Houghton Mifflin Harcourt

HMH SCIENCE DIMENSIONS™
ENGINEERED for the NEXT GENERATION

Biology

GRADES 9–12

Effective NGSS Instruction

Your Guide to the 5Es and Three-Dimensional Learning

NEXT GENERATION SCIENCE STANDARDS

Print & Digital Curriculum

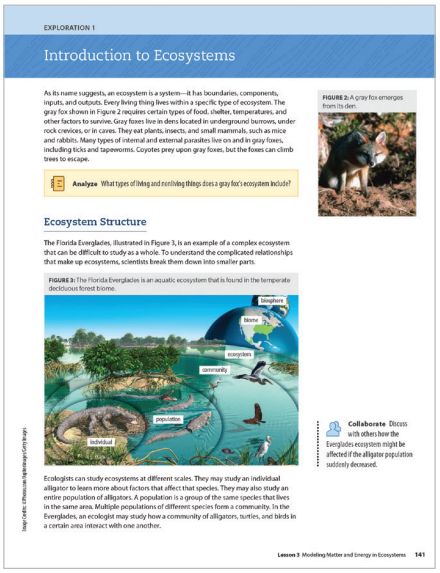
HMH Science Dimensions™ provides the richest NGSS-based 3D learning experiences available. Whether you choose print, digital, or a combination approach, students will be ready to succeed at the **Performance Expectations**.

BOTH PATHS OFFER

- Parallel Lesson Content
- Hands-on Investigations
- 5E Learning Model
- Math & ELA Connections
- Evidence Notebooking
- Engineering Activities
- Collaborative Learning
- Assessment
- Unit Performance Task
- Three-Dimensional Learning

PRINT PATH

High school Biology builds interest with a hardcover text enlivened by cartoons from Randall Munroe's *Thing Explainer*.


EXPLORATION 1

Introduction to Ecosystems

As its name suggests, an ecosystem is a system—it has boundaries, components, inputs, and outputs. Every living thing lives within a specific type of ecosystem. The gray fox shown in Figure 2 requires certain types of food, shelter, temperatures, and other factors to survive. Gray foxes live in dens located in underground burrows, under rock crevices, or in caves. They eat plants, insects, and small mammals, such as mice and rabbits. Many types of internal and external parasites live on and in gray foxes, including ticks and tapeworms. Coyotes prey upon gray foxes, but the foxes can climb trees to escape.

FIGURE 2: A gray fox emerges from its den.

Analyze What types of living and nonliving things does a gray fox's ecosystem include?

Ecosystem Structure

The Florida Everglades, illustrated in Figure 3, is an example of a complex ecosystem that can be difficult to study as a whole. To understand the complicated relationships that make up ecosystems, scientists break them down into smaller parts.

FIGURE 3: The Florida Everglades is an aquatic ecosystem that is found in the temperate deciduous forest biome.

biosphere
biome
ecosystem
community
population
individual

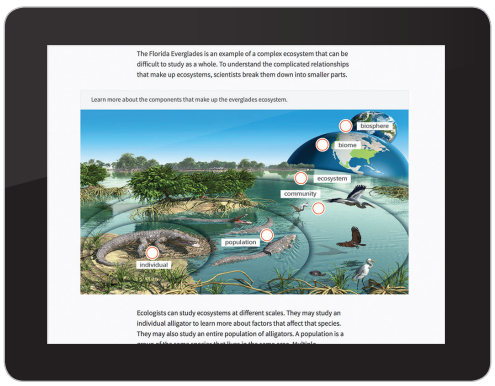
Collaborate Discuss with others how the Everglades ecosystem might be affected if the alligator population suddenly decreased.

Ecologists can study ecosystems at different scales. They may study an individual alligator to learn more about factors that affect that species. They may also study an entire population of alligators. A population is a group of the same species that lives in the same area. Multiple populations of different species form a community. In the Everglades, an ecologist may study how a community of alligators, turtles, and birds in a certain area interact with one another.

Lesson 3 Modeling Matter and Energy in Ecosystems 141

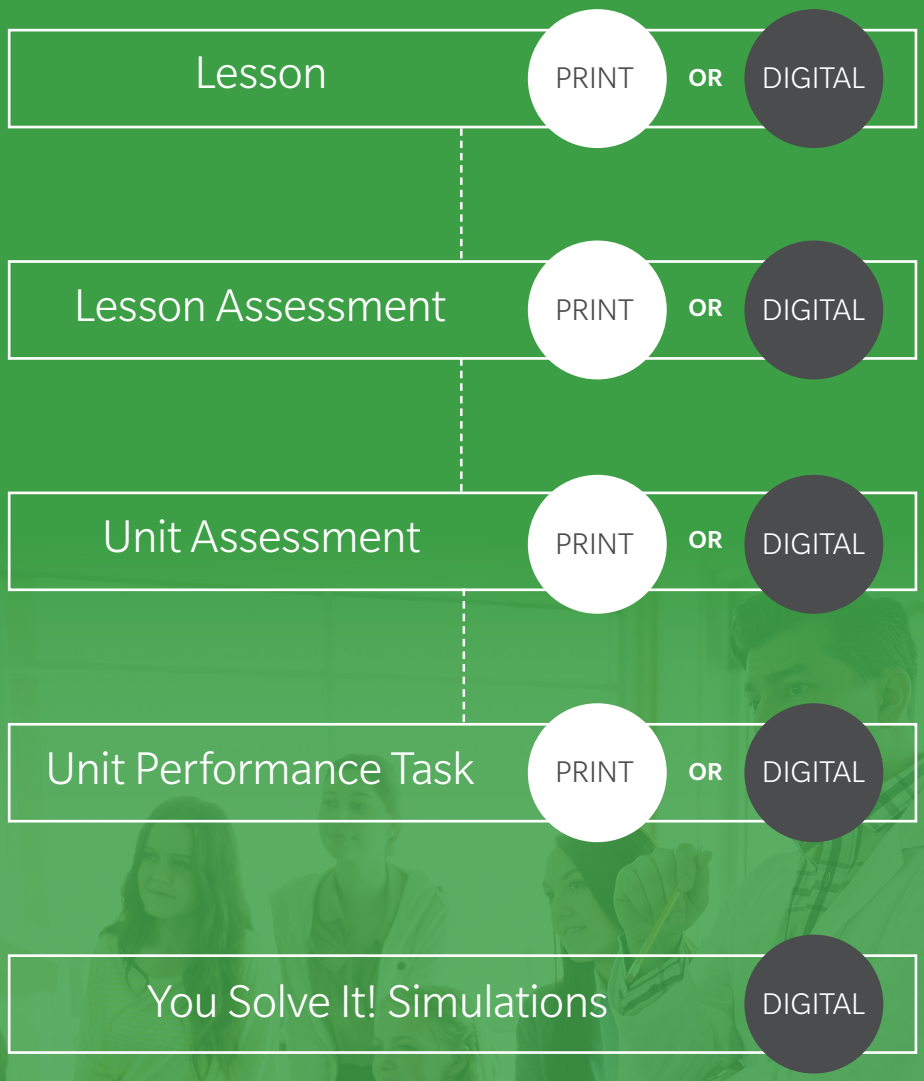
DIGITAL PATH

The robust interactive online Student Edition contains all the content from the print books, enhanced with high-interest interactive elements!



