

Properties of Matter

Lesson 5b: What Have We Learned about Matter?

Grade 2	Length of lesson: 50 minutes	Placement of lesson in unit: 5b 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 questions: What is matter made of? How can matter change?
<p>Main learning goal: All matter is made up of very small pieces called <i>atoms</i> and <i>molecules</i>. Matter can change from a solid to a liquid when heat is added and the molecules begin to move faster. When they move fast enough, they break away from their rigid structure and flow around more freely as a liquid. Matter can change from a liquid to a solid when heat is removed and the molecules slow down. When they slow down enough, they join together in a rigid structure and vibrate in place as a solid.</p>		
<p>Science content storyline: All matter is made up of very small particles that are either atoms or combinations of atoms called <i>molecules</i>. Matter undergoes physical changes when heat is added or removed. These changes cause the molecules to move more rapidly or more slowly, but the structure of the molecules doesn't change. In physical changes, the matter is always the same substance, like water or butter, but the states of matter (solid, liquid, gas) are reversible. Solid matter can become liquid matter when heat is added, and liquid matter can become solid matter again when heat is removed and the matter cools down.</p>		
<p>Ideal student response to the focus questions: Matter is made up of very small pieces called <i>atoms</i> and <i>molecules</i>. Matter can change when heat is added or taken away. If you add heat to a solid, the molecules move faster. When they move fast enough, they break away from each other and flow around more freely as a liquid. If you take heat away from a liquid, the matter cools down, and the molecules move more slowly until they stick together and vibrate in place as a solid. This process is reversible, so solid matter can change to liquid matter and back to solid matter over and over again when heat is added or taken away. The molecules themselves don't change, so water is always water in a solid or a liquid. The only thing that changes is how the molecules are arranged and move.</p>		
Preparation		
<p>Materials Needed</p> <ul style="list-style-type: none"> • Science notebooks • Chart paper and markers • Communicating in Scientific Ways (CSW) poster <p>Student Handouts</p> <ul style="list-style-type: none"> • 5.1 Changes in Matter—Before, During, and After (from lesson 5a) 		<p>Ahead of Time</p> <ul style="list-style-type: none"> • Review the content background document.

Lesson 5b General Outline

Time	Phase of Lesson	How the Science Content Storyline Develops
8 min	Link to previous lessons: The teacher engages students in connecting key science terms to the big ideas in the unit.	<ul style="list-style-type: none"> All matter is made up of very small pieces called <i>atoms</i> and <i>molecules</i>. Matter can change from a solid to a liquid when heat is added and the molecules move fast enough to flow around each other more freely. Matter can change from a liquid to a solid when heat is removed and the matter cools. When the molecules slow down enough, they form a rigid structure and vibrate in place.
1 min	Lesson focus questions and unit central questions: The teacher reviews the focus questions and unit central questions, <i>What is matter made of? How can matter change?</i>	
6 min	Setup for activity: Students gather in their teams from the previous lesson to plan their comic-strip presentations.	
20 min	Activity: Students communicate in scientific ways as teams share their comic strips with the class. Following each presentation, the teacher summarizes how each comic strip answers the unit central questions.	<ul style="list-style-type: none"> All matter is made up of very small pieces called <i>atoms</i> and <i>molecules</i>. Matter can change from a solid to a liquid when heat is added and the molecules move fast enough to flow around each other more freely. Matter can change from a liquid to a solid when heat is removed and the matter cools. When the molecules slow down enough, they form a rigid structure and vibrate in place.
10 min	Follow-up to activity: Using science ideas and words they've learned in this unit, students come up with as many sentences as they can that describe what matter is made of and how it can change.	<ul style="list-style-type: none"> Matter is made up of very small pieces called <i>atoms</i> and <i>molecules</i>. Matter can change when heat is added or taken away. If you add heat to a solid, the molecules move faster. When they move fast enough, they break away from each other and flow around more freely as a liquid. If you take heat away from a liquid, the matter cools down, and the molecules move more slowly until they stick together and vibrate in place as a solid. This process is reversible, so solid matter can change to liquid matter and back to solid matter over and over again when heat is added or taken away. The molecules themselves don't change. The only thing that changes is how the molecules are arranged and move.
5 min	Synthesize/summarize today's lesson: Students share the sentences they came up with to describe what matter is made of and how it can change. Then the teacher creates summary statements for each unit central question using these science ideas. For additional support with the NGSS, the teacher continues with extension lessons 6 and 7.	<ul style="list-style-type: none"> Matter is made up of very small pieces called <i>atoms</i> and <i>molecules</i>. Matter can change from a solid to a liquid and from a liquid to a solid when heat is added or removed. This process is reversible, so solid matter can change to liquid matter and back to solid matter over and over again. The molecules themselves don't change. The only thing that changes is how the molecules are arranged and move.

