

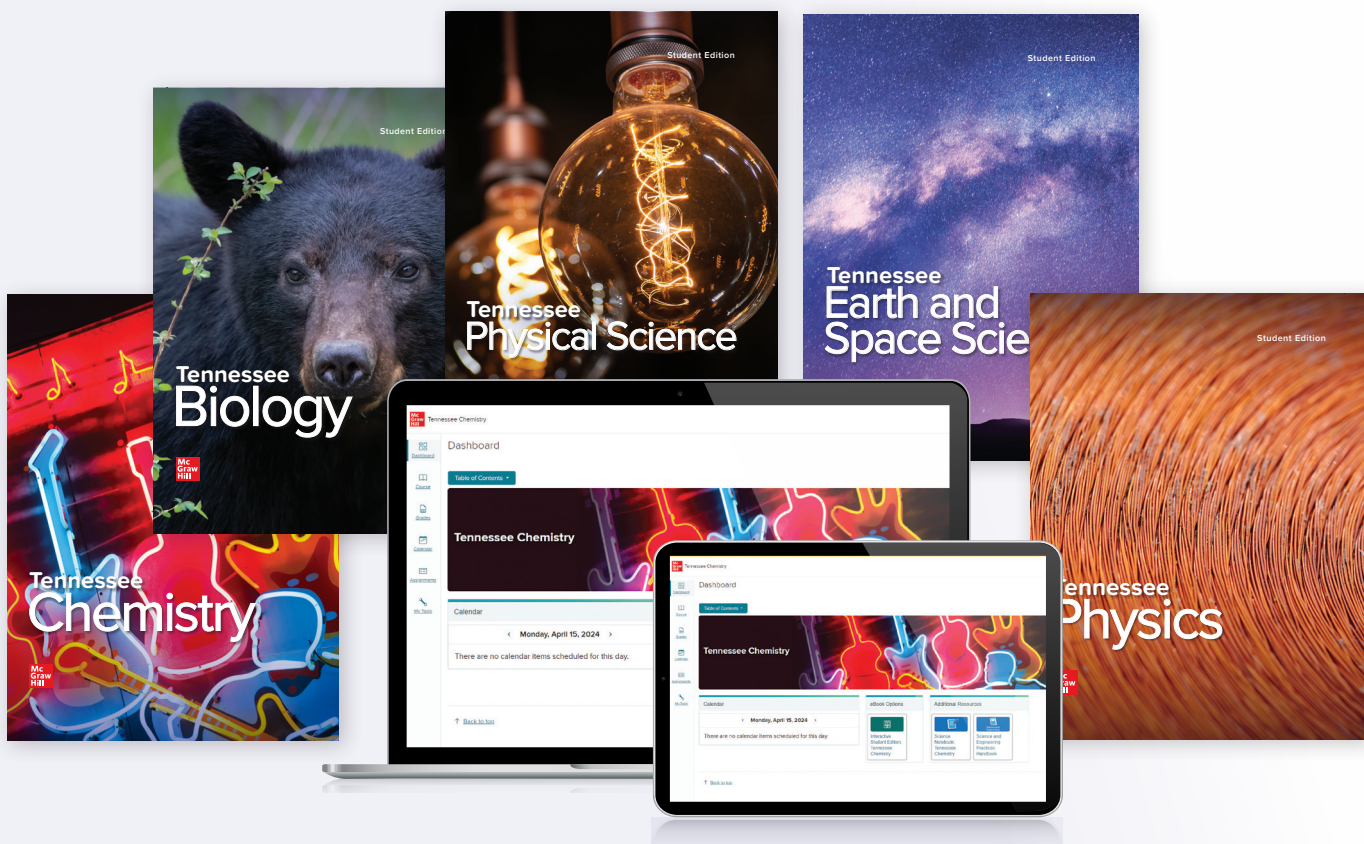


Program Overview
High School Series

Tennessee Science

High School Series

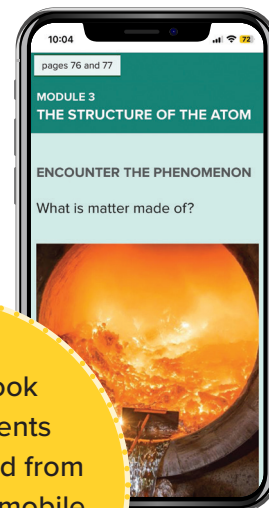
Biology • Chemistry • Physics
Earth and Space • Physical Science



Welcome to *Tennessee Science* High School Series

Engaging, Flexible, Cross-Curricular Learning

Designed with the Tennessee Academic Standards for Science in mind, *Tennessee Science* provides the structure for students to develop a solid background of foundational science knowledge while they learn to practice problem solving and critical thinking skills inherent in science.



Student eBook and assignments can be accessed from anywhere on a mobile device using the K-12 Portal App!



Develop Students to Become Critical Thinkers and Problem Solvers

Our *Tennessee Science* High School Series—including Tennessee Biology, Tennessee Chemistry, Tennessee Earth & Space Science, Tennessee Physical Science, and Tennessee Physics—provides an in-depth, collaborative, and project-based learning experience designed to interest students and empower them to ask questions and think critically. A new generation of innovators is ready to take on today's challenges to become tomorrow's scientists. **Are you ready to help guide them to be prepared to meet the problem-solving demands of the 21st Century?**

Designed to Meet Tennessee Academic Standards for Science

Tennessee Science ensures that Tennessee educators have the resources and tools to deliver high-quality instruction to help students meet the rigor and challenge of the Tennessee Academic Standards for Science.

Comprehensive Tennessee Academic Standards for Science Planning

At the beginning of each module, Tennessee Academic Standards for Science codes and descriptions help teachers quickly see performance expectations addressed in the module.

Three Dimensions at a Glance Building to Tennessee Academic Standards

Use this chart to identify the focus of the three dimensions that build to the Tennessee Academic Standards expectations within the module.

Module 5: Biodiversity and Conservation

Tennessee Academic Standards for Science
 Students will explore content and develop skills related to the following Tennessee Academic Standards for Science. Mastery can be assessed using the associated online Applying Practices activities.

BIO1.LS2.3 Obtain, evaluate, and communicate information based on evidence to describe how the impact of varying levels of disturbance is related to the resilience of an ecosystem.		
SEP Science and Engineering Practices Engage in Argument from Evidence	DCI Disciplinary Core Ideas BIO1.LS2 Ecosystems: Interactions, Energy, and Dynamics	CCC Crosscutting Concepts Stability and Change
BIO1.LS4.5 Obtain, evaluate, and communicate information about how changes in environmental conditions may result in (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.		
SEP Science and Engineering Practices Engaging in Argument from Evidence	DCI Disciplinary Core Ideas BIO1.LS4 Biological Change: Unity and Diversity	CCC Crosscutting Concepts Cause and Effect
BIO1.LS2.4 Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.		
SEP Science and Engineering Practices Constructing Explanations and Designing Solutions	DCI Disciplinary Core Ideas BIO1.LS2 Ecosystems: Interactions, Energy, and Dynamics	CCC Crosscutting Concepts Cause and Effect

96A Module 5 • Biodiversity and Conservation

DCI BIO1.LS2 Ecosystems: Interactions, Energy, and Dynamics

BIO1.LS2.3 Obtain, evaluate, and communicate information based on evidence to describe how the impact of varying levels of disturbance is related to the resilience of an ecosystem.

CCC Stability and Change

Assign this task as weekend homework and follow up during the next class. Ask students to use the questions in their text to guide their observations. Remind students to ensure that their activities do not negatively affect the ecosystem that they are observing.

Lesson 1: Community Ecology

DCI BIO1.LS2 Ecosystems: Interactions, Energy, and Dynamics

BIO1.LS2.3 Obtain, evaluate, and communicate information based on evidence to describe how the impact of varying levels of disturbance is related to the resilience of an ecosystem.

Engage

Launch the Lesson Interactive Content can be assigned the night before class as a lesson preview, during class to spark discussion, as a resource during inquiry, or as homework.

Driving Question Board

Have students revisit the DQB to remind themselves of the Unit and Module questions. Have them identify the sticky note questions they think will be answered in this lesson. Then, have students read the **Focus Question** and add it to the DQB. Students will revisit the **Focus Question** at the end of the lesson.

Explore and Explain

Science Journal Remind students to keep records of their investigations in their Science Journals. Additionally, be sure that each reading or activity is added to the class Summary table.

Three-Dimensional Thinking The activities called out in the Student Edition will allow students to practice three-dimensional thinking. Worksheets for these activities can be found online.

Activate Prior Knowledge

Ask: *What are some changes you associate with the change of seasons? Answers may include changes in length of day, temperatures, and precipitation patterns. Why do these changes occur? The tilt of Earth's axis, lower temperature, Earth's annual revolution around the Sun, amount of rainfall, humidity, or sunlight.*

GO ONLINE

PRESENTATION Teacher Presentation: Community Ecology	INTERACTIVE CONTENT Launch the Lesson: Community Ecology
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IMPLEMENTATION OPTIONS

Presentation: Teacher-Facilitated Pathway
Use the Teacher Presentation to support classroom instruction and spark discourse. Obtain data to inform your instruction by assigning the Interactive Content, Additional Resources, and Assessment.

Interactive Content: Student-Led Pathway
Students can use the online Interactive Content, along with the Student Edition, Science Notebook, projects, and labs, to collect evidence to support their claim. They can record their evidence in their Science Journals and the class Summary Table.

GO ONLINE

INTERACTIVE CONTENT Explore and Explain: Ecological Succession
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Integrate Geology

Discourse: Engage students in a discussion of the idea that the geology of an area might make it more susceptible to disturbance. For instance, hillsides erode more quickly than level areas if all other variables are the same. Human activities might also contribute to succession.

Ask: *What would be the effect of overgrazing a grassland or clear cutting a forest? Both activities would disturb the plant community, resulting in ecological succession.*

Critical Thinking

Analyze Have students use their knowledge of pioneer species to explain why these species are often able to adapt to a greater range of tolerance than some other later species. A community of many species tends to buffer the range of some factors. Pioneer species lack such a buffer and must survive extreme ranges in factors such as heat and humidity.

CCC Stability and Change

Assign this task as weekend homework and follow up during the next class. Ask students to use the questions in their text to guide their observations. Remind students to ensure that their activities do not negatively affect the ecosystem that they are observing.

SEP Quick Practice

Obtaining, Evaluating, and Communicating Information Have the class research abnormal weather patterns for their region. Then have them summarize their findings and identify any abnormal weather pattern they have experienced. Students should present their information and identify the abiotic factors that may have contributed to the abnormal weather.

Differentiated Instruction

AI Providing structure will help students who are approaching level succeed. Review concepts from previous lessons, summarize main ideas, and model activities that students will be expected to perform.