Digital? Print? It's Your Choice!

Because both the digital and print paths include the same content, your learners can follow *any* path to the Performance Expectations that you designate. Leverage digital for small-group work, flipped classrooms, learning centers, and 1:1 technology situations.



Whether you use the print book or the online interactive Student Edition, your students will encounter plenty of opportunities for **science and engineering practices, small-group work,** and **collaborative projects!**

HMH Science Dimensions

Designed—not aligned—for NGSS!

HMH Science Dimensions™ Biology was built for you from the ground up to authentically and effectively address both the spirit and the letter of the Next Generation Science Standards (NGSS)*.

The Digital Advantage

HMH Science Dimensions Biology incorporates highly motivating interactive digital elements, like animations, videos, simulations, and more. This approach allows the program to harness the power of technology, so that students are more engaged, resulting in a more effective learning experience. Throughout this walkthrough, note the ▼ **DIGITAL ADVANTAGE** sections highlighting the interactive elements designed to optimize learning.

*Next Generation Science Standards and logo are registered trademarks of Achieve. Neither Achieve nor the lead states and partners that developed the Next Generation Science Standards was involved in the production of, and does not endorse, this product.

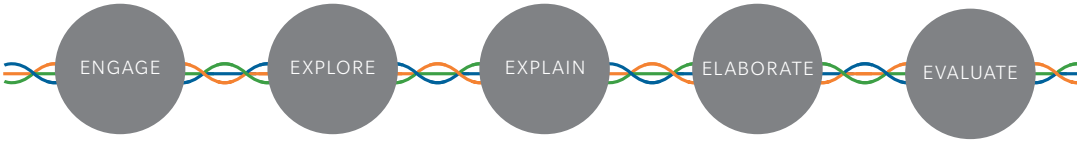
Three-Dimensional Learning

Any curriculum based on the NGSS must integrate the **Science and Engineering Practices, Crosscutting Concepts,** and **Disciplinary Core Ideas** (the Three Dimensions of Learning) throughout all lessons. ***HMH Science Dimensions*** intertwines the Three Dimensions into a cohesive, braided approach that ensures students will increase science proficiency.

Lesson Structure—the 5E Model

HMH Science Dimensions consists of units containing closely related lessons.

Each lesson is built around the familiar **5E instructional model**, endorsed by NGSS thought leaders. We've overlaid the **Claims/Evidence/Reasoning** learning model below with the 5Es to give you a better understanding of how a pedagogy driven by NGSS aligns to the 5Es.



ENGAGE **Stimulated to engage** with a discrepant phenomenon or puzzling question, students begin each lesson by making connections to the real world around them.

- **CLAIMS** Students hypothesize a model or explanation to the puzzle or problem presented. By evaluating their own mental models, students are prepared to study the phenomenon.

EXPLORE **Inspired to explore** new concepts and gather evidence, they learn actively through a variety of activities and resources.

- **EVIDENCE** Students perform experiments and pursue several methods of scientific inquiry to gather data and explore their model.

EXPLAIN **Challenged to explain** and test their ideas and claims, students become skilled at reasoning about how well their evidence supports their claims.

- **REASONING** Armed with real data related to the initial phenomenon or problem, students draw conclusions and adjust models.

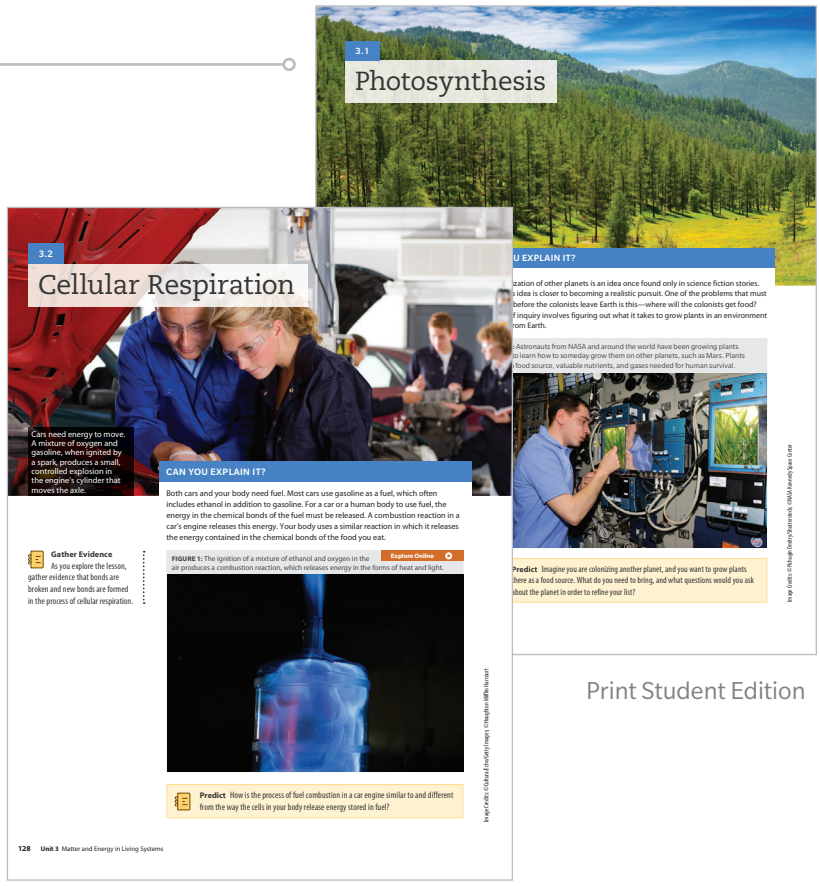
ELABORATE **Motivated to extend** their new learning, students apply this knowledge in different situations to deepen understanding.

EVALUATE **Enabled to evaluate** how their understanding has changed, students are supported by a progression of formative and summative activities during the lesson.

ENGAGE

Every lesson starts with an Engage opportunity that asks: **Can You Explain It?** The Engage section involves a **phenomenon to explain**, **a problem to solve**, or a **discrepant event** to spark students' curiosity.

As students state **claims**, they begin to analyze their assumptions and ideas, preparing for the learning experiences that follow.