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8 min	<p>Link to Previous Lessons</p> <p>Synopsis: The teacher engages students in connecting key science terms to the big ideas in the unit.</p> <p>Main science idea(s):</p> <ul style="list-style-type: none"> All matter is made up of very small pieces called <i>atoms</i> and <i>molecules</i>. Matter can change from a solid to a liquid when heat is added and the molecules move fast enough to flow around each other more freely. Matter can change from a liquid to a solid when heat is removed and the matter cools. When the molecules slow down enough, they form a rigid structure and vibrate in place. 	<p>Link science ideas to other science ideas.</p> <p>Summarize key science ideas.</p> <p>Ask questions to probe student ideas and predictions.</p> <p>Ask questions to challenge student thinking.</p> <p>Engage</p>	<p>Show slides 1 and 2.</p> <p>Today you'll have an opportunity to share your comic strips with the class. But first, let's pull together some of the important science ideas from our unit on matter.</p> <p>When I list two or three words, make a complete sentence connecting these words to science ideas about matter.</p> <p>Are you ready to play Connect the Science Ideas?</p> <p>Here is your first pair of words: <i>matter</i> and <i>molecules</i>. Who can make a complete sentence connecting these words to key science ideas about matter?</p> <p>NOTE TO TEACHER: <i>Throughout today's lesson, try to surface common student ideas and misconceptions. Ask questions to probe and challenge student thinking and invite other students to offer alternative ideas. For example, students may say that atoms and molecules are "inside" matter rather than saying they make up matter. This may be an issue of semantics, because students at this age don't have very precise language skills, and the Lego model isn't totally accurate either. But it's important to have the conversation</i></p>	<p>Molecules are in matter.</p> <p>Well, I guess you could say that matter is made up of molecules.</p>	<p>Tell me more about what you're thinking. Are the molecules <i>inside</i> the matter, like our Lego molecules were inside the baggie?</p>

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		students in communicating in scientific ways.	<p><i>and raise the questions. Try not to lead students to the “correct” answer; instead, focus on making student thinking visible. These are complex, abstract ideas, but as students express their ideas and listen to others’ ideas, their understandings of the science content will deepen.</i></p> <p>What sentence can you make with the words <i>atoms</i> and <i>molecules</i>?</p> <p>Who can make a sentence with the words <i>heat</i> and <i>molecules</i>?</p> <p>NOTE TO TEACHER: <i>As time allows have students continue making sentences that connect science words with big ideas about matter. Following are other word</i></p>	<p>Atoms and molecules aren’t exactly the same.</p> <p>Atoms are the parts of a molecule, like in our Lego water molecules.</p> <p>Atoms and molecules are really, really small, and we can’t see them.</p>	<p>Can anyone add to this idea?</p> <p>How are they different?</p> <p>Who can make another sentence using these words?</p>

