STEM Module **Descriptions**

for Pre-Kindergarten through 8th Grade

ASET STEM Education

What is **ASSET STEM Education?**

ASSET STEM Education is a national Science, Technology, Engineering and Math (STEM) education improvement nonprofit established by Bayer Corporation and several community partners in 1994. It fosters STEM fluency and college/career readiness by providing educators with highly effective professional development, hands-on educational materials and consulting services — impacting students pre-K through career. All of its programs are results oriented, research and inquiry based and align with national and state standards.

Our Mission

To advance teaching and learning to engage, inspire and empower all students.

Our Vision

ASSET STEM Education will equip educators with effective tools and strategies to create innovative and relevant learning environments so all students acquire the knowledge and skills needed to work, live and contribute in a global community.

This is no **experiment.**

ASSET STEM Education is the future of education.

ASSET accomplishes its mission by supporting schools in implementing all five essential components identified by the National Science Resources Center for sustaining quality standards-based science education programs: Curriculum Materials, Ongoing Professional Development, Materials Support, Assessment and Community/Administrative Involvement.

Independent evaluations have consistently shown a positive effect on teacher development and student achievement. On the Pennsylvania System of School Assessments, ASSET 4th-grade students outperformed their peers in science. ASSET currently impacts more than 250 public, charter, and private schools and educational organizations in Pennsylvania. ASSET also provides professional development in New Mexico, North Carolina and Texas and has consulted with educational organizations across the U.S. on STEM education reform and capacity building. ASSET's programs influence the lives of more than 7,000 teachers and 225,000 students across the nation.

ASSET represents Pennsylvania as part of Battelle's STEMx national network, a multi-state network with an imperative for action on STEM. STEMx is comprised of 19 member state networks, more than a third of the nation's states, and currently impacts more than 8 million students nationwide. Additionally, ASSET's Elementary Program met the rigorous criteria for inclusion in the Change the Equation STEMworks Database, a national database of evidence-based STEM programs. In 2010, ASSET was selected as one of the first-round recipients of a U.S. Department of Education Investing in Innovation Grant to validate its model in rural and high-needs schools. From 2006-2011, ASSET designed and implemented the statewide Science: It's Elementary initiative in partnership with the Pennsylvania Department of Education.

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ASSET STEM Education

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For more information and to view our video "Planting the Roots for STEM Education" please visit ***www.assetinc.org****.*

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Curriculum Materials

Module Descriptions

Pre-K through 6

Engineering is Elementary®

ASSET STEM Education **Curriculum Framework**

Elementary Curriculum Materials (Pre-K – 6)

Modules

Each module contains materials for 30 students to complete a 9 to 12 week unit. Modules marked with an asterisk (*) correspond to an ASSET Toolbox or the technology-based enrichment listed below and can be used together to enhance the module content or separately.

Grade	Life Science	Earth Science	Physical Science	Engineering & Technology
Pre-K (BBS)	• Discovering Plants • My Senses		• Push, Pull, Go	• Push, Pull, Go
K (FOSS)	• Animals Two by Two • Trees *		• Fabric • Wood & Paper	
K (BBS)	• Discovering Animals • Discovering Plants • My Senses	• Digging Earth Materials	• Patterns All Around • Push, Pull, Go	• Digging Earth Materials • Push, Pull, Go
1 (FOSS)	• Insects*	• Air & Weather	• Balance & Motion	
1 (STC)	• Organisms	• Weather	• Solids & Liquids	• Comparing & Measuring
2 (FOSS)	• New Plants*	• Pebbles, Sand & Silt	• Solids & Liquids	
2 (STC)	• The Life Cycle of Butterflies*	• Soils	• Changes	• Balancing & Weighing
3 (FOSS)	• Structures of Life	• Earth Materials	• Magnetism & Electricity	• Ideas & Inventions
3 (STC)	• Plant Growth & Development*	• Rocks & Minerals*	• Chemical Tests	• Sound
4 (FOSS)	• Human Body	• Water	• Measurement	• Physics of Sound
4 (STC)	• Animal Studies*	• Land & Water		• Electric Circuits
5 (FOSS)	• Environments*	• Landforms	• Levers & Pulleys	• Models & Design
5 (STC)	• Microworlds	• Ecosystems*	• Motion & Design	• Floating & Sinking
6 (FOSS)	• Food & Nutrition		• Variables	• Mixtures & Solutions
6 (STC)	• Experiments with Plants	• Measuring Time		• Magnets & Motors

ASSET Toolboxes/Technology-Based Enrichment

ASSET Toolboxes can be leased individually or with the corresponding module.

Grade	Life Science	Earth Science
K	• PA Trees	
1	• PA Butterflies & Insects	
2	• PA Plants • PA Butterflies & Insects	
3	• PA Plants	• Properties of Rocks Web Based Simulation (RJ Lee Education)
4	• PA Animals	
5	• PA Ecosystems	• PA Ecosystems
6		

Middle School Curriculum Materials (6 – 8)

FOSS Modules

18 weeks

Life Science	Earth Science	Physical Science, Engineering & Technology
• Diversity of Life • Populations & Ecosystems	• Earth History • Weather & Water	• Chemical Interactions • Force & Motion

STC Modules

STC units can be ordered as individual 9 week modules, or as a combined 18 week set for a discount. Modules ordered in a set will be delivered together.

Life Science	Earth Science	Physical Science, Engineering & Technology	
• Investigating Digestion and Motion • Exploring Respiration and Circulation **Leased together as:** • Digestion, Motion, Respiration and Circulation *(Formerly Human Body Systems)*	• Understanding Weather and Climate • Exploring Plate Tectonics **Leased together as:** • Weather, Climate and Plate Tectonics *(Formerly Catastrophic Events)*	• Exploring the Properties of Matter • Experimenting with Mixtures, Compounds and Elements **Leased together as:** • Matter, Mixtures, Compounds and Elements *(Formerly Properties of Matter)*	• Investigating Circuit Design • Discovering Electrical Systems **Leased together as:** • Circuit Design and Electrical Systems *(Formerly Electrical Energy and Circuit Design)*
• Investigating Biodiversity and Interdependence • Studying the Development and Reproduction of Organisms **Leased together as:** • Biodiversity and the Development of Organisms *(Formerly Organisms - Macro to Micro)*	• Exploring Planetary Systems • Researching the Sun-Earth-Moon System **Leased together as:** • Sun-Earth-Moon and Planetary Systems *(Formerly Earth in Space)*	• Experimenting with Forces and Motion • Working with Motors and Simple Machines **Leased together as:** • Forces, Motion, Motors and Simple Machines *(Formerly Energy, Machines and Motion)*	• Exploring the Nature of Light • Researching Optical Systems **Leased together as:** • Light and Optical Systems *(Formerly Light)*

SEPUP Modules

Year-long with 9 or 18 week individual units

Science & Life Issues
• Ecology & Evolution • Micro-Life • My Body & Me • Our Genes Our Selves

Science & Life Issues is a year-long module, however individual 9 or 18 week units can be ordered separately.

ASSET STEM Education Engineering is Elementary® Units

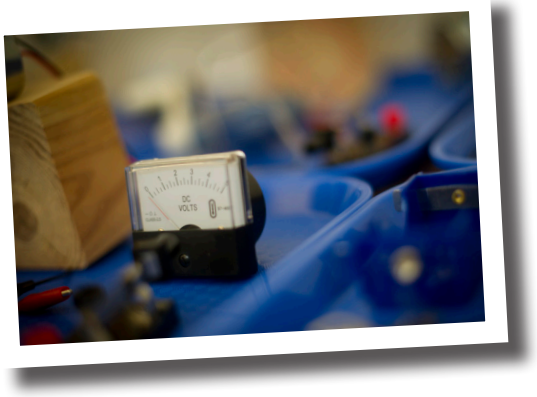
Approximately 6-8 Instructional Hours

Available Now

Grade	*EiE Unit	Science Module Connection	Science Topic	Engineering Field	Storybook/ Setting
**Basic 1-2	Catching the Wind: Designing Windmills	• Air & Weather (FOSS) • Weather (STC)	Wind & Weather	Mechanical	Denmark
	The Best of Bugs: Designing Hand Pollinators	• Insects (FOSS) • New Plants (FOSS) • Structures of Life (FOSS) • The Life Cycle of Butterflies (STC) • Organisms (STC) • Plant Growth & Development (STC)	Insects & Plants	Agricultural	Dominican Republic
	A Sticky Situation: Designing Walls	• Pebbles, Sand & Silt (FOSS) • Soils (STC) • Rocks & Minerals (STC)	Earth Materials	Materials	China
	Thinking Inside the Box: Designing Plant Packages	• New Plants (FOSS) • Structures of Life (FOSS) • Plant Growth & Development (STC) • Experiments with Plants (STC)	Plants	Package	Jordan
**Advanced 3-5	Marvelous Machines: Making Work Easier	• Levers & Pulleys (FOSS)	Simple Machines	Industrial	United States (Boston, MA)
	Water, Water Everywhere: Designing Water Filters	• Water (FOSS) • Land & Water (STC)	Water & the Water Cycle	Environmental	India
	The Attraction is Obvious: Designing MagLev Systems	• Magnetism & Electricity (FOSS) • Magnets & Motors (STC)	Magnetism	Transportation	Japan
	An Alarming Idea: Designing Alarm Circuits	• Magnetism & Electricity (FOSS) • Electric Circuits (STC) • Magnets & Motors (STC)	Electricity	Electrical	Australia
	Taking the Plunge: Designing Submersibles	• Water (FOSS) • Floating & Sinking (STC)	Floating & Sinking	Ocean	Greece
	A Slick Solution: Cleaning an Oil Spill	• Environments (FOSS) • Ecosystems (STC)	Ecosystems	Environmental	United States (Pacific Northwest)

**EiE units are NOT independent curriculum materials. Each unit is designed to be taught in conjunction with or after the completion of a science topic/module.*

***All EiE units include teacher tips, handouts, etc. for **both** Basic and Advanced grade levels, and should be chosen based upon where the corresponding science topics/modules are being taught.*



Approximately 6-8 Instructional Hours

Coming Fall 2013

Grade	*EiE Unit	Science Module Connection	Science Topic	Engineering Field	Storybook/ Setting
**Basic 1-2	To Get to the Other Side: Designing Bridges	• Balance & Motion (FOSS) • Balancing & Weighing (STC)	Balance & Forces	Civil	United States (Texas)
	A Work in Process: Improving a Play Dough Process	• Solids & Liquids (FOSS) • Solids & Liquids (STC)	Solids & Liquids	Chemical	Canada
**Advanced 3-5	Just Passing Through: Designing Model Membranes	• Environments (FOSS) • Animal Studies (STC)	Organisms & Basic Needs	Bioengineering	El Salvador
	Solid as a Rock: Replicating an Artifact	• Earth Materials (FOSS) • Rocks & Minerals (STC)	Rocks & Minerals	Materials	Russia
	No Bones About It: Designing Knee Braces	• Human Body (FOSS)	Human Body	Biomedical	Germany

Coming Spring 2014

Grade	*EiE Unit	Science Module Connection	Science Topic	Engineering Field	Storybook/ Setting
**Advanced 3-5	Sounds Like Fun!: Seeing Animal Sounds	• Physics of Sound (FOSS) • Sound (STC)	Sound	Acoustical	Ghana
	A Stick in the Mud: Evaluating a Landscape	• Landforms (FOSS) • Land & Water (STC)	Landforms	Geotechnical	Nepal
	A Long Way Down: Designing Parachutes		Astronomy	Aerospace	Brazil
	Lighten Up: Designing Lighting Systems		Light	Optical	Egypt
	Now You're Cooking: Designing Solar Ovens		Energy	Green Engineering	Botswana

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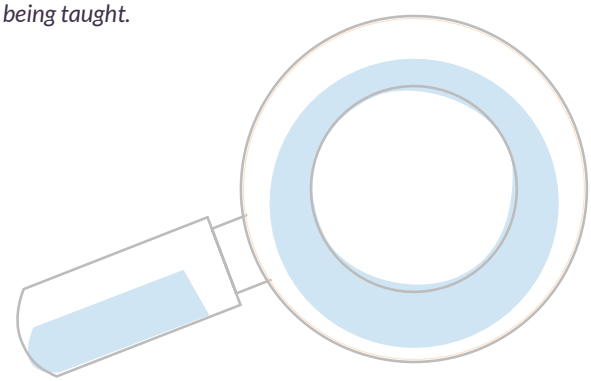

Pre-K and Elementary **Module Descriptions**

Spark student interest and understanding of STEM at an early age.