Print Student Edition

DIGITAL ADVANTAGE

Interactive Illustrations

The interactive nature of online illustrations maximizes student engagement. ***HMH Science Dimensions Biology*** encourages learners to interact with images online. The digital delivery platform also allows students to collect evidence and **save it all online**. Students are also able to share their work with their teacher.

Interactive Online Student Edition

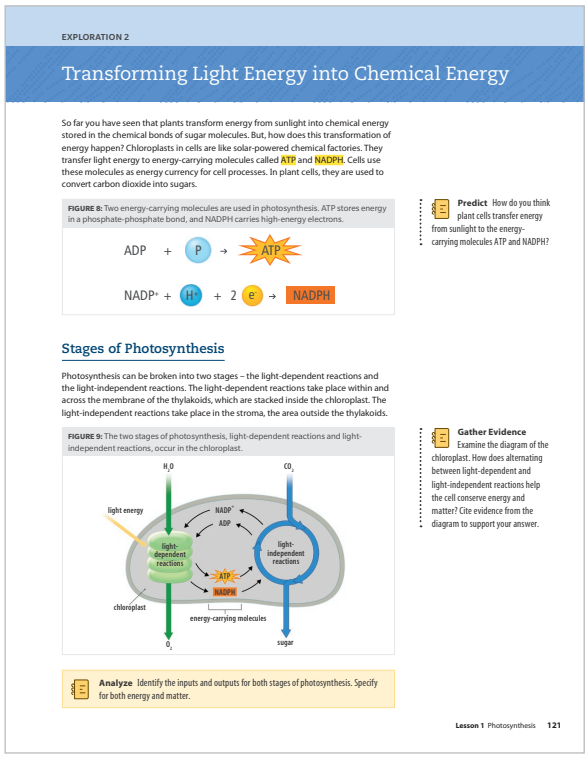
EXPLORE & EXPLAIN

In the next phases of the 5E model, a series of related Explore & Explain activities are organized as **Explorations**. During these activities, learners embark on a discovery process of gathering **evidence** to either support or challenge their **claims** through:

- hands-on activities and labs
- data analysis
- instructional diagrams
- informative videos
- immersive virtual activities

Throughout the lesson, students are prompted to record their evidence using **Evidence Notebooks** where appropriate.

Student-directed formative assessments embedded in the lesson help students assess the evidence they gather. They also share their evidence with peers and collaborate on the activities.



EXPLORATION 2

Transforming Light Energy into Chemical Energy

So far you have seen that plants transform energy from sunlight into chemical energy stored in the chemical bonds of sugar molecules. But, how does this transformation of energy happen? Chloroplasts in cells are like solar-powered chemical factories. They transfer light energy to energy-carrying molecules called ATP and NADPH. Cells use these molecules as energy currency for cell processes. In plant cells, they are used to convert carbon dioxide into sugars.

FIGURE 8: Two energy-carrying molecules are used in photosynthesis. ATP stores energy in a phosphate-phosphate bond, and NADPH carries high-energy electrons.

ADP + P → ATP

$NADP^+$ + H^+ + 2 e^- → NADPH

Predict How do you think plant cells transfer energy from sunlight to the energy-carrying molecules ATP and NADPH?

Stages of Photosynthesis

Photosynthesis can be broken into two stages – the light-dependent reactions and the light-independent reactions. The light-dependent reactions take place within and across the membrane of the thylakoids, which are stacked inside the chloroplast. The light-independent reactions take place in the stroma, the area outside the thylakoids.

FIGURE 9: The two stages of photosynthesis, light-dependent reactions and light-independent reactions, occur in the chloroplast.

Gather Evidence Examine the diagram of the chloroplast. How does alternating between light-dependent and light-independent reactions help the cell conserve energy and matter? Cite evidence from the diagram to support your answer.

Analyze Identify the inputs and outputs for both stages of photosynthesis. Specify for both energy and matter.

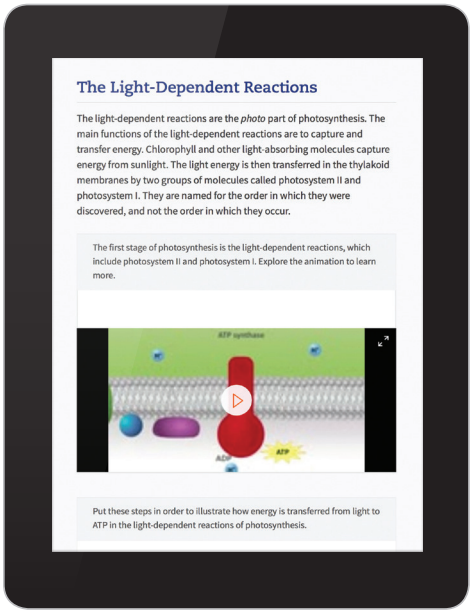
Lesson 1 Photosynthesis 121

Print Student Edition

DIGITAL ADVANTAGE

Rich Media

The audio and motion aspects of multimedia help learners visualize and see the Three Dimensions of Learning in action. Adding motion and context helps learners **relate to and internalize** the concepts portrayed.



The Light-Dependent Reactions

The light-dependent reactions are the *photo* part of photosynthesis. The main functions of the light-dependent reactions are to capture and transfer energy. Chlorophyll and other light-absorbing molecules capture energy from sunlight. The light energy is then transferred in the thylakoid membranes by two groups of molecules called photosystem II and photosystem I. They are named for the order in which they were discovered, and not the order in which they occur.

The first stage of photosynthesis is the light-dependent reactions, which include photosystem II and photosystem I. Explore the animation to learn more.

Put these steps in order to illustrate how energy is transferred from light to ATP in the light-dependent reactions of photosynthesis.

Interactive Online Student Edition

EXPLORE & EXPLAIN

Crosscutting Concepts

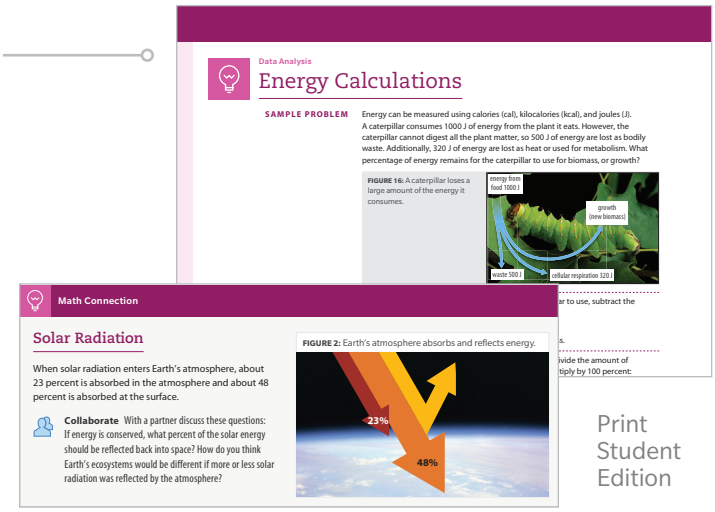
In each lesson, important Crosscutting Concepts are called out via a special feature and icon. Students are asked to dive deeper into the intelligent patterns of life, including:

- Energy and Matter
- Cause and Effect
- Scale, Proportion, and Quantity
- Systems and System Models
- Structure and Function
- Stability and Change

EXPLORE & EXPLAIN

Language Arts and Math Connections and Data Analysis

Being science literate requires a strong foundation in English language arts and math. So ***HMH Science Dimensions Biology*** includes strong connections to these disciplines. These features, called **Language Arts Connection, Math Connection,** and **Data Analysis**, offer activities that are **integral to the core objectives** of the lesson.



