

Properties of Matter

Lesson 1a: Observing Changes in Matter

Grade 2	Length of lesson: 48 minutes	Placement of lesson in unit: 1a of 5 two-part lessons on properties of matter, with two additional extension lessons
Unit central questions: What is matter made of? How can matter change?		Lesson focus question: What changes in matter can we see?
Main learning goal: Matter can undergo observable changes that can be described and categorized.		
Science content storyline: Matter is anything that takes up space and has mass (weight). Matter can change, and we can observe those changes. Changes happen when heat is added or taken away. Some changes are reversible and some aren't.		
Ideal student response to the focus question: I can see matter, like butter, changing from a solid to a liquid when heat is added. I can also see matter changing from a liquid to a solid when heat is taken away. This can happen when liquid water changes to ice when it cools down. Matter can also change back to the way it was before. So butter can change from a liquid back to a solid if it cools down, and ice can change back to liquid if it heats up.		

Preparation

<p>Materials Needed</p> <ul style="list-style-type: none"> • Science notebooks • Chart paper and markers • Station 1 (4 setups): <ul style="list-style-type: none"> • 2 pats of butter (1 melted, 1 not melted) • 2 small plastic containers (or heat-resistant bowls) • Pot holders • Station 2 (4 setups): <ul style="list-style-type: none"> • 2 ice-cube trays filled with water (1 frozen, 1 not frozen) • 2 plastic containers or trays to hold the ice-cube trays <p>Student Handouts and Teacher Masters</p> <ul style="list-style-type: none"> • 1.1 Station Setup and Instructions (Teacher Master) • 1.2 Student Station Instructions—Stations 1 and 2 (1 laminated card for each corresponding station setup) • 1.3 Data Table (Teacher Master) 	<p>Ahead of Time</p> <ul style="list-style-type: none"> • Read the content background document. • Cut apart handout 1.2 (Student Station Instructions—Stations 1 and 2). Laminate the cards and place one card with each corresponding station setup (4 setups per station). Follow the instructions in handout 1.1 (Station Setup and Instructions) to set up Stations 1 and 2. • Based on the sample in handout 1.3, create a data table on chart paper to record the changes in matter students observe at each station. Display this table throughout the unit. • Introduce the term <i>matter</i> before the unit begins. Students should be able to describe matter as anything that takes up space and has mass (weight) and identify examples of matter in the classroom (including air). Students should understand that matter can be described by its properties or characteristics, including its color, density, and texture. Properties of matter describe a substance regardless of the amount. Weight and size are <i>not</i> properties of matter because they can change depending on the amount of a substance there is. • ELL support: Introduce ELL students to the lesson content, structure, materials, and activities in advance so they understand what's expected of them and can participate more fully in the lesson. You might also want to walk students through Stations 1 and 2. Many students may not be familiar with the concept of matter, so get them thinking about this idea by contrasting matter with feelings. Matter takes up space and can be weighed, but feelings don't take up space and can't be weighed. Also note that matter isn't the same as energy. Light and sound are examples of energy, not matter. Identify Tier 2 and 3 words in the lesson plan to introduce ahead of time, including <i>summarize</i>, <i>reverse/reversible</i>, <i>matter</i>, <i>physical</i>, <i>properties</i>, and <i>characteristics</i>. Have students write these terms and their meanings in their science notebooks or create a key-word or picture dictionary. Also post the terms on a word wall for students to refer to as needed.
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Lesson 1a General Outline

