Name:_____________________ Per._____

Gas Laws Lab Series

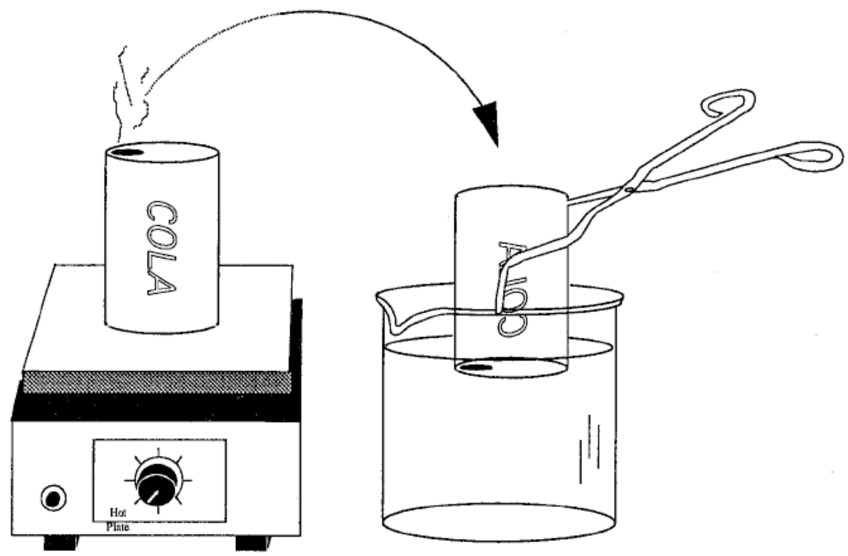
Introductory Phenomenon: Collapsing Can Demonstration.

Objective: To develop a model to explain the collapsing can demonstration & the molecular behavior of gases. Using feedback from the laboratory periods you will refine your model to more accurately explain and predict the collapsing soda can demonstration.

Discrepant Event:

Describe the demonstration shown to you <u>in great detail</u>. Include as much information as you can, you will develop a model to explain this event by the end of this lab series! Use the following picture as a starting point.

Notes:



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Kinetic Molecular Theory:

Using your knowledge from the previous unit state the 4 basic assumptions of kinetic molecular theory

1.

2.

3.

4.

Boyle's Law:

Collect data from the lab here:

Be sure to include the units you are using!

Volume	Pressure

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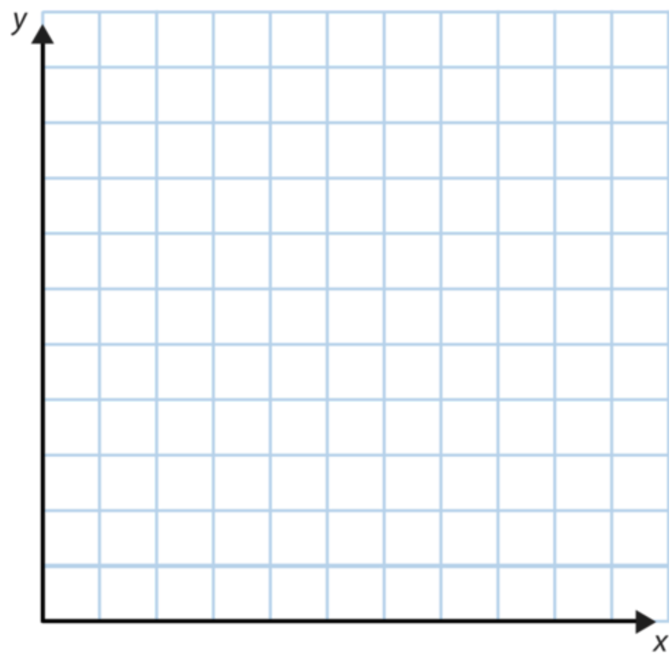
Sketch a rough graph of your data:



1. What parameters were held constant in this lab?

2. Why were the parameters held constant?

3. Using your data as a source, what is the overall relationship between pressure and volume? Some things to think about: If the volume doubles what happens to pressure? If the volume halves what happens to the pressure?
   When volume _____________ pressure ____________________.

