

ACTIVITY 26: BOILING WATER IN A SYRINGE



QUESTION ?

How does the boiling point of water change with pressure?

SAFETY

Use caution when working with hot tap water, as it can burn if splashed. Clean up any spills immediately.

PROCEDURE

The boiling point of a liquid depends on several factors. First, each substance has a unique boiling point under constant conditions. Also, contaminants can change the boiling point of a substance. Salt water has a higher boiling point than pure water. Finally, the pressure surrounding the liquid also changes the boiling point. Liquids boil when the pressure of the vibrating molecules is greater than the air pressure surrounding it. To increase the pressure of the liquid (the vapor pressure), you can heat it up. Or, by decreasing the pressure around the liquid, the boiling point can be changed because it is easier for the liquid molecules to escape. You will demonstrate that effect in this lab.

1. Put some hot tap water into a coffee cup.
2. Carefully draw water up into the syringe until it is at about 10 ml.

3. Put the cap on the syringe and slowly pull the plunger out as far as you can. Record your observations.

Post-Lab Questions

1. If the pressure in the syringe was 1.0 atm before you pulled on the plunger, what was the pressure after (in kPa)? Show your work.
2. What was the substance inside the bubbles that erupted in the liquid?
3. How is this different than the hand boiler toy in which you hold a liquid-filled glass container in your hand and the liquid begins to boil? If you have never seen a hand boiler before, you can find videos of them online.

Extensions

Experiment with this lab and see how long you can continue to make the liquid boil as the water cools. Use a table of vapor pressures and figure out how cool the water can get and still boil in the syringe. Calculate the lowest pressure you can create in the syringe and use the table of vapor pressures in your chemistry book or online to see what is the coolest temperature at which water can be boiled in the syringe.