

Food Webs

Lesson 4a: Matter Is Conserved

Grade 5	Length of lesson: 58 minutes	Placement of lesson in unit: 4a 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 question: What happens to matter as it moves from organism to organism in a food chain?
<p>Main learning goal: As matter moves from organism to organism in a food chain, the molecules get rearranged and used in different ways: for growth, to release energy, to produce wastes, and to pass food along to other organisms in the food chain. <i>Supporting ideas:</i> Plants use carbon dioxide and water matter (molecules) to make energy-supplying food molecules. Each organism in the food chain can use those food molecules to grow bigger and release energy needed for life processes. Each organism also gives off some of that matter as wastes left on the ground or released into the air. If an organism is eaten by another organism, some of its food matter is passed along to that organism.</p>		
<p>Science content storyline: We know from the previous lesson that plants take in matter (carbon dioxide and water) and turn it into energy-supplying food molecules with the help of energy from sunlight. And we know that plants can use this food matter to grow bigger. It can also be passed on to other organisms and used to build their bodies as they grow. But the story is more complicated than that. In addition to using the food to build their bodies and grow, organisms can break down the food molecules to release the energy they need for growth. This process produces carbon dioxide and water “wastes” that are released into the air. And some of each organism’s food matter ends up in other 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.</p>		
<p>Ideal student response to the focus question: Every organism, including plants, uses food molecules to grow bigger and supply the energy they need to live. In the process, they create waste products that are released into the air (as carbon dioxide and water) or end up in the soil (as feces, water, and dead plant parts). This means that only some of the food molecules inside an organism are passed on to the next organism in the food chain. Molecules do a lot of rearranging and moving from one organism to another or are released into the air or the soil.</p>		

Preparation

<p>Materials Needed</p> <ul style="list-style-type: none"> • Science notebooks • Sample student work from previous class for display (4 food-chain diagrams and student sentences) • Simulation materials for each group of 4 students: <ul style="list-style-type: none"> • Tree, squirrel, and mountain lion posters/mats from lesson 3b • Plastic bags containing 16 linking-cube CO₂ molecules (2 white and 1 red cubes each) and 8 linking-cube H₂O molecules (2 blue and 1 white cubes each); total linking cubes needed: 16 red, 16 blue, 40 white • 4 small bowls labeled Water, CO₂, Oxygen, Wastes • 3 sheets of chart paper for summarizing key ideas; markers 	<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. • Select 3–4 student food-web diagrams and sentences from the previous lesson to share as examples in class. Each example should include strengths and common misunderstandings/gaps. Decide how to display these examples (e.g., using a document projector or scanning into a computer and projecting as PowerPoint slides). • Review the PowerPoint slides for the simulation activity to make sure you understand the flow. The math component for tracking matter won’t be addressed until lesson 4b.
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Lesson 4a General Outline

Time	Phase of Lesson	How the Science Content Storyline Develops
4 min	Link to previous lesson: In a class discussion, students share the food-chain diagrams and sentences they created during the previous lesson.	<ul style="list-style-type: none"> Matter in the environment moves in a pattern of food chains from producers that use it to make their own food to consumers (herbivores, carnivores, omnivores) that get the matter they need to grow by eating plants or other consumers that eat plants. All living things use the matter in food to grow bigger.
3 min	Lesson focus question: The teacher introduces the focus question, <i>What happens to matter as it moves from organism to organism in a food chain?</i> and elicits student ideas about matter.	<ul style="list-style-type: none"> Unlike energy, matter has mass and takes up space. Food provides matter that living things use to grow bigger.
10 min	Setup for activity: Students work with linking cubes to review ideas from the previous lesson. Then they draw and write about two things plants do with matter. The teacher orients students to the focus question and activity.	<ul style="list-style-type: none"> Plants use energy from the Sun to turn carbon-dioxide and water molecules into food molecules. These food molecules are used to help the plants grow. Organisms that eat the plants use some of the food molecules to grow bigger.
25 min	Activity: The teacher guides students in simulating with linking cubes what happens to matter as organisms use it and pass it on to other organisms in a food chain. The class summarizes key ideas on a chart for each organism in the food chain. Then students draw and write about what happens to food molecules in each organism.	<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 other consumers that eat them.
5 min	Follow-up to activity: From the linking-cube simulation, students summarize four ways that organisms can use food matter.	
10 min	Synthesize/summarize today's lesson: Students write about what happens to the matter in a worm when a bird eats it.	
1 min	Link to next lesson: The teacher emphasizes the key idea that matter is rearranged in many different ways as it moves through a food chain. The teacher then foreshadows the focus question in the next lesson.	

