Mc Graw Hill

Program Overview
Grades 6–8

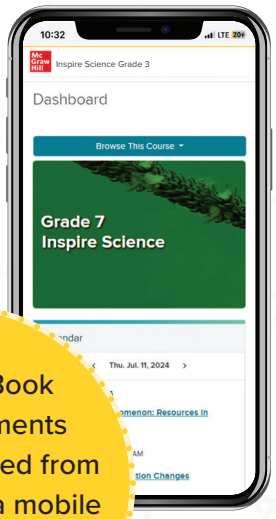
Pennsylvania Inspire Science

Earth, Life & Physical also available

Welcome to *Pennsylvania Inspire Science*

Engaging, Flexible, Cross-Curricular Learning

Pennsylvania Inspire Science provides an in-depth, collaborative, project-based learning experience designed to engage students, empower them to ask questions, and learn to think critically. Designed with the Pennsylvania's Science, Technology & Engineering, Environmental Literacy & Sustainability Standards in mind, *Pennsylvania Inspire 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!

Tap Into and Extend Student Curiosity

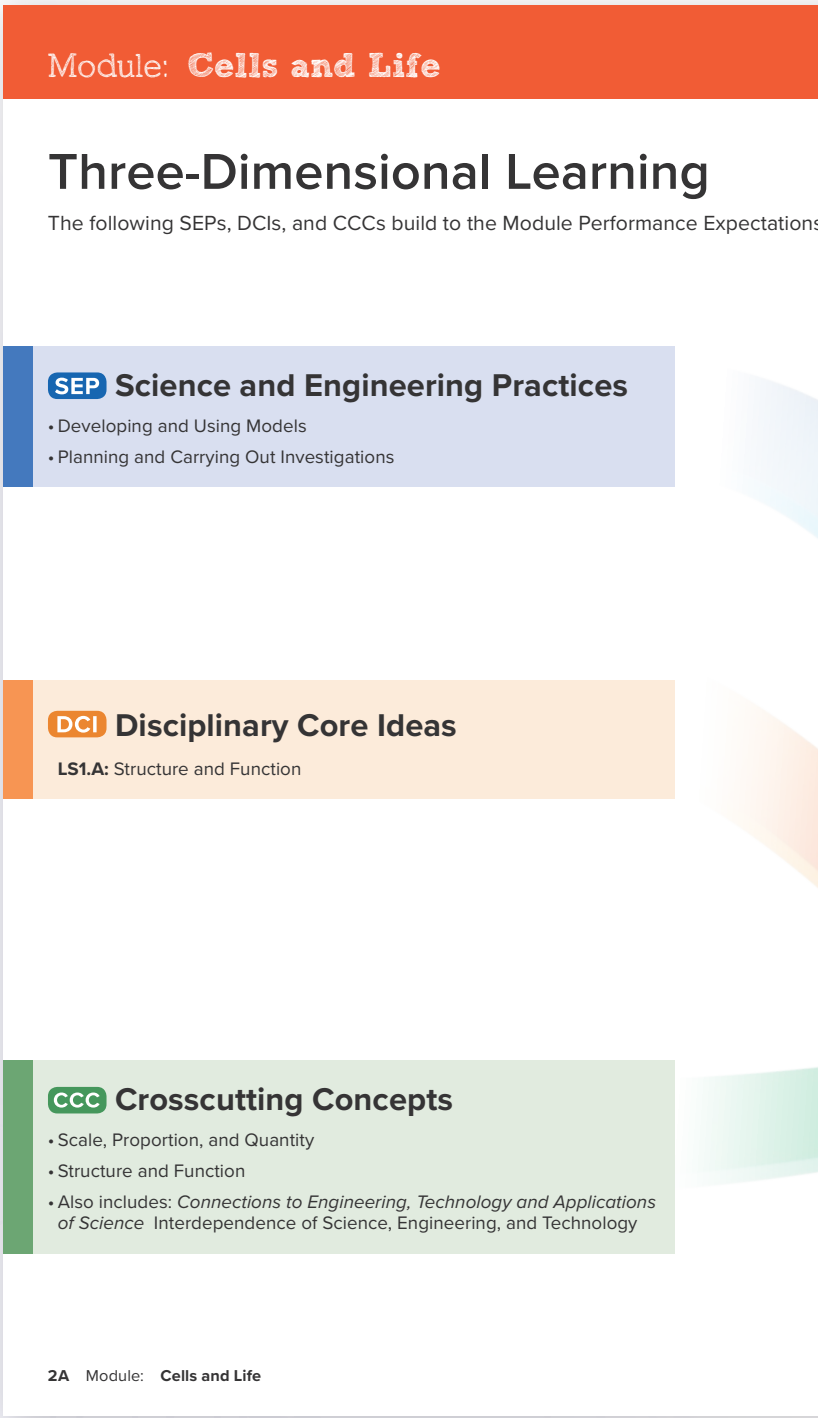
Middle school students have a wealth of new experiences competing for their attention which can lead to challenges with learning engagement. With *Pennsylvania Inspire Science*, each module and lesson are designed with student interest and curiosity in mind. When fueled by curiosity, students look to the world around them through the investigation of real-world phenomena in interesting, innovative, and hands-on ways. A new generation of innovators is ready to take on today's challenges to become tomorrow's scientists.

Aligned to the Rigor of the Pennsylvania STEELS Standards

Pennsylvania Inspire Science ensures that Pennsylvania educators have the resources and tools to deliver high-quality instruction to help students meet the rigor and challenge of the Pennsylvania Science, Technology & Engineering, Environmental Literacy & Sustainability (STEELS) Standards.

Comprehensive Pennsylvania STEELS Standards Planning

At the beginning of each module, NGSS codes and descriptions help teachers quickly see performance expectations addressed in the module.


Module: Cells and Life

Three-Dimensional Learning

The following SEPs, DCIs, and CCCs build to the Module Performance Expectations

SEP Science and Engineering Practices

- Developing and Using Models
- Planning and Carrying Out Investigations

DCI Disciplinary Core Ideas

LS1.A: Structure and Function

CCC Crosscutting Concepts

- Scale, Proportion, and Quantity
- Structure and Function
- Also includes: *Connections to Engineering, Technology and Applications of Science* Interdependence of Science, Engineering, and Technology

2A Module: **Cells and Life**

s.

Performance Expectations

MS-LS1-1. Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells.

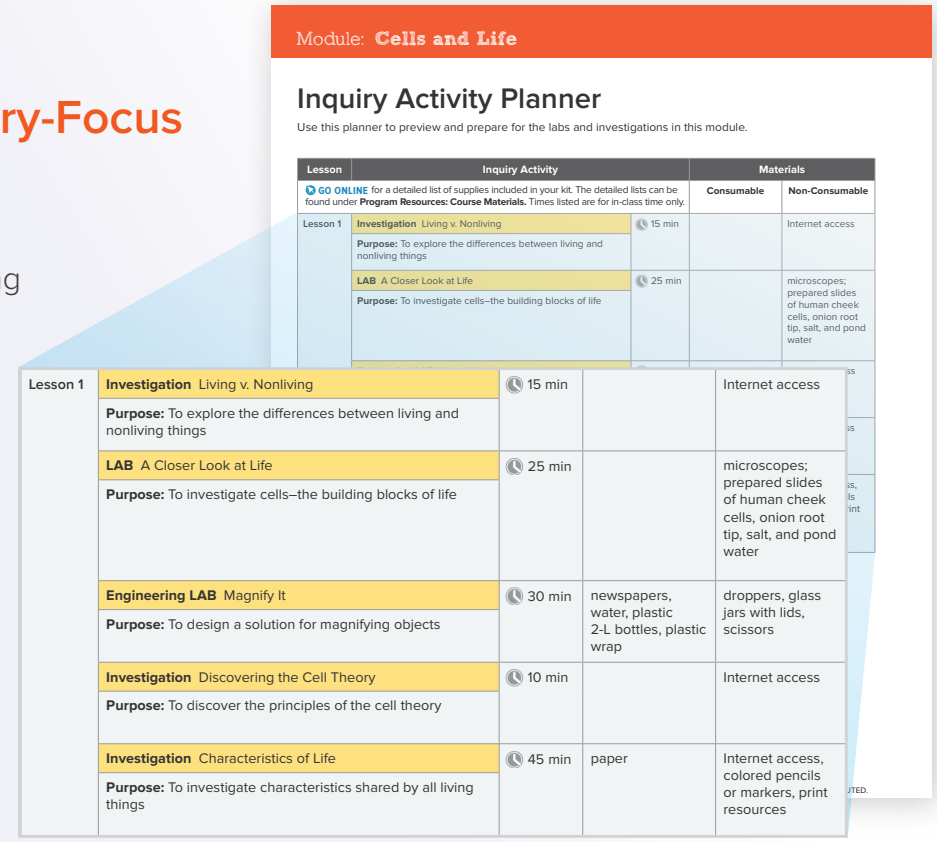
MS-LS1-2. Develop and use a model to describe the function of a cell as a whole and ways parts of cells contribute to the function.

CROSS-CURRICULAR Connections

In addition to in-depth coverage of the three dimensions, this module also covers connections to Engineering, History, Math, Reading, and Writing topics.

