

Food Webs

Lesson 6a: Energy Flow in Food Chains

Grade 5	Length of lesson: 56 minutes	Placement of lesson in unit: 6a 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: What happens to energy in food chains? Is it recycled? (Part 1)
Main learning goal: While matter is continuously recycled in a food chain, energy <i>flows through</i> food chains, is released as heat into the environment, and is not recycled; therefore, food chains require a constant supply of new energy from the Sun to keep them going.		
Science content storyline: In food chains, energy moves from the Sun to producers and then to consumers. Producers (plants) transform light energy from the Sun into energy stored in food molecules. When herbivores eat plants, when carnivores eat other organisms, or when decomposers eat wastes and dead organisms, energy is passed from one organism to another in a food chain. Each organism uses some of this food energy to live, move, and reproduce. As organisms use the energy stored in food, they also give off heat energy into the environment. Because living things can't use this heat energy again, a constant supply of new energy from the Sun is needed in food chains. Therefore, energy <i>flows through</i> food chains, is released as heat into the environment, and is not recycled.		
Ideal student response to the focus questions: Energy stored in food molecules is passed from one organism to another in a food chain. As an organism uses this stored energy, it also gives off heat energy into the environment. Organisms can't use this heat energy again, so it can't be recycled in food chains. Instead, a constant supply of new energy from the Sun is needed in food chains.		

Preparation

<p>Materials Needed</p> <ul style="list-style-type: none"> • Science notebooks <p><i>For each small group:</i></p> <ul style="list-style-type: none"> • Laminated organism posters/mats from lesson 3 (tree, squirrel, mountain lion) • Bag of 15 linking-cube sugar (food) molecules (1 blue, 1 red, 1 white for each molecule) • Bowl or bag containing 10–15 white linking cubes (oxygen) • <i>Optional:</i> highlighters (for marking handout 6.2) <p>Student Handouts</p> <ul style="list-style-type: none"> • 5.2 Rotting Is a Good Thing! (from lesson 5b) • 6.1 Decomposers, 11" × 17" laminated poster (1 per group of 4 students) • 6.2 Energy in Food Chains (1 per student) 	<p>Ahead of Time</p> <ul style="list-style-type: none"> • Review the Food Webs Content Background Document: part 3, How Does Energy Flow in Food Webs? • Review the PowerPoint slides and modify them as you wish. • Assemble the baggies of linking cubes for small groups. • Review handout 6.2 (Energy in Food Chains) and decide whether to have students read it individually, in pairs, or as a class.
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Lesson 6a General Outline

Time	Phase of Lesson	How the Science Content Storyline Develops
15 min	Link to previous lesson: Students use organism posters (mats) and linking cubes to model how decomposers recycle matter.	<ul style="list-style-type: none"> Decomposers use as their food dead organisms and wastes organisms leave behind. As they consume their food, decomposers recycle matter by breaking down wastes and dead organisms into minerals, carbon dioxide, and water that are released into the air and soil for plants to use again. Plants can use the carbon dioxide and water from the air and soil to make more food to keep the food chain going.
5 min	Lesson focus questions: The teacher introduces the focus questions, <i>What happens to energy in food chains? Is it recycled?</i> and students discuss what they already know about energy in food chains	
5 min	Setup for activity: The teacher prepares students for reading about energy in food chains.	
10 min	Activity: Students read about energy in food chains.	<ul style="list-style-type: none"> Energy flows through food chains, is released as heat into the environment, and is not recycled. Energy enters a food chain as light energy from the Sun. Producers (plants) transform light energy into energy stored in food molecules.
10 min	Follow-up to activity: Students review and underline key ideas from the food-chains reading. Then they compare their ideas with a partner and share them in a class discussion.	<ul style="list-style-type: none"> When organisms throughout a food chain use food energy to live and grow, some of this energy is changed to heat energy and released into the environment. Living things can't use this heat energy again, so a constant supply of new energy from the Sun is needed in food chains.
10 min	Synthesize/summarize today's lesson: Students use ideas from the food-chains reading to answer the focus questions.	<ul style="list-style-type: none"> Energy is not recycled in food chains. Energy enters a food chain as light energy from the Sun. Producers (plants) change this light energy into energy stored in food molecules, and when living things use the stored energy to live and move and grow, heat energy is released into the environment. Living things can't capture and reuse that heat energy.
1 min	Link to next lesson: The teacher previews science ideas that will be the focus of the next lesson.	