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4 min	<p>Link to Previous Lesson</p> <p>Synopsis: In a class discussion, students share the food-chain diagrams and sentences they created during the previous lesson.</p> <p>Main science idea(s):</p> <ul style="list-style-type: none"> Matter in the environment moves in a pattern of food chains from producers that use it to make their own food to consumers (herbivores, carnivores, omnivores) that get the matter they need to grow by eating plants or other consumers that eat plants. All living things use the matter in food to grow bigger. 	Link science ideas to other science ideas.	<p>Show slides 1 and 2.</p> <p>NOTE TO TEACHER: <i>Make sure the focus question from the previous lesson—How do animals grow bigger?—is displayed where students can see it.</i></p> <p>Last time we made diagrams of food chains to show how matter moves from one organism to another, and how each organism uses that matter to grow. An organism gets bigger by adding more and more molecules to its body.</p> <p>Let’s look at some examples of the food chains we drew. Each example has some strengths and some ways they could be improved that I want you to think about.</p> <p>ELL support: Also highlight what students did “right” in their food-chain diagrams.</p>	<p><i>One example might show the food chain accurately drawn and labeled but with an unclear statement about growth:</i></p> <p>The oak tree grows from the CO₂ and H₂O, but the squirrel and the wolf grow bigger from food they eat.</p>	<p>What is one strength of this diagram and sentence?</p> <p>Does anyone have a suggestion for improving the diagram or the</p>

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				<p><i>Another diagram might have an arrow pointing in the wrong direction—from the carnivore to the herbivore to the producer.</i></p>	<p>sentence?</p> <p>What do you mean that “the tree grows from the CO₂ and the H₂O”?</p> <p>How does that work?</p> <p>Is that the tree’s food?</p> <p>Any ideas about the strengths of this diagram and ways to improve it?</p> <p>How could the arrows be labeled so that this order makes sense [e.g., “gets matter from”]?</p>
3 min	<p>Lesson Focus Question</p> <p>Synopsis: The teacher introduces the focus</p>	Set the purpose with a <u>focus question</u> or goal	<p>Show slide 3.</p> <p>Our focus question for today’s lesson is <i>What happens to matter as it moves from organism to organism in a food chain?</i></p>		

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	<p>question, <i>What happens to matter as it moves from organism to organism in a food chain?</i> and elicits student ideas about matter.</p> <p>Main science idea(s):</p> <ul style="list-style-type: none"> • Unlike energy, matter has mass and takes up space. • Food provides matter that living things use to grow bigger. 	<p>statement.</p> <p>Link science ideas to other science ideas.</p>	<p>Write this question in your science notebooks and draw a box around it.</p> <p>ELL support: Although the term <i>living things</i> may be used instead of <i>organisms</i>, we recommend going with <i>organisms</i>.</p> <p>NOTE TO TEACHER: Also post the focus question where students can see and refer to it throughout the lesson.</p> <p>Show slide 4.</p> <p>Before we answer the focus question, let's review what we already know about a key word that appears in the question. That word is <i>matter</i>.</p> <p>What is matter?</p> <p>ELL support: Also review the terms <i>producer</i>, <i>consumer</i>, and <i>molecule</i>, as well as any other new vocabulary words introduced during the previous lesson.</p>	<p>Matter is the stuff that plants and animals use to grow.</p> <p>Matter helps living things get bigger.</p> <p>Yes, everything we can touch in this room is matter!</p>	<p>Are there other kinds of matter besides what living things use to grow?</p> <p>What's the definition of <i>matter</i> that we talked about in lesson 1?</p>