Teachers can access 90 module titles through ASSET. Pre-K and elementary modules are from nationally respected science programs like BBS, FOSS, STC and EiE®. Modules cover life, earth and physical science and engineering and technology. ASSET offers numerous module titles per grade.

- **Hands-on materials for 30 students**
- **9 to 12 week units**
- **Modules align with national and state education standards**

9-12 Week Modules

Pre-K

Life Science

Discovering Plants
BBS

There's a baby plant inside! To discover what plants need to live and grow, each young scientist plants a bean seed and the entire class plants and tends to a class garden (under a grow light). Throughout the unit, they then carefully uproot the plants to see and record what's happening underground. The focus is on general plant similarities and differences, especially for the varieties in the class garden. Students also compare a pine seedling to their garden plants. Learning opportunities grow like weeds as students compare sprouting seeds, count emerging leaves, measure stem growth, and watch flowers unfold and seedpods develop. The unit concludes with students setting up simple experiments in the class garden to find out how light, water and other growing conditions can affect plant growth and health.

My Senses
BBS

Give students inquiry-based experiences that build upon one another using the senses of sight, hearing, smell, taste and touch. Students trace and record how tools such as hand lenses and 3-D glasses change our perception of objects. They also use Carolina™ scent cards and their senses of smell and touch to analyze real-life safety scenarios. Cooperation in the inquiry classroom is spiraled into learning experiences using literature, hands-on activities, and character education. Throughout the unit, students make predictions, document findings, and explain reasoning through class discussions and science note-booking opportunities. The activities also expose students to vocabulary through song, musical patterns, graphing, sign language and dramatization.

Pre-K

Physical Science / Engineering & Technology

Push, Pull, Go
BBS

Build it, push it and watch it go. Students discover the patterns of how objects move as they work through a series of lessons about motion. In the tradition of Rube Goldberg, your young scientists build action toys that move. Using a foam ball, a line of tumbling dominos, a Kid K'NEX® swing, a slide and a spinning top, student pairs are challenged to build a contraption that "works." Each science toy that students build moves in a different but predictable pattern. As a result, students build a grade-level-appropriate concept of systems and an understanding of moving objects.

Math & Science Notebooks

Helping students articulate what they know, the incorporation of science and math notebooks helps foster students' use of language, writing and mathematics as well as the process and social skills of predicting, observing, hypothesizing, experimenting and communicating. Classroom sets of 30 notebooks are available. Primary science notebooks are available for K-1 students and are designed with large, primary-lined pages with blank spaces for drawing.

Kindergarten

Life Science

Animals Two by Two
FOSS

The Animals Two by Two module provides young students with close and personal interactions with some common land and water animals. Appropriate classroom habitats are established and students learn to care for the animals. In four activities, the animals are studied in pairs. Students observe and care for one animal over time, and then they are introduced to another animal similar to the first but with differences in structure and behavior. This process enhances opportunities for observation, communication and comparison.

Trees
FOSS

The giant sequoia is the most massive living organism on Earth. It is a tree, magnificent in dimension and awe inspiring in its longevity and durability. To stand in the company of such giants is to experience the scale of life. To a kindergartner the oak on the corner, the pines at the park and the mulberry trees at school are giants. Systematic investigation of trees will bring students to a better understanding of trees' place at school and in the community, and will provide some solid experiences on the way to understanding all plants.

PA Trees
ASSET Toolbox (E&E)

This ASSET toolbox corresponds with the Trees module. See p. 25 for details.

Kindergarten

Life Science

Discovering Animals
BBS

Pond snails, wiggle worms and pill bugs, oh my! Students explore, sort, compare and experience the similarities, differences and basic needs of animals. Live pond snails, redworms and pill bugs encourage students to observe carefully, look closer with a hand lens, draw what they see, mimic movement, discover how parent and offspring are alike and different, and build on their intuitive ideas about the basic needs of animals. Sorting a selection of colorful toy models provides students with multiple opportunities to compare themselves both to the model animals and to those taking up residence in their classroom. Living materials were chosen because of their high interest and easy maintenance in today's classroom.

Discovering Plants
BBS

There's a baby plant inside! To discover what plants need to live and grow, each young scientist plants a bean seed and the entire class plants and tends to a class garden (under a grow light). Throughout the unit they then carefully uproot the plants to see and record what's happening underground. The focus is on general plant similarities and differences, especially for the varieties in the class garden. Students also compare a pine seedling to their garden plants. Learning opportunities grow like weeds as students compare sprouting seeds, count emerging leaves, measure stem growth, and watch flowers unfold and seedpods develop. The unit concludes with students setting up simple experiments in the class garden to find out how light, water and other growing conditions can affect plant growth and health.

My Senses
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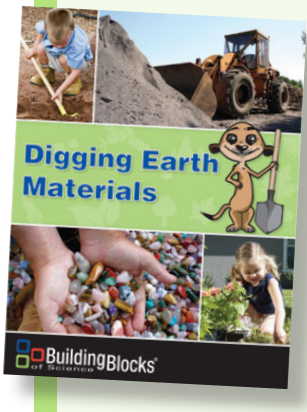
Earth Science / Engineering & Technology

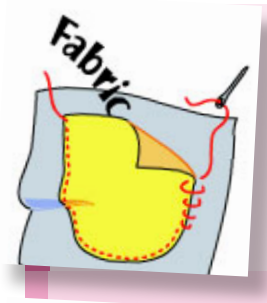


Digging Earth Materials
BBS

Soil, rocks and water are naturals with kindergarten scientists. This unit begins with student pairs describing and sorting a set of eight rocks and minerals chosen for color, pattern and high interest. It's all about particle size as students move to investigating sand and soil. How are soil and sand the same? How is sandstone like sand and how is it different? What might happen when water is added to the investigation? Throughout the activities, students ask questions, make predictions and build age-appropriate understandings of earth materials. Finally, students identify landforms and bodies of water. The kit provides enough earth materials and modeling dough for each student to build a model island complete with landforms and bodies of water. Island hopping, anyone?

Kindergarten

Physical Science



Fabric
FOSS

Fabric, a material so often taken for granted, makes a fascinating study for early-childhood students. In the Fabric module, students are introduced to a wide variety of fabrics in a systematic way so that they become familiar with fabrics' properties, discover what happens when they are tested and discover how they interact with other materials, including water.

Wood & Paper
FOSS

The modern world is a wonderland of different materials for early-childhood students. Two of those materials are wood and the paper that is derived from it. In the Wood and Paper module, students are introduced to a wide variety of woods and papers in a systematic way. They will observe the properties of these materials and discover what happens when they are subjected to a number of tests and interactions with other materials. Students learn that wood and paper can be recycled to create new forms of paper or wood that have new properties. Finally, they use what they know about the properties of these marvelous materials as they change wood and paper into a variety of products.

Patterns All Around
BBS

Bright blocks, real seashells, white clouds in a blue sky, finding the moon and the school bus stopping at the mailbox - is there a connection? Build on students' intuitive sense of patterns with a series of seven lessons developed for today's kindergarten scientist. Students sort a collection of natural shells (noting similarities, differences and repeating patterns), investigate patterns outdoors, create colorful patterns with geometric shapes, discover patterns in everyday activities and explore patterns that repeat in longer cycles of time (e.g., birthdays, seasonal cycles and life cycles). Students explore patterns in the night and daytime sky, consider apparent changes in the shape of the moon and design a drip-drop "star" map with far too many stars in the "sky" to count.

Physical Science / Engineering & Technology

Push, Pull, Go
BBS

Build it, push it and watch it go. Students discover the patterns of how objects move as they work through a series of lessons about motion. In the tradition of Rube Goldberg, your young scientists build action toys that move. Using a foam ball, a line of tumbling dominos, a Kid K'NEX® swing, a slide and a spinning top, students pairs are challenged to build a contraption that "works." Each science toy that students build moves in a different but predictable pattern. As a result, students build a grade-level-appropriate concept of systems and an understanding of moving objects.

Grade 1

Life Science

Insects
FOSS

The Insects module provides experiences that heighten students' awareness of the diversity of animal forms. They come to know firsthand the life sequences of a number of insects. In each investigation an insect is introduced, and students observe structures and behaviors, discuss their findings and ask questions. Students observe life cycles of insects and compare the stages of metamorphosis exhibited by each species.

PA Butterflies & Insects
ASSET Toolbox (E&E)

This ASSET toolbox corresponds with the Insects module. See p. 25 for details.

Organisms
STC

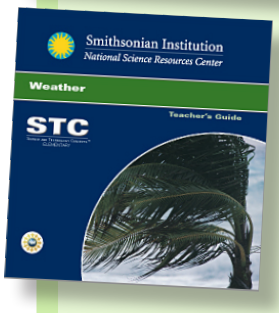
This unit provides hands-on experiences that help students develop an understanding of and sensitivity to living things. Students create and maintain a woodland habitat containing pine seedlings, moss, pill bugs, and Bess beetles or millipedes. They also set up and observe a freshwater habitat into which they introduce elodea and cabomba plants, pond snails and guppies. With both plants and animals in each habitat, students have the opportunity to observe how these organisms coexist. Through studying the needs and characteristics of a variety of organisms, the students are able to draw conclusions about how plants and animals are similar and different. In a final lesson, students apply to humans what they have learned about organisms, exploring how human beings are similar to and different from other living things.

**Organisms Literacy Series available for purchase separately*

Earth Science

Air & Weather
FOSS

The Air and Weather module consists of four sequential investigations, each designed to introduce concepts in earth science. The investigations provide opportunities for young students to explore the natural world by using simple tools to observe and monitor change.



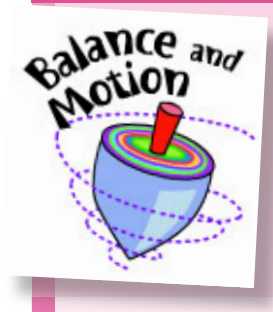
Weather
STC

This unit introduces first-graders to the concept of weather and how it affects their lives. Using a variety of tools, students observe, discuss, measure and record data on cloud cover, precipitation, wind and temperature. They learn how to read a thermometer and construct a rain gauge to measure precipitation. They also study cloud formations and use a wind scale to estimate the speed of wind. To apply their new skills and knowledge, students compare their own weather predictions with an actual weather forecast and use the weather data they have collected to form generalizations about the weather in their own locale.

**Weather Literacy Series available for purchase separately*

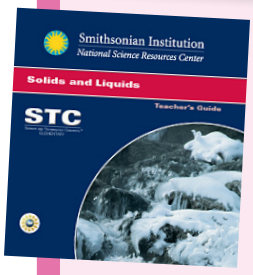
Grade 1

Physical Science



Balance & Motion
FOSS

We live in a dynamic world where everything is in motion, or so it seems. But not everything is moving the same way. Some things move from one place to another. Other things go around and around in a rotational motion. Still other things are stationary, stable for a time, balanced on a thin line between stop and go. These are the global phenomena that students experience in this module.

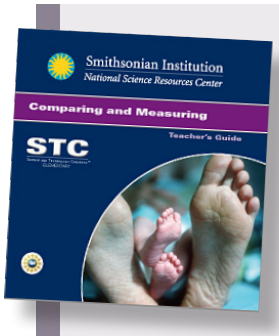


Solids & Liquids
STC

The investigations in Solids and Liquids introduce students to two key concepts of physical science—that solids and liquids are two states of matter and that each state of matter has its own identifiable properties. Students begin by investigating a set of solids, focusing on properties such as shape, color, texture and hardness. They conduct experiments to determine whether the solids will float or sink, roll or stack, or attract a magnet. Next, students actively explore the properties of liquids, how they look and feel, their fluidity, how they mix with water and their degree of absorption. Students communicate their observations and the results of their experiments through discussion, writing and drawing, and improve their ability to follow directions and conduct experiments.

