Changing Matter

Strand	Matter	
Topic	Physical changes	
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 c) physical properties remain the same as the material is reduced in size.
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 b) predictions are formulated using a variety of sources of information; j) inferences are made and conclusions are drawn.

Background Information

Physical properties (e.g., color, texture, phase of matter, temperature, ability to dissolve in water) remain the same even if the visible material is reduced in size. Making something smaller is a physical change; it does not change its chemical makeup. When a substance dissolves, it is broken into smaller pieces; however, it is still a solid. Students often have the misconception that dissolving and melting are the same thing and that when a substance dissolves, it turns into a liquid.

At the atomic scale, some materials actually change properties. Nanotechnology is the study of materials at the molecular (atomic) scale. Items at this scale are so small they are no longer visible with the naked eye. Nanotechnology has shown that the behavior and properties of some substances at the nanoscale (a nanometer is one-billionth of a meter) contradict how they behave and what their properties are at the visible scale.

Materials

- Science journal
- Salt
- Sand
- Water
- 2 cups/group
- 1 spoon/group
- 1 black construction paper square/group
- 1 coffee filter/group
- Pie tin or other dish to catch filtered water
- Pot
- Burner or other heat source

Vocabulary

dissolve, mixture

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

Introduction

1. Divide the students into small groups. Provide each group with sand, salt, water, 2 cups, a square of black construction paper, and spoon.
2. Ask the students to describe each object using the object's physical properties (including the phase of matter).
3. Ask, *"How are the sand and salt alike? How are they different? How is the water like the sand and salt?"* (It has mass and takes up space.) *"How is the water different?"*

Procedure

1. Have the students plan to record their observations in their science journals or on a lab sheet.
2. Have the students mix a small amount of sand and salt on a piece of black paper. Ask, *"What happened? Did the matter change? Describe the mixture. Would it be easy to separate this mixture of solids? If not easy, could they be separated? "*
3. Have the students add salt to one cup and sand to the other. Have the students add water to both cups and stir each with the spoon for 1 minute. Have the students observe the two cups and write down their observations of the material that was placed in each. Ask, *"What happened? Did the matter change? Describe the mixtures."* (The salt will dissolve in the water, but the sand will not.)
4. Have the students observe the water with the dissolved salt and the sand. Ask them to think about how they can separate the mixtures and write down their ideas.
5. Have each group select a spokesperson to share the ideas from the group.
6. Next have the students strain the water-sand mixture through a coffee filter over a pan so that the water goes into the pan and the sand is in the filter. Have the students observe what is in the pan and what is in the filter.
7. Now have the students also strain the water-salt mixture through a coffee filter. Have them observe that the salt does not strain like the sand. Ask if there is an alternate method they can think of to get the salt out of the water.
8. For safety, the teacher will boil one group's salt-water mixture in a pot on a burner or other heat source until the water is boiled away (be sure to wear safety goggles). After the pot has cooled, have the students observe that the water has vaporized and the salt remains in the pan. (An optional method is to allow the water to evaporate on its own. Students may measure the volume of water and record each day until all of the water has evaporated.)
9. Have the students discuss in their groups the observations of the experiment and demonstration and then write their observations in their journals.

Assessment

- **Questions**
  - In this experiment, salt was dissolved in the water. Did dissolving change what the material is? Why or why not? What observations did you make in the experiment to support your conclusion?
- **Journal/writing prompts**
  - Before participating in this experiment, what did you know about dissolving and matter? What have you learned about dissolving and matter?
- **Other**
  - Have students prepare a demonstration of their own which shows that changing what a material looks like does not change the material. Have students share their demonstration with their classmates.

Extensions and Connections (for all students)

- Ask students to predict other common materials that will dissolve (sugar). Design an experiment to test predictions.

Strategies for Differentiation

- Use clay to let students see that changing the shape of the clay does not mean it is no longer clay.
- Allow students to dictate or draw responses about what is happening in the experiment.