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			<p>What are some examples of matter that living things use?</p> <p>Are plants and animals matter?</p>	<p>Matter has mass and takes up space.</p> <p>Desks. Books. Paper. Chairs. Windows. Jackets.</p> <p>Carbon dioxide. Oxygen. Food. Water.</p> <p>No, but they have matter in them. [<i>Common misconception</i>]</p> <p>I think every part of the tree and the dog is matter, because if you took every part of the tree—the leaves, the branches, the roots—you could weigh them and find out they have</p>	<p>So what things in this room have mass and take up space?</p> <p>Let's think about a tree or a dog. What part of a tree is not matter? What part of a dog is not matter?</p>

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			<p>What do we call the smallest pieces of matter?</p> <p>What do we know from our last lesson about what living things like a tree, a squirrel, and a mountain lion do with matter?</p>	<p>mass. They also take up space.</p> <p>Molecules (or atoms).</p> <p>They use it to grow.</p> <p>They use the food molecules they eat to make themselves bigger.</p>	<p>What do you mean by “it”? What kind of matter?</p> <p>Say more about how they do that.</p>
10 min	<p>Setup for Activity</p> <p>Synopsis: Students work with linking cubes to review ideas from the previous lesson. Then they draw and write about two things plants do with matter. The teacher orients students to the focus question and activity.</p> <p>Main science idea(s):</p> <ul style="list-style-type: none"> Plants use energy from the Sun to turn 	<p>Make explicit links between science ideas and activities before the activity.</p> <p>Select content representations and models matched to the learning goal and engage students in their use.</p>	<p>Let’s get ready to explore food chains a bit more using linking cubes as our pieces of matter—our atoms and molecules.</p> <p>Show slide 5.</p> <p>I’m going to pass out to each group some carbon-dioxide linking-cube molecules and some water linking-cube molecules. Lay out your mats of the tree, the squirrel, and the mountain lion and show what happens to that matter in a food chain.</p> <p>ELL support: Review the types of molecules that the linking cubes represent.</p> <p>Group work time.</p>		

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	<p>carbon-dioxide and water molecules into food molecules. These food molecules are used to help the plants grow. Organisms that eat the plants use some of the food molecules to grow bigger.</p>	<p>Engage students in communicating in scientific ways.</p>	<p>NOTE TO TEACHER: <i>Students in each group should show how the tree rearranges the carbon-dioxide and water molecules into food molecules and uses them to grow bigger. They should then show the squirrel eating some of the food molecules from the tree to grow bigger.</i></p> <p><i>Listen as students work to identify any confusion or gaps in their understanding. A common gap is to leave out any mention of energy from the Sun and energy stored in food molecules.</i></p> <p>NOTE TO TEACHER: <i>If you notice any students having difficulties showing how food moves from one organism to another in a food chain, have a class discussion to clear up any confusion or misunderstandings. Otherwise, proceed with the directions for writing in their notebooks.</i></p> <p>Show slide 6.</p> <p>Now set up a page in your science notebooks and draw a chart that looks like the one on the slide. Based on what we did yesterday, draw and write in the first two boxes about two things plants do with matter. Have your drawings ready to share with the class.</p> <p>Individual work time.</p> <p>NOTE TO TEACHER: <i>Students should demonstrate that plants use matter to make food</i></p>		<p><i>Challenge questions:</i></p> <p>What is happening to the matter?</p> <p>What is happening to the energy?</p>