Designed for an Inquiry-Focus for Proficiency

Pennsylvania Inspire Science is infused with inquiry-based learning to capture student interest and empower them to ask questions and think more critically. Within each lesson are multiple inquiry-based learning opportunities designed to give students the practice they need to achieve proficiency and succeed with science and engineering practices.



Module: **Cells and Life**

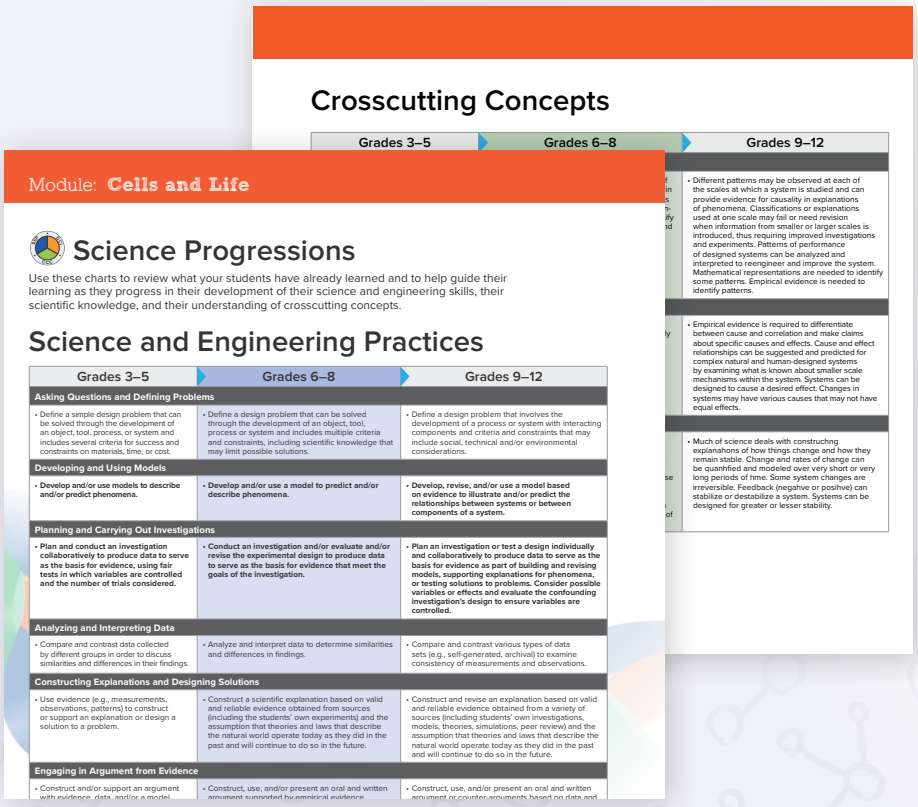
Inquiry Activity Planner

Use this planner to preview and prepare for the labs and investigations in this module.

Lesson	Inquiry Activity		Materials	
GO ONLINE for a detailed list of supplies included in your kit. The detailed lists can be found under **Program Resources: Course Materials.** Times listed are for in-class time only.			**Consumable**	**Non-Consumable**
Lesson 1	**Investigation** Living v. Nonliving **Purpose:** To explore the differences between living and nonliving things	15 min		Internet access
	LAB A Closer Look at Life **Purpose:** To investigate cells–the building blocks of life	25 min		microscopes; prepared slides of human cheek cells, onion root tip, salt, and pond water
Lesson 1	**Investigation** Living v. Nonliving **Purpose:** To explore the differences between living and nonliving things	15 min		Internet access
	LAB A Closer Look at Life **Purpose:** To investigate cells–the building blocks of life	25 min		microscopes; prepared slides of human cheek cells, onion root tip, salt, and pond water
	Engineering LAB Magnify It **Purpose:** To design a solution for magnifying objects	30 min	newspapers, water, plastic 2-L bottles, plastic wrap	droppers, glass jars with lids, scissors
	Investigation Discovering the Cell Theory **Purpose:** To discover the principles of the cell theory	10 min		Internet access
	Investigation Characteristics of Life **Purpose:** To investigate characteristics shared by all living things	45 min	paper	Internet access, colored pencils or markers, print resources

Science Progression

Each module includes a table illustrating in detail the Science and Engineering Practices and Crosscutting Concept Progressions across grade bands.



Crosscutting Concepts

Grades 3–5	Grades 6–8	Grades 9–12
		• Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena. Classifications or explanations used at one scale may fail or need revision when information from smaller or larger scales is introduced, thus requiring improved investigations and experiments. Patterns of performance of designed systems can be analyzed and interpreted to reengineer and improve the system. Mathematical representations are needed to identify some patterns. Empirical evidence is needed to identify patterns.
		• Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. Cause and effect relationships can be suggested and predicted for complex natural and human-designed systems by examining what is known about smaller scale mechanisms within the system. Systems can be designed to cause a desired effect. Changes in systems may have various causes that may not have equal effects.
		• Much of science deals with constructing explanations of how things change and how they remain stable. Change and rates of change can be quantified and modeled over very short or very long periods of time. Some system changes are irreversible. Feedback (negative or positive) can stabilize or destabilize a system. Systems can be designed for greater or lesser stability.

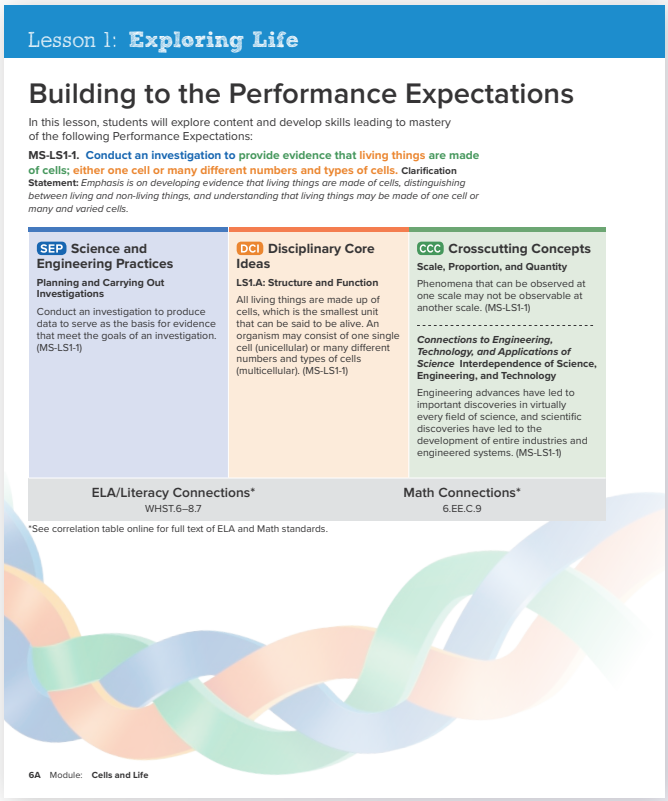
Module: **Cells and Life**

Science Progressions

Use these charts to review what your students have already learned and to help guide their learning as they progress in their development of their science and engineering skills, their scientific knowledge, and their understanding of crosscutting concepts.

Science and Engineering Practices

Grades 3–5	Grades 6–8	Grades 9–12
Asking Questions and Defining Problems		
• Define a simple design problem that can be solved through the development of an object, tool, process, or system and includes several criteria for success and constraints on materials, time, or cost.	• Define a design problem that can be solved through the development of an object, tool, process or system and includes multiple criteria and constraints, including scientific knowledge that may limit possible solutions.	• Define a design problem that involves the development of a process or system with interacting components and criteria and constraints that may include social, technical and/or environmental considerations.
Developing and Using Models		
• **Develop and/or use models to describe and/or predict phenomena.**	• **Develop and/or use a model to predict and/or describe phenomena.**	• **Develop, revise, and/or use a model based on evidence to illustrate and/or predict the relationships between systems or between components of a system.**
Planning and Carrying Out Investigations		
• **Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered.**	• **Conduct an investigation and/or evaluate and/or revise the experimental design to produce data to serve as the basis for evidence that meet the goals of the investigation.**	• **Plan an investigation or test a design individually and collaboratively to produce data to serve as the basis for evidence as part of building and revising models, supporting explanations for phenomena, or testing solutions to problems. Consider possible variables or effects and evaluate the confounding investigation's design to ensure variables are controlled.**
Analyzing and Interpreting Data		
• Compare and contrast data collected by different groups in order to discuss similarities and differences in their findings.	• Analyze and interpret data to determine similarities and differences in findings.	• Compare and contrast various types of data sets (e.g., self-generated, archival) to examine consistency of measurements and observations.
Constructing Explanations and Designing Solutions		
• Use evidence (e.g., measurements, observations, patterns) to construct or support an explanation or design a solution to a problem.	• Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students' own experiments) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.	• Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.
Engaging in Argument from Evidence		
• Construct and/or support an argument with evidence, data, and/or a model.	• Construct, use, and/or present an oral and written argument supported by empirical evidence.	• Construct, use, and/or present an oral and written argument or counter-arguments based on data and



Lesson 1: **Exploring Life**

Building to the Performance Expectations

In this lesson, students will explore content and develop skills leading to mastery of the following Performance Expectations:

MS-LS1-1. **Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells.** **Clarification Statement:** *Emphasis is on developing evidence that living things are made of cells, distinguishing between living and non-living things, and understanding that living things may be made of one cell or many and varied cells.*

SEP Science and Engineering Practices	DCI Disciplinary Core Ideas	CCC Crosscutting Concepts
Planning and Carrying Out Investigations Conduct an investigation to produce data to serve as the basis for evidence that meet the goals of an investigation. (MS-LS1-1)	**LS1.A: Structure and Function** All living things are made up of cells, which is the smallest unit that can be said to be alive. An organism may consist of one single cell (unicellular) or many different numbers and types of cells (multicellular). (MS-LS1-1)	**Scale, Proportion, and Quantity** Phenomena that can be observed at one scale may not be observable at another scale. (MS-LS1-1) ***Connections to Engineering, Technology, and Applications of Science* Interdependence of Science, Engineering, and Technology** Engineering advances have led to important discoveries in virtually every field of science, and scientific discoveries have led to the development of entire industries and engineered systems. (MS-LS1-1)

ELA/Literacy Connections*	Math Connections*
WHST.6–8.7	6.EE.C.9

*See correlation table online for full text of ELA and Math standards.

