

## Properties of Matter

### Lesson 1b: Observing More Changes in Matter

<b>Grade 2</b>	<b>Length of lesson:</b> 45 minutes	<b>Placement of lesson in unit:</b> 1b of 5 two-part lessons on properties of matter, with two additional extension lessons
<b>Unit central questions:</b> What is matter made of? How can matter change?		<b>Lesson focus question:</b> What changes in matter can we see?
<b>Main learning goal:</b> Matter can undergo observable changes that can be described and categorized.		
<b>Science content storyline:</b> 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.		
<b>Ideal student response to the focus question:</b> 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 a liquid if it heats up.		

#### Preparation

<p><b>Materials Needed</b></p> <ul style="list-style-type: none"> <li>• Science notebooks</li> <li>• Chart paper and markers</li> <li>• Station 3 (4 setups)             <ul style="list-style-type: none"> <li>• 2 clear, sealable plastic bags (or plastic containers); 2 pieces of paper, 4.25" × 5.5" (1 piece unburned and 1 piece partially burned but still recognizable as paper)</li> </ul> </li> <li>• Station 4 (4 setups)             <ul style="list-style-type: none"> <li>• 1 quart-sized, sealable, plastic freezer bag; 1 teaspoon of baking soda in bag; 2 tablespoons of vinegar in a clear plastic vial with snap-on cap; paper towels</li> </ul> </li> </ul> <p><b>Student Handouts and Teacher Masters</b></p> <ul style="list-style-type: none"> <li>• 1.1 Station Setup and Instructions (Teacher Master) (from lesson 1a)</li> <li>• 1.3 Data Table (from lesson 1a)</li> <li>• 1.4 Student Station Instructions—Stations 3 and 4 (1 laminated card for each corresponding station setup)</li> </ul>	<p><b>Ahead of Time</b></p> <ul style="list-style-type: none"> <li>• Review the content background document.</li> <li>• Cut apart handout 1.4 (Student Station Instructions—Stations 3 and 4). Laminate the cards and place 1 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 3 and 4.</li> <li>• Display the class data table from lesson 1a (created on chart paper based on the sample in handout 1.3).</li> <li>• <b>ELL support:</b> 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 3 and 4. Review the format and content of the data table from lesson 1a, as well as the sentence starters for the synthesize/summarize activity. Also review vocabulary words from the previous lesson, including <i>summarize</i>, <i>reverse/reversible</i>, <i>matter</i>, <i>physical</i>, <i>properties</i>, and <i>characteristics</i>. Identify new vocabulary words in the lesson plan to introduce ahead of time.</li> </ul>
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## Lesson 1b General Outline

Time	Phase of Lesson	How the Science Content Storyline Develops
5 min	<b>Link to previous lesson:</b> Students summarize what they learned in the previous lesson about changes in matter.	<ul style="list-style-type: none"> <li>Matter is anything that takes up space and can be weighed (has mass). Matter can change, and we can observe those changes. We observed that butter can change from a solid to a liquid when heat is added, and water can change from a liquid to a solid when heat is taken away (when matter cools). Both changes are reversible, which means the matter can change back to the way it was before.</li> </ul>
1 min	<b>Lesson focus question:</b> The teacher reviews the focus question from the previous lesson, <i>What changes in matter can we see?</i>	
6 min	<b>Setup for activity:</b> The teacher introduces two new stations and reviews the procedure for observing and discussing how matter changes at each station.	
15 min	<b>Activity:</b> Working in teams, students visit two new 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"> <li>Matter can change, and we can observe these changes. Some matter can change without adding or taking away heat.</li> </ul>
9 min	<b>Follow-up to activity:</b> 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. The teacher records student observations and ideas on a class data table.	<ul style="list-style-type: none"> <li>Matter can change, and we can observe these changes. Some matter can change without adding or taking away heat, and some changes can't be reversed.</li> </ul>
8 min	<b>Synthesize/summarize today's lesson:</b> The teacher reviews the focus question, and students share their answers with a partner based on the changes in matter they observed at Stations 3 and 4. Then the teacher summarizes key science ideas from the lesson.	<ul style="list-style-type: none"> <li>Matter is anything that takes up space and can be weighed (has mass). Matter can change, and we can observe those changes. When heat is added, matter changes from a solid to a liquid. When heat is taken away, matter cools down and changes from a liquid to a solid. Some matter can change without adding or taking away heat. Some changes in matter are reversible (the matter can change back to the way it was before), and some changes can't be reversed.</li> </ul>
1 min	<b>Link to next lesson:</b> The teacher foreshadows the next lesson in which students explore what causes matter to change from a solid to a liquid or from a liquid to a solid.	

