Gas Law Activities - 2006

You are to complete the set of activities as described on this sheet, during class. They may be done in any order. For EACH Activity **complete the following in your comp book**:

1. Give an appropriate Title to each activity
2. Data Table: Where applicable, record your data in a data table of your own construction in your comp book.
3. Procedure/Discussion: Describe, in detail, what you did and how you did it as well as your results answering any of the questions asked in the activity. Include simple diagrams of the apparatus where appropriate.
4. Write a Hypothesis and Conclusion for each activity. Be sure to include what relationships/concepts each task illustrates.
5. Link each activity with a specific standard cited from "Properties of Gases" section of the California Content Standards for Chemistry.

ACTIVITY #1: Pressure and a Plastic Bag

At this station, there are two large jars with plastic bags taped over the mouths. Without tearing either bag, try to push the bag that is outside the jar into the jar, and then, try to pull the bag that is inside the jar, out of the jar. Were you successful? Why not? What is holding the bag out of the jar? (when trying to push it in.) What is keeping the bag inside the jar?(when trying to take it out.) Include a simple diagram of the two bottles in your comp book to aid in your discussion.

ACTIVITY #2: How DID the Balloon get inside the Flask?

At this station is a flask with a balloon inside it. Without touching the balloon, examine it carefully, and construct a hypothesis about how the balloon was put inside the flask. Draw a simple diagram to aid in your discussion and conclusion. Attempt to accomplish this task with the available Erlenmeyer and balloon at the station. Discuss your results and why this was or was not possible.

ACTIVITY #3: Charles' Law

Select a 125 mL Erlenmeyer flask with a double hole stopper which has bent glass tube and a thermometer inserted. Secure a balloon to the end of the glass tubing with a rubber band. Place approximately 50 mL of water and a few boiling chips in the Erlenmeyer Flask. Measure the temperature of the air inside the flask and record it. With a metric measuring tape, record the initial circumference of the balloon.

Place the flask on a fully heated hot plate and begin to heat the flask. Note what happens to the balloon and record your observation. After the flask has heated for one minute, re-measure the circumference of the balloon and again at 2 minutes. When you have completed this task, place a glove on one hand as a hot pad to remove the flask from the hotplate, remove the rubber stopper and set it aside to allow the apparatus to cool for the next period. Sample Data Table:

Time	Temperature of water	Circumference of Balloon	Observation of Balloon
Start			
30 seconds			
60 seconds			
90 seconds			
120 seconds			

Explain what happened in terms of **molecular motion**. Note that the pressure on the surface of the balloon remained constant, at atmospheric pressure. Draw a representation of the apparatus in the four timing stages to illustrate your observations. Make a graph of the temperature (x axis) versus the circumference (y axis) data. Make a best-fit line to represent the relationship and discuss this in your conclusion. (Try using Excel for evaluating and graphing this!)

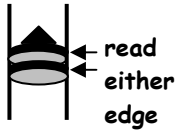
Activity #1-3 Designed by P. Mason, Indiana, #4 Designed by W. Lee, GHCHS,#6 credited to Al Guenther, LAUSD,
Revised, Edited and Altered by J. Flint Baumwirt – Granada Hills Charter High School 2-04

ACTIVITY #4: Boyle's Law Lab Activity

Utilizing a Pressure Bottle and enclosed Syringe, the Air Compressor and a Pressure Gauge collect Pressure and Volume data. Fill the bottle with air using the compressor, (Note the temperature change upon filling) take the pressure with the gauge and record the volume of the syringe. You can read either the top or bottom of the syringe's black gasket as long as you read it from the same location for each trial.

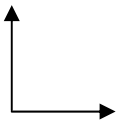
Data Table – Record a minimum of 7 points

Trial	Pressure (psi)	Corrected Pressure (+14.3 psi)	Volume (mL)	$\frac{1}{\text{Volume}}$
1				
2				
3				
4				
5				
6				
7				
Final Observation:				

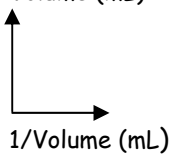


After your 7th reading, let all the remaining air out of the bottle by holding down the pin in the valve. **Record your Final Observation.**
Explain why this occurred.
←

Graph: #1
Pressure*
(psi)



Graph: #2
Pressure*
(psi)



Data Evaluation:
Create two graphs with an appropriate scale representing you data ranges. Label your axis and title your graphs.
Graph #1 Plot Pressure (corrected) versus Volume.
Draw a line showing the general trend of your data
Graph #2 Plot Pressure (corrected) versus 1/Volume.
Draw a best straight-line fit to this data.
Conclusion: What is the relationship between Pressure and Volume established from your experimental data and from these graphs?

You can complete the above activity with the large syringe attached to a pressure gauge, however you must convert the scale of the gauge (in mmHg) to psi. (14.7 psi=760 mmHg)

ACTIVITY #5: Boyle's Law Lab Activity ~ The Case of the Exploding Cans:

Put a small amount of water (approximately 1/16 inch deep) in the bottom of an empty aluminum soda can. Place on a hot plate and heat until you see a visible amount of vapor escaping from the can opening.

1. Quickly pick up the can with your lab tongs, and place the can right side up into a tray of water. Record your observation.
2. Repeat this experiment and when a very visible amount of vapor is observed escaping from the can, invert the can (place it upside down) in the tray of water. **Record your observation IN DETAIL**.
3. **Explain the results** of your experiment and answer the following questions: Why do you see a difference between activity 1 and 2? What is the difference? What change of state is occurring? What relationships regarding the behavior of gases does this involve? What is happening on a molecular level?

ACTIVITY #6: THE RISING WATER MYSTERY

Mount a candle upright in the center of a pie pan. Set a coin in the pan near the candle. Fill a cylindrical glass bottle about 2/3 full of water and pour it into the pan. Light the candle, carefully dry the container and invert it over the candle with the rim sitting on the coin so that the water can flow in and out of the container.

1. **Observe and record all changes** that take place in the candle flame, the inside of the container and the water level in the jar. Repeat and check your observations to insure that you did not miss any changes and the order of these changes as they occurred.
2. **Draw a diagram** of the set up for this activity in your comp book.
3. **Hypothesize** as to **WHY** the water rose into the container. Try to write an IF and THEN statement: If this shows that … THEN every time it is repeated…, etc.

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