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			<p><i>combinations you can use:</i></p> <ul style="list-style-type: none"> • <i>Heat and solid</i> • <i>Heat and liquid</i> • <i>Molecules, motion, and liquid</i> • <i>Molecules, motion, and solid</i> • <i>Molecules, move faster, and liquid</i> • <i>Molecules, move slower, and solid</i> • <i>Vibrate in place and flow around each other</i> • <i>Matter and change</i> <p>You've done a great job connecting science words and ideas about matter!</p> <p>Today you'll show more of what you know about matter when you share the comic strips you created in our last lesson.</p>		
1 min	<p>Lesson Focus Questions and Unit Central Questions</p> <p>Synopsis: The teacher reviews the focus questions and unit central questions, <i>What is matter made of? How can matter change?</i></p>	Set the purpose with a <u>focus question</u> or goal statement.	<p>Show slide 3.</p> <p>This is the final lesson in our unit on matter, so we'll focus on answering our unit central questions, <i>What is matter made of? How can matter change?</i></p> <p>These are also our focus questions for today.</p> <p>It's time to show what you know about matter and how it changes!</p>		
6 min	Setup for Activity		Show slide 4.		

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	<p>Synopsis: Students gather in their teams from the previous lesson to plan their comic-strip presentations.</p>	<p>Make explicit links between science ideas and activities before the activity.</p>	<p>First, I'd like you to gather in your teams from last time and plan your class presentations.</p> <p>If your team created one comic strip, that's the one you'll share. If each of you created your own comic strip, you'll need to decide as a team which comic strip to share with the class.</p> <p>Make sure to include each member of your team in the presentation. For example, each of you could share a different section or panel of the comic strip.</p> <p>Your comic strip should also answer our unit central questions, <i>What is matter made of? How can matter change?</i></p> <p>NOTE TO TEACHER: <i>If every team created individual comic strips, you could have each team share more than one strip with the class if time allows. The remaining comic strips could be displayed somewhere in the classroom. Encourage teams to include all team members in the class presentation. For example, each team member could present a different section or panel of the comic strip (e.g., before, during, or after).</i></p>		
20 min	Activity		Show slide 5.		

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	<p>Synopsis: Students communicate in scientific ways as teams share their comic strips with the class. Following each presentation, the teacher summarizes how each comic strip answers the unit central questions.</p> <p>Main science idea(s):</p> <ul style="list-style-type: none"> All matter is made up of very small pieces called <i>atoms</i> and <i>molecules</i>. Matter can change from a solid to a liquid when heat is added and the molecules move fast enough to flow around each other more freely. Matter can change from a liquid to a solid when heat is removed and the matter cools. When the molecules slow down enough, they form a rigid structure and vibrate in place. 	<p>Engage students in communicating in scientific ways.</p> <p>Engage students in making connections by synthesizing and summarizing key science ideas.</p>	<p>Let’s review how to communicate our ideas in scientific ways like scientists do.</p> <p>NOTE TO TEACHER: <i>Review key strategies on the CSW poster that students should use during the comic-strip presentations, such as listening to others’ ideas, asking clarifying questions, agreeing or disagreeing, adding onto someone else’s ideas, and providing evidence or reasoning.</i></p> <p>Strategy 13 on our poster is a good reminder: Let your ideas change and grow!</p> <p>Show slide 6.</p> <p>When you present your comic strips to the class, explain what happens to the molecules before, during, and after the matter changes.</p> <p>Describe your drawings and any labels, captions, and talk bubbles you used to illustrate important science ideas.</p> <p>Listen carefully as your classmates share their comic strips and think about whether the ideas make sense based on what we’ve learned about matter. If they do, be open to changing your own ideas.</p> <p>Don’t interrupt your classmates as they</p>		

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		<p>Ask questions to probe student ideas and predictions.</p> <p>Ask questions to challenge student thinking.</p> <p>Summarize key science ideas.</p>	<p>share their comic strips. Let them finish their presentations first; then you can ask questions, agree or disagree, and add your own ideas. Remember to communicate in scientific ways!</p> <p>Also feel free to compliment your classmates on the comic strips they share. If you especially like a drawing or description, let them know.</p> <p>Now who would like to begin?</p> <p>NOTE TO TEACHER: <i>If possible, ask each team to give you their comic strip to display on a document reader during the presentation. Following each presentation, ask questions to probe and challenge student thinking, and encourage students to communicate in scientific ways. Also give a brief summary of how each comic strip answers the unit central questions. Record students' ideas on chart paper to revisit later in the lesson as time allows. Along with student comments and questions, your summary statements will help reinforce the key science ideas from the unit and the unit central questions.</i></p> <p> Listen to students' ideas. What's visible about student thinking?</p>		