**Solids & Liquids Literacy Series available for purchase separately*

Engineering & Technology



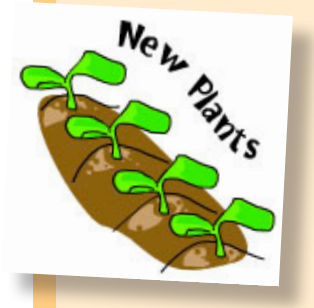
Comparing & Measuring
STC

Comparing and Measuring introduces key skills students need to make sense of their lives and to successfully conduct experiments. This unit develops the skills of comparison, matching and measuring. Students begin by comparing their heights, then matching their height to others in the class using strips of adding machine tape. Students test a series of measurement experiments using nonstandard units, such as their own feet, and discover that nonstandard units produce unreliable results. Students measure height, width and distance, this time using Unifix Cubes™ and measuring strips to represent standard units of measure. These activities develop student understanding of fair comparisons, starting and ending points, common starting lines and standard units of measure.

**Comparing & Measuring Literacy Series available for purchase separately*

Grade 2

Life Science

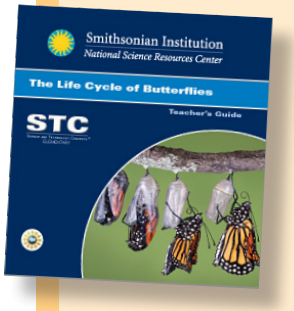


New Plants
FOSS

The New Plants module provides experiences that heighten students' awareness of the diversity of life in the plant kingdom. Students care for plants to learn what they need to grow and develop. They observe the structures of flowering plants and discover ways to propagate new plants from mature plants (from seeds, bulbs, roots and stem cuttings). They observe and describe changes that occur as plants grow, and organize their observations on a calendar and in a journal.

PA Plants
ASSET Toolbox (E&E)

This ASSET toolbox corresponds with the New Plants module. See p. 25 for details.



The Life Cycle of Butterflies
STC

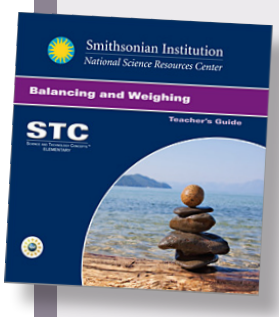
The Life Cycle of Butterflies unit introduces students to the concepts of life cycles by inviting them to investigate one organism—the painted lady butterfly (Vanessa cardui) for eight weeks. As students care for the caterpillars and butterflies, they observe, record, and describe in words and drawings the metamorphosis from caterpillar to chrysalis and from chrysalis to butterfly. In many cases, students will get to see a butterfly lay eggs. Some butterflies will die natural deaths, completing students' observations of the life cycle. Through these investigations, students will understand that the term "cycle" implies continuity and that life cycles exist for all living organisms. This experience deepens their understanding of the diversity and complexity of life on earth.

**The Life Cycle of Butterflies Literacy Series available for purchase separately*

PA Butterflies & Insects
ASSET Toolbox (E&E)

This ASSET toolbox corresponds with The Life Cycle of Butterflies module. See p. 25 for details.

Engineering & Technology



Balancing & Weighing
STC

In Balancing and Weighing, students explore balance and discover that it is affected by three variables—the mass of an object, the length of the lever arm and the position of the fulcrum. Using an equal-arm balance to conduct their investigations, students learn to measure mass and are able to arrange objects in serial order according to their mass. Students discover that mass is not directly related to volume as they measure the mass of equal volumes of foods and find that the masses are not equal. This is a perfect opportunity to introduce students to the concept of density and illustrate how mass, volume and density are related. Students practice measuring mass, making comparisons and recording data throughout this unit. They represent their data visually in a number of different ways including line plots, data tables and bar graphs.

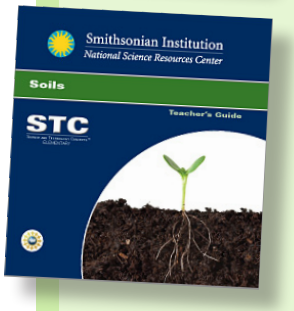
**Balancing & Weighing Literacy Series available for purchase separately*

Grade 2

Earth Science

Pebbles, Sand & Silt
FOSS

The Pebbles, Sand and Silt module consists of four sequential investigations, each designed to introduce concepts in earth science. The investigations provide experiences that heighten students' awareness of rocks as earth materials and natural resources. They will come to know rocks by many names and in a variety of sizes. Pebbles and sand are the same material—just different sizes.

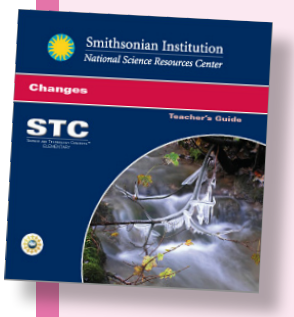


Soils
STC

In this unit, students investigate the chief components of soil—sand, clay and humus—and explore the relationship between soil and plant growth. Early in the unit, they create their own compost bags. This activity enables them to observe the decomposition of organic materials over time. Students observe and read about earthworms to learn about their connection to plant roots and soil. The students also conduct tests that enable them to observe and compare such properties of soil as odor, appearance and texture. Phenomena such as settling, water content and soil consistency are also explored. These observations are then related to plant growth, as students plant cucumber seeds in a clear plastic tube. By observing root growth, students learn about the role of roots in keeping the plant anchored and upright. In a final activity, students apply what they have learned to investigate a sample of local garden soil.

**Soils Literacy Series available for purchase separately*

Physical Science



Changes
STC

Students expand their understanding of solids, liquids and gases by exploring changes in state. They investigate freezing, melting, evaporation and condensation of water. In a sequence of lessons, students produce a mixture of two solids and a mixture of solids with liquids and observe the results. They work through several methods to separate mixtures: sieving, filtration, evaporation and chromatography. The students set up races that involve sugar dissolving in water and observe the effects of particle size and water temperature on the rate at which the sugar dissolves. They also observe crystals formed as a result of evaporation. Students observe some changes that occur immediately and some that occur over time, and they begin to recognize the characteristics of chemical reactions. They investigate rusting, and they observe and collect the gas formed by mixing an effervescent tablet in water. Students have several opportunities to practice their new skills in lessons in which they devise ways of separating a mystery mixture and plan and carry out investigations that involve other changes.

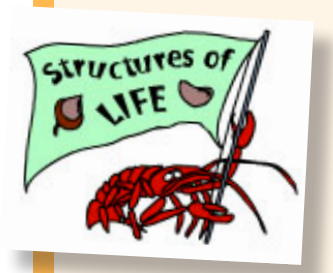
**Changes Literacy Series available for purchase separately*

Solids & Liquids
FOSS

The Solids and Liquids module provides experiences that heighten students' awareness of the physical world. Matter with which we interact exists in three fundamental states: solid, liquid and gas. In this module first and second graders have introductory experiences with two of these states of matter, solid and liquid.

Grade 3

Life Science



Structures of Life
FOSS

The Structures of Life module consists of four sequential investigations dealing with observable characteristics of organisms. Students observe, compare, categorize and care for a selection of organisms, and in so doing they learn to identify properties of plants and animals and to sort and group organisms on the basis of observable properties. Students investigate structures of the organisms and learn how some of the structures function in growth and survival.

Plant Growth & Development
STC

Students observe each stage in the life cycle of a simple plant. Working with Wisconsin Fast Plants™ (Brassica rapa) which germinate, mature and go to seed within a 40-day period, students plant seeds and watch the seedlings emerge. Later, they thin and transplant seedlings. As they watch their plants grow, students learn that plants need nutrients from the soil, as well as water and light, to thrive. As the unit expands to focus on the interdependence of living things, students cross-pollinate the flowers with dried honeybees. Finally, they harvest mature seeds and determine seed yields. These experiences deepen students' understanding of the characteristics of living organisms and their relationship with and dependence on their environment.

**Plant Growth & Development Literacy Series included with module*

PA Plants
ASSET Toolbox (E&E)

This ASSET toolbox corresponds with the Plant Growth & Development module. See p. 25 for details.

Engineering & Technology

Ideas & Inventions
FOSS

The Ideas and Inventions module consists of four sequential investigations that promote student creativity and inventiveness. Each investigation provides valuable science content while introducing a conventional technique for revealing the unseen.

Sound
STC

In Sound, students use tuning forks, slide whistles, strings and other sound-producing objects to investigate the characteristics of sound. Students discover that sound is caused by vibrations, and they experiment with vibrating air columns, strings and rulers. Through their experiments, students are able to relate pitch and volume to the frequency and amplitude of the vibrations. Once students understand the mechanics of sound, they learn how it travels. The human ear is integral to sound, and students build a model eardrum to learn how the ear functions and how to protect ears from sound. Students apply what they have learned by designing and building their own musical instruments. This activity not only assesses how much information students learned during the unit, but also examines their ability to develop and execute a plan and communicate what they built and why they built it.

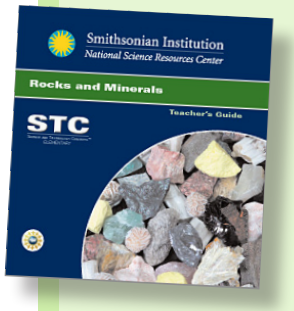
**Sound Literacy Series included with module*

Grade 3

Earth Science

Earth Materials
FOSS

The Earth Materials module consists of four sequential investigations dealing with observable characteristics of solid materials from the earth—rocks and minerals. The focus is on taking materials apart to find what they are made of and putting materials together to better understand their properties. The module introduces fundamental concepts in earth science and takes advantage of the students' intrinsic interest in the subject matter and in the physical world around them.



Rocks & Minerals
STC

Students explore the differences and similarities between rocks and minerals by investigating samples of these earth materials, performing a series of tests similar to geologists' field tests, and reading about rocks and minerals and how they are used. The first lessons focus on rocks. The students then turn their attention to a set of 12 minerals and test them to identify properties such as streak color, luster, transparency, hardness, shape and magnetism. After completing these observations, students compile them into their own "Minerals Field Guide." In a culminating activity, they are challenged to apply their knowledge and skills to identify new minerals. They then report on how rocks and minerals are used.

**Rocks & Minerals Literacy Series included with module*

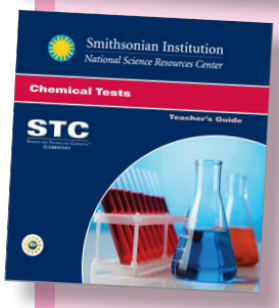
Properties of Rocks Web-Based Simulation
RJ Lee Education

Properties of Rocks uses microscope simulation to deliver science content in an interactive, inquiry-based manner. It consists of five investigations, each having a stated objective, procedure and scientific background that leads the students through their exploration of rock samples. After completing each investigation, the students are encouraged to reflect upon their observations. There is also a teacher version of the module.

Physical Science

Magnetism & Electricity
FOSS

The Magnetism and Electricity module consists of five sequential investigations each designed to introduce or reinforce concepts in physical science. The investigations provide opportunities for students to explore the natural and human-made worlds by observing and manipulating materials in focused settings using simple tools.



Chemical Tests
STC

This unit introduces third-graders to the science of chemistry by challenging them to explore and determine the identity of five common household chemicals: sugar, alum, talc, baking soda and cornstarch. Students begin by focusing on the physical properties of color, form and texture. Next, they explore chemical properties by observing how the five powders interact with water, vinegar, iodine and red cabbage juice. These tests enable them to explore phenomena such as crystallization and to observe the processes of evaporation and filtration. Finally, students apply their skills and their knowledge of the five chemicals to identify a variety of "mystery" mixtures. As a result of conducting these investigations, students develop scientific skills such as observing and recording results, forming conclusions on the basis of experience, communicating results and applying their knowledge to solve problems.

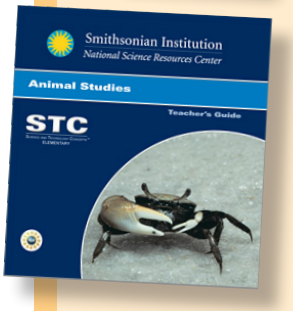
**Chemical Tests Literacy Series included with module*

Grade 4

Life Science

Human Body
FOSS

The Human Body module consists of four sequential investigations that engage students in thoughtful activities about the form and function of a most remarkable machine, their own body.