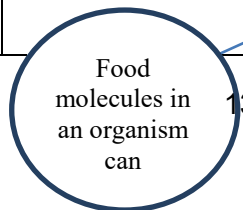
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			<p><i>and grow.</i></p> <p><i>Look at students' work and identify a few drawings/sentences you want students to share with the class. Include examples that have strengths as well as misunderstandings and gaps.</i></p> <p>Whole-class share-out: Now I'd like a few of you to share your diagrams and sentences with the class. I want those listening to think about questions to ask, things to add on, or ways to make our writing better.</p> <p>NOTE TO TEACHER: <i>Let a few students share their diagrams and sentences.</i></p>	<p><i>Possible description of student drawings:</i></p> <p>My first drawing shows the plant making food molecules. And my second one shows the plant using the food molecules to grow.</p>	<p><i>Questions that encourage students to be accurate and complete in their descriptions:</i></p> <p>Can you add some words to describe what this picture is showing?</p> <p>Can you show how the molecules help the organism grow?</p> <p>Let's hear some feedback. What did you like about this drawing?</p> <p>Did this feedback</p>

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		<p>Highlight key science ideas and focus question throughout.</p>	<p>Now I want everyone to work alone for a minute or two revising or adding to your drawings and sentences based on our discussion.</p> <p>Individual work time.</p> <p>Show slide 7.</p> <p>Whole-class discussion: Let’s look at our focus question again: <i>What happens to matter as it moves from organism to organism in a food chain?</i> Do we already have an answer to that question? And do we know anything about what the squirrel and the mountain lion do with the food matter?</p> <p>Yes, all of the organisms in this food chain use matter to grow bigger. They stack those molecules on top of each other to make themselves get bigger and bigger.</p>	<p>Yes, plants use the matter to make food molecules and grow.</p> <p>The squirrel and mountain lion use the food to grow bigger too.</p>	<p>give you an idea of something to add to your picture?</p> <p>Do you have anything to add to what’s been said so far? Anything you disagree with?</p>

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			<p>Show slide 8.</p> <p>Let's summarize on a class chart what the tree can do with matter. What are two ways the tree uses matter? What did you write on your charts?</p> <p>So we've learned that organisms use food molecules (matter) to build their body structures. But it's more complicated than that.</p> <p>Show slide 9.</p> <p>Today we're going to use the linking cubes again to show what happens when matter moves from organism to organism in a food chain. In your groups, you'll come up four ways a tree uses food matter. Then you'll draw and write about it in your science notebooks. We'll also do this for the squirrel and the mountain lion. This is going to challenge your scientific thinking!</p> <p>What question are we going to think about as we work through this simulation?</p>	<p>The tree uses carbon-dioxide and water molecules with energy from the Sun to make food molecules.</p> <p>The tree uses the food molecules to grow bigger.</p> <p>What happens to matter as it moves from organism to organism in a food</p>	<p>What else can the tree do with matter?</p>

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				chain?	
25 min	<p>Activity</p> <p>Synopsis: The teacher guides students in simulating with linking cubes what happens to matter as organisms use it and pass it on to other organisms in a food chain. The class summarizes key ideas on a chart for each organism in the food chain. Then students draw and write about what happens to food molecules in each organism.</p> <p>Main science idea(s):</p> <ul style="list-style-type: none"> Organism 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 other consumers that eat them. 	Select content representations and models matched to the learning goal and engage students in their use.	<p>Show slides 10–28.</p> <p>Now we’ll break up into small groups for the simulation. I’ll guide you through each step as you work with the linking cubes to show what happens to matter in a food chain as organisms use it and pass it on to other organisms.</p> <p>Students work in small groups.</p> <p>NOTE TO TEACHER: <i>As students work in small groups, use the PowerPoint slides to guide them through each step of the simulation.</i></p> <p><i>At the end of each simulation (tree, squirrel, mountain lion), summarize key ideas on a chart and have students draw and write in their science notebooks.</i></p> <p><i>Students don’t need to learn all the details of the chemical reactions that are represented in this simulation. Following are the important points to emphasize:</i></p> <ul style="list-style-type: none"> Energy-supplying food matter is moving from one organism to another. Each organism <ul style="list-style-type: none"> uses food matter to grow bigger; breaks down some food molecules to release the energy it needs to live and grow, creating carbon dioxide and water in the process; 		

