What makes a solid a solid?

Strand Matter
Topic Identifying solids, liquids, and gases
Primary SOL 2.3 The student will investigate and understand basic properties of solids, liquids, and gases. Key concepts include
a) identification of distinguishing characteristics of solids, liquids, and gases.
Related SOL 2.1 The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which
d) two or more characteristics or properties are used to classify items;
j) conclusions are drawn;
k) observations and data are communicated.

Background Information

Matter is anything that takes up space and has mass. There are three phases of matter that are studied in second grade: solids, liquids, and gases. Solids keep their shape and have a definite volume. Liquids have a definite volume (1 gallon of water in a bucket is still one gallon if poured into a sink) and it takes the shape of its container. Gas does not have a definite shape and it does not have a definite volume; gas molecules have so much energy that they spread out to fill any size container. Substances, such as iron, have different temperatures in which they are solids, liquids, and gases. Iron is a solid at room temperature while water is a liquid at the same temperature.

Materials

- For each group: water, measuring cups, different sizes of plastic containers, balloons
- For each student: a copy of the graphic organizer
- Optional: a helium balloon
- Optional: books about solids, liquids, and gases

Vocabulary

solid, liquid, gas, mass, volume, molecule

Student/Teacher Actions (what students and teachers should be doing to facilitate learning)

The lesson is divided into three 20-minute sections that may be completed on the same day or on consecutive days.

Introduction

1. Tell students that they are going to complete some activities and experiments that will help them learn about the characteristics of solids, liquids, and gases.

2. Explain to students that matter is everywhere. Define the three different phases of matter.
3. Tell students they are going to use their bodies to show how the molecules act in a solid, a liquid, and a gas.
    a. Have students stand as close together as they can and wiggle but stay in the same place. Relate this to a solid. They have made a definite shape.
    b. Next have students move so just their fingertips are touching each other and wiggle around, still touching each other fingertips. Relate this to a liquid. They have made a shape that has some form but changes.
    c. Finally, have students move so they are no longer touching and move all around within a predefined area. Relate this to a gas. There is no defined shape. The shape is defined by the area they can move in.
4. Ask students to look around the room and identify solid objects. Ask the students what makes them a solid.
5. Have students complete the first column on the graphic organizer.

Procedure: Activity 1

1. Preparation: Set up stations in the classroom with plastic containers of different shapes and sizes) and one cup of water in a measuring cup at each station.
2. Remind students that the molecules in a liquid have some energy and some movement.
3. Ask students how much water is in the measuring cup (exactly one cup).
4. Direct students to pour the water into the different containers and notice how the shape of the water changes depending on the shape of the container.
5. As students pour the water into the different containers, ask them again how much water they have (exactly one cup).
6. Discuss why the water changes shape.
7. Ask students to name some other liquids.
8. Have students complete the second column on the graphic organizer.

Procedure: Activity 2

- Remind students that the molecules in a gas have high energy and high movement.
- Give each student a balloon.
- Direct students to blow some air into the balloon and pinch it closed. Ask students to look at other students' balloons and discuss the differences they see between theirs and others.
- Repeat a few times, directing students to put different amounts of air into the balloon each time.
- Discuss why the shape of the balloons change (the amount of gas in the balloon).

- Bring in a balloon filled with helium. Discuss why it floats (some gases are heavier than others).
- Ask students to name some other gases. Students often think gasoline is a gas-this issue will require clarification.
- Have students complete the third column on the graphic organizer.

Assessment

- **Questions**
  - What are the characteristics of a solid, a liquid, and a gas?
  - How could you determine if something is a solid or a liquid?
- **Journal/writing prompts**
  - Write a riddle about a solid, liquid, or gas.
  - Create a Venn diagram to compare and contrast a solid, a liquid, and a gas.
- **Other**
  - Have students sort pictures of objects into solids, liquids, and gases.
  - Give students a blank graphic organizer and ask them to list as many solids, liquids, and gases as they can.

Extensions and Connections (for all students)

- Make a substance that has characteristics of both solids and liquids by combining a mixture of 1 tablespoon cornstarch and 1 tablespoon water. Have the students place their finger on it slowly. Describe what happens. Have students poke it quickly with their finger and describe what happens. Discuss what characteristics make it a solid and what characteristics make it a liquid.

Strategies for Differentiation

- Take pictures of students as they act out the different configurations of matter in Part I so they can better see the molecules.
- Use a modified graphic organizer with sentence starters included.
- Provide several cups of water so that students can see one cup of water in more than one kind of container at the same time.
- Provide a Venn diagram for students to use.
- Display some examples of riddles for students to use as models.

Identifying Solids, Liquids, and Gases

Directions: Everything you see and feel around you is made up of matter! Draw at least one example of each type of matter and explain what makes it a solid, a liquid, or a gas.

Solid	Liquid	Gas
A solid has a shape and volume that do not _____.	A liquid has a shape that can _____ but its volume does not _____.	A gas has a shape and a volume that _____.