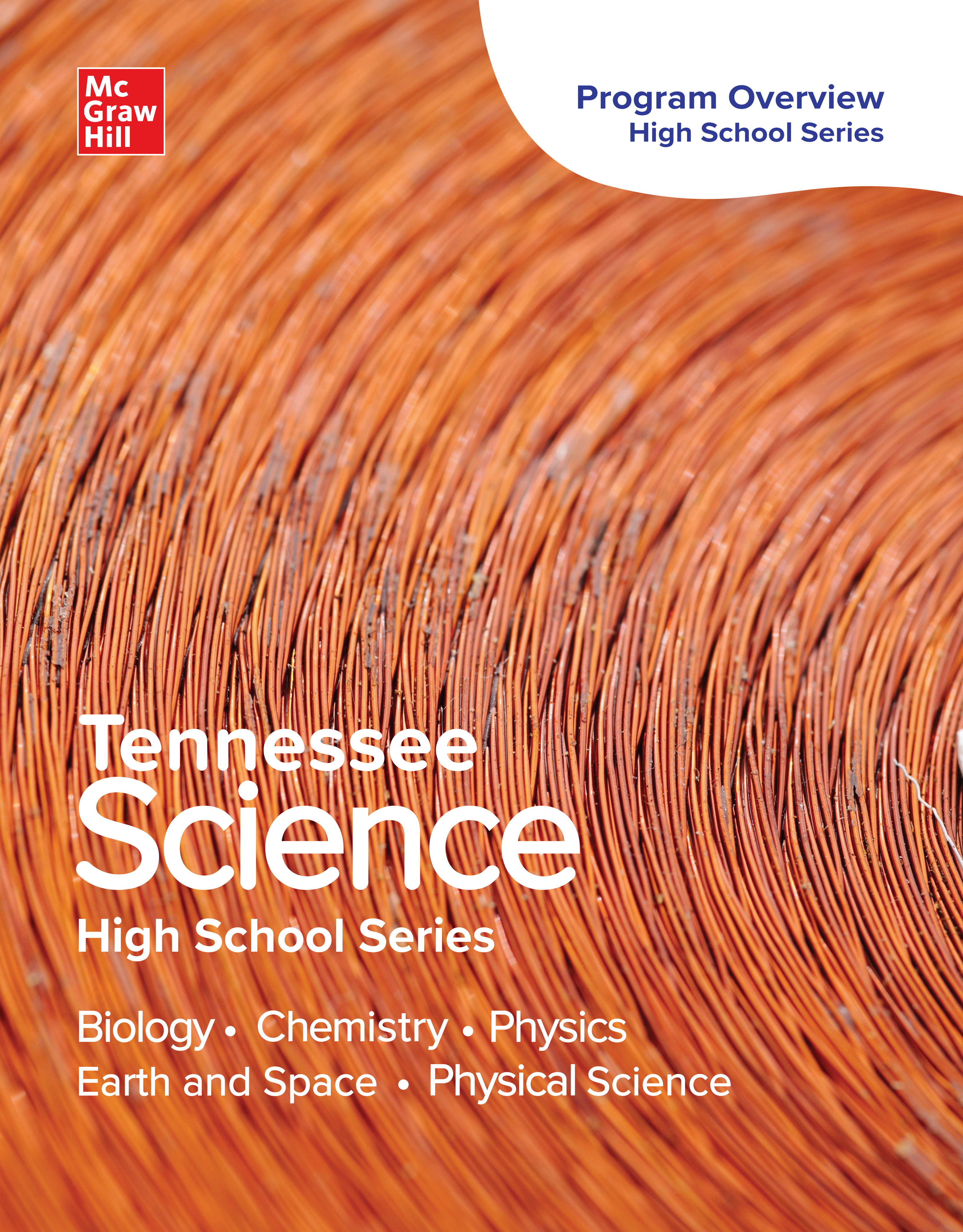
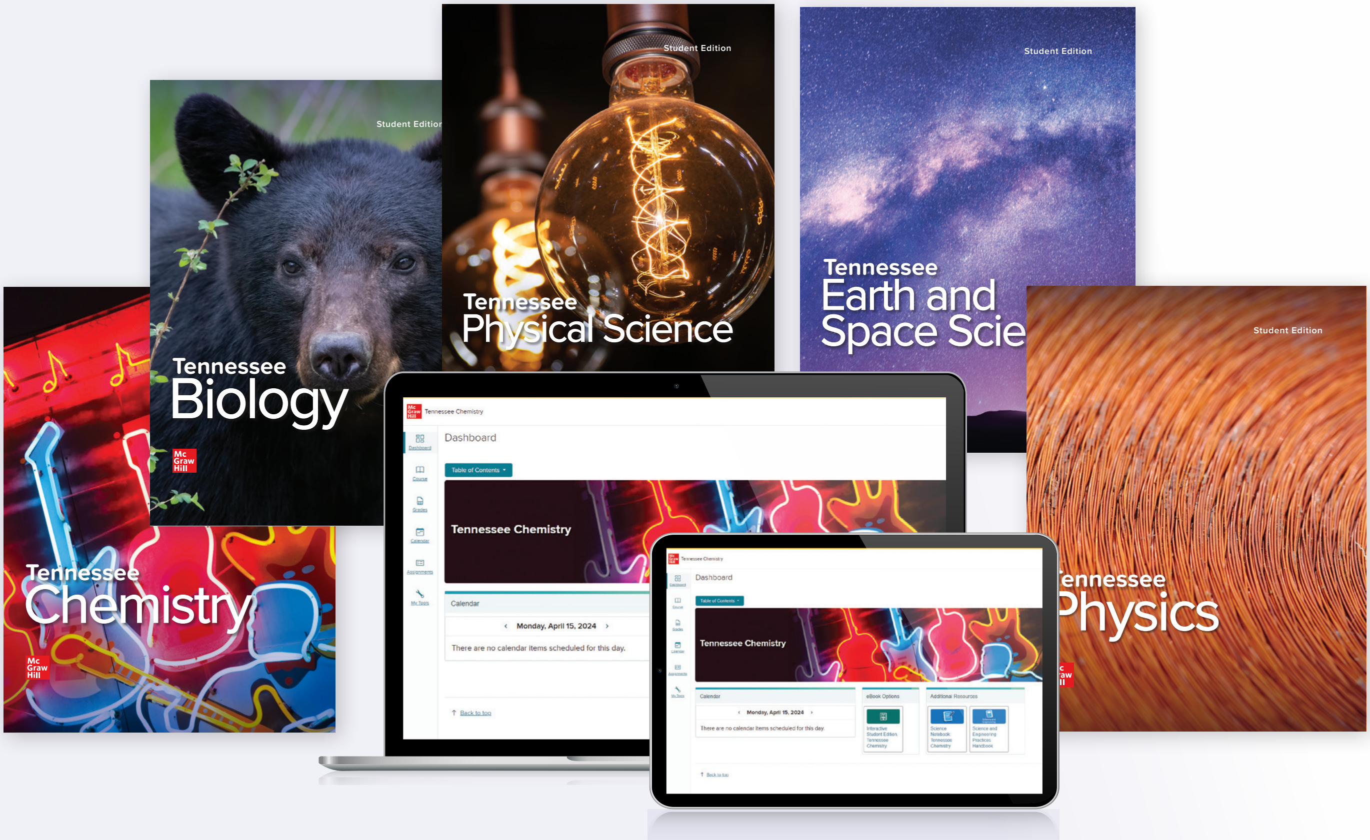


