20.0-cm distance.
 9. Move the support block so that it is under the midsection of the inclined track, as shown in **Figure 2** in the textbook. Place the ball on the track just above the point supported by the block. Release the ball and measure the time needed for the ball to travel the 20.0-cm distance.
 10. Calculate the speed of the ball in steps 8 and 9. Move the support block to a point about three-fourths of the way down the length of the inclined track, as shown in **Figure 3** in the textbook.
 11. Predict the amount of time the ball will take to travel the 20.0-cm distance. Record your prediction.
 12. Test your prediction.
 13. Place the support block at the midpoint of the inclined track (Figure 2). Measure a point on the inclined portion of the track that is 1.0 cm above the level portion of the track. Be sure to measure 1.0 cm above the level portion, and not 1.0 cm above the table.
 14. Release the ball from this point and measure the time required for the ball to travel the 20.0-cm distance and record it in your data table.
 15. Use a ruler to measure a point that is 2.0 cm above the level track. Release the ball from this point and measure the time required for the ball to travel the 20.0-cm distance. Record the time in your data table.
 16. Repeat step 15 for 3.0 cm, 4.0 cm, 5.0 cm, 6.0 cm, 7.0 cm, and 8.0 cm. Record the times.

Alternate lab procedure, using a CBL unit

1. Place the two sections of grooved track together, as shown in **Figure 1** in the textbook. Raise one end of the track and place the block under it, about 5 cm from the raised end. Make sure the ball can roll smoothly across the junction of the two tracks.
2. Set up a data table like the one shown in the textbook.
3. The two photogates will be used as an electronic stopwatch to measure the time it takes for the ball to roll a specific distance. Place the two photogates 20.0 cm apart, center to center, on the table at the bottom of the ramp so that a marble rolling down the ramp will pass through the middle of the gates. Record the 20.0-

cm distance in your data table. Secure the photogates to the table with pieces of masking tape.

4. Cascade the photogates by plugging one photogate lead into the second photogate and then plugging the second photogate into the DIG/SONIC port of the CBL unit. Alternatively, connect a dual photogate adapter to the DIG/SONIC port of the CBL unit and plug the photogates into the adapter.
5. Connect the CBL unit to the TI graphing calculator with a link cable. Turn on the CBL unit and the graphing calculator. Start the PHYSICS program and go to the MAIN MENU. From the MAIN MENU, select SETUP PROBES.
6. Select ONE as the number of probes. From the SELECT PROBE menu, select PHOTOGATE. Press ENTER to go to the TIMING MODES menu.
7. If desired, check the photogate operation before proceeding. To do this, select CHECK GATE. Watch the screen as each photogate is blocked. It should indicate blocked or unblocked. Press “+” to return back to the TIMING MODES menu when you are done.
8. From the TIMING MODES menu, select PULSE. Press ENTER to set the system for timing.
9. Using your pre-selected location as described in the text, roll the marble down the incline and the time to travel the 20.0 cm will be displayed on the calculator. After you have recorded the time, press ENTER and select YES to make another trial.
10. Move the support block so that it is under the midsection of the inclined track, as shown in **Figure 2** in the textbook. Place the ball on the track just above the point supported by the block. Release the ball and measure the time needed for the ball to travel the 20.0-cm distance.
11. Calculate the speed of the ball in steps 9 and 10. Move the support block to a point about three-fourths of the way down the length of the inclined track, as shown in **Figure 3** in the textbook.
12. Predict the amount of time the ball will take to travel the 20.0-cm distance. Record your prediction.
13. Test your prediction.
14. Place the support block at the midpoint of the inclined track (Figure 2). Measure a point on the inclined portion of the track that is 1.0 cm above the level portion of the track. Be sure to measure 1.0 cm above the level portion, and not 1.0 cm above the table.
15. Release the ball from this point and measure the time required for the ball to travel the 20.0-cm distance and record it in your data table.

16. Use a ruler to measure a point that is 2.0 cm above the level track. Release the ball from this point and measure the time required for the ball to travel the 20.0-cm distance. Record the time in your data table.
17. Repeat step 15 for 3.0 cm, 4.0 cm, 5.0 cm, 6.0 cm, 7.0 cm, and 8.0 cm. Record the times.