

# Lesson 3

## Solids, Liquids, and Gases in Our World

### A QUICK LOOK

#### How Do You Know It Is a Solid?

hard (sometimes)  
 squishy (sometimes)  
 can pick it up  
 can't drink it  
 can't see through it (usually)  
 has a texture  
 holds its shape

#### Big Idea

Materials can be classified as solid, liquid, or gas based on whether they have certain properties.

#### Process Skills

- Observing
- Classifying
- Reasoning

#### Overview

In this lesson children classify substances in the classroom as solid, liquid, or gas. Then they take a walk outside to look for more solids, liquids, and gases and practice classifying them.

#### Key Notes

- In this lesson the children will take a walk outside. Choose when and where the children should go, and arrange for adult assistants as needed.
- You may want to conduct the lesson in two sessions, spending a whole session on the Engage section of the lesson where children begin to define how they know something is a solid, liquid, or gas.
- If state or local standards require studies of the properties of air and other gases, consider extending this lesson with the Further Science Exploration "Explorations with Air."
- If state or local standards require investigating the differences between natural and manufactured materials, consider extending the lesson with the Further Science Exploration "Natural Objects and Manufactured Objects."
- For more information about the science content in this lesson, see the "Classifying Materials as Solid, Liquid, or Gas" section of the Teacher Background Information on page 109.

# Lesson 3

## Standards and Benchmarks

The students' experiences in this lesson provide exposure to Physical Science Standard D (Properties of Earth Materials): "Earth materials are solid rocks and soils, water, and gases of the atmosphere. The varied materials have different physical and chemical properties...."

## Lesson Goals

- Identify solids, liquids, and gases in class samples and in the environment.
- Discuss the choices made in classifying things as solid, liquid, or gas.

## Assessment Option

Throughout this lesson, listen to children's ideas and questions as they classify materials. Their ideas and questions can be used as a pre-assessment of their initial understanding of criterion A on Assessment 2.



**Solids, Liquids, and Gases Assessment 2:  
Solids, Liquids, and Gases**

As you evaluate children's discussions and work, determine if they demonstrate understanding of the following concepts:

Children's Names	Assessment Criteria:		
	A. Materials commonly exist as solid, liquid, or gas.	B. Liquids have unique properties that distinguish them from solids and gases.	C. Solids have unique properties that distinguish them from liquids and gases.
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Assessment 2: Solids, Liquids, and Gases      Solids, Liquids, and Gases Teacher Master 3

Teacher Master 3, Assessment 2

## Materials

Item	Quantity	Notes
<b>Classroom Supplies</b>		
Chart paper	8 sheets	To make posters for recording children's classifications.
Clipboards	1 per child	To record in the field.
Dirt mixed with water in resealable bag	1	To make mud mixture for sensory observation.
Duct tape	1 roll	To further seal bags of colored water.
Food coloring	Small amount	To make liquid samples for sensory observation.
Paper towels	1 roll	To clean up in case liquid sample bags leak.
Pea gravel, dried beans, or other small solids in resealable bag	1	To make sample of small solids for sensory observation.
Pencils	1 per child	To record in the field.
Plastic bags, resealable. sandwich size	3 per group, plus 2	To hold samples for sensory observation.
Poster board	1	For Science Center.
Rocks	1 per group	To place in bags as solid samples for sensory observation.
Water	30 ml (1 ounce) per group	To make liquid samples for sensory observation.
<b>Curriculum Items</b>		
<i>Solids, Liquids, and Gases Science Notebook, pages 8-9</i>		
<b>Teacher Master "Sample Solid, Liquid, or Gas" (for Science Center)</b>		
<b>Solids, Liquids, and Gases Assessment 2 "Solids, Liquids, and Gases" (optional)</b>		
<b>Family Link Homework "Solids, Liquids, and Gases at Home"</b>		

### NOTES

### Preparation

- Survey the place where you plan to take the children outside. If your outdoor space has no visible liquids, you might add bottles of water or create "puddles" by pouring water on the ground or leaving a water-filled Frisbee on the ground. Think about where children might identify gases, and consider adding air-filled playground balls, a bicycle with air-filled wheels, or a helium-filled balloon to the site.
- Prepare three resealable plastic bags for each group. For the sensory observation, each group will need:
  - One bag containing a rock
  - One bag containing about 30 ml (1 ounce) of water with a small amount of food coloring, sealed with very little air, and then taped to make more secure
  - One bag puffed with air and sealed