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15 min	<p>Link to Previous Lesson</p> <p>Synopsis: Students use organism posters (mats) and linking cubes to model how decomposers recycle matter.</p> <p>Main science idea(s):</p> <ul style="list-style-type: none"> Decomposers use as their food dead organisms and wastes organisms leave behind. As they consume their food, decomposers recycle matter by breaking down wastes and dead organisms into minerals, carbon dioxide, and water that are released into the air and soil for plants to use again. Plants can use the carbon dioxide and water from the air and soil to make more food to keep the food chain going. 	Engage students in using and applying new	<p>Show slides 1 and 2.</p> <p>NOTE TO TEACHER: <i>Pass out the organism posters/place mats (tree, squirrel, and mountain lion) and linking cubes from lesson 3. Also distribute handout 6.1 (Decomposers).</i></p> <p>Last time our focus question was <i>What happens to the matter that makes up wastes and dead organisms?</i></p> <p>Are you ready for a challenge to see how well you understand what happens to dead organisms and how decomposers recycle matter in a food chain?</p> <p>First, take out your organism place mats and put your sugar molecules on the tree, the squirrel, and the mountain lion.</p> <p>What does this show us about how organisms use their food?</p> <p>ELL support: Allow ELL students to pair up. Review questions beforehand to make sure students comprehend what the challenge (slide 2) is asking them to do. Remind students they have vocabulary resources around the room to help with words they may have forgotten.</p> <p>Show slide 3.</p> <p>Now your challenge is to use your organism posters/mats and linking cubes to show how</p>	<p>They use food molecules to grow bigger.</p> <p>The food molecules become part of their bodies.</p>	<p>This is a very important point. The food molecules make up each part of an organism's body.</p>

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		<p>science ideas in a variety of ways and contexts.</p> <p>Select content representations and models matched to the learning goal and engage students in their use.</p>	<p>decomposers recycle matter so that plants can use it again. You may use three important resources to help guide your thinking:</p> <ol style="list-style-type: none"> 1. Our previous work with the linking cubes and organism posters 2. The reading from last time: Rotting Is a Good Thing! 3. The word bank on the slide: <ul style="list-style-type: none"> Producers Consumers Decomposers Recycle Matter Food Carbon dioxide Water Minerals <p>I'll give you 5 minutes to figure out a strategy, and then we'll share our solutions to this challenge as a group.</p> <p>Individual work time.</p> <p>Show slide 4.</p> <p>Whole-class discussion: Now let's hear your solutions for this challenge. How do you think decomposers recycle matter?</p> <p>As you listen to your classmates' solutions, be ready to give each other feedback. Think about</p>	<p><i>Possible solutions:</i></p> <p>Students show sugar</p>	<p><i>Possible challenge questions:</i></p> <p>Why didn't you</p>

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		Highlight key science ideas and focus question	<p>what’s good about each solution and what could be improved. Are the science ideas accurate or inaccurate? Support your explanations using evidence from the essay we read last time (Rotting Is a Good Thing!).</p> <p>So an important idea we learned from this challenge is that matter gets used over and over</p>	<p>molecules moving from any or all of the three organisms to decomposers. Then decomposers break down the food molecules. Some of the separate linking cubes (food molecules) end up back in the air or the soil for the tree to use again.</p> <p>Some students may show producers and consumers producing wastes that are passed on to decomposers, broken down, and recycled for producers to use again.</p> <p>A more sophisticated solution would show decomposers breaking down the food molecules from dead organisms and forming CO₂ and H₂O molecules, which plants use to make more food/sugar molecules.</p>	<p>show all the food molecules going back to the plants? [<i>Ideal student response:</i> Because the decomposer is consuming some of the food molecules to live and grow.]</p> <p>Is the matter that decomposers are recycling food for the tree? [<i>Ideal student response:</i> No! The tree uses the matter to make more food molecules.]</p>