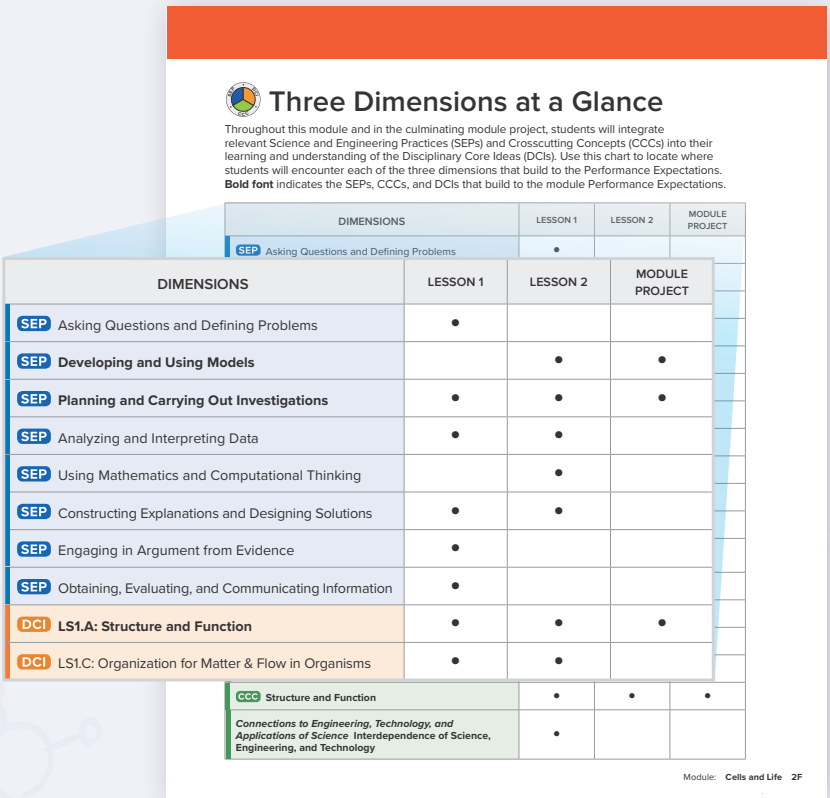
6A Module: **Cells and Life**

Focused Lesson Planning for Effective Standards-Based Instruction

Within the lesson opener, find the extension of Building to the NGSS to help focus student learning by standard and integrated Science and Engineering Practices, Disciplinary Core Ideas, and Crosscutting Concepts.

Three Dimensions at a Glance, Aligns to Pennsylvania STEELS Standards

Use this chart to locate where students will encounter each of the three dimensions that build to the performance expectations within the module.



Three Dimensions at a Glance

Throughout this module and in the culminating module project, students will integrate relevant Science and Engineering Practices (SEPs) and Crosscutting Concepts (CCCs) into their learning and understanding of the Disciplinary Core Ideas (DCIs). Use this chart to locate where students will encounter each of the three dimensions that build to the Performance Expectations. **Bold font** indicates the SEPs, CCCs, and DCIs that build to the module Performance Expectations.

DIMENSIONS	LESSON 1	LESSON 2	MODULE PROJECT
SEP Asking Questions and Defining Problems	•		
SEP **Developing and Using Models**		•	•
SEP **Planning and Carrying Out Investigations**	•	•	•
SEP Analyzing and Interpreting Data	•	•	
SEP Using Mathematics and Computational Thinking		•	
SEP Constructing Explanations and Designing Solutions	•	•	
SEP Engaging in Argument from Evidence	•		
SEP Obtaining, Evaluating, and Communicating Information	•		
DCI **LS1.A: Structure and Function**	•	•	•
DCI LS1.C: Organization for Matter & Flow in Organisms	•	•	
CCC **Structure and Function**	•	•	•
***Connections to Engineering, Technology, and Applications of Science* Interdependence of Science, Engineering, and Technology**	•		

Module: **Cells and Life** 2F

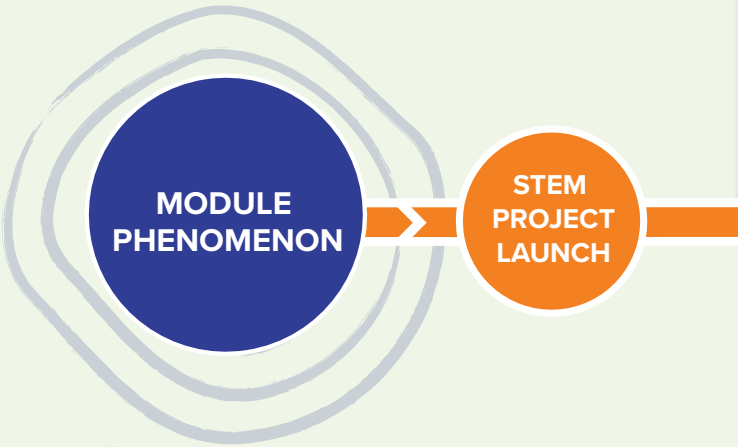
Learning Through Storylines

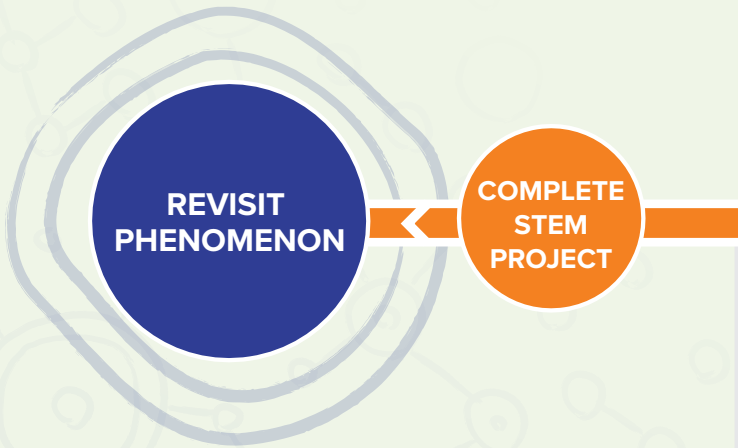
Students are surrounded by natural phenomena.

These phenomena are the centerpiece of each *Pennsylvania Inspire Science* module and lesson; find Module Storylines as the anchor to engage students as they investigate each lesson-level phenomenon. Within each lesson-level phenomenon, they will gather pieces of the puzzle to help solve and explain the module-level phenomenon.

