

Food Webs

Lesson 4b: Matter Is Conserved

Grade 5	Length of lesson: 50 minutes	Placement of lesson in unit: 4b of 7 two-part lessons on food webs
Unit central question: How do living things depend on one another to get the food (matter and energy) they need to live and grow?		Lesson focus questions: As matter moves from organism to organism in a food chain, does any of the matter disappear? What is your evidence?
Main learning goal: Although matter changes forms and moves from organism to organism in food chains, no matter is ever lost or destroyed. The total amount of matter in the system remains the same.		
Science content storyline: In addition to using food matter to build their bodies, organisms can break down the food molecules to release the energy they need to grow. And some of each organism's food ends up in wastes, such as feces, urine, or plant parts that fall to the ground (leaves, branches, berries, nuts). Only some of the food inside an organism is passed on to other organisms in the food chain. So organisms use food matter in four ways: (1) to grow bigger, (2) to get the energy they need to live, (3) as waste products, and (4) as energy-supplying matter for other organisms that eat them. When we used linking cubes to track matter mathematically as it moved from organism to organism in a food chain, we observed that although matter changed forms and moved from organism to organism and from place to place, it was never lost or destroyed. The total amount of matter in the system remained the same.		
Ideal student response to the focus questions: In the linking-cube activity, we found that matter in food chains is always changing and rearranging as it moves from one organism to another or into the air or the soil. But the matter never disappears. The total amount of matter always stays the same.		

Preparation

<p>Materials Needed</p> <ul style="list-style-type: none"> • Science notebooks • Student responses to this question from the previous lesson: <i>What different things might happen to the food matter in a worm when a bird eats it?</i> • Simulation materials for each group of 4 students: <ul style="list-style-type: none"> • Tree, squirrel, and mountain lion posters/mats from lesson 3a/b • Plastic bags containing 16 linking-cube CO₂ molecules (2 white cubes and 1 red cube each) and 8 linking-cube H₂O molecules (2 blue cubes and 1 white cube each); total linking cubes: 16 red, 16 blue, 40 white • 4 small bowls labeled Water, CO₂, Oxygen, Wastes • Chart paper, markers <p>Student Handouts</p> <ul style="list-style-type: none"> • 4.1 Tracking the Matter in a Food Chain (1 per student) 	<p>Ahead of Time</p> <ul style="list-style-type: none"> • Review the Food Webs Content Background Document: sections 2.3 and 3.8 (cellular respiration) • Review the PowerPoint slides and modify them as you wish. Carefully read the PowerPoint directions for the simulation activity and play around with the linking cubes and organism posters (mats) to understand how this activity will work out in terms of materials and mathematics. • The tracking handout and lesson plan suggest counting the linking cubes and adding up the fractions 4 times: (1) at the beginning of the simulation, (2) after the tree makes food molecules, (3) after food matter is passed to the squirrel, and (4) after the mountain lion uses food matter from the squirrel. Be prepared to skip one of these segments if you're running out of time or think students understand the concepts and don't need an additional data point.
--	--

Lesson 4b General Outline

Time	Phase of Lesson	How the Science Content Storyline Develops
7 min	Link to previous lesson: Students share their writing from the previous lesson about what might happen to the matter in a worm when a bird eats it. After receiving feedback, they revise their writing.	<ul style="list-style-type: none"> Organisms can use food matter (1) to grow bigger, (2) to get the energy they need to live, (3) as waste products, or (4) as energy-supplying matter for consumers that eat them. Matter changes form as it moves from organism to organism in a food chain.
1 min	Lesson focus questions: The teacher introduces the focus questions, <i>As matter moves from organism to organism in a food chain, does any of the matter disappear? What is your evidence?</i> Students copy the questions into their science notebooks.	
4 min	Setup for activity: The teacher elicits student ideas about the focus questions.	
20 min	Activity: Using linking cubes that represent atoms (individual cubes) and molecules (connected cubes of water, carbon dioxide, oxygen, and food), the teacher guides each group of students in simulating what happens to matter as organisms use it and pass it on to other organisms. Students track the changes in food matter mathematically by counting the number of linking cubes at the beginning of the simulation, in the middle as food matter passes from organism to organism, and at the end.	<ul style="list-style-type: none"> Organisms can use food matter (1) to grow bigger, (2) to get the energy they need to live, (3) as waste products, and (4) as energy-supplying matter for other organisms that eat them.
10 min	Follow-up to activity: Students analyze the patterns in the linking-cube fractions data and then use these patterns to write a claim and evidence to answer the focus questions.	<ul style="list-style-type: none"> As matter moves from organism to organism in a food chain, it's never lost or destroyed. It changes forms and moves around, but it never disappears. Matter is conserved as it moves through a food chain.
7 min	Synthesize/summarize today's lesson: Students share their claims and evidence. Afterward, the teacher summarizes key ideas from the lesson.	<ul style="list-style-type: none"> Although matter moves from place to place and from organism to organism in a food chain, none of it is ever lost or destroyed or disappears. The total amount of matter in the system remains the same.
1 min	Link to next lesson: The teacher emphasizes key ideas about the conservation of matter and foreshadows the next lesson.	