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5 min	<p><b>Link to Previous Lesson</b></p> <p><b>Synopsis:</b> Students summarize what they learned in the previous lesson about changes in matter.</p> <p><b>Main science idea(s):</b></p> <ul style="list-style-type: none"> <li>Matter is anything that takes up space and can be weighed (has mass). Matter can change, and we can observe those changes. We observed that butter can change from a solid to a liquid when heat is added, and water can change from a liquid to a solid when heat is taken away (when matter cools). Both changes are reversible, which means the matter can change back to the way it was before.</li> </ul>	Ask questions to elicit student ideas and predictions.	<p><b>Show slide 1.</b></p> <p>In our last lesson, you observed changes in matter at two different stations. Let’s summarize what we learned.</p> <p>What changes in matter did you see at Stations 1 and 2? Look at the descriptions we recorded on our data table if you need a reminder.</p> <p>OK. So one thing we observed was that matter can change into a liquid.</p> <p>What kind of matter did we start with at each station, and what did it change into? Use our science word <i>matter</i> in your answer.</p>	<p>We saw ice that melted and butter that melted.</p> <p>They’re runny.</p> <p>When something is runny, it’s a liquid.</p> <p>One kind of matter was ice, and it changed into water.</p>	<p>What do you mean by “melted”?</p> <p>Can anyone add to this idea?</p> <p>What do you think caused the solid ice to change into liquid water?</p>

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			<p>Were any of the changes we observed reversible. Could the matter change back to the way it was before? How do you know?</p>	<p>The ice got warmer.</p> <p>Ice can't stay frozen if it's out in the room.</p> <p>Yes, water and ice can change back to the way they were before.</p> <p>Ice and water are really the same thing, but water turns into ice when it's in the freezer.</p>	<p>Say more about the ice getting warmer.</p> <p>Can anyone add to this idea?</p> <p>Tell us more about ice and water.</p> <p>What makes the change in ice and water reversible? Can anyone use our science words <i>solid</i> and <i>liquid</i>?</p> <p>What about the solid butter and the melted butter? Is that change reversible? How</p>

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		Summarize key science ideas.	<p><b>Show slide 2.</b></p> <p>So in our investigation, we learned that matter can change from a solid to a liquid, like solid butter changing to melted butter and ice changing to liquid water. We agreed that adding heat caused this change in matter. And we agreed that we can change water back to ice and melted butter back to solid butter by taking away heat and cooling the matter.</p> <p>Today we'll observe other kinds of matter to find out whether all matter changes in the same way.</p>		do you know?
1 min	<p><b>Lesson Focus Question</b></p> <p><b>Synopsis:</b> The teacher reviews the focus question from the previous lesson, <i>What changes in matter can we see?</i></p>	Set the purpose with a <u>focus question</u> or goal statement.	<p><b>Show slide 3.</b></p> <p>Today we'll continue thinking about the focus question from our last lesson: <i>What changes in matter can we see?</i></p> <p>Circle this question in your science notebooks to remind yourself that this is the focus of today's lesson, too.</p>		
6 min	<p><b>Setup for Activity</b></p> <p><b>Synopsis:</b> The teacher introduces two new stations and reviews the procedure for observing and discussing how matter changes at each</p>	Make explicit links between science ideas and activities <b>before</b> the activity.	<p><b>Show slide 4.</b></p> <p>I've set up two new stations for you to visit. Like last time, each station has four setups with the same materials so that you can work together in teams.</p> <p>Why are we visiting different stations? What are we observing?</p>	We're supposed to	

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	station.		<p>Yes, you're visiting these stations to look for changes in matter.</p> <p><b>NOTE TO TEACHER:</b> <i>Have students gather in teams of three or four students. You may have them work in the same teams from lesson 1a or form new teams. Assign each team to one of the station setups and review the tasks students will complete. Then have teams begin the investigation, following the instructions on the setup cards. 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><b>Show slide 5.</b></p> <p>Like last time, your team will find a card with instructions at each station setup. You'll observe how matter changes in this setup and discuss the questions on the card with your teammates. These questions should look familiar to you:</p> <ul style="list-style-type: none"> <li>• What change in matter do you see?</li> <li>• What do you think caused the change?</li> <li>• Could you ever reverse the change that you see?</li> </ul> <p>Make sure to look at the matter even more carefully today. Some of the changes might surprise you!</p>	<p>look for changes.</p> <p>Changes in matter.</p>	<p>Changes in what?</p>