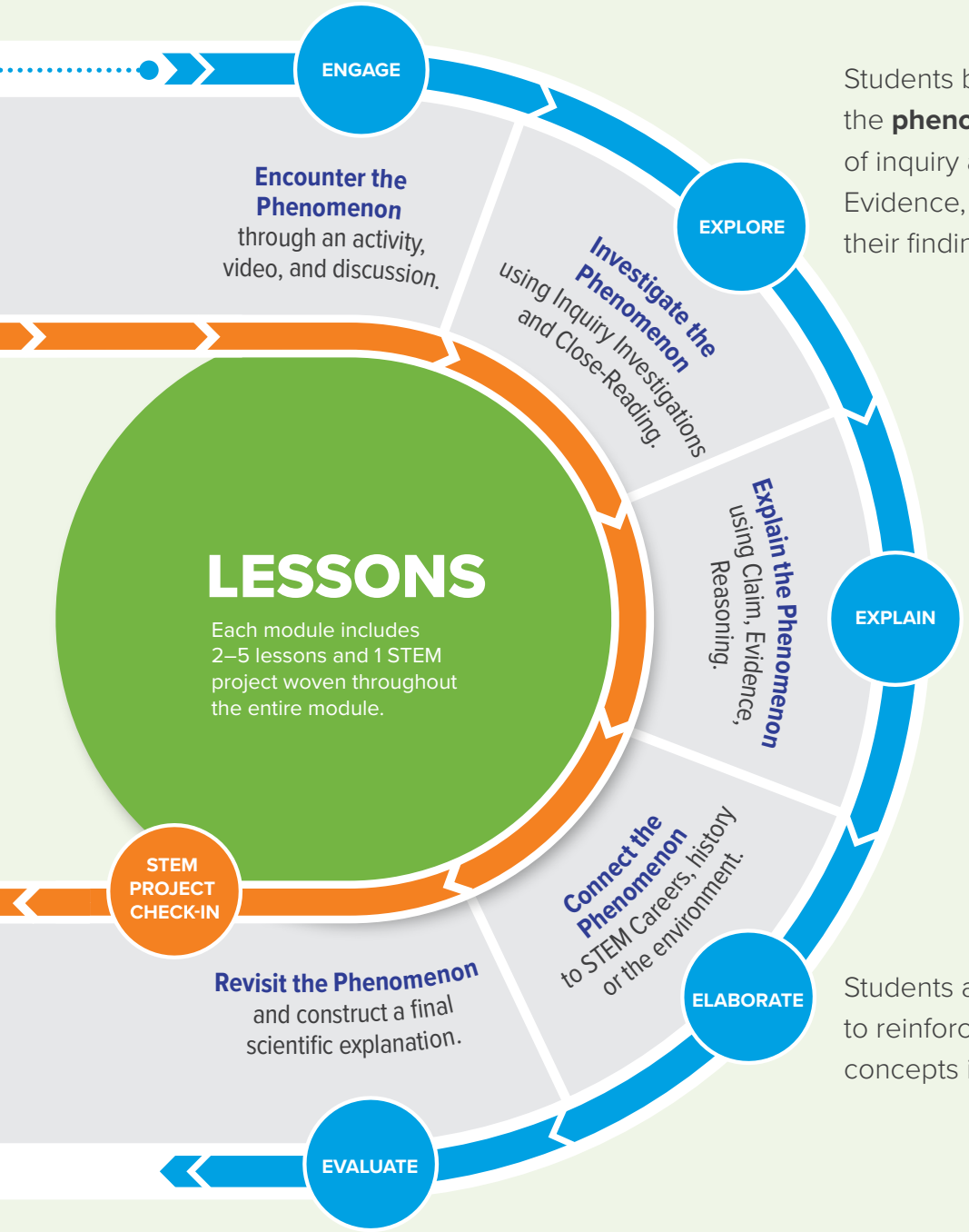
Students experience the topic through multiple related phenomena. This strategy offers students multiple entry points for connection to their lives and a deeper understanding of the world around them.

Pennsylvania Inspire Science is built around the 5E+IA framework to guide students toward scientific understanding using a thorough and methodical process aligned with Pennsylvania STEELS Standards.





Each module and lesson in *Pennsylvania Inspire Science* begins by introducing a natural **phenomenon**, which students are charged with investigating as they progress through the text.



Students begin to explore and investigate the **phenomenon** through different types of inquiry activities, using the CER (Claim, Evidence, Reasoning) framework to record their findings and results.

Students delve into an array of informational text, supportive resources, and interactive activities designed to help them synthesize and convey their understanding of **phenomena** while practicing close-reading skills.

Students apply knowledge to new situations to reinforce deep understanding of lesson concepts introduced by the **phenomenon**.

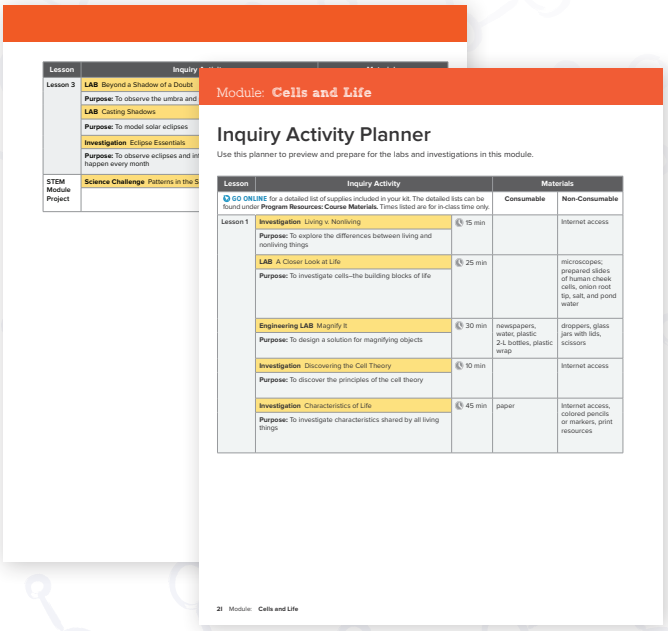
Students explain the **phenomenon** so that teachers can gauge progress and assess understanding.

Empower Students With Hands-On, Inquiry-Based Learning

During two to three Inquiry Activities per lesson—typically found in Explore/Explain or Elaborate—students use the same techniques as scientists and engineers as they use their results and findings to communicate their understanding. These Inquiry Activities drive home science topics in meaningful, engaging ways.

There are five types of Inquiry Activities in *Pennsylvania Inspire Science* that enable students to investigate phenomena and record findings in the same way as real-world practitioners do:

- Hands-On
- Engineering
- Investigations
- Simulations
- Data Analysis



Inquiry Activity Planning

Planning and preparing for students to become elbows-deep in science is made easier with the *Pennsylvania Inspire Science* Inquiry Activity Planner that clearly identifies all the materials needed within the module.

Inquiry Spectrum

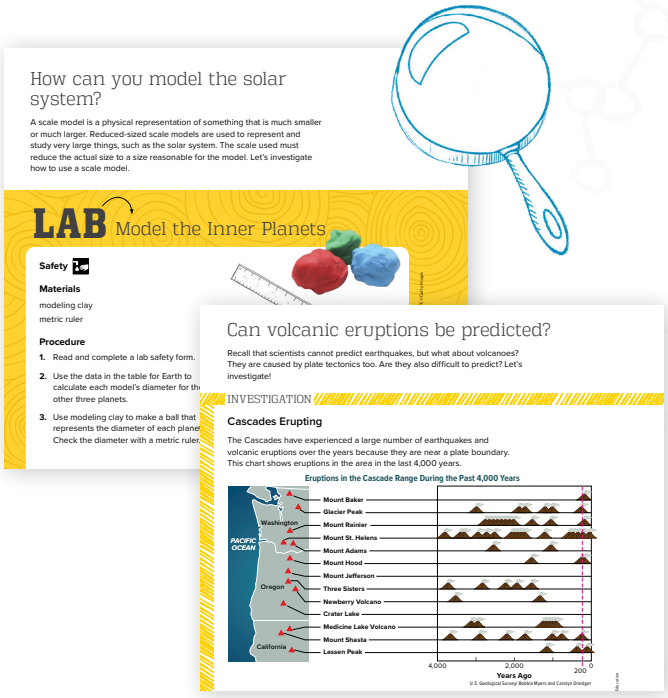
Not all inquiry activities are the same. Depending upon the available time and student readiness, structured inquiry might be perfect, or your class may be ready for open inquiry. The *Pennsylvania Inspire Science* Inquiry Spectrum provides flexible options to adjust the inquiry level to align with the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

Each lesson offers inquiry activities developed with a recommended inquiry spectrum level, giving you the flexibility to modify the level of instruction based on your students' needs.

Structured Inquiry
In this Inquiry Activity, students are given a question to investigate and procedure to follow.

Guided Inquiry
To make this a guided inquiry activity, have students plan their own investigation by selecting their own volumes and temperatures of water, making their predictions, and conducting their plan.

Open Inquiry
To make this an open inquiry activity, have students develop their own question about the link between amount of matter and its energy to investigate and design the investigation.



Student-Driven Data Analysis

All Inquiry Activities in *Pennsylvania Inspire Science* promote student engagement and allow each student to develop skills in both inquiry and science and engineering skills. The combination of Investigations and Labs enable students to cover the full range of the inquiry spectrum.

Labs provide students an opportunity to conduct an investigation and gather their own data to analyze, interpret, and apply to the lesson and module phenomena.

Investigations offer students practice with data sets, graphs and other scientific scenarios to further hone their abilities to think like scientists.

Collaboration Kits

When students are engaged in their learning, they succeed, and nothing is more engaging than rolling up your sleeves and digging into hands-on activities. Developed to support engagement, *Inspire Science* Collaboration Kits make it easy to innovate and incorporate investigative thinking about core science concepts.

Support Every Learner

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

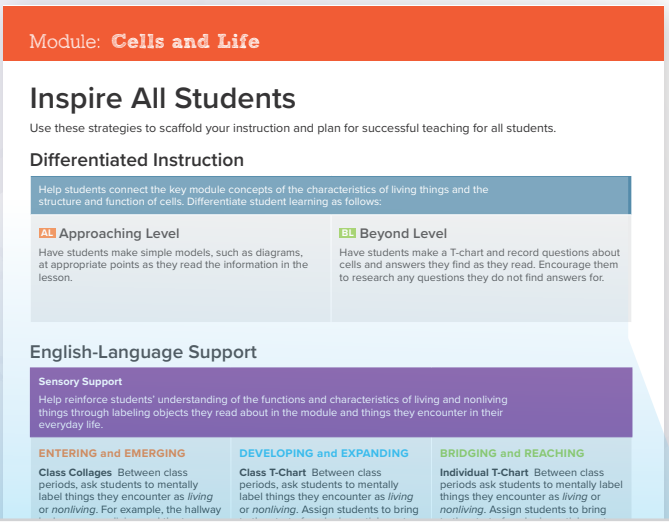
Support with practical strategies is found at the module and lesson level at multiple points. The Leveled text aligns with the Lexile ranges appropriate for each grade level.