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10 min	<p>Follow-Up to Activity</p> <p>Synopsis: Using science ideas and words they've learned in this unit, students come up with as many sentences as they can that describe what matter is made of and how it can change.</p> <p>Main science idea(s):</p> <ul style="list-style-type: none"> Matter is made up of very small pieces called <i>atoms</i> and <i>molecules</i>. Matter can change when heat is added or taken away. If you add heat to a solid, the molecules move faster. When they move fast enough, the break away from each other and flow around more freely as a liquid. If you take heat away from a liquid, the matter cools down, and the molecules move more slowly until they stick together and vibrate in place as a solid. This process is reversible, so solid matter can change to liquid matter and 	<p>Make explicit links between science ideas and activities after the activity.</p> <p>Engage students in making connections by synthesizing and summarizing key science ideas.</p>	<p>Show slide 7.</p> <p>Remember the words we used at the beginning of the lesson to pull together the important science ideas we've been learning about in this unit?</p> <ul style="list-style-type: none"> Matter Change Atoms Molecules Motion Heat Solid Liquid Move faster Move slower Vibrate in place Flow around each other <p>I'd like you to use these words to write as many complete sentences as you can in your science notebooks. Connect two or more words in each sentence to an important science idea. Make sure your sentences describe your team's comic strip and answer our unit central questions, <i>What is matter made of? How can matter change?</i></p> <p> <i>Embedded Assessment Task</i></p>		

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	<p>back to solid matter over and over again when heat is added or taken away. The molecules themselves don't change. The only thing that changes is how the molecules are arranged and move.</p>		<p>Here's an example: <i>Matter</i> is made up of <i>atoms</i> and <i>molecules</i>.</p> <p>I connected three of our science words to one important science idea that answers our first unit central question, <i>What is matter made of?</i></p> <p>Let's see how many sentences you can write!</p>		
5 min	<p>Synthesize/Summarize Today's Lesson</p> <p>Synopsis: Students share the sentences they came up with to describe what matter is made of and how it can change. Then the teacher creates summary statements for each unit central question using these science ideas. For additional support with the NGSS, the teacher continues with extension lessons 6 and 7.</p> <p>Main science idea(s):</p> <ul style="list-style-type: none"> Matter is made up of very small pieces called <i>atoms</i> and <i>molecules</i>. Matter can change from 	Summarize key science ideas.	<p>How did you connect the words on our list to the science ideas about matter?</p> <p>Let's hear some of your sentences. Show us what you know!</p> <p>NOTE TO TEACHER: <i>As students share their sentences, capture their ideas in summary statements that represent key science ideas from the unit. Write these statements on chart paper and relate them to the unit central questions.</i></p> <p>Show slides 8 and 9.</p> <p>As we end our final lesson on matter, let's summarize the key science ideas we learned about in this unit:</p> <ul style="list-style-type: none"> Matter is made up of very small pieces called <i>atoms</i> and <i>molecules</i>. 		

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	<p>a solid to a liquid and from a liquid to a solid when heat is added or removed. This process is reversible, so solid matter can change to liquid matter and back to solid matter over and over again. The molecules themselves don't change. The only thing that changes is how the molecules are arranged and move.</p>		<ul style="list-style-type: none"> • Atoms and molecules are way too small to see, even with a microscope. • Matter can change from a solid to a liquid and from a liquid to a solid when heat is added or removed. • When heat is added to a solid, the molecules move faster until they break away from their rigid structure and flow freely around each other. • When heat is removed from a liquid and the matter cools, the molecules move slower until they stick together and vibrate in place in a rigid structure. • When matter undergoes a physical change, the molecules themselves don't change. The only thing that changes is how the molecules are arranged and move. • Physical changes in matter are reversible, so matter can change back and forth between a solid and a liquid over and over again. <p>NOTE TO TEACHER: <i>For additional support with the NGSS, continue with extension lessons 6 and 7.</i></p>		