Food Webs
Lesson 5a: Decomposition in Food Webs

Grade 5	**Length of lesson:** 65 minutes (includes a 10-minute math connection to be completed before the lesson)	**Placement of lesson in unit:** 5a 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 the matter that makes up wastes and dead organisms? (Part 1)
Main learning goal: Dead organisms and parts of dead organisms break down into small pieces. This is called *decomposition*.		
Science content storyline: What happens to the wastes that organisms leave behind, and what happens to dead organisms and parts of dead organisms? Do they just pile up? When we observed strawberries that were no longer part of a strawberry plant, we saw that they started to rot. This rotting process is called *decomposition*. It breaks down dead matter into many tiny pieces. We also observed mold on the strawberries and noted that the mass of the jar of fresh strawberries didn't change after the strawberries decomposed. Now we have new questions to answer: What does the mold on the strawberries have to do with decomposition? Why isn't the mass of the jar decreasing as the strawberries get smaller and smaller?		
Ideal student response to the focus question: Dead things or parts of dead things—like the strawberries in our experiment—will decompose. This means they'll break down into tiny pieces. We observed mold growing on the strawberries, so maybe it's causing them to decompose.		

Preparation

Materials Needed

- Science notebooks
- Clear jars with fresh strawberries (Small Ball canning jars work well; sides must be clear and smooth. Fill the jars almost to the top with loosely packed berries) (1 per group)
- Clear jars with strawberries that have been rotting for 2–3 weeks (1 per group)
- Hand magnifying lenses (2–4 per group)
- 1 digital kitchen scale
- Optional: Large or jumbo-sized balloon (1 setup for class demonstration)
- Optional: Chart paper, markers

Student Handouts

- 5.1 Matter in a Simple Food Chain (1 per student)

Ahead of Time

- Review the Food Webs Content Background Document: sections 2.4, 2.5, and 3.1.
- Review the PowerPoint slides and modify them as you wish.
- Two or three weeks ahead of time, put strawberries in jars to start the decomposition process. The strawberries can be cut in half and should be loosely packed in the jars. Fill the jars with strawberries almost to the top. To start the rotting process, leave the lids off initially and then put the lids on once the strawberries begin rotting.
- **Optional activity:** Decide whether to do the optional math connection at the beginning of this lesson or in a separate math lesson. This activity is a mathematical way to revisit and deepen student understandings from lesson 4 about the various things that can happen to food matter in an organism. It also provides an aquatic example of a food chain.
- If you want to use a balloon to demonstrate that carbon dioxide has mass, weigh a deflated and inflated balloon in advance to assure that your scale can detect the difference.
- Make sure students hold on to handout 5.1 (Matter in a Simple Food Chain). They'll need it in lesson 5b.

Lesson 5a General Outline

Time	Phase of Lesson	How the Science Content Storyline Develops
10 min	**Math connection:** *Do this activity **before** teaching the lesson, perhaps during math time*. Students analyze fractions data that show what happens to matter in a freshwater food chain. They add fractions to show that all the matter is accounted for (the fractions always add up to one). No matter is ever lost or destroyed as it changes and moves through the food chain.	• 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.
10 min	**Link to previous lesson:** Students add to and label a simple food-chain diagram to show what happens to matter.	• In a food chain, plants use energy from sunlight to change carbon-dioxide and water molecules into food molecules. These molecules then get passed along to other organisms (consumers) in the food chain. • 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.
6 min	**Lesson focus question:** The teacher introduces the focus question, *What happens to the matter that makes up wastes and dead organisms?* and reviews the meaning of the word *matter*.	• Matter is anything that has mass and takes up space. Energy is not matter.
5 min	**Setup for activity:** The teacher elicits students' initial ideas about what happens to the matter in dead organisms.	• Some food molecules end up in wastes and dead organisms.
5 min	**Activity—part 1:** Students observe fresh strawberries in a jar and make predictions about what will happen to them over a long period of time, and whether their mass will increase, decrease, or stay the same.	
10 min	**Activity—part 2:** Students observe rotting strawberries in jars. Then they discuss their observations and ideas about why this is happening.	• Over time, once-living matter (strawberries) will start to rot.
10 min	**Follow-up to activity:** Students discuss their observations of the strawberries and their ideas about what is happening. The teacher informs students that the mass of the jar didn't change, and they try to explain why.	• Dead organisms and parts of dead organisms break down into tiny pieces. This is called *decomposition*.
8 min	**Synthesize/summarize today's lesson:** The teacher provides a lesson summary. Students generate questions they're wondering about regarding the decomposition process.	• Dead organisms and parts of dead organisms break down into tiny pieces. This is called *decomposition*.
1 min	**Link to next lesson:** The teacher summarizes key unanswered questions and previews the focus of the next lesson.	

