EasyData Tutorial 6

Boyle's Law Using LabPro or CBL 2 and a Gas Pressure Sensor

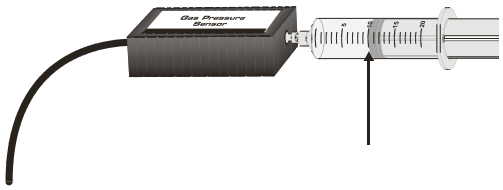
In the previous tutorial you learned how to collect time-based data using a temperature probe. This tutorial will guide you through using the Events with Entry data collection mode to investigate the relationship between the pressure and volume of a gas, also known as Boyle's law. The Events with Entry mode in the EasyData App collects a data point each time you select KEEP. The application then prompts you to enter a corresponding value for that point.

MATERIALS

TI graphing calculator
TI CBL 2 or Vernier LabPro interface
Vernier EasyData App
Vernier Gas Pressure Sensor
20 mL plastic syringe

PROCEDURE

1. Connect the LabPro or CBL 2 interface to the calculator's I/O port. Firmly press in the cable ends. Connect the Gas Pressure Sensor to CH1 of the interface.
2. Turn on your graphing calculator and make sure that it is on the home screen. Press APPS and then select EasyData. Notice that the program automatically identifies the Gas Pressure Sensor. It displays the channel it is connected to and a pressure reading in kilopascals (kPa). Select [Fitb] and then select **New** to reset the program.
3. Prepare the Gas Pressure Sensor and an air sample for data collection.
   a. With the 20 mL syringe disconnected from the Gas Pressure Sensor, move the piston of the syringe until the front edge of the inside black ring (see the figure at right) is positioned at the 10.0 mL mark.
   b. Attach the 20 mL syringe to the valve of the Gas Pressure Sensor. The Vernier Gas Pressure Sensor has a white stem protruding from the end of the sensor box—attach the syringe directly to the white stem with a gentle half-turn.



4. To collect pressure *vs*. volume data for Boyle's law, you will collect the data in Events with Entry mode.
   a. Select [Setup].
   b. Select **Events with Entry**.
5. You are now ready to collect pressure and volume data. Select [Start] to begin data collection and follow the on-screen instructions.
6. Move the piston so the front edge of the inside black ring is positioned at the 5.0 mL line on the syringe. Hold the piston firmly in this position until the pressure value displayed on the calculator screen stabilizes and select [Keep].
7. Type **5**, the gas volume in mL, and then select [OK]. You have recorded the first pressure-volume data pair.
8. To collect another data pair, move the syringe to 7.5 mL. When the pressure reading stabilizes, select [Keep] and type **7.5** as the volume. Note that the first two points are now plotted.
9. Repeat Step 8 for volumes of 10.0, 12.5, 15.0, 17.5, and 20.0 mL. As you conduct the experiment, note that the graph is updated after you record a pressure reading.
10. After you have collected your final data pair, select [Stop].
11. Use the ▷ or ◁ keys to examine the data pairs on the graph.
12. Boyle's law states, in brief, that the pressure and volume of a sealed vessel of gas are inversely proportional when the temperature of the gas is held constant. Does the graph of your data support Boyle's law?
13. Select [Main] to return to the Main screen. Select [Quit] and then select [OK] to exit EasyData.