Animal Studies
STC

By caring for and observing three unique animals—the dwarf African frog, the fiddler crab and the millipede—students are able to focus on animal behavior, comparing and contrasting the needs, behaviors and anatomical structures of each organism. Each student creates and maintains a personal observation log in which he or she records notes about each animal throughout the unit. Students apply what they learn about body structure, habitat, survival needs and behavior to a fourth animal—the human—identifying ways that humans are similar to and different from other animals. Students practice observing and recording data in their logs as well as in Venn diagrams, class webs, tables and drawings. Students conduct a research-based inquiry that moves them away from general observations and asks them to apply their scientific process skills as they gather and synthesize information about their animals' behavior.

** Animal Studies Literacy Series included with module*

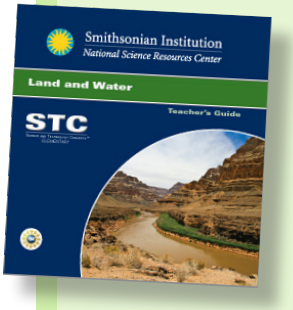
PA Animals
ASSET Toolbox (E&E)

This ASSET toolbox corresponds with the Animal Studies module. See p. 25 for details.

Earth Science

Water
FOSS

Water is the most important substance on Earth. Water dominates the surface of our planet, changes the face of the land and defines life. These powerful, pervasive ideas are introduced here. The Water module consists of four investigations in which students explore properties of water, changes in water, interactions between water and other earth materials, and how humans use water.



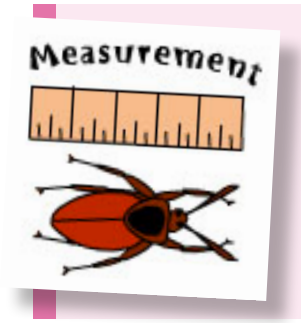
Land & Water
STC

Using a stream table, students explore different interactions between land and water, such as how runoff causes stream formation; how groundwater forms; how soil is eroded, transported, and deposited; and how water shapes land. The unit invites students to manipulate their model, create hills, build dams and grow vegetation to observe how these things affect land and water interactions. Students come to understand how water shapes the land and how, in turn, the land directs the flow of water. Connections between the stream tables and the real world are made as students apply the concepts they have learned to photographs of land and water on earth. Finally, students have the opportunity to plan and create a landscape in their stream tables. Students use the concepts from the unit to predict the flow of water and how the landscape they create will alter the direction and flow of the water or how the shape of the land may change. Students design and conduct experiments and test their predictions.

**Land & Water Literacy Series included with module*

Grade 4

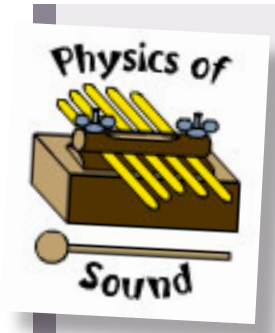
Physical Science



Measurement
FOSS

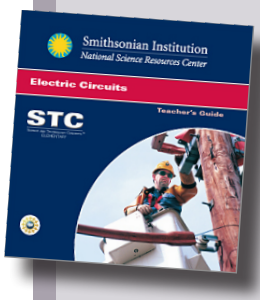
Measurement, the process of quantifying observations, is one of the cornerstones of science. Measurement compares nature—the unknown—to a standard unit—the known. Through such comparison, the organization of the world becomes more comprehensive. The FOSS Measurement module consists of four investigations, each designed to emphasize a particular type of metric measurement—length, mass, temperature and volume.

Engineering & Technology



Physics of Sound
FOSS

The Physics of Sound module consists of four sequential investigations each designed to expose a specific set of concepts. Students learn to differentiate between sounds generated by dropped objects, how sounds can be made louder or softer and higher or lower, how sounds travel through a variety of materials and how sounds get from a source to a receiver. The investigations provide opportunities for students to explore the natural and humanmade worlds by observing and manipulating materials in focused settings using simple tools.



Electric Circuits
STC

In Electric Circuits, students investigate electricity by wiring a circuit to light a bulb. They come to understand that a circuit must form a complete circle through which electric current can pass in order to light the bulb. Students use this knowledge to explore other electrical concepts, such as what conductors and insulators are and how they work and how diodes affect the flow of electricity. Students also learn about the symbolic language of electricity and use it to read and draw diagrams for wiring circuits and constructing a flashlight. Students apply what they learn about electricity and electrical safety to a final activity in which they design and implement a wiring plan for a cardboard house. These activities cultivate students' abilities to analyze problems, think critically and develop solutions.

**Electric Circuits Literacy Series included with module*

Grade 5

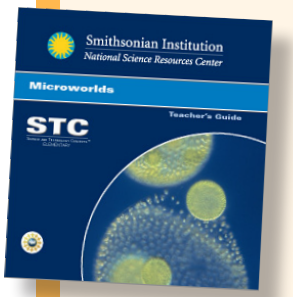
Life Science

Environments
FOSS

All living things depend on the conditions in their environment. The study of the relationships between one organism and its environment builds knowledge of all organisms. With this knowledge comes an awareness of limits. Changes in an environment can be hard on organisms. Such knowledge is important because humans can change environments. To do so without awareness of possible consequences can lead to disasters. The Environments module consists of six investigations that introduce students to these basic concepts in environmental biology.

PA Ecosystems
ASSET Toolbox (E&E)

This ASSET toolbox corresponds with the Environments module. See p. 25 for details.



Microworlds
STC

In Microworlds, students explore magnifiers, learning that tools like lenses and microscopes can be used to extend the sense of sight to view objects in greater detail. By observing everyday objects with a variety of lenses, students learn that a magnifier must be transparent and curved. Students use a microscope, learn the functions of all its parts, and practice proper lighting and focusing techniques. Preparing their own slides, students are able to view onion skin under magnification. Students turn their attention to living specimens and view three microorganisms—Volvox, Blepharisma and vinegar eels. Observing the structure of these microorganisms, and how they move, feed, grow and multiply develops the students' sense of microbial life and interactions among living things and between living things and their environment.

**Microworlds Literacy Series included with module*

Earth Science

Landforms
FOSS

The Landforms module consists of five investigations that introduce students to these fundamental concepts in earth science: change takes place when things interact; all things change over time; patterns of interaction and change are useful in explaining landforms. Students also learn about some of the tools and techniques used by cartographers and use them to depict landforms.

Grade 5

Earth Science

Ecosystems
STC

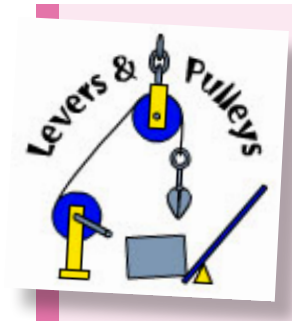
In Ecosystems, students set up terrariums for crickets and isopods. Duckweed, algae, Elodea, guppies and snails are introduced to an aquarium. Connecting the two habitats to create an "ecocolumn," students observe the relationship between the two environments and the organisms living within them. Students simulate the effects of pollutants—road salt, fertilizer and acid rain—on the environment. To discover how pollutants might affect the organisms in their ecocolumn, students create a food chain and make inferences about the effects of pollutants based on the relationships between the organisms in their ecocolumns. Students explore the Chesapeake Bay as a model ecosystem, analyzing the environmental problems present there from various perspectives. Applying their knowledge of ecosystems to a real-world situation, students generate possible solutions to the pollution problem and share their conclusions with the class. This activity enables students to appreciate the trade-offs necessary to reach mutually acceptable solutions to environmental problems.

**Ecosystems Literacy Series included with module*

PA Ecosystems
ASSET Toolbox (E&E)

This ASSET toolbox corresponds with the Ecosystems module. See p. 25 for details.

Physical Science



Levers & Pulleys
FOSS

Humans are the only living creatures that have been able to put materials together to construct machines to do work. Our capacity to see and invent relationships between effort and work produced through simple machines has led us into a world that is becoming more technologically oriented. Knowledge of these relationships is necessary for understanding all mechanics. The Levers and Pulleys module consists of four investigations that involve students in fundamental concepts of simple machines.

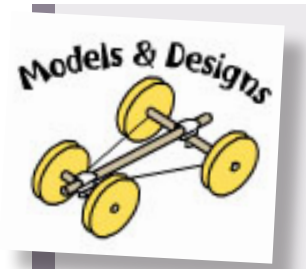
Motion & Design
STC

The Motion and Design unit combines the physics of forces and motion with technological design. Students use plastic construction materials, weights, rubber bands, and propellers to design and build vehicles, then test how those vehicles respond to different forces of motion, like pushes, pulls or rubber band energy. They explore, through experiments and multiple trials, how forces like friction, gravity and air resistance work against motion to slow their vehicles down. Students must apply the concepts they learn to a design challenge, designing a vehicle that can perform to certain specifications but also meets certain "cost" requirements. Collaboratively, student teams must design a vehicle, calculate the cost, test it and refine their design. This unit develops skills in recording design through drawing, making accurate measurements, completing and analyzing data tables, making and testing predictions, and communicating results and experimental data.

**Motion & Design Literacy Series included with module*

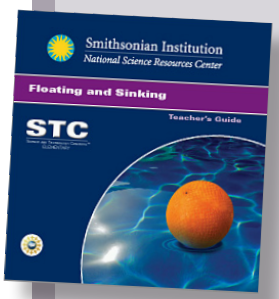
Grade 5

Engineering & Technology



Models & Design
FOSS

The four investigations in the Models and Designs module provide experiences that develop the concept of a scientific model and engage students in design and construction. The atmosphere generated by this module is one of open discussion, free exchange of ideas, and development of ideas into products.



Floating & Sinking
STC

In Floating and Sinking, students begin by simply making and testing predictions about whether a set of objects will sink or float. This investigation serves as an introduction to inquiries regarding the effect weight, size and shape have on whether an object floats or sinks, which challenges most students' conceptions. Students are introduced to a spring scale and use it to measure the weight of their objects and the buoyant force on fishing bobbers. Students explore the effect of shape on buoyancy in depth by manipulating a ball of clay and testing multiple times to determine whether it sinks or floats. This prepares them for a design challenge in which they design a clay boat that will float and hold a specific capacity of marbles. By recording and analyzing their own data, students become aware of surprising phenomena—some "floaters" are heavier than some "sinkers," and large objects are not always heavier than smaller objects. Students are challenged to apply prior knowledge to the inquiries in each lesson to make predictions and solve challenges.

**Floating & Sinking Literacy Series included with module*

Grade 6

Life Science

Food & Nutrition
FOSS

The Food and Nutrition module consists of four sequential investigations that help students understand what food is, what it is made of and how several nutrient groups contribute to healthful nutrition.

Experiments With Plants
STC

The main objective of the unit is to enable students to design and conduct a controlled experiment. They begin by studying the key variables that affect the life, health and reproduction of the Wisconsin Fast Plant™ (Brassica rapa) and how they can manipulate these variables. Working in teams, students formulate a question about the plant and carry out a controlled experiment designed to answer that question. During the ensuing weeks, they observe the plants and record their data. Each team then shares its results with the class. Final activities entail germinating seeds that students have gathered from the plants and exploring tropisms.

**Experiments with Plants Literacy Series included with module*

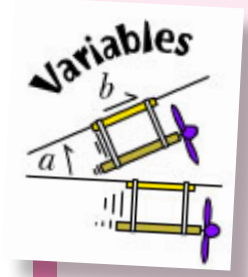
Earth Science

Measuring Time
STC

In the first part of this unit, students explore the use of natural phenomena, such as the phases of the moon, to keep time. In the second section, students conduct experiments using some of the instruments that have been used to keep time throughout the centuries. They build and experiment with a water clock and investigate the characteristics of the pendulum. Finally, they apply what they have learned to assemble and evaluate a clock escapement and modify the device in order to make it more accurate. The unit provides students with an opportunity to learn how to measure time, to investigate machines, to explore concepts such as energy and motion, and to learn about the science of astronomy.

**Measuring Time Literacy Series included with module*

Physical Science



Variables
FOSS

Some of the most important scientific concepts students learn are the result of their ability to see relationships between objects and events. Relationships always involve interactions, dependencies, and cause and effect. The Variables module has four investigations that help students discover relationships through controlled experimentation. Students will fling, float, fly and flip objects as they discover relationships in each investigation.

