

Grade 5: Life Science Module

Lesson Sequence 7: Energy Transfer

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Overview

Total Time: 2 hours of instruction (divided into two sections)

In this lesson sequence, students learn more about the transfer of energy between organisms in a food chain through a simulation and an informational text. Students continue to refine their expert ecosystem explanatory models to reflect their learning. Finally, students individually add their learning about the cycle of energy and how to make a model to their student science notebook.



Lesson Sequence Focusing Question and Big Ideas

What happens to energy as it is transferred among organisms in an ecosystem?

- When organisms consume other organisms, they obtain only a fraction of their original energy because most of the energy was used by the plant or animal to function (body repair and maintaining temperature).
- Only a fraction of sunlight is obtained by plants; the rest of the sunlight heats the earth and atmosphere.

Long-Term Learning Addressed (Based on NGSS)

Use a model (food web) in explaining that food provides animals with the matter and energy they need for body repair, growth, motion, and maintaining body warmth and for motion. (Based on NGSS 5-LS2-1 and 5-PS3-1)

This lesson sequence explicitly addresses:

Science and Engineering Practices:

- **Developing and Using Models:** Develop a model to describe phenomena. *Students add information to their expert ecosystem explanatory model about how matter and energy pass from the sun to producers to consumers and then decomposers return matter to producers.*

Crosscutting Concepts:

- **Energy and Matter:** Energy can be transferred in various ways and between objects. Matter is transported into, out of, and within systems. *Students learn that matter and energy move from organism to organism through the food web.*

Disciplinary Core Ideas:

- **LS2.B: Cycles of Matter and Energy Transfer in Ecosystems:** Matter cycles between the air and soil and among plants, animals, and microbes as these organisms live and die. *Student revise their ecosystem model to explain how matter cycles through the food web.*



Lesson Sequence Learning Target

- I can revise a food web model to explain what happens to energy as it is transferred among organisms in an ecosystem.

Ongoing Assessment

- Scientists Meeting: Building Understanding
- Student science notebooks: Matter and Energy Transfer entry
 - Matter and energy transfer model
- Expert ecosystem explanatory model

Agenda

Total Time: 2 hours of instruction

Section 1

1. Opening

A. Introducing Learning Target and Focusing Question (10 minutes)

2. Obtaining Information

A. Playing “Pass the Energy, Please” (25 minutes)

B. Close Reading: “How Animals Use Energy” (30 minutes)

Optional Extension: Weigh a Class Pet

Optional Extension: Food Chain Pyramid

Section 2

3. Communicating Information

A. Revising Expert Ecosystem Explanatory Models (20 minutes)

B. Scientists Meeting: Building Understanding (20 minutes)

C. Independent Practice: Creating Models (15 minutes)

Teaching Notes

Purpose of lesson sequence and alignment to NGSS standards:

- In this lesson sequence, students continue to refine their understanding of how energy and matter cycle through an ecosystem (a Disciplinary Core Idea). They learn that 100 percent of the energy does not transfer from organism to organism because some energy is stored by animals as food matter and a lot of energy is used by animals for body repair, basic functions to support life, and staying warm.
- In Section 1, students participate in a simulation to replicate how food energy is transferred throughout a system (a Crosscutting Concept) to demonstrate that 100 percent of energy does not transfer from organism to organism. They then read the informational text “How Animals Use Energy,” which explains how animals use energy for staying warm and body repair.
- In Section 2, expert groups return to their expert ecosystem explanatory models (a Science and Engineering Practice) and revise them to reflect their new learning. They then participate in a Scientists Meeting to discuss how they collaborated to revise their models. Finally, students create independent models in their student science notebooks.

How it builds on previous work in the Life Science Module:

- Students continue to refine their knowledge of the energy cycle—a component of a healthy ecosystem.

How it connects to the CCSS Standards and EL Education’s Language Arts Grade 5 Module 2:

- The close read in Section 1 provides students the opportunity to practice reading informational texts and explaining the relationship between two or more ideas (CCSS ELA RI.5.3).
- The Scientists Meeting in Section 1 provides students the opportunity to practice their speaking and listening skills while collaborating in whole group discussions (CCSS ELA SL.5.1).

