Properties of Matter

1. Make copies of Student Resource 1.1, Vocabulary, and distribute to students. Discuss the definitions with students as the terms come up throughout the section.

2. Review with students the properties of solids, liquids, and gases. Ask: Which states of matter take the shapes of their containers? (liquid and gas) How can you describe the shape of a solid? (It has its own definite shape.) Which state of matter expands to fill its container? (gas) How can you describe the volume of a liquid or a solid? (They have their own definite volume.)

3. Draw three columns on the board and label them with the three states of matter. Read aloud the names of each of the following substances, and have students place each one in the correct column: helium (gas), oxygen (gas), water (liquid), nitrogen (gas), sugar (solid), and carbon dioxide (gas).

4. Point out that matter can change from one state to another. Explain that the temperature at which a solid becomes a liquid is its melting point, and the temperature at which a liquid becomes a gas is its boiling point. Melting point and boiling point are two physical properties of matter.
Melting and Boiling Points

30 minutes

Teacher Demonstration

Objectives

- Students determine the melting point of ice and the boiling point of water.
- Students observe that temperature plateaus during a change of state.

Materials

For the teacher
- 1 hot pot
- *ice
- 1 plastic spoon
- 1 thermometer
- *timer, or watch with second hand

*Not provided in kit

Student Resource
- 1.2 Melting and Boiling Points

Inquiry Focus
- Record Data

1. Distribute the Student Resource.
Make copies of Student Resource 1.2, *Melting and Boiling Points*, and distribute to students.

2. Review use of a thermometer.
Review with students how to read the scales on a thermometer. Tell them they will use the Celsius scale in this investigation.

3. Melt the ice.
Place ice in the hot pot until it is about half-full. Have a student take the temperature of the ice, and have students write this temperature on the Resource page. Start heating the ice. Have students read and record the temperature every minute until all the ice is melted.

4. Boil the water.
Continue heating the water after the ice is melted. Also continue to have students read and record the temperature every minute until the water starts to boil and for an additional two minutes. Point out that students might not use all the boxes on the Resource page, or they might have to add more boxes.
5. Help students draw conclusions.
   Point out the areas on the table where the temperature of the ice/water stayed the same for several minutes. Explain that while a substance is changing state, its temperature does not rise or fall because the energy is being used to change the state of the substance.
   Ask: **What is the melting point of water?** (0°C)
   **What is the boiling point of water?** (100°C) Have students complete the Resource page.

6. Explain that melting and boiling points are unique.
   Point out that every substance has a melting point and a boiling point that are different from those of other substances. The temperature data from this investigation are unique to water.

**Assessment**

Ask: **Do you think that the temperature of the boiling water would increase if you kept on heating it?** (No, the temperature remains the same while water boils.)

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**Boiling Point and Air Pressure**

1. Show students a cup of hot water (140°F) from the hot pot so they can see it is not boiling. Push the plunger all the way into a syringe. Place the syringe into hot (140°F) water, and pull the plunger out until the syringe contains 10 mL of hot water. The syringe should contain no air.

2. Put your thumb firmly over the tip of the syringe so no air can enter. Pull the plunger out. Have students observe that the water boils at a lower temperature when the air pressure above the water is reduced.

3. Explain that gases are affected by pressure, so boiling point depends on air pressure. However, melting point is not affected by pressure because a gas is not involved in this change of state.

▲ In a low-pressure environment, water boils at a lower temperature.