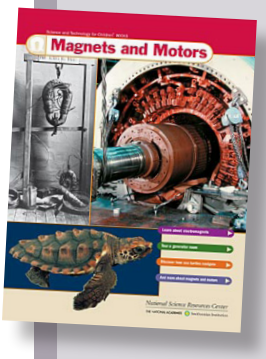
Engineering & Technology

Mixtures & Solutions
FOSS

Chemistry is the study of the structure of matter and the changes or transformations that take place in it. Learning about the makeup of substances gives us knowledge about how things go together and how they can be taken apart. Learning about changes in substances is important for several reasons: changes can be controlled to produce new materials; changes can be used to give off energy to run machines. This module has four investigations that introduce students to these fundamental ideas in chemistry.

Grade 6

Engineering & Technology



Magnets & Motors
STC

This unit, which builds on the knowledge that students gained in the STC® Electric Circuits unit, offers students the opportunity to explore the properties of magnets and the magnetic properties of electric currents. The unit includes information on the historical development of scientists' understanding of the use of magnetism, electricity and electromagnetism. Students begin by studying magnets and making a compass. They then investigate the relationship between magnetism and electricity, as they explore the characteristics of switches and circuits. Finally, students experiment with three different motors. Applying their learning and experience they dismantle, experiment with and reassemble a manufactured motor.

**Magnets & Motors Literacy Series included with module*

STC Literacy Series

The STC Literacy Series is available for select modules in 1st through 6th grade. They are either included with the module or available for purchase separately (see module descriptions for details). This series can be taught in conjunction with Common Core Standards. All Literacy Series offerings are available in packs of eight.

Literacy Series in 1st and 2nd grade:
- Provide students with informational text that is aligned with current state standards in science, social studies and math.
- Stories are correlated to lessons in the modules.

Literacy Series in 3rd through 6th grade:
- Helps students to improve reading comprehension and gain a grasp of science content.

ASSET Toolboxes

Look for the leaf to find the ASSET Toolboxes on pp. 10-25.

Environment & Ecology Toolboxes

ASSET offers Environment & Ecology Toolboxes to help teachers meet the Pennsylvania Environment & Ecology Standards not addressed in specific science modules. Open up an Environment & Ecology Toolbox and you will find a collection of standards-based lessons, thematic field study units and materials, designed to enhance specific FOSS or STC modules. Every lesson links directly to the content, concepts and skills introduced within those modules. Toolbox titles include:

- **PA Animals**
- **PA Butterflies & Insects**
- **PA Ecosystems**
- **PA Plants**
- **PA Trees**

Middle School **Module Descriptions**

Inspire the scientists of tomorrow with hands-on science modules.

Grades 6-8

All middle school modules are provided by nationally respected science programs: FOSS, STC/MS and SEPUP. All modules are approved by the National Science Foundation, are research- and inquiry-based and align to national standards.

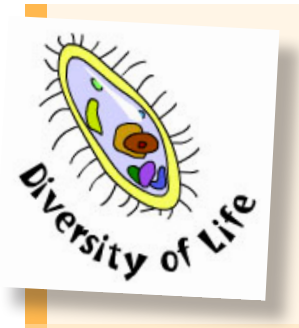
Cooperative- and inquiry-based learning in middle school promotes the critical thinking and problem solving skills necessary for high school science courses and labs. It also provides an introduction for content taught at the high school level.

The modules incorporate math, reading extensions, technology, connections to real world application, research and writing (notebooks). Extensions are highlighted in the modules for specific cross curricular connections. Additionally, use of science notebooks at the middle school level promotes strong writing skills and attention to details.

STC Module Updates

STC units can be ordered as individual 9 week modules, or as a combined 18 week set (under a different name) for a discount. Modules ordered in a set will be delivered together. Please reference the STC descriptions on the following pages for the names of the individual 9 week modules, the combined 18 week module names and what the combined modules were formerly named.

Life Science



Diversity of Life
FOSS

Diversity of Life emphasizes the use of knowledge and evidence to construct explanations for the structures and functions of living organisms. Students observe and maintain protists, plants and animals in the classroom and study their characteristic features. The study progresses from macroscopic to microscopic observation to discover the fundamental unit of life, the cell. Students then investigate organism subsystems and behaviors and consider their diversity of adaptive structures and strategies.

Populations & Ecosystems
FOSS

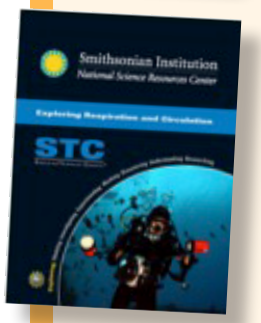
Populations and Ecosystems explores ecosystems as the largest organizational unit of life on Earth, defined by its physical environment and the organisms that live in the physical environment. Students learn that every organism has a role to play in its ecosystem and has structures and behaviors that allow it to survive. Students raise populations of organisms to discover population dynamics and interactions over a range of conditions. They learn that food is the source of energy used by all life forms in all ecosystems to conduct life processes. Reproduction, including limiting factors, heredity and natural selection are explored as ways to understand both the similarity and the variation within and between species.

Middle School

Life Science

Investigating Digestion and Motion
STC

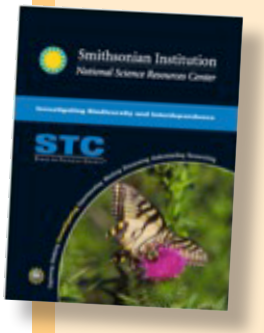
These days, students are exposed to media information about leading a healthy lifestyle by eating right and exercising, yet they may not be aware of the reasons why leading such a lifestyle is important. Investigating Digestion and Motion explores the interconnectedness of the various body systems, including the digestive processes and organs, nutrients and vitamins, and the musculoskeletal system—all key elements of a healthy body.



Exploring Respiration and Circulation
STC

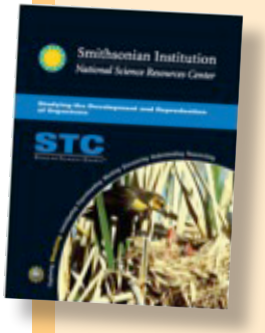
Functions that the body performs automatically are often given little thought, yet these body functions are important to sustaining life. Tapping into a natural curiosity that students have about their bodies, Exploring Respiration and Circulation explores the respiratory and circulatory systems while developing an awareness of students' own bodies and the intricacies of body systems in general.

***Leased together as: Digestion, Motion, Respiration and Circulation**
(Formerly Human Body Systems)
Some of the contents of these modules have changed. Please inquire for details.



Investigating Biodiversity and Interdependence
STC

Investigating Biodiversity and Interdependence introduces students to the structure, function and diversity of living things. Students clarify what they already know about organisms and expand their knowledge about the structure and diversity of three particular groups—animals, protists and fungi - through the study of representative organisms. Although these organisms seem to be dissimilar, students discover that they share many common features. Students also study humans as organisms and their experience of life processes that other organisms undergo.



Studying the Development and Reproduction of Organisms
STC

Studying the Development and Reproduction of Organisms gives students the opportunity to study two of the most important taxonomic groups— plants and animals. Students discover that the life cycles of two fascinating organisms are linked, and neither can survive without the other. They also get further grounding in the concept of humans as organisms, studying that humans are composed of dividing cells and that a unique form of cell division, meiosis, enables organisms to transfer their traits to the next generation.

***Leased together as: Biodiversity and the Development of Organisms**
(Formerly Organisms - Macro to Micro)
Some of the contents of these modules have changed. Please inquire for details.

Middle School

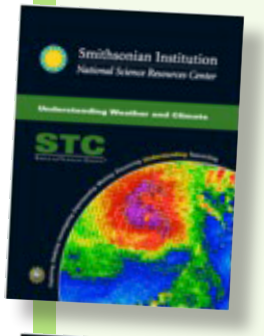
Earth Science

Earth History
FOSS

Earth History emphasizes the use of knowledge and evidence to construct explanations about the processes and systems that have operated over geological time. Students investigate sedimentary rocks and fossils from the Grand Canyon to discover clues that reveal Earth's history. They study the processes that create sedimentary, igneous, and metamorphic rocks and organize their observations and inferences into the Rock Cycle. Students use the knowledge and data gained from observing rocks to make inferences about organisms, environments and events that occurred over Earth's history.

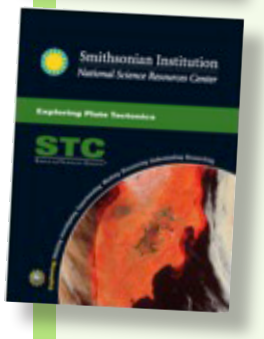
Weather & Water
FOSS

Weather and Water focuses on Earth's atmosphere, weather and water. A good understanding of meteorology as an earth science isn't complete without an introduction to the physics and chemistry that drive weather. Understanding weather is more than reading a thermometer and recording air-pressure measurements. The course consists of nine investigations. Students first learn about atoms and molecules, changes of state and heat transfer. Then they investigate the water cycle, air masses, fronts, winds and severe weather.



Understanding Weather and Climate
STC

Understanding Weather and Climate explores the atmospheric events and oceanic processes that dramatically impact the earth and its inhabitants. Students experiment with factors that determine storms and daily weather, explore the impact of oceans on the earth, and examine the influences that produce climate zones and climate changes. Throughout the unit, students make models to simulate Earth processes while making predictions, collecting data to test hypotheses and drawing conclusions based on evidence.



Exploring Plate Tectonics
STC

Exploring Plate Tectonics helps students clarify what they already know about earthquakes, volcanoes, and plate tectonics and deepens their understanding of their world and some of the powerful natural events that significantly affect it. Students explore the theory of plate tectonics as well as the destructive and constructive forces of volcanoes and earthquakes. Through the manipulation of simple models and the study of maps, students extend and enrich their knowledge of the structure of the earth's interior and crust.

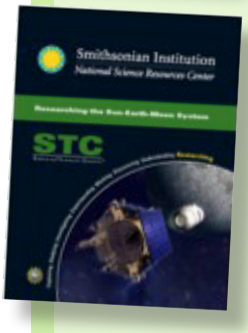
***Leased together as: Weather, Climate and Plate Tectonics**
(Formerly Catastrophic Events)
Some of the contents of these modules have changed. Please inquire for details.

Middle School

Earth Science

Exploring Planetary Systems
STC

Students of all ages have an innate curiosity about our solar system's planets, moons, asteroids, comets and meteoroids. Exploring Planetary Systems helps students clarify and expand their knowledge of our solar system and Earth as a planet through a series of engaging, hands-on activities, discussions, presentations and reading selections. Students also explore scale models, the effect of gravity on planets, surface impacts and effects of planetary processes, and the uniqueness of Earth's ability to sustain life.



Researching the Sun-Earth-Moon System
STC

Although the Sun and Moon are Earth's closest neighbors, the relationships between these three bodies are often misunderstood by students and adults alike. Researching the Sun-Earth-Moon System helps students understand the Sun- Earth-Moon system through the use of models, computer simulations and outdoor investigations. Students build a foundation to understand ideas about the effects of the Sun-Earth-Moon System: tracking shadows, modeling seasons and the apparent motion of the Sun across the sky, analyzing and modeling lunar phases, eclipses, and understanding gravity and tides as well as the Sun as an energy source.

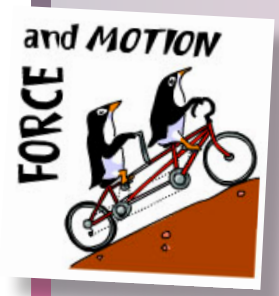
***Leased together as: Sun-Earth-Moon and Planetary Systems**
(Formerly Earth in Space)
Some of the contents of these modules have changed. Please inquire for details.

Middle School

Physical Science / Engineering & Technology

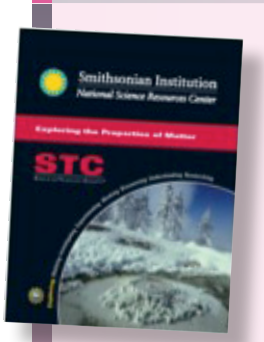
Chemical Interactions
FOSS

Chemical Interactions provides students with a diverse mix of empirical experiences that help students construct a solid basic understanding of the structure and behavior of matter in their world. Students conduct experiments to observe the macroscopic transformations of matter—phase change, dissolution, reaction—and apply kinetic particle theory to explain those transformations at the microscopic level. In the process, students learn useful conventions for thinking about and communicating chemical concepts including elements, atom, substances, molecules and compounds. Students will also observe energy transfers associated with reactions and infer energy transfers associated with phase change.