Program Overview
High School Series

Tennessee Science
High School Series

Biology • Chemistry • Physics

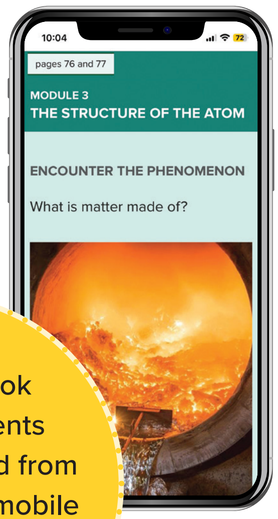
Earth and Space • Physical Science



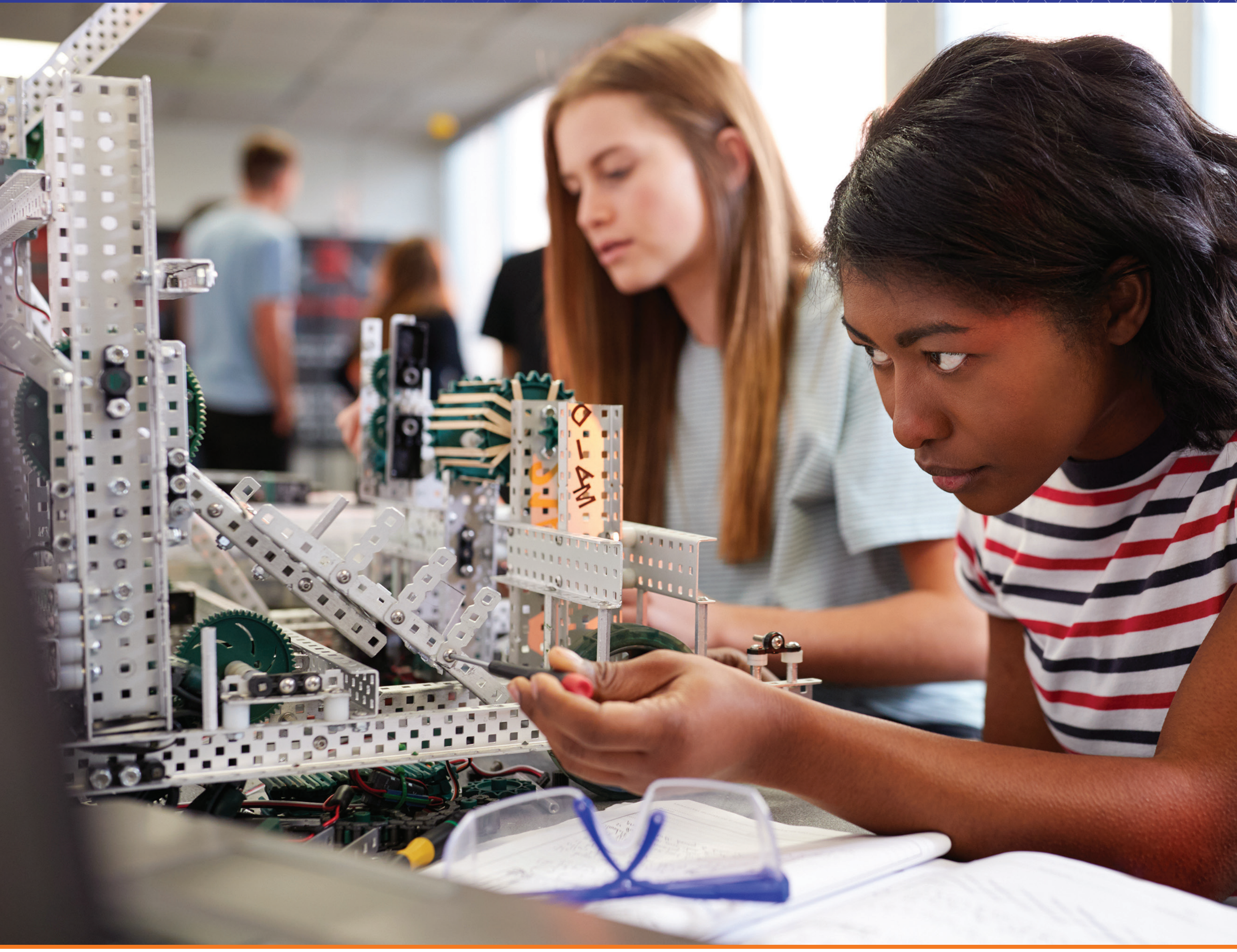
Welcome to *Tennessee Science* High School Series

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	DCI Disciplinary Core Ideas	CCC Crosscutting Concepts
Engage in Argument from Evidence	BIO1.LS2 Ecosystems: Interactions, Energy, and Dynamics	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	DCI Disciplinary Core Ideas	CCC Crosscutting Concepts
Engaging in Argument from Evidence	BIO1.LS4 Biological Change: Unity and Diversity	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	DCI Disciplinary Core Ideas	CCC Crosscutting Concepts
Constructing Explanations and Designing Solutions	BIO1.LS2 Ecosystems: Interactions, Energy, and Dynamics	Cause and Effect

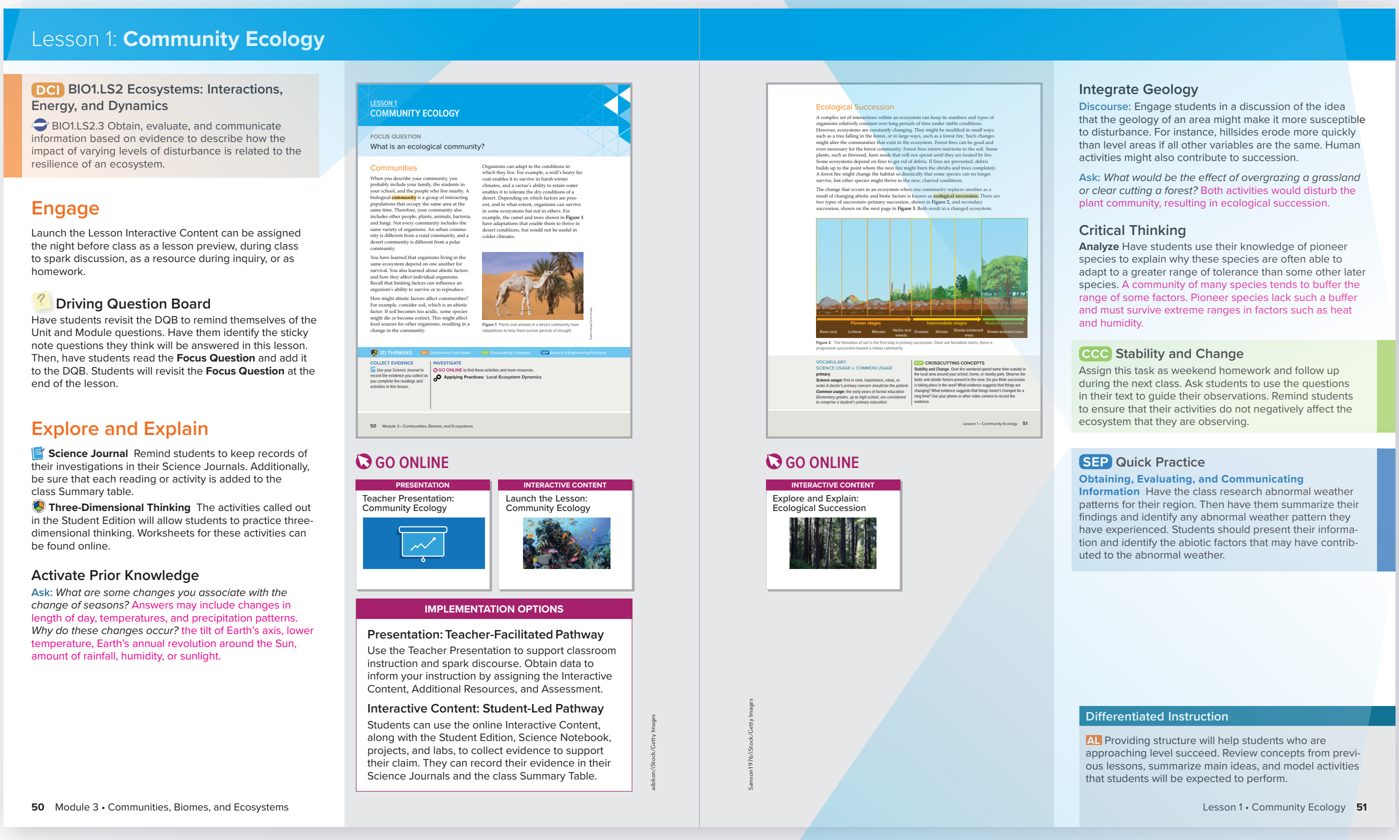
96A Module 5 • Biodiversity and Conservation

