Chemistry Lab

#11 = Gas Laws Lab

Name: _____

Period: _____ Date: _____

INTRODUCTION:

You work for Aluminum Products Incorporated. It is a company that produces and manufactures aluminum and a variety of products made of aluminum. In the current economy there is a high demand for the ability to transport gases that range from the freezing to boiling point of water while keeping costs to a minimum. Since aluminum is one of the cheapest metals, your company has given your group the task of researching the use of aluminum pipes to transport these gases. The first trial will be to test a currently existing technology (aluminum can) to determine which direction the research should go. Your group must conduct a scientific research experiment and report your findings in a report which must be able to stand up to the review of the scientific community before advancing to the next level of research.

PURPOSE:

The purpose of this lab activity is to use the knowledge of how gases work to determine whether or not a company could use the same basic structure of aluminum cans to transport gases between the freezing and boiling points of water.

LAB SETUP:

You will be taking an empty aluminum soda-can and using a hot-plate to heat it up to the boiling point of water, then cool it down to the freezing point of water by submerging it in an ice-water bath. Using what you know about gas laws, you should be able to predict what will happen, and by how much. You will then confirm or reject your hypothesis and decide whether API should proceed with this technology or whether it should go in another direction or modify the technology to improve it.

PRELAB:

1. What are the 4 possible variables to consider when working with gases and their behavior?

2. Which of the variables is going to be changed by the experimenter in the experiment? That makes it which type of variable during the experiment?

3. Which of the variables are we assuming is held constant, but because we are using a used soda-can with a hole in the top, is probably not going to actually be constant? Why?

4. Of the two variables left, which one is most likely to stay "constant" because we are using a thin piece of metal? Why does this make it likely to be constant?

5. Which variable is left as the one we are looking for? That makes it which type of variable during the experiment?

6. What is considered to be the boiling point of water in Celsius? What temperature is that measured in Kelvin and Fahrenheit? Show work.

7. What is considered to be the freezing point of water in Celsius? What temperature is that measured in Kelvin and Fahrenheit? Show work.

PROCEDURE:

1. Measure the volume of the empty can
    - Name/Label your empty soda-can so that it can be easily identified. Each group will share their data so that the class can base their calculations on several trials.
    - Rinse the can with water to remove all contaminants and then measure the initial volume.
        - Fill the can up to the top with water and then pour it into a graduated cylinder and determine how much water the can holds.
    - Enter your data into the initial volume column of the data table for Trial #1.
2. Place approximately 30 mL (an ounce) of water in the empty can and prepare to test the can.
    - Need a heat-source to heat the can to the boiling point of water.
    - Need an ice-bath to cool the can to the freezing point of water.
    - Need a pair of tongs to use to transfer the can from the heat-source to the ice-bath
3. Place the can on the heat-source and heat the can.
    - Using the tongs, stir the can to distribute the heat as evenly as possible.
    - Steam will come out before the boiling point, so make sure you are at the boiling point
    - Once you can see/hear the water boiling at the bottom of the can, go to step 4
4. Transfer the can to the ice-bath to cool the can
    - Using the tongs, grip the side of the can underhanded (palm up) so you can rotate the can top-down into the ice-bath. You need the hole to be submerged for it to work.
    - Quickly move the can from the heat-source to the ice-bath getting the top of the can submerged as soon as possible
5. Measure the new volume of the can
    - Fill the can up to the top with water and then pour it into a graduated cylinder and determine how much water the can holds.
    - Enter your data into the final volume column of the data table for Trial #1.
6. Collect the data for initial and final volumes of the other cans being tested from other groups and enter the data into the table for Trails #2-#10.

Data Table	Trial #1	Trial #2	Trial #3	Trial #4	Trial #5	Trial #6	Trial #7	Trial #8	Trial #9	Trial #10	Average
Initial Volume (mL)											
Final Volume (mL)											

HYPOTHESIS:

For your hypothesis, you will need to construct it to predict the theoretical CHANGE IN VOLUME of the can. Make sure to include your if, then, because, and the specific details using your average of all the cans from the experiment.

ANALYSIS:

Determine the actual CHANGE IN VOLUME of the can. Use this value to calculate the percent yield for the change

Report

A lab report must be typed which must include all of the steps of the scientific process. Make sure to incorporate all of your prelab answers in your data/rationale and explain in full detail all of your thinking processes, steps, and any assumptions or inferences you make in your report. Formatting must be normal (10-12 pt. font, 1 inch margins, single-spaced) and 3rd person with present tense must be used. A rubric will be posted on Canvas for you to use to self-grade your draft before submitting a final report to the teacher. In your conclusion, be sure to include reasoning for why you should or should not use the technology as well as what you would recommend as the next step in the project with rationale as to why.

Lab Report is Due One Week from the Day the Lab!

Date of Lab = _____ Lab Report Due = _____