Point of Use Standards-Based Instruction

Within the lesson, find the call outs focused on Tennessee Disciplinary Core Ideas, to focus student learning by standard as well as call outs for Cross Cutting Concepts and Science and Engineering Practices.

SEP Quick Practice

Obtaining, Evaluating, and Communicating Information Have the class research abnormal weather patterns for their region. Then have them summarize their findings and identify any abnormal weather pattern they have experienced. Students should present their information and identify the abiotic factors that may have contributed to the abnormal weather.

Optimized for Teacher Success and Student Content Mastery

Structured for flexibility, *Tennessee Science* supports experienced teachers to quickly assess what adaptations fit the needs of their classes, while new teachers or those with non-traditional certification will find a clear, recommended lesson path with necessary supporting information.

Pacing included for every lesson allow you to plan out modules.

Resource Overviews in

every module and lesson can help curriculum writers recommend specific resources to cover the Tennessee Academic Standards for Science.

PROGRAM FEATURE!

Module Planner

GO ONLINE to curate your presentations, interactive content, additional resources, and media library, and find answer keys, materials lists, rubrics, differentiated instruction, and more.

Module Resources

	Module Launch	Lesson 1	Lesson 2	Lesson 3	Module Wrap-Up
Pacing (min)	45	65	45	90	45
CER Claim, Evidence, Reasoning	Encounter the Phenomenon Make Your Claim	Collect Evidence	Collect Evidence	Collect Evidence	Revisit the Phenomenon Go Further: Data Analysis Lab
Labs and Investigations	LL: What lives here?	QI: Investigate Threats to Biodiversity	BioLab: How do we measure biodiversity? VI: Assessing Water Quality	BioLab: How can surveying a plot of land around your school help you understand the health of your ecosystem?	
Media and OER	Beyond the Classroom: Google Expedition	Beyond the Classroom: Google Expedition	Beyond the Classroom: Google Expedition		
Assess	Module Pretest	Lesson Check	Lesson Check	Lesson Check	Module Vocabulary Practice Module Test
Applying Practices		Biodiversity in Leaf Litter BIO1.LS2.1	Evaluating Impacts of Environmental Change on Populations BIO1.LS2.3	Microbeads, Mega-Problem BIO1.LS2.4 Cleaning Up an Oil Spill BIO1.LS2.4	
KEY:	LL: Launch Lab	QI: Quick Investigation	VI: Virtual Investigation	PT: Personal Tutor	

Three-Course Model

GO ONLINE If teaching a 3-course model, go online to find associated Earth and Space Science content.

Applying Practices are tied to every standard to ensure mastery throughout the module.

View the **Labs, Investigations, and Media** associated with the module to think through which will most resonate in your classroom.

Engage: In the Engage phase, students are introduced to the science topic and establish links with their existing knowledge. This stage piques their interest and fosters their curiosity, motivating them to delve deeper into the subject matter.

Explore and Explain: The Explore and Explain phase encourages students to get involved and investigate through a related, common experience. Students will carry out an investigation and collect and interpret data as they reveal answers to their questions to build understanding using different types of inquiry activities.

Lesson 1: Biodiversity

DCI BIO.1.LS2 Ecosystems: Interactions, Energy, and Dynamics

Engage

Launch the Lesson Interactive Content that can be assigned the night before class as a preview, during class to spark discussion, as a resource during inquiry, or as homework.

Driving Question Board

Have students revisit the DQB to remind themselves of the Unit and Module questions. Have them identify the sticky note questions they think will be answered in this lesson. Then, have students read the **Focus Question** and add it to the DQB. Students will revisit the **Focus Question** at the end of the lesson.

Explore and Explain

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Three-Dimensional Thinking The activities called out in the Student Edition will allow students to practice three-dimensional thinking. Worksheets for these activities can be found online.

Caption Question Fig. 1: number of spots, size.

LESSON 1: BIODIVERSITY

FOCUS QUESTION
Why is biodiversity important?

What is Biodiversity?
The loss of an entire species in a hard-to-reach habitat is just an imaginary situation. Entire species permanently disappear from the landscape when the last member of the species dies in a natural cause. **Biodiversity** is an ecosystem's variety, the variety of species in the landscape diversity, which determines the health of the ecosystem. **Biodiversity** is the variety of life in an area that is determined by the number of different species in that area. It is measured by the number of species and diversity by the size of species (individuals). Biodiversity increases the ability of an ecosystem and contributes to the health of the landscape. There are three types of biodiversity to consider: genetic diversity, species diversity, and ecosystem diversity.

Genetic diversity
The variety of genes or inheritable characteristics that are present in a population compares to **genetic diversity**. Figure 1 shows characteristics that are shared by Arvicola field mice, such as ground squirrels.

Figure 1 These Arvicola field mice, ground squirrels, illustrate genetic diversity because of their inheritable traits.

Figure 2 These Arvicola field mice, ground squirrels, illustrate genetic diversity because of their inheritable traits.

Figure 3 These Arvicola field mice, ground squirrels, illustrate genetic diversity because of their inheritable traits.

Figure 4 These Arvicola field mice, ground squirrels, illustrate genetic diversity because of their inheritable traits.

Figure 5 These Arvicola field mice, ground squirrels, illustrate genetic diversity because of their inheritable traits.

Figure 6 These Arvicola field mice, ground squirrels, illustrate genetic diversity because of their inheritable traits.

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Figure 10 These Arvicola field mice, ground squirrels, illustrate genetic diversity because of their inheritable traits.

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Elaborate: Students will apply knowledge to new situations to develop a deeper understanding of the lesson concepts, use the skills they are learning, and make connections.

Lesson 1: Biodiversity

Elaborate

Return to the DQB and have students determine what questions they can answer. At this point, they should be able to answer the **Focus Question**.

Evaluate

Formative Assessment Check

Have students list and describe three types of biodiversity: genetic diversity—variety of alleles of genes present in the gene pool of a species; species diversity—number and abundance of species in a small area; ecosystem diversity—overall number of species in an ecosystem

Remediation Write the following phrases: *dogs in a neighborhood, tropical rain forest, microorganisms in a pond, vegetable garden, and students in school.*

Ask: Which type of value—does each of these represent? dogs—genetic; tropical rain forest—ecosystem; pond—species; vegetable garden—species; students—genetic

Check Your Progress

- Biodiversity maintains a healthy biosphere and provides both direct and indirect benefits to humans.
- Extinction reduces the variety of species.
- Humans depend on various species for food, medicines, clothing, and shelter.
- direct economic value—apparent and often recognized immediately; indirect economic benefit—not obvious and/or realized after time
- Scientists have analyzed only a fraction of species for the medicines they can provide. It is important to maintain biodiversity to preserve species that might prove valuable.
- Students should address measures that will conserve biodiversity, such as replanting species of plants, and keeping water sources clean.
- disadvantage—maintaining undesirable traits; advantage—increases chances of survival during times of environmental change

Formative Assessment: Lesson Check

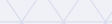
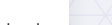
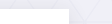
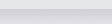
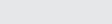
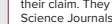
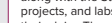
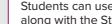
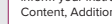
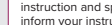
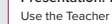
GO ONLINE You might want to assign from the Additional Resources the pre-made Lesson Check based on key concepts and disciplinary core ideas, or you can customize your own using the customization tool.

Evaluate: In the Evaluate phase, teachers gauge student progress. A question is provided to assess students' knowledge and offer remediation suggestions if additional help is needed.

GO ONLINE

PRESENTATION

Teacher Presentation: Biodiversity



The last of water shown in Figure 8 Lake Tahoe's Emerald Bay in California. This area is an ecosystem with many different species. Lake Tahoe was once pristine, but unfortunately, over time, and the effects of pollution have harmed the ecosystem's health. Invasive species such as lake trout, pond weed, and even domestic geese have also upset the lake's ecosystem. Many groups are working together to remedy their problems, and to try to keep Lake Tahoe healthy and beautiful.

There is also value in a scientific study of the environment. Such studies on the planet's past of Earth's biosphere, or study of the environment has the potential to benefit ecosystems. Attempting to solve a problem often brings diverse groups of people together. Each group can have their own ideas about how to approach the situation. Bringing together these different perspectives not only increases the likelihood of finding a solution, it can also lead to a greater understanding of their cultures or groups. Bringing together people to study the environment can also lead to the formation and development of new technologies.

Overseeing the scientific benefits of biodiversity ecosystems can be difficult for people to see or understand. However, many scientists are finding ways to show the value in protecting and studying the environment.

Check Your Progress

Summary

Biodiversity is important to the health of the biosphere.

There are three types of biodiversity: genetic, species, and ecosystem.

Biodiversity has aesthetic and scientific value, and direct and indirect economic value.

It is important to maintain biodiversity to preserve the resources of genes that might be needed in the future.

Healthy ecosystems can provide some services as a natural response to the use of technology.

Chromosomes Understanding

1. Explain why maintaining biodiversity is essential to supporting and enhancing life on Earth.

2. Explain how extinction affects biodiversity.

3. Generate why maintaining biodiversity has a direct economic value to humans.

4. Differentiate between the direct and indirect economic value of biodiversity.

5. Evaluate and discuss the importance of maintaining biodiversity for future medicinal needs.

Explain Your Thinking

6. Design a course of action for the development of a healthy ecosystem that you currently, such as choosing appropriate city parks or gardens that provides for the maintenance of biodiversity in the plan.

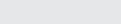
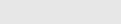
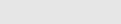
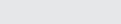
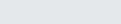
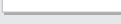
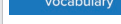
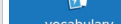
7. **CRITICAL THINKING** Bring an argument and describe the importance of maintaining genetic diversity in domesticated animals, such as dogs, cats, pigs, cattle, and chickens. Include the advantages and disadvantages in your report.

LEARNSMART Go online to follow your personalized learning path to review practice and reinforce your understanding.

GO ONLINE

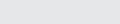
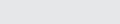
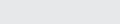
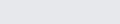
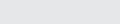
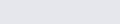
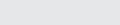
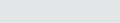
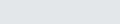
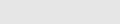
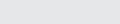
ADDITIONAL RESOURCE

Vocabulary Flashcards: Biodiversity



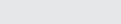
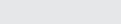
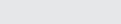
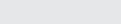
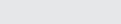
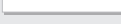
ADDITIONAL RESOURCE

Lesson Check: Biodiversity



ADDITIONAL RESOURCE

Biology LearnSmart



Teach Your Way With Phenomena-Driven 5E Lessons

The *Tennessee Science* High School Series provides two pathways for learning, teacher-facilitated and student-led. Each pathway provides teachers and students flexibility dependent on the preferred method of learning, day, or topic.