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.



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.

PROGRAM FEATURE!

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

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.

Module 5 • Biodiversity and Conservation **96B**

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.

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

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

Engage

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

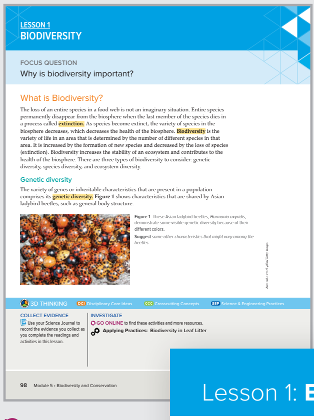
Driving Question Board
Have students revisit the DQB to remind themselves of the Unit and Module questions. Have them identify the sticky note questions they think will be answered in this lesson. Then, have students read the **Focus Question** and add it to the DQB. Students will revisit the **Focus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

Explore and Explain

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.

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



GO ONLINE

PRESENTATION
Teacher Presentation: Biodiversity

IMPLEMENTATIO
Presentation: Teacher-Fa
Use the Teacher Presentatio instruction and spark discou inform your instruction by as Content, Additional Resourc
Interactive Content: Stu
Students can use the online along with the Student Editic projects, and labs, to collect their claim. They can record Science Journals and the cla

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 biodiversity–number and abundance of species in a small area; ecosystem biodiversity–overall number of species in an ecosystem

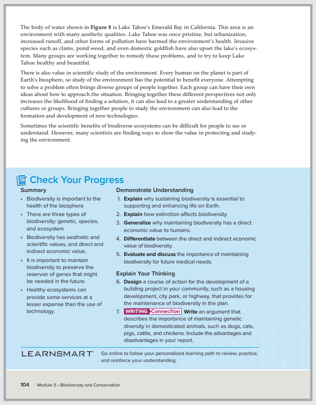
Remediation Write the following phrases: *dogs in a neighborhood, tropical rain forest, microorganisms in a pond, vegetable garden, and students in school.*

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

Check Your Progess
1. Biodiversity maintains a healthy biosphere and provides both direct and indirect benefits to humans.
2. Extinction reduces the variety of species.
3. Humans depend on various species for food, medicines, clothing, and shelter.
4. direct economic value—apparent and often recognized immediately; indirect economic benefit—not obvious and/or realized after time
5. 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.
6. Students should address measures that will conserve biodiversity, such as replanting species of plants, and keeping water sources clean.
7. 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.



GO ONLINE

ADDITIONAL RESOURCE
Vocabulary Flashcards: Biodiversity
vocabulary

ADDITIONAL RESOURCE
Lesson Check: Biodiversity

ADDITIONAL RESOURCE
Biology LearnSmart
LEARNSMART

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.

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.

UNIT OPENER

Encounter the Phenomenon

STEM Unit Project Launch

Formative Assessment Science Probe

MODULE OPENER

Encounter the Phenomenon

CER Claim, Evidence, Reasoning

ENGAGE → EXPLORE AND EXPLAIN → ELABORATE → EVALUATE → ENGAGE

LESSON

ENGAGE:
Encounter the Phenomenon
Phenomenon Question

EXPLORE/EXPLAIN:
Virtual Labs
PhET Simulations
Labs
Applying Practices
Supporting Resources

ELABORATE:
Environmental Connection
STEM Career Connections

EVALUATE:
Lesson Review
Three-Dimensional Assessment

MODULE CLOSE

Revisit the Phenomenon

State Assessment Practice

CER Claim, Evidence, Reasoning

Labs/Projects

Revisit STEM Unit Project

Module Test

Vocabulary Review

UNIT CLOSE

Go Online

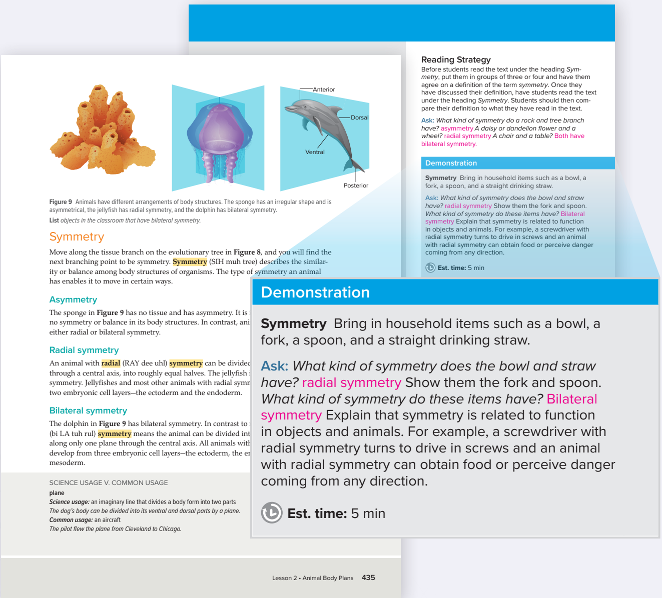
Complete STEM Unit Project

Empower Students With Inquiry-Based Learning

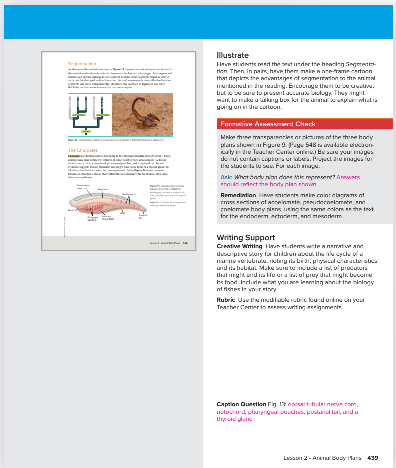
Investigate questions and solve problems from a variety of angles. Inquiry-driven instruction gives students the practice they need to succeed in developing solutions to whatever challenges they may encounter.