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			<p><b>NOTE TO TEACHER:</b> <i>You may want to demonstrate what students will do with the baking soda and vinegar at Station 4, or ask another available adult to assist students with this activity. Encourage students to observe the matter at Station 4 very closely because the change might happen quickly and is likely to surprise them!</i></p> <p><b>ELL support:</b> As in lesson 1a, 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>		
15 min	<p><b>Activity</b></p> <p><b>Synopsis:</b> Working in teams, students visit two new 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><b>Main science idea(s):</b></p> <ul style="list-style-type: none"> <li>Matter can change, and we can observe these changes. Some matter</li> </ul>	<p>Make explicit links between science ideas and activities <b>during</b> the activity.</p>	<p><b>NOTE TO TEACHER:</b> <i>Continue displaying slide 5 throughout the activity to help students stay focused on answering the questions about the changes in matter they see.</i></p> <p>When I give the signal, your team should 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 the matter returns to the way it was before.</p>		

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	<p>can change without adding or taking away heat.</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>Any questions before we begin?</p> <p><b>NOTE TO TEACHER:</b> <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> <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 in lesson 1a introduced students to <b>physical changes</b> in matter (solid to liquid and liquid to solid). In this lesson, Stations 3 and 4 introduce students to <b>chemical changes</b> that aren't caused by adding or removing heat (burning paper and mixing baking soda and vinegar). Students aren't expected to know the terms physical change and chemical change or identify the changes in this lesson as chemical changes. However, they should be able to compare the changes from Stations 1 and 2 with the changes from Stations 3 and 4. They should also notice that the (physical) changes they observed in the previous lesson are reversible, and the (chemical) changes they observed today aren't.</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>Highlight key science ideas and focus question throughout.</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>Students may say that heat is causing the piece of paper to change. Although heat is definitely involved, burning is the primary cause of the change. This change is different from the change caused when heat melted the ice and butter at Stations 1 and 2. Don't dissuade students from using the word heat in their descriptions, but emphasize the difference between changes caused when something burns and changes caused when heat is added. This pertains to the follow-up discussion as well.</i></p>	<p><i>Sample dialogue:</i> The paper burned.</p> <p>The paper is ash and black stuff now, not paper. I couldn't write on it.</p> <p>The paper used to be white and kind of square. Now it's black, ashy, and crumbly.</p> <p>Burned paper comes</p>	<p><i>Questions to ask teams:</i></p> <ul style="list-style-type: none"> <li>• What change in matter do you see?</li> <li>• Can anyone add to that idea?</li> <li>• What else do you see?</li> </ul> <p>What do you think caused the change?</p>

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				<p>from burned trees.</p> <p>You caught the paper on fire.</p> <p>The paper starts to melt, but it doesn't turn into liquid. It gets weaker and weaker.</p> <p>Fire is hot, and the heat or fire caused the paper to change.</p> <p>No! You can't turn ashes back into paper.</p> <p>I'm not sure. Maybe</p>	<p>Tell me more about your ideas.</p> <p>What happens to paper when it catches on fire?</p> <p>Any other ideas about what caused the change?</p> <p>Do you think you could change the ashes and black stuff back into paper?</p> <p>If you cooled the ashes or put them in the freezer, do you think they would turn back to paper?</p>

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			<p><b>NOTE TO TEACHER:</b> <i>Following the activity, have students either return to their desks or gather in a circle (or on a rug) for the activity follow-up.</i></p>	if you added water to them.	
9 min	<p><b>Follow-Up to Activity</b></p> <p><b>Synopsis:</b> 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. The teacher records student observations and ideas on a class data table.</p> <p><b>Main science idea(s):</b></p> <ul style="list-style-type: none"> <li>• Matter can change, and we can observe these changes. Some matter can change without adding or taking away heat, and some changes can't be reversed.</li> </ul>	<p>Make explicit links between science ideas and activities <b>after</b> the activity.</p> <p>Engage students in constructing explanations and arguments.</p>	<p><b>Show slide 6.</b></p> <p>Let's talk about the changes in matter you observed at our two new stations, and what you think caused those changes. I'll record your observations and ideas on our data table from last time.</p> <p><b>NOTE TO TEACHER:</b> <i>Record student observations and ideas for Stations 3 and 4 on the data table from lesson 1a.</i></p> <p><b>ELL support:</b> 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.</p> <p>Who would like to describe one kind of change you observed at Station 3?</p> <p> <b>Listen to students' ideas. What's visible about student thinking?</b></p> <p><b>NOTE TO TEACHER:</b> <i>As students share the changes in matter they observed at Station 3 and then at Station 4, encourage them to use the sentence starter, "The change in matter that I saw</i></p>	<p>I saw that the paper burned.</p> <p>The change in</p>	<p>Can you begin your sentence by saying, "The change in matter that I saw was ..."?</p>