Force & Motion
FOSS

The FOSS Force and Motion course investigates linear motion, including position and several aspects of change of position—distance, displacement, speed, velocity and acceleration. They investigate fundamental forces (gravity and electromagnetism) in familiar environments such as pushes, pulls, impacts and falls. Interaction and outcomes are represented graphically to help students think mathematically about their observations. Investigations of opposing forces and additive forces help students develop the idea that a net force on an object produces motion. An object in motion has momentum, which is conserved. Students acquire the most fundamental and important understanding about the interplay between force and motion.



Exploring the Properties of Matter
STC

In the unit Exploring the Properties of Matter, students investigate some basic properties of matter and the use of these properties to distinguish one substance from another. Students begin by examining some physical properties and then turn to the characteristic properties of density; boiling, melting and freezing points; rates of thermal expansion; and solubility. They determine that these properties are independent of amount and, taken together, can be used to identify an unknown substance.

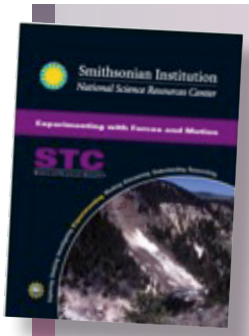
Experimenting with Mixtures, Compounds and Elements
STC

The focus of Experimenting with Mixtures, Compounds and Elements is to build an understanding of the physical and chemical properties that distinguish the three types of matter. In this unit, students investigate how such properties can be used to separate mixtures or how additional energy (in the form of heat or electricity) is needed to separate compounds. They examine elements and discover that elements can combine to form compounds but cannot be further separated into different components. Students also investigate chemical reactions to discover the law of conservation of mass.

***Leased together as: Matter, Mixtures, Compounds and Elements**
(Formerly Properties of Matter)
Some of the contents of these modules have changed. Please inquire for details.

Middle School

Physical Science / Engineering & Technology



Experimenting with Forces and Motion
STC

Forces and energy transformations make the motion of our world possible. Experimenting with Forces and Motion allows students to investigate the nature of energy, the different forms it can take, the nature of different forces and how those forces affect the motion of objects. Students begin by exploring elastic, magnetic, frictional and gravitational forces. Learning from experimentation that force affects the motion of objects, students turn their attention to energy and motion, learning about kinetic energy, how to calculate speed and the relationship between forces, energy and motion.

Working with Motors and Simple Machines
STC

Students use machines and motors every day to do simple tasks, but may not know how they work. Students are also familiar with the term "work," but probably do not understand it in a scientific context. Working with Motors and Simple Machines provides students the opportunity to explore forces, work, power and efficiency; how to calculate them; and how these concepts relate to motors and simple machines. To gain an understanding of these concepts, students explore motors and three simple machines— the inclined plane, the lever and the pulley. Students are challenged to combine their knowledge of motors and machines to design a system that lifts a heavy load.

***Leased together as: Forces, Motion, Motors and Simple Machines**
(Formerly Energy, Machines and Motion)
Some of the contents of these modules have changed. Please inquire for details.

Investigating Circuit Design
STC

Students routinely use electricity and circuits, although few of them may actually understand how circuits function and what electricity does. Investigating Circuit Design provides students with a hands-on introduction to electricity and circuits. By building their own circuits and using them to light bulbs and power fans, students are able to explore the idea that circuits provide a way to transform electrical energy into sound, heat, light or kinetic energy. Students also investigate how this happens, using ammeters and voltmeters to measure current and voltage. Students experiment to determine the various effects that arrangement has on circuits and to find one that supplies the most energy to a system.

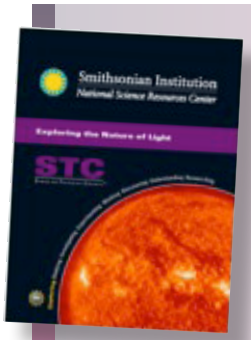
Discovering Electrical Systems
STC

In Discovering Electrical Systems, students get the chance to look inside some of the electrical devices they use every day and identify the various components that they find. Throughout the unit, they investigate how some of these components function in circuits. Students keep an inventory of all the electrical components that they investigate, including their schematic symbol, what they do in the circuit and a drawing of each. Students build simple circuits into which they install each new component to get a first-hand account of how it functions. Students experiment with resistors, capacitors, diodes and different gauges of wire. Students explore components common to all systems such as input, output, and controls and are challenged to design and build their own systems.

***Leased together as: Circuit Design and Electrical Systems**
(Formerly Electrical Energy and Circuit Design)
Some of the contents of these modules have changed. Please inquire for details.

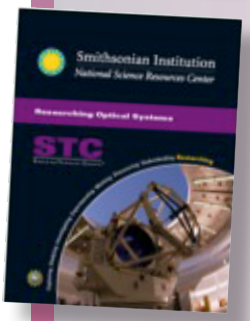
Middle School

Physical Science / Engineering & Technology



Exploring the Nature of Light
STC

Light enables us to see yet is rarely seen. Scientists have been intrigued by light for centuries, yet students may not have considered the nature of light. Exploring the Nature of Light introduces students to light as a form of energy by providing opportunities for students to investigate where light comes from, how it is produced, to experiment with light beams and shadow formation to determine how light travels, and to explore the phenomena of color and the electromagnetic spectrum.



Researching Optical Systems
STC

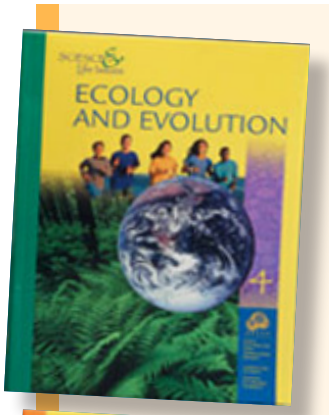
Light can be applied in many ways to achieve varied results. Flashlights and televisions are obvious examples of how we can harness the power of light. But what about adjusting our vision, experiencing optical illusions or sending information? Can light be applied to situations like these? Building on a preliminary understanding of the characteristics and behavior of light, Researching Optical Systems invites students to apply their existing knowledge about light to explore different optical systems, such as cameras, optical fibers, lenses, mirrors and spectroscopes; how they are designed; and how they work.

***Leased together as: Lights and Optical Systems**
(Formerly Light)
Some of the contents of these modules have changed. Please inquire for details.

Middle School

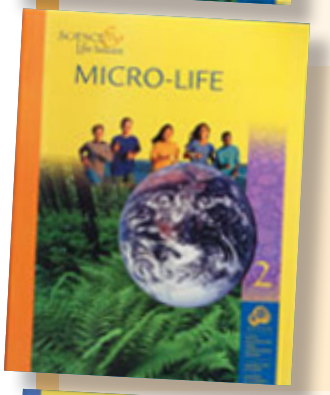
Science & Life Issues (Full-Year Study)

Students will find that many of the issues they will study in Science and Life Issues appear frequently in the media. Science and Life Issues does not tell students what decisions to make, instead, it provides them with knowledge, skills, and understanding that will help them to make their own decisions. How do you decide what type(s) of medication, if any, to take when you are ill? Relevant issues provide a framework for student work and reflection and a context in which to understand concepts. Students are challenged to investigate how life science issues affect their everyday lives, and they learn about the scientific ideas that are used to analyze these issues. Science and Life Issues can be studied in separate components: Ecology and Evolution, Micro-Life, My Body and Me and Our Genes Our Selves.



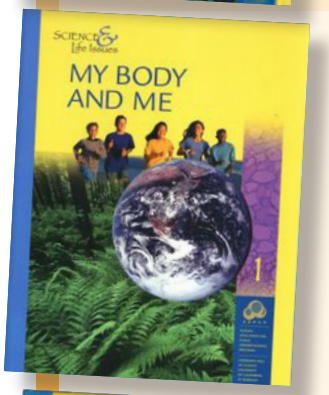
Ecology & Evolution
SEPUP

The Ecology unit begins by focusing on what happens when a new species is introduced into an ecosystem. Students consider this issue as they model ecological relationships. They simulate the effect of competition, predation and other factors on population size. Students culture and investigate black worms (small aquatic worms) as they differentiate between observation and inference. Students further develop their research skills by completing a project on the problems of introduced species. In the Evolution unit, students consider whether an extinct species should be brought back to life as they begin to explore evolution. Students examine fossils as they continue to distinguish between observation and inference. Activities model the lines of evidence for evolution, natural selection and the role of genetic mutations. Finally, students evaluate the impact of humans on the extinction and evolution of species.



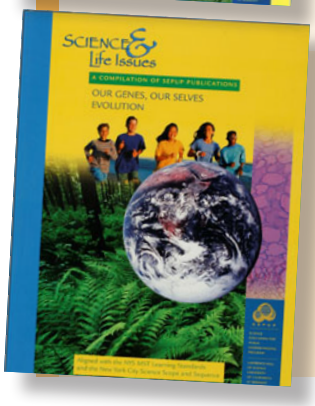
Micro-Life
SEPUP

By exploring how infectious diseases affect people, students study microbiology. In this unit, they'll focus on cell size, structure, function, permeability and the different systems of classification. They learn how to use a microscope, and then use it to gather data, building on their ability to conduct experiments. Students also explore the function of the immune system and the growth of antibiotic-resistant organisms through a series of laboratory activities and simulations. A project on disease provides students with an opportunity to develop research skills.



My Body & Me
SEPUP

The unit begins with a scientific study of humans. Students focus on themselves as subjects of the investigation. It helps students develop different scientific approaches to problem solving. Student investigations also address important ideas about the nature of science, the traditional scientific method and experimental design. In this unit, students investigate concepts and issues related to sustaining personal health. A major goal of this unit is to provide a foundation for evidence-based decision-making about health issues such as the use of medication, nutrition, exercise and heart disease. The unit focuses on the role of organ systems in providing nutrients and oxygen to the body, and also on transporting and eliminating wastes (maintaining internal balance). Students investigate the heart and circulatory system in depth with an emphasis on the relationship between structure and function.



Our Genes Our Selves
SEPUP

Students consider whether to be tested for a hereditary condition as they explore fundamental principles of Mendelian genetics. Laboratory activities and simulations allow students to examine the inheritance of traits through generations. Students investigate heredity among imaginary "critters," pea plants and humans. Other activities focus on the difference between asexual and sexual reproduction, the process of cell division, and the role of nature and nurture in determining traits. Near the end of the unit, students model the use of DNA technologies to solve real-world problems.

***Science & Life Issues** is a year-long module; however, individual 9 or 18 week units can be ordered separately.*

Engineering is Elementary® Modules

Engineering is Elementary® (EiE) Developed by Museum of Science, Boston

Engineering is Elementary® (EiE) fosters engineering and technological literacy among children. EiE has created a research-based, standards-driven and classroom-tested program that integrates engineering and technology concepts and skills with elementary science topics. EiE lessons not only promote STEM learning, but also connect with literacy and social studies. ASSET was one of the first professional development organizations endorsed by the EiE program.

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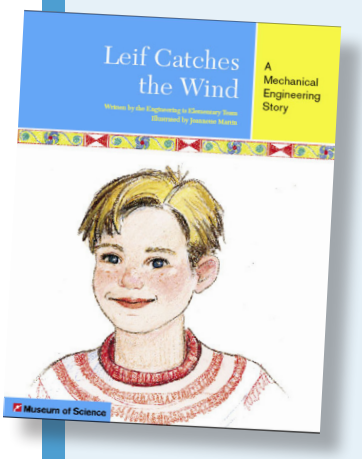
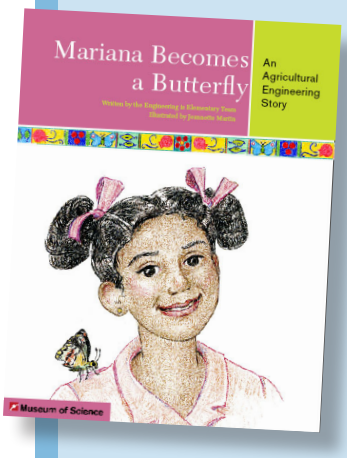


Catching the Wind: Designing Windmills

Basic (Grades 1-2)

This unit guides students to think like mechanical engineers as they use their knowledge of wind to design and create machines that can be used to capture wind energy. The storybook "Leif Catches the Wind" reinforces the science concept of air as wind and introduces the field of mechanical engineering. The wind turbines found in Leif's home country, Denmark, are used as an example of a renewable energy source and a machine designed in part by mechanical engineers. Students will look critically at several common machines (mechanical pencils, egg beaters, rolling pins) and diagram how the parts of the machine interact with other parts of the machine and allow the object to function. Students will then use their mechanical engineering skills to explore different materials and shapes conducive to catching the wind, first by designing sails for small boats and finally for designing windmill blades.



