

Thermal Energy and Heat ▪ *Technology Lab*

Build Your Own Thermometer

Problem

Can you build a thermometer out of simple materials?

Design Skills

evaluating the design, measuring, making models

Materials

bowl of hot water
bowl of ice water
water of unknown temperature
tap water
500-mL beaker
food coloring
plastic dropper
metric ruler
cooking oil
clear glass bottle, 20–25 cm tall
clear plastic straw, 18–20 cm tall
modeling clay
fine-point marker

**Procedure****Part 1 Research and Investigate**

1. You can use simple materials to build a model of an alcohol thermometer. First, mix food coloring into a beaker of tap water. Then fill a glass bottle with the colored water.
2. Place a straw in the bottle. Use modeling clay to position the straw so that it extends at least 10 cm above the bottle mouth. Do not let the straw touch the bottom. The clay should completely seal off the bottle mouth. Make sure there is no air in the bottle.
3. Using a dropper, add colored water into the straw to a level 5 cm above the bottle. Place a drop of cooking oil in the straw to prevent evaporation.
4. Place your thermometer into a bowl of hot water. When the colored water reaches its highest level, place a mark on the straw.

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5. Place your thermometer in the bowl of ice water. Place a mark on the straw when the water reaches its lowest level.
6. Create a scale for your model thermometer. Divide the distance between the two marks into 5-mm intervals. Starting with the lowest point, label the intervals on the straw 0, 1, 2, 3, and so on.
7. Measure the temperature of two unknown samples with your thermometer. Record both temperatures.

Analyze and Conclude

1. **Evaluating the Design** Do you think your model accurately represents an alcohol thermometer? How is it like a real thermometer? How is it different?

2. **Inferring** How can you use the concepts of matter and the kinetic energy of particles to explain the way your model works?

3. **Measuring** Approximately what Celsius temperatures do you think your model measures? Explain your estimate. (*Hint:* Refer to Figure 3 in your textbook.)

4. **Making Models** Examine the structure and materials used in your model. Propose a change that would improve the model. Explain your choice.

Communicate

Create a poster to show how an alcohol thermometer works. Explain how the Celsius and Fahrenheit scales compare. For example, does 0° have the same meaning on both scales? Use a diagram with labels and captions to communicate your ideas. (*Hint:* Refer to Figure 3 in your textbook.)