- ❑ Prepare two more resealable plastic bags for the sensory observation. Fill one with pea gravel, dried beans, or some other small solids. In the second bag, mix some lumpy, rocky dirt and water to make a very wet mud.
- ❑ Write these titles on five sheets of chart paper: Solids, Liquids, Gases, Mixtures, and Don't Know. On three more sheets, write the question "How Do You Know?" Attach one "How Do You Know?" sheet to the bottom of each of the Solids, Liquids, and Gases sheets.
- ❑ Make three copies of the **Teacher Master "Sample Solid, Liquid, or Gas"** to place in the **Science Center**.
- ❑ Copy the **Family Link Homework "Solids, Liquids, and Gases at Home"** for each child to take home.

## Vocabulary

**gas** .....A material that does not have a definite shape or take up a definite amount of space. A gas can expand to fill any available space in a container.

**liquid** .....A material that does not have a definite shape but takes up a definite amount of space. A liquid fills the bottom of its container when at rest, and flows freely when poured.

**solid** .....A material that has a definite shape and takes up a definite amount of space. A solid keeps its shape when at rest, whether or not it is in a container.

**TEACHER NOTE:** In this instance, definitions are listed here for your convenience. Do not share these formal definitions with the children. The children will build on their initial understanding of solids, liquids, and gases through hands-on experiences over time.

## Teaching the Lesson



### Engage

#### *Sensory Observation*

1. Distribute the bags containing rocks, colored liquid, and air to the groups. Point out that the bags are containers for the things inside.

**MANAGEMENT NOTE:** Tell the children to handle the sealed bags of liquids gently. The bags may leak a little, so have paper towels on hand.

2. Display the five posters with these headings: Solids, Liquids, Gases, Mixtures, Don't Know.

3. Tell the children that scientists classify most of the world's materials as solids, liquids, or gases. Prompt them to classify the contents of the bags with questions and follow-up actions such as the following:

- Which bag contains a solid? Does everyone agree? Can they identify other things around them that are solids? (*Possibilities include a desk, a shirt, the floor, etc.*) Write the solids that the children identify on the Solids poster.
- How do they know something is a solid? (*Possible answers include it's hard, they can pick it up, they can't drink it, etc.*) Write the children's ideas at the bottom of the Solids poster under the title "How Do You Know?"

**TEACHER NOTE:** As children suggest properties that apply only to some solids, discuss whether the idea applies to all solids. For example, if a child says "A solid is hard," you might ask "Are all solids hard?" Add notes such as "(sometimes)" or "(usually)" to the "How Do You Know?" list.

How Do You Know It Is a Solid?

hard (sometimes)  
 squishy (sometimes)  
 can pick it up  
 can't drink it  
 can't see through it (usually)  
 has a texture  
 holds its shape

- Which bag contains a liquid? Does everyone agree? Can they identify any liquids in the classroom? (*Possibilities include contents of water bottles, water in a fish tank, drinks in their lunchboxes, saliva in their mouths, etc.*) Write the liquids that the children identify on the Liquids poster.
- How do they know something is a liquid? (*Possible answers include it's watery, it's squishy, or squeeze it and it moves, etc.*) Write the children's ideas at the bottom of the Liquids poster under the title "How Do You Know?"

- Is the third bag empty? (*No*) What is inside the third bag? (*Air*) Is air a solid, liquid, or gas? (*A gas*) Can they identify where air or other gases might be in the classroom? (*Possibilities include the air around them, air in their lungs, air trapped in cushions or balloons, tiny bits of air in the water that fishes get oxygen from, etc.*) On the Gases poster, write down where the children find gases.
- How do they know something is a gas? (*Possible answers include they can't see it, they can breathe it, etc.*) Write the children's ideas at the bottom of the Gases poster under the title "How Do You Know?"

**TEACHER NOTE:** You may need to distinguish "gasoline" (a liquid that people use as fuel for cars) from this use of the word "gas," which means a material like air which the children can't see, but which they can sense in other ways. Point out to the children that they are surrounded by air, which is a gas. See the Further Science Exploration "Explorations with Air" for activities to help children understand gases better.

