

Boiling Temperature of Water

The physical properties of a pure substance can be used to identify the substance and distinguish it from other pure substances. Boiling temperature is one such physical property. Boiling is characterized by the formation of vapor bubbles within the liquid phase as a substance changes from a liquid to a gas. In this experiment, you will study the boiling of water.

OBJECTIVES

In this experiment, you will

- Observe the boiling of water.
- Use a computer to make measurements.
- Analyze the data.
- Graph the data.
- Use the graph to make conclusions about boiling.
- Determine the boiling temperature of water.
- Apply the concepts studied in a new situation.

MATERIALS

computer
Vernier computer interface
LoggerPro
Vernier Temperature Probe
250 mL beaker

ring stand
utility clamp
hot plate
water

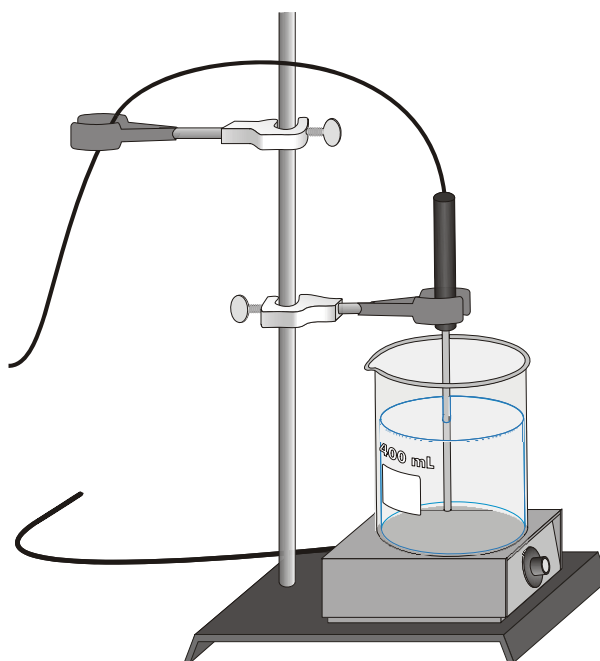


Figure 1

Experiment 3.11

PROCEDURE

1. Obtain and wear goggles. **CAUTION:** Handle hot water and hot equipment with care throughout the experiment.
2. Prepare the water sample.
 - Arrange a hot plate next to the base of a ring stand.
 - Fill a 250 mL beaker 2/3 full with hot tap water.
 - Place the 250 mL beaker on the hot plate. Turn the hot plate to the temperature setting suggested by your teacher.
 - Use a utility clamp to suspend a Temperature Probe on the ring stand as shown in Figure 1. The tip of the probe should be 1-2 cm above the bottom of the beaker. **CAUTION: Do not burn yourself or melt a probe wire with the hot plate!**
3. Connect the Temperature Probe to the computer interface. Prepare the computer for data collection by opening the file “02 Boiling Temperature” from the *Physical Science w Computers* folder.
4. Click to begin data collection.
5. Record your observations as the water is heated to its boiling temperature and boils. When the water begins to boil, turn the hot plate setting down to a setting just high enough to maintain boiling.
6. When the water has boiled with noticeable bubbling for six minutes, click to end data collection. Turn off the hot plate and remove the Temperature Probe from the boiling water. Allow the beaker, water, and hot plate to cool before handling them.
7. On the displayed graph, analyze the flat part of the curve to determine the boiling temperature of water:
 - Move the mouse pointer to the beginning of the graph’s flat part. Press the mouse button and hold it down as you drag across the flat part to *select* it.
 - Click on the Statistics button, . The mean temperature value for the selected data is listed in the statistics box on the graph. Record this value as the boiling temperature in your data table.
8. Print copies of the graph as directed by your teacher.

OBSERVATIONS

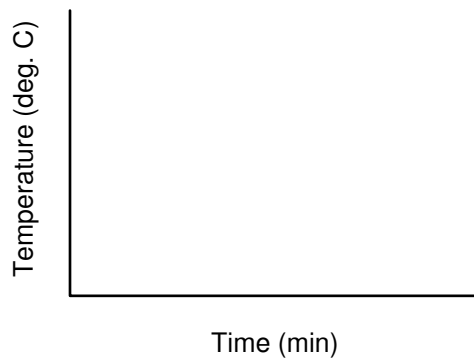
DATA

Boiling temperature of water _____ °C

PROCESSING THE DATA

1. Describe your temperature vs. time graph.
2. What happened to the temperature of the water as it was heated prior to boiling?
3. What happened to the temperature of the water as it boiled?
4. According to your data, what is the boiling temperature of water?
5. Your water sample experienced a wide range of temperatures during this experiment, yet we can correctly speak of its boiling “temperature.” Explain.

6. The normal boiling temperature of isopropyl alcohol is 82°C . In the space to the right, sketch and label a graph for the boiling of isopropyl alcohol. Use a starting temperature of 20°C . Identify the boiling temperature on the graph.



EXTENSION

1. Determine the boiling temperatures of other liquids.