

**INTRODUCTION**

Students delight in exploring the world they live in. They naturally observe the properties of the objects in order to make sense of them. This unit provides students with skills and concepts that will assist in this natural discovery. Students will learn that having an understanding of what constitutes a liquid, solid or a gas, is a valuable skill for organizing and classifying physical things.

**SCIENCE STANDARDS AND INDICATORS**

**Conceptual Theme;** Properties of Matter- How does the structure of matter affect the properties and uses of materials?

**Content Standard 2.1-** Materials can be classified as solid, liquid or gas based on their observable properties.

**Core Science Inquiry Expected Performance**

A INQ.1- Make observation and ask questions about objects, organisms and the environment.

A INQ.2 - Use senses and simple measuring tools to collect data

A INQ.6 - Present information in words and drawings

A INQ.9 - Count order and sort objects by their properties.

**CMT Expected Performances**

A.18- Describe the differences in the physical properties of solids and liquids.

**Grade Level Concept:** Solids tend to maintain their own shapes, while liquids tend to assume the shapes of their containers, and gases fill their containers fully.

**GRADE-LEVEL EXPECTATIONS:**

- All materials (matter) take up space. Matter can be classified by whether it is in solid, liquid or gas form. Each state of matter has unique properties.
- Solids are the only state of matter that keeps their own shape. A solid's shape can only be changed if a force is applied to it, such as hammering, slicing or twisting. Solids can be hard, soft, bouncy or stretchy.
- Solids take up a certain amount of space (volume); the volume does not change if the solid is placed in different containers.
- Liquids do not have their own shape; they go to the bottom of a container and take on the shape of the part of the container they occupy. Liquids pour and flow from a higher point to a lower point; some liquids flow faster than others.
- Liquids have a definite volume. When a liquid is poured into different containers, the shape of the liquid may change, but the volume does not.
- Gases do not have a definite shape; they take on the shape of whatever container they occupy. For example, the air in an inflated balloon can be squeezed and reshaped.
- Gases do not have a definite volume; they spread out in all directions to fill any size container, or they keep spreading in all directions if there is no container. For example, blowing even a small amount of air into a balloon immediately fills the entire balloon; the smell of baking bread eventually fills the entire house and even outside.

**KEY SCIENCE VOCABULARY:** property, classify, matter, state of matter, solid, liquid, gas, volume

## SCIENCE CONTENT STANDARD 2.1

<p>CONCEPTUAL THEME:</p> <p><i>Properties of Matter - How does the structure of matter affect the properties and uses of materials?</i></p> <p>CONTENT STANDARD:</p> <p><b>2.1 – Materials can be classified as solid, liquid or gas based on their observable properties.</b></p>	<p><b>GRADE-LEVEL CONCEPT:</b> ♦ Solids tend to maintain their own shapes, while liquids tend to assume the shapes of their containers, and gases fill their containers fully.</p> <p><b>GRADE-LEVEL EXPECTATIONS:</b></p> <ol style="list-style-type: none"> <li>1. All materials (matter) take up space. Matter can be classified by whether it is in solid, liquid or gas form. Each state of matter has unique properties.</li> <li>2. Solids are the only state of matter that keep their own shape. A solid’s shape can only be changed if a force is applied to it, such as hammering, slicing or twisting. Solids can be hard, soft, bouncy or stretchy.</li> <li>3. Solids take up a certain amount of space (volume); the volume does not change if the solid is placed in different containers.</li> <li>4. Liquids do not have their own shape; they go to the bottom of a container and take on the shape of the part of the container they occupy. Liquids pour and flow from a higher point to a lower point; some liquids flow faster than others.</li> <li>5. Liquids have a definite volume. When a liquid is poured into different containers, the shape of the liquid may change, but the volume does not.</li> <li>6. Gases do not have a definite shape; they take on the shape of whatever container they occupy. For example, the air in an inflated balloon can be squeezed and reshaped.</li> <li>7. Gases do not have a definite volume; they spread out in all directions to fill any size container, or they keep spreading in all directions if there is no container. For example, blowing even a small amount of air into a balloon immediately fills the entire balloon; the smell of baking bread eventually fills the entire house and even outside.</li> </ol> <p><b>KEY SCIENCE VOCABULARY:</b> property, classify, matter, state of matter, solid, liquid, gas, volume</p>	<p><b>CMT EXPECTED PERFORMANCES</b></p> <p><b>A18</b> Describe differences in the physical properties of solids and liquids.</p>
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**SCIENCE INQUIRY:** Scientific inquiry is a thoughtful and coordinated attempt to search out describe, explain and predict natural phenomena.

**SCIENCE LITERACY:** Science literacy includes speaking listening, presenting, interpreting, reading and writing about science.