Time	Phase of Lesson and How the Science Content Storyline Develops	STeLLA Strategy	Teacher Talk and Questions	Anticipated Student Responses	Possible Probe/Challenge Questions
7 min	<p>Link to Previous Lesson</p> <p>Synopsis: Students share their writing from the previous lesson about what might happen to the matter in a worm when a bird eats it. After receiving feedback, they revise their writing.</p> <p>Main science idea(s):</p> <ul style="list-style-type: none"> Organisms can use food matter (1) to grow bigger, (2) to get the energy they need to live, (3) as waste products, or (4) as energy-supplying matter for consumers that eat them. Matter changes form as it moves from organism to organism in a food chain. 	<p>Link science ideas to other science ideas.</p> <p>Highlight key science ideas and focus question throughout.</p>	<p>Show slides 1 and 2.</p> <p>Our focus question from yesterday’s lesson was <i>What happens to matter as it moves from organism to organism in a food chain?</i></p> <p>At the end of the lesson, you used what you learned about matter in the linking-cube simulation to write about what might happen to the matter in a worm when a bird eats it. Now I’d like you to share what you wrote and help one another come up with other examples.</p> <p>NOTE TO TEACHER: <i>Make sure the focus question from the previous lesson—What happens to matter as it moves from organism to organism in a food chain?—is displayed where students can see it.</i></p> <p><i>In pairs and/or as a class, have students share their writings from the previous lesson about what different things might happen to the food matter in a worm when a bird eats it. Have students suggest improvements by adding more examples of what might happen to the matter.</i></p> <p>Pairs or whole class: What are some other examples of what might happen to the matter?</p>	<p><i>Possible answers:</i></p> <ul style="list-style-type: none"> The worm might poop some of the food matter onto the ground. 	

Time	Phase of Lesson and How the Science Content Storyline Develops	STeLLA Strategy	Teacher Talk and Questions	Anticipated Student Responses	Possible Probe/Challenge Questions
			<p>Check your writing to make sure you mentioned four things that could happen to the food matter in the worm, and add anything you forgot to include. The food matter could be used</p>	<ul style="list-style-type: none"> • The worm could use energy in the food molecules to try to get away from the bird. When the energy is released from the food molecules, carbon dioxide and water go into the air. • The bird could use some of the food molecules to grow bigger. • The bird could use some of the food molecules for energy to help it fly. • The bird could poop out some of the food molecules. • A hawk could eat the bird and use the food molecules to grow bigger. 	

Time	Phase of Lesson and How the Science Content Storyline Develops	STeLLA Strategy	Teacher Talk and Questions	Anticipated Student Responses	Possible Probe/Challenge Questions
			<ul style="list-style-type: none"> • for growth, • for energy, • as waste products, and • as energy-supplying matter for another organism. 		
1 min	<p>Lesson Focus Questions</p> <p>Synopsis: The teacher introduces the focus questions, <i>As matter moves from organism to organism in a food chain, does any of the matter disappear? What is your evidence?</i> Students copy the questions into their science notebooks.</p>	Set the purpose with a <u>focus question</u> or goal statement.	<p>Show slide 3.</p> <p>Let’s read our new focus questions together: <i>As matter moves from organism to organism in a food chain, does any of the matter disappear? What is your evidence?</i></p> <p>Write these questions in your science notebooks and draw a box around them.</p> <p>NOTE TO TEACHER: <i>Also post the focus questions where students can see and refer to them throughout the lesson.</i></p> <p>Show slide 4.</p> <p>Yesterday we saw how matter changes as it moves from organism to organism in a food chain. Today we’re going to use our linking-cube simulation again to show how matter moves <i>through</i> a food chain. But this time, we’ll track the matter mathematically to see if any of it disappears.</p>		
4 min	<p>Setup for Activity</p> <p>Synopsis: The teacher elicits student ideas about the focus questions.</p>	Make explicit links between science ideas and activities before the	<p>Show slide 5.</p> <p>Last time we used linking cubes to simulate what happens to matter as it moves from organism to organism in a food chain. What were those linking cubes? What did they represent?</p>	They were	