Types of Inquiry Activities

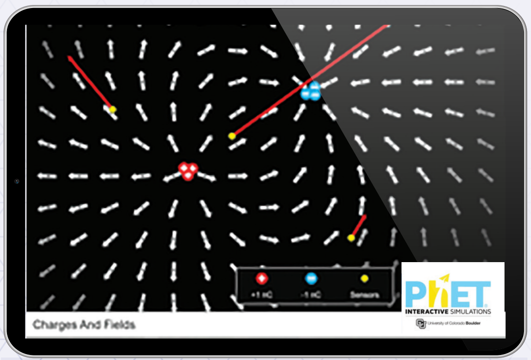
Each course in the High School Series of *Tennessee Science* includes inquiry that builds beyond hands-on activities. With *Tennessee Science*, students will investigate phenomena through several techniques reflective of the way science and engineering are done in the real world.



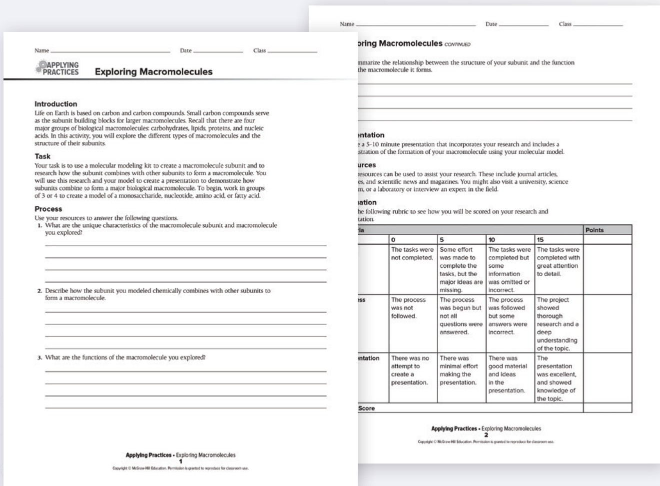
Demonstrations & Hands-on Activities



Engineering



Simulations



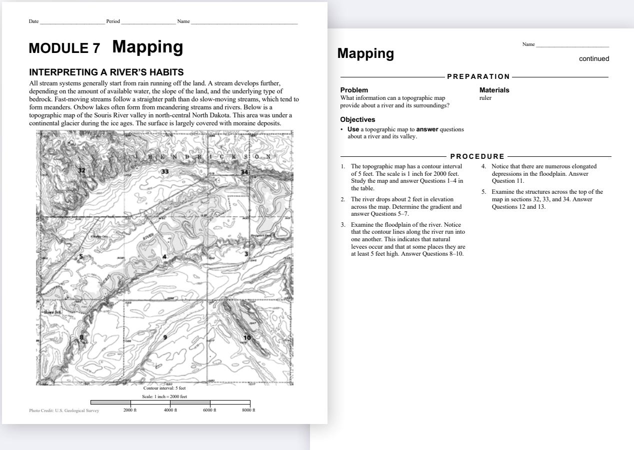
Research

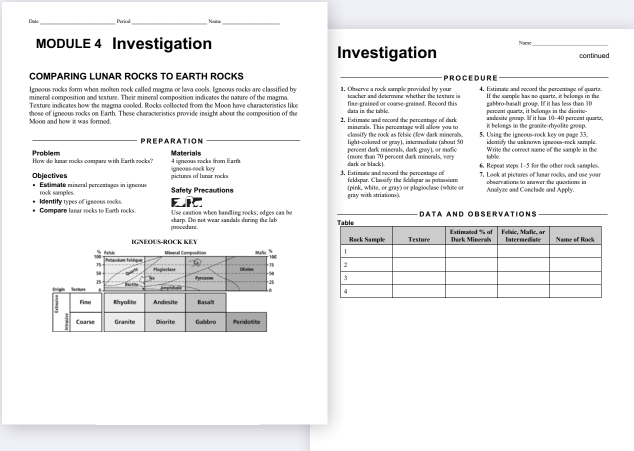
Hands-On Inquiry

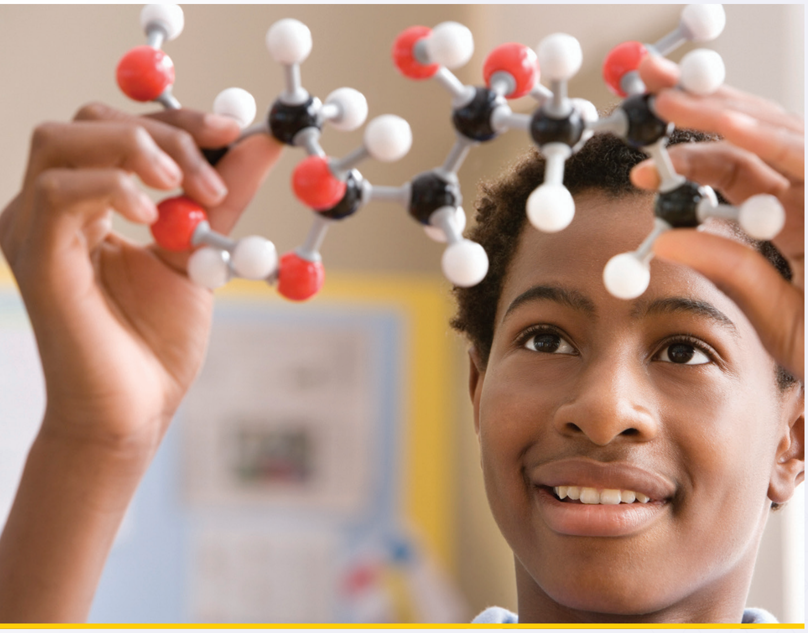
Tennessee Science is centered around inquiry. The program provides several opportunities in each module for student exploration.

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.







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.

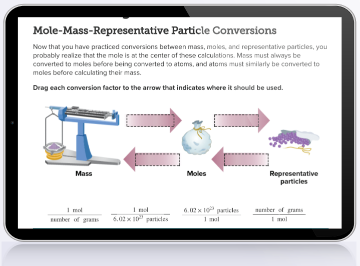
Teach Your Way With Innovative Digital Resources

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

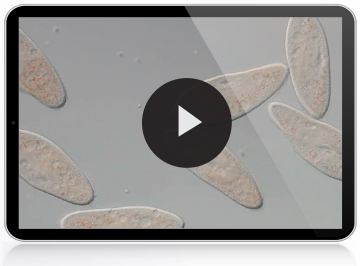
Fun and easy-to-use, these features align with lesson topics to spark scientific curiosity, support discussion, enhance review, and deepen understanding.

Why Go Online?

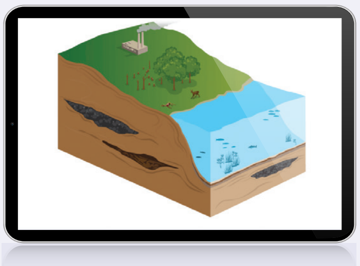
- Engaging Interactive Content
- Science Content Videos
- Text Read Aloud and Highlighting Features
- Dynamic Search Tools



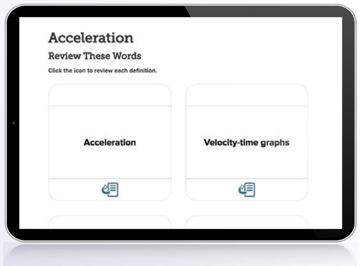
Drag and Drop activities offer students the chance to manipulate new concepts.