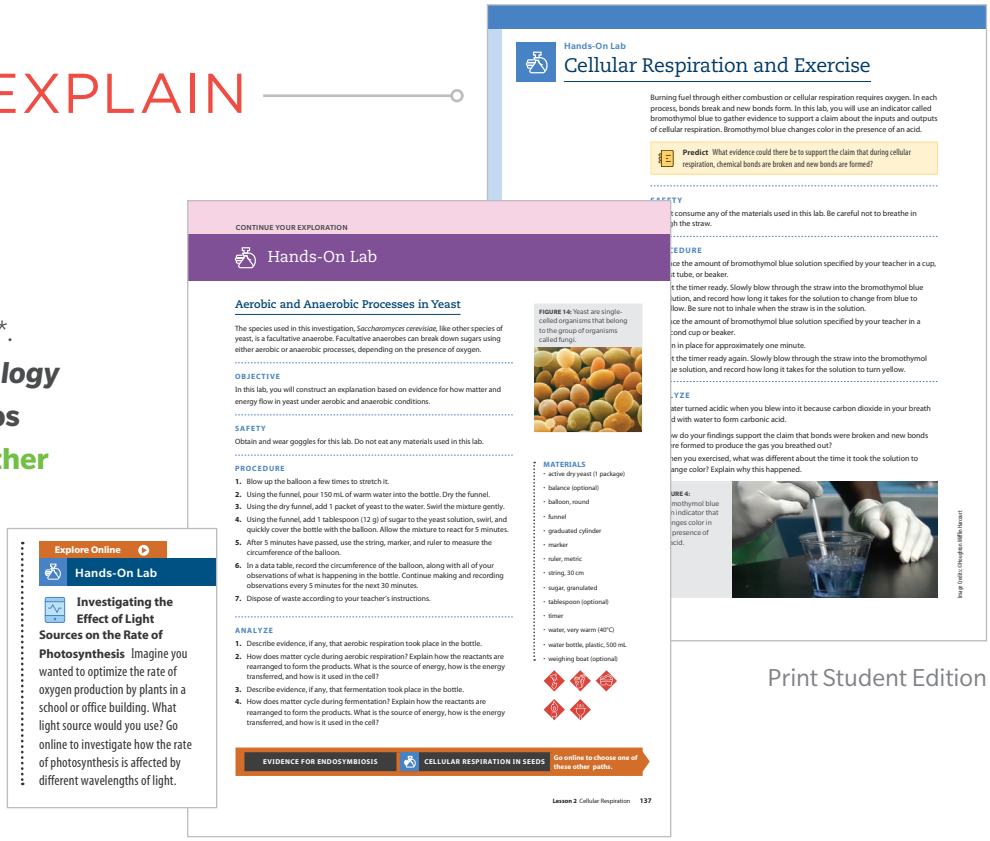
Print Student Edition

LANGUAGE ARTS CONNECTION

Carry out further research to learn more about these variations in photosynthesis. Prepare a presentation to explain the differences between C3, C4, and CAM plants. In your presentation, include information about how each type of plant carries out photosynthesis, and how these differences help plants survive in different environments. Use text, visuals, and interactive components to make the concepts in your presentation engaging and easy to understand.

EXPLORE & EXPLAIN
Hands-On Labs

Hands-On Labs are one way of addressing the Science and Engineering Practices of NGSS*. ***HMH Science Dimensions Biology*** offers plenty of **Hands-On Labs** that encourage students to **gather their own evidence**.



Print Student Edition

EXPLORE & EXPLAIN
Science Notebooks and Journals

While completing the variety of data gathering activities within a lesson, students are often prompted to **Model, Gather Evidence, Explain,** and **Analyze** their findings. These writing prompts encourage students to act like scientists by handling data like a scientist.

MODEL

Draw a plant and label the inputs and outputs of photosynthesis. Where should the labels for enzymes and light be placed?

GATHER EVIDENCE

What information do scientists need in order to determine how much energy is converted into biomass at different trophic levels?

EXPLAIN

Summarize the evidence that you have gathered to explain how bonds are rearranged and energy is transferred in the process of cellular respiration.

1. Cite evidence to support the claim that bonds are broken and new bonds are formed in each stage of cellular respiration.
2. Explain how energy is transferred from the bonds of food molecules to cellular processes.

ANALYZE

Is energy conserved in this system? In your analysis, use the amount of energy transferred to explain why the energy model is shaped like a pyramid.

ELABORATE

Take It Further and Continue Your Exploration

To promote interest in science and prepare students for college and careers in engineering and science, we've added a **Take It Further** or **Continue Your Exploration** feature to EVERY lesson. These features **relate science to students' own lives and futures**, inspiring their interest in STEM. The **Guided Research** feature provides students with tips on how to consider research questions, analyze evidence, and prepare responses in the forms of presentations or papers, thus further strengthening their language arts skills.

CONTINUE YOUR EXPLORATION

Guided Research

Evaluating Solutions to Human Impacts

Scientists and engineers are working to develop solutions to human impacts on the hydrologic and biogeochemical cycles. Burning fossil fuels for energy has one of the largest impacts on these cycles. Finding alternatives to fossil fuel energy is key to decreasing human impact and making lasting changes.

Currently engineers and scientists are investigating solar, wind, water, biological, and geothermal energies as potential alternatives to fossil fuels. You may have already heard of wind and solar farms. Scientists must ask many questions when they consider implementing new energy sources such as these, including:

- **Costs** - Is the solution cost effective? Can a similar solution be reached in a less costly manner without losing quality?
- **Safety** - Is the solution safe for humans and other living things?
- **Reliability** - Is the solution going to hold up over time in the given conditions? Will it need large amounts of upkeep to be maintained over time?
- **Aesthetics** - Does the solution add to or detract from the natural visual beauty of the area?
- **Social and cultural impacts** - How does the solution impact human societies and cultures? Are there any concerns about these impacts?
- **Environmental impacts** - How does the solution impact the environment? Are there any concerns about these impacts?
- **Meeting criteria** - Does the solution solve the problem and meet the needs of those who will use the new energy source?
- **Evidence to support the solution** - How well does the evidence provided support the claims that are being made about this solution and how it will work?

