

10.9 Gas Pressure Sensor: Pressure and temperature relationship of a gas

Subjects: Properties of gases, temperature effect on pressure

Description: The relationship between pressure of a gas and temperature is explored using the pressure sensor. Data is displayed using the Logger Pro program.

Materials:

Gas pressure sensor
Temperature probe
Computer and LabQuest interface
Logger Pro software
Rubber stopper assembly
Plastic tubing with connectors
125 mL Erlenmeyer Flasks
3 1-liter beakers
Hot plate
Ice
Glove

Procedure:

1. Prepare a hot water bath, an ice bath and a room temperature bath.
2. Connect the Gas sensor to Channel 1 of the Labquest interface and connect the temperature probe to Channel 2.
3. Assemble the apparatus. Connect the white rubber stopper to the Gas Pressure Sensor with the clear tubing. (About one-half turn of the fittings will secure the tubing tightly.) Be sure the valve is open to the sensor. Twist the white stopper snugly into the neck of the Erlenmeyer flask to seal it. Be sure the valve to the unused connection is closed.
4. Open the file "30b Gases" from the Advanced Chemistry with Vernier folder. This file is set up to collect pressure and temperature data from the attached sensors using "Selected Events Mode". This mode allows you to collect a data pair simultaneously from the Gas Pressure Sensor and Temperature Probe by clicking the [Keep] button.
5. Place temperature probe in the ice water bath. Then place the flask in the bath making sure it is submerged up to the neck. When the readings stabilize click [Keep].
6. Repeat step 4 for the room temperature and hot water baths. Use a pair of insulated gloves for the hot water bath to avoid burns.
7. Compare the pressure of air in the flask at different temperatures.

Discussion:

This experiment demonstrates the relationship between absolute temperature of a gas sample and the pressure it exerts. As temperature increases, pressure of a gas also increases.

Safety: Use caution when handling boiling water to prevent spills and burns.

Disposal: None

References:

Demo adapted from:

1. Randall, J. et al. Advanced Chemistry with Vernier. 2nd Ed. 2007. Vernier Software and Technology. Experiment 30.

http://www.vernier.com/files/sample_labs/CHEM-A-30-COMP-gas_laws.pdf