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		Engage students in communicating in scientific ways	<p><i>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, such as totally changed, changed to something else, didn’t look the same, made something new, went from paper to ash, burned, fizzed, or puffed up the bag.</i></p> <p><i>In column 2, write down a word or two indicating what students think caused the change (e.g., burning, fire, fizzing, mixing). These terms may or may not echo student descriptions in column 1. Because the changes in matter at Stations 3 and 4 aren’t as straightforward as the changes at Stations 1 and 2, students might suggest that heat (Station 3) or melting (Station 4) caused the change. Don’t try to address misconceptions at this point. Simply capture student thinking on the data table to revisit later in the unit. Activities in subsequent lessons will also help change students’ thinking and move it forward toward more-scientific understandings.</i></p> <p><i>In column 3, 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 3 on the data table before moving on to</i></p>	<p>matter that I saw was the paper turning into ashes.</p> <p>The paper was on fire.</p> <p>The matter changed because it burned.</p>	<p>What do you think caused that change in matter?</p> <p>Can anyone add to this idea and use our science idea of matter?</p>

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			<p><i>Station 4.</i></p> <p>What change in matter did you see at Station 4?</p>	<p>The change in matter that I saw was baking soda and vinegar turning into bubbles.</p> <p>I think they changed into something else, but I don't know what! The stuff is still white.</p> <p>The bag puffed all up.</p> <p>The bubbles popped and made air.</p>	<p>Do you think the baking soda and vinegar are still baking soda and vinegar? Or did they change into another kind of matter?</p> <p>What else did you see?</p> <p>Say more about the bag puffing up. How might that happen?</p> <p>Who can add another idea?</p> <p>Do you think you</p>

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				No, you can't pull the baking soda and vinegar apart. They changed forever!	could change the matter back into baking soda and vinegar again?
8 min	<p><b>Synthesize/Summarize Today's Lesson</b></p> <p><b>Synopsis:</b> The teacher reviews the focus question, and students share their answers with a partner based on the changes in matter they observed at Stations 3 and 4. Then the teacher summarizes key science ideas from the lesson.</p> <p><b>Main science idea(s):</b></p> <ul style="list-style-type: none"> <li>Matter is anything that takes up space and can be weighed (has mass). Matter can change, and we can observe those changes. When heat is added, matter changes from a solid to a liquid. When heat is taken away, matter cools</li> </ul>	<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><b>Show slide 7.</b></p> <p>Let's revisit our focus question, <i>What changes in matter can we see?</i></p> <p><b>Turn and Talk:</b> Turn to an elbow partner and describe the changes in matter that you observed at our stations today. Use the same sentences you used last time 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><b>NOTE TO TEACHER:</b> <i>If time allows, have students answer the focus question in their science notebooks.</i></p> <p><b>ELL support:</b> During the lesson preview, give ELL</p>		

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	<p>down and changes from a liquid to a solid. Some matter can change without adding or taking away heat. Some changes in matter are reversible (the matter can change back to the way it was before), and some changes can't be reversed.</p>	<p>Engage students in analyzing and interpreting data and observations.</p> <p>Summarize key science ideas.</p>	<p>students a chance to practice completing the sentence starters to summarize their observations and ideas from Stations 3 and 4. This will prepare them to participate more fully in the actual lesson.</p> <p><b>Whole-class share-out:</b> Let's hear some of your summary sentences.</p> <p><b>NOTE TO TEACHER:</b> <i>As time allows, invite as many students as possible to share their summary statements.</i></p> <p><b>Show slides 8 and 9.</b></p> <p>Let's review what we've learned so far about matter.</p> <ul style="list-style-type: none"> <li>• Matter is anything that takes up space and has weight.</li> <li>• Matter can change, and we can observe these changes.</li> <li>• Matter can change from a solid to a liquid when we heat it (like melting butter or ice).</li> <li>• Matter can change from a liquid to a solid when we take heat away and the matter cools (like liquid water changing to ice).</li> <li>• Sometimes matter can change without adding or taking away heat (like the baking soda and vinegar).</li> <li>• Some changes in matter are reversible, and the matter can change back to the way it was before (like water changing back to ice).</li> <li>• But sometimes matter can't change back to</li> </ul>		

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			the way it was before (like the vinegar and baking soda).		
1 min	<p><b>Link to Next Lesson</b></p> <p><b>Synopsis:</b> The teacher foreshadows the next lesson in which students explore what causes matter to change from a solid to a liquid or from a liquid to a solid.</p>	Link science ideas to other science ideas.	<p><b>Show slide 10.</b></p> <p>Why does matter change from a solid to a liquid or from a liquid to a solid? We know that adding or taking away heat has something to do with it, but we need more information.</p> <p>We'll explore more about these ideas next time!</p>		