

Lab 9: Under Pressure - Gases and Pressure

Goals: Improve communication and teamwork capacities; Improve confidence in hands-on work with equipment; Improve ability to make, describe, and record observations; Gain kinesthetic and observational experiences with pressure differences and see how pressure difference manifest macroscopically.

Equipment: You will be oriented to the equipment, set-up, and use of the equipment for today's investigation, which involves a series of stations. Make sure you include sketches of the various experimental set-ups in your lab notebook.

Groups & Lab Notebook: Groups of 2. Update Table of Contents. General Lab Notes guidelines.

Part 0: Getting Started. You will be oriented to equipment and today's investigations in the opening remarks.

Part I: The Heat is On

Station 1: I Can Crush You

- CAUTION: Pay attention to make sure that you don't boil away all the water while still leaving the can on the hot plate.
- Pour a small amount of water into one of the soda cans, and place it on the hot plate. Turn on the heat.
- While heating, put an ice/water mixture into the large beaker; have about half water and half ice, and only fill your container half full.
- At some point, steam will be emerging from the can; this may occur before the water is at a rolling boil. Once steam is emerging from the can, get ready.
- Using the beaker tongs, quickly move the can and invert it into the container of ice water. You need to completely submerge the opening of the can under water so that you create a seal. Hold the can in that position for a little while, until something startling happens.
- Turn off the heat to the hot plate.
- Make notes of your activities and observations.

Station 2: HullaBalloon

- CAUTION: Pay attention to make sure that all the water in the beaker doesn't boil away.
- Carefully pour a small amount of boiling water into the plastic ehrlenmeyer flask. You only need a little bit. Make sure it is nice and steamy in the flask.
- Quickly stretch a balloon over the mouth of flask.
- Observe what happens to the balloon as soon as you put it on and for about 2 minutes.
- Turn off the heat to the hot plate.
- Check on your flask approximately every 5 minutes while you work on other stations.
- Make notes of your activities and observations.

Station 3: Boiling Lukewarm?

- CAUTION: Pay attention to make sure that all the water in the beaker doesn't boil away.
- Carefully pour a boiling water into the plastic ehrlenmeyer flask until it is about $\frac{1}{4}$ height full.
- Immediately put the flask into your plastic pressure chamber. Note whether or not the water is boiling.
- Quickly, evacuate the chamber using the vacuum port. What do you observe?
- Push the release button on your pressure chamber. If needed dry out your pressure chamber with a paper towel. Repeat if you like (you may need to replace the water in the flask with water from the hot plate).
- Turn off the heat to the hot plate.
- Attach the hose to the air port and blow the hose dry.
- Make notes of your activities and observations.

Part II: The Pressure's High, Tell Me Can You Feel It?

Station 4: Feel it

- Each member of your group should actually do the hands-on part of the following activities, as part of the task is to actually feel the effort you are exerting for use as a comparative measure.
- Assemble the smallest pressure chamber. Put the lid on the container. Then pull them apart, paying attention to the relative difficulty of assembly and disassembly.
- Reassemble your chamber, and then pump on it using the hand pump. As you continue to pump, what do you notice about the effort it takes to continue pumping?
- Now, try to disassemble the chamber. What do you notice, especially as compared to when you disassembled it previously, before it was pumped?
- Reset the chamber, paying very careful attention, *especially with your ears*. What do you notice?
- Now try to disassemble the chamber. What do you notice as compared to your immediately prior attempt?
- Again, make sure everyone in your group has done this. This means your group has to do this several times, but it's important that everyone actually experience this.
- Repeat using the Magderburg sphere.
- Ask your instructor to work with you on an associated activity involving suction cups.
- Make notes of your activities and observations.

Station 5: See It

- Place an inflated balloon into the pressure chamber. Close the lid.
- Use the vacuum port to pump out the chamber. Observe the balloon.
- Reset your chamber. Observe the balloon.
- Make notes of your activities and observations.

Station 6: Weight It

- Determine the mass of the large chamber with lid.
- Use the vacuum port to pump out the chamber (don't do this on the balance).
- Determine the mass of the pumped out chamber and lid.

Station 7: Poke It

- Do this at the sink.
- Take one of the soda bottles with screw top lid. You are going to poke a hole in a bottle full of water. What do you think will happen after poking the hole?
- Fill the bottle with water, and cap it tightly. Make sure you're above the sink. Poke a hole in the side of the bottle, somewhere in the lower half, with the push pin. You'll want the hole to go completely through the side of the bottle, but you don't want or need a very large hole. What happens after you poke the hole?
- Make sure you are still above the sink. Loosen the cap on the bottle. What happens after you loosen the cap?
- Tighten the cap again. What happens after you tighten the cap?
- Make notes of your activities and observations.

Station 8: Ex-Straw-Vaganza. Do this with your instructor. Record the activity and your observations.