

Section 2: Measurement of volume change from liquid to gas

In the water experiment we were not able to capture the vapor. In order to understand what happens to the transition between liquid and gas phases, we will build a special apparatus that can capture the gas. Your goal in the experiment will be to measure the volume expansion in the liquid to gas phase transition.

Discuss, without looking at the instructions given on the next page, how one can build such an apparatus using a 2 L plastic bottle, a stand for an inverted soda bottle, a large rubber container, a flexible tube, and water. If you are confident that you can put such an apparatus together, make a drawing of it and build it.

Instructions for building a simple apparatus that can capture the gas.

1. Fill the plastic bottle with 2 liters of water and dump into the large rectangular rubber container. Place the stand for the inverted soda bottle in the container.
2. Fill the plastic bottle completely with water and put its lid on and put it on its stand. The lid should be facing down and fully immersed in water.
3. Remove the lid in water. Notice the water will remain in the soda bottle.
4. Insert the flexible tube inside the soda bottle.

You have completed the building apparatus that can capture up to 2 L of gas. You will use this apparatus to capture boiling liquid nitrogen. For this experiment your instructor will fill a marked glass tube with liquid nitrogen. Note that liquid nitrogen is a cryogenic liquid with boiling temperature of 77 K (-196 °C), so it will boil off very quickly at room temperature. When the liquid nitrogen level reaches the marked red line (2 mL) put the lid, attached to the rubber tube, on. After all the liquid is boiled off, how much nitrogen gas is captured in the soda bottle? Calculate the ratio of the volume of nitrogen gas to that of a liquid.

Model with pennies: Discuss, if there are things that you would change in your model with pennies based on your results?

Group Discussion: We will discuss if one can see individual atoms and how atoms are arranged in real materials.