TEACHING

States of Matter

First Grade Reading Level
Standards

Science
- Understands atmospheric processes and the water cycle.
- Understands the structure and properties of matter.
- Understands the nature of scientific knowledge.
- Understands the nature of scientific inquiry.
- Understands the scientific enterprise.

Language Arts
- Gathers and uses information for research purposes.
- Uses the general skills and strategies of the reading process.
- Uses reading skills and strategies to understand and interpret a variety of informational texts.

Working with Others
- Contributes to the overall effort of a group.

Multiple Intelligences Utilized
- Linguistic, logical-mathematical, spatial, and naturalistic
Teaching the States of Matter to Primary Students

Background Information
Raders’ Chem4Kids website (http://www.chem4kids.com/files/matter_intro.html) presents information on the topic of matter and its various states. Although written above most primary students’ reading level, teachers will find a visit to this site helpful before teaching a unit on matter.

About This Guide
Teaching States of Matter contains general lessons on the topics of matter and the three main states: solid, liquid, and gas. Also included are ideas for interactive science activities.

Interactive Teaching
Exploring the states of matter with young children is perfect for interactive science teaching. Hands-on learning provides a much-needed spark for students. However, interactive teaching does require more planning and different classroom management techniques. Here are some ideas to make interactive teaching more manageable:

- **Presentation Style:** Not all activities need to be completed as student experiments. Science demonstrations are very effective when the presenter engages the audience with questions and opportunities to participate in the procedure.

- **Classroom Management:** Younger children may work more effectively in smaller groups than in pairs. Assign each group member a task or role. Small groups are also effective for demonstrations. Similar to a guided reading period, have five or six students work with the teacher while the others are engaged in another activity.

- **Materials:** Science materials do not have to be expensive, especially at the primary level. Use common materials in experiments to build on students’ previous experience with the materials and to keep costs down. Ask parents to donate supplies or have a parent volunteer arrange for donations from local businesses.

- **Science Skills:** There are many skills students develop through interactive science. Observing, classifying, measuring, collecting and organizing, predicting and identifying variables, and synthesizing are important skills. During a science demonstration, these skills can be modeled if the presenter uses a thinking-aloud approach. It is not necessary to focus on every skill with every activity. If measuring is not a chosen focus, provide students with pre-measured materials to save time. An Experiment Report form is included on pages 15–16 for students to record the experiment.

- **Safety:** Elementary science should be exciting, not dangerous. Use plastic containers instead of glass, and take precautions if using an open flame. It is very important to teach students science safety rules. Students should know not to taste or smell anything unless told it is safe to do so. Also, confirm that students with environmental allergies will not be affected (mold, pollen, etc.).

- **Failure IS an Option:** Just as accidents sometimes happen, experiments and demonstrations do not always produce desired results. Use this “problem” as a teachable moment. Discuss with students what may have gone wrong and what should be done differently next time. Remind students that many failed experiments have produced wonderful results. Correction fluid, sticky notes, and chewing gum are all examples of experiment “failures.” Trying the activity ahead of time will help keep experiment failure to a minimum.

- **Clean Up:** The potential for accidents and messes greatly increases during clean up time. Have a plan for clean up and communicate it to the students before the activity begins. Repeat the plan before it is time to clean up. Also, make sure students have enough time to clean up. Most often, rushing is the main cause of accidents. If time is a problem, consider using plastic tubs similar to those used to clear tables in restaurants. This way the students’ area can be cleared quickly, but the other clean up (washing and storing) can take place later when there is more time.
Lesson 1
What Is Matter?

Purpose: Students will identify matter around them.

Materials
- States of Matter books
- Is It Matter? p. 10
- chart paper or chalkboard
- markers or chalk
- flashlight
- clear, wide-mouth four-cup container
- water
- medium-sized rock
- one cup of liquid hand soap
- drinking straw
- small radio or music box

Objectives
- Define matter.
- Describe how to identify matter.
- Identify items in the classroom.
- Categorize items as matter or non-matter.
- Suggest additional examples of matter.
- Evaluate peer responses.

Activity Procedures

Prepare
(teacher)
- Copy Is It Matter? p. 10 for each student.
- Fill the container halfway with water.
- Gather and arrange the materials for a class demonstration.
- Make a blank T-chart on the chart paper or board. The headings for each side will be determined by the students near the end of the lesson.

Pretest
(teacher, students)
- Name some things that are around us.
- List the students' ideas on the board.

Read
(teacher, students)
- Read States of Matter books.