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10 min	**Math Connection** **Synopsis:** *Do this activity **before** teaching the lesson, perhaps during math time*. Students analyze fractions data that shows what happens to matter in a freshwater food chain. They add fractions to show that all the matter is accounted for (the fractions always add up to one). No matter is ever lost or destroyed as it changes and moves through the food chain. **Main science idea(s):** • 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.	Link science ideas to other science ideas.	**NOTE TO TEACHER:** *This warm-up activity engages students in adding fractions to support the idea developed in the previous lesson that matter is never lost or destroyed as it moves from one organism to another in a food chain.* *To allow more time for this activity, you could do this part of the lesson during math class.* **Show slides 1 and 2.** Yesterday we used linking cubes to track how matter changed and moved around as it passed from the tree to the squirrel to the mountain lion in a food chain. What did we find out about what happened to the amount of matter by the end of the activity? Did the total amount of matter increase, decrease, or stay the same? Let's look at another food chain—this time in a lake—and see what happens to the amount of matter. **Show slide 3.** **NOTE TO TEACHER:** *Use mathematics strategies to help students convert and add the fractions to solve the problem. Make sure they understand what the fractions represent and what they are adding up.* Some plants in a lake used one half of their food to build new body parts. One tenth of their food matter ended up being given off as wastes, one fifth was broken down into CO_2 and H_2O for energy, and one fifth was passed on to the carp fish that were feeding on them.	The amount of matter stayed the same.	

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			How much of the plants' food matter was used up and disappeared?	None!	Right, none of it disappeared or was used up. What happened to it?
				Some was given off as wastes. Some was used to help the plant grow. Some was broken down to release energy. And some got eaten by the carp.	
			Show slide 4. Now let's look at what happened to the food that the carp ate. Make sure to use fractions to solve the problem. **Student work time.** So the carp used one quarter of its food to build new body parts, two sixteenths was given off as wastes, one eighth was broken down into CO_2 and H_2O for energy, and the bear consumed one half of the food. How much of the carp's food matter was used up and disappeared?	None!	
			Show slide 5. What pattern do you notice as matter moves from one organism to another in this food chain and in the food chain from last time? What is always the same?	The matter moves	

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				around, but it never gets used up. Every organism uses some of the food to grow, gives off some as wastes, uses some for energy, and passes some on to the next consumer. The fractions always add up to 1 (10/10; 16/16). No matter goes away. It's always there.	What does it mean that the fractions always add up to 1? What does it tell us about the matter?
		Highlight key science ideas and focus question throughout.	**Show slide 6.** This is a very important pattern because it tells us that matter changes form and moves from one organism to another, but no matter is ever lost or destroyed. The food matter is used in four ways: It becomes part of an organism's body, it's broken down to release energy, it's given off as wastes, or it's passed on to another organism. These are the ideas we talked about last time as we considered what would happen to matter as it moved from one organism to the next in our food chain with the tree, the squirrel, and the mountain lion.		
10 min	**Link to Previous Lesson**		**NOTE TO TEACHER:** *Distribute handout 5.1, Matter in a Simple Food Chain*.		

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	Synopsis: Students add to and label a simple food-chain diagram to show what happens to matter. **Main science ideas(s):** • In a food chain, plants use energy from sunlight to change carbon-dioxide and water molecules into food molecules. These molecules then get passed along to other organisms (consumers) in the food chain. • 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.	Engage students in using and applying new science ideas in a variety of ways and contexts.	**Show slide 7.** Now I'd like you to use what you've learned in previous lessons to show how each organism in a food chain gets the matter it needs to live and grow. Add words and arrows to this diagram, and be sure to include labels. **NOTE TO TEACHER:** *If you want to include this work in students' science notebooks, you could have them either draw the diagram in their notebooks or paste/tape the handout into their notebooks.* **Student work time.** **NOTE TO TEACHER:** *After students have completed their drawings, have them compare their work to the answer key and make revisions.* **Show slide 8.** **Whole-class discussion:** Let's talk about this diagram. Which organisms use matter to make food? Which organisms use food matter to grow bigger? Which organisms use food matter to get or release energy? Which organisms use food matter to produce wastes and leave them behind? **NOTE TO TEACHER: Save this work!** *Students will need to add to this diagram at the end of lesson 5b.*	The bush (plants). All of them! All of them! All of them!	