Time	Phase of Lesson and How the Science Content Storyline Develops	STeLLA Strategy	Teacher Talk and Questions	Anticipated Student Responses	Possible Probe/Challenge Questions
		<p>activity.</p> <p>Ask questions to elicit student ideas and predictions.</p>	<p>From what we've learned so far from our linking-cube simulation, do you think any of the matter that moves around in food chains ever disappears? Why or why not?</p> <p>Turn and Talk: Discuss this question with a partner, and be ready to share your ideas with the class.</p> <p>Whole-class discussion: What ideas did you come up with?</p>	<p>molecules.</p> <p>Water and carbon-dioxide and food molecules.</p> <p>And oxygen molecules.</p> <p>We think that just a little bit of the matter disappears each time a food molecule breaks apart. Like when we broke apart the linking cubes to let the energy escape.</p> <p>But that was energy escaping, not matter.</p> <p>When you break the cubes apart, you make CO₂, and that's a gas you</p>	<p>What kinds of molecules?</p> <p>Anyone want to add on, agree, or disagree with that?</p>

Time	Phase of Lesson and How the Science Content Storyline Develops	STeLLA Strategy	Teacher Talk and Questions	Anticipated Student Responses	Possible Probe/Challenge Questions
			<p>OK, let's see if we can find some evidence to support or challenge your predictions. As we track our linking cubes mathematically in the simulation, we'll use fractions and count each piece of matter (each atom) at the beginning, at different points during the simulation, and at the end to see if any of the matter disappears.</p>	<p>can't see. So it kind of disappears into the air.</p> <p>Yeah, but it's still there; we just can't see it. So it doesn't really disappear.</p> <p>We think the matter doesn't disappear; it just moves around because none of our cubes disappeared.</p> <p>We agree with that!</p>	
20 min	<p>Activity</p> <p>Synopsis: Using linking cubes that represent atoms (individual cubes) and molecules (connected cubes of water, carbon dioxide, oxygen, food), the teacher guides each</p>	<p>Select content representations and models matched to the learning goal and engage students in their use.</p>	<p>Show slide 6.</p> <p>In a moment we're going to repeat the simulation from yesterday. But before we do, let's look at a handout and discuss the questions on the slide. Then we'll break up into small groups for the simulation.</p> <p>CONTENT BACKGROUND NOTE TO TEACHER: <i>We want students to understand that tiny pieces of matter are rearranged as food moves</i></p>		

Time	Phase of Lesson and How the Science Content Storyline Develops	STeLLA Strategy	Teacher Talk and Questions	Anticipated Student Responses	Possible Probe/Challenge Questions
	<p>group of students in simulating what happens to matter as organisms use it and pass it on to other organisms. Students track the changes in food matter mathematically by counting the number of linking cubes at the beginning of the simulation, in the middle as food matter passes from organism to organism, and at the end.</p> <p>Main science idea(s):</p> <ul style="list-style-type: none"> Organisms can use food matter (1) to grow bigger, (2) to get the energy they need to live, (3) as waste products, and (4) as energy-supplying matter for other organisms that eat them. 	<p>Make explicit links between science ideas and activities during the activity.</p>	<p><i>through a food chain. Learning the difference between atoms and molecules is NOT a learning goal for students. But for your information, the individual cubes represent atoms and the linked cubes of water, carbon dioxide, oxygen, and food are molecules. Each molecule is made up of two or more atoms.</i></p> <p>NOTE TO TEACHER: <i>Distribute handout 4.1 (Tracking the Matter in a Food Chain) and discuss the questions on the slide before starting the simulation. Although students are manipulating the cubes in small groups, each student should complete the handout individually.</i></p> <p>Show slides 7–24.</p> <p>NOTE TO TEACHER: <i>As students work with the cubes in small groups, use the questions and directions on the PowerPoint slides to guide them through each step of the simulation. Have students stop at key points during the simulation to count the number of pieces of matter (atoms) and track their location. Make sure students consistently record their numbers as fractions (e.g., 48/72).</i></p> <p>Small group and individual work time. ELL support: ELL students especially benefit from role-plays. Look for ways to engage all students in role-playing.</p> <p>NOTE TO TEACHER: <i>At the conclusion of the simulation, have students put away the materials before moving on to the follow-up.</i></p>		

Time	Phase of Lesson and How the Science Content Storyline Develops	STeLLA Strategy	Teacher Talk and Questions	Anticipated Student Responses	Possible Probe/Challenge Questions
10 min	<p>Follow-Up to Activity</p> <p>Synopsis: Students analyze the patterns in the linking-cube fractions data and then use these patterns to write a claim and evidence to answer the focus questions.</p> <p>Main science idea(s):</p> <ul style="list-style-type: none"> As matter moves from organism to organism in a food chain, it's never lost or destroyed. It changes forms and moves around, but it never disappears. Matter is conserved as it moves through a food chain. 	Engage students in analyzing and interpreting data and observations.	<p>In this simulation, we tracked the number of linking cubes in terms of fractions, with the cubes representing the smallest pieces of matter (atoms).</p> <p>What was the denominator in all of our fractions?</p> <p>Why was 72 the denominator? What does it represent?</p> <p>Show slide 25.</p> <p>So we introduced 72 cubes (or pieces of matter) into our food chain. Now look at your data sheets in your small groups and discuss what you see. Be on the lookout for patterns in your data and be ready to share your observations with the class.</p> <p>Students work in small groups.</p> <p>Whole-class discussion: What patterns did your group identify in the data?</p>	<p>72</p> <p>It represents the total number of cubes we started with.</p> <p>It's the total amount of matter we put into our food chain.</p> <p>Every column adds up to 72/72.</p> <p>At every point in time, there were always 72 total cubes or atoms.</p>	<p>Can you say more about that?</p> <p>What else did you notice besides the</p>

