



How Engineering is Elementary units link to the Next Generation Science Standards*

Kindergarten	Physical Science		
	Disciplinary Core Idea	Performance Expectations	Relevant EiE Units
	K-PS2 Motion and Stability: Forces and Interactions	K-PS2-1. Plan and conduct an investigation to compare the effects of different strengths or different directions of pushes and pulls on the motion of an object.	<i>To Get to the Other Side: Designing Bridges</i>
		K-PS2-2. Analyze data to determine if a design solution works as intended to change the speed or direction of an object with a push or a pull.	<i>To Get to the Other Side: Designing Bridges</i>
	K-PS3 Energy	K-PS3-1. Make observations to determine the effect of sunlight on Earth's surface.	
		K-PS3-2. Use tools and materials to design and build a structure that will reduce the warming effect of sunlight on an area.	
	Life Science		
	Disciplinary Core Idea	Performance Expectations	Relevant EiE Units
	K-LS1 From Molecules to Organisms: Structures and Processes	K-LS1-1. Use observations to describe patterns of what plants and animals (including humans) need to survive.	<i>Thinking Inside the Box: Designing Plant Packages</i> <i>Just Passing Through: Designing Model Membranes</i>
	Earth Science		
	Disciplinary Core Idea	Performance Expectations	Relevant EiE Units
	K-ESS2 Earth's Systems	K-ESS2-1. Use and share observations of local weather conditions to describe patterns over time.	<i>Catching the Wind: Designing Windmills</i>
		K-ESS2-2. Construct an argument supported by evidence for how plants and animals (including humans) can change the environment to meet their needs.	
	K-ESS3 Earth and Human Activity	K-ESS3-1. Use a model to represent the relationship between the needs of different plants or animals (including humans) and the places they live.	<i>A Slick Solution: Cleaning an Oil Spill</i>
		K-ESS3-2. Ask questions to obtain information about the purpose of weather forecasting to prepare for, and respond to, severe weather.	
K-ESS3-3. Communicate solutions that will reduce the impact of humans on the land, water, air, and/or other living things in the local environment.			

Physical Science		
Disciplinary Core Idea	Performance Expectations	Relevant EiE Units
1-PS4 Waves and Their Applications in Technologies for Information Transfer	1-PS4-1. Plan and conduct investigations to provide evidence that vibrating materials can make sound and that sound can make materials vibrate.	<i>Sounds Like Fun: Seeing Animal Sounds</i>
	1-PS4-2. Make observations to construct an evidence-based account that objects can be seen only when illuminated.	
	1-PS4-3. Plan and conduct an investigation to determine the effect of placing objects made with different materials in the path of a beam of light.	<i>Lighten Up: Designing Lighting Systems</i>
	1-PS4-4. Use tools and materials to design and build a device that uses light or sound to solve the problem of communicating over a distance.	<i>Sounds Like Fun: Seeing Animal Sounds</i>
Life Science		
Disciplinary Core Idea	Performance Expectations	Relevant EiE Units
1-LS1 From Molecules to Organisms: Structures and Processes	1-LS1-1. Use materials to design a solution to a human problem by mimicking how plants and/or animals use their external parts to help them survive, grow, and meet their needs.	<i>Just Passing Through: Designing Model Membranes</i> <i>The Best of Bugs: Designing Hand Pollinators</i>
	1-LS1-2. Read texts and use media to determine patterns in behavior of parents and offspring that help offspring survive.	
1-LS3 Heredity: Inheritance and Variation of Traits	1-LS3-1. Make observations to construct an evidence-based account that young plants and animals are like, but not exactly like, their parents.	
Earth Science		
Disciplinary Core Idea	Performance Expectations	Relevant EiE Units
1-ESS1 Earth's Place in the Universe	1-ESS1-1. Use observations of the sun, moon, and stars to describe patterns that can be predicted.	
	1-ESS1-2. Make observations at different times of the year to relate the amount of daylight to the time of year.	