**SCIENCE NUMERACY:** Mathematics provides useful tool for the description, analysis and presentation of scientific data and ideas.

### **BIG IDEA**

Solids tend to maintain their own shapes, while liquids tend to assume the shapes of their containers, and gases fill their containers fully.

### **ALIGNMENT TO OTHER STANDARDS**

Science is an opportunity for students to use literary and math skills. They will explore, discover the world around them and use math skills to sort and quantify what they see. They will then develop their thinking by communicating what they notice, by writing, talking and describing what they understand. Science would not be possible without language arts and math skills. Providing students with the chance to develop inquiry skills is perfect for developing and applying skills in other content areas.

## **MATH**

1.1a1 - Describe and classify data and objects based on more than one attribute.

1.1a2 - Use patterns and the rules that describe them, to identify a missing object, objects with common or different attributes and the complement of a set of objects.

1.1a3 - Explore a variety of ways to describe and write rules for patterns.

### **ESSENTIAL KNOWLEDGE:**

- Solids have a definite shape. The shape of a solid can be changed by applying a force (for example, hammering, cutting, squeezing).
- Solids take up a certain amount of space (volume); the volume does not depend on the size or shape of the container.
- Some solids bend easily (for example, paper or latex), while others do not (for example, steel or wood.)
- Some solids are made up of small particles that can be poured (for example, powders, salt or breakfast cereals).
- Liquids have no definite shape. They take on the shape of the part of the container they occupy. Liquids pour and flow.
- Liquids have a definite volume the amount of liquid does not vary when it is poured into a different container.
- Liquids flow from a higher point to a lower point; some liquids flow faster than others. The rate at which liquids flow depends on the thickness of the liquid (viscosity) or the steepness of the slope.
- Gases have no definite shape. They take on the shape of the whole container they occupy.
- Gases have no definite volume. They spread out in all directions to fill any size container.

### **CONCEPTS**

- Solids and liquids can be described by their properties
- Some properties of solids are colors, shape, ability to roll or stack, hardness, magnetic attraction, and whether they float or sink.
- Some properties of liquids are color, tendency to flow, degree of viscosity or fluidity, whether they are miscible with water, whether they float or sink in water
- Test can be performed to investigate properties of solids and liquids that cannot otherwise be observed.

### **SKILLS: Students will be able to do:**

- Observing and describing the properties of solid and liquids.
- Conducting tests to investigate the properties of solids and liquids.
- Sorting solid into groups on the basis of their properties.
- Comparing similarities and differences among solids.
- Comparing similarities and difference among liquids.

- Applying tests to investigate new solids and liquids
- Compare the properties of solids with the properties of liquids
- Communicating ideas, observations and experiences through writing drawing, and discussion

**ESSENTIAL QUESTIONS TO GUIDE INSTRUCTION AND ASSESSMENT:**

- 
- What are the properties of liquid?
- What are the properties of a solid?
- What are the properties of liquids, solids, and gas?
- How do the properties help determine the usage?

**MATERIALS AND SUPPLIES**

- STC Solids and liquids Kit
- See Resources

**OBJECTIVES AND GOALS**

**LESSON ONE**

**Observing and Describing Two Solids**

- Students observe compare and describe two solid objects
- Students discuss the similarities and differences between the two objects
- Students write about what they know about solids

**LESSON TWO**

**Observing Properties**

- Students sort solids on the basis of the properties of color and shape.
- Students describe and discuss the similarities and difference in the ways they have grouped the solids.
- Students discuss the idea that a solid can be described by either its color or shape.

**LESSON THREE**

**Comparing Solids That Roll with Solids That Stack**

- Students test a set of solids to determine whether they roll or stack.
- Students apply the results of their test to sort the solids into groups.
- Students describe the similarities among the solids in each group.
- Students describe the differences among the solids in each group.
- Students discuss the characteristics of the solids that both roll and stack.

**LESSON FOUR**

**Rolling Solids**

- Students predict which solids will roll down a ramp and which will roll the farthest.
- Students test their predictions.
- Students discuss the similarities among the solids that roll the farthest and among those that do not roll at all down the ramp.
- Students determine how far they can make a solid move by blowing on it through a straw.
- Students discuss their observations and record their discoveries.

**LESSON FIVE**

**Testing the Hardness of Solids**

- Students arrange a set of solids in serial order on the basis of how hard they are.
- Students discuss and compare the ways they have arranged the solids.
- Students recognize that different words can be used to describe how hard something is.

**LESSON SIX**

**Investigation Solids in Water**

- Students investigate what happens when they place solid in water.
- Students describe their observation of the solids in water.

- Students perform a test to determine which solids float and which sink.
- Students describe and compare the similarities among the solids that float and those that sink.