Time	Phase of Lesson	How the Science Content Storyline Develops
6 min	Link to previous ideas: The teacher engages students in a review of what they've already learned about matter and its properties.	<ul style="list-style-type: none"> Matter is anything that takes up space and can be weighed (has mass). We can identify matter by its properties or characteristics. Examples of matter in our classroom are desks and chairs, people, the floor, lockers, pens, and paper. Light and sound aren't matter; they're forms of energy. Our feelings are also not matter.
3 min	Unit central questions and lesson focus question: The teacher introduces the unit central questions, <i>What is matter made of? How can matter change?</i> Then the teacher introduces the focus question, <i>What changes in matter can we see?</i>	
8 min	Setup for activity: Students share ideas and examples of how matter can change.	
15 min	Activity: Working in teams, students visit two classroom stations and observe matter that has undergone some kind of change. Then they discuss their observations and share ideas about what might have caused the changes.	<ul style="list-style-type: none"> Matter can change, and we can observe these changes. Matter, such as butter and water, changes when heat is added or taken away (when matter cools).
10 min	Follow-up to activity: Students share the changes in matter they observed at each station, their ideas about what might have caused these changes, and whether they think the changes can be reversed. During this discussion, the teacher records student observations and ideas on a class data table.	<ul style="list-style-type: none"> Matter can change, and we can observe these changes. Matter, such as butter and water, can change from a solid to a liquid when heat is added, or it can change from a liquid to a solid when heat is taken away (when matter cools). Some changes are reversible, and the matter can change back to the way it was before.
5 min	Synthesize/summarize today's lesson: The teacher reviews the focus question. Then students share their answers and ideas with a partner based on their observations at the two stations.	<ul style="list-style-type: none"> We can see matter changing and describe these changes. When heat is added, matter changes from a solid to a liquid, like when butter melts. When heat is taken away, matter cools down and changes from a liquid to a solid, like when water freezes.
1 min	Link to next lesson: The teacher announces that in the next lesson, students will observe how two other kinds of matter can change.	

Time	Phase of Lesson and How the Science Content Storyline Develops	STeLLA Strategy	Teacher Talk and Questions	Anticipated Student Responses	Possible Probe/Challenge Questions
6 min	<p>Link to Previous Ideas</p> <p>Synopsis: The teacher engages students in a review of what they've already learned about matter and its properties.</p> <p>Main science idea(s):</p> <ul style="list-style-type: none"> Matter is anything that takes up space and can be weighed (has mass). We can identify matter by its properties or characteristics. Examples of matter in our classroom are desks and chairs, people, the floor, lockers, pens, and paper. Light and sound aren't matter; they're forms of energy. Our feelings are also not matter. 	<p>Link science ideas to other science ideas.</p> <p>Summarize key science ideas.</p>	<p>Show slides 1 and 2.</p> <p>Over the past couple of days, we've been talking about something called <i>matter</i>. Who can tell me what matter is?</p> <p>CONTENT NOTE: <i>In scientific terms, matter has mass, not weight. However, since 2nd graders often have difficulty differentiating mass and weight, matter is described in this unit as anything that has weight and can be weighed. Matter also includes things we can't see or touch, such as molecules of oxygen in the air. This idea isn't included in the 2nd-grade curriculum, so avoid bringing it up. However, if students bring it up during a class discussion, be prepared to address it as simply and concisely as possible.</i></p> <p>If everything we can see or touch is matter, what about something like happiness? I can see happiness when you smile, so is that matter?</p>	<p>Matter is everything.</p> <p>Matter is everything I can see and touch.</p> <p>The table is matter.</p> <p>I'm matter.</p> <p>The water in my water bottle is matter.</p> <p>No! My mouth and my teeth are matter, but happiness isn't matter.</p> <p>Happiness doesn't take up space, and it</p>	<p>What do you mean by "everything"? Can you be more specific?</p> <p>Can you give me an example of matter in this room?</p>