FIGURE 14: These wind turbines capture energy from the wind and convert it to electricity. Wind energy is an alternative to energy from fossil fuels.

Language Arts Connection
Choose an alternative energy source and research how it impacts the biogeochemical and hydrologic cycles or how it reduces human impact on these cycles. Write a blog entry detailing your research. Explain how the alternative energy source will work for human populations in terms of its trade-offs, such as cost, reliability, and impact on society and the environment. Gather evidence from multiple sources and describe specific evidence from each source.

THE LUNGS OF THE PLANET | NITROGEN FIXATION | Go online to choose one of these other paths.

Image Credits: ©Malcolm Fife/Photodisc/Getty Images

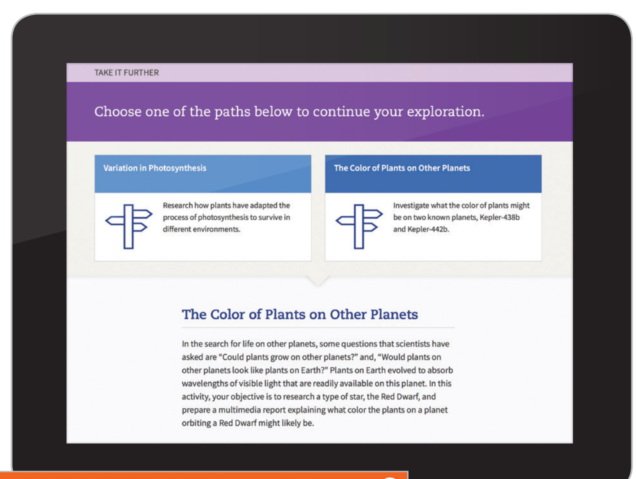
168 Unit 3 Matter and Energy in Living Systems

Print Student Edition

DIGITAL ADVANTAGE

Student's Choice: Take It Further

Digital delivery allows for more student choice than in print. Nowhere is this more evident than the **Take It Further** and Continue Your Exploration (Elaborate) portion of the lesson. Online, students have **several options to choose from**, one of which is sure to capture their interest.



Tip **Use Media in a Presentation**

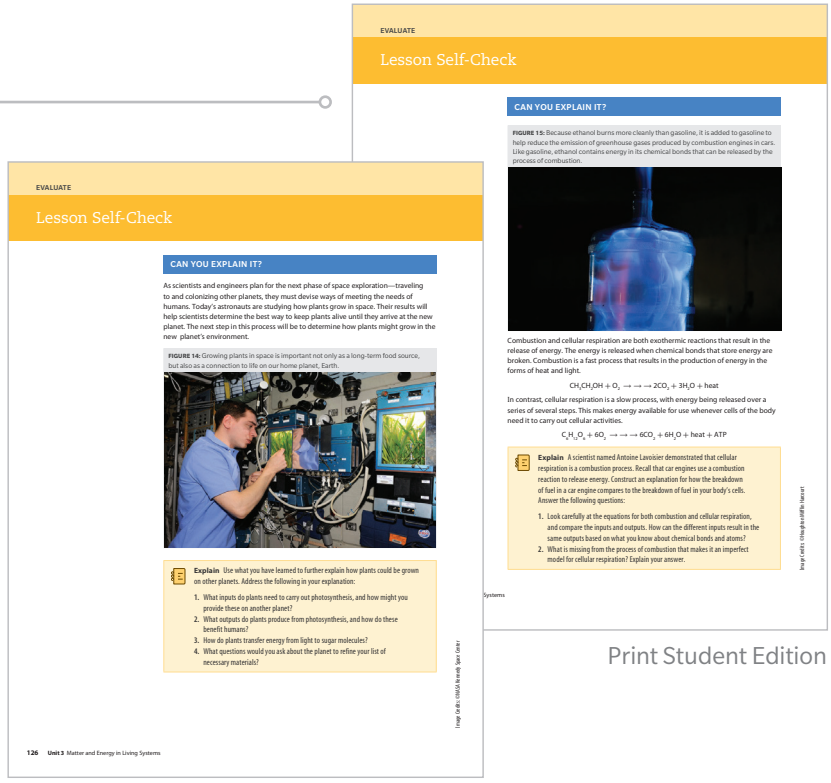
A multimedia presentation combines text, sounds, and images. A successful multimedia presentation includes:

- a clear and consistent focus
- ideas that are presented clearly and logically
- graphics, text, music, video, and sounds that support key points
- an organization that is appropriate to it's purpose and audience

EVALUATE

Lesson Self-Check

All the students' learning experiences come together in the Evaluate section. Students revisit the puzzling occurrence or intriguing problem they made a claim about in the Engage section. As students progress through the lesson, they gathered evidence throughout the Explore and Explain sections. When they reach Evaluate, students return to their **claim** and evaluate the **evidence** they gather. They **reason** how the evidence supports or challenges their claim, thereby strengthening their understanding of the science.



Print Student Edition

DIGITAL ADVANTAGE

Formative Assessment with Instant Feedback

Online delivery of assessments can provide **instant feedback**. This allows learners to truly take charge of their learning by monitoring their progress while actively engaging with the lesson.

Interactive Online Student Edition

Scaffolded Formative Assessment

Online learning allows scaffolded formative assessment. By responding to questions with limited-response options, students gradually increase their understanding of concepts. In these examples, students are given a choice of answers or an example of a possible answer.