Teacher-Facilitated Pathway

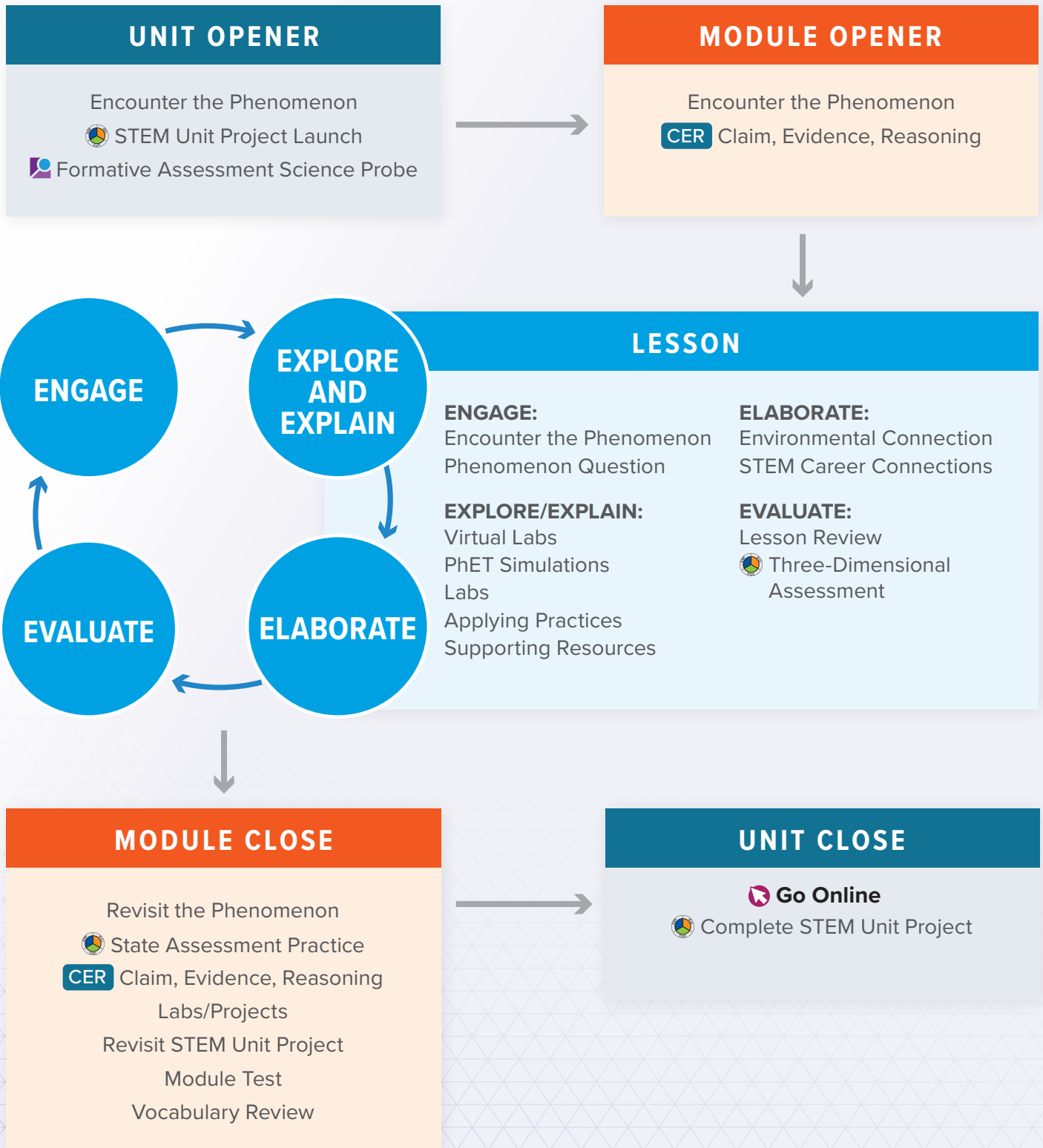
Use the Teacher Presentation to support classroom instruction and spark discourse. Obtain data to inform your instruction by assigning the Interactive Content, Additional Resources, and Assessment.



Student-Led Pathway

Students can use the online Interactive Content, along with the Student Edition, Science Notebook, and printable projects and labs, to collect evidence to support their claims and demonstrate 3D thinking.

Each *Tennessee Science* High School Series unit phenomenon sets the stage for the STEM Unit Project. Each module within the unit supports the STEM Unit Project with phenomena-driven 5E lessons to support a variety of learning pathways.



Empower Students With Inquiry-Based Learning

Investigate questions and solve problems from a variety of angles. Inquiry-driven instruction gives students the practice they need to succeed in developing solutions to whatever challenges they may encounter.

Types of Inquiry Activities

Each course in the High School Series of *Tennessee Science* includes inquiry that builds beyond hands-on activities. With *Tennessee Science*, students will investigate phenomena through several techniques reflective of the way science and engineering are done in the real world.

Symmetry
Move along the tissue branch on the evolutionary tree in Figure 9, and you will find the next branching point to be symmetry. **Symmetry** (SIF) much level describes the similarity or balance among body structures of organisms. The type of symmetry an animal has enables it to move in certain ways.

Asymmetry
The sponge in Figure 9 has no tissues and has asymmetry. It is no symmetry or balance in its body structures. In contrast, an either radial or bilateral symmetry.

Radial symmetry
An animal with **radial (RAY) symmetry** can be divided through a central axis, into roughly equal halves. The jellyfish's symmetry. Jellyfishes and most other animals with radial symmetry have two embryonic cell layers—the ectoderm and the endoderm.

Bilateral symmetry
The dolphin in Figure 9 has bilateral symmetry. In contrast to the (RAY) radial symmetry, the animal can be divided into along only one plane through the central axis. All animals with bilateral symmetry have three embryonic cell layers—the ectoderm, the mesoderm.

SCIENCE USAGE V. COMMON USAGE
plane
Science usage: an imaginary line that divides a body from top to bottom. The dog's body can be divided into its ventral and dorsal parts by a plane. Common usage: an aircraft.
The pilot flew the plane over Cleveland to Chicago.

Reading Strategy
Before students read the text under the heading **Symmetry**, put them in groups of three or four and have them agree on a definition of the term **symmetry**. Once they have discussed that definition, have students read the text under the heading **Symmetry**. Students should then compare their definition to what they have read in the text.

Demonstration
Symmetry Bring in household items such as a bowl, a fork, a spoon, and a straight drinking straw.

Ask: What kind of symmetry does the bowl and straw have? **radial symmetry**. Show them the fork and spoon. What kind of symmetry do these items have? **Bilateral symmetry**. Explain that symmetry is related to function in objects and animals. For example, a screwdriver with radial symmetry turns to drive in screws and an animal with radial symmetry can obtain food or perceive danger coming from any direction.

Est. time: 5 min

Illustrate
Have students read the text under the heading **Segmentation**. Then, in pairs, have them make a one-frame cartoon that depicts the advantages of segmentation to the animal mentioned in the reading. Encourage them to be creative, but to be sure to present accurate biology. They might want to make a labeling box for the animal to explain what is going on in the cartoon.

Formative Assessment Check
Make three transparent or plastic copies of the three body plans shown in Figure 9. (Page 548 is available electronically in the Teacher Center online.) Use your images (do not contain captions or labels). Project the images for the students to see. For each image:

Ask: What body plan does this represent? **Asymmetry** should reflect the body plan shown.

Redirection: Have students make color diagrams of cross-sections of amoebae, parameciums, and colonial body plans, using the same color as the best for the endoderm, ectoderm, and mesoderm.

Writing Support
Creative Writing: Have students write a narrative and descriptive story for children about the life cycle of a marine gastropod, noting its basic physical characteristics and its habitat. Make sure to include a list of predators that could include an in or a list of any that might become its food. Include when you are learning about the biology of fishes in your story.

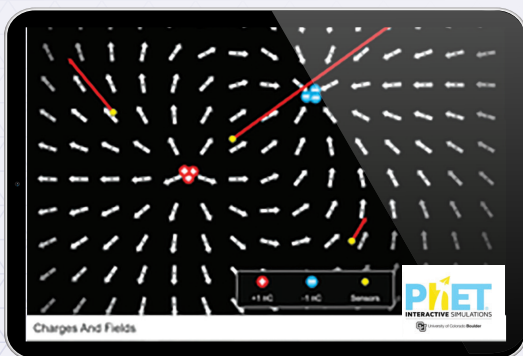
Rubric: Use the rubric table found online on your Teacher Center to assess writing assignments.

Caption Question Fig. 12: dorsal tubular nerve cord, metanephros, protonephros, posterior tail, and a three-part girdle.

Lesson 2 • Animal Body Plans 439

Engineering

Demonstrations & Hands-on Activities



Simulations

Exploring Macromolecules

Introduction
Life on Earth is based on carbon and carbon compounds. Small carbon compounds serve as the where building blocks for larger macromolecules. Recall that there are four major groups of biological macromolecules: carbohydrates, lipids, proteins, and nucleic acids. In this activity, you will explore the different types of macromolecules and the structure of their subunits.

Task
Your task is to use a molecular modeling kit to create a macromolecule subunit and to research how the subunit combines with other subunits to form a macromolecule. You will use this research and your model to create a presentation to demonstrate how subunits combine to form a major biological macromolecule. To begin, work in groups of 3 or 4 to create a model of a monosaccharide, nucleotide, amino acid, or fatty acid.

Process
Use your resources to answer the following questions.

- What are the unique characteristics of the macromolecule subunit and macromolecule you explored?
- Describe how the subunit you modeled chemically combines with other subunits to form a macromolecule.
- What are the functions of the macromolecule you explored?

Assessment
The following rubric is used to assess your research and presentation.

	0	5	10	15	Points
Task	The subunit was not completed.	Some effort was made to complete the subunit, but the major pieces are missing.	The subunit was completed but some information was omitted or incorrect.	The subunit was completed with great attention to detail.	
Process	The process was not followed.	The process was begun but not all questions were answered.	The process was thorough but some answers were incorrect.	The project showed thorough research and a deep understanding of the topic.	
Assessment	There was no attempt to create a presentation.	There was minimal effort made in the presentation.	There was good material and ideas in the presentation.	The presentation was accurate, and showed knowledge of the topic.	

Score

Applying Practices - Exploring Macromolecules

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Research

Hands-On Inquiry

Tennessee Science is centered around inquiry. The program provides several opportunities in each module for student exploration.

All inquiry activities in *Tennessee Science* promote student engagement and allow each student to develop inquiry, science, and engineering skills. Activities range from simple investigations to more complex lab explorations, and cover the full range of the inquiry spectrum.

Investigations offer students the ability to quickly dive into a topic with simple questions in single or group settings. Lab activities provide more complex explorations with hands-on approaches to learning.

