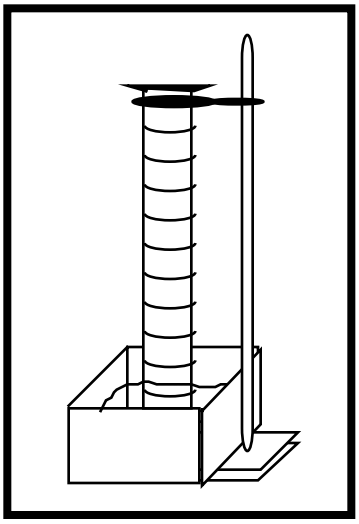
Liters vs. Moles and Molar Volume Name:

Intro

In this lab you will explore the relationship between the number of moles of a gas and its volume. This will be done by measuring the mass of several volumes of butane gas - C4H10.

Procedure:

1) Get a one liter graduated cylinder, a deep pan, a ring stand and a large ring which fists over the cylinder.
2) Put 4 or 5 cm of tap water into the pan. Fill the cylinder to the brim with tap water. Put your hand or some flat object over the top of the cylinder and invert it into the pan without the water falling out. A little bit of air is OK, but try to minimize this.
3) Put the pan onto the base of the ring stand, lift the cylinder a little bit and slide the large ring under it. Lift the ring and attach it to the ring stand so that the cylinder is suspended above the bottom of the pan and the 1000ml. mark is just above the surface of the water.



4) Get a butane cylinder and a rubber hose. Make a couple of quick practice tries at releasing some butane by grasping the hose and pushing DOWN on the nozzle. Don't bend it to the side.
5) Weigh the butane can without the nozzle. Attach the rubber hose to the glass tube, Put the other end of the hose under the graduated cylinder so that it rests just below the lip. You know the beginning mass of the can of butane. By releasing some of the butane into the graduated cylinder you will be able to measure the volume of gas released. After releasing some gas you will weigh the can again to measure the mass of that gas. Collect data on mass and volume of butane. I recommend only 4 or 5 evenly spaced data points. For example, measure the mass of 250ml, 500 ml, 750ml, and 1000 ml of gas.
6) After you have completed collecting data, lift the graduated cylinder of butane. When the water has drained, put your hand over the end and carry it to the fume hood. Lay it on its side. Dump the water out of the pan and return all the equipment.
7) Record our current room temperature and pressure. See the barometer near the door of the lab. Adjust the knob on the right of the barometer to slide the panel to the level of the mercury. Then read the value from the scale on the right hand side.

Questions + Problems

1) Convert all grams measurements to moles and graph the data with volume on the y-axis and moles of butane (do not include the mass of the can) on the x-axis.

2) Is the relationship between volume and moles directly proportional or inversely proportional? Why?

3) What is the formula for the best fit line through your data?

4) We have seen that PV = a constant, and V / T = a constant, each resulting in a particularly shpaed graph. What simple relationship is depicted by the graph of volume vs. moles (Look at your previous graphs.)?

5) If you calculated this constant using the simple formula derived in #3, what would be the units of this constant?

6) This constant is what is known as the molar volume or how many liters of a gas are occupied by one mole of that gas. We have found the molar volume at our current temperature and pressure. Using the combined gas law convert this molar volume to what it would be at Standard Temperature (0°C) and Standard Pressure (760.0 mmHg). (You will need to measure today's temp. and pressure. To measure the pressure see the barometer on the wall near the door of the lab.)