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6 min	**Lesson Focus Question** **Synopsis:** The teacher introduces the focus question, *What happens to the matter that makes up wastes and dead organisms?* and reviews the meaning of the word *matter*. **Main science idea(s):** • Matter is anything that has mass and takes up space. Energy is not matter.	Set the purpose with a focus question or goal statement.	**Show slide 9.** Today we'll explore another question about the matter in food chains: *What happens to the matter that makes up wastes and dead organisms?* Write this question in your science notebooks and draw a box around it. **ELL support:** Provide an opportunity for ELL students to share their thinking with one another in a way that allows them to explore the focus question rather than merely produce a "right" answer. In our simulation with the linking cubes last time, we ended up with a bowl of wastes. Today's focus question asks what happens to that matter. Where do you think it originally came from? We're also going to talk about what happens to dead organisms and any parts of once-living organisms, like leaves or branches and fruits that fall to the ground from plants, or parts of animals that fall off, like the skins that snakes shed. Read the focus question in your notebooks and underline any words you aren't sure you understand. **Individual work time.** **Whole-group discussion:** What words did you underline? Let's clarify what these words mean.	Leaves falling off plants. Poop from animals.	

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			NOTE TO TEACHER: *Terms such as* organisms, matter*, and* wastes *may need clarification. Be sure to review what the word* matter *means.* How do we know whether something is matter?	If it takes up space. If it has mass.	
			Is carbon dioxide matter?	No, because it has no weight. *[Misconception]*	
			OPTION: *For additional evidence that carbon dioxide is matter, show a large/jumbo-sized, deflated balloon.* Is a balloon matter?	Yes! It has mass. It takes up space.	Why do you say yes? 
		Select activities that are matched to the learning goal.	Let's see if we can gather some evidence showing that carbon dioxide is matter. First we'll find the mass of a balloon that isn't blown up. The scale tells us that this balloon has a mass of ____ grams. Now let's find the mass of an inflated balloon. The scale shows a mass of ____ grams **NOTE TO TEACHER:** *Blow up the balloon and find its mass on a sensitive kitchen scale. (It's tricky getting an inflated balloon to sit still on a scale, so place it in a small bowl.) There should be a small*		

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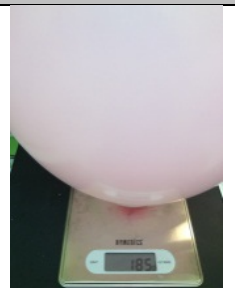
			increase in mass because of the carbon dioxide. So which balloon has more mass or weigh: the one with carbon dioxide in it or the empty balloon? What does the evidence tell us? Does carbon dioxide have mass or weight? What is our definition of *matter*? So is carbon dioxide matter? Make sure to support your answers with evidence from your observations of the balloon experiment. Today we'll explore what happens to matter that living things give off—like poop (or feces) and urine—which scientists call *wastes*. We're also going to think about what happens to dead things or dead parts of living things. **ELL support:** Include the term *wastes* with other vocabulary words and discuss the definition.	The balloon with carbon dioxide in it. Yes! Matter has mass and takes up space. Yes, carbon dioxide is matter because it filled up the balloon and has mass or weight.	
5 min	**Setup for Activity** **Synopsis:** The teacher elicits students' initial ideas about what happens to the matter in dead organisms. **Main science idea(s):**		The simulation we did last time sets up a new question for us to explore: What happens to dead organisms and the wastes living things leave behind? Yesterday we saw how food molecules got passed from one organism to another organism in a food chain. But we also saw that some of the food molecules ended up as wastes or dead plant parts on		

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	• Some food molecules end up in wastes and dead organisms.	Highlight key science ideas and focus question throughout. Ask questions to elicit student ideas and predictions. Make explicit links between science ideas and activities **before** the activity.	the ground. **Show slide 10.** To help us explore our focus question, *What happens to the matter that makes up wastes and dead organisms?* let's think about the food chains we drew. What happens to living things in a food chain when they die? What happens to the matter that made up the body parts of the berry bush, the mouse, and the hawk? Do their remains just pile up on the ground? And what happens to the wastes living things produce? What ideas do you have? **NOTE TO TEACHER:** *During this discussion, list student ideas on a chart titled* Our Ideas: What Happens to the Matter in Wastes and Dead Organisms? *Note that some students may already know some of the language of decomposition. If they use words like* decomposition/decompose*,* decomposers*, and* recycling*, probe to see what they really understand about these words. Often they know the words but don't understand the science concepts.* **ELL support:** ELL students often understand the science concepts but not the words. Ask students if they can think of other words that might express what they're trying to describe.	I think dead things go into the soil. Like they get buried in the soil. I think they turn into dirt. I've seen dead squirrels in the road, and they look gross and have bugs all over them. I've seen bugs on cow dung, too! Probably eating the squirrel or the cow dung. So I think that dead things get eaten	Can you say more about that? What's your evidence for that? What do you think the bugs are doing?