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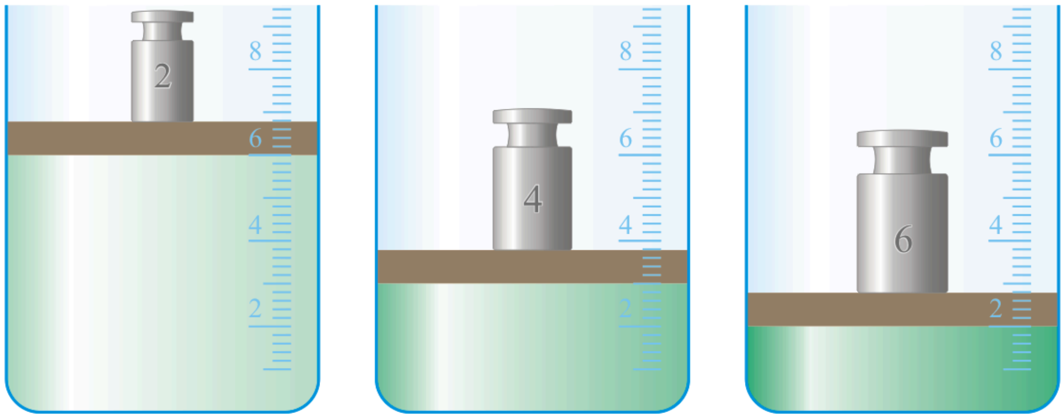
$T = \text{const.}$

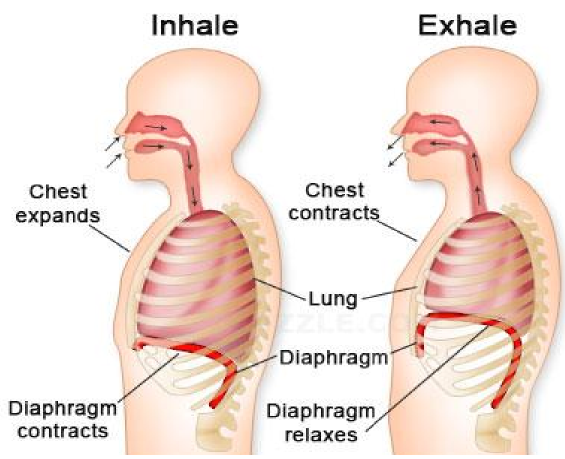


4. Predict the pressure for the following series given an initial pressure of 4 atm:

4 atm _____ atm _____ atm

5. A sample of helium gas in a balloon is compressed from 4.0 L to 2.5 L at a constant temperature. If the pressure of the gas is 210 kPa at 4.0 L volume, what will the pressure be at 2.5 L? Show all your work.

6. Using your lab data and the lung demonstration, develop a model to explain how we are able to breathe air with our lungs. Use terms such as: pressure, volume, inversely proportional.



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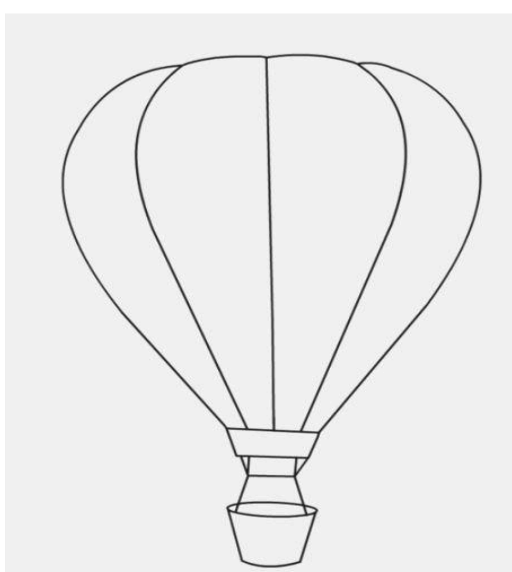
Charles Law:

Record your observations from the demonstration:

Develop a model to explain the demonstrations shown:

Based on the demonstration, what is the relationship between temperature and volume?

Using the previous information develop a model to demonstrate how a hot air balloon might work:



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Charles Law Practice

1. A sample of hydrogen gas occupies a volume of 364mL at 32.0^{o}C. What volume will it occupy at 112^{o}C?

2. Nitrogen gas is at a temperature of 65.0^{o}C when it occupies a volume of 3.20 liters. To what temperature should it be raised to occupy a volume of 7.80 liters?