Date _____ Period _____ Name _____

MODULE 7 Mapping

INTERPRETING A RIVER'S HABITS

All stream systems generally start from rain running off the land. A stream develops farther, depending on the amount of available water, the slope of the land, and the underlying type of bedrock. Fast-moving streams follow a straighter path than do slow-moving streams, which tend to form meanders. Oxbow lakes often form from meandering streams and rivers. Below is a topographic map of the Sverre River valley in north-central North Dakota. This area was under a continental glacier during the ice ages. The surface is largely covered with moraine deposits.

Photo Credit: U.S. Geological Survey

Name _____

Mapping

continued

PREPARATION

Problem
What information can a topographic map provide about a river and its surroundings?

Materials
None

Objectives

- Use a topographic map to answer questions about a river and its valley.

PROCEDURE

- The topographic map has a contour interval of 1 foot. The scale is 1 inch for 2000 feet. Study the map and answer Questions 1–4 in the table.
- The river drops about 2 feet in elevation across the map. Determine the gradient and answer Question 5.
- Examine the bend(s) of the river. Notice that the contour lines along the river run one way or another. This indicates that natural levees occur and that at some places they are at least 5 feet high. Answer Questions 6–10.
- Notice that there are numerous elongated depressions in the floodplain. Answer Question 11.
- Examine the structure across the top of the map in sections 12, 13, and 14. Answer Questions 12 and 13.

Date _____ Period _____ Name _____

MODULE 4 Investigation

COMPARING LUNAR ROCKS TO EARTH ROCKS

Igneous rocks form when molten rock called magma or lava cools. Igneous rocks are classified by mineral composition and texture. Their mineral composition indicates the nature of the magma. Texture indicates how the magma cooled. Rocks collected from the Moon have characteristics like those of igneous rocks on Earth. These characteristics provide insight about the composition of the Moon and how it was formed.

PREPARATION

Problem
How do lunar rocks compare with Earth rocks?

Materials
Igneous rocks from Earth
Igneous-rock key
Pieces of lunar rocks

Objectives

- Estimate mineral percentages in igneous rock samples.
- Identify types of igneous rocks.
- Compare lunar rocks to Earth rocks.

Safety Precautions
Use caution when handling rock samples on the table. Do not wear sandals during the lab procedure.

IGNEOUS-ROCK KEY

% Silica		Mineral Composition		Grain Size	
High	Low	Light-colored	Dark-colored	Small	Large
Granite	Diorite	Basalt	Andesite	Granite	Basalt
Rhyolite	Andesite	Basalt	Andesite	Granite	Basalt
Rhyolite	Andesite	Basalt	Andesite	Granite	Basalt
Rhyolite	Andesite	Basalt	Andesite	Granite	Basalt

Name _____

Investigation

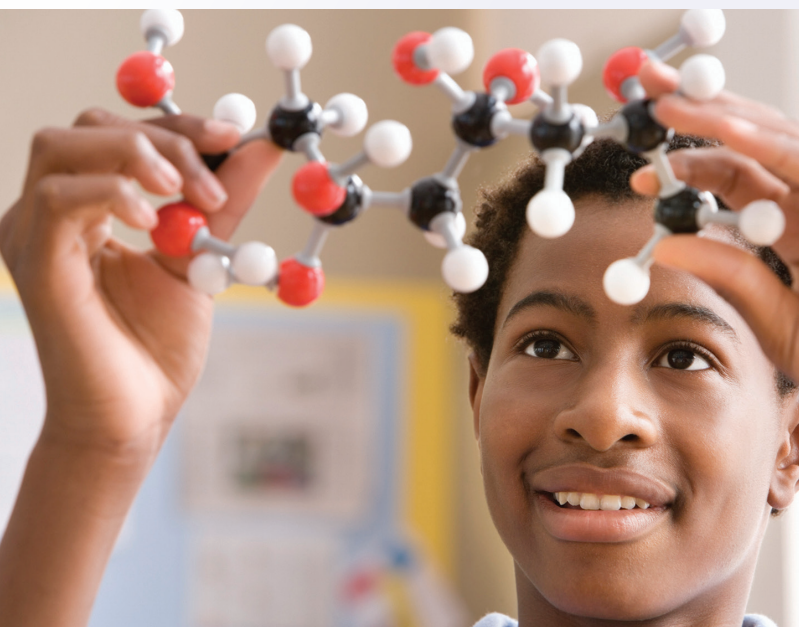
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PREPARATION

- Observe a rock sample provided by your teacher and determine whether the texture is fine-grained or coarse-grained. Record this data in the table.
- Estimate and record the percentage of dark minerals. This percentage will allow you to identify the rock in table 1. Use dark minerals (more than 70 percent dark minerals, very dark or black).
- Estimate and record the percentage of light-colored minerals. Classify the silicate as plagioclase (pink, white, or gray) or pyroxene (white or gray with minerals).
- Estimate and record the percentage of quartz. If the sample has one quartz, it belongs in the plagioclase group. If it has less than 10 percent quartz, it belongs in the dark-colored group. If it has 10–40 percent quartz, it belongs in the granite-diorite group.
- Using the igneous-rock key on page 53, identify the unknown igneous-rock sample. Write the correct name of the sample in the table.
- Repeat steps 1–5 for the other rock samples.
- Look at pictures of lunar rocks, and use your observations to answer the questions. Analyze and Conclude and Apply.

DATA AND OBSERVATIONS

Rock Sample	Texture	Estimated % of Dark Minerals	Color, Make, or Identification	Name of Rock
1				
2				
3				
4				



The Tennessee Science Inquiry Spectrum

Not all inquiry activities are the same. Depending upon the available time and student readiness, structured inquiry might be perfect, or your class may be ready for open inquiry. The *Tennessee Science Inquiry Spectrum* provides flexible options to adjust the inquiry level to align with the learning needs of each student.

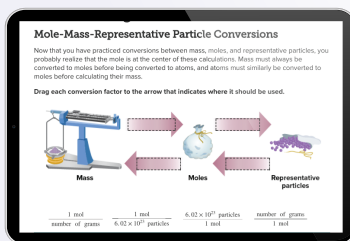
Teach Your Way With Innovative Digital Resources

Transport students beyond the walls of your classroom with cutting-edge digital content, including interactives, simulations, videos, and more.

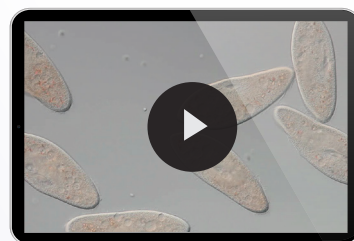
Fun and easy-to-use, these features align with lesson topics to spark scientific curiosity, support discussion, enhance review, and deepen understanding.

Why Go Online?

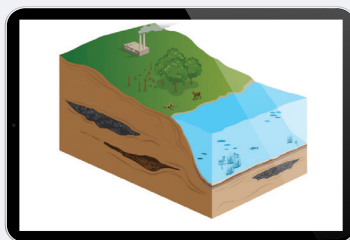
- Engaging Interactive Content
- Science Content Videos
- Text Read Aloud and Highlighting Features
- Dynamic Search Tools



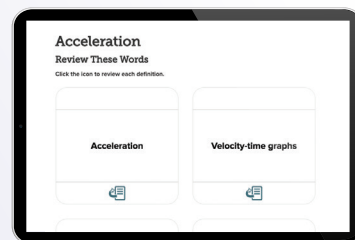
Drag and Drop activities offer students the chance to manipulate new concepts.



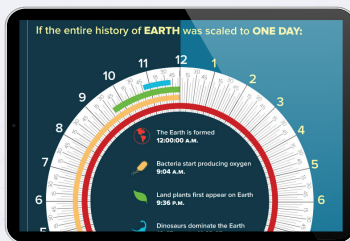
Phenomena videos showcase ultra-engaging, content-related examples of science in real life.



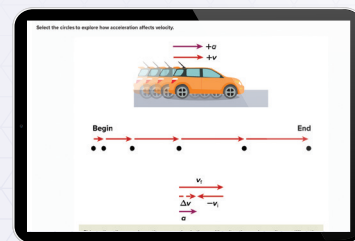
Simulations allow students to manipulate variables in a scenario beyond the limits of the classroom.



Vocabulary flashcards deliver focused support for key words.



Infographics provide an engaging graphic to foster collaborative and hands-on learning in the world surrounding them.

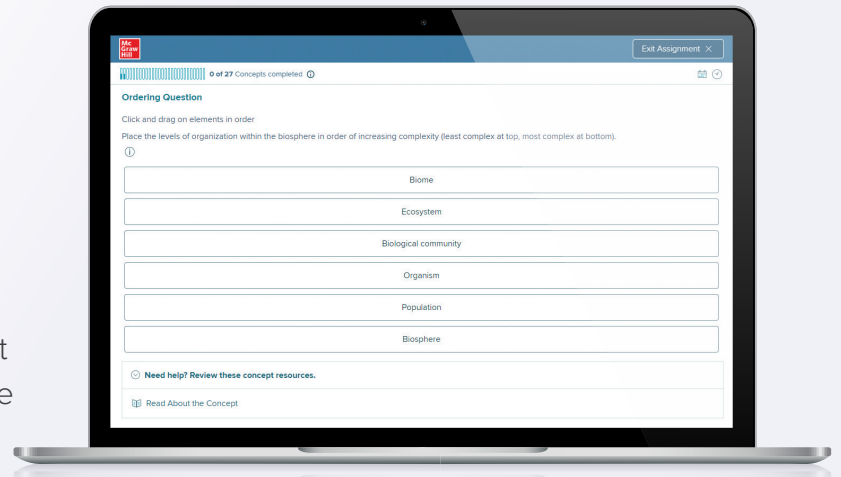


Interactive Visual Literacy features prepare students to identify visual representations of scientific phenomena.

Adaptive Learning With *SmartBook*[®]

Each student enters the classroom with different strengths, interests, and abilities. Eliminate guesswork and get to the heart of their learning needs with adaptive, comprehensive differentiation.

The secret is *SmartBook*, the first and only adaptive reading experience designed to change the way students read and learn. As the student progresses, *SmartBook* highlights the most impactful concepts the student needs to learn. When *SmartBook* detects what a student is most likely to forget, that content is presented for review to improve the student's knowledge retention.



See the duration students take to complete the assignment compared to the estimate.

Challenging concepts are revealed as students wrap up assignments, giving teachers the chance to reinforce topics before the next lesson.



Track progress on the assignment as students work through the questions.

Breakdown reporting to the individual student level.

Real-Time Reporting Tools

Find efficiencies by managing and tracking individual student progress and the progress of the whole class. Teachers can focus on what students don't understand or still need to learn, rather than what they've already mastered.