Possible student misconceptions:

- Students may think that when animals “use the energy” for body repair or growth, the energy is being “lost” or “used up.” Remind them of the law of conservation they learned about in Lesson Sequence 5—energy cannot be created or destroyed but is transferred.

Possible broader connections:

- Ask students to describe the food web that they are a part of and trace the path of energy from the sun to themselves.

Areas where students may need additional support:

- Students will closely read a text in this lesson sequence. Some students may benefit from additional support. Consider these options:
 - For students who are overwhelmed by too much print on a page: Consider copying the text so that there is only one paragraph on each page, with an organized space for recording the gist and meanings of the unfamiliar words on that page.
 - For students who may need additional support with paraphrasing: Consider providing running notes on today’s text.
 - Offer selected shorter passages to specific groups based on the readiness and needs of the group. This gives students an opportunity to read a complex text within the fifth-grade level span but differentiates the length of the text, not the complexity.
 - For students who may need additional support staying on pace during the close read: Consider gathering these students in one place in the room to support them quickly and quietly throughout the close-read portion of the lesson. Give prompts to help students stay on task, point out where the class is, or offer sentence frames as needed.
 - For ELLs and students who may need additional support with reading and/or writing: Strategically pair students with a peer model.
 - For students who may need additional support determining the gist: Consider highlighting or underlining key phrases in their individual copy of the text in advance. This will lift the gist up for them.

Down the road:

- Continue to provide time for students to make informal observations of the ecosystems in a baggie until Lesson Sequence 8, when students formally revisit their ecosystems in a baggie. Creating a regular schedule for observation of the ecosystems will help integrate the use of live plants into your classroom.

- Students will continue to return to their expert ecosystem explanatory models to revise them and add new learning. In Lesson Sequence 9, they will use them to construct an argument about the health of ecosystems. Post (or store) them in a safe and easily accessible location.

In advance:

- Read each section and complete the Preparing to Teach: Self-Coaching Guide
- Pre-determine groups of four students for the “Pass the Energy, Please” simulation in Section 1.
- Post: Lesson sequence learning target, lesson sequence focusing question, Schoolyard Ecosystem Poster-Size Explanatory Model, and Scientists Do These Things anchor chart.

Optional extensions:

- Weigh a Class Pet:* Weigh a class pet before and after feeding, as well as all food. Ask: “What happens to the weight of the food as the pet eats it? Why does the pet’s weight not change very much as it eats food?”
- Food Chain Pyramid:* Guide students to apply their understanding of how useful energy decreases as it moves to each level of the food chain to create a food chain pyramid. For more information, see: <<https://www.learner.org/courses/essential/life/session7/closer5.html>>

Vocabulary

revise: to change or make different in order to improve
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Materials

General Materials

- Student science notebook (from Lesson Sequence 1; one per student)
 - Energy Transfer entry (page 30 of student science notebook)
- Organism Name cards (one set per group)
- Directions for “Pass the Energy, Please” (one to display)
- “How Animals Use Energy” (one per student)
- Schoolyard Ecosystem Poster-Size Explanatory Model (begun in Lesson Sequence 5; added to during Section 2)
- Schoolyard Ecosystem Explanatory Model: Model for Lesson Sequence 7 (for teacher reference)
- Expert ecosystem explanatory model (begun in Lesson Sequence 5; added to during Section 2; one per expert group)
- Scientists Do These Things anchor chart (begun in Lesson Sequence 2 added to during Section 2; see supporting materials)
- Example of individual model (for teacher reference)

Science-Specific Materials (gathered by the teacher)

- Materials for “Pass the Energy, Please” (one set per group; used in Section 1)
 - Bottle of soda or colored water (1-liter size)

- Plastic cups (four)
- 100 milliliter graduated cylinder
- Eyedropper (one)
- ☑ Teacher science notebook (from Lesson Sequence 1; for teacher reference)