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

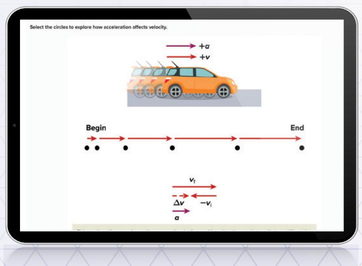


Simulations allow students to manipulate variables in a scenario beyond the limits of the classroom.



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.

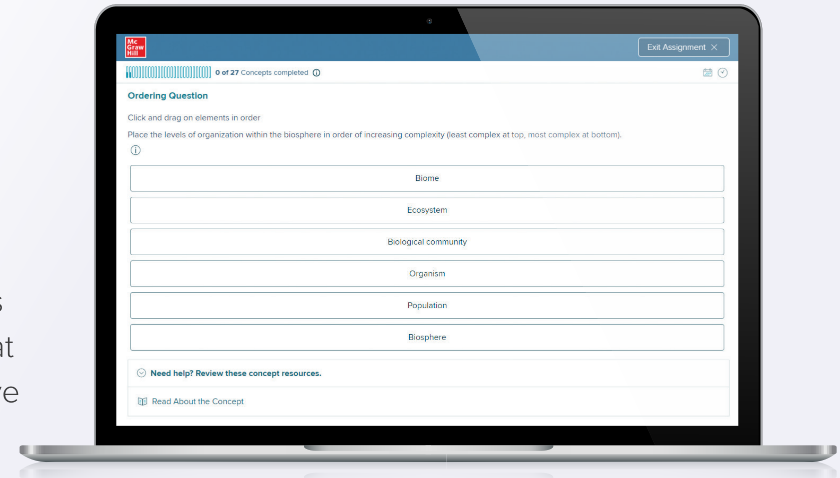


Interactive Visual Literacy features prepare students to identify visual representations of scientific phenomena.

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.

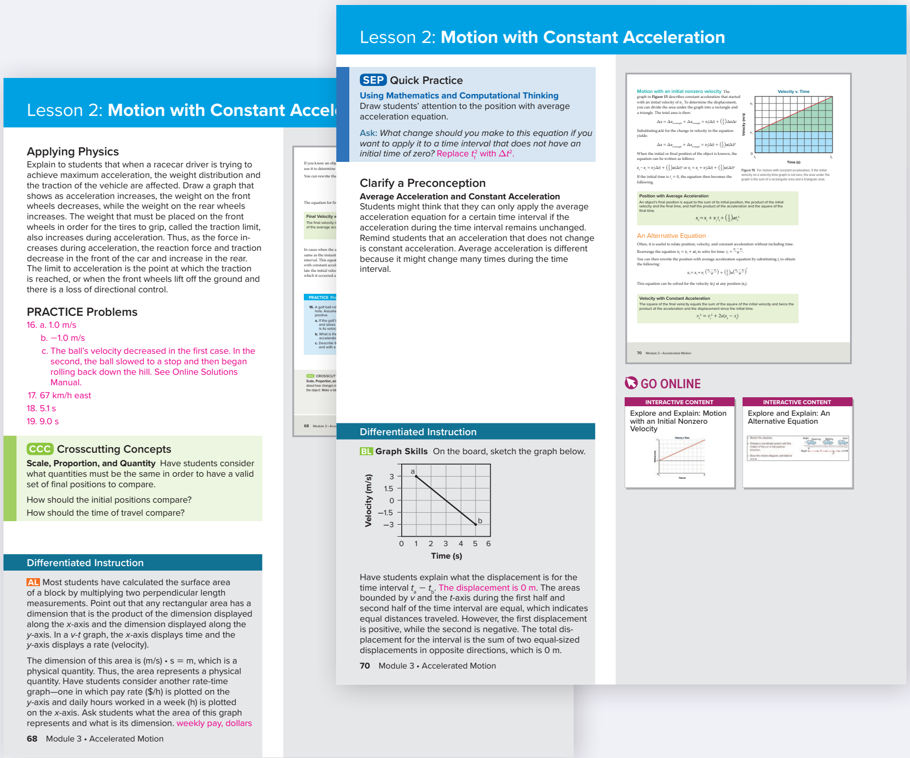
Real-Time Reporting Tools

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.



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.

Supporting Reading Comprehension in Science

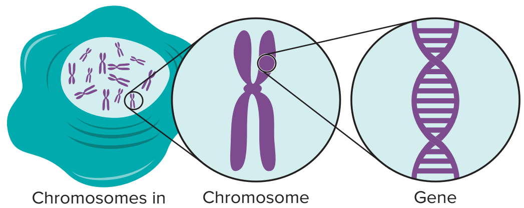
Tennessee Science empowers all students to succeed in science—no matter their starting point. The Science Reading Essentials for Tennessee Biology and Tennessee Physical Science provide reading and writing support for students in need of a little extra help, including:

- Content written two Lexile levels lower than the on-level content
- Teacher tips to provide ample student support

Tips and questions throughout the margins of the lesson provide support for students at point of use.

Reading Essentials include visual supports to enhance learning for all types of students.

"factors" are part of chromosomes. And, each cell in offspring contains chromosomes from both parents. These exist as pairs, one chromosome from each parent.



TIP Note that the lines to the chromosome show that this is one of many chromosomes in the nucleus of a cell. The lines to the gene show that a gene is part of a chromosome.

History Connection How did scientists discover DNA? Rosalind Franklin and Maurice Wilkins were scientists who used X-rays to study DNA. ...

Science Notetaking Support

Note booking is vital to success in the science classroom. The digital Science Notebook is your students' Cornell Notetaking Guide, ensuring they are writing down and keeping track of the important vocabulary, new ideas, and all of the progress along the way!

19 Chemical Reactions

ENCOUNTER THE PHENOMENON

Write the Encounter the Phenomenon question for this module.

Use the "What I Know" column to list the things you know about the Encounter the Phenomenon question. Then list the questions you have about the Encounter the Phenomenon question in the "What I Want to Find Out" column. As you read the module, fill in the "What I Learned" column.

K *What I Know*	W *What I Want to Find Out*	L *What I Learned*

Every module starts out with a **KWL chart** tied to the new module phenomena.

Chemical Reactions

1 Chemical Changes

REVIEW VOCABULARY
chemical formula

Recall the definition of the Review Vocabulary term.
chemical formula

NEW VOCABULARY
chemical reaction
reactants
products
chemical equation
coefficient
balanced chemical equation
mole
molar mass

Use your book to define each term.
chemical reaction
reactants
products
chemical equation
coefficient
balanced chemical equation
mole
molar mass

Vocabulary support gives students the opportunity to find the new words in the text and write the definitions themselves.

2 Classifying Chemical Reactions (continued)

CHECK YOUR PROGRESS (CONTINUED)

17. **Math Connection** The following chemical reaction is balanced, but the coefficients used are larger than necessary. Rewrite this balanced equation using the smallest coefficients possible.

$$9Fe(s) + 12H_2O(l) \rightarrow 3Fe_3O_4(s) + 12H_2(g)$$

18. **Math Connection** Sulfur trioxide (SO_3), a pollutant released by coal-burning plants, can react with water (H_2O) in the atmosphere to produce sulfuric acid (H_2SO_4). Write the balanced equation for this reaction.