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		throughout.	again and is never destroyed. It changes forms, moves from organism to organism, and is released into the air and soil as minerals, carbon dioxide, and water, but it's always there and can be reused.		
5 min	<p>Lesson Focus Questions</p> <p>Synopsis: The teacher introduces the focus questions, <i>What happens to energy in food chains? Is it recycled?</i> and students discuss what they already know about energy in food chains.</p>	<p>Set the purpose with a <u>focus question</u> or goal statement.</p> <p>Ask questions to elicit student ideas and predictions.</p>	<p>Show slide 5.</p> <p>We know that food matter gets recycled, but it also contains energy. Our focus questions for today are <i>What happens to energy in food chains? Is it recycled?</i></p> <p>Write these questions in your science notebooks and draw a box around them.</p> <p>Show slide 6.</p> <p>What do you already know about energy in food chains and what happens to it? Do you think it gets recycled like matter?</p> <p>Turn and Talk. Discuss these questions with a partner and be ready to share your ideas in a class share-out.</p> <p>Whole-class share-out: So let's hear your ideas. What do we already know about energy in food chains and what happens to it?</p>	<p>There's energy in food.</p> <p>Energy comes from the Sun.</p>	<p>Say more about that.</p> <p>What do you mean by "energy comes from the Sun"?</p> <p>What does that have</p>

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			<p>Do you think the energy in food chains gets recycled like matter? Any ideas on this?</p>	<p>Organisms use the energy in food molecules.</p> <p>We hear a click!</p> <p>CO₂ and H₂O molecules are made.</p> <p>We know that food contains energy that living things can use to live and grow.</p> <p>Plants get energy from sunlight that they turn into food by mixing it with carbon dioxide and water.</p> <p>Maybe it's just like the matter, and the producers use it again.</p>	<p>to do with food chains?</p> <p>Which organisms use energy in food? Do you remember what happens (from our linking cubes) when energy is released from food molecules?</p> <p>And how does that energy get there?</p> <p>What kind of energy</p>

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				Light energy. I don't see how that could happen.	do producers use to make food? So do you think the energy in food molecules gets turned back into light?
5 min	<p>Setup for Activity</p> <p>Synopsis: The teacher prepares students for reading about energy in food chains.</p>	Make explicit links between science ideas and activities before the activity.	<p>Show slide 7.</p> <p>NOTE TO TEACHER: <i>Distribute handout 6.2, Energy in Food Chains.</i></p> <p>Let's explore whether energy gets recycled in food chains by reading about what scientists think.</p> <p>As you read the handout, be thinking about today's focus questions. Afterward, I'll ask you to go back and highlight or underline information that can help us answer them.</p>		
10 min	<p>Activity</p> <p>Synopsis: Students read about energy in food chains.</p> <p>Main science idea(s):</p> <ul style="list-style-type: none"> Energy flows through food chains, is released as heat into the environment, 	Link science ideas to other science ideas.	<p>NOTE TO TEACHER: <i>Decide whether you want students to read the handout individually, in pairs, or as a group.</i></p> <p>Now spend the next few minutes reading the handout [<i>individually, in pairs, or as a group</i>] and thinking about today's focus questions.</p> <p>Student reading time.</p>		