Uniting Phenomena

Phenomena-driven instruction levels the playing field for learners by allowing them to access the core science instruction via a shared experience by observing a highly relevant real-world phenomenon. These shared experiences with supporting instruction ensure learning is truly accessible to ALL students.

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.


Module: **Cells and Life**

Inspire All Students

Use these strategies to scaffold your instruction and plan for successful teaching for all students.

Differentiated Instruction

Help students connect the key module concepts of the characteristics of living things and the structure and function of cells. Differentiate student learning as follows:

AL **Approaching Level**

Have students make simple models, such as diagrams, at appropriate points as they read the information in the lesson.

BL **Beyond Level**

Have students make a T-chart and record questions about cells and answers they find as they read. Encourage them to research any questions they do not find answers for.

English-Language Support

Sensory Support

Help reinforce students' understanding of the functions and characteristics of living and nonliving things through labeling objects they read about in the module and things they encounter in their everyday life.

ENTERING and EMERGING

Class Collages Between class periods, ask students to mentally label things they encounter as *living* or *nonliving*. For example, the hallway

DEVELOPING and EXPANDING

Class T-Chart Between class periods, ask students to mentally label things they encounter as *living* or *nonliving*. Assign students to bring

BRIDGING and REACHING

Individual T-Chart Between class periods ask students to mentally label things they encounter as *living* or *nonliving*. Assign students to bring

Help students connect the key module concepts of the characteristics of living things and the structure and function of cells. Differentiate student learning as follows:

AL **Approaching Level**

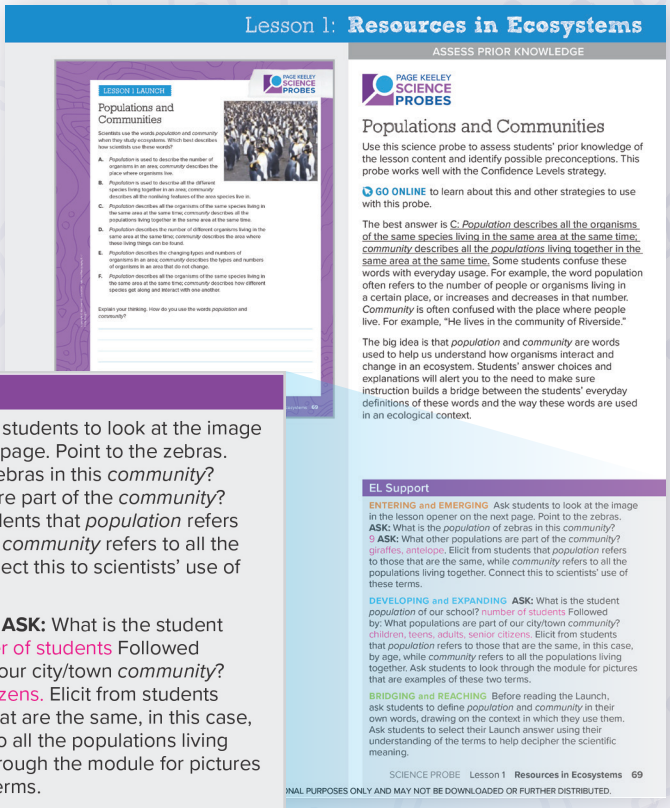
Have students make simple models, such as diagrams, at appropriate points as they read the information in the lesson.

BL **Beyond Level**

Have students make a T-chart and record questions about cells and answers they find as they read. Encourage them to research any questions they do not find answers for.

English-Language Support

Pennsylvania Inspire 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.


Lesson 1: Resources in Ecosystems

ASSESS PRIOR KNOWLEDGE

PAGE KEELEY SCIENCE PROBES

Populations and Communities

Use this science probe to assess students' prior knowledge of the lesson content and identify possible preconceptions. This probe works well with the Confidence Levels strategy.

GO ONLINE to learn about this and other strategies to use with this probe.

The best answer is C; *Population* describes all the organisms of the same species living in the same area at the same time; *community* describes all the *populations* living together in the same area at the same time. Some students confuse these words with everyday usage. For example, the word population often refers to the number of people or organisms living in a certain place, or increases and decreases in that number. *Community* is often confused with the place where people live. For example, "He lives in the community of Riverside."

The big idea is that *population* and *community* are words used to help us understand how organisms interact and change in an ecosystem. Students' answer choices and explanations will alert you to the need to make sure instruction builds a bridge between the students' everyday definitions of these words and the way these words are used in an ecological context.

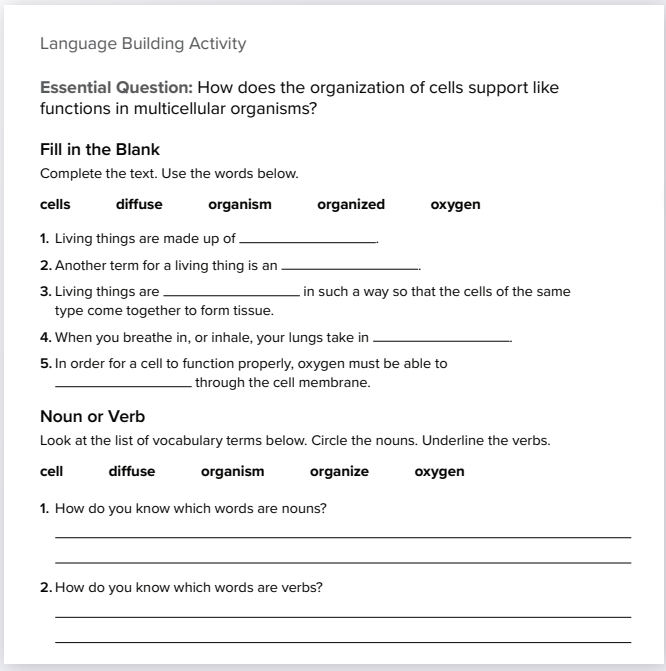
EL Support

ENTERING and EMERGING Ask students to look at the image in the lesson opener on the next page. Point to the zebras. **ASK:** What is the *population* of zebras in this *community*? 9 **ASK:** What other populations are part of the *community*? giraffes, antelope. Elicit from students that *population* refers to those that are the same, while *community* refers to all the populations living together. Connect this to scientists' use of these terms.

DEVELOPING and EXPANDING **ASK:** What is the student *population* of our school? number of students Followed by: What populations are part of our city/town *community*? children, teens, adults, senior citizens. Elicit from students that *population* refers to those that are the same, in this case, by age, while *community* refers to all the populations living together. Ask students to look through the module for pictures that are examples of these two terms. Ask students to look through the module for pictures that are examples of these two terms.

BRIDGING and REACHING Before reading the Launch, ask students to define *population* and *community* in their own words, drawing on the context in which they use them. Ask students to select their Launch answer using their understanding of the terms to help decipher the scientific meaning.

SCIENCE PROBE Lesson 1 **Resources in Ecosystems** 69


Language Building Activity

Essential Question: How does the organization of cells support like functions in multicellular organisms?

Fill in the Blank

Complete the text. Use the words below.

cells **diffuse** **organism** **organized** **oxygen**

1. Living things are made up of _____.
2. Another term for a living thing is an _____.
3. Living things are _____ in such a way so that the cells of the same type come together to form tissue.
4. When you breathe in, or inhale, your lungs take in _____.
5. In order for a cell to function properly, oxygen must be able to _____ through the cell membrane.

Noun or Verb

Look at the list of vocabulary terms below. Circle the nouns. Underline the verbs.

cell **diffuse** **organism** **organize** **oxygen**

1. How do you know which words are nouns?

_____

_____

2. How do you know which words are verbs?

_____

_____

Language Building Resources

Pennsylvania Inspire Science lessons carefully and purposefully integrate reading, writing, speaking, listening, and collaborating into each lesson. This structure provides EL students with purposeful language usage and resource access to convey their understanding.

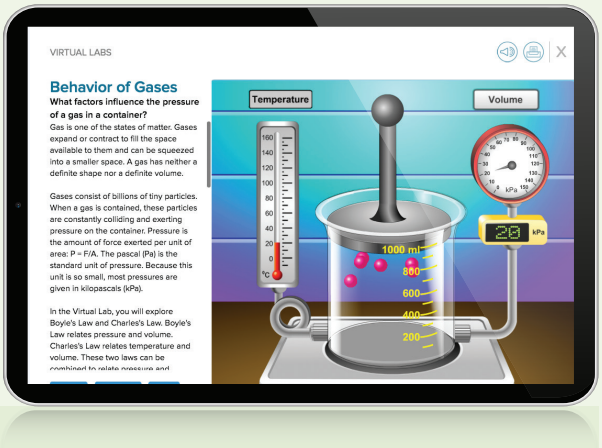
Bring Science to Life

Pennsylvania Inspire 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.

