Investigating Matter: Size

Strand Matter
Topic Physical properties
Primary SOL 3.3 The student will investigate and understand that objects are made of materials that can be described by their physical properties. Key concepts include
b. materials are composed of parts that are too small to be seen without magnification.
Related SOL 3.1 The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which
a) observations are made and are repeated to ensure accuracy;
h) data are gathered, charted, graphed, and analyzed;
j) inferences are made and conclusions are drawn;
k) data are communicated.

Background Information

There are four phases of matter: solid, liquid, gas, and plasma. In third grade, the students are held responsible for solid, liquid, and gas. Solids have a definite shape and volume; they do not change shape. Liquids have a definite volume (one liter of water is always one liter no matter what size container it is placed in) and a shape that changes. Liquids take the shape of their containers. Gases do not have a definite shape or a definite volume. They can fill any size container. Matter can be described by its physical properties such as color, size, shape, smell, texture, and phase of matter.

Materials

- Science journals
- Water
- Different size containers to hold water
- Clay for each student
- Baggies
- Solid object

Vocabulary

solid, liquid, gas, physical property

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

Introduction

1. Explain that everything in the world is made up of matter. It is all around us. Have the students look around the room and point out as many solids, liquids, and gases as they can. Make sure that air is included in the discussion.
2. Display a baggie containing a solid (e.g., a rock or ball), and introduce the term solid. Students will investigate the object with their senses. Ask, *"Does it take up space? Does it have mass? Does it keep its shape?"* The answers to these questions should be placed on a chart (see attached example) under "Solids." Have the students provide other examples of solids for the chart under "Examples."
3. Display a closed baggie containing water and introduce the term liquid. Have the students inspect the baggie of water using their senses. Ask, *"Does the liquid take up space? Can you see it? Does it have mass? Does it keep its shape?"* Pour the water into a clear plastic container to demonstrate that a liquid takes the shape of its container. Have the students record information on the chart under "Liquid."
4. Blow air into a third baggie, seal it, and introduce the term gas. Have the students observe the baggie filled with air with their senses. Ask, *"What's in the baggie? Does it take up space? Does it have mass?"* (Students will often say that a gas does not have mass. Demonstrate that it does by placing the zipped baggie of gas on one side of a pan balance and an "empty" baggie of equal size on the other pan. Ask, *"Why is the pan holding the baggie with gas lower than the pan holding the "empty" baggie?"*) Ask, *"Does gas keep its shape?"* Release the air from the bag and lead students to the understanding that gases fill the space they are in. Students will add information gathered to the chart under "Gases."
5. Review from the board or chart the properties of solids, liquids, and gases.

Procedure

1. Give each student a piece of clay and ask the students to describe it using properties of matter. Ask the students to change the shape of their clay. Then have them change the size of their clay. Lead a discussion with the students as to how the matter was changed. Help lead students to the understanding that the changing of the size and shape of the clay does not change the material.
2. Supply groups of three to four students with water and at least two different shaped containers. Have the students experiment with pouring the water from container to container and observing the change in the water. Lead a discussion about the changing of the shape of the water. Be sure that students understand that the volume of the water and the water itself does not change.

Assessment

- **Questions**
  - Why is it important to understand that changing the size of an object does not change what the material is made of?

- **Journal/writing prompts**
  - Thinking about yourself, if you were bigger or smaller than you are, would it make you a different person? Why or why not? How does this apply to matter?
- **Other**
  - Have students design an investigation to determine whether the physical properties of a material will remain the same when the material is reduced in size.

Extensions and Connections (for all students)

- To increase understanding of gases, demonstrate that gases take up space by placing vinegar and baking soda in a soft drink bottle and then quickly placing a balloon over the opening. The chemical reaction of the ingredients will produce carbon dioxide which will fill the balloon showing that gasses take up space.
- Provide two visuals - one of a balloon marked “helium” and one of a balloon marked “air.” Ask the students to explain the difference between the two balloons and discuss that while both are gasses, they are different kinds of gasses.
- Provide a visual of a helium balloon or a helium tank as an example of a gas.

Strategies for Differentiation

- Have students act out the motion of particles by moving their bodies by just vibrating only for a solid, moving their bodies more quickly for a liquid, and moving very quickly for a gas. Have students write, draw or verbally describe particle motion for solid, liquid and gas.
- Have the whole class act out a solid by standing closely together, a liquid by touching but moving (slipping and sliding) past each other, and a gas by moving around the room without touching.
- Have students decide if gelatin, pudding, and a mixture of cornstarch and water are liquid or solid and defend their answer.

Sample Table for Recording Data

	Solid	Liquid	Gas
Does it take up space?			
Does it have mass?			
Does it keep its shape?			
Can you see it?			
Examples			