PROCEDURE

Your teacher will provide you with a bottle. This bottle contains air under considerable pressure, so handle it carefully. Do not unscrew the cap of the bottle.

1. Use the tire pressure gauge to measure the gauge pressure of the air in the bottle, as accurately as you can read the gauge. It might be convenient for one student to hold the bottle securely, wrapped in a cloth towel, while another student makes the pressure measurement. Record this pressure in your data table.
2. Measure the mass of the bottle plus the air it contains, to the nearest 0.01 g. Record this mass in your data table.
3. With one student holding the wrapped bottle, depress the tire stem valve carefully to allow some air to escape from the bottle until the observed gauge pressure has decreased by 5 to 10 psig. Then, repeat the measurements in steps 1 and 2.
4. Repeat the steps of releasing some pressure (step 3) and then measuring gauge pressure (step 1) and measuring the mass (step 2) until no more air comes out.
5. Now repeat steps 1 and 2 one last time. The gauge pressure should be zero; if it is not, then you probably have not released enough air, and you should depress the valve for a longer time. You should have at least five measurements of gauge pressure and mass, including this final set.
6. Read the atmospheric pressure in the room from the barometer, and record the reading in your notebook.

CLEANUP AND DISPOSAL

7. Return all equipment to its proper place. Wash your hands thoroughly before you leave the lab and after all work is finished.

ANALYSIS AND INTERPRETATION

1. **Organizing Data:** Correct each gauge pressure in your data table to the actual gas pressure in psi, by adding the barometric pressure (in psi) to each measured gauge pressure. Enter these results in the column "Corrected gas pressure."
2. **Analyzing Data:** Make a graph of your data. Plot corrected gas pressure on the *x*-axis and mass of bottle plus air on the *y*-axis. The *x*-axis should run from 10 psi to at least 80 psi. The *y*-axis scale should allow extrapolation to corrected gas pressure of zero.
3. **Analyzing Data:** If your graph is a straight line, write an equation for the line in the form $y = mx + b$. If the graph is not a straight line, explain why, and draw the straight line that comes closest to including all of your data points. Give the equation of this line.
4. **Interpreting Data:** What is the mass of the empty bottle? (Hint: When no more air escapes from the bottle in steps 4 and 5, the bottle is *not* empty; it still contains air at 1 atm.)
5. **Analyzing Data:** For each of your readings, calculate the mass of air in the bottle. Enter these masses in your data table.
6. **Interpreting Data:** The density of air at typical laboratory conditions is 1.19 g/L. Find the volume of the bottle.
7. **Interpreting Data:** Calculate the density of air at each pressure for which you made measurements. Enter these density values in your data table.

CONCLUSIONS

1. **Inferring Relationships:** Based on your results in this experiment, state the relationship between the mass of a gas sample and the gas pressure. Be sure to include limitations (that is, the quantities that must be kept constant).
2. **Interpreting Graphics:** Using your graph from item 2 of Analysis and Interpretation, predict the mass of the bottle plus air at a gauge reading of 60.0 psig. Estimate the mass of the gas in the bottle at that pressure.