

# Matter Matters

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<b>Strand</b>	Matter
<b>Topic</b>	Physical properties
<b>Primary SOL</b>	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 a. objects are made of one or more materials.
<b>Related SOL</b>	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; c) objects with similar characteristics or properties are classified into at least two sets and two subsets; h) data are gathered, charted, graphed, and analyzed.

## Background Information

All objects are made of materials that have observable physical properties such as color, shape, and size. Objects can be made up of one or more materials (i.e., wire can be made out of only copper, and steel is made out of a combination of different metals).

In this investigation, students will use their observation skills to investigate five different powdered substances, some of which dissolve and some of which do not. Students must solve the mystery of which substances would make good bricks and which would make good bread.

Concentrate on describing objects in terms of their *physical* properties. You might want to mention that when salt or sugar form a solution, something happens that we can't see without magnification. However, once the water evaporates, the salt or sugar is left behind. You might also talk about how sand and clay are formed as rock erodes yet still have many of the same properties as the original rock, which makes them good choices for making bricks.

Dissolve means to break into component parts or to pass into solution. A mixture is something made up of a combination of different substances; two or more elements or compounds that are blended without combining chemically. A solution is a mixture in which one substance (the solute) is dissolved in another substance (the solvent).

## Materials

Per group of students:

- One tsp. salt sealed in plastic bag labeled "Mystery Substance 1"
- One tsp. sugar sealed in plastic bag labeled "Mystery Substance 2"
- One tsp. sand sealed in plastic bag labeled "Mystery Substance 3"
- One tsp. clay sealed in plastic bag labeled "Mystery Substance 4"
- One tsp. barley flour sealed in plastic bag labeled "Mystery Substance 5"
- Five 4-inch squares of black paper numbered 1, 2, 3, 4, and 5
- Magnifying glass

- One-tsp. measuring spoon
- One-tbsp. measuring spoon
- One small bottle filled with at least 7 tbsp. of warm water
- Handful of dried grass
- Five small plastic cups labeled “Mystery Substance 1, 2, 3, 4, or 5”
- “Mystery Substance Observation” sheet

## Vocabulary

*dissolve, mixture, solution*

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

### Introduction

1. If your class has never done an activity that focuses on observation of physical properties, you may start by asking, “What are the five senses?” As the students name the five senses, write them as headings on the board. Put a handful of dried grass (an ingredient in Egyptian bricks) where everyone can see it. Ask for descriptive words about grass for each of the senses — e.g., a few words to put under the headings Sight, Hearing, Touch, and Smell. Put an X over the Taste heading, and stress that scientists never taste their experiments! Ask students why they think this might be.
2. Once the students seem to have the concept of physical properties, summarize their descriptions, and tell them that they have just described the physical properties of grass. Reinforce the definition of physical property — something that can be observed using the five senses.

### Procedure

1. Divide the class into five groups, and provide each group with a table or other appropriate surface for this experiment. Put a sheet of newspaper in the middle of the table, and have paper towels available so that the students can clean their fingers as needed.
2. Distribute the five bags of mystery substances to each group, and allow the students to examine them with the proviso that they must keep the bags sealed until you give them permission to open them. Also, tell the students that they must not smell or taste the substances. Good scientists never taste their experiments, and they use special smelling techniques when they use their sense of smell. Distribute the black paper squares and the magnifying glass to each group.
3. **Sight Observations:** Ask the students to observe each substance and write down at least four things they notice about it, using their unaided eyes. Then, ask them whether they can think of a tool that might help them see the substances more closely. Allow them to use the magnifying glass to make the observations again. If they need guidance, prompt them with questions, such as: “*What color is the substance? Does it cling to the bag? How large or small are its particles?*” Again, have the students write down at least four things they notice about each substance.

