Name_____Date _____Period _____

Boyle's Law Computer Activity Chemistry

Objectives- use Boyle's Law to examine the effect of volume and pressure on a gas.

Methods

1. Start Gas Properties sim: http://phet.colorado.edu/en/simulations/category/chemistry
2. Click on the "Measurement Tools" button. Click on the Ruler. The ruler's units are in nanometers (nm) but we are going to use the ruler to give us an estimated measurement of volume in liters, e.g. the box has an initial width of 6.6 nm which will be recorded in your data table as 6.6 liters.
3. First, you need to add a gas to your container. Click on the handle of the pump, and add ONE PUMPFUL of gas to your container. Describe the particle's motion:

   _____

4. Boyle's Law looks at the relationship between volume and pressure when there is a constant temperature. You must set your container to constant temperature. Click on the Temperature button in the "Constant Parameters" on the upper right corner. This will cause the temperature to automatically adjust to whatever the initial value is set at. What is the temperature (K) of your box?

   _____

5. You are going to adjust the volume of the container by clicking on the handle on the left side of the container and dragging it to various widths. Dramatically change the volume of the container to a smaller size. What happened to the temperature as the box got smaller?

   _____

   What did the simulation use to keep the box at a constant temperature?

   _____

6. Change the gas to 100 molecules of the HEAVY species by manually setting this in the right box. According to the Kinetic Molecular Theory, what action causes pressure on the inside of the container?

   _____

7. Hypothesize: If you make the container smaller, how will this affect the answer to the previous question?

   _____

If you make it larger? _____

8. Fill in the following chart by increasing the volume. Calculate values in the other columns using constant °T.

Results

Data Table

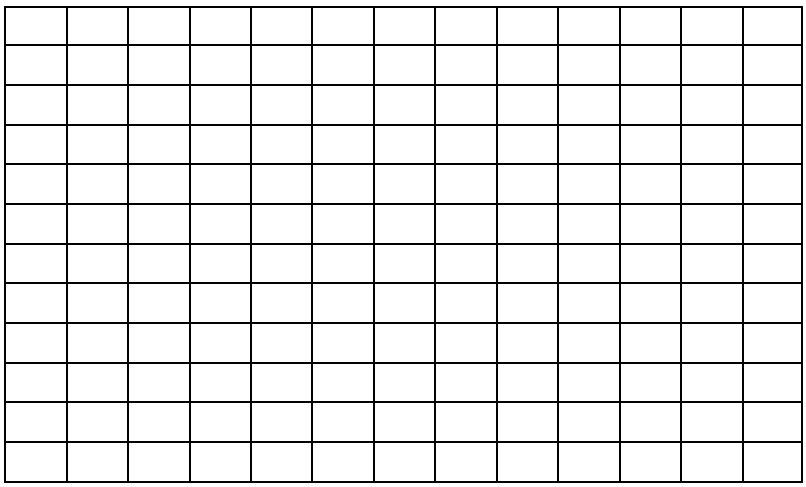
Trial	Volume (V)	Pressure (P)	Calculate k_1 = P x V	Calculate k_2 =P / V
1				
2				
3				
4				
5				
6				

Which variable did you control, i.e. was the independent variable? _____

Which variable is the dependent variable (responding)? _____

Make a Line Graph of Pressure and Volume in the graph below. Use proper scaling. Label the graph appropriately (including title, axes, scales). Draw a curved line connecting all of the points.

Title: _____



Looking at your graph, what is the type of relationship between volume and pressure?

_____

_____

As the volume gets larger, what happens to the pressure of the gas?

_____

_____

Which k-value is nearly constant in the data table? (circle one) k_1 or k_2

This k-value is constant; the ratio between volume and pressure of any point on the graph will be the same. Pick any two points from the graph or table:

Point #1	Point #2
V_1 = _____	V_2 = _____
P_1 = _____	P_2 = _____

Show this *k*-value calculation:

$K = P_1 \times V_1$ =_____ $K = P_2 \times V_2$ = _____

Now, write the equation for **Boyles' Law**:

_____ x _____ = _____ x _____

Questions- Use the above formula to predict the pressure (P_2) or volume (V_2) of any gas. Show All of Your Work or No Credit!

1. If a gas has a volume of 1.25 L and a pressure of 3.0 atm, what will the pressure be if the volume is changed to 2.50 L?

2. If a gas has a volume of 2.97 L and a pressure of 728 mm Hg, what will the pressure be if the volume is compressed to 0.95 L? What is the pressure in atmospheres (atm)? *Hint: first convert pressure units (760mm Hg = 1 atmosphere).*

3. A container has a volume of 5.85 L and a pressure of 4.50 atm. What will the volume be if the container's pressure is changed to 2.25 atm?

4. A high altitude balloon has a volume of 7,589 L at atmospheric pressure (1 atm). If the pressure decreases to 3.6 mm Hg, what is the container's new volume? *Hint: first convert pressure units (760 mm Hg = 1 atmosphere).*