FLINN SCIENTIFIC

Name_____

Post-Lab Questions and Calculations

Complete the calculations and record your answers in the Ideal Gas Laws Data Sheet.

1. Calculate the pressure inside the bottle, P_2, for each of your trials, in atm. Use the volume of air in the 10-mL syringe and Boyle's Law, $P_1V_1 = P_2V_2$

   $$P_1 \text{ (atmospheric pressure, in atm)} \times V_1(10 \text{ mL}) = P_2 \times V_2(\text{volume of air in the syringe})$$

   Note: To find the atmospheric pressure, P_1, in atm, divide your measured atmospheric pressure by one of the following: 760 torr (mm of Hg), 29.92 inches of Hg, 101.3 kPa, or 1013 millibars.

2. Calculate the mass of air, m, in the bottle using a form of the ideal gas law equation:

   $$PV = nRT \quad \text{or} \quad PV = \frac{m}{M}RT \quad \text{or} \quad m = \frac{PVM}{RT}$$

   Where P = atmospheric pressure, in atmospheres

   V = volume of the soda bottle, in L ([Measured volume – 10-mL syringe volume]/1000)

   M = average molar mass of air, 29.0 g/mol

   R = ideal gas constant, 0.0821 L·atm/°K·mol

   T = room temperature, in degrees K

   m = mass of the gas in the bottle

3. Calculate the mass of the bottle/syringe by subtracting the mass of air in the bottle from the mass of the bottle/syringe plus air for each trial. How consistent is the mass for the bottle/syringe? How can you explain any discrepancies?

4. For each trial, calculate the number of moles of air in the bottle, n, from the mass of air and its molar mass, 29.0 g/mol

   $$n = \frac{\text{mass of air (g)}}{29.0 \text{ g/mol}}$$

5. For each trial, calculate the ratio of the pressure, P, to the moles of air in the bottle, n and find the average P/n ratio.

6. *a.* Plot the pressure inside the bottle as a function of the number of moles of air. Draw the best straight line through the data points.

   b. Calculate the slope of the line.

7. Calculate the theoretical pressure to moles of air ratio (P/n) from the ideal gas constant, R, room temperature, T, and the volume of the bottle, V.

   If $PV = nRT$, then the theoretical pressure-to-moles ratio $\frac{P}{n} = \frac{RT}{V}$

8. How does the slope of your graph compare with the theoretical pressure-to-moles ratio? Explain.

9. Explain how the results of the experiment are consistent with PV = nRT.

10. How did the temperature change when the bottle was first filled with air and then, when the pressure inside the bottle was released? Account for these changes.

11. What are possible sources of error in this experiment?

Ideal Gas Law Data Sheet

Room temperature: _____ °C

Volume of the bottle: _____ mL

Barometric pressure: _____

Trial	Mass of Bottle/Syringe plus Air (g)	Volume of Air in the Syringe (mL)	Pressure Inside the Bottle (atm)	Mass of Air in the Bottle (g)	Mass of the Bottle/Syringe (g)	Moles of Air in the Bottle (mol)	Pressure-to-Moles Ratio
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
Average value for the pressure-to-moles-of-air ratio, P/n							