3. Oxygen gas was cooled from 126.0^{o}C to 29.0^{o}C. Its new volume is 45.0mL. What was its original volume?

4. Krypton gas occupies a volume of 75.0mL at 312K. What volume will it occupy at 628K?

5. A sample of chlorine gas at 70.0^{o}C and a volume of 5.20 liters is cooled to 12.0^{o}C. What is the new volume?

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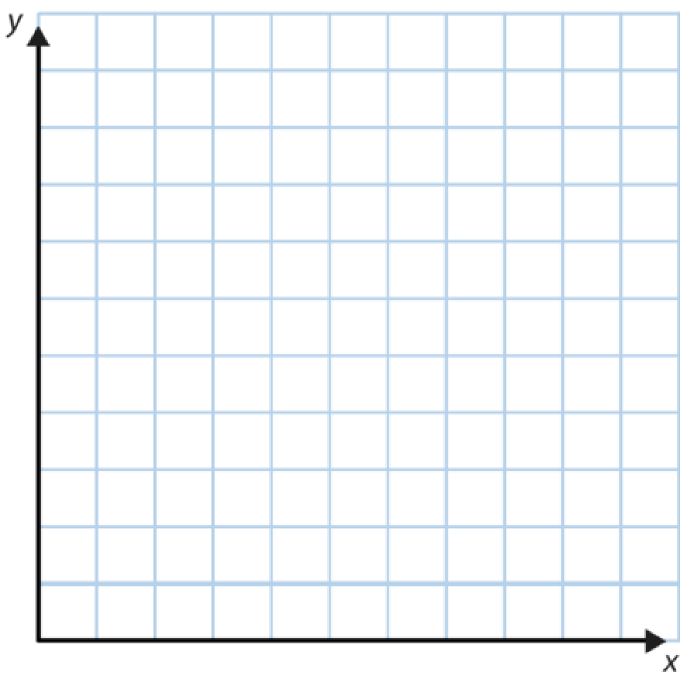
Gay-Lussac's Law:

Collect data from the lab here:

	Pressure	Temperature
Regular		
Hot		
Cold		

Sketch a rough graph of your data here:



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Gay-Lussacs Law Practice

1. What parameters were held constant in this lab?

2. Why were the parameters held constant?

3. What is the relationship between pressure and temperature?

4. Which do you think is the correct equation to reflect this relationship?
   a. $P_1 \times T_1 = P_2 \times T_2$
   b. $P_1/T_1 = P_2/T_2$
   c. $T_1/P_1 = T_2/V_2$
   d. $P_1 \times P_2 = T_1 \times T_2$

5. What is the pressure change when a constant volume of gas at 1.00 atm is heated from 298K to 308K?

6. What is the pressure at standard temperature of a gas that has a pressure of 50.6kPa and 11.0^{o}C?

7. What is the temperature at standard pressure of a gas that is at a pressure of 825torr and 25.0^{o}C?

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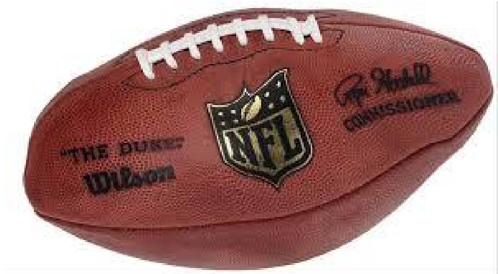
Deflategate!!!



If an official NFL football is inflated to the lowest regulation pressure at 12.5psi (0.850atm) in a warm locker room at 80.0°F (27°C) and is then taken out to a football field with an outdoor temperature of 51.0°F (11.0°C).

1. Does the air pressure inside the football change because of the temperature change?

2. Would we expect the pressure inside the ball to increase or to decrease?

3. If the NFL regulations require that the football be inflated to a pressure between 12.5 psi and 13.5 psi, does the football pass the inflation regulation?

4. Whose gas law would we use to solve this problem?

5. If the ball was tested to have had a pressure of about 10 psi, was the ball legally played?

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Combined Gas Law:

1. List the mathematical relationship for the following laws:
   a. Boyle's Law:

   b. Charles Law:

   c. Gay-Lussac's Law:

2. Using the previous laws develop a mathematical relationship between all variables discussed during these labs:

3. A container holds nitrogen gas at 1.50 atm and 3.00 liters at 22.0ºC. When the temperature is raised to 30.0ºC, the pressure increases to 2.50 atm. What is the new volume?

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Revised Model: Now that you have developed a greater understanding of the gas laws, revise and improve your previous model of the collapsing can demonstration