Section 1: Opening

A. Introducing Learning Target and Focusing Question (10 minutes)

- Invite students to take out their **student science notebooks** and open to the **Matter and Energy Transfer entry** ⁽¹⁾.
- Select a volunteer to read the focusing question listed under “Opening” aloud while the other students follow along, reading silently in their heads:
 - “What happens to energy as it transferred among organisms in an ecosystem?”
- Remind students that in the previous lesson sequence they learned that organisms are connected in a food web and as animals consume plants and other animals, the matter of the plants or animals’ bodies moves on to the next consumer. This movement of matter and energy is an important part of the health of an ecosystem ⁽²⁾.
- Using a total participation technique, invite responses from the group:
“What might happen to the energy that is stored in the plants and animals’ bodies after they are consumed?” (Responses will vary. Do not correct students but note initial understanding.)
- Direct students’ attention to the posted lesson sequence learning target and read it aloud as students follow along, reading them silently in their heads:
 - **“I can revise a food web model to explain what happens to energy as it is transferred among organisms in an ecosystem.”**
- Underline the word *revise* in the first learning target.
- Using a total participation technique, invite responses from the group:
“What does it mean to revise something? (to change or make different in order to improve)
- Tell students that they will be completing an activity and reading an article to help them gather more information about what happens to the energy in a food web so that they can revise their food web models to show this learning.
- Invite students to record their initial ideas about the lesson sequence focusing question or learning target under the “Opening” section in their student science notebook.

Preparing to Teach: Self-Coaching Guide

1. How can I help my students quickly and efficiently transition to science time?
2. What do my students know about energy transfer? Do I need to revisit the law of conservation?

Section 1: Obtaining Information

A. Playing “Pass the Energy, Please” (25 minutes)

- Tell students that they are going to conduct a simulation to demonstrate what happens to matter and energy as they move from organism to organism in a food web.
- Move students into pre-determined groups of four.
- Using a total participation technique, invite responses from the group:

“What are the types of organisms that are in a food web?” (producers, consumers—primary and secondary—and decomposers)

- Tell students that in the simulation, “Pass the Energy, Please,” each member of their group is going to take on one of these roles (producer, primary consumer, secondary consumer, decomposer) ⁽¹⁾.
- Distribute the **Organism Name cards** and other necessary materials, including the **bottle of soda or colored water, cups, 100 milliliter graduated cylinder, and eyedropper**.
- Display the Directions for “Pass the Energy, Please” and read them aloud.
- Reiterate that, for the simulation, the liquid in the bottle represents the energy from the sun.
- Invite groups to follow the directions to complete one cycle of the simulation.
- After each group has completed one cycle, ask students to turn and talk with their group members ⁽²⁾ ⁽³⁾:

“Why do you think the sun did not give all of its energy to the plants? Where do you think that energy might have gone?” (Much of the energy from the sun goes into warming the environment. Plants receive only about 10 percent of the sun’s energy.)

“Why do you think the directions told you to not pass on all your energy to whoever consumed you?” (Only 10 percent of the energy is stored in food energy. Ninety percent of plants and animals’ energy is used for body repair, maintaining temperature, and movement for animals.)

“What do you think happens to the energy that doesn’t get passed on?” (The energy that is not passed on is used by that organism for body repair or is released into the environment as heat.)

“Where do you think the energy might go?” (It is released into the environment.)

“If you were a primary consumer, how many plants do you think you would to consume to get enough energy?” (Responses will vary.)

“If you were a secondary consumer, how many primary consumers would you need to consume to get enough energy?” (Responses will vary. Students should understand that because not all the energy gets passed on, secondary consumers need to eat many primary consumers)

- Invite groups to share out. As students share, capture their ideas in the **teacher science notebook** and encourage students to record their ideas in the “Obtaining Information” section of their student science notebook.
- Tell students that they will now read an article to find out more about what happens to energy and matter as they move through an ecosystem.

Preparing to Teach: Self-Coaching Guide

1. Should I have the whole class participate in this simulation or choose a few students to demonstrate it for the class?
2. Students will not know these answers yet. This part of the lesson is to begin to uncover student misconceptions as well as create a need to know.
3. Students will learn the answers to these questions during their reading in the next agenda item.