Model
(teacher, students)
- Explain to students that matter is anything that takes up space.
- Show students the container of water. Explain that the container is matter, and that the water and air inside are also matter.
- Mark the water level on the outside of the container. Show students the rock. Tell them to watch what happens to the water level when you put the rock in the water.
- Drop the rock in the container. The water level should rise.
- Ask the students what happened. Lead them to the conclusion that if the rock moved the water level up, it must take up space, and therefore it is matter.
- Write rock on the left side of the blank T-chart, and remove the rock from the water.
- Tell students you will now put more air into the container using the straw. Tell them to watch what happens.
- Using the straw, blow hard enough to create bubbles in the water.
- Ask the students what happened. Lead them to the conclusion that if the bubbles of air moved the water, air must take up space, and therefore it is matter. Ask about the straw as well.
- Write air and straw under rock on the T-chart.
- Show students the cup of liquid soap. Ask them what they think will happen if the soap is poured into the water.
- Pour the soap into the water. Make sure the students can see the liquid flow from the cup into the container.
- Ask the students what happened. Lead them to the conclusion that if the soap moved the water level up, it must take up space, and therefore it is matter.
- Write soap under straw on the T-chart.
- Show students the flashlight. Dim the lights in the room so the light beam can easily be seen. Shine the light beam onto the wall.
- Ask students what they think will happen if the light is shone into the container.
- Shine the light beam into the container.
· Ask the students what happened. Lead them to the conclusion that if the light did not move the water, it doesn’t take up space and therefore is not matter.
· Write light on the right side of the T-chart.
· Play some music for the students. Ask what will happen if you put the music into the container.
· Hold the playing radio over the water. Be careful not to bump the container or have the volume too loud.
· Ask the students what happened. Lead them to the conclusion that if the sound did not move the water up, it doesn’t take up space and therefore it is not matter.
· Write sound under the word light on the T-chart.
· Ask students about the arrangement of words on the T-chart. Ask why one side has the words rock, air, straw, and soap and the other has light and sound. Lead them to label the left side Matter and the right side Not Matter.

Discuss
(teacher, students)
· What are some other examples of matter in the classroom?
· Review the list of things created at the beginning of the lesson.
· Ask students if these things are matter or non-matter. Ask students if they agree or disagree with the ideas. Have students show their opinion by giving a thumbs-up if they agree or a thumbs-down if they disagree.
· Add these to the T-chart.

Practice
(students, teacher)
· Review the images and labels on Is It Matter? p. 10 with the students. The labels are needed to understand the non-matter images.
· Complete Is It Matter? p. 10. Students may complete it independently, or the teacher may guide them picture by picture, depending on their ability.

Evaluate
(teacher)
· Check Is It Matter? p. 10 for accuracy and completeness.

Extension
(class)
· Lead students on a matter tour. Walk to different areas in the school building and discuss the matter found in each.
Lesson 2
Solids, Liquids, Gases

Purpose: Students will identify differences between solids, liquids, and gases.

Materials
- States of Matter books
- States of Matter minibook pp. 11–14
- construction paper
- glue
- magazines
- scissors
- pencils
- crayons

Objectives
- Define solid, liquid, and gas.
- Describe solids, liquids, and gases.
- Identify solids, liquids, and gases in the classroom.
- Categorize items as solids, liquids, and gases.
- Suggest additional examples of solids, liquids, and gases.
- Discuss the similarities and differences between students’ work.

Activity Procedures

Prepare
(teacher)
- Assemble the States of Matter minibook.

   Step 1 Copy minibook template pp. 11–12 back-to-back for each student.
   Step 2 Copy minibook template pp. 13–14 back-to-back for each student.
   Step 3 Fold both pages on the dotted line.
   Step 4 Put the pages together with page 1 on the outside.
   Step 5 Fold construction paper around the pages to make a cover.
   Step 6 Staple together in the fold.

Pretest
(teacher, students)
• How are water, ice, and steam similar?

Read
(teacher, students)
• Read States of Matter books.

Discuss
(class)
• What are the three states of matter?
• Ask students to provide examples of solids, liquids, and gases.

Model
(teacher)
• Explain to students that they will be filling in the blanks and drawing or pasting pictures in their own minibooks.
• Show them how to complete a minibook page.

Practice
(students)
• Have students complete the minibooks. Students may complete them independently, or the teacher may guide them page by page, depending on their ability.

Discuss
(class)
• Students share their minibooks with the class.
• Discuss similarities and differences between minibooks.

Evaluate
(teacher)
• Evaluate the minibooks for understanding.