			<p>We discussed the idea that matter can be described by its properties or characteristics. Who can recall some of the ways we described matter? What are some of its properties?</p> <p>Look around our classroom and find one example of matter you can see.</p> <p>Does everyone have an example of matter in mind?</p> <p>Who would like to share your example of matter? Make sure to describe it by the properties we've talked about, such as its color and whether it's hard or soft, shiny or dull, bendable or rigid, big or small.</p> <p>Are there any properties or characteristics we've mentioned that you think aren't properties of matter?</p>	<p>doesn't weigh anything, so it can't be matter.</p> <p>Yes.</p> <p>We described matter by its color.</p> <p>How hard or soft something is.</p> <p>How shiny or dull something is.</p> <p>How big something is.</p> <p>My example of matter is my pencil. It's yellow and hard and small and stiff.</p>	<p>Oh, so not everything we can see is matter? Only things that take up space?</p> <p><i>Questions to ask:</i></p> <ul style="list-style-type: none"> • What do others think? • Do you agree or disagree? • Do you have any ideas to add?
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		Highlight key science ideas and focus question throughout.	<p>Show slide 3.</p> <p>Remember that a property of matter is something that won't change even if you add more of it or take some of it away. For example, if I break a piece of wood in half, both pieces are still wood with the same properties of wood.</p>		
3 min	<p>Unit Central Questions and Lesson Focus Question</p> <p>Synopsis: The teacher introduces the unit central questions, <i>What is matter made of? How can matter change?</i> Then the teacher introduces the focus question, <i>What changes in matter can we see?</i></p>	Set the purpose with a <u>focus question</u> or goal statement.	<p>Show slide 4.</p> <p>Today we'll begin a new unit about matter and how it changes in the world around us. Over the next several lessons, we'll think about two important questions: <i>What is matter made of?</i> and <i>How can matter change?</i></p> <p>These are our unit central questions. Open your science notebooks to a clean page and write these to questions at the top. Then draw a double-lined box around them.</p> <p>We'll keep these questions in mind in each lesson and gather ideas that might help us answer them. By the end of our unit, we'll see how our ideas about matter have changed.</p> <p>NOTE TO TEACHER: <i>Write the unit central questions on the board for students to refer to throughout the lesson series. Also show students how to draw a double-lined box around the questions.</i></p> <p>Show slide 5.</p> <p>Another question that will guide our learning each day is called a <i>lesson focus question</i>. Today's focus question is <i>What changes in matter can we see?</i></p>		

			<p>Write this question in your science notebooks underneath our unit central questions and draw a box around it to remind yourself that this question is the focus of our lesson.</p> <p>NOTE TO TEACHER: <i>Write the focus question on the board for students to refer to throughout the lesson.</i></p>		
8 min	<p>Setup for Activity</p> <p>Synopsis: Students share ideas and examples of how matter can change.</p>	<p>Make explicit links between science ideas and activities before the activity.</p> <p>Ask questions to elicit student ideas and predictions.</p>	<p>Show slide 6.</p> <p>Think about our focus question and the examples of matter you saw around our classroom.</p> <p>NOTE TO TEACHER: <i>Mention a few examples of matter that students identified in the classroom.</i></p> <p>Can you imagine any of this matter changing? In what ways might the matter in these examples change? What might cause the matter to change?</p> <p>NOTE TO TEACHER: <i>Give students 20 or 30 seconds of think time before inviting them to share their ideas. Keep this discussion brief.</i></p> <p>Show slide 7.</p> <p>Now I'd like you to think of an example of matter outside our classroom, in the world around us. How might this matter change? What might cause it to change?</p> <p>Turn and Talk (2 min): Share your example of matter with an elbow partner and talk about these questions.</p> <p>NOTE TO TEACHER: <i>Circulate around the room and listen as students share their ideas. Write down any ideas that represent physical or chemical</i></p>		