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				up by other organisms. We eat dead things! We kill animals and eat them. Dead things get decomposed. They rot. They turn into soil.	What do you mean by "decomposed"? How does that happen? Have you ever seen this happen?
5 min	**Activity—Part 1** **Synopsis:** Students observe fresh strawberries in a jar and make predictions about what will happen to them over a long period of time, and whether their mass will increase, decrease, or stay the same.	Select activities that are matched to the learning goal. Ask questions to	Let's think about a specific case that will help us answer our focus question. Here are some jars of fresh strawberries that were once part of a plant. [*Place one jar on each table.*] Now they're no longer part of the plant. If humans don't tend the fruit and animals don't eat it, it will fall to the ground and no longer be part of the living plant. **ELL support:** You may need to explicitly point out that the strawberries aren't exactly dead even though they're no longer part of the plant. **Show slide 11.** Look at the strawberries and think about what will happen if we leave them in the jars for a long time. So what do you predict? What do you think will happen?		

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		elicit student ideas and predictions.	Write your predictions in your notebooks, using the sentence starter, "After a long time, I think the strawberries will _____ because _____." **Individual writing time.** **Whole-class share-out:** Let's hear your ideas. What do you think will happen to the strawberries if they're left in the jars for a long time?	*Student predictions:* I don't think anything will happen if you keep the jars tightly closed so no bugs can get to them. I think the strawberries will get moldy because I've seen that happen in our refrigerator. Are you going to put them in the refrigerator? I think they'll rot.	Tell us what you mean by "moldy." What does that look like? Does anyone know what mold is? Tell us what you mean by "rot." And why do you think the strawberries will rot?

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			Now I'm going to weigh this jar of strawberries to find the mass. The jar weighs ___ grams. If I let it sit for, like, a month or two, do you think it will gain weight, lose weight, or stay about the same weight? **Show slide 12.** Here's another way of thinking about it: Will the mass of the strawberry jar stay the same, go down, or go up? Write your predictions in your notebooks and make sure to give your reasoning. Use the sentence starter, "I think the jar of strawberries will weigh more/less/the same because _____." **ELL support:** Give ELL students a chance to talk in same-language groups or with same-language partners before writing their predictions. **Student writing time.** **Whole-class discussion:** OK, give a thumbs-up if you think the strawberry jar will gain weight, thumbs-down if you think it will lose weight, and thumbs-sideways if you think it will stay the same weight. Show me your thumbs! Now let's hear the reasons for your predictions.	*Gain weight:* I think the jar will gain weight because mold will start to grow in there and add weight.	*Questions to ask for each prediction:* Do others want to add on or challenge that prediction?

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				Lose weight: I think the jar will lose weight because the strawberries are going to rot away, and they'll shrink as they get eaten up. *Same weight:* I think it'll stay the same. Nothing is going to change because the top on the jar will prevent anything from getting in or out. I think the jar will stay the same mass because it's like the math we did.	Any questions about this idea? Any other reasons to support this prediction? Say more about the link to our math activity.
10 min	**Activity—Part 2** **Synopsis:** Students observe rotting strawberries in jars. Then they discuss their observations and ideas about why this is happening. **Main science idea(s):** • Over time, once-living matter (strawberries)		Now I'm going to show you what happened to some strawberries I put in jars a while ago. **ELL support:** Have students draw what they see as well and remind them to label their diagrams with descriptive words. **Show slide 13.** **NOTE TO TEACHER:** *Pass out the jars of decomposing strawberries*.		

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	will start to rot.	Engage students in analyzing and interpreting data and observations. Make explicit links between science ideas and activities **during** the activity.	**Small groups:** In your small group, I want you to carefully observe what's happening to the strawberries and then share your observations. You can use your hand magnifying lenses to take a closer look. **NOTE TO TEACHER:** *As students observe the decomposing strawberries in the jars, are they noticing that they appear to be shrinking? Are they noticing the mold? Are they noticing the liquid that is being produced?* **Show slide 14.** **NOTE TO TEACHER:** *After students have had time to observe the strawberries carefully, have them discuss in their groups their ideas and explanations about what is happening.* **Small-group discussion:** Now discuss what you think is happening to the strawberries and why. **Optional writing activity:** Now I want you to think about your observations and group discussions and write your ideas about these questions in your science notebooks.		
10 min	**Follow-Up to Activity** **Synopsis:** Students discuss their observations of the strawberries and their ideas about what is		Let's hear some of your observations. What do you see happening with the strawberries?	It's getting liquidy in the jar. The strawberries have mold on them.	