2nd Grade

			Physical Science			
Disciplinary Core Idea		Performance Expectations		Relevant EiE Units		
2-PS1 Matter and Its Interactions		2-PS1-1. Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties.		<i>A Sticky Situation: Designing Walls</i> <i>Catching the Wind: Designing Windmills</i> <i>The Best of Bugs: Designing Hand Pollinators</i> <i>A Work in Process: Improving a Play Dough Process</i> <i>To Get to the Other Side: Designing Bridges</i> <i>Water, Water Everywhere: Designing Water Filters</i> <i>A Long Way Down: Designing Parachutes</i> <i>Solid as a Rock: Replicating an Artifact</i> <i>Thinking Inside the Box: Designing Plant Packages</i> <i>A Slick Solution: Cleaning an Oil Spill</i> <i>No Bones About It: Designing Knee Braces</i> <i>An Alarming Idea: Designing Alarm Circuits</i> <i>The Attraction is Obvious: Designing Maglev Systems</i> <i>Now You're Cooking: Designing Solar Ovens</i> <i>Taking the Plunge: Designing Submersibles</i> <i>Lighten Up: Designing Lighting Systems</i> <i>Just Passing Through: Designing Model Membranes</i>		
		2-PS1-2. Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose.		<i>Water, Water Everywhere: Designing Water Filters</i> <i>Catching the Wind: Designing Windmills</i> <i>A Sticky Situation: Designing Walls</i> <i>A Long Way Down: Designing Parachutes</i> <i>Solid as a Rock: Replicating an Artifact</i> <i>The Best of Bugs: Designing Hand Pollinators</i> <i>Just Passing Through: Designing Model Membranes</i> <i>A Slick Solution: Cleaning an Oil Spill</i> <i>No Bones About It: Designing Knee Braces</i> <i>Marvelous Machines: Making Work Easier</i> <i>To Get to the Other Side: Designing Bridges</i> <i>An Alarming Idea: Designing Alarm Circuits</i> <i>A Work in Process: Improving a Play Dough Process</i> <i>The Attraction is Obvious: Designing Maglev Systems</i> <i>Now You're Cooking: Designing Solar Ovens</i> <i>Taking the Plunge: Designing Submersibles</i> <i>Lighten Up: Designing Lighting Systems</i>		
		2-PS1-3. Make observations to construct an evidence-based account of how an object made of a small set of pieces can be disassembled and made into a new object.		<i>A Sticky Situation: Designing Walls</i>		
		2-PS1-4. Construct an argument with evidence that some changes caused by heating or cooling can be reversed and some cannot.				
			Life Science			
Disciplinary Core Idea		Performance Expectations		Relevant EiE Units		
2-LS2 Ecosystems: Interactions, Energy, and Dynamics		2-LS2-1. Plan and conduct an investigation to determine if plants need sunlight and water to grow.		<i>Thinking Inside the Box: Designing Plant Packages</i>		
		2-LS2-2. Develop a simple model that mimics the function of an animal in dispersing seeds or pollinating plants.		<i>The Best of Bugs: Designing Hand Pollinators</i>		
2-LS4 Biological Evolution: Unity and Diversity		2-LS4-1. Make observations of plants and animals to compare the diversity of life in different habitats.				

2nd Grade		Earth Science		
	Disciplinary Core Idea	Performance Expectations	Relevant EiE Units	
	2-ESS1 Earth's Place in the Universe	2-ESS1-1. Use information from several sources to provide evidence that Earth events can occur quickly or slowly.	<i>A Stick in the Mud: Evaluating a Landscape</i>	
	2-ESS2 Earth's Systems	2-ESS2-1. Compare multiple solutions designed to slow or prevent wind or water from changing the shape of the land.		
2-ESS2-2. Develop a model to represent the shapes and kinds of land and bodies of water in an area.				
2-ESS2-3. Obtain information to identify where water is found on Earth and that it can be solid or liquid.				

Engineering Design		
Disciplinary Core Idea	Performance Expectations	Relevant EiE Units
K-2-ETS1 Engineering Design	K-2-ETS1-1. Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.	<i>All EiE Units</i>
	K-2-ETS1-2. Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.	<i>Catching the Wind: Designing Windmills</i> <i>A Sticky Situation: Designing Walls</i> <i>A Long Way Down: Designing Parachutes</i> <i>The Best of Bugs: Designing Hand Pollinators</i> <i>Thinking Inside the Box: Designing Plant Packages</i> <i>No Bones About It: Designing Knee Braces</i> <i>Marvelous Machines: Making Work Easier</i> <i>To Get to the Other Side: Designing Bridges</i> <i>Sounds Like Fun: Seeing Animal Sounds</i> <i>An Alarming Idea: Designing Alarm Circuits</i> <i>The Attraction is Obvious: Designing Maglev Systems</i> <i>Now You're Cooking: Designing Solar Ovens</i>
	K-2-ETS1-3. Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.	<i>All EiE Units</i>

K-2nd Grade

3rd Grade

Physical Science		
Disciplinary Core Idea	Performance Expectations	Relevant EiE Units
3-PS2 Motion and Stability: Forces and Interactions	3-PS2-1. Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object.	<i>Marvelous Machines: Making Work Easier</i> <i>To Get to the Other Side: Designing Bridges</i>
	3-PS2-2. Make observations and/or measurements of an object's motion to provide evidence that a pattern can be used to predict future motion.	
	3-PS2-3. Ask questions to determine cause and effect relationships of electric or magnetic interactions between two objects not in contact with each other.	<i