Check Your Progress asks questions reflecting on the new content covered in the lesson.

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.

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.*

Javier Larrea/Pixtal/age fotostock

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

CCC CROSSCUTTING CONCEPT

Systems and systems models

SEP SCIENCE & ENGINEERING PRACTICES

Constructing explanations and designing solutions

Lesson 3 • Cycling of Matter 39

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

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.

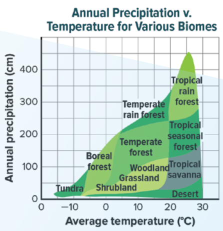


Figure 5 Temperature and precipitation are two major factors that influence the kind of vegetation that can exist in an area.

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.

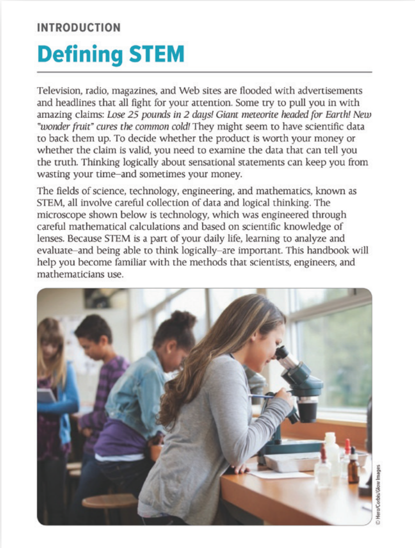
Major Land Biomes

Biomes are classified primarily according to the characteristics of their plants. Biomes also are characterized by abiotic 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.

Lesson 2 • Terrestrial Biomes 55

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

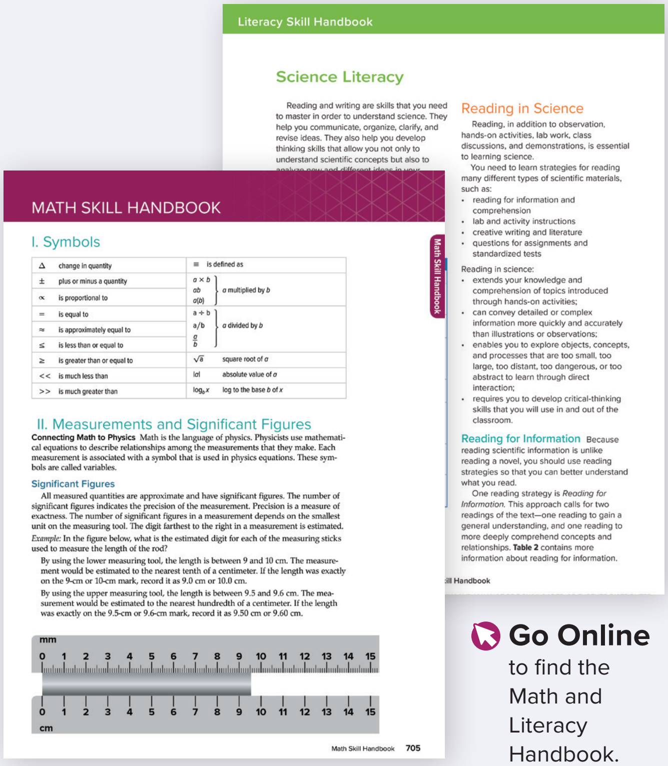
Television, radio, magazines, and Web sites are flooded with advertisements and headlines that all fight for your attention. Some try to pull you in with amazing claims: *Lose 25 pounds in 2 days! Giant meteorite headed for Earth! New "wonder fruit" cures the common cold!* They might seem to have scientific 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.

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	≡	is defined as
±	plus or minus a quantity	$a \times b$, ab, $a(b)$	a multiplied by b
∝	is proportional to		
=	is equal to	$a \div b$, a/b, $\frac{a}{b}$	a divided by b
≈	is approximately equal to		
≤	is less than or equal to		
≥	is greater than or equal to	$\sqrt{a}$	square root of a
<<	is much less than	$\lvert a \rvert$	absolute value of a
>>	is much greater than	$\log_b x$	log to the base b 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

Go Online to find the Math and Literacy Handbook.

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.

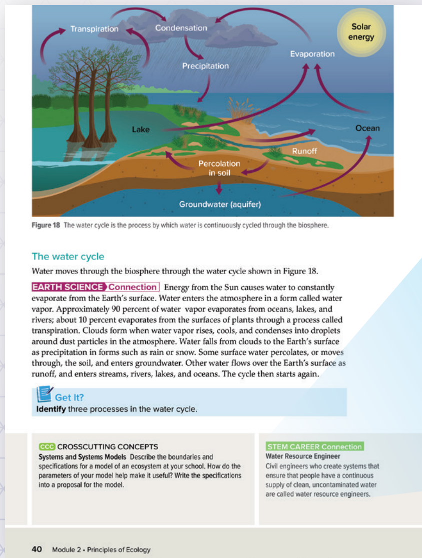


Figure 18 The water cycle is the process by which water is continuously cycled through the biosphere.

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.

CCC 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.

40 Module 2 • Principles of Ecology

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.

Bring Science to Life

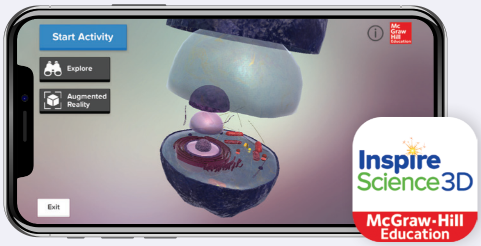
Tennessee Science transports students beyond the walls of your classroom with cutting-edge digital content, including interactives, simulations, videos, and more.

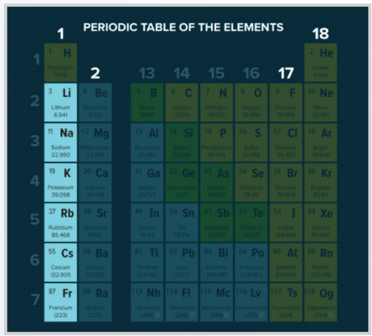
Fun and easy-to-use, these features align with lesson topics to spark scientific curiosity, support discussion, enhance review, and deepen understanding.

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.



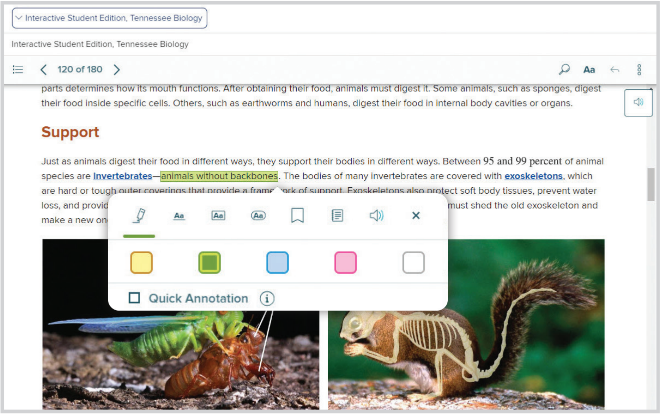


Inspire Science 3D App

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.