B. Close Reading: “How Animals Use Energy” (30 minutes)

- Distribute “**How Animals Use Energy.**”
- Tell students that they will work hard as readers now to understand what happens to energy as it moves through the food web.
- Remind students that when they read complex texts, they often need to read the text multiple times. Tell them that it’s okay if they do not understand everything the text says the first time. Reiterate that generally, each reading is for a different purpose. For example, the first reading is generally to get the gist or an idea of what the text is about and to identify unfamiliar vocabulary. Then, additional readings are done to glean details and a better understanding of what the text is saying explicitly and implicitly ⁽¹⁾.
- Remind students of some of the close reading routines they use in their Language Arts lessons:
 - Read small chunks of the text slowly and think about the gist.
 - Talk with my partner or group about the text.
 - Circle or underline words I don’t know.
 - Write notes or answer questions about the text.
- Refer students to the “Obtaining Information” section of the Matter and Energy Transfer entry in their student science notebook. Let students know they are going to have the opportunity to independently read the text. Tell them to stop after each paragraph during this first read and jot the gist of that paragraph and any unfamiliar vocabulary in their notebook. Review and model finding the gist as necessary.
- Ask students to begin reading. Circulate and support them as they read and determine the gist.
- After 5 minutes, ask students to turn to and talk to an elbow partner:
“What gist notes or vocabulary words did you write down? What similarities and differences are there between our notes?”
- After 3 minutes, refocus whole class. Point out to students that their job is to learn everything they can about what happens to the energy as it flows through organisms in an ecosystem. Explain that they should gather as many *facts*, *definitions*, and *details* as they can as they read. Clarify these terms as needed.
- Tell students they are going to read the text again. This time, they should read closely for details to add to the “Obtaining Information” section of their science notebook.
- Consider doing a brief guided practice, as necessary.
- Ask students to begin reading. Circulate and support students as they read.
- After 10 minutes, refocus whole group and debrief with students ⁽²⁾.

- Ask:

“What happens to the energy coming from the sun?” (It is captured by plants.)

“What happens to the energy as it cycles through animals?” (Some of it used for body functions and movement, and some of it is stored and transferred from animal to animal.)

“Think back to “Pass the Energy, Please.” What happened to the energy inside the animal? Why didn’t all the energy get passed to the next consumer?” (Some of it was used by the animals to function and, in the case of warm-blooded animals, for heat. It wasn’t “used up,” but rather transformed into a different type of energy.)

“Do you think something similar happens in plants? Do you think they capture and pass on 100 percent of the energy they get from the sun? Why or why not?” (Plants do not pass on 100 percent of the energy they capture from the sun. They also use some of the energy for plant growth. It is not lost, but rather transferred into a different form.)

“If you were a primary consumer, how many plants do you think you would need to consume to get enough energy? Why?” (many because the energy isn’t passed 100 percent)

“If you were a secondary consumer, how many primary consumers would you need to consume to get enough energy? Why?” (many because a fraction of the energy is passed up the food chain)

Preparing to Teach: Self-Coaching Guide

1. Based on the close reads in the earlier lesson sequences, what support will my students need?
2. Some of my students may benefit from having a visual with this conversation. Keeping in mind that students will eventually create their own models, what can I draw on the board to augment this discussion?

Section 2: Communicating Information

A. Revising Expert Ecosystem Explanatory Models (20 minutes)

- Invite students to move to sit with their ecosystem expert groups.
- Direct students’ attention to the **Schoolyard Ecosystem Poster-Size Explanatory Model**.
- Using a total participation technique, invite responses from the group:

“How can we revise our ecosystem explanatory models to reflect our learning about the way energy is passed between organisms?” (Add arrows and lines to the model to represent how energy passed and how that energy is used within the bodies of each organism and released into environment as heat energy, plus labels to explain.)

“How would using a different color for energy make our model clearer?” (Using a different color for energy makes the transfer of energy clearer)
- Distribute the groups’ **expert ecosystem explanatory models**.
- Tell students that they will now revise their group’s explanatory model to include information about what happens to the energy as organisms use it.
- Ask students to give a quick thumbs-up if they have an idea of how they might revise their model. Check in with groups where only one student was showing a thumbs-up.