4. Help the children classify examples that may be a little more difficult.
  - Carry a resealable bag containing pea gravel or dried beans around the room. Ask: Is this a solid, liquid, gas, or mixture? (*It is a lot of little solid pieces.*)
  - Carry a resealable bag containing mud around the room and let the children touch it. Ask: Is this a solid, liquid, gas, or mixture? (*It is a mixture of dirt, which is a lot of little solid pieces, and liquid water.*)
  - Ask the children if they think a shirt is a solid, liquid, or gas. If there is some debate, refer to the "How Do You Know?" notes to see if the class can reach consensus. (*A shirt is a solid.*)

**TEACHER NOTE:** The question of whether fabric is a solid may raise some controversy. Help the children reach a conclusion by telling them that they must choose one of the categories, then model how to compare a shirt to a liquid. For example, you might ask: "If we put a shirt on the table, would it flatten out and drip onto the floor?" or "Could someone drink a shirt?" You might ask: "Is a shirt a liquid? Why not?" and "Is a shirt a gas? Why not?"

5. Tell the children that they will be going outside to identify different solids, liquids, gases, and mixtures in their environment. Tell them they will write lists in their science notebooks. They should feel free to guess, and feel free to use the "Don't Know" list.

*Point out words on the "I Wonder" circle related to observing, recording, and classifying. These are important aspects of doing science.*



- Where were the gases outside? (Possible correct answers include inside tires, balls, or balloons; the air around them; and wind, which is moving air.)
- Where did they find liquids? Did they find any liquids besides water?
- What solids did they find?

**TEACHER NOTE:** You may want to move some items tactfully from a child’s chosen list to the “Don’t Know” list in order to avoid misconceptions. For example, if a child categorized “light” or “cloud” as a gas, you might say something like “I’d like to talk about that more at another time, so let’s put that on the ‘Don’t Know’ list for now.” See the “Materials That Are Hard to Classify” topic beginning on page 111 of the Teacher Background Information for ideas on how to talk about some hard-to-categorize items.

### Synthesizing

1. Ask whether the children have anything to add to the “How Do You Know?” notes at the bottom of the Solids, Liquids, and Gases posters, and record their ideas.
2. (Optional) Once you have recorded the children’s outdoor findings, you’ll probably find that the list of solids is quite long, with shorter lists for liquids and gases. Consider bringing the lists into perspective by pointing out that although there are many solids on the lists, and fewer liquids and gases, it doesn’t mean that liquids and gases don’t make up enormous parts of the world. Develop ideas such as the following:
  - If the class were to pile all the solid objects in the classroom into one corner of the room, the pile of solids would be smaller than the rest of the room, which is filled with a gas (air).
  - Air (a gas) fills the space around and above us.
  - The world’s oceans are filled with liquid water. They are huge.



### assessment opportunity

*The children’s lists will give you lots of information about their understanding of solids, liquids, and gases at this time. You can refer back to these posters throughout the unit as children’s understandings of what properties are associated with solids, liquids, and gases become more sophisticated.*

**Materials:** Three resealable bags and their contents from the Sensory Observation, poster board

Name: _____ Date: _____	
<b>Sample Solid, Liquid, or Gas</b>	
This object is a:    solid    liquid    gas mixture    don't know	
<b>It feels:</b> (circle one or more)	hard    soft    rough    smooth wet    sloshy    heavy    light
<b>Shape:</b> (circle one or more)	keeps its own shape is the same shape as its container changes shape easily doesn't change shape easily
<b>Color:</b>	
<b>Can you see through it?</b>	
<b>Other words that describe this object:</b>	
<small>Sample Solid, Liquid, or Gas (Lessons 3, 4, and 5)      Solids, Liquids, and Gases Teacher Master 11</small>	

**Teacher Master 11**

Name: _____ Date: _____	
Family Link with Science—Homework	
<b>Solids, Liquids, and Gases at Home</b>	
<small>As part of their study of Solids, Liquids, and Gases, the children are practicing identifying solids, liquids, and gases in their own environment. If needed, you can do the writing for your child by writing down what she or he tells you.</small>	
Find a solid, a liquid, and a gas at home. Describe them.	
My solid is _____ Here is a picture:	Properties of this solid:
My liquid is _____ Here is a picture of the liquid in its container:	Properties of this liquid:
My gas is _____ Here is a picture of where I found the gas:	Properties of this gas:
<small>Please complete this assignment for science class.</small>	
<small>Family Link: Solids, Liquids, and Gases at Home (Lesson 3)      Solids, Liquids, and Gases Teacher Master 14</small>	

**Teacher Master 14, Family Link**

- If children placed living organisms on their Mixtures list, point out that living organisms depend on water and air.

