

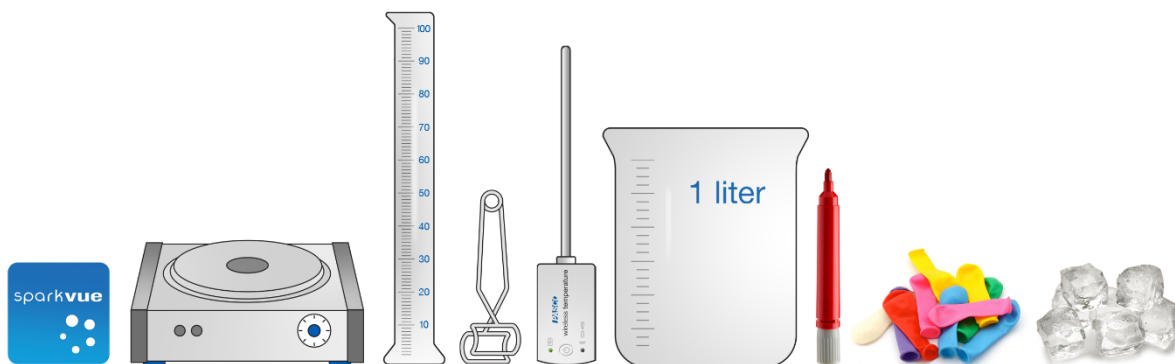
12C – CHARLES' LAW

INQUIRY

What is the relationship between the temperature and volume of a gas?

MATERIALS

- Device with SPARKvue software
- Temperature sensor
- Beaker, 1-L
- Graduated cylinder, 100-mL
- Heater stirrer
- Tongs
- Water balloon
- Dry erase marker
- Ice
- Water



BACKGROUND

Charles' Law states the relationship between the volume and temperature of a gas. In this investigation, you will expose the gas molecules inside of a partially filled water balloon to varying temperature conditions (hot, cold, and room temperature). By graphing the results, you will be able to determine the relationship expressed by Charles' Law.

SAFETY

Follow these important safety precautions in addition to your regular lab procedures.

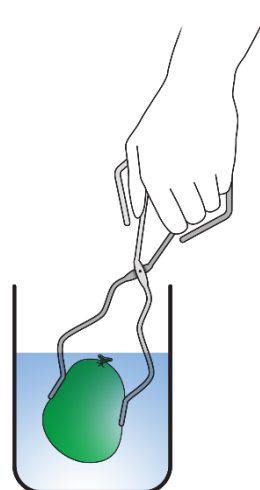
- Wear safety goggles at all times.

PROCEDURE

1. Open SPARKvue.
2. Open the 12C Charles' Law lab file in SPARKvue.
3. Use the Bluetooth icon to connect the Temperature sensor.
4. Blow up a water balloon to about the size of a baseball and tie it closed.
5. Fill beaker to the 400-mL mark with room temperature water. Mark the water line with a dry erase marker.
6. Place the temperature sensor in the water. Start collecting data. Once the temperature stabilizes, select the check mark to record the value in SPARKvue. Also record the temperature reading in Table 1 on your answer sheet.

PROCEDURE

- Use tongs to submerge the balloon and hold it in the water for 2-3 minutes. The entire top of the balloon must be no more than 3 or 4 mm below the water surface. Take note of how you are holding the balloon and how much water covers the tongs. Use the same technique throughout each part of the investigation so that pressure from the water remains the same throughout the entire investigation.
- Use the dry erase marker to mark the beaker with the new water line. Remove the balloon.
- Fill the graduated cylinder to 100.0 mL with tap water. Pour water from the graduated cylinder into the beaker up to the mark. Record how much water you poured into the beaker to reach the mark. This is the volume of the balloon at room temperature. Record the volume in SPARKvue and in Table 1.
- Remove the mark from the beaker and empty it. Fill the beaker about one-quarter full of ice. Add water to the 400-mL line and mark the water line with the dry erase marker.
- Place the temperature sensor in the beaker. When the temperature stabilizes, select the check mark to record the temperature of the ice water bath in SPARKvue. Also record the temperature in Table 1.
- Use tongs exactly as before to submerge the balloon in the beaker. Hold it underwater for 2-3 minutes.
- Mark the new waterline on the side of the beaker and remove the balloon. Fill the graduated cylinder to 100 mL. Use the graduated cylinder to pour water up to the second mark. Record the volume of water added as the volume of the balloon in SPARKvue and in Table 1.
- Empty the beaker and remove the waterline marks.
- Fill the beaker to the 400-mL mark with water and heat it on the heater stirrer at high setting for 5 minutes.
- Remove the beaker from the heater stirrer and make a mark indicating the waterline for the hot water.
- Repeat steps 11-14 for the hot water bath.
- Stop collecting data.



ANALYSIS

Complete the analysis on your answer sheet.

QUESTIONS

Answer the questions on your answer sheet.