Support Every Learner

Tennessee Science incorporates the research-based Universal Design Learning Principles to ensure that all students have access to rigorous curriculum.

Support with practical strategies is found at the module and lesson level at multiple points. The Leveled text aligns with the Lexile ranges appropriate for each grade level.

Lesson 2: Motion with Constant Acceleration

SEP Quick Practice
Using Mathematics and Computational Thinking
Draw students' attention to the position with average acceleration equation.
Ask: What change should you make to this equation if you want to apply it to a time interval that does not have an initial time of zero? Replace t_i with Δt .

Clarify a Preconception
Average Acceleration and Constant Acceleration
Students might think that they can only apply the average acceleration equation for a certain time interval if the acceleration during the time interval remains unchanged. Remind students that an acceleration that does not change is constant acceleration. Average acceleration is different because it might change many times during the time interval.

GO ONLINE
INTERACTIVE CONTENT
Explore and Explain: Motion with an Initial Nonzero Velocity
INTERACTIVE CONTENT
Explore and Explain: An Alternative Equation

Applying Physics
Explain to students that when a racecar driver is trying to achieve maximum acceleration, the weight distribution and the traction of the vehicle are affected. Draw a graph that shows as acceleration increases, the weight on the front wheels decreases, while the weight on the rear wheels increases. The weight that must be placed on the front wheels in order for the tires to grip, called the traction limit, also increases during acceleration. Thus, as the force increases during acceleration, the reaction force and traction decrease in the front of the car and increase in the rear. The limit to acceleration is the point at which the traction is reached, or when the front wheels lift off the ground and there is a loss of directional control.

PRACTICE Problems
16. a. 1.0 m/s
b. -1.0 m/s
c. The ball's velocity decreased in the first case. In the second, the ball slowed to a stop and then began rolling back down the hill. See Online Solutions Manual.
17. 67 km/h east
18. 5.1 s
19. 9.0 s

CCC Crosscutting Concepts
Scale, Proportion, and Quantity Have students consider what quantities must be the same in order to have a valid set of final positions to compare.
How should the initial positions compare?
How should the time of travel compare?

Differentiated Instruction
Most students have calculated the surface area of a block by multiplying two perpendicular length measurements. Point out that any rectangular area has a dimension that is the product of the dimension displayed along the x-axis and the dimension displayed along the y-axis. In a $v-t$ graph, the x-axis displays time and the y-axis displays a rate (velocity).
The dimension of this area is $(m/s) \cdot s = m$, which is a physical quantity. Thus, the area represents a physical quantity. Have students consider another rate-time graph—one in which pay rate ($\$/h$) is plotted on the y-axis and daily hours worked in a week (h) is plotted on the x-axis. Ask students what the area of this graph represents and what its dimension, **weekly pay, dollars**.

Graph Skills On the board, sketch the graph below.

Have students explain what the displacement is for the time interval $t_1 - t_2$. The displacement is 0 m. The areas bounded by v and the t -axis during the first half and second half of the time interval are equal, which indicates equal distances traveled. However, the first displacement is positive, while the second is negative. The total displacement for the interval is the sum of two equal-sized displacements in opposite directions, which is 0 m.

70 Module 3 • Accelerated Motion

Differentiated Instruction

Robust differentiation support including guiding questions for different student levels, as well as differentiation guidance is found in the Teacher's Edition. Module and lesson level practice strategies are also found at multiple points.

English Language Support

Tennessee Science applies the best instructional practices for teaching EL students. Each module and lesson have scaffolded activities that offer students of any level of English language proficiency the opportunity to engage in academically challenging science and engineering content while supporting language acquisition.

EL Support

Support students in understanding compare/contrast structures to interpret the paragraph "Two basic cell types."

EMERGING LEVEL Ask students to highlight the two sentences that contain a comparison. Elicit the comparison words in these two sentences (one hundred times larger than, both have...but...). Create a Venn diagram together and elicit from students similarities and differences in the cells to include in the diagram.

BRIDGING LEVEL Elicit compare/contrast words from students using the classroom environment/realia. Then, direct students to use the text and images to list similarities and differences in the cells on a Venn Diagram.

Cross-Curricular Connections

Tennessee Science has been designed to seamlessly integrate science content across disciplines within each course to help students make connections within them.

By integrating Literacy and Mathematics, STEM Careers, and integrated Engineering students approach a single phenomenon from different perspectives.

CHEMISTRY Connection Refer back to the energy and biomass pyramids in **Figure 16**. At each link upward in a food web, only a fraction of the matter and energy consumed is transferred to produce growth and release

LESSON 3 Cycling of Matter

Guiding Questions

- How does matter move through biotic and abiotic parts of an ecosystem?
- Why are nutrients important to living organisms?
- What are the biogeochemical cycles of nutrients and how are they alike?

Cycles in the Biosphere

The law of conservation of mass states that matter is not created or destroyed. All new life on the Earth is built from existing atoms. Therefore, natural processes cycle matter through the biosphere. **Matter**—anything that takes up space and has mass—provides the nutrients needed for organisms to function. A **nutrient** is a chemical substance that an organism must obtain from its environment to sustain life. All organisms contain water and nutrients such as carbon, nitrogen, and phosphorus.

The exchange of matter through the biosphere is called a **biogeochemical cycle**. These cycles involve living organisms (*bio*), geological processes (*geo*), and chemical processes (*chemical*). Chemical elements that make up the molecules of organisms pass through food webs and biogeochemical cycles, combining and recombining in different ways.

CHEMISTRY Connection Refer back to the energy and biomass pyramids in **Figure 16**. At each link upward in a food web, only a fraction of the matter and energy consumed is transferred to produce growth and release

energy in cellular respiration at the higher level. Given this inefficiency, fewer organisms are found at higher levels of the food web.

Algae and plants are the lowest level of the food chain. As the matter and energy move through an ecosystem like that in **Figure 17**, some matter reacts to release energy for life functions, some is stored, and much is discarded. Regardless of how the matter and energy change, they are conserved.



Figure 17 Chemical elements are cycled through the biosphere through organisms. As producers, grasses begin the cycle by capturing energy from the Sun. Explain how chemical elements continue to be cycled through the biosphere in this photo.

APPLYING PRACTICES
When you complete this lesson, you are ready for the Applying Practices project *The Cycling of Matter and Flow of Energy in Aerobic and Anaerobic Conditions*.

DCI DISCIPLINARY CORE IDEAS
LS1.C Organization for Matter and Energy Flow in Organisms
LS2.B Cycles of Matter and Energy Transfer in Ecosystems
CCO CROSSCUTTING CONCEPT
Systems and systems models
SEP SCIENCE & ENGINEERING PRACTICES
Constructing explanations and designing solutions

Lesson 3 • Cycling of Matter 39

Latitude

EARTH SCIENCE Connection The distance of any point on the surface of Earth north or south from the equator is **latitude**. Latitudes range from 0° at the equator to 90° at the poles. Light from the Sun strikes Earth more directly at the equator than at the poles, as illustrated in **Figure 4**. As a result, Earth's surface is heated differently in different areas. Ecologists refer to these areas as "zones." Polar zones extend to about 66° from each pole, while tropical zones extend about 23° north and south of the equator. Temperate zones are found between the polar and tropical zones.

Climate

The average weather conditions in an area, including temperature and precipitation, describe the area's **climate**. An area's latitude has a large effect on its climate. If latitude were the only abiotic factor involved in climate, biomes would be spread in equal bands encircling Earth. However, other factors such as elevation, continental landmasses, proximity to mountains, and ocean currents also affect climate.

The graph in **Figure 5** shows how temperature and precipitation influence the communities that develop in an area, and help to define the various biomes. Note that there is considerable variation in temperature and precipitation in most of the biomes.

Recall that a biome is a large group of ecosystems that share the same climate and have similar types of communities. It is a group of plant and animal communities that have adapted to a region's climate and other abiotic factors.

There can be more than one ecosystem in a biome. A biome's ecosystems occur over a large area and have similar plant communities. Even a small difference in temperature or precipitation can affect the composition of a biome.

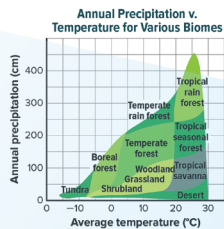


Figure 5 Temperature and precipitation are two major factors that influence the kind of vegetation that can exist in an area.

Analyze Which biome would you expect in an area that receives 200 cm of precipitation annually if the average annual temperature is 10°C?

Refer to **Figure 6** (next page) to learn how Earth's ocean currents and prevailing winds affect climate. Also illustrated in **Figure 6** are two ways humans might be affecting climate—through the hole in the ozone layer and through global warming. Global warming is in part a result of the greenhouse effect.

Get It?
Explain the difference between weather and climate.

Major Land Biomes

Biomes are classified primarily according to the characteristics of their plants. Biomes also are characterized by abiotic climate characteristics such as temperature, precipitation, the amount of sunlight, and the amount and type of wind.

The plants and abiotic characteristics in a biome influence the types of animals that live there. This section describes each of the major land biomes.

EARTH SCIENCE Connection The distance of any point on the surface of Earth north or south from the equator is **latitude**. Latitudes range from 0° at the equator to 90° at the poles. Light from the Sun strikes Earth more directly at the equator than at the poles, as illustrated in **Figure 4**. As a result, Earth's surface is heated differently in different areas. Ecologists refer to these areas as "zones." Polar zones extend to about 66° from each pole, while tropical zones extend about 23° north and south of the equator. Temperate zones are found between the polar and tropical zones.

INTRODUCTION

Defining STEM

Television, radio, magazines, and Web sites are flooded with advertisements and headlines that all fight for your attention. Some try to pull you in with amazing claims: *Lose 25 pounds in 2 days!* *Giant meteorite headed for Earth!* New “wonder fruit” cures the common cold! They might seem to have scientific data to back them up. To decide whether the product is worth your money or whether the claim is valid, you need to examine the data that can tell you the truth. Thinking logically about sensational statements can keep you from wasting your time—and sometimes your money.

The fields of science, technology, engineering, and mathematics, known as STEM, all involve careful collection of data and logical thinking. The microscope shown below is technology, which was engineered through careful mathematical calculations and based on scientific knowledge of lenses. Because STEM is a part of your daily life, learning to analyze and evaluate—and being able to think logically—are important. This handbook will help you become familiar with the methods that scientists, engineers, and mathematicians use.



Go Online to find the Science and Engineering Handbook to learn more about each of the eight SEPs.

Integrated Engineering

Tennessee Science High School series supports teachers and students with the integration of engineering into the science curriculum. For broad support, teachers and students can access the Science and Engineering Handbook, which provides simple, approachable descriptions of science and engineering practices. Students can also practice these skills as they read through the handbook.

