

LESSON
52

LAB

Hot Enough Thermometers

Name _____

Date _____ Period _____

Purpose

To examine how the volumes of a liquid and a gas change in response to temperature.

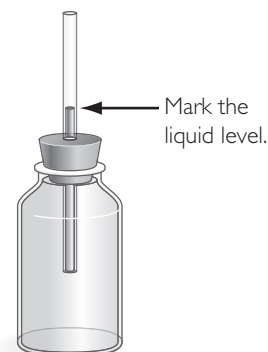
Part I: Liquid Thermometer**Materials**

- small glass vial
- 250 mL beakers (3)
- hot plate
- ice
- salt, 1 tbsp
- small metric ruler
- ethylene glycol (antifreeze), ~25 mL per thermometer
- rubber septum or rubber stopper
- clear plastic straw
- test tube holder, wire
- fine-point permanent marker
- alcohol (to remove markings)

Procedure

Use the permanent marker to mark the level the liquid reaches in the straw in the ethylene glycol thermometer for these five conditions:

- room temperature
- 200 mL ice water with 1 tbsp salt
- vial warmed by your hand
- boiling water (thermometer should not touch the bottom of the beaker)
- ice water

**Observations and Analysis**

1. What did you generally observe when you warmed and cooled the thermometer?
2. What is happening to the liquid in the vial to make it move up and down in the straw?
3. Create a scale for the thermometer.
 - a. Assign numbers for the places you marked on the straw for boiling water and ice water. What numbers did you choose and why?
 - b. Based on your newly created temperature scale, estimate the temperature in the room. How did you arrive at your answer?

4. The Fahrenheit scale and the Celsius scale are shown here side by side:

a. What is the temperature of the room in degrees

Celsius? _____ Fahrenheit? _____

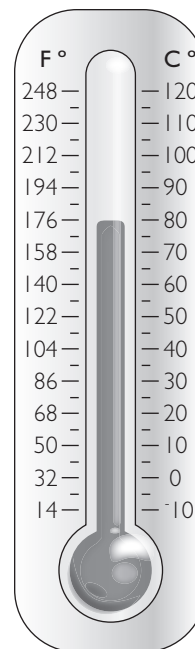
b. What is body temperature in degrees

Celsius? _____ Fahrenheit? _____

c. Which is hotter, 30 °C or 30 °F? Explain your reasoning.

d. Estimate what 50 °C would be on the Fahrenheit scale.

e. The formula for conversion from degrees Celsius to degrees Fahrenheit is $F = \frac{9}{5}(C) + 32$. Check your answer to part d by performing the calculation.



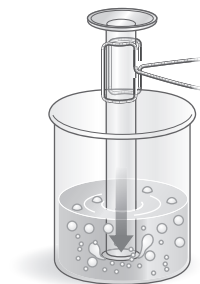
Part 2: Gas Thermometer

Materials

- | | | |
|----------------------|--------------------------|----------------------------|
| ■ 250 mL beakers (3) | ■ test tube holder, wire | ■ 10 mL graduated cylinder |
| ■ ice | ■ hot plate | ■ food coloring |

Procedure

1. Put 200 mL of water with one or two drops of food coloring into a 250 mL beaker. Heat the water to about 80 °C. Place room temperature water in a second beaker. Place crushed ice into a third beaker.
2. Hold the 10 mL graduated cylinder with a test tube clamp and invert it in the hot water for at least a minute. Make sure the mouth of the cylinder is almost touching the bottom of the beaker.
3. Quickly move the graduated cylinder to the room temperature water. Make sure the mouth of the cylinder is almost touching the bottom.
4. Keep the graduated cylinder in the second beaker as you add ice to the water. Record your observations for all three situations.



Analysis

1. Explain how you can use the air sample trapped inside the graduated cylinder as a thermometer.

2. **Making Sense** Describe how a thermometer works.