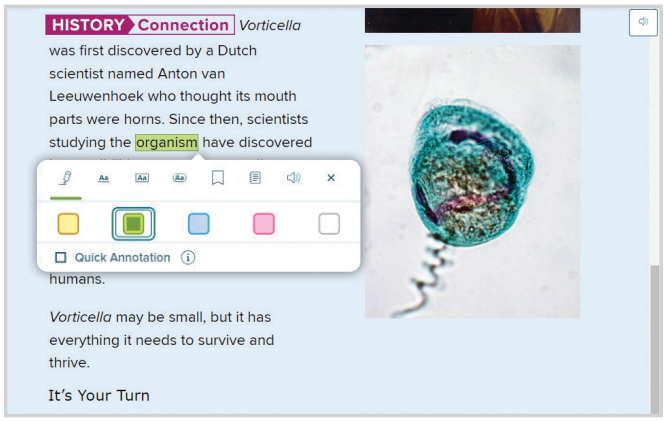
Simulations

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



Virtual Labs

Virtual Labs provide an alternative engaging way for students to interact with an experiment that cannot always be done in a classroom setting. These interactive Virtual Labs are found throughout your *Pennsylvania Inspire Science* program.

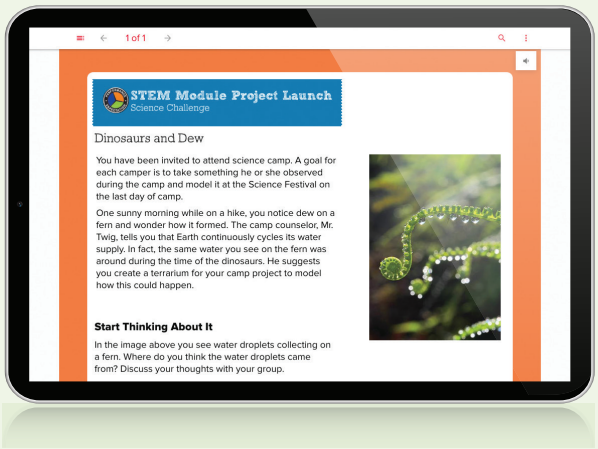


Interactive Text

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.

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 and to experience worlds beyond their own.



Project Based Learning

Pennsylvania Inspire Science provides activities and instruction that progress toward a culminating STEM Module project where students meet grade-level Performance Expectations.

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.

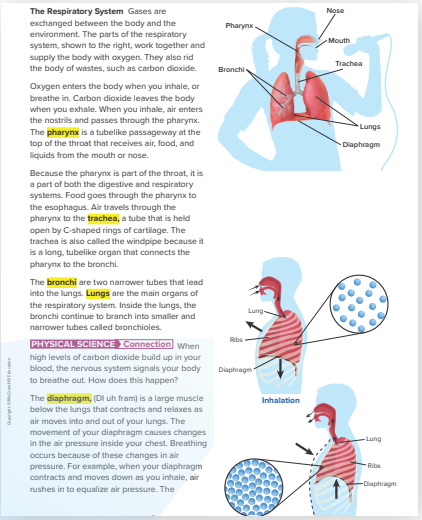
Cross-Curricular Connections

When students study science, they practice and build upon other skill sets along the way.

Pennsylvania Inspire Science has been designed to maximize opportunities for cross-curricular connections, integrating ELA/Literacy and Mathematics standards so they are prepared for success on the PSSA.

Other connections, such as those listed below, are found throughout *Pennsylvania Inspire Science* Lessons. These connections are found vertically and horizontally across disciplines as students approach a single phenomenon from different perspectives.

- Physical Science
- Earth Science
- Environmental
- Health
- Writing
- Reading



The Respiratory System Gases are exchanged between the body and the environment. The parts of the respiratory system, shown to the right, work together and supply the body with oxygen. They also rid the body of wastes, such as carbon dioxide.

Oxygen enters the body when you inhale, or breathe in. Carbon dioxide leaves the body when you exhale. When you inhale, air enters the nostrils and passes through the pharynx. The **pharynx** is a tubelike passageway at the top of the throat that receives air, food, and liquids from the mouth or nose.

Because the pharynx is part of the throat, it is a part of both the digestive and respiratory systems. Food goes through the pharynx to the esophagus. Air travels through the pharynx to the **trachea,** a tube that is held open by C-shaped rings of cartilage. The trachea is also called the windpipe because it is a long, tubelike organ that connects the pharynx to the bronchi.

The **bronchi** are two narrower tubes that lead into the lungs. **Lungs** are the main organs of the respiratory system. Inside the lungs, the bronchi continue to branch into smaller and narrower tubes called bronchioles.

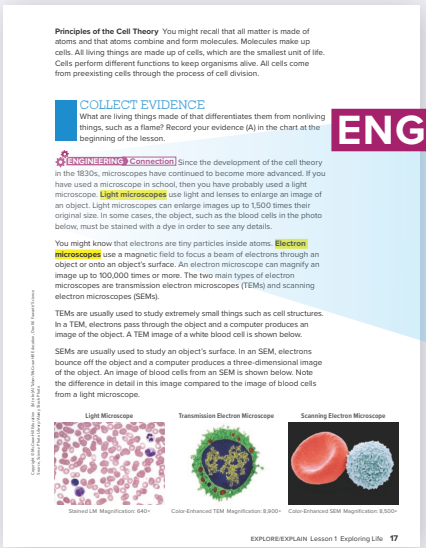
PHYSICAL SCIENCE Connection When high levels of carbon dioxide build up in your blood, the nervous system signals your body to breathe out. How does this happen?

The **diaphragm,** (DI uh fram) is a large muscle below the lungs that contracts and relaxes as air moves into and out of your lungs. The movement of your diaphragm causes changes in the air pressure inside your chest. Breathing occurs because of these changes in air pressure. For example, when your diaphragm contracts and moves down as you inhale, air rushes in to equalize air pressure. The

Nose
Pharynx
Mouth
Trachea
Bronchi
Lungs
Diaphragm
Lung
Ribs
Diaphragm
Inhalation
Lung
Ribs
Diaphragm

PHYSICAL SCIENCE Connection When high levels of carbon dioxide build up in your blood, the nervous system signals your body to breathe out. How does this happen?

The **diaphragm,** (DI uh fram) is a large muscle below the lungs that contracts and relaxes as air moves into and out of your lungs. The



Principles of the Cell Theory You might recall that all matter is made of atoms and that atoms combine and form molecules. Molecules make up cells. All living things are made up of cells, which are the smallest unit of life. Cells perform different functions to keep organisms alive. All cells come from preexisting cells through the process of cell division.

COLLECT EVIDENCE
What are living things made of that differentiates them from nonliving things, such as a flame? Record your evidence (A) in the chart at the beginning of the lesson.

ENGINEERING Connection Since the development of the cell theory in the 1830s, microscopes have continued to become more advanced. If you have used a microscope in school, then you have probably used a light microscope. **Light microscopes** use light and lenses to enlarge an image of an object. Light microscopes can enlarge images up to 1,500 times their original size. In some cases, the object, such as the blood cells in the photo below, must be stained with a dye in order to see any details.

You might know that electrons are tiny particles inside atoms. **Electron microscopes** use a magnetic field to focus a beam of electrons through an object or onto an object's surface. An electron microscope can magnify an image up to 100,000 times or more. The two main types of electron microscopes are transmission electron microscopes (TEMs) and scanning electron microscopes (SEMs).

TEMs are usually used to study extremely small things such as cell structures. In a TEM, electrons pass through the object and a computer produces an image of the object. A TEM image of a white blood cell is shown below.

SEMs are usually used to study an object's surface. In an SEM, electrons bounce off the object and a computer produces a three-dimensional image of the object. An image of blood cells from an SEM is shown below. Note the difference in detail in this image compared to the image of blood cells from a light microscope.

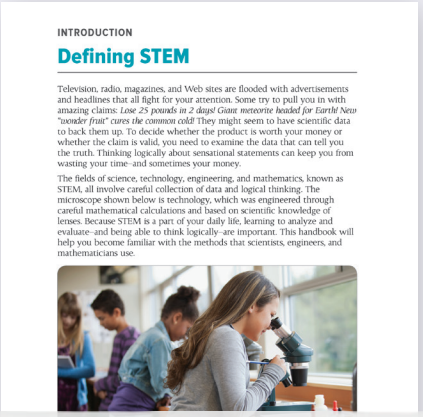
Light Microscope
Transmission Electron Microscope
Scanning Electron Microscope
Stained LM Magnification: 640×
Color-Enhanced TEM Magnification: 8,000×
Color-Enhanced SEM Magnification: 8,500×

EXPLORE/EXPLAIN Lesson 1 Exploring Life 17

ENGINEERING Connection Since the development of the cell theory in the 1830s, microscopes have continued to become more advanced. If you have used a microscope in school, then you have probably used a light microscope. **Light microscopes** use light and lenses to enlarge an image of an object. Light microscopes can enlarge images up to 1,500 times their original size. In some cases, the object, such as the blood cells in the photo below, must be stained with a dye in order to see any details.

Integrated Engineering

Pennsylvania Inspire Science 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 the Science and Engineering practices. Students can also practice these skills by applying them as they read through the handbook. The Student Edition also helps students understand the integration of engineering through lab explorations and module projects, where the science and engineering practices are interwoven with other concepts and content.