Math and Literacy

Tennessee Science High School series supports students with literacy and math access through the Literacy Handbook and the Math Handbook. Each of these handbooks provides background information, student support, and examples that get students ready to make the connections they need to science.

Literacy Skill Handbook

Science Literacy

Reading and writing are skills that you need to master in order to understand science. They help you communicate, organize, clarify, and revise ideas. They also help you develop thinking skills that allow you not only to understand scientific concepts but also to

Reading in Science

Reading, in addition to observation, hands-on activities, lab work, class discussions, and demonstrations, is essential to learning science.

You need to learn strategies for reading many different types of scientific materials, such as:

- reading for information and comprehension
- lab and activity instructions
- creative writing and literature
- questions for assignments and standardized tests

Reading in science:

- extends your knowledge and comprehension of topics introduced through hands-on activities;
- can convey detailed or complex information more quickly and accurately than illustrations or observations;
- enables you to explore objects, concepts, and processes that are too small, too large, too distant, too dangerous, or too abstract to learn through direct interaction;
- requires you to develop critical-thinking skills that you will use in and out of the classroom.

Reading for Information Because reading scientific information is unlike reading a novel, you should use reading strategies so that you can better understand what you read.

One reading strategy is *Reading for Information*. This approach calls for two readings of the text—one reading to gain a general understanding, and one reading to more deeply comprehend concepts and relationships. **Table 2** contains more information about reading for information.

MATH SKILL HANDBOOK

I. Symbols

Δ	change in quantity	\equiv	is defined as
\pm	plus or minus a quantity	$a \times b$	or multiplied by b
\propto	is proportional to	ab	
$=$	is equal to	$a + b$	or divided by b
\approx	is approximately equal to	a/b	
\leq	is less than or equal to	$\frac{a}{b}$	
\geq	is greater than or equal to	\sqrt{x}	square root of x
\ll	is much less than	$ a $	absolute value of a
\gg	is much greater than	$\log_a x$	log to the base a of x

II. Measurements and Significant Figures

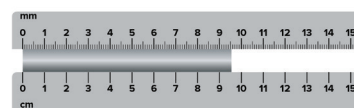
Connecting Math to Physics Math is the language of physics. Physicists use mathematical equations to describe relationships among the measurements that they make. Each measurement is associated with a symbol that is used in physics equations. These symbols are called variables.

Significant Figures

All measured quantities are approximate and have significant figures. The number of significant figures indicates the precision of the measurement. Precision is a measure of exactness. The number of significant figures in a measurement depends on the smallest unit on the measuring tool. The digit farthest to the right in a measurement is estimated. **Example:** In the figure below, what is the estimated digit for each of the measuring sticks used to measure the length of the rod?

By using the lower measuring tool, the length is between 9 and 10 cm. The measurement would be estimated to the nearest tenth of a centimeter. If the length was exactly on the 9-cm or 10-cm mark, record it as 9.0 cm or 10.0 cm.

By using the upper measuring tool, the length is between 9.5 and 9.6 cm. The measurement would be estimated to the nearest hundredth of a centimeter. If the length was exactly on the 9.5-cm or 9.6-cm mark, record it as 9.50 cm or 9.60 cm.



Math Skill Handbook 705

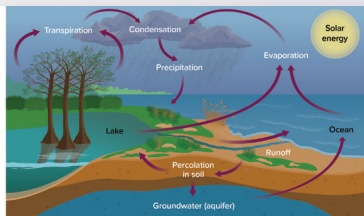


Figure 18 The water cycle is the process by which water is continuously cycled through the biosphere.

The water cycle

Water moves through the biosphere through the water cycle shown in Figure 18.

EARTH SCIENCE Connection Energy from the Sun causes water to constantly evaporate from the Earth's surface. Water enters the atmosphere in a form called water vapor. Approximately 90 percent of water vapor evaporates from oceans, lakes, and rivers about 10 percent evaporates from the surfaces of plants through a process called transpiration. Clouds form when water vapor rises, cools, and condenses into droplets around dust particles in the atmosphere. Water falls from clouds to the Earth's surface as precipitation in forms such as rain or snow. Some surface water percolates, or moves through, the soil, and enters groundwater. Other water flows over the Earth's surface as runoff, and enters streams, rivers, lakes, and oceans. The cycle then starts again.

Get It?

Identify three processes in the water cycle.

CCO CROSSCUTTING CONCEPTS

Systems and Systems Models Describe the boundaries and specifications for a model of an ecosystem at your school. How do the parameters of your model help make it useful? Write the specifications into a proposal for the model.

STEM CAREER Connection

Water Resource Engineer Civil engineers who create systems that ensure that people have a continuous supply of clean, uncontaminated water are called water resource engineers.

STEM CAREER Connection

Water Resource Engineer

Civil engineers who create systems that ensure that people have a continuous supply of clean, uncontaminated water are called water resource engineers.

STEM Career Connections

allow students to connect with science by seeing potential career paths, as well as how what they're studying connects to the real world.

Go Online to find the Math and Literacy Handbook.

Bring Science to Life

Tennessee Science transports students beyond the walls of your classroom with cutting-edge digital content, including interactives, simulations, videos, and more.

Fun and easy-to-use, these features align with lesson topics to spark scientific curiosity, support discussion, enhance review, and deepen understanding.

Student Advantages

Simulations

Simulations offer a chance to experience real-life scenarios that depict true events. These proven tools improve learning and create safe and engaging learning environments where failure is possible—something that is often missed when students are learning.



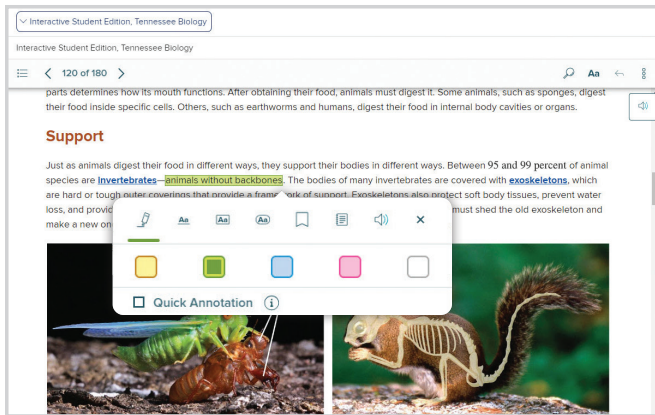
Inspire Science 3D App

Inspire Science 3D application provides students the ability to explore through the wonders of augmented virtual reality and provides students the opportunity to engage with science topics in a 3D environment rather than just a 2D image found on a page.

PERIODIC TABLE OF THE ELEMENTS																																									
1																	18																								
1 H Hydrogen 1.008	2 He Helium 4.003																																								
3 Li Lithium 6.941	4 Be Beryllium 9.012	5 B Boron 10.811	6 C Carbon 12.011	7 N Nitrogen 14.007	8 O Oxygen 15.999	9 F Fluorine 18.998	10 Ne Neon 20.180																																		
11 Na Sodium 22.990	12 Mg Magnesium 24.305	13 Al Aluminum 26.982	14 Si Silicon 28.086	15 P Phosphorus 30.974	16 S Sulfur 32.065	17 Cl Chlorine 35.453	18 Ar Argon 39.948																																		
19 K Potassium 39.098	20 Ca Calcium 40.078	21 Sc Scandium 44.956	22 Ti Titanium 47.883	23 V Vanadium 50.942	24 Cr Chromium 51.996	25 Mn Manganese 54.938	26 Fe Iron 55.845	27 Co Cobalt 58.933	28 Ni Nickel 58.693	29 Cu Copper 63.546	30 Zn Zinc 65.38	31 Ga Gallium 69.723	32 Ge Germanium 72.630	33 As Arsenic 74.922	34 Se Selenium 78.96	35 Br Bromine 79.904	36 Kr Krypton 83.80																								
37 Rb Rubidium 85.468	38 Sr Strontium 87.62	39 Y Yttrium 88.906	40 Zr Zirconium 91.224	41 Nb Niobium 92.906	42 Mo Molybdenum 95.94	43 Tc Technetium 98.906	44 Ru Ruthenium 101.07	45 Rh Rhodium 102.905	46 Pd Palladium 106.42	47 Ag Silver 107.868	48 Cd Cadmium 112.411	49 In Indium 114.818	50 Sn Tin 118.710	51 Sb Antimony 121.757	52 Te Tellurium 127.60	53 I Iodine 126.905	54 Xe Xenon 131.29																								
55 Cs Cesium 132.905	56 Ba Barium 137.327	57 La Lanthanum 138.905	58 Ce Cerium 140.12	59 Pr Praseodymium 140.908	60 Nd Neodymium 144.24	61 Pm Promethium 144.913	62 Sm Samarium 150.36	63 Eu Europium 151.964	64 Gd Gadolinium 157.25	65 Tb Terbium 158.925	66 Dy Dysprosium 162.50	67 Ho Holmium 164.930	68 Er Erbium 167.259	69 Tm Thulium 168.930	70 Yb Ytterbium 173.054	71 Lu Lutetium 174.967	72 Hf Hafnium 178.49	73 Ta Tantalum 180.948	74 W Tungsten 183.84	75 Re Rhenium 186.207	76 Os Osmium 190.23	77 Ir Iridium 192.222	78 Pt Platinum 195.084	79 Au Gold 196.967	80 Hg Mercury 200.59	81 Tl Thallium 204.387	82 Pb Lead 207.2	83 Bi Bismuth 208.980	84 Po Polonium 209	85 At Astatine 210	86 Rn Radon 222										
87 Fr Francium 223	88 Ra Radium 226	89 Ac Actinium 227	90 Th Thorium 232.038	91 Pa Protactinium 231.036	92 U Uranium 238.029	93 Np Neptunium 237.048	94 Pu Plutonium 244.064	95 Am Americium 243.061	96 Cm Curium 247.070	97 Bk Berkelium 247.070	98 Cf Californium 251.083	99 Es Einsteinium 252.083	100 Fm Fermium 257.103	101 Md Mendelevium 258.103	102 No Nobelium 259.103	103 Lr Lawrencium 260.103	104 Rf Rutherfordium 261.103	105 Db Dubnium 262.103	106 Sg Seaborgium 263.103	107 Bh Bohrium 264.103	108 Hs Hassium 265.103	109 Mt Meitnerium 266.103	110 Ds Darmstadtium 267.103	111 Rg Roentgenium 268.103	112 Cn Copernicium 269.103	113 Nh Nihonium 270.103	114 Fl Flerovium 271.103	115 Mc Moscovium 272.103	116 Lv Livermorium 273.103	117 Ts Tennessine 274.103	118 Og Oganesson 277.103										

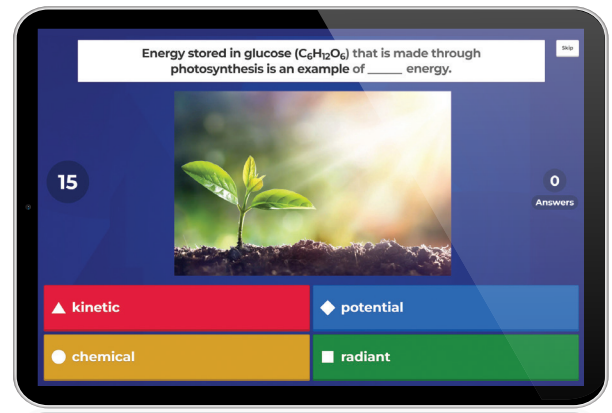
Poptips Plus

Poptips Plus is an interactive tool with a single image or an array of text and images with markers that define clickable hot spots. This engaging resource allows students to interact with images and connect them to related information to support understanding of core content.