### **LESSONS SEVEN**

#### **Testing Solids with a Magnet**

- Students test a set of solids with a magnet
- Students sort the solids into two groups those that are attracted to a magnet and those that are not attracted to a magnet.
- Students describe and compare similarities among the solids that are attracted to a magnet.
- Students describe and compare similarities among the solids that are not attracted to a magnet.

### **LESSON EIGHT**

#### **Guess My Reason**

- Students sort a set of solids into groups on the basis of a property of their choice.
- Students guess the reason that served as the basis for how a partner grouped the solids
- Students describe new ways to sort solids

### **LESSON NINE**

#### **Investigation Two Solids**

- Student observe two new solids
- Students conduct tests to learn more about the two new solids
- Students record their observations
- Students discuss and compare their observation and test results
- Students read a story tow girls building a snow friend

### **LESSON TEN**

#### **Observing and Describing Two Liquids**

- Students observe, describe and compare two liquids
- Students discuss the similarities and differences between the two liquids
- Students write about what they know about liquids

### **LESSON ELEVEN**

#### **Investigating Liquids**

- Students observe and compare the appearance and feel of four liquids.
- Students observe a drop of each liquid under a hand lens.
- Students discuss and record their observations.

### **LESSON TWELVE**

#### **Flowing Liquids**

- Students manipulate liquids in re-sealable plastic bags
- Students record their observations.
- Students discuss the idea that liquids have no definite shape and that they flow at different rates.

### **LESSON THIRTEEN**

#### **Drop Races**

- Students predict which of two liquids will travel sown a slick surface faster.
- Students conduct a drop race to test their predictions
- Students record discuss and compare their results

### **LESSON FOURTEEN**

#### **Mixing Liquids**

- Students predict what will happen when they pour a liquid into a cup of water.
- Students test their predictions.
- Students record and discuss their results.

### **LESSON FIFTEEN**

#### **Investigating Two New Liquids**

- Students observe two new liquids
- Students conduct tests to learn more about the two liquids
- Students record, discuss, and compare their observations and test results.

### **LESSON SIXTEEN** **Comparing Solids and Liquids**

- Students record what they have learned about solids and liquids.
- Students create a class Venn diagram to compare the similarities and differences between the properties of solids and liquids
- Students use their science journals entries to make presentations on what they have learned about solids liquids or both.

#### **Significant Task**

#### **Post-Unit Assessment\**

##### **Overview**

This post-unit assessment is matched to the pre-unit assessments in Lesson 1 (solids) and Lesson 10 (liquids), when students developed the charts entitled "Comparing the Spoon and the Ball" and "Comparing Water and Glue," respectively. When students revisit these charts during this activity, you will have an opportunity to assess what they have learned about investigating solids and liquids. Students will also have a chance to see how much they have learned. Students' science journal entries are another source of information you may use in assessing the growth in their knowledge of solids and liquids.

By the end of the post-unit assessment, you will have compiled information from the notes you took during the discussions, students' comments on the charts and students' journal entries to use in assessing students' knowledge about solids and liquids. Many teachers have commented that by the end of the unit, their students' knowledge of specific properties of solids and liquids increased; their vocabulary broadened; and their communication and writing skills become more sophisticated. Teachers have noted that the students also developed skills in observing, sorting, and identifying solids and liquids and that many students felt confident about their abilities to conduct tests and use data in the same way that scientists do. These comments are provided here as examples of the range of abilities, skills, and knowledge that you might expect from your students.

#### **Materials**

##### **FOR EACH STUDENT**

- 1 science journal
- 1 pencil

##### **FOR THE CLASS**

- 2 sheets of newsprint
- 1 marker
- "Properties of Solids" chart (from Lessons 2-8)
- "Properties of Liquids" chart (from Lessons 11-14)
- "Comparing the Spoon and the Ball" chart (from Lesson 1)
- "Comparing Water and Glue" chart (from Lesson 10)

#### **Preparation**

1. On one sheet of newsprint, write the title "Comparing the Spoon and the Ball." Beneath the title, create two columns and label them "Different" and "Alike." Write the current date on the chart.
2. On another sheet of newsprint, write the title "Comparing Water and Glue." Beneath the title, create two columns label them "Different." and "Alike." Write the current date on the chart.
3. Make sure the "Properties of Solids" and "Properties of Liquids" charts are displayed.

4. Have the class charts from Lessons 1 and 10 ready, but do not post them until Steps 8 and 11, respectively, of the Procedure.