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	happening. The teacher informs students that the mass of the jar didn't change, and they try to explain why. **Main science idea(s):** • Dead organisms and parts of dead organisms break down into tiny pieces. This is called *decomposition*.	Engage students in communicating in scientific ways. Engage students in analyzing and interpreting data and observations.	Now let's share out some of your ideas about why or how this is happening. Why did the strawberries shrink and get liquidy? Listen to others' ideas and think about whether you agree, disagree, want to add on, or have a question.	It's shrinking. I think mold is on the strawberries, and I think the mold is eating them. That's why they're shrinking. I think the juice in the strawberries leaked out, and that's why it looks so liquidy. Like there are little pores, and the liquid leaked out. Maybe because the strawberries are no longer connected to the plant. When they get disconnected, they fall apart, and stuff leaks out.	What is shrinking? So do you think mold is a living thing? Why? Anyone agree, disagree, or want to add on? Any questions? Any idea why the liquid leaked out of the strawberries? Say more about why being disconnected from the plant would cause the strawberries to fall

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					apart.
				I agree they're leaking, but I think it's because the strawberries are old. Like old people get wrinkles, maybe old strawberries get leaky.	
				I think they're decomposing.	What do you mean by "decomposing"? What causes decomposing?
			Show slide 15.		
		Make explicit links between science ideas and activities **after** the activity.	Now I'm going to give you some new data to consider. I weighed these strawberries in the jar when they were fresh and again the way they are now. Guess what? The mass of the jar stayed the same. [*Tell students what the mass of jar was in both instances.*] So there was no loss of mass or weight.		
		Engage students in constructing explanations and arguments.	How do you explain that the mass of the strawberry jar stayed the same? Does that surprise anyone? **Optional activity:** *Do a Turn and Talk before opening up a class discussion.*	I thought it would decrease because the strawberries are shrinking, but now I think maybe the strawberries are still there but turned from a solid into a liquid, like an ice cube melting.	So you think the liquid is melted strawberry? Why do

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			You've done some really good thinking!	I think the mass stayed the same because even though the strawberries shrank, there is a lot more mold, so this kind of balanced things out. It's like when we did the linking cubes and the fractions, and it always came out to the same number of cubes. No matter was ever lost.	you think the strawberries melted? What is happening to the mold? How is it getting the matter it needs to grow?
8 min	**Synthesize/Summarize Today's Lesson** **Synopsis:** The teacher provides a lesson summary. Students generate questions they're wondering about regarding the decomposition process. **Main science idea(s):** • Dead organisms and parts of dead organisms break down into tiny pieces. This	Engage students in communicating in scientific ways.	**Show slide 16.** Let's summarize where we are in trying to figure out what happens to the matter that makes up wastes and dead things. In particular, what is happening to our strawberries that were once part of a living plant? **NOTE TO TEACHER:** *Supply the following information as students ponder this question.* Here's what we know so far: 1. We know the strawberries are changing and shrinking. Scientists call this process *decomposition*. The strawberries are decomposing; that is, they are getting broken		

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	is called *decomposition*.		down into tiny pieces. 2. We know there is something on top of the strawberries that wasn't there at the beginning. We think that is mold. 3. And we know that the mass of the strawberry jar isn't changing. No mass or weight is being lost even though the strawberries are getting smaller. **Show slide 17.** So what does this leave you wondering about? What do we need to know so we can explain what is happening to the strawberries? I'll capture your questions on this chart paper. **NOTE TO TEACHER:** *Label the chart Our Questions.*	*Possible questions:* • Is that mold on the strawberries? • What is mold? • What is the mold doing? • Where is all the juice coming from? • Why do the strawberries shrink? • Will the strawberries eventually disappear? • I mean will they eventually be completely liquid? • How did the mold get in the jar?	What do you mean by "disappear"?

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1 min	**Link to Next Lesson** **Synopsis:** The teacher summarizes key unanswered questions and previews the focus of the next lesson.	Link science ideas to other science ideas.	**Show slide 18.** You have a lot of questions! Here are two questions I have: 1. What does the mold on the strawberries have to do with decomposition? 2. Why isn't the mass of the jar going down as the strawberries get smaller? And, of course, we have today's focus question: *What happens to the matter that makes up wastes and dead organisms?* We'll gather more information next time to help us answer all of these questions!		