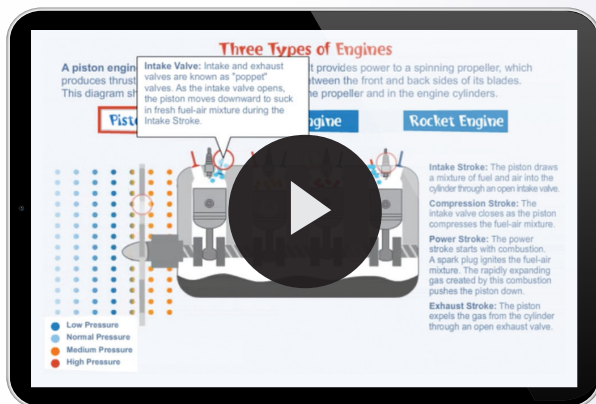
Interactive Text

Engage students in online literacy learning with tools like text-to-speech, note-taking, and text highlighting. Interacting with learning creates a dynamic experience that's more engaging and will improve student learning and retention.



Kahoot!

Help students review important material in an engaging way with fun, game show-like quizzes using Kahoot!



Videos

Enhance teaching and learning with videos that reinforce concepts and spark discussion. Videos encourage students to hone their analytical skills by analyzing media using the theories and concepts they are studying while experiencing worlds beyond their own.



McGraw Hill K-12 Portal App

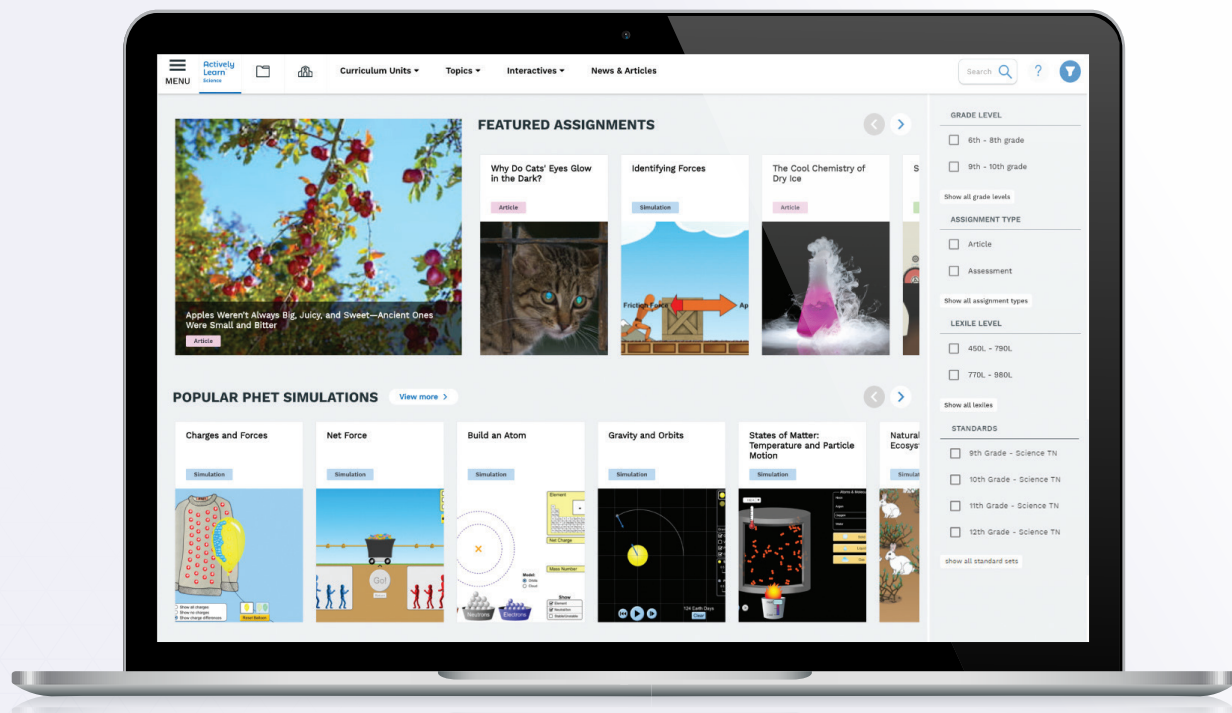
Students can access their content anywhere, any time, on any device—with or without internet access—using the McGraw Hill K-12 Portal App.

Drive Deeper Science Learning With *Actively Learn*

As educators, we know how important it is to keep students engaged.

That's why each *Tennessee Science* module and lesson is designed to tap into students' natural curiosity about the world around them through the investigation of real-world phenomena.

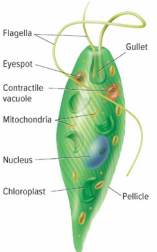
Student engagement is further fueled through an innovative digital experience, and connections to real-world applications.



- **Engaging, relevant, standards-based content** for all learners
- **Science texts, articles, and videos** at each student's level
- **Inquiry-driven science simulations** that bring natural phenomena to life
- **Interactive reading and study aids** that promote active collaboration
- **Rich, cross-curricular connections** to literature and history
- **Powerful tools** that let teachers customize content or upload their own
- **Access to student data** to inform instructional decisions

Fuel Student Engagement Using the World Around Them

SCIENCE PROBES **Biology Unit 5: The Diversity of Life**
How did the study of genetics impact species classification?



A student found their grandmother's high school biology textbook from 1963 in the attic. They noticed that the section on classification of life forms looked different than their current biology text. As the student shared their discovery with friends, they all wondered why the classification of protists had changed. This is what they said:

Zane: "I think scientists discovered so many more protists, they needed new categories."

Hattie: "I think it's different because different characteristics are used for classification today."

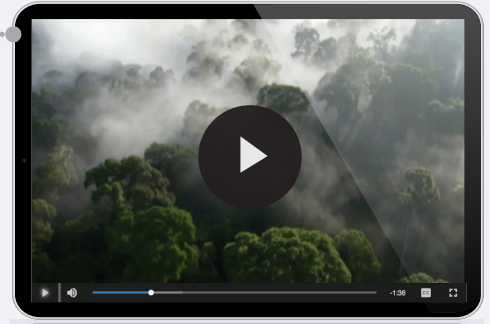
Boch: "I think it's because of adaptation. Protists have changed in the last 50 years."

Which friend do you agree with the most? Explain why you agree.

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Visualizing Phenomena in Action

Encounter the Phenomenon Videos enable students to observe scientific topics in action, providing a visual experience that encourages thinking and collaborative conversations.



Science Probes

Science Probes are module launch questions centered around relevant phenomena designed to interest and get students talking about their ideas. When students do the talking, it is evidence that they are thinking and provides you an avenue to uncover and resolve commonly-held preconceptions or misconceptions.

Solve a Problem
STEM UNIT PROJECT

Biomimetics Investigate how biology and the diversity of life can inspire designs for buildings and structures.

GO ONLINE In addition to reading the information in your Student Edition, you can find the STEM Unit Project and other useful resources online.

VIRTUAL LABS

Assessing Water Quality
How do population changes of aquatic invertebrates indicate water quality?

Purpose
In this investigation you will demonstrate how water quality can be assessed by studying the effects of acid rain on different populations of aquatic invertebrates.

Objectives
Investigate the effects of acid rain on different species of aquatic invertebrates.
Describe how the presence or absence of populations of aquatic invertebrates indicates water quality.

Procedure
1. Click information to read about acid rain.

1% Carbonic Acid

Information Result

Virtual Investigations

Extend experiments beyond the classroom setting. With Virtual Lab, students have an engaging, alternative, digital interaction to interact with an experiment.

UNIT 5
THE DIVERSITY OF LIFE

ENCOUNTER THE PHENOMENON
Mudskippers are amphibious fish that have adapted to live in the water and on land. How is this possible?

3D Ask Questions
What questions do you have about the phenomenon? Write your questions on sticky notes and add them to the driving question board for this unit.

Look for Evidence
As you go through this unit, use the information and your experiences to help you answer the phenomenon question as well as your own questions. For each activity, record your observations in a Summary Table, add an explanation, and identify how it connects to the unit and module phenomenon questions.

Solve a Problem
STEM UNIT PROJECT
Biomimetics Investigate how biology and the diversity of life can inspire designs for buildings and structures.

GO ONLINE In addition to reading the information in your Student Edition, you can find the STEM Unit Project and other useful resources online.

Unit 5 - The Diversity of Life 421

STEM Unit Projects

Students assume the role of a scientist or engineer and are charged with the task of designing a solution in the STEM Unit Project. Each project relates to a specific standard correlating to the unit.

Tennessee Assessment Strategies

Tennessee Science includes a variety of assessment options to support teachers with differentiation strategies and support students on their journey to mastery of the Tennessee Academic Standards for Science and culminating with success on the End of Course Assessment and the ACT.

Formative Assessment

Formative assessment, embedded at many points throughout each module and lesson, facilitates student reflection on their thinking (metacognition) and allows teachers to dynamically differentiate instruction. The table below shows the types of formative assessment resources in *Tennessee Science* found online and in print.

FEATURE	INSTRUCTIONAL PURPOSE
Science Probes	Found at the beginning of each unit in the online resources, Science Probes reveal student preconceptions to guide instruction.
Claim, Evidence, Reasoning	With the CER Framework (Claim, Evidence, Reasoning) students will make claims and document their reasoning during the EXPLORE phase and add evidence and adjust their claims as needed later in the lesson.
Three-Dimensional Thinking Questions	Students will encounter questions that address the 3 dimensions of the Tennessee Academic Standards for Science check progress with the SEPs, DCIs, CCCs, and Performance Expectations.
Applying Practices	Within each lesson you will find Applying Practices Projects to help you apply the Science and Engineering Practices and build understanding of the Disciplinary Core Ideas so that you can complete each STEM Unit Project.