4. **Hearing Observations:** Warn the class that they must be very quiet during this step. Ask for a volunteer in each group to be the bag opener. The bag opener should carefully open the first bag. One of the other students should take a small pinch of Mystery Substance 1. The bag opener should then reseal the bag. Then the whole group should listen as the pincher lets the substance fall to the sheet of black paper numbered “1.” This procedure is then repeated for each of the other substances with a pause after each “drop” to let the students write down their observations.
5. **Touch Observations:** Next, the students should take turns touching each of the substances on the numbered sheets. If they need prompting, you might ask if the substance feels grainy or soft. Have the students write down their observations.
6. The class will expect the smell observations to come next. Surprise! Explain that you will come back to the smell observations after the next step. Smelling powdery substances can irritate the sinuses. Pass out the sets of labeled cups and the bottles of warm water.
7. Ask for a volunteer to be the water measurer. The water measurer should use the measuring spoon to measure and pour 1 tbsp. of warm water into each of the cups. Next the bag opener should carefully open the first bag. One of the other students should use the small measuring spoon to measure out 1 tsp. of Mystery Substance 1. The bag opener should then reseal the bag. The whole group should watch carefully as the substance measurer pours the tsp. of Mystery Substance 1 into the cup labeled Mystery Substance 1. The substance measurer should then gently swirl the cup around until the substance is completely wet. Repeat this procedure for each of the substances. Some will dissolve, others will not. Pause between each step to let the students record their observations.
8. **Smell Observations:** Tell the students that scientists have a special technique for smelling unknown substances. It’s called wafting. The scientist gently waves a hand above the substance toward the nose and sniffs gently. (There are no dangerous substances in this experiment; however, it’s never a good idea to take a deep lungful of a completely unknown substance.) Let the students take turns wafting and smelling the substances in the cups and writing down their observations.
9. At the end of the exercise, let each group pick a different place to put their cups on a tray or piece of cardboard. You might suggest the windowsill, a shady corner, a shelf in a closet, an area far away from the heating source, and an area near the heating source. Remind the students to check on the substances every day for the next week or so. Have students record their observations, and discuss them with the class.
10. After students have matched names to the substances, have them tell what each substance is and describe how they came to each conclusion. Then, reveal the true names of the substances, and compare these to the students’ conclusions. Discuss any incorrect conclusions.
11. Review which of the substances dissolve in water and which do not.

## Assessment

- **Questions**
  - What senses did you use to make your observations?

- Why would a scientist not taste a substance during an observation? Would there ever be a time that a scientist would taste a substance?
- **Journal/writing prompts**
  - Have students explain in their science journals what physical properties helped them to distinguish between one substance and another.
- **Other**
  - Review the observations that the students made of the substances. Make a list on the board. Let students hypothesize as to what each substance may be.
  - Give students the list of possibilities for the substances at this point to see if they can match the correct name to each substance.

### **Extensions and Connections (for all students)**

- Provide students with two very different objects and have students compare and contrast their physical properties.

### **Strategies for Differentiation**

- This activity can be done over a period of several days.
- Have students use a word processor to record the observations and complete electronic versions of the Mystery Substance Observation Sheet in Word after scanning into the computer.
- Have students go to the grocery store and make observations of bulk food items (i.e., lentils, rice, and beans) noting texture, size, shape, color, and scent.
- Have students brainstorm a list of words to describe the properties of matter. Give each group a different color marker and have them create a word chart for this investigation.
- The students need to know the following vocabulary: observation, matter, physical properties, wafting, and descriptive vocabulary (i.e., shapes, colors, textures, size).
- Make a descriptive vocabulary word bank for the classroom.
- Have students make a categorization chart using two to three descriptive words and brainstorm other words that would fit each category (i.e., size, color, shape, and texture, etc.).

# Mystery Substance Observation Sheet

Group Names: \_\_\_\_\_ Date: \_\_\_\_\_

**Mystery Substance #** \_\_\_\_\_

Sight: \_\_\_\_\_  
\_\_\_\_\_

Hearing: \_\_\_\_\_  
\_\_\_\_\_

Touch: \_\_\_\_\_  
\_\_\_\_\_

Smell: \_\_\_\_\_  
\_\_\_\_\_

*(WARNING: Do the sense of smell observation only after you mix the mystery substance with water. Powdery substances can irritate your sinuses.)*

Describe what happened when this mystery substance was mixed with water:

Did the substance dissolve? \_\_\_\_\_ (Yes or No)

Did the water get cloudy? \_\_\_\_\_ (Yes or No)

Did the color change? \_\_\_\_\_ (Yes or No)

Did the substance sink immediately? \_\_\_\_\_ (Yes or No)

Did the substance float at first? \_\_\_\_\_ (Yes or No)

Conclusions:

My group's hypothesis is that this mystery substance is \_\_\_\_\_.

This mystery substance turned out to be \_\_\_\_\_.