INTRODUCTION

Defining STEM

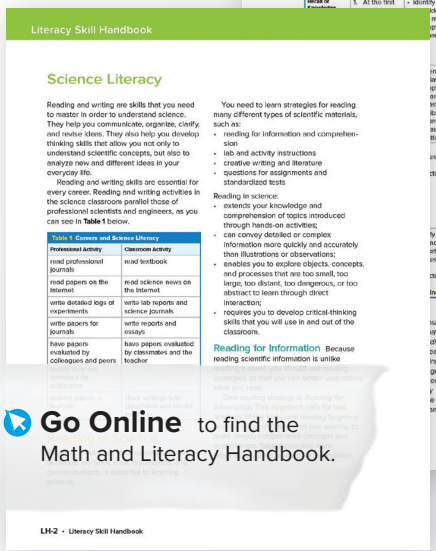
Television, radio, magazines, and Web sites are flooded with advertisements and headlines that all fight for your attention. Some try to pull you in with amazing claims: *Lose 25 pounds in 2 days! Giant meteorite headed for Earth! New "wonder fruit" cures the common cold!* They might seem to have scientific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

Pennsylvania Inspire Science 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 analyze new and different ideas in your everyday life.

Reading and writing skills are essential for every career. Reading and writing activities in the science classroom parallel those of professional scientists and engineers, as you can see in **Table 1** below.

Table 1 Careers and Science Literacy

Professional Activity	Classroom Activity
read professional journals	read textbook
read papers on the Internet	read science news on the Internet
write detailed logs of experiments	write lab reports and science journals
write papers for journals	write reports and essays
have papers evaluated by colleagues and peers	have papers evaluated by classmates and the teacher

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

LH-2 • Literacy Skill Handbook

Table 2 Reading for Information

Components	Steps	Actions
Recall of Knowledge	1. At the first	• identify the

Active reading strategies include the following:

- Be aware of whether you understand each statement or question.
- When you do not understand, stop and reread.
- Relate what you read to your prior knowledge.
- Consider how new concepts fit with preceding concepts.
- Predict what concepts might be presented next.

Science in Media

News, educational, and entertainment media provide many sources of scientific and pseudo-scientific information. Pseudo-scientific information is false information that is presented as scientific fact.

Newspapers, magazines, Web sites, advertisements, and movies can contain scientific topics. They can contain information that is scientifically accurate, and they also can contain false information that is designed to persuade the reader to a specific point of view. These diverse media require you to analyze the purpose of the information presented and evaluate the motives of the writer or writers.

Reading Science Media Newspapers, magazines, and the Internet are all forms of media that involve reading. When reading about science in these various forms of media, you will realize that science is relevant and useful to your daily life. You also will quickly realize that all things on the Internet are not scientifically accurate. Just as you use strategies to read [illegible] and analyze diverse forms of [illegible]

Literacy Skill Handbook

Go Online to find the Math and Literacy Handbook.

STEM Career Connection

STEM Career Connection allow students to connect with science by seeing potential career paths, as well as how what they're studying connects to the real world. Students can read about the STEM career, and then do an activity for further exploration in the It's Your Turn section of the feature.

STEM CAREER Connection


STEM Careers

A Day in the Life of a Microbiologist

Microbiologists study living things that are too small to be seen with the unaided eye, such as bacteria, algae, and fungi. Some microbiologists also study viruses. Without microscopes, the field of microbiology and the industries it supports, such as the food and medical industries, would not be the same today.

A typical day in the life of a microbiologist depends on what specific field of microbiology he or she works in. Some microbiologists focus solely on certain organisms, such as bacteria; some focus on the ways in which microorganisms interact with the environment; and some focus on ways to detect, treat, and prevent diseases caused by microorganisms.

Microbiologists spend much of their time preparing the samples that they study, conducting experiments, and writing reports on their findings. Since their specimens cannot be seen with the unaided eye, microbiologists use microscopes, along with many other technologies, in their work.

It's Your Turn

WRITING Connection Suppose that you are planning on getting a college degree in microbiology. Which area of microbiology would you like to focus on? Research the different fields and specialties of microbiology, and then choose the one that interests you the most. Write a paragraph explaining the field of microbiology that you have selected and why that field interests you.

18 ELABORATE Module: Cells and Life

Pennsylvania Assessment Strategies

Pennsylvania Inspire Science includes a variety of digital assessment options to support teachers with differentiation strategies and support students on their journey to mastery of the Pennsylvania STEELS Standards and culminating with success.

Each *Pennsylvania Inspire Science* lesson begins with a Formative Assessment Science Probe.

Page Keeley, M.Ed.

Page Keeley's Science Probes present the lesson phenomenon in an engaging way to promote student thinking and discussion, revealing commonly-held preconceptions students bring to their learning to guide differentiated instruction strategies.

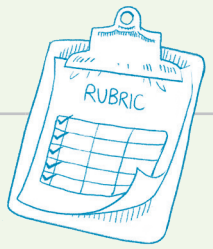
Formative Assessment

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 *Pennsylvania Inspire Science*.

FEATURE	INSTRUCTIONAL PURPOSE
Page Keeley Science Probes	Found at the beginning of each lesson, **Science Probes** reveal student preconceptions to guide instruction.
Claim-Evidence-Reasoning	With the **CER Framework** (Claim/Evidence/Reasoning), found in all lessons, 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 at least two of the three dimensions of the Pennsylvania STEELS Standards.
LABS and INVESTIGATIONS	In each **Lab** or **Investigation** (2–3 per lesson), students may encounter analyzing and concluding questions that help build Three-Dimensional Thinking.
SmartBook®	*SmartBook* transforms the way students read. A proven, adaptive learning program, it individualizes instruction to help students study more efficiently and retain more knowledge.

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 *Pennsylvania Inspire Science*.

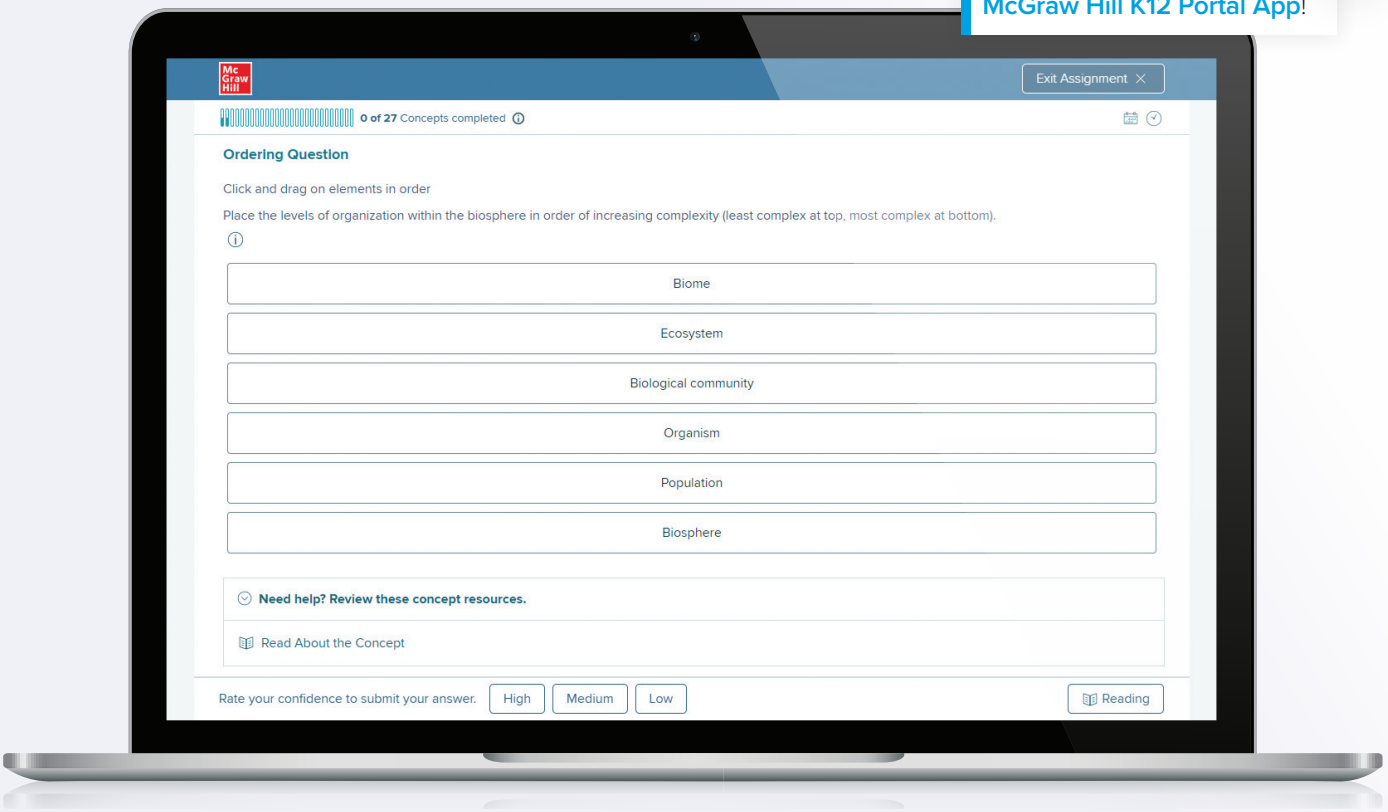
FEATURE	INSTRUCTIONAL PURPOSE	
Module Pretest	The **Module Pretests**, found at the beginning of each module, assess prerequisite knowledge of Disciplinary Core Ideas from prior grades to evaluate student readiness for the module.	
Three-Dimensional Thinking Questions	At the end of the lessons, students will demonstrate their understanding of at least two of the three dimensions of Pennsylvania STEELS Standards 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 Module Project Performance-Based Rubrics	With each STEM Module Project 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.	
Vocabulary Check	Through online interactives, students practice and check their understanding of science language. Immediate feedback from the system is provided.	