- Remind students to work cooperatively with the members of their group.
- Invite students to begin working.
- Circulate to support students and consider capturing student thinking in the teacher science notebook ⁽¹⁾.
- After 15 minutes, collect and post explanatory models until the next lesson sequence.

Preparing to Teach: Self-Coaching Guide

1. What support do groups need as they revise?

B. Scientists Meeting: Building Understanding (20 minutes)

- Ask students to bring their science notebooks and gather for a Scientists Meeting ⁽¹⁾.
- Using a total participation technique, invite responses from the group:
“What are the norms of a Scientists Meeting?” (take turns talking, build on one another’s ideas, disagree respectfully, ask questions to clarify information)
- Remind students that a Scientists Meeting is a conversation where they speak to one another as scientists and not just to the teacher.
- Share with students that the goal of today’s meeting is to build their understanding about what happens to energy as it moves through organisms in an ecosystem and how to develop a model.
- Ask for a volunteer from each group to explain how their group added to and revised their explanatory model.
- Clarify students’ thinking with questions such as:
“Why do you think...?”
“What is your reason...?”
“What is your evidence for saying that...?”
- If conflicting information arises, help students challenge each other’s ideas respectfully. Consider asking:
“Why do you think you have different conclusions?”
“What in ‘John’s’ argument do you disagree with?”
“What evidence do you have?”
“What points do you agree on?”
- As students share, emphasize that energy changes forms as it moves through an ecosystem but the overall amount of energy is conserved and does not disappear; it always goes somewhere.
- Ask:
“As you think about the way energy moves through a food chain, in a healthy ecosystem do you think you would see more producers or more secondary consumers? Why?” (more producers because then more energy would be passed along the food chain; without producers there wouldn’t be enough energy to support secondary consumers)
- After 15 minutes of conversation, draw students’ attention to the second bullet in the “Develop a Model” column of the **Scientists Do These Things anchor chart**.
 - “Collaborate to revise models based on evidence.”

- Ask students to think about how they used the new information they have learned about food webs and how energy moves through an ecosystem to revise their models and how they collaborated to revise their models. Ask students to share some examples of their collaboration process.
- Add these examples to the “Develop a Model” column of the Scientists Do These Things anchor chart.
- Invite students to return to their seats.

Preparing to Teach: Self-Coaching Guide

1. Students should be familiar with this practice now. What can I do to encourage this discussion to be more student centered and less teacher centered?

C. Independent Practice: Creating Models (15 minutes)

- Tell students that they will now show what they understand about matter and energy transfer in an ecosystem by independently creating a small model in their student science notebook ⁽⁹⁾.
- Say:

“In Lesson Sequence 6, you learned how matter cycles through an ecosystem when you learned about food webs. You also learned about how energy cycles. In this lesson sequence, you learned more about how energy flows through an ecosystem. Now you’re going to draw a small model to capture your learning.”
- Invite students to open their student science notebook to the Matter and Energy Transfer entry and find the “Communicating Information” section.
- Tell them that in the space provided, they should create a model that shows the flow of matter and energy throughout an ecosystem.
- Post and prompt students to show their understanding of:
 - How matter moves through the organism to organism
 - Where the energy comes from
 - Where the energy goes
 - How the energy moves and changes
 - What happens to energy as it moves from organism to organism
- Collect student science notebooks to assess students’ understanding of the content and ability to make a clear model.

Preparing to Teach: Self-Coaching Guide

1. My students may need more practice creating a model. How can I spend more time here and make this assignment more robust?
 - Consider these scaffolds:
 - Ask students to turn and talk with a partner about what they are drawing and revise their drawing.
 - Ask a student to share an exemplar and then ask students to revise their model based on it.

The Cycle of Matter and Energy in Healthy Ecosystems

- Ask students to work in pairs. One student is the “matter expert” and one student is the “energy expert.” Students draw in two colors—one for energy and one for matter—and work together on the model.

See **example individual model (for teacher reference)** for an example of what students may draw.