			<p><i>changes and use them to get the class discussion started on the right track.</i></p> <p>Whole-class share-out: Who would like to share your example of matter in the world around us and how it can change?</p> <p>NOTE TO TEACHER: <i>Accept all ideas at this point and record them on chart paper so students can refer to them as they gain understanding throughout the unit.</i></p>	<p>A tree grows from a little seed. That's a change in matter.</p> <p>I grew from a little baby.</p> <p>I could burn a tree down, and it would turn into ash.</p> <p>If I spilled some water, it would dry up. That's a change in matter.</p> <p>I could paint the wall, and then it would be a different color. That's a change in matter. <i>[Incorrect]</i></p> <p>If I have some soft clay, and I leave it out and it dries out, that's a change in matter.</p> <p>One time, I left my popsicle on the picnic table, and it melted into a puddle. I think that's</p>	
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			These are all interesting examples. Let's keep them in mind as we investigate some other ways matter can change.	a change in matter.	
15 min	<p>Activity</p> <p>Synopsis: Working in teams, students visit two classroom stations and observe matter that has undergone some kind of change. Then they discuss their observations and share ideas about what might have caused the changes.</p> <p>Main science idea(s):</p> <ul style="list-style-type: none"> Matter can change, and we can observe these changes. Matter, such as butter and water, changes when heat is added or taken away (when matter cools). 	Make explicit links between science ideas and activities during the activity.	<p>Show slide 8.</p> <p>Next, we're going to explore some changes in matter. I've set up two different stations around the classroom. Each station has four setups with the same materials so that you can work together in teams.</p> <p>NOTE TO TEACHER: <i>Divide the class into teams of three or four students. Assign each team to one of the station setups and go over the tasks students will complete. Then have teams begin the investigation, following the instructions on the setup card. When teams have finished the tasks for their assigned station, have them move on to the next station and follow the instructions on the card for that station.</i></p> <p>At each station setup, your team will find a card with instructions. You'll observe how matter changes in this setup and discuss the questions on the card with your teammates:</p> <ol style="list-style-type: none"> 1. What change in matter do you see? 2. What do you think caused the change? 3. Could you ever reverse the change you see? <p><i>Reversing the change</i> means changing the matter back to the way it was before. For example, if you see ice in one container and water in the other container, do you think you could change the water back into ice?</p> <p>NOTE TO TEACHER: <i>Continue displaying slide</i></p>		

		<p><i>8 throughout the activity to help students stay focused on answering the questions about the changes in matter they observe.</i></p> <p>ELL support: Preview the questions on the setup cards to make sure ELL students understand what they mean. It might also be helpful to elicit examples from students to connect the questions with their experiences. Consider walking students through this activity in advance so they know what to expect and what's expected of them.</p> <p>When I give the signal, I want your team to quickly and quietly move to your assigned station. Have one team member read the first question on the card; then look at the matter and talk about the change you see. Next, have a different team member read the second question; then discuss what you think caused the change. Finally, have another team member read the third question; then share your ideas about whether you could reverse the change so that the matter returns to the way it was before.</p> <p>You'll have about 5 minutes at each station, so stay focused on answering the questions. When your team has answered all of the questions at the first station, stay there until I give you the signal to move on to the next station.</p> <p>Do you have any questions before we begin our investigation?</p> <p>NOTE TO TEACHER: <i>Keep track of the time to make sure students move from one station to the next after 5 minutes. Give students a 1-minute warning before the station change and direct them to finish discussing the questions in their groups.</i></p>		
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		<p>Ask questions to elicit student ideas and predictions.</p> <p>Ask questions to probe student ideas and predictions.</p>	<p><i>While teams work through the questions for each station, circulate from team to team and listen to students' ideas. The goal of today's activity is to reveal student thinking about changes in matter. Stations 1 and 2 introduce students to physical changes in matter (solid to liquid and liquid to solid). Stations 3 and 4 in lesson 1b will introduce students to chemical changes in matter (burning paper and mixing baking soda and vinegar). Students aren't expected to know the terms physical change and chemical change or be able to recognize the differences between them. However, they should notice that some changes are reversible (physical changes) and some aren't (chemical changes).</i></p> <p><i>Subsequent lessons in this unit will concentrate on physical changes, but exposing students to chemical changes in lesson 1b will help them understand that matter can change in many ways, and these changes aren't always reversible.</i></p> <p><i>As you circulate among the teams, ask questions to elicit student observations and ideas and probe their thinking (see sample dialogue in columns 5 and 6). Take notes, if possible, so you can discuss students' ideas during the activity follow-up. You may use challenge questions to help students stay focused and clarify their thinking about the three main questions, but at this point, avoid asking challenge questions to move student thinking forward or challenge students to change their ideas.</i></p>		<p><i>Questions to ask teams:</i></p> <ul style="list-style-type: none"> • How would you describe the change in matter you see? • Can anyone add to that idea? • What else do you see?
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				<p><i>Sample dialogue:</i> The butter is runny in one dish and just soft in the other dish.</p> <p>I think the butter melted.</p> <p>The butter must have gotten hot.</p> <p>I think that if you put the melted butter in the refrigerator, it would turn back into butter.</p>	<p>What do you mean by “melted”? What do you think causes something to melt?</p> <p>Does anyone agree or disagree with that idea?</p> <p>Do you think the melted butter could ever change back to look like the other dish of butter?</p> <p>That’s an interesting idea. What do you mean by “turn back into butter”?</p>
10 min	Follow-Up to Activity		Show slide 9.		