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			<ul style="list-style-type: none"> leaves behind some food matter as waste products; and can pass on energy-supplying matter to other organisms that consume it. <p>At the conclusion of this simulation, have students put away the materials before moving on to the follow-up.</p>		
5 min	<p>Follow-Up to Activity</p> <p>Synopsis: From the linking-cube simulation, students summarize four ways organisms can use food matter.</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 other consumers that eat them. 	Highlight key science ideas and focus question throughout.	<p>Look at the class summary charts and the drawings and sentences in your notebooks as you think about our focus question: <i>What happens to matter as it moves from organism to organism in a food chain?</i></p> <p>Show slide 29.</p> <p>Small groups: Talk about this question in your group and come up with four things that can happen to matter (food molecules) in all organisms in a food chain. Then write these ideas in your science notebooks.</p> <p>Group work time.</p>		



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			<div data-bbox="1003 342 1314 545" data-label="Diagram"> </div> <p data-bbox="772 634 1356 797">NOTE TO TEACHER: <i>If students are having difficulty coming up with four things, ask challenge questions that encourage them to think through what happened to the food molecules in the linking-cube simulation.</i></p> <p data-bbox="772 1003 1318 1101">Whole-class discussion: Now let's hear your ideas, and I'll summarize on this chart the key ideas I want you to understand.</p>	<p data-bbox="1388 1105 1629 1203">The food molecules can be used to make an organism bigger.</p> <p data-bbox="1388 1240 1650 1403">The molecules can be used to release energy, forming CO₂ and H₂O in the process.</p> <p data-bbox="1388 1440 1650 1468">The molecules can be</p>	<p data-bbox="1682 667 1940 797"><i>Challenge questions to ask if students are having difficulty with the task:</i></p> <p data-bbox="1682 834 1919 899">Where did the food molecules go?</p> <p data-bbox="1682 937 1929 1002">How did the food molecules get there?</p>

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				<p>eliminated and end up on the ground as waste products.</p> <p>The molecules can be passed on to another consumer in the food chain.</p>	
10 min	<p>Synthesize/Summarize Today's Lesson</p> <p>Synopsis: Students write about what happens to the matter in a worm when a bird eats it.</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 other consumers that eat them. 	Engage students in making connections by synthesizing and summarizing key science ideas.	<p>Show slide 30.</p> <p>Let's think about our focus question again: <i>What happens to matter as it moves from organism to organism in a food chain?</i></p> <p>Our linking-cube activity showed us that matter moves around a lot!</p> <p>Now it's time to use what you've learned about matter to answer another question.</p> <p>Show slide 31.</p> <p>To see if you understand what happens to matter in food chains, I want you to write in your notebooks about this worm. What different things might happen to the food matter in this worm when a bird eats it?</p> <p>You have several resources to help you answer this question, such as our class charts, the drawings and sentences in your notebooks, and the word bank on this slide. Challenge yourself to use words we've talked about that aren't in this word bank.</p>		

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			<p>NOTE TO TEACHER: <i>Read the words listed on the slide: matter, food molecules, carbon dioxide, water, food chains, wastes, energy.</i></p> <p>ELL support: Include <i>consumers, molecules</i> (not food molecules), and <i>omnivores</i> in the word bank.</p> <p>Individual work time.</p> <p>NOTE TO TEACHER: <i>If time allows, have students share their sentences (in pairs or as a class) and help one another improve their responses. Alternatively, you can do this at the beginning of lesson 4b.</i></p>		
1 min	<p>Link to Next Lesson</p> <p>Synopsis: The teacher emphasizes the key idea that matter is rearranged in many different ways as it moves through a food chain. The teacher then foreshadows the focus question in the next lesson.</p>	Summarize key science ideas.	<p>Show slide 32.</p> <p>So today we found out that matter moves from organism to organism in a food chain, and it gets changed and rearranged as organisms use it.</p> <p>But does the matter in a food chain ever disappear?</p> <p>That’s what we’ll explore next time.</p>		