South Pasadena • AP Chemistry

Name _____
Period ___ Date ___/___/___

12 • The Gas Laws

B O Y L E ' S L A W L A B E T T E

PURPOSE:

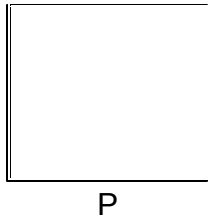
We will study the relationship between pressure exerted on a sample of gas and the volume of that gas by collecting data and looking at that data graphically as well as mathematically.

APPARATUS:

10 cc (10 cm^3 or 10 mL) syringe air compressor barometer
water bottle tire gauge tire valve goggles

OVERVIEW:

We will gather some actual data about a gas sample trapped in a sealed syringe. Using a compressor or a bicycle pump, we will increase the pressure around the syringe and observe the volume of the gas in the syringe. We can release some of the air and using a tire gauge obtain volume data at several pressures.
We will plot the various pressures and resulting volumes.
Predict what the graph will look like? **Sketch the graph**.



PROCEDURE:

1. Wear your goggles! We will be pumping air inside a sealed bottle. While the bottles should easily stand the stress, tiny stress cracks could weaken the bottle. Protect your eyes.
2. Obtain a PETE bottle with a tire valve inserted in the cap and containing a sealed syringe.
3. Read the volume of the gas inside the syringe. Using the pump, increase the pressure inside the bottle until the gas in the syringe has a volume around 2 cc (mL).
4. Use the tire gauge to measure the pressure inside the bottle. Record this value.
5. Read the volume of the gas sample that is inside the syringe. Record this value.
6. Release some of the air from the bottle. Repeat steps 4, 5, and 6 until you have at least seven data values. Be certain to include the volume when all of the pressure is released (0 psi)

DATA:

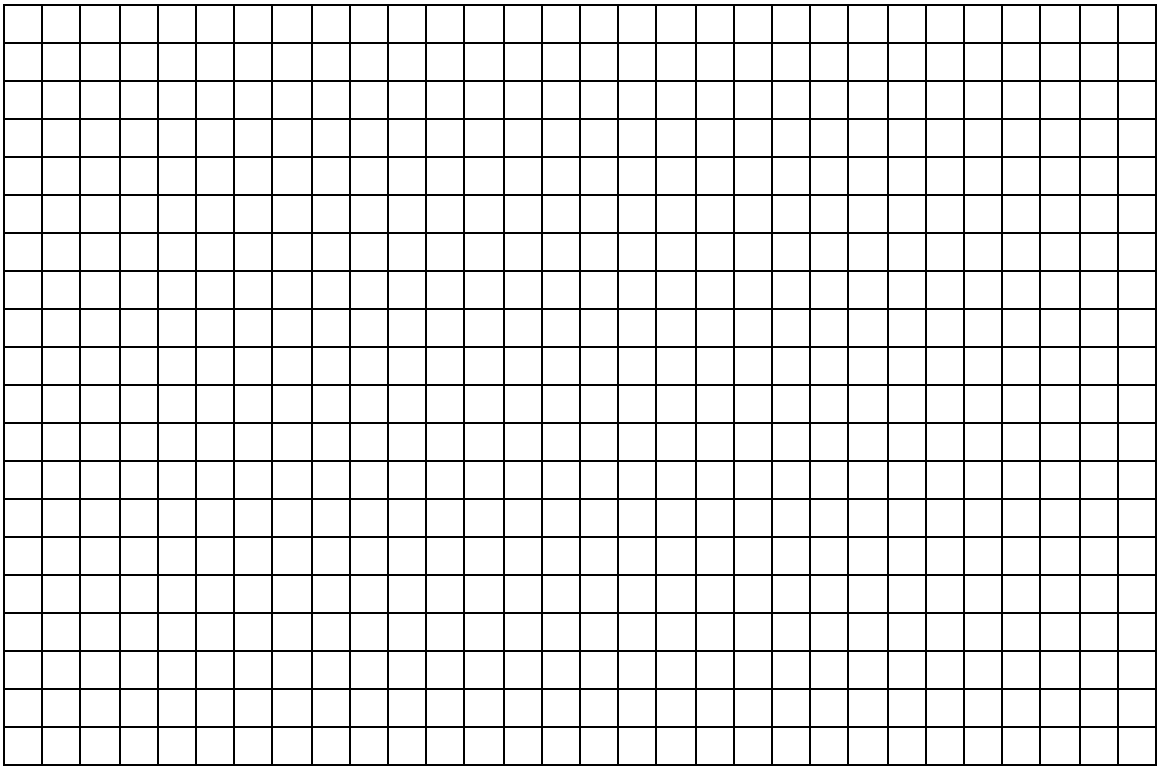
Air Pressure (psi)	Gauge Pressure (psi)	Actual Pressure (psi)	Volume (mL)
"			
"			
"			
"			
"			
"			
"			
"			

CALCULATIONS AND CONCLUSIONS:

Tire gauges are designed to read the amount of pressure <u>above</u> atmospheric pressure.
We need to determine the actual pressures by adding the value of air pressure to each value of gauge pressure.

Read the barometer and record today's air pressure is _____ mmHg.
Convert this to psi: (show your work)

Graph the data values. (Since you have control over the pressure (independent variable) and are reading the resulting volume (the dependent variable), place **actual pressure on the horizontal axis** and **volume on the vertical axis**.)



When graphically looking for a relationship between two variables, it is most useful to have a straight line. Does P vs V result in a straight line? _____ Since P seems to be inversely related to V (P increases as V decreases), perhaps P is related to 1/V.
Complete the following Calculation Table and graph P vs 1/V on the same graph above. Use the right vertical axis to label values of 1/V (values range from 0 to 0.100 mL^{-1})

Pressure (psi)	Volume (mL)	$\frac{1}{Volume}(mL^{-1})$	P x V

Does the graph of P vs 1/V result in a straight line? ____

P increases as V decreases. As P increases, what happens to 1/V? _____
As P approaches 0 psi, V approaches ∞. 1/V will approach _____ (0, ∞).

Should your graph of P vs 1/V include the point (0,0)? ____

Go back and look at your data. Is P x V ˜ constant? ___