Lower Merion High School Chemistry

Gay Lussac's Law

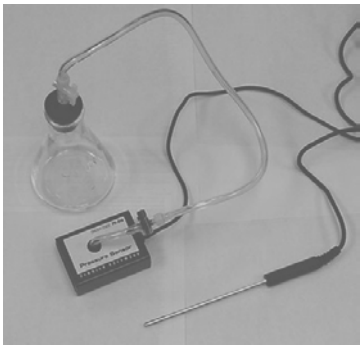
Lab #18

Gay Lussac's Law describes the mathematical relationship between the temperature of a gas (a measure of the average kinetic energy of the gas molecules) and the pressure of the gas (a measure that is proportional to the force it exerts on the walls of its container). In this lab you will alter the temperature of a trapped sample of air and will measure the resultant pressure.

Materials:

TI-83 Calculator with CHEMBIO	CBL	Pressure sensor
Erlenmeyer flask	stopper	

Procedure:



Connect the calculator, CBL, pressure sensor and temperature probe.

Connect the tubing and stopper to the pressure sensor and find a flask that fits the stopper tightly. Be sure all connections are tight and secure.

Run CHEMBIO. Set up probes. If you are asked about calibration for the temperature probe use STORED calibration and then the pressure sensor using the STORED calibration and mm Hg as the unit of measurement.

When you return to the main menu, choose COLLECT DATA, then TRIGGER. Around the room you will find 4 different temperature baths. Start at one extreme (either the boiling water or the ice bath) and immerse both the temperature probe and the flask into the water. Monitor pressure and temperature on the CBL screen by pressing the [CH VIEW] button on the CBL. When "CH1" in the upper-left corner of the CBL screen blinks, the *Channel 1* temperature (in °C) is displayed on the CBL. When you press [CH VIEW] again, "CH2" starts to blink—the *Channel 2* pressure (in mm Hg) is now displayed on the CBL. Continue to press [CH VIEW] to alternate between the two readings. When the temperature and pressure readings displayed on the CBL screen have both stabilized, press [TRIGGER] on the CBL to store the pressure-temperature data pair.

Choose more data, then move the apparatus to the next water bath. (Go in order, from highest to lowest temperature.) Repeat the above steps to obtain data for each of the water baths. When you have taken the four data points choose STOP AND GRAPH. Your data should be linear. If your data is lousy, check your setup for leaks and repeat the experiment. If your data looks good quit the program and either upload the data to a computer and save it, or write the data points down for later use.

Calculations:

Graph pressure v. temperature. Determine the equation of the line. Use the equation of the line to find absolute zero (the temperature at which pressure is zero).

For each data point, calculate P/T, being sure to use the absolute temperature (K).