

Experiment 20 – The Relationship of Boiling Point to Atmospheric Pressure

A liquid will boil when its vapor pressure equals the atmospheric or external pressure. There are thus two ways to make a liquid boil:

1. Raise the temperature of the liquid to its normal boiling point, or
2. Lower the pressure above the liquid until the pressure equals the vapor pressure of the liquid at that temperature.

In this experiment, you will be using an aspirator to remove most of the air from the inside of a flask that contains some water. Removing most of the air lowers the gas pressure inside the flask. It is then possible to make a liquid boil at a much lower temperature than is usually needed.

Safety Precautions:

- Wear your safety goggles.
- Use caution when handling the side-arm flask. Do not let it fall over and break.
- Use caution when handling thermometers. Do not let them break.

Waste Disposal:

- There is no waste for this experiment.

Procedure

1. Obtain a side-arm suction flask with a solid rubber stopper. Add tap water to the flask until the flask is about 1/4 full. Stopper the flask, and clamp the neck of the flask to a ring stand.
2. Connect a piece of thick-walled rubber tubing from the side arm of the flask to a water aspirator. When you are putting the tube on the flask, twist it, don't shove – if you force it on, the side arm might break off and injure you. (Check to find an aspirator that works well, and form a relatively large group to make this observation.)
3. Turn on the water, so that the aspirator creates a partial vacuum in the flask. Allow the water to run for up to about five minutes. If at the end of that time you do not notice anything happening in the flask, begin again, this time with warm (about 35°C) water.

Observations

What happened in the flask? (Pretty exciting, isn't it?) Be sure to feel the outside of the flask in order to get an idea of the water temperature.

Question

1. Explain how the water in the flask is able to boil, even though it is not hot.