**Note:** This activity invites students to review what they have learned about the steel ball, blue plastic spoon, water, and glue. It is not essential for students to have these materials in front of them. If you decide to provide the materials to students, make sure to prepare the distribution center in advance. Refer to the Materials lists in Lessons 1 and 10 to determine what materials are needed. Also, because the post-unit assessment activities require students to engage mostly in writing and discussion, you may want to break the activities into two lessons. If you do so, you could conduct Steps 8 through 12 of the Procedure at another time.

### Procedure

1. Have students take out their science journals. Ask them to turn to a new page and to write the current date on top of the page.
2. **Note:** You may want to prepare today's science entry in advance. If so, write the statements in Steps 2 and 4 of the Procedure on one copy of the black line master of a sample journal- entry sheet (in Appendix A) and make a copy for each student.
3. Write the following statements on the board and ask the students to copy the statements in their science journals and to complete the sentence.
4. I know that the ball is a solid because \_\_\_\_\_.
5. I know that the glue is a liquid because \_\_\_\_\_.
6. Then, ask students 'to write on the same page in their journals two or more things that they learned about solids and liquids during the unit.
7. Have students turn to the pages in their science journals on which they first recorded their ideas about the ball and the glue (Lessons 1 and 10, respectively). Encourage students to compare those comments with the ones they have just written. During this discussion, highlight differences in students' comments that reflect what they have learned as a result of their investigations during the unit.
8. **Note:** During the discussion, you may want to make note of comments of individual students that reflect the growth in their knowledge about solids and liquids. These notes can provide important information to use in student assessment.
9. Display the "Comparing the Spoon and the Ball" chart that you prepared for this assessment. Ask students to describe how these two solids are alike and different. Encourage students to *refer* to the "Properties of Solids" chart to remind them of the properties of these two solids that they investigated in Lessons 2 through 7. Record their comments on the chart in the appropriate columns.
10. Now display the "Comparing the Spoon and the Ball" chart from Lesson 1. Ask students to compare the comments on the two charts. Then, ask them to look at the new chart and identify any observations that do not appear on the first one. Encourage students to describe what they have learned about the two solids since Lesson 1.
11. Display the "Comparing Water and Glue" chart that you prepared for this lesson. Ask students to describe how these two liquids are alike and different. Encourage students to *refer* to the "Properties of Liquids" chart to remind them of the properties of these two liquids that they investigated in Lessons 10 through 14. Record their comments on the chart in the appropriate columns.
12. Now display the chart from Lesson 10. Ask students to compare the comments written on the two charts. Ask them to look at the new chart and identify any observations that do not appear on the first one. Encourage students to describe what they have learned about the two liquids since Lesson 10.
13. Collect the students' science journals. Compare their observations *from* the post-unit assessment with those from Lessons 1 and 10. As you compare the entries, note the following:
  - Whether students record new observations in their post-unit responses. For example, note whether students record observations of the properties they investigated during the unit when they describe how they know that the ball is a solid and the glue is a liquid.
  - Whether student's post-unit responses show greater detail than those from Lessons 1 and 10.

- Whether students' post-unit responses contain more diverse descriptions of solids and liquids than those *from* Lessons 1 and 10.

## RESOURCES

### Web sites

<http://www.grc.nasa.gov/WWW/K-12/airplane/state.html>

<http://www.nyu.edu/pages/mathmol/textbook/statesofmatter.html>

<http://www.usoe.k12.ut.us/curr/science/sciber00/7th/matter/sciber/intro.htm>

### Literacy Books

Solids, Liquids and Gases; Ray Boudreau

What Is the World Made Of? (Let's-Read-and-Find-Out Science, Stage 2) (Paperback)

Solids, Liquids, and Gases by Ballard, Carol

From Cow to Ice Cream; Bertram T. Knight, Bertram T. Knight

Why Are the Ice Caps Melting?; F. Rockwell, Paul Meisel

Soap making: 50 Fun & Fabulous Soaps to Melt & Pour (Kid's Crafts Series) Joe Rhatigan

Where Do Snowmen Go when They Melt?; Hank Bruce,

States of Matter; Carol Baldwin

Oil Spill; Melvin Berger

The Snowman; Raymond Briggs

What Am I?; N. N. Charles

The Magic School Bus at the Waterworks; Joanna Coles

Bouncing and Rolling; Terry Jennings

The Snowy Day; Ezra Keats

Hammers and Mops; True Kelley

The Great Blueness and Other Predicaments; Arnold Lobel

Prince William; Gloria Rand

Sylvester and the Magic Peble; William Steig

I Don't Want to Melt!; Alma Florada,

### Extension Activities

Make soap

Make Ice cream

### Field trips

Maple Syrup in the making

Ice house

### Links to United Streaming

For this unit, go to <http://www.unitedstreaming.com>

Search strand: Solids and liquids

Grade Level (left): K-2