Extension
(class)
• (From Lesson 1) Lead the students on a matter tour. Walk to different areas in the school building and discuss the matter found in each. This tour could be taken during the lesson or after reading the States of Matter books to inspire classroom discussion.
States of Matter Activity Ideas

After reading books from the States of Matter series, use these activities to help students explore the different states of matter. Students can record the experiments or demonstrations on Experiment Report pp. 15–16. Make back-to-back copies for each student or group.

Solids

Title: Solid Sand
Objective: Students will identify sand as a solid.
Materials: sand, water, small bucket or sand molds, magnifying glass or microscope
Description: Fill the bucket or mold with wet sand. Remove the sand so it keeps the shape of the bucket or mold. Show students the sand and the container. Ask students if the sand and the container are the same shape. Ask students if sand is a liquid since it took the shape of its container. Explain that sand sticks together when it gets wet, but the little grains of sand do not change their shape to fit the container. Have students observe the grains of sand with microscopes and magnifying glasses to see that the grains of sand do not change.

Title: Solid Descriptions
Objective: Students will find examples of solids and use adjectives to describe them.
Materials: magazines, glue, scissors, chart paper
Description: In large lettering, label each piece of chart paper with one of the following words: soft, hard, large, red, squishy, and rough. Hang the six pieces of paper around the room so students may reach them. Have students look for magazine images of solids that match one of the adjectives. Students glue the pictures onto the piece of chart paper with the matching adjective.

Liquids

Title: Liquid Shapes
Objective: Students will observe how liquids take the shape of their containers.
Materials: water, containers of different shapes and sizes
Description: Have students fill different containers with water. They should observe how the liquid takes the shape of the container it is in and changes to the shape of the container it is poured into. Students can also try the demonstration presented on page 19 of What Is a Liquid?

Title: Layered Liquids
Objective: Students will observe which liquids mix together.
Materials: ¼ c. (60 ml) dark corn syrup or honey, ¼ c. (60 ml) dishwashing liquid, ¼ c. (60 ml) water, ¼ c. (60 ml) vegetable oil, ¼ c. (60 ml) rubbing alcohol, a tall 12 oz. (350 ml) glass or clear plastic cup, two other cups for mixing, food coloring
Description: Pour the syrup or honey into the middle of the 12 oz. glass. (Do not let it run down the sides of the glass.) Pour enough syrup in to fill the glass ⅛ of the way. After you have added the syrup or honey, tip the glass slightly and pour an equal amount of dishwashing liquid slowly down the side of the glass. Ask students to observe whether the dishwashing liquid floats on top of the syrup or sinks to the bottom. Next mix a few drops of food coloring with water in one of the mixing cups. Color the rubbing alcohol a different color in another mixing cup. Add the next liquids very slowly because they mix more easily than the others. Tip the glass slightly, and slowly pour the colored water down the side of the glass. Using the same technique, add the vegetable oil and then the colored rubbing alcohol. Explain that some liquids are thicker than others, and thicker liquids will sink to the bottom. Also explain that some liquids do not mix together. Stir up the liquids in the glass and tell students to watch what happens to the layers. Have any of the layers mixed? Look again in a few minutes. Have any of the liquids separated?
Title: Changing Liquids

Objective: Students will observe how some liquids change to another state.

Materials: thawed ice pack, frozen ice pack, hotplate and pot or steam vaporizer, water, heavy whipping cream, small container with lid (baby food jar), refrigerated butter

Description: Show students the thawed and frozen ice packs. Heat water to the point of boiling. Have students watch the steam rise into the air. Fill the small container halfway full with heavy whipping cream. With the lid on, shake the container constantly until the cream turns to butter. Show students that the butter becomes hard after it is refrigerated. Discuss how the liquids changed in each of the demonstrations.

Gases

Title: Invisible Push

Objective: Students will observe how air can move an object.

Materials: clear drinking glass, clear bowl, cork, water

Description: Fill the bowl halfway with water. Float the cork in the water. Put the opening of the glass over the cork, and push the glass straight into the water. The cork is being pushed down by the air trapped inside the glass. Push the glass down to the bottom. Slightly tip the glass to allow a few bubbles of air to float to the surface. Discuss that when the air escapes the glass, water is filling the space in the glass.

Title: Raisin Divers

Objective: Students will observe how CO₂ bubbles move in a carbonated beverage.

Materials: ginger ale, raisins, clear jar or glass

Description: Fill the glass with ginger ale. Have students observe the bubbles. Explain CO₂ and carbonation. Drop 2 or 3 raisins into the glass. The raisins will sink to the bottom. Have students observe that the CO₂ bubbles attach themselves to the raisins and lift them to the top of the glass. When the bubbles reach the top, the CO₂ is released, and the raisins sink to the bottom. The raisin will rise again, once more bubbles attach.