Time	Phase of Lesson and How the Science Content Storyline Develops	STeLLA Strategy	Teacher Talk and Questions	Anticipated Student Responses	Possible Probe/Challenge Questions
		<p>Make explicit links between science ideas and activities after the activity.</p> <p>Engage students in constructing explanations and arguments.</p>	<p>So we see a clear pattern in our data that matter moves around, but the total is always the same.</p> <p>Show slide 26.</p> <p>Now let's use the tracking data to think about our focus questions: <i>As matter moves from organism to organism in a food chain, does any of the matter disappear? What is your evidence?</i></p> <p>Write your answers to these questions in your notebooks, using these sentence starters:</p> <ul style="list-style-type: none"> • My claim is ... • My evidence is ... <p>ELL support: It's less stressful for ELL students if they can verbalize their responses rather than trying to construct a sentence using all the right words. It will also help them focus on the science ideas rather than the proper form of expression.</p> <p>Individual writing time.</p>	<p>The matter changed its location a lot. Like in column 2, it was all in the tree, but in column 3, there was some in multiple places.</p>	<p>total pieces of matter?</p>
7 min	Synthesize/Summarize Today's Lesson	Engage students	<p>Show slide 27.</p> <p>Whole-class share-out: What claims and evidence</p>		

Time	Phase of Lesson and How the Science Content Storyline Develops	STeLLA Strategy	Teacher Talk and Questions	Anticipated Student Responses	Possible Probe/Challenge Questions
	<p>Synopsis: Students share their claims and evidence. Afterward, the teacher summarizes key ideas from the lesson.</p> <p>Main science idea(s):</p> <ul style="list-style-type: none"> Although matter moves from place to place and from organism to organism in a food chain, none of it is ever lost or destroyed or disappears. The total amount of matter in the system remains the same. 	<p>in making connections by synthesizing and summarizing key science ideas.</p> <p>Summarize key</p>	<p>did you come up with after analyzing the mathematical data from tracking the matter in this simple food chain? Make sure to be good listeners and presenters by communicating in scientific ways.</p> <p>NOTE TO TEACHER: <i>If you prefer, have students share their claims and evidence with a partner first. Make sure you hear from a number of students in this class discussion. Encourage students to ask questions and give one another feedback. Be on the lookout for any remaining confusion or misunderstandings and address them.</i></p> <p>Show slide 28.</p> <p>Our tracking data highlighted a very important idea:</p>	<p>My claim is that no matter disappears in a food chain. My evidence is that we always had 72 cubes.</p> <p>I agree, but I want to add that the matter moves around and changes partners. For example, water molecules break apart and end up becoming part of food molecules.</p> <p>My evidence is that even though matter started in the air and ended up in all these different locations, the total number was still 72.</p>	<p>Anyone want to add on, agree, or disagree?</p> <p>Nice example. Did anyone else give specific examples as evidence?</p>

Time	Phase of Lesson and How the Science Content Storyline Develops	STeLLA Strategy	Teacher Talk and Questions	Anticipated Student Responses	Possible Probe/Challenge Questions
		science ideas.	Matter can never disappear or be destroyed! It can change locations, and the pieces, or atoms, can be rearranged to form different kinds of molecules, but the matter is always there. It moves from organism to organism, but it never disappears. We showed this mathematically by carefully counting the linking cubes or atoms.		
1 min	<p>Link to Next Lesson</p> <p>Synopsis: The teacher emphasizes key ideas about the conservation of matter and foreshadows the next lesson.</p>	Highlight key science ideas and focus question throughout.	<p>Show slide 29.</p> <p>Today we considered the focus questions, <i>As matter moves from organism to organism in a food chain, does any of the matter disappear?</i></p> <p>We learned from our linking-cube activity that matter never gets destroyed or disappears. It can move from organism to organism in a food chain, and it can change and get rearranged, but it's always there.</p> <p>Show slide 30.</p> <p>Next time we'll think about what happens to the waste matter that the tree, the squirrel, and the mountain lion left behind in our simulation. We'll also explore what happens to dead organisms.</p> <p>It looks like we have more "matter" puzzles to solve, doesn't it?</p>		