## Ongoing Learning

### Science Center

Place one of the resealable bags containing a rock, a second bag containing colored water, and a third containing air in the Science Center. Place three copies of the Teacher Master “Sample Solid, Liquid, or Gas” for the children to work on in the Science Center. When the Teacher Masters are complete, attach the bags (holding their contents) along with the Teacher Masters to a poster board and display the poster.

### Family Link

Distribute the Family Link Homework “Solids, Liquids, and Gases at Home.” In this link the children identify a solid, a liquid, and a gas at home. They write down their choices, draw them, and list some of the properties of the object or material.

### Maintenance

Keep the Solids, Liquids, Gases, Mixtures, and Don’t Know posters to refer to throughout the unit. There will be other opportunities to add to the “How Do You Know?” lists. When the class revisits the posters, children may also find that they can move some of their “Don’t Know” items onto other posters.

## Extending the Lesson

### Further Science Explorations

#### *Explorations with Air*

The remainder of the lessons in this unit focus on solids and liquids, but it may be a good idea (depending on children’s interest, or on local and state requirements) to give the children more experiences with the properties of gases. Supply the following materials for various explorations. As children work, ask them to identify and record answers to the questions “Where is the air?” or “Where is the gas?”

- Supply plastic grocery bags, resealable bags, balloons, or other items that can trap air. Allow children to explore the

ways that gases change shape as their container changes shape. Point out that the gases in the container take up space, and “push back” when compressed.

- Supply tubs of water and sponges, syringes (with no needles), turkey basters, balloons, straws, or other ways to create air bubbles in water. Invite children to notice bubbles in water, as well as the ways that water moves into spaces that were once occupied by air, and the ways that bubbles of air can move water and push water out of their way.

**+** **SAFETY NOTE:** Make sure that children do not share straws that they have put in their mouths.

- Supply fans, balloons, bicycle pumps or ball bumps, syringes (with no needles), stiff paper, or other ways to create wind. Allow children to explore the idea that wind is moving air, and that it can push objects around.

**+** **SAFETY NOTE:** Before distributing air pumps, instruct children to never point the end of the tube where air emerges at someone’s face.

- Go outside on a windy day, or look at books about hurricanes and tornados. Invite children to reflect on the potential strength of moving air.

### *Natural Objects and Manufactured Objects*

Use the lists of solids, liquids, and gases that the children found outside to discuss things that occur in nature, and things that people make using materials that come from nature. For example, you might have the children classify the things they found into two lists:

- **Things that occur in nature:** tree, rock, dirt, rain water, air, sand, feather, fungus
- **Things that people make from natural materials:** wooden picnic table, cement from sand, cars made of metal, etc.

## Planning Ahead

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### For Lesson 4

In Lesson 4, children will work with various liquids. You may need to make a trip to the grocery store to acquire dish soap, milk or





## Teacher Master 14, Family Link

Name: \_\_\_\_\_ Date: \_\_\_\_\_

### Family Link with Science—Homework

## Solids, Liquids, and Gases at Home

*As part of their study of Solids, Liquids, and Gases, the children are practicing identifying solids, liquids, and gases in their own environment. If needed, you can do the writing for your child by writing down what she or he tells you.*

Find a solid, a liquid, and a gas at home. Describe them.

My solid is _____ Here is a picture:  	Properties of this solid:  
My liquid is _____ Here is a picture of the liquid in its container:  	Properties of this liquid:  
My gas is _____ Here is a picture of where I found the gas:  	Properties of this gas:  

Please complete this assignment for science class.

Family Link: Solids, Liquids, and Gases at Home (Lesson 3) Solids, Liquids, and Gases Teacher Master 14