EVALUATE

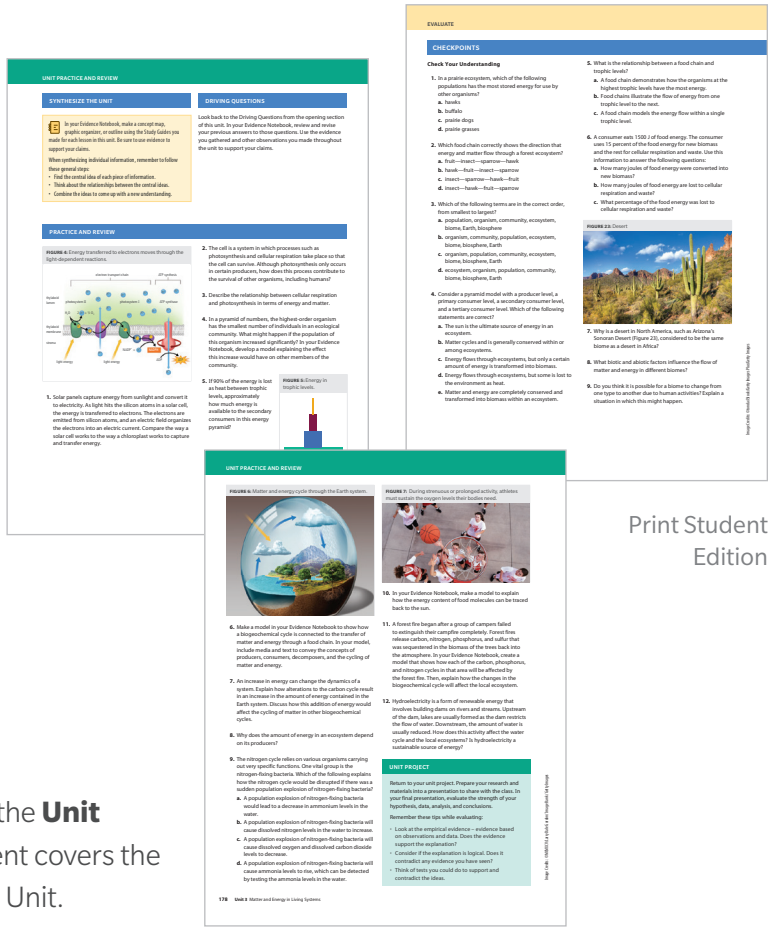
Formative Assessment

Lesson Formative Assessment

The interactive nature of the lessons provides constant formative assessment, but additional formative assessment is provided in the **Self-Check** and **Checkpoints** at the end of each lesson. As is true throughout the program's lessons, the assessment **fully integrates all three dimensions** of science learning—Crosscutting Concepts, Disciplinary Core Ideas, and Science and Engineering Practices.

Unit Formative Assessment

At the end of each Unit, learners have access to the **Unit Practice and Review**. This formative assessment covers the same three dimensions of learning for the entire Unit.



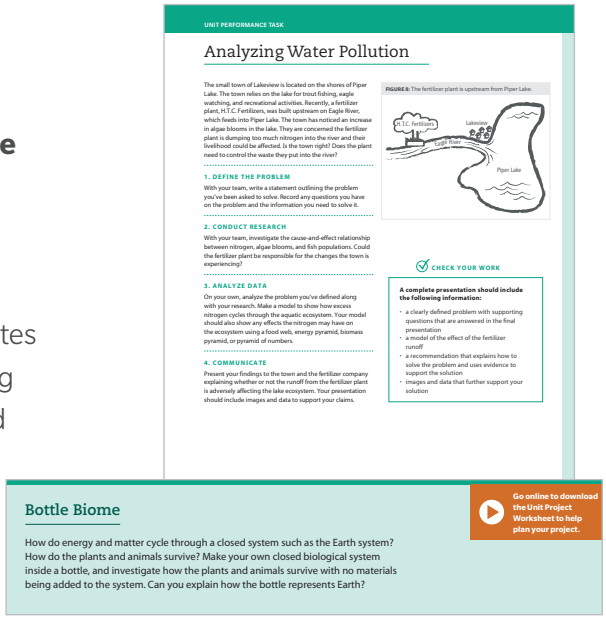
Print Student Edition

Summative Assessment

Each Unit includes a **Unit Project** and a separate **Performance Task** so students can demonstrate the **NGSS* Performance Expectation** competency using the **Claims/Evidence/Reasoning** approach they practiced using in the lessons.

The authentic and practical application of student learning creates a full three-dimensional science learning experience, addressing Science and Engineering Practices, Disciplinary Core Ideas, and Crosscutting Concepts.

Many performance-based activities are designed around STEM applications and the Engineering Design Process.

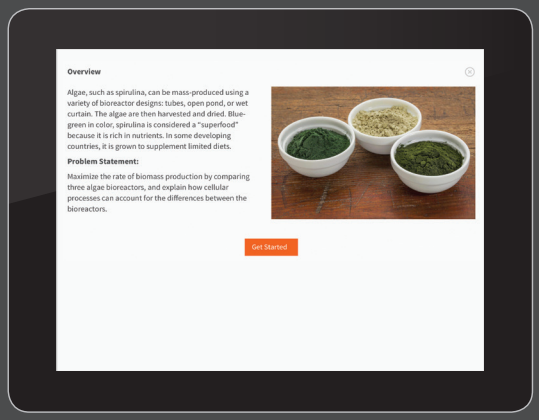


Unique Digital Simulations Reinforce Three-Dimensional Learning and Claims/Evidence/Reasoning

DIGITAL ADVANTAGE

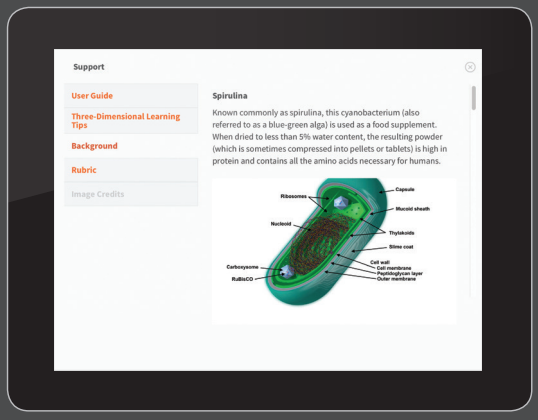
You Solve It! Open-ended Simulations

You Solve It! simulations involve a rich data-gathering or problem-solving exploration that goes far beyond requiring merely a single right answer. Available as part of the digital path, these unparalleled NGSS-centric open-ended simulations support the **Claims/Evidence/Reasoning** instructional model and allow students to answer questions and solve problems in their own way.



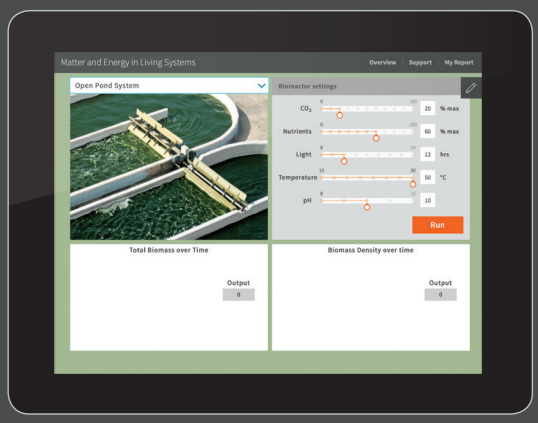
Overview

This provides context and some basic instructions on using the open-ended simulation.



Support

The Support section reminds students of the NGSS connections, such as relevant SEPs, DCIs, and CCCs. It also provides helpful background information and instruction on how to control the simulation.



