**NAME:**

**LAB MEMBERS:**

**Crushed Can Lab**

http://www.lnhs.org/hayhurst/ips/Crushed_Can_Lab_files/image001.gif

            Does the air around us have a mass? Is it made of molecules? Does it take up space? If so, then it must be made up of matter. **Matter** is defined as *anything that takes up space and has a mass*. If this is correct then the air around us must be made up of matter. If the air has mass then it must be under the influence of the Earth's gravity. If it is under the influence of gravity then the air around us must have a weight or a force. How can we prove this?

            We are so accustomed to the pressure of the air around us that we don't even notice it. However, the air pressure is large enough to crush a soda can. You will be able to see the force of air crush a can in this experiment.

**OBJECTIVES**

·        Students will demonstrate the affects of air pressure.

·        Students will demonstrate that as a gas is heated it expands and as it cools it will contract.

**MATERIALS**

For this experiment you will need:

* 4 empty aluminum soft-drink can
* a 500 mL beaker or large bowl ( the plastic container of your labware works well)
* 1 liter ICE WATER with 2 tbs salt
* a pair of beaker tongs
* Bunsen burner of hot plate
* Thermometer

**PROCEDURE**

**LABEL YOUR CANS 1-4**

1.      http://www.lnhs.org/hayhurst/ips/Crushed_Can_Lab_files/image005.gifFind out EXACTLY how liquid your can will hold. Record that data on the data sheet.

2. Fill the beaker with cold water (tap water is fine). ADD ICE, Take the temperature of this water before each can. This is crucial for understanding the experiment.

3.      Put 15 milliliters (1 tablespoon) of water into the empty soft-drink can, #1.

4.      Heat the can on the burner; bring the water in the can to a boil. When the water boils, a cloud of http://www.lnhs.org/hayhurst/ips/Crushed_Can_Lab_files/image007.gifcondensed vapor will escape from the opening in the can. Allow the water to boil for about 30 seconds. **CAUTION: Do not heat the can over high heat or heat the can when it is empty. This may cause the ink on the can to burn or the aluminum to melt.**

5.      Using the beaker tongs, grasp the can and quickly invert it and dip it into the water in the pan.

6. Fill your container completely up with water and record how much it holds.

7. Repeat this process with your other cans, putting 20ml in #2, 25ml in 3# and 30 ml in #4

**ANALYSIS**

What caused the can to collapse? When you heated the can you caused the water in it to boil. The vapor from the boiling water pushed the air out of the can. When the can was filled with water vapor, you cooled it suddenly by inverting it in the water. Cooling the can caused the water vapor in the can to condense, leaving the can empty. When the can was empty, the pressure of the air outside crushed it.

A can is crushed when the pressure outside is greater than the pressure inside, and the pressure difference is greater than the can is able to withstand. You can crush an open aluminum can with your hand. When you squeeze on the can, the pressure outside becomes greater than the pressure inside. If you squeeze hard enough the can collapses. Usually, the air pressure inside an open can is the same as the pressure outside. However, in this experiment, the air was driven out of the can and replaced by water vapor. When the water vapor condensed, the pressure inside the can became much less than the air pressure outside. Then the air outside crushed the can.

When the water vapor inside the can condensed, the can was empty. You may have expected the water in the pan to fill the can through the hole in the can. Some water from the pan may do this. However, the water cannot flow into the can fast enough to fill the can before the air outside crushes it.

GRAPH

Create a BAR graph of the BEFORE, and AFTER volumes of each can

 CONCLUSIONS

1. Using what you know about Boyle’s Law and Charles’ Law, explain why the can was crushed. What crushed the can?
2. Why did you have to heat the can up in order for the can to be crushed?
3. Could you have made the air inside the can push outward? If so, how?
4. Why do you feel the wind when it blows, and what do you think causes it?
5. DATA

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| CANS | BEFORE mL | AFTER mL | TEMPERATURE OF WATER you put in the can | Temperature of dunk water | % crush |  |
| #1  15 mL |  |  |  |  |  |  |
| #2  20 mL |  |  |  |  |  |  |
| #3  25 mL |  |  |  |  |  |  |
| #4  30 mL |  |  |  |  |  |  |