	<p>Synopsis: Students share the changes in matter they observed at each station, their ideas about what might have caused these changes, and whether they think the changes can be reversed. During this discussion, the teacher records student observations and ideas on a class data table.</p> <p>Main science idea(s):</p> <ul style="list-style-type: none"> • Matter can change, and we can observe these changes. Matter, such as butter and water, can change from a solid to a liquid when heat is added, or it can change from a liquid to a solid when heat is taken away (when matter cools). Some changes are reversible, and the matter can change back to the way it was before. 	<p>Make explicit links between science ideas and activities after the activity.</p> <p>Engage students in constructing explanations and arguments.</p>	<p>Let’s talk about the changes in matter you observed at our two stations, and what you think caused those changes. Like scientists, we’ll use a data table to track our observations and ideas.</p> <p>NOTE TO TEACHER: <i>Record student observations and ideas for Stations 1 and 2 on the data table you created based on handout 1.3. The rows for Stations 3 and 4 will be completed in lesson 1b. In this lesson series, we have chosen not to formally introduce the terms melting and freezing, but if students use them to describe the changes in matter they observed, make sure they’re using them correctly. At this age, students typically use the word melting to describe different kinds of substances changing from solids to liquids, and they tend to think that freezing requires substances to be cold. However, all solid substances—even substances that are solid at high temperatures—aren’t frozen.</i></p> <p>ELL support: Review the format and content of the data table with ELL students before the lesson so they know what to expect and what’s expected of them. This will enable them to participate more fully in the actual lesson. Let ELL students know in advance that you’ll be asking them to share their ideas during the discussion. Then make sure to give each student an opportunity to respond. Let students know that it’s OK to repeat other classmates’ ideas. This is not only good practice but will help make student thinking visible.</p> <p>Who would like to describe one kind of change you observed at Station 1?</p> <p> Listen to students’ ideas. What’s visible about student thinking?</p>	<p>I saw the melted butter.</p>	<p>Can you say more about melted butter? Is it a liquid or a solid?</p>
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		<p>Engage students in communicating in scientific ways.</p> <p>Highlight key science ideas and focus questions throughout.</p>	<p>NOTE TO TEACHER: <i>As students share the changes in matter they observed at Station 1 and then at Station 2, encourage them to use the sentence starter, “The change in matter that I saw was” Record their descriptions (words, phrases, or short sentences) in column 1 on the data table. Highlight (or underline) specific words students use to describe the changes (e.g., melt, becomes runny, goes from solid to liquid). You’ll revisit this list in lesson 2.</i></p> <p><i>In column 2, write down a word or two indicating what students think caused the change (e.g., heat, getting warm, cooling). These terms may or may not echo student descriptions in column 1. In column 3, simply record students’ responses as either yes or no. Also make sure students understand the term reversible.</i></p> <p><i>Encourage students to respond to the ideas others share. Ask questions like “What do others think?” “Do you agree or disagree with this idea?” and “Can anyone add to this idea?”</i></p> <p><i>Finish recording student observations and ideas for Station 1 on the data table before moving on to Station 2.</i></p> <p><i>During this discussion, encourage students to compare the same kind of matter (i.e., the solid butter and the melted butter; the water/ice) in its solid and liquid forms. Also highlight any references students make to heating or cooling as a possible cause of change. This will alert students that these are key concepts they should pay attention to. Don’t spend time teaching students about heating or cooling in this lesson; simply highlight when they’re mentioned in the discussion.</i></p>	<p>The melted butter is a liquid because it can move around like water.</p>	