Simulation

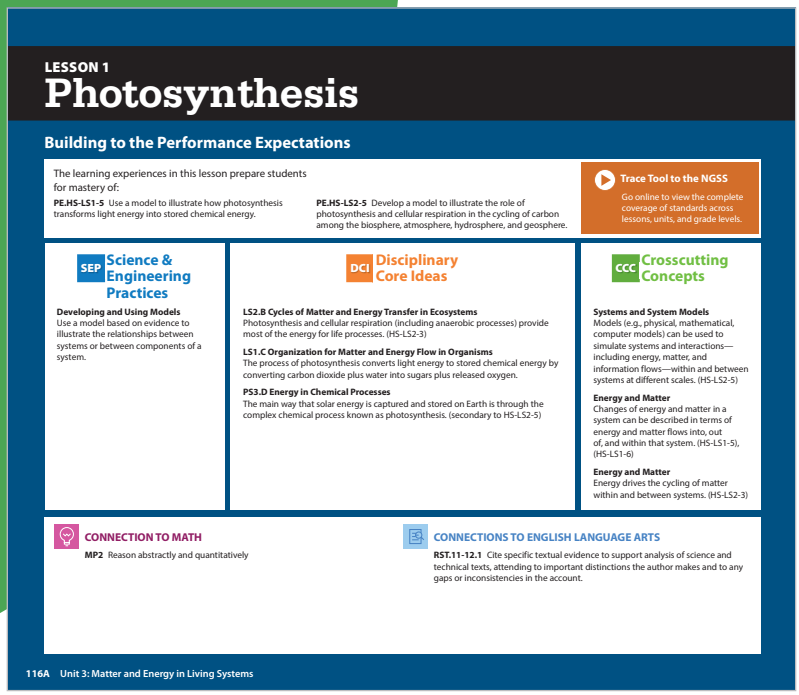
This open-ended simulation gives students FULL control. They make their own choices on how to gather evidence or achieve a solution.

Notes/Report

Students can jot notes about their evidence and reasoning for later creating a report about their claim. They can restart their work at home or on the go when they log into their online Student Edition with any compatible device.

The Teacher Edition—Your NGSS Companion

The Teacher Edition is designed to easily guide you through an NGSS* lesson organized around the 5E model.


LESSON 1
Photosynthesis

Building to the Performance Expectations

The learning experiences in this lesson prepare students for mastery of:

PE.HS-LS1-5 Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy.

PE.HS-LS2-5 Develop a model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere.

Trace Tool to the NGSS
Go online to view the complete coverage of standards across lessons, units, and grade levels.

SEP Science & Engineering Practices

Developing and Using Models
Use a model based on evidence to illustrate the relationships between systems or between components of a system.

DCI Disciplinary Core Ideas

LS2.B Cycles of Matter and Energy Transfer in Ecosystems
Photosynthesis and cellular respiration (including anaerobic processes) provide most of the energy for life processes. (HS-LS2-3)

LS1.C Organization for Matter and Energy Flow in Organisms
The process of photosynthesis converts light energy to stored chemical energy by converting carbon dioxide plus water into sugars plus released oxygen.

PS3.D Energy in Chemical Processes
The main way that solar energy is captured and stored on Earth is through the complex chemical process known as photosynthesis. (secondary to HS-LS2-5)

CCC Crosscutting Concepts

Systems and System Models
Models (e.g., physical, mathematical, computer models) can be used to simulate systems and interactions—including energy, matter, and information flows—within and between systems at different scales. (HS-LS2-5)

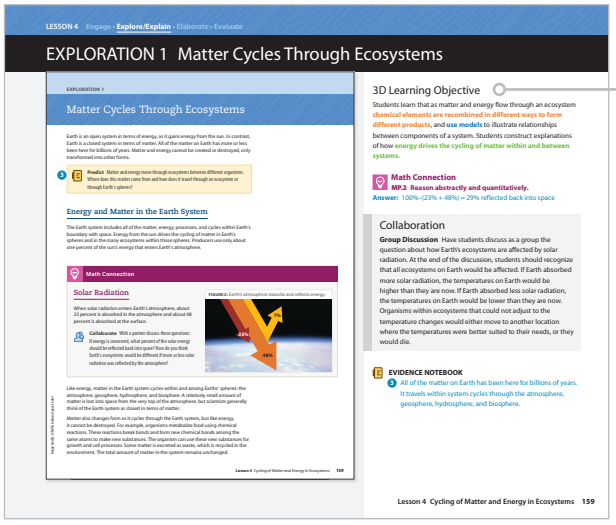
Energy and Matter
Changes of energy and matter in a system can be described in terms of energy and matter flows into, out of, and within that system. (HS-LS1-5), (HS-LS1-6)

Energy and Matter
Energy drives the cycling of matter within and between systems. (HS-LS2-3)

CONNECTION TO MATH
MP2 Reason abstractly and quantitatively

CONNECTIONS TO ENGLISH LANGUAGE ARTS
RST.11-12.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.

116A Unit 3: Matter and Energy in Living Systems


LESSON 4 Engage · Explore/Explain · Elaborate · Evaluate

EXPLORATION 1 Matter Cycles Through Ecosystems

Matter Cycles Through Ecosystems

Energy and Matter in the Earth System

Math Connection

Solar Radiation

3D Learning Objective

Students learn that as matter and energy flow through an ecosystem chemical elements are recombined in different ways to form different products, and use models to illustrate relationships between components of a system. Students construct explanations of how energy drives the cycling of matter within and between systems.

Math Connection
MP.2 Reason abstractly and quantitatively.
Answer: 100%–(23% + 48%) = 29% reflected back into space

Collaboration
Group Discussion Have students discuss as a group the question about how Earth's ecosystems are affected by solar radiation. At the end of the discussion, students should recognize that all ecosystems on Earth would be affected. If Earth absorbed more solar radiation, the temperatures on Earth would be higher than they are now. If Earth absorbed less solar radiation, the temperatures on Earth would be lower than they are now. Organisms within ecosystems that could not adjust to the temperature changes would either move to another location where the temperatures were better suited to their needs, or they would die.

EVIDENCE NOTEBOOK
1 All of the matter on Earth has been here for billions of years. It travels within system cycles through the atmosphere, geosphere, hydrosphere, and biosphere.