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.

PROGRAM FEATURE!

Smartbook is also available offline with the **McGraw Hill K12 Portal App**!



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.

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.

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.

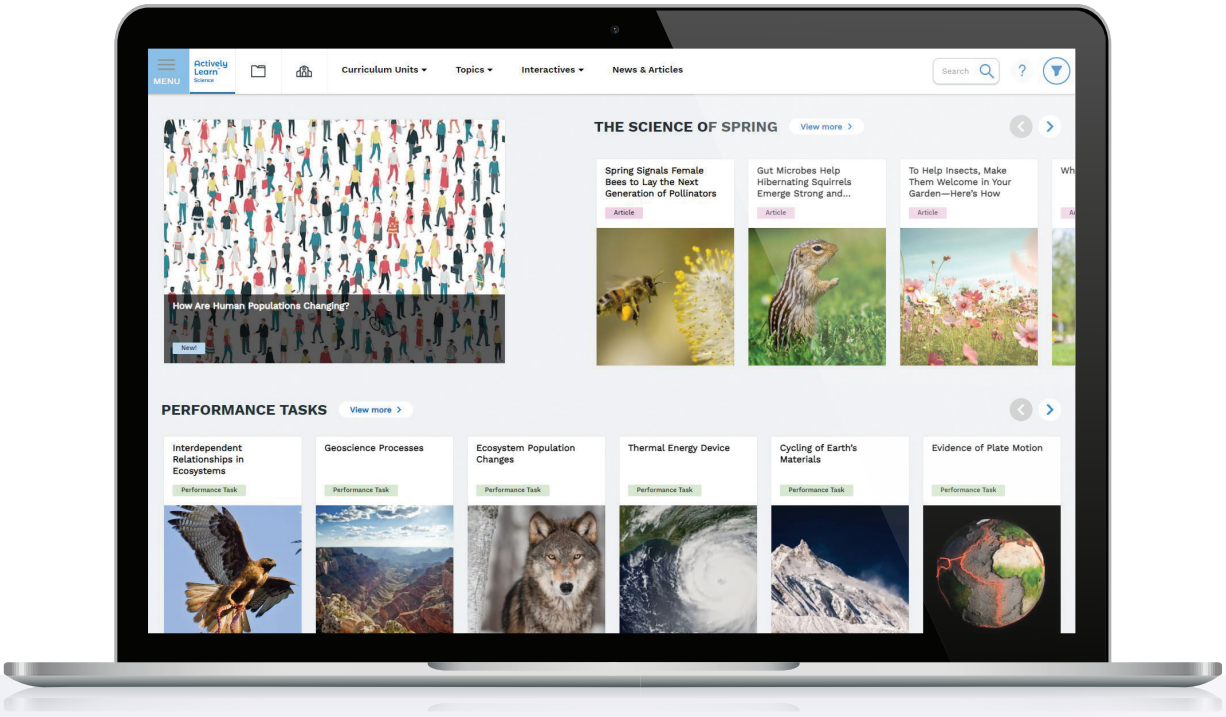
Track progress on the assignment as students work through the questions.

Breakdown reporting to the individual student level.

Drive Deeper Science Learning With *Actively Learn*

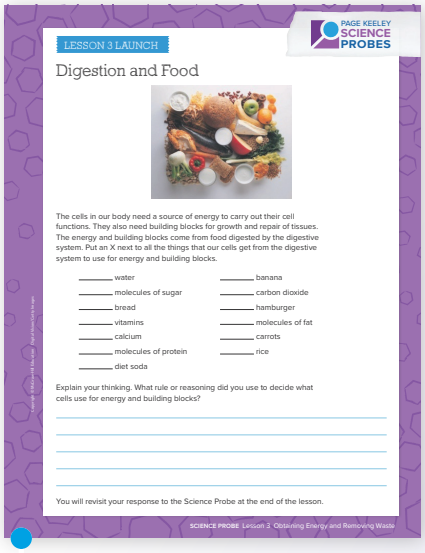
As educators, we know how important it is to keep students engaged.

That's why each *Pennsylvania Inspire 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 with *Actively Learn*.



- **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
- **TUVA Data Sets and PhET Simulations** include teacher instructional support
- **Interactive reading and study aids** that promote active collaboration
- **Rich, cross-curricular connections** to other subjects
- **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

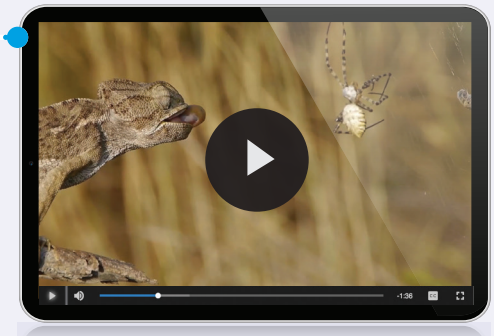


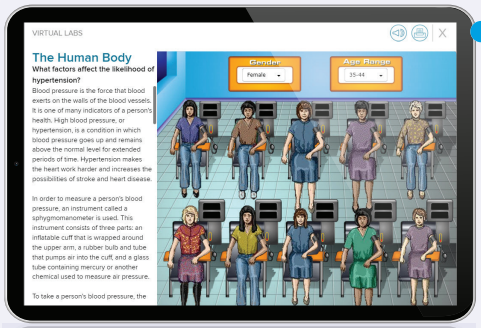
Science Probes

Page Keeley 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.

Visualizing Phenomena in Action

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





Virtual Labs

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

STEM Module Project
Planning and Completing the Science Challenge
How will you meet this goal? The concepts you will learn throughout this module will help you plan and complete the Science Challenge. Just follow the prompts at the end of each lesson!

STEM Module Projects

Introduce students to real-world STEM Science or Engineering Challenge to get them thinking about questions they have, what plan they can put in place to complete the challenge, and begin experiencing the same engineering-design processes, including research and experimentation, just like science professionals do.

Three-Dimensional Assessment Guide

Following the scope and sequence of *Pennsylvania Inspire Science*, this Three-Dimensional Assessment Guide provides Guided Practice and 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.

Unit Tests provide extra assessment support for groups of Pennsylvania Content Standards to help you measure how students are progressing to the end of year goals for Pennsylvania Content Standards mastery.

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

- ✓ Use the guided practice and independent practice sections before a Module Test to provide extra support.
- ✓ Use the practice sections after a Module Test but before a Unit Test for remediation.
- ✓ Administer the independent practice section first and use the guided practice as remediation.
- ✓ Use the Unit Test before implementing a *Pennsylvania Inspire Science* unit for pre-assessment to serve as a benchmark, or after to identify reteaching opportunities.

Seamless Integration Services

We are proud to work with schools across Pennsylvania 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.

Google Classroom

Clever

PowerSchool

CANVAS BY INSTRUCTURE

schoology

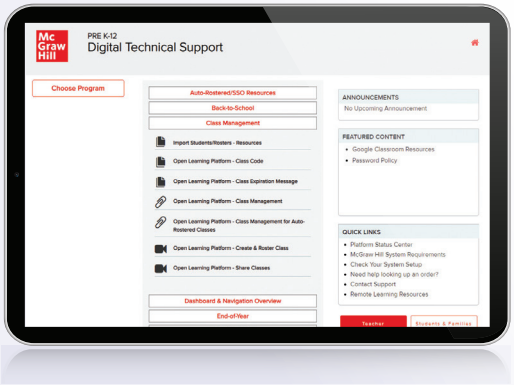
Continued Professional Learning

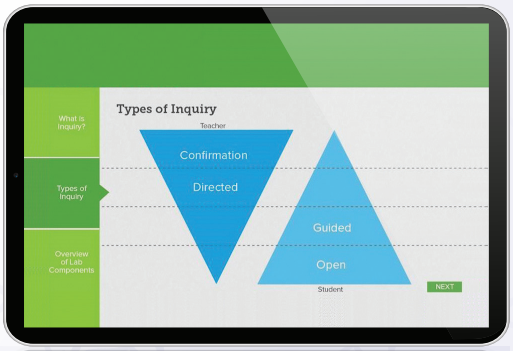
Professional Development

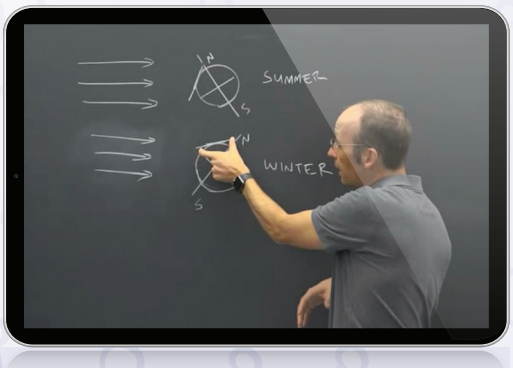
We know it can be a challenge to implement a new science program with new standards. That's why *Pennsylvania Inspire Science* comes with a library of relevant, self-paced, professional learning videos and modules to support you from implementation through instructional progression and mastery, all available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

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 *Pennsylvania Inspire 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.

Pennsylvania Inspire Science

Learn more at
mheducation.com/pennsylvania

Mc Graw Hill

SC.1057947