The Best of Bugs: Designing Hand Pollinators

Basic (Grades 1-2)

This unit guides students to connect their knowledge of insects and plants to a broader understanding of the natural system of pollination. Science concepts about insects, life cycles, pollination and natural systems are introduced and reinforced, and different aspects of agricultural engineering are explored. Through lessons and the unit's storybook – set in and around a young girl's butterfly garden in the Dominican Republic – students learn about the importance of balance within natural and agricultural systems, and consider what can happen when this balance goes awry. Students are introduced to agricultural engineering from a broad perspective, with brief overviews of Integrated Pest Management and pollination. For the design challenge students design and improve hand pollinators to work with different model flowers.

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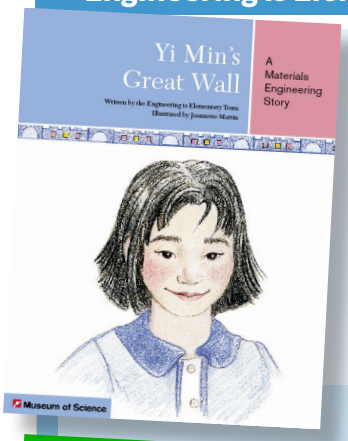
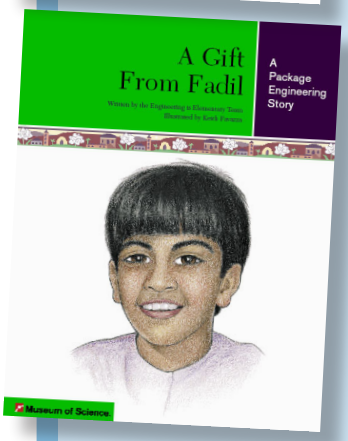


A Sticky Situation: Designing Walls

Basic (Grades 1-2)

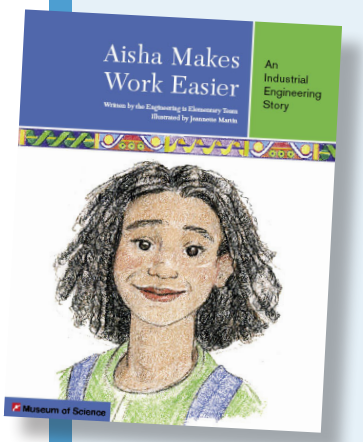
This unit addresses the use of earth materials in the design and construction of technology. What properties make an earth material useful? Different properties, making them appropriate for different uses. Students investigate various earth materials (clay, sand and soil) to be used in a mortar to build a stone wall. They then design a mortar mixture, taking advantage of the properties of these different materials, and plan, create, test and improve their own walls.



Thinking Inside the Box: Designing Plant Packages

Basic (Grades 1-2)

Are brown paper packages tied up with strings always a favorite thing? Not necessarily to packaging engineers! In this unit, students encounter the rapidly growing field of package engineering. They take a fresh look at the packaging they encounter daily – and often toss out without appreciating its importance. As children investigate the functions of packages, they discover the relationship between the needs of the product (in this unit, a plant) and the functions that must be considered in package design. Ultimately, students design, test and improve their own packages to solve a tricky challenge: carry a plant and keep it safe for several days – while also ensuring it has the light, air and moisture it needs. Hands-on activities, discussion and reading focus on package engineering and the Engineering Design Process. Engineering concepts are introduced at a level appropriate for elementary students.



Marvelous Machines: Making Work Easier

Advanced (Grades 3-5)

This unit guides students to learn about how factories use processes, systems and machines to help make work easier and safer for workers. The story "Aisha Makes Work Easier" – set in and around the U.S. city of Boston, Massachusetts – as well as follow-up lessons reinforce concepts about simple machines. Special emphasis is given to the sometimes surprising settings in which we can find simple machines in our everyday world, as well as in a potato chip factory. The lessons add depth to the notion that simple machines help make work easier, and also introduce the idea that different systems can help make work simpler. Students will compare individual craftsmanship to factory production and explore the benefits and disadvantages of the assembly line as a production process. Students will measure the force required to complete a given task with and without simple machines to understand the types of advantages simple machines offer. During the culminating design challenge, students will put their data to the test as they combine a series of simple machines to complete the various tasks of a model potato chip factory and make work easier.

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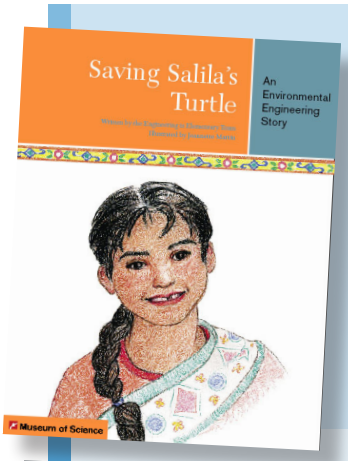
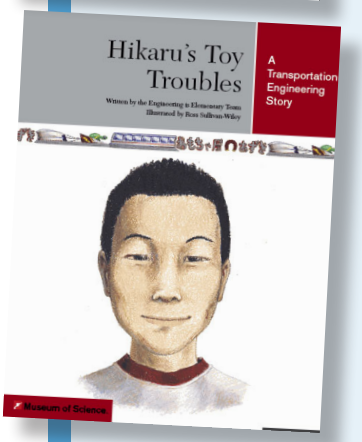


Water, Water Everywhere: Designing Water Filters

Advanced (Grades 3-5)

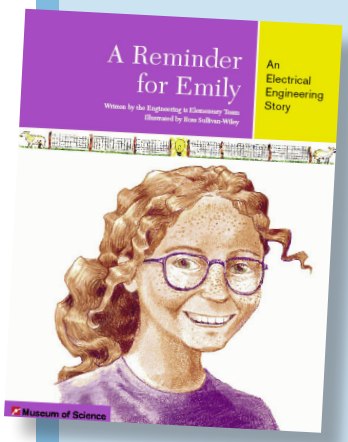
This unit addresses the increasingly important issue of water quality through lessons that teach students about water contamination and the ways that people ensure the quality of their drinking water. Students will first think like environmental engineers as they review a mural of a small American community, noting the possible source of pollution and suggesting ways to clean up or eliminate the source. Students will then focus on the environmental engineering problem of providing safe drinking water as they plan, construct, test and improve their own water filters.



The Attraction is Obvious: Designing MagLev Systems

Advanced (Grades 3-5)

In this unit, student understanding will rise to new heights as they explore transportation engineering, magnetism and the technological innovation of the Magnetic Levitation Train. Following the lead of the storybook characters – who need to attract customers to a family-owned toy store before the business fails – students engineer a way to design a levitating vehicle system that will carry packages without them touching the ground. In the classroom, students explore the science behind the magic-seeming effect of MagLev. Students send magnets "sailing," help magnets hover and poke around magnetic poles. Creativity and excitement abound as children use their new insights and the Engineering Design Process to design, test and improve their own tabletop MagLev transportation systems.



An Alarming Idea: Designing Alarm Circuits

Advanced (Grades 3-5)

This unit helps students to apply their knowledge of electricity, circuits, conductors and insulators as they design and construct their own alarm circuits. The science concepts of electricity/energy transfer, conductors and insulators, and complete and incomplete circuits are reinforced and students are also introduced to schematic diagrams, a symbol "language" that electrical engineers use to plan and design circuits. Through lessons and the unit's storybook, which takes place on a station (or ranch) in the Australian outback, students embark on an electricity scavenger hunt; practice drawing schematic diagrams from circuits; and finally design, create and improve their own alarm circuits and switches to remind them when it is time to do an important chore.

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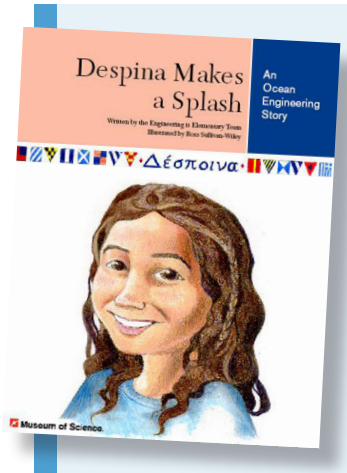
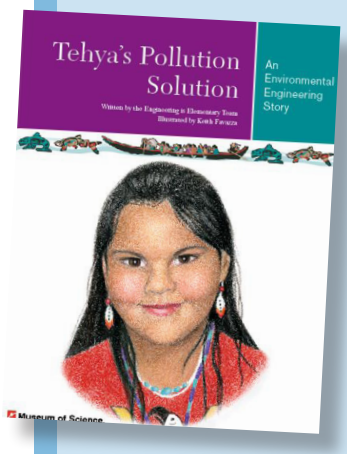


Taking the Plunge: Designing Submersibles

Advanced (Grades 3-5)

This unit and storybook introduce students to the field of ocean engineering and the concept of density. In the storybook, Despina and her cousin Chrisanthy are faced with a problem. While sailing off the coast of their hometown of Santorini, Greece, Chrisanthy drops her goggles. A chance encounter with a piece of "treasure" floating in the ocean leads the girls to speak with ocean engineers who are designing instruments used on ocean submersibles. Inspired by what they learn, Despina and Chrisanthy design their own submersible to retrieve the lost goggles. Students will have the chance to map a section of the ocean floor using sounding pole technology and will review images of the ocean floor gathered with sonar technology. Challenged to design their own submersibles, which need to float unassisted, students will test the floating and sinking behaviors of instruments that they could include in their submersible designs. Along with the floating criterion, students will need to consider the volume of their submersibles and the number of instruments they are able to take on board. After creating their submersible designs, groups will attempt to retrieve packages off of a model ocean floor.



A Slick Solution: Cleaning an Oil Spill

Advanced (Grades 3-5)

In this unit, students are introduced to a girl named Tehya who is a member of the Lower Elwha Klallam tribe. While walking by the Elwha River near her home in Washington state, Tehya and her friend Sam are horrified to find an oil spill. With the help of Thomas, a neighbor and environmental engineer, Tehya and Sam play an active role in the cleanup efforts. Students learn about the interconnectedness of components of an ecosystem, methods for cleaning oil spills and the severe impact oil spills can have on an ecosystem. Throughout this unit, students will act as environmental engineers using their knowledge of ecosystems, environments and properties of materials to design solutions to environmental problems. Students will investigate the pH of soil and water samples to gather clues to identify potential sources of pollution in a fictional town. This exercise points out that pollution is rarely an isolated problem – pollution in one area often spreads through soil, water and air to other areas. Students will also be challenged to design their own process for cleaning an oil spill. They will have the opportunity to test and think carefully about properties of various materials that might be used to help clean an oil spill. Finally, they will be able to design, test and improve their own process for cleaning an oil spill.

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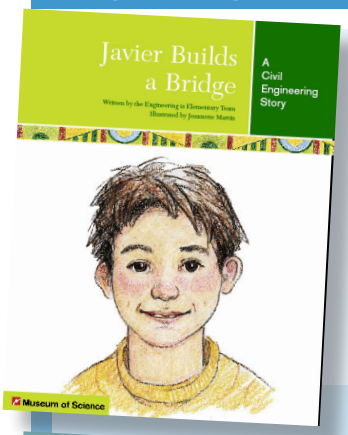
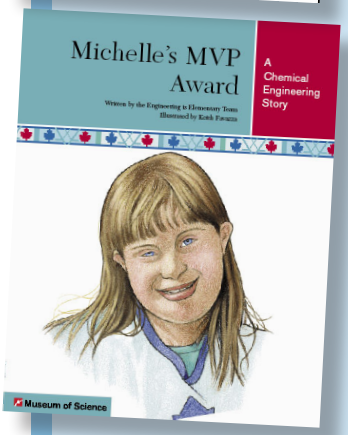


To Get to the Other Side: Designing Bridges

Basic (Grades 1-2)

When they are designing bridges, civil engineers integrate the physical science phenomena of balance and motion. In this unit, students explore why bridges are shaped differently. Students distinguish between beam, arch, and suspension bridges and learn how bridge designs counteract and redirect forces and motion. In the culminating design challenge, students design, construct and test their own bridges.