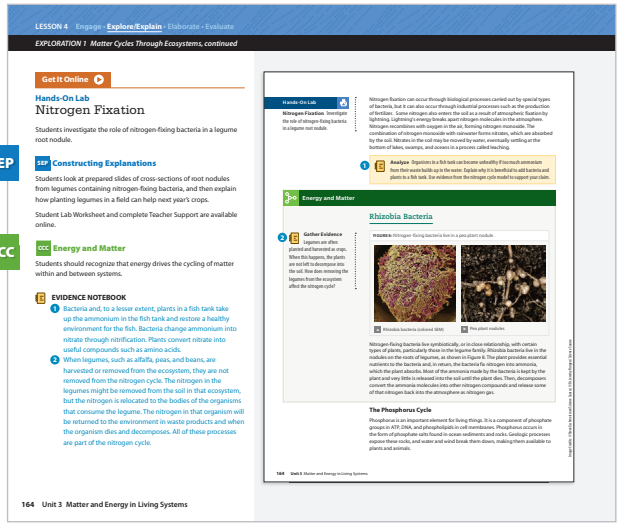
Lesson 4 Cycling of Matter and Energy in Ecosystems 159

3D Learning Objectives

Using the program's customized 3D Learning Objective and clearly labeled Disciplinary Core Ideas, Crosscutting Concepts, and Science and Engineering Practices, educators can keep track of the specific standards that students are covering at any given point in the lesson.

3D Learning Objective

Students learn that as matter and energy flow through an ecosystem **chemical elements are recombined in different ways to form different products**, and **use models** to illustrate relationships between components of a system. Students construct explanations of how **energy drives the cycling of matter within and between systems.**


LESSON 4 Engage · Explore/Explain · Elaborate · Evaluate

EXPLORATION 1 Matter Cycles Through Ecosystems, continued

Get It Online

Hands-On Lab
Nitrogen Fixation

Students investigate the role of nitrogen-fixing bacteria in a legume root nodule.

SEP Constructing Explanations

Students look at prepared slides of cross-sections of root nodules from legumes containing nitrogen-fixing bacteria, and then explain how planting legumes in a field can help next year's crops.

Student Lab Worksheet and complete Teacher Support are available online.

CCC Energy and Matter

Students should recognize that energy drives the cycling of matter within and between systems.

EVIDENCE NOTEBOOK
1 Bacteria and, to a lesser extent, plants in a fish tank take up the ammonium in the fish tank and restore a healthy environment for the fish. Bacteria change ammonium into nitrate through nitrification. Plants convert nitrate into useful compounds such as amino acids.
2 When legumes, such as alfalfa, peas, and beans, are harvested or removed from the ecosystem, they are not removed from the nitrogen cycle. The nitrogen in the legumes might be removed from the soil in that ecosystem, but the nitrogen is relocated to the bodies of the organisms that consume the legume. The nitrogen in that organism will be returned to the environment in waste products and when the organism dies and decomposes. All of these processes are part of the nitrogen cycle.

Hands-On Lab
Nitrogen Fixation

Energy and Matter

Rhizobia Bacteria

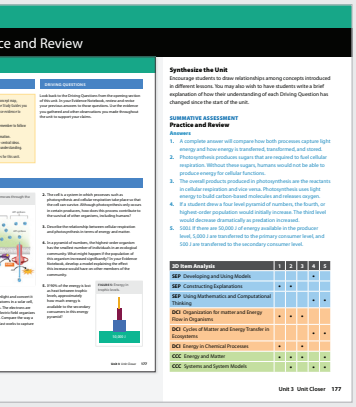
Gather Evidence

The Phosphorus Cycle

164 Unit 3 Matter and Energy in Living Systems

3D Item Analysis

The 3D Item Analysis in the Unit Review identifies the associated Three Dimensions of Learning for EACH review question. This helps educators assess students' knowledge of each component of the Next Generation Science Standards.



3D Item Analysis	1	2	3	4	5
SEP Developing and Using Models				•	
SEP Constructing Explanations	•	•			
SEP Using Mathematics and Computational Thinking				•	•
DCI Organization for matter and Energy Flow in Organisms	•	•	•		
DCI Cycles of Matter and Energy Transfer in Ecosystems				•	•
DCI Energy in Chemical Processes	•		•		
CCC Energy and Matter	•	•	•		•
CCC Systems and System Models		•		•	•

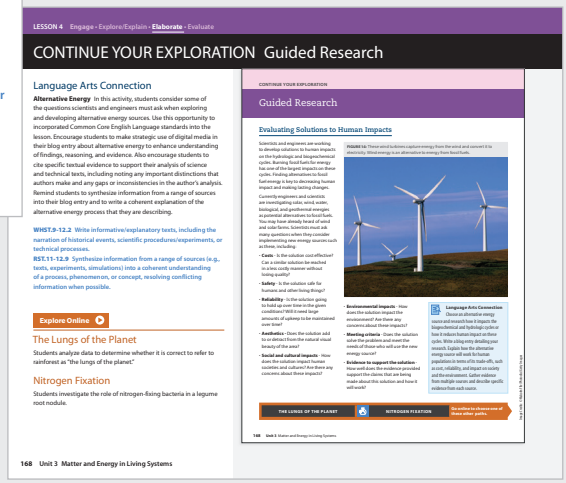
Common Core State Standards

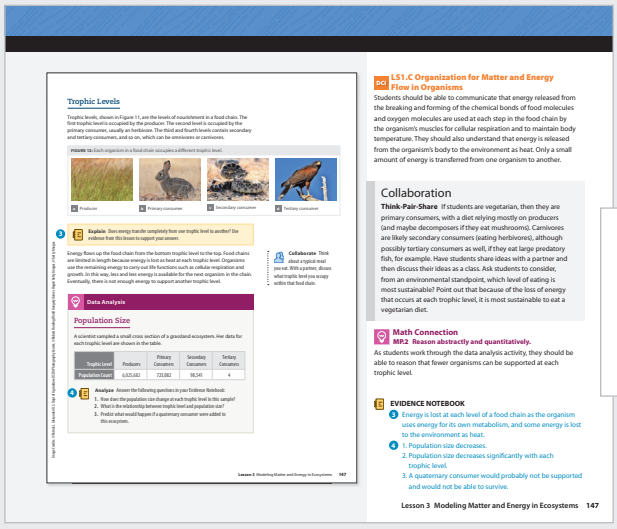
For added convenience, many of the Math and ELA features in the lessons identify the Common Core State Standards that are referenced by NGSS.

Language Arts Connection

Alternative Energy In this activity, students consider some of the questions scientists and engineers must ask when exploring and developing alternative energy sources. Use this opportunity to incorporated Common Core English Language standards into the lesson. Encourage students to make strategic use of digital media in their blog entry about alternative energy to enhance understanding of findings, reasoning, and evidence. Also encourage students to cite specific textual evidence to support their analysis of science and technical texts, including noting any important distinctions that authors make and any gaps or inconsistencies in the author's analysis. Remind students to synthesize information from a range of sources into their blog entry and to write a coherent explanation of the alternative energy process that they are describing.

WHST.9-12.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.
RST.11-12.9 Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.





Math Connection

MP.2 Reason abstractly and quantitatively.

As students work through the data analysis activity, they should be able to reason that fewer organisms can be supported at each trophic level.

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