Title: Yeast Power

Objective: Students will observe the effects of combining yeast and warm water.

Materials: frozen bread dough*, large mixing bowl, small bowl, ½ c. warm water, 2 Tbsp. active dry yeast, 2 tsp. sugar, empty 2-liter soda bottle, funnel, balloon

Description: Place frozen bread dough in a large mixing bowl. Have students observe how much the bread dough fills the bowl. Leave the bread dough out at room temperature for 8 hours. Observe how much the bread dough fills the bowl now. You may either deflate the dough by a couple of hits with a fist or let it “over-rise.” (The dough deflates and has a wrinkled top.) Discuss what happened to the bread and how yeast is the ingredient that makes bread rise. To prepare the second part of the experiment, mix ½ c. warm water, 2 Tbsp. active dry yeast, and 2 tsp. sugar in a small mixing bowl. Stir until the yeast is completely dissolved. Pour the mixture into a 2-liter bottle using a funnel. Put a balloon over the mouth of the bottle. Have students observe what is happening in the bottle and to the balloon. Do not leave the balloon on for more than 15 minutes, as the gas pressure will cause it to pop.

*You may use fresh bread dough, but students need to see it before it starts rising. The Baking 101 website (http://www.baking911.com/bread/101_rise.htm) provides a good explanation of how to raise and deflate bread dough.
Additional Resources

BOOKS
Readers learn about solids, liquids, and gases through experiments that they can do at home.
This book explores the effects of heat on different objects.
Investigate the properties of matter, including size, weight, shape, color, temperature, and the ability to change.
With simple text and color photographs, students learn about the different states of matter.
Readers explore common materials to discover their properties, such as why some stretch while others snap.
These two titles from the Primary Physical Science series introduce readers to the properties of matter and how matter can change.
Young readers will discover how water changes from a solid to a liquid and back again.
Mr. Whiskers encourages the kids in his class to use all their senses to make observations and draw conclusions about matter.
Use this book to teach that matter exists in different forms, each with unique properties.
Discover the world of matter! Readers learn what matter is and how its state can change.
This book explains how everything on Earth can be grouped into states of matter, and how matter can change from one state to another.

WEBSITES
Dialogue for Kids: States of Matter
Find background information to understand and teach about the states of matter. A list of links is also provided.
Harcourt School Publishers
Change a material into three different states: solid, liquid, and gas. See the differences between the three states of matter.
Revise Wise Science
http://www.bbc.co.uk/schools/revisionwise/science/materials/08_act.shtml
Explore the states of matter with this interactive site from the United Kingdom’s BBC.
Science Clips: Changing State
http://www.bbc.co.uk/schools/scienceclips/ages/9_10/changing_state.shtml
Visitors can heat and cool water to change its state in this interactive experiment.
WonderNet
http://chemistry.org/portals/a/c/s/1/wondernetdisplay.html?DOC=wondernet%5Cactivities%5Cmatter%5Cmatter.html
This site presents activities that visitors can try to change matter from one state to another! Once you complete the activity, click the link to see an explanation of what happened in the experiment.
Is It Matter?

Directions: Circle the examples of matter. Draw an X on the things that are not matter.

<table>
<thead>
<tr>
<th>Crayon</th>
<th>Paint</th>
<th>Music</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glue</td>
<td>Air</td>
<td>Fun</td>
</tr>
<tr>
<td>Child</td>
<td>Love</td>
<td>Juice</td>
</tr>
<tr>
<td>Rain</td>
<td>Sunlight</td>
<td>Helium balloons</td>
</tr>
</tbody>
</table>
A liquid flows. It takes the shape of its container.

A ___________________ is a solid.

A ___________________ is a solid.
A solid has its own shape. It does not take the shape of its container.

Is a liquid.
A gas is hard to see. A gas takes the shape of its container. It fills the container.

There are three kinds of matter. Matter can be a solid, a liquid, or a gas.
All things are made of matter. Matter is anything that takes up space. All things are made of matter. __________ is a gas.
Name

Experiment Report

My Hypothesis (What is my question?)


My Prediction (What do I think will happen?)


My Procedure (What do I do?)


My Result (What happened?)


Was my prediction correct? YES NO
### Directions:

Draw a picture of what is happening at the beginning, middle, and end of the experiment. Label the pictures.

<table>
<thead>
<tr>
<th>End</th>
<th>Middle</th>
<th>Beginning</th>
</tr>
</thead>
</table>

and end of the experiment. Label the pictures.