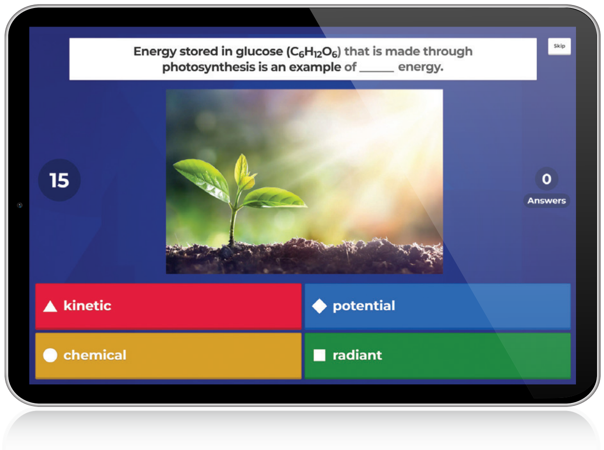
Poptips Plus

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.



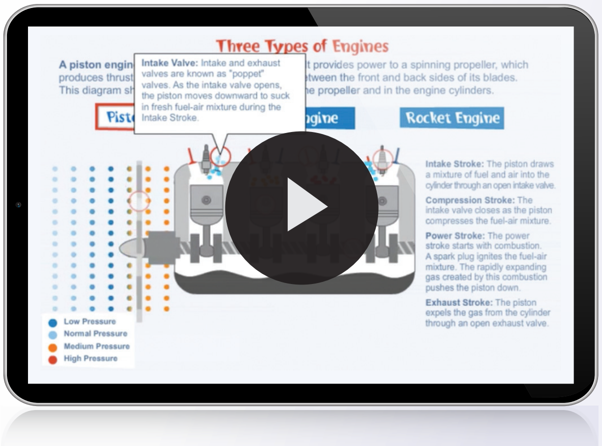
Interactive Text

Engage students in online literacy learning with tools like text-to-speech, note-taking, and text highlighting. 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.

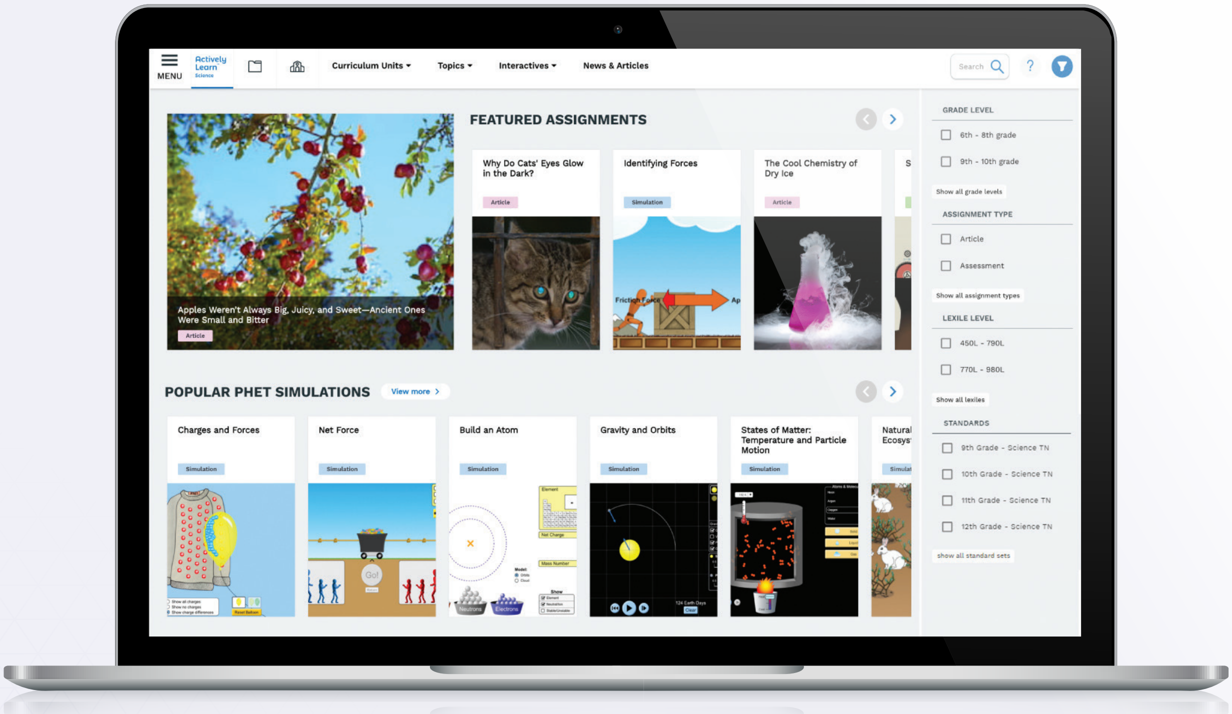
McGraw Hill K–12 Portal App

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*

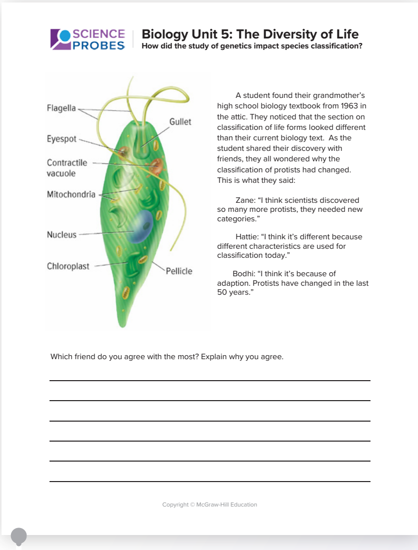
As educators, we know how important it is to keep students engaged.

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


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."

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

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

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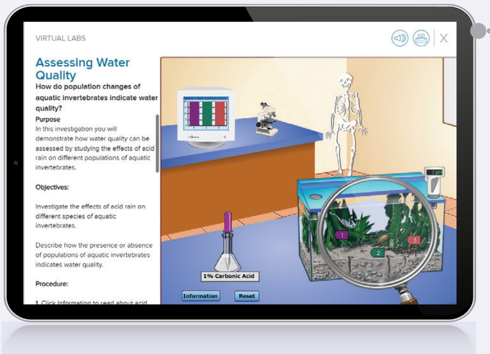
Visualizing Phenomena in Action

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

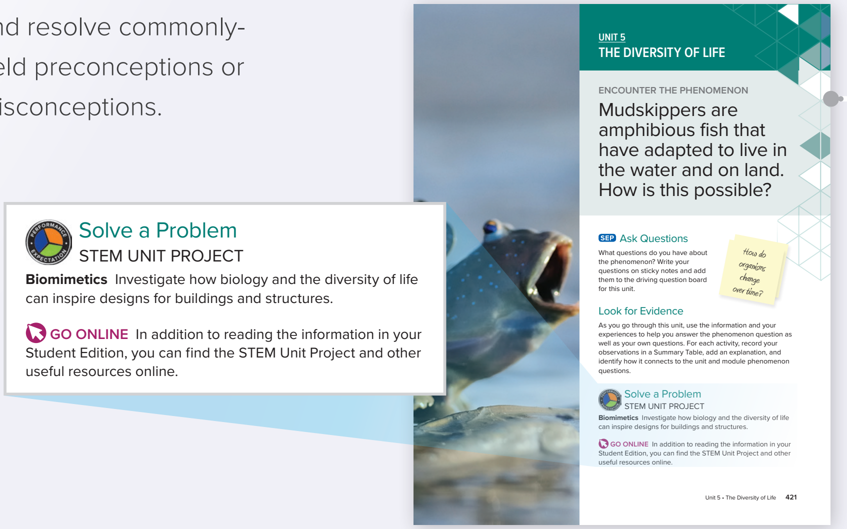
Science Probes

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.