Summative Assessment

Summative assessment tools at the module and lesson level help ensure lasting learning and alignment of student skills to the Performance Expectations with the following summative assessment tools found in *Tennessee Science* in print Student Editions and online.

FEATURE	INSTRUCTIONAL PURPOSE
Module Pretest	The Module Pretests, found at the beginning of each module, assess prerequisite knowledge of Disciplinary Core Ideas from prior grades to evaluate student readiness are ready for the module.
Three-Dimensional Thinking Questions	At the end of the lessons, students will demonstrate their understanding of at least two of the three dimensions of Tennessee Academic Standards for Science to develop three-dimensional thinking skills.
Lesson Check	Found in every lesson online, Lesson Checks determine how students are building a progression of learning toward the performance expectations.
Module Test	Found at the end of each module online, Module Tests evaluate student proficiency against the performance of the module with multiple choice, extended response, constructed response, and performance-task items.
STEM Unit Project	With each STEM Module Project, found at the end of each module, students will complete performance-based rubrics and answer summative questions to demonstrate how they've applied their knowledge and understanding of the performance expectations to their project.
Module Vocabulary Practice	Through online interactives, students practice and check their understand of science language. Immediate feedback from the system provided!

State Assessment Guide

Organized by the *Tennessee Science* High School Series scope and sequence for each program, the State Assessment Guide provides guided and independent practice for both discrete items and performance tasks with teacher support for each. Also included are standards alignment correlations, DOK levels, evidence statements, answer keys with rationale for correct and incorrect answers, and scoring rubrics for performance tasks.

Use this guide in your classroom in a variety of ways to meet the needs of your students.

- ✓ Use the Guided Practice and Practice sections prior to a Module Test to provide extra support or as preassessment to serve as a benchmark.
- ✓ Use the Guided Practice and Practice sections after a Lesson Check, but prior to a Module Test for remediation.
- ✓ Choose an approach by administering the Guided Practice section first and then give students the Practice section.

Seamless Integration Services

We are proud to work with schools across Tennessee to implement our programs into a range of classroom environments using different platforms. Both our Integration team and our Digital Technical Support team are ready to support you and your implementation.

To learn more, visit
mheducation.com/tennessee.



Google Classroom



Clever

PowerSchool

schoolology®



Preparing Students for the ACT

Tennessee Science is an inquiry-based program that leads students to be able to think, reason, and problem solve. The science portion of the ACT measures the interpretation, analysis, evaluation, reasoning, and problem solving skills.

Interpretation of Data 40–50%

Applying Practices, Go Further Activities, and Practice Problems all give students opportunities to interpret data to answer questions.

Scientific Investigation 20–30%

With well over 100 Labs, Projects, and Demos in the *Tennessee Science* program, students will have a thorough understanding of experimental tools, procedures, and design and compare, extend, and modify experiments.

Evaluation of Models, Inferences, and Experimental Results 25–35%

With real-world articles and data, students are able to make inferences, think critically and problem solve.

Continued Professional Learning

Professional Development

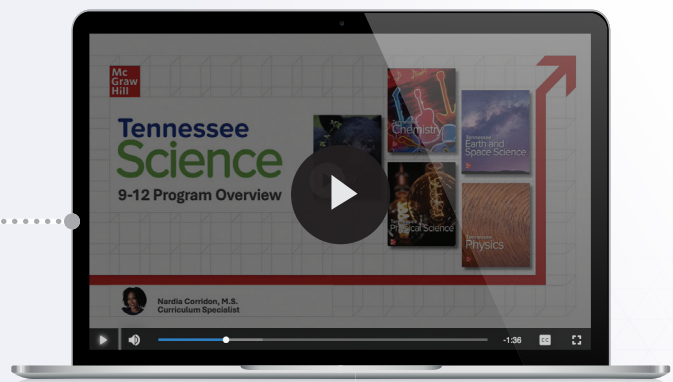
We know it can be a challenge to implement a new science program with new standards. That's why *Tennessee Science* comes with a library of relevant, self-paced, professional learning videos and modules to support you from implementation through instructional progression and mastery, all available 24/7, from any device.



Program Implementation Support

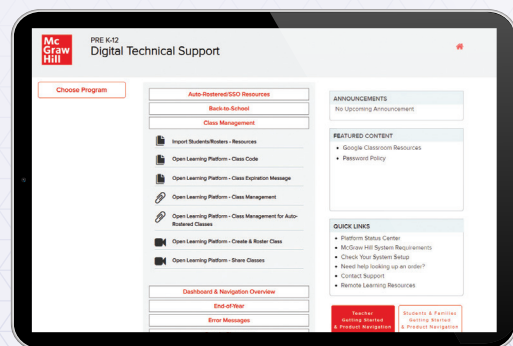
Implementation support provides everything you need to know to get up to speed on the first day of school.

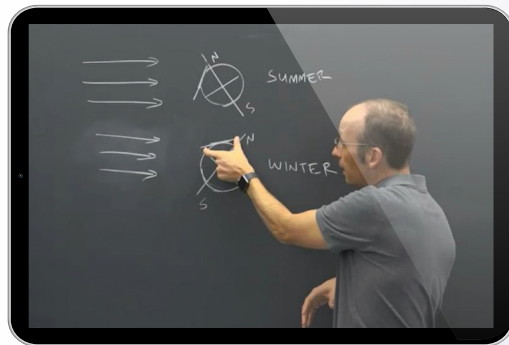
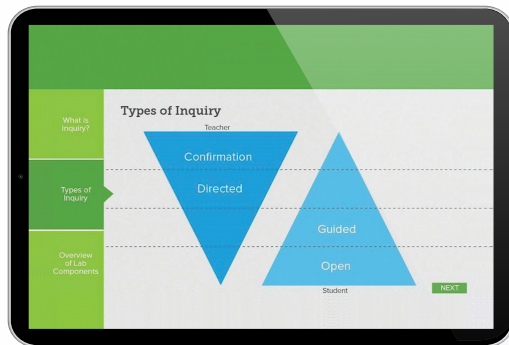
Quick Start Videos explain program basics to help get you started.



Digital Platform Support

In the Technical Support Resource Library, you will find step-by-step instructions for each of your digital tools to help you feel confident planning, teaching, and assessing in the digital experience. Step-by-step instructions for each of your digital tools help you feel confident planning, teaching, and assessing with digital.

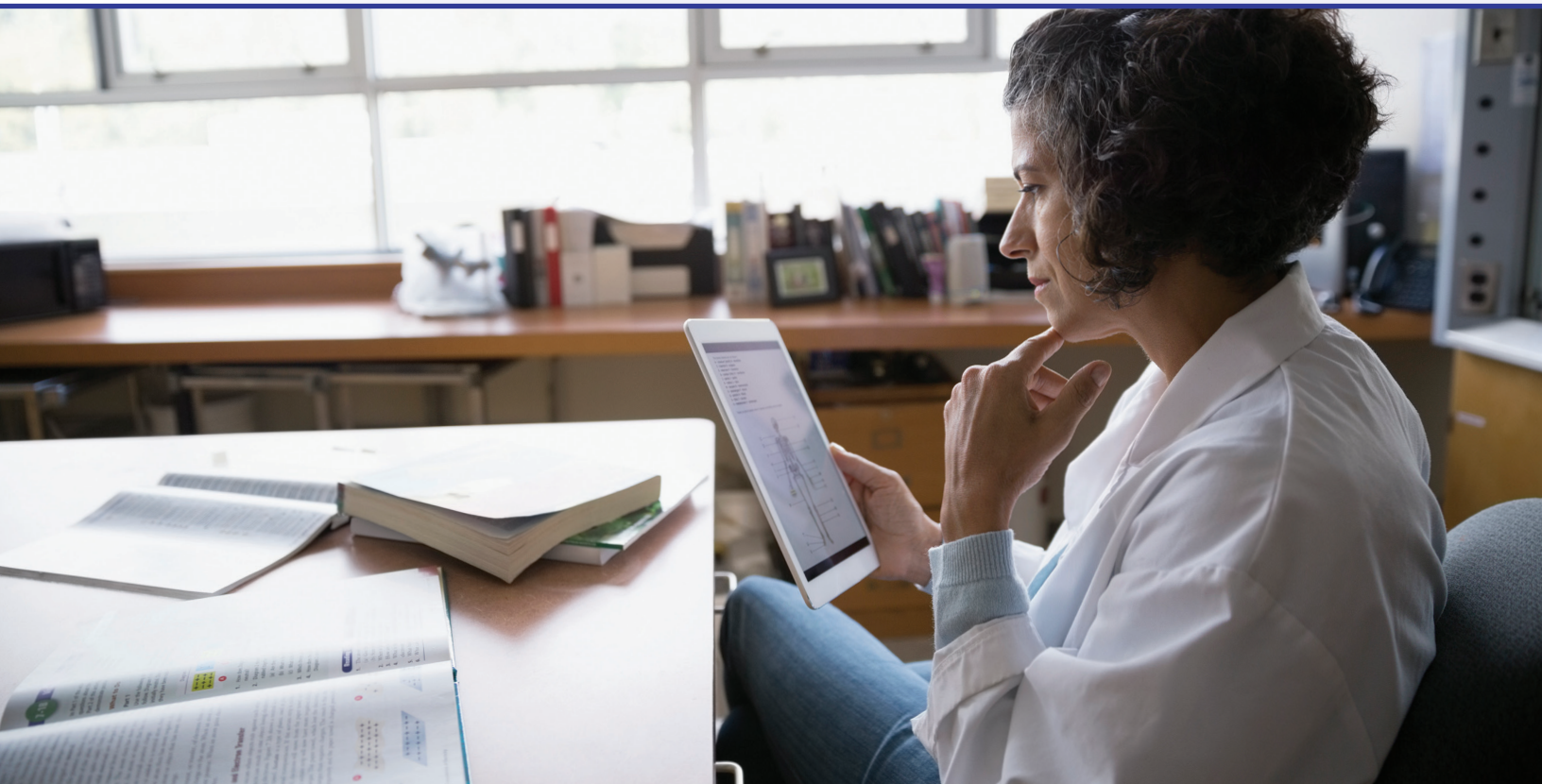




Ongoing Pedagogy Support

With *Tennessee Science*, you will find a wide range of resources on key instructional and pedagogical topics, including videos from our program authors and consultants.

- **STEM Classroom Videos** model lessons from real classrooms
- **Science Preconceptions Videos** review common preconceptions and strategies to overcome them
- **Instructional Coaching Videos** discuss best practice strategies and the “Why” behind the success
- **Teacher Activity Videos** show planning tips and expected results to help with hands-on activity time
- **Science Pedagogy Micro-Courses** provide facilitation guides for both self-guided or small group courses



Tennessee Science



Learn More at mheducation.com/tennessee