

Boyle's Law: Pressure-Volume Relationship in Gases

INTRODUCTION

You will be examining the relationship between the volume of a confined gas and the pressure exerted by that gas. The relationship was first described by Robert Boyle, so it is referred to as Boyle's Law.

CLAIM

Make a prediction about what will happen to the pressure exerted by the gas in the syringe as the volume decreases. What will happen as volume increases?

MATERIALS

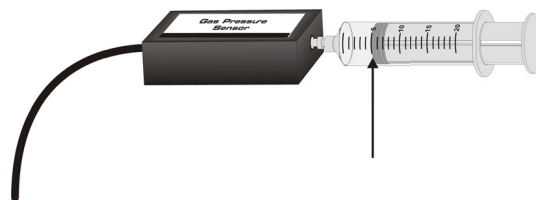
Vernier gas pressure sensor and syringe, Go! Link adapter, Chromebook

PROCEDURE

1. Prepare the Pressure Sensor and an air sample for data collection.
 - a. Plug the Pressure Sensor into the USB channel of your Chromebook using the Go! Link adapter. **DO NOT** attach the syringe yet!
 - b. Start the Vernier Graphical Analysis app for your Chromebook. If you don't have it yet, install it from the Chrome Store.
 - c. The Graphical Analysis app should recognize the pressure probe and immediately measure pressure in kPa (kiloPascals). It should read a pressure of near atmospheric pressure (101.3 kPa). If the reading is drastically different, inform your instructor.
 - d. With the 20-mL syringe **disconnected** from the Pressure Sensor, move the piston of the syringe until the front edge of the inside black ring is positioned at the 10.0 mL mark.
 - e. Attach the 20-mL syringe to the valve of the Pressure sensor. Vernier Gas Pressure Sensors have a white stem protruding from the end of the sensor box—attach the syringe directly to the white stem with a gentle half-turn.
2. Select "Events with Entry" as the mode of data collection (lower left corner of Graphical Analysis).
 - a. For "Event Name" type: Volume
 - b. For units, type: mL or milliliters
3. You are now ready to collect pressure and volume data. It is best for one person to take care of the gas syringe and for another to operate the Chromebook as needed.



- a. 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 screen stabilizes. **CAUTION: Handle the syringe carefully – the tip breaks quite easily. Do not compress the pressure probe and syringe together.**



- b. Select "Collect" at the top of the window in Graphical Analysis. When you have a stable pressure reading, select "Keep" and enter the volume. The program will record the pressure for you.
- c. Continue with this procedure using volumes of 7.5, 10.0, 12.5, 15.0, 17.5, and 20.0 mL.

EVIDENCE

1. Export the graph and data table from Graphical Analysis and place it here in your lab report.