Virtual Investigations

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



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 Appling 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

CANVAS BY INSTRUCTURE

schoology

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.

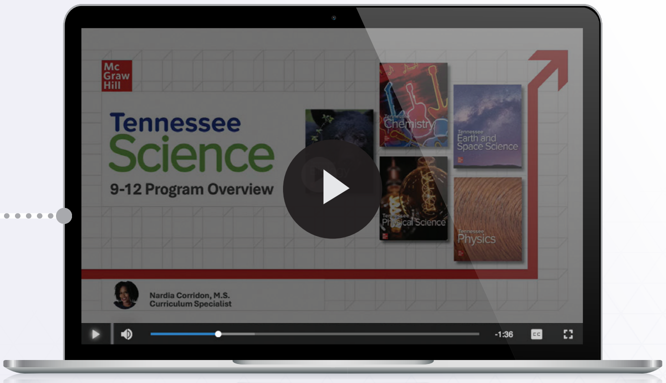
Continued Professional Learning

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.

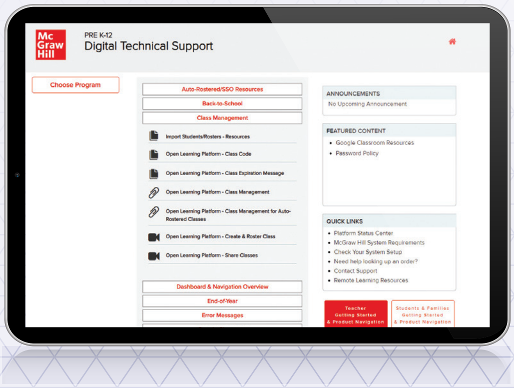
Program Implementation Support

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

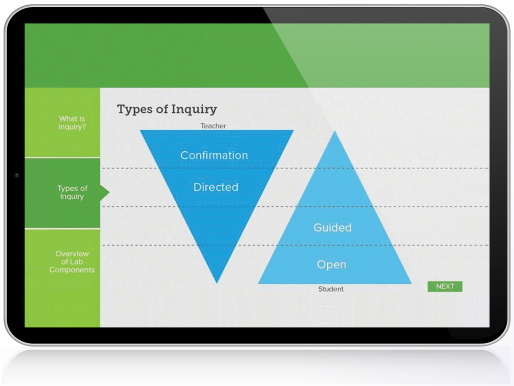


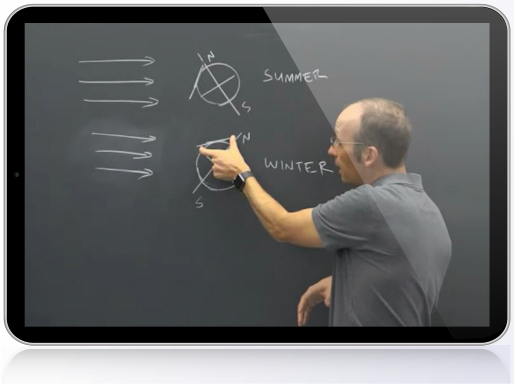
Quick Start Videos explain program basics to help get you started.

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.

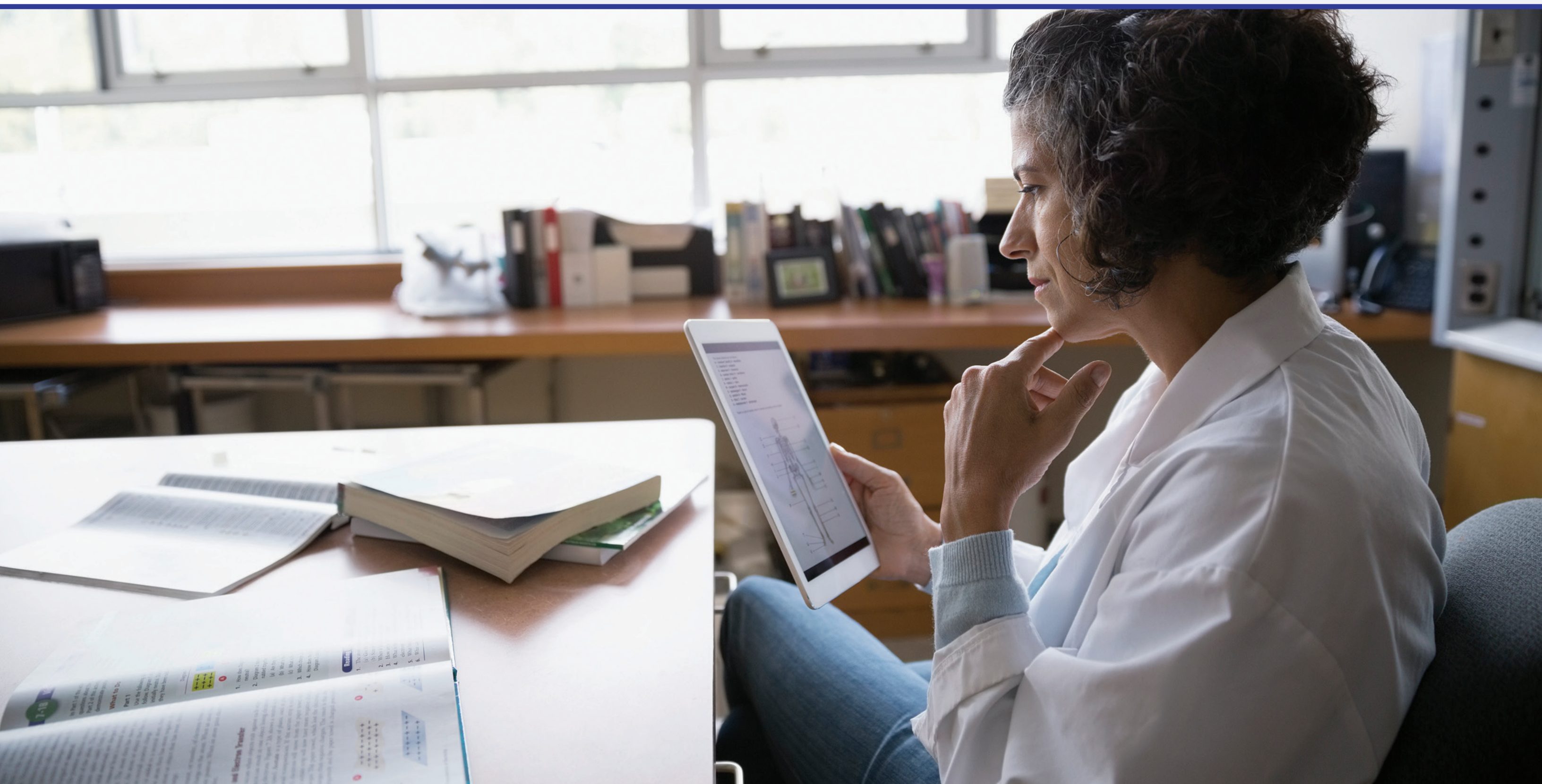




Ongoing Pedagogy Support

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

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