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			<p>What do you think caused this change?</p> <p>Do you think melted butter can turn back into solid butter? How might that happen?</p> <p>What change in matter did you see at Station 2?</p> <p>What do you think caused this change?</p> <p>Do you think ice can be changed back to liquid water? How might that happen?</p> <p>NOTE TO TEACHER: <i>After students share their observations and ideas about the matter at Stations 1 and 2, ask them to think of other substances (matter) that change when they're heated or cooled. This will help reinforce the lesson content</i></p>	<p>Butter melts when you leave it in hot stuff or in the microwave.</p> <p>I don't know if it could turn back into a stick of butter, but maybe it would if you put it in the refrigerator.</p> <p>You have to get butter cold; then it will turn back into a solid.</p>	<p>What do you mean by "hot stuff"?</p> <p>Do you think melted butter is still butter? Or has it changed into something else?</p>
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			<p><i>and transition to the synthesize/summarize task. Begin a class list of these substances on chart paper to review and add to in subsequent lessons.</i></p> <p>What other substances, or matter, can you think of that change when they're heated or cooled?</p>		
5 min	<p>Synthesize/Summarize Today's Lesson</p> <p>Synopsis: The teacher reviews the focus question. Then students share their answers and ideas with a partner based on their observations at the two stations.</p> <p>Main science idea(s):</p> <ul style="list-style-type: none"> We can see matter changing and describe these changes. When heat is added, matter changes from a solid to a liquid, like when butter melts. When heat is taken away, matter cools down and changes from a liquid to a solid, like when water freezes. 	<p>Highlight key science ideas and focus question throughout.</p> <p>Engage students in making connections by synthesizing and summarizing key science ideas.</p> <p>Engage students in constructing explanations and arguments.</p> <p>Engage students in analyzing and interpreting data and observations.</p>	<p>Show slide 9.</p> <p>Today we explored the focus question, <i>What changes in matter can we see?</i></p> <p>Turn and Talk: Turn to an elbow partner and describe the changes in matter you observed today at the different stations. You may also talk about any other examples of changes in matter that you've seen in the world around you. Use the sentence starters on the slide to begin your conversation.</p> <p><i>The matter I saw started out as _____ and changed to _____.</i></p> <p><i>I think _____ caused the change.</i></p> <p><i>I think I [can/can't] change this matter back to the way it was before because _____.</i></p> <p>NOTE TO TEACHER: Encourage students to use the science terms solid and liquid in context in their responses. If time allows, have them answer the focus question in their science notebooks.</p> <p>ELL support: Introduce the sentence starters during the lesson preview and give ELL students a chance to practice completing them. This will prepare them to participate more fully in the actual lesson.</p>		

1 min	<p>Link to Next Lesson</p> <p>Synopsis: The teacher announces that in the next lesson, students will observe how two other kinds of matter can change.</p>	Link science ideas to other science ideas.	<p>Show slide 11.</p> <p>Do you notice that half of our data table is still incomplete?</p> <p>In our next lesson, we'll explore how two new kinds of matter can change.</p> <p>Do you think these changes will be like the changes we saw today? We'll find out next time!</p>		
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