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	<p>and is not recycled.</p> <ul style="list-style-type: none"> • Energy enters a food chain as light energy from the Sun. Producers (plants) transform light energy into energy stored in food molecules. • When organisms throughout a food chain use food energy to live and grow, some of this energy is changed to heat energy and released into the environment. • Living things can't use this heat energy again, so a constant supply of new energy from the Sun is needed in food chains. 				
10 min	<p>Follow-Up to Activity</p> <p>Synopsis: Students review and underline key ideas from the food-chains reading. Then they compare their ideas with a partner and share them in a class discussion.</p>	<p>Make explicit links between science ideas and activities after the activity.</p> <p>Highlight key science ideas and</p>	<p>Show slide 8.</p> <p>Next I want you to review what you read and highlight, underline, or circle information (sentences or diagrams) that can help us answer our focus questions, <i>What happens to energy in food chains? Is it recycled?</i></p> <p>Students individually review and mark up the handout.</p>		

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	<p>Main science idea(s):</p> <ul style="list-style-type: none"> • Energy flows through food chains, is released as heat into the environment, and is not recycled. • Energy enters a food chain as light energy from the Sun. Producers (plants) transform light energy into energy stored in food molecules. • When organisms throughout a food chain use food energy to live and grow, some of this energy is changed to heat energy and released into the environment. • Living things can't use this heat energy again, so a constant supply of new energy from the Sun is needed in food chains. 	focus question throughout.	<p>Turn and Talk: Now turn and talk with a partner about your ideas. Try to reach an agreement on two key sentences or diagrams that can help answer our first focus question, <i>What happens to energy in food chains?</i></p> <p>NOTE TO TEACHER: <i>Emphasize that students should look for just two sentences or diagrams that are most helpful to them in understanding what happens to energy in food chains. You might rephrase the task this way: "If a person could look at only two sentences or diagrams about energy in food chains, which two would best help them answer the question?" This isn't an easy task for 5th graders. They want to highlight everything!</i></p> <p>Whole-class discussion: Let's hear what you and your partner decided. What are the two best sentences or diagrams in the handout that can help us understand what happens to energy in food chains?</p>	<p><i>Possible key sentences or diagrams:</i></p> <p>The two diagrams on page 1.</p> <p>The first two sentences in the summary.</p>	
10 min	<p>Synthesize/Summarize Today's Lesson</p> <p>Synopsis: Students use</p>	Engage students in making	<p>Show slide 9.</p> <p>Turn and Talk: Now pair up again and use the ideas from today's reading to answer the first</p>		

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	<p>ideas from the food-chains reading to answer the lesson focus questions.</p> <p>Main science idea(s):</p> <ul style="list-style-type: none"> • Energy is not recycled in food chains. • Energy enters a food chain as light energy from the Sun. Producers (plants) change this light energy into energy stored in food molecules, and when living things use the stored energy to live and move and grow, heat energy is released into the environment. • Living things can't capture and reuse that heat energy. 	<p>connections by synthesizing and summarizing key science ideas.</p>	<p>focus question, <i>What happens to energy in food chains?</i></p> <p>Next I'd like you to write in your notebooks at least two sentences that answer this question. You can refer to the reading but don't copy it. Write the sentences in your own words!</p> <p>Individual writing time.</p> <p>NOTE TO TEACHER: <i>If time is short, skip the writing activity.</i></p> <p>Whole-class share-out: Let's hear your sentences. Be good listeners as your classmates share, and be ready to agree, disagree, add on, and ask clarification questions.</p> <p>NOTE TO TEACHER: <i>Ask challenge questions to assess whether students really understand the science ideas or are just quoting from the reading. Challenge students to provide evidence from the reading to support their answers.</i></p>	<p><i>Example of a good response:</i></p> <p>Energy starts out as light energy from the Sun that gets turned into food energy by producers. All organisms use the food to release energy for them to run. They also release heat energy that can't be caught and recycled. The reading says that living things can't use that heat energy to live and grow. They need food energy.</p>	<p>Can anyone add on to that?</p>

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1 min	<p>Link to Next Lesson</p> <p>Synopsis: The teacher previews science ideas that will be the focus of the next lesson.</p>		<p>Show slide 10.</p> <p>So in previous lessons about food chains, we learned a lot about what happens to matter. And today we learned about what happens to energy in food chains.</p> <p>Next time we'll continue this focus as we explore whether energy can be recycled. You'll also be challenged to use your new knowledge!</p>		