South Pasadena • Chemistry Name_____

Date ___/___/___ Period ___

8 • Why Do Hot Air Balloons Float?

PRESSURE & VOLUME

Question: How do the **Pressure** and **Volume** of a gas relate to each other?
Can we find a ***mathematical relationship*** between the two variables?

Materials: computer with Vernier "Gas Pressure Sensor" and 20 cc (20.0 mL) syringe

PROCEDURE: DATA Collection

1. Disconnect the syringe from the gas pressure sensor and set the plunger in the syringe to 10.0 mL. Reconnect the syringe to the sensor (not TOO tight). The pressure reads: _____ kPa.

2. Click the button on the screen marked "Collect." The buttons will change to "Stop" and "Keep."

3. Push the plunger in the syringe to 5.0. The pressure _____ (increases / decreases). Click the button "Keep" and type the volume (5.0) into the window. Click OK.

4. Repeat procedure with the other volumes to fill the data table. If you need to start over, click "Stop" and go back to step 2.

DATA TABLE // CALCULATION TABLE Today's Air Pressure = _____ mmHg

Trial #	Pressure (kPa)	Volume (mL)	Actual Volume (mL)	Constant
1		5.0	5.8	
2		7.5		
3		10.0		
4		12.5		
5		15.0		
6		17.5		
7		20.0		

CALCULATIONS:

There is a correction we need to make. Inside the "Gas Pressure Sensor" there is a chamber that has a volume of 0.8 mL. So, the actual volume is not 5.0 mL, it is 5.8 mL. Fill in the Actual Volume column and use actual volume for future calculations.

Graph the data placing Actual Volume (mL) along the "x" axis and Pressure (kPa) on the "y" axis. You may do the graph by hand on graph paper (not notebook paper) or use Excel or the online website, Create-a-Graph (http://nces.ed.gov/nceskids/createagraph/index.asp). Attach the graph to this handout.

Questions:

1. The two variables, pressure and volume are changing during this experiment. What are the two variables that remain **constant** during the experiment?
   _____ and _____

2. From your graph, what kind of mathematical relationship exists between the pressure and volume of your gas? Directly Proportional or Inversely Proportional

3. If the variables are ***directly*** proportional, the mathematical relationship is: $P = kV$ or $\frac{P}{V}$ = constant

   If the variables are ***inversely*** proportional, the relationship is: $P = k\frac{1}{V}$ or $P \cdot V$ = constant.

   Choose which relationship should be correct and calculate the constant for your seven trials of data using Pressure and **Actual** Volume. Include the answers in your Data/Calculation Table.
   Are the values pretty close (compare the first two digits). _____

4. Refer back to step 1 of your Procedure. Convert the pressure you wrote down to **mmHg**. (Show your work.)

5. According to the barometer, the actual pressure on the day was ___ mmHg. Calculate the % error. (Show your work.)

Bonus Point Opportunity:
Make a graph of Pressure vs. 1/Actual Volume.

Trial #	Pressure (kPa)	Actual Volume (mL)	1/Actual Volume (mL^{-1})
1		5.8	
2			
3			
4			
5			
6			
7			