A Work in Process: Improving a Play Dough Process

Basic (Grades 1-2)

In this unit, students shape their understanding of sequenced processes, the properties of solids and liquids, and some possible outcomes of mixing the two, as they get serious about play dough. Students follow in the skate-steps of Michelle, the storybook's Canadian kid hockey-player turned junior-chemical engineer. Michelle uses her knowledge of processes and play dough to help her team raise money to see their favorite pro team play. In the classroom, students tackle the challenge of creating the way to improve an "okay" play dough recipe. On the way, they explore the properties of a good dough and compare their own sample to it. Then they improve a standard process for mixing the ingredients – to ensure that it creates a just-right dough. Along the way, they discover that the process really can make the difference between a goopy blob and a super sculpting medium.

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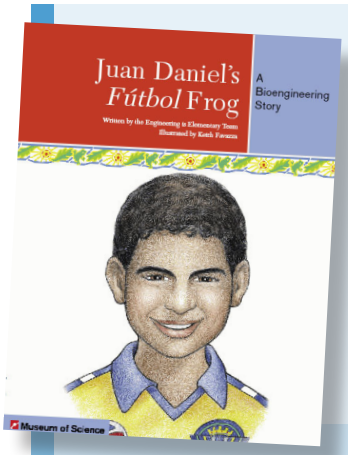
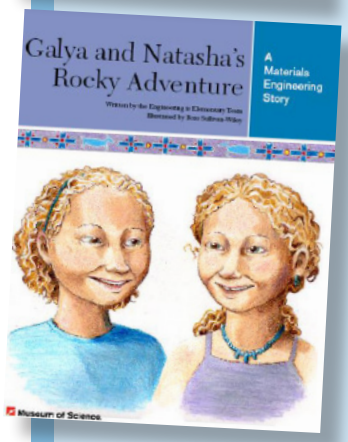


Just Passing Through: Designing Model Membranes

Advanced (Grades 3-5)

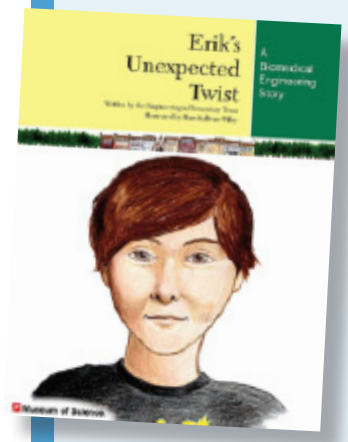
This unit provides students with the opportunity to apply their knowledge of organisms and their basic needs through a series of activities related to the diverse field of bioengineering. After reading the storybook "Juan Daniel's Futbol Frog," students learn to think like bioengineers as they play a "concentration" style card game and match technologies with their natural inspirations. Students are then challenged to be bioengineers and design a model membrane that can deliver water to an imaginary pet frog in a controlled manner, helping the frog to meet its basic needs.



Solid as a Rock: Replicating an Artifact

Advanced (Grades 3-5)

Students will have the chance to think like materials engineers throughout this unit as they learn about the rock cycle and properties of rocks. In this design challenge, students are tasked by a museum to design a replica of an artifact – a carving made in stone (also known as a petroglyph). The storybook introduces students to Galya and Natasha – twin sisters from Russia who have very different personalities and interests. The sisters decide to create replicas of a petroglyph they discover. The rock cycle, the three types of rocks produced through the rock cycle, materials engineering and the engineering design process are introduced. Materials engineering thinking will be reinforced as students analyze twill and terry – two different products created from the same raw material. The processes that led to the varied properties of the final products, as well as the advantages and disadvantages of each material, will be discussed. Students reflect upon how materials processing, a central concept of materials engineering, affects both human-made and natural products, such as rocks. Students will then perform a range of tests to help analyze the properties of a set of human-made materials and naturally made rocks. The information gathered through these investigations will allow students to think carefully about the criteria and constraints put forth to guide the design of their own petroglyph replicas.



No Bones About It: Designing Knee Braces

Advanced (Grades 3-5)

In this unit, students are introduced to Erik, a boy from Germany who is dreading an upcoming trip with his camping club. Whenever Erik goes camping, disaster seems to follow. During a scavenger hunt, one of the other campers, Matthias, injures his knee. Erik is able to use knowledge he gained from his mother, a biomedical engineer, and pull from his personal experience with a torn ligament in his knee, to help design a knee brace for Matthias. Students will think like biomedical engineers as they learn about differences in arch height of people's feet, and make recommendations to a fictional sneaker company about how many different types of sneakers they should create. Students will then measure the range of motion of healthy knees and the range of motion of a model injured knee. After exploring the properties of materials available to them, students are asked to design a knee brace for the model injured knee that helps to restore its normal range of motion.

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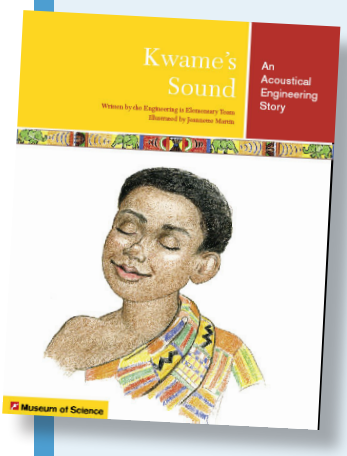
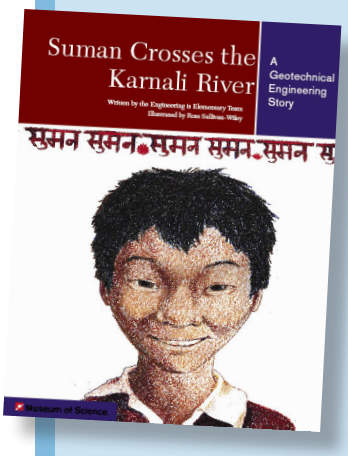


Sounds Like Fun!: Seeing Animal Sounds

Advanced (Grades 3-5)

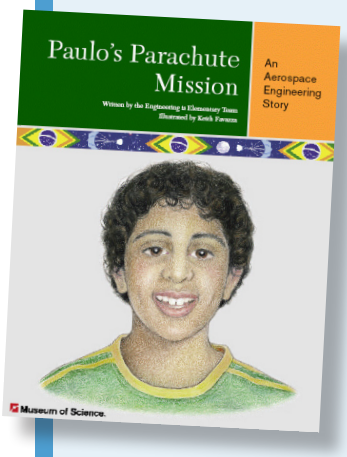
This unit brings new levels of excitement and depth to traditional sound units, reinforcing basic concepts while introducing students to the field of acoustical engineering. The storybook "Kwame's Sound," introduces Kwame, a young, blind drummer from Ghana. Kwame's father, an acoustical engineer, brings Kwame into the forest, where he hears the elephants that are currently subjects of his father's work. Kwame's father introduces him to the possibility of visually or tactilely representing sound. The storybook and the unit lessons reinforce the idea that sound is vibration, and the properties of sound include volume and pitch. Students will investigate ways to damp sound, and then will focus on developing a visualization of sound in a way that captures its key elements and communicates the sound clearly to others.



A Stick in the Mud: Evaluating a Landscape

Advanced (Grades 3-5)

This unit takes students to Nepal, where the real-life TarPul Project (an Ecosystems, Ltd., project) helps ensure that people in monsoon-prone areas don't get stranded on one side of a flooded river. After meeting storybook character Suman, who worries about how his ailing grandmother will receive health care from the clinic across the river when the flood season comes, students appreciate how important it is to find a safe, flood-and erosion-proof site for the innovative TarPul river-crossing cable system. Digging into the role of geotechnical engineers, students use models to represent a larger, real-life riverbank system and see how different factors impact a TarPul. Students' objective: Use the Engineering Design Process to select and recommend to villagers a TarPul site, even though each site had advantages and disadvantages based on several factors. To meet the goal, students must run tests on the models and determine the ideal soil base for a TarPul site, explore the costs and benefits of changing the soil to make it more suitable for building, examine maps to consider various sites' potentials for eroding in the next flood and weigh the villagers' traditional preferences for the TarPul's location. In the end, each student team must make a choice in the midst of some realistic ambiguity and justify its recommendations.



A Long Way Down: Designing Parachutes

Advanced (Grades 3-5)

In this unit students meet Paulo, a boy from Brazil whose parents are aerospace engineers. As Paulo struggles with a move to a new town and his fears about classmates and neighbors not accepting him, he soon realizes that his past experience with creating parachutes might make him a fast friend after all. Students will be introduced to the concept of drag and the role that different atmospheres play in creating drag. All of this knowledge will be applied by students in order to eventually complete their design challenge: creating a parachute that is "Mission Ready." Students will explore and analyze data related to three variables of a parachute: suspension line length, canopy size and canopy material. Students use this data to help them design a parachute that meets both the packing criterion and the speed criterion for a mission traveling to a planet with an atmosphere thinner than Earth's.

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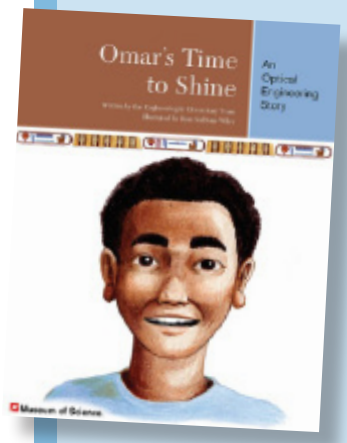
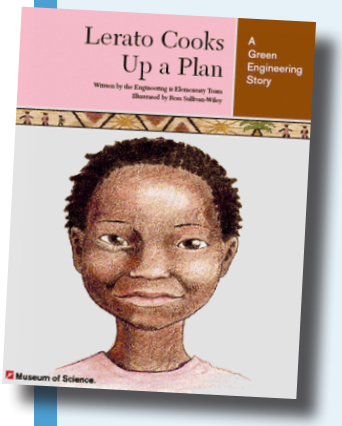


Lighten Up: Designing Lighting Systems

Advanced (Grades 3-5)

This unit and storybook introduce students to the field of optical engineering and some of the properties of light. In the storybook, Omar, a boy from Egypt, learns about optical engineering from his older brother, Zane. Zane is working to block light from reaching and fading some of the hieroglyphs in an ancient Egyptian tomb. All of Omar's optical engineering knowledge is put to good use when a brownout occurs just before a school production is set to take the stage. Omar saves the day by using what he's learned to design a lighting system to highlight the performers in the show. Students will think like optical engineers as they explore how light interacts with a variety of materials (specifically observing reflection, transmission and absorption). Then, students will use what they've learned about materials, light, how light moves and the intensity of light in order to design a system to light hieroglyphs in a model tomb.



Now You're Cooking: Designing Solar Ovens

Advanced (Grades 3-5)

This unit guides students to explore energy and how heat energy from the Sun can be harnessed by a solar cooker to heat food. Many students might take technologies such as stoves, ovens and toasters for granted, but these conveniences aren't available to Lerato, a girl who lives in Botswana. Through the storybook "Lerato Cook Up a Plan," students will be introduced to Lerato and her family. Lerato and her siblings have to gather firewood in order to build a cooking fire to heat their food. When Tsoane, another villager, returns from University, Lerato learns about the field of green engineering. Green engineers are concerned with designing technologies that have as little impact on the environment as possible. Tsoane shows Lerato how she could use a well insulated solar cooker to help cook food, eliminating the chore of gathering firewood and the environmental impacts of creating cooking fires. Key concepts introduced in the storybook include life cycle assessments of engineered products, thermal insulators and thermal conductors.

In the classroom students are given the challenge of creating a well-insulated solar oven. Students will test an array of materials to find the best thermal insulators and will also consider the environmental impacts of each material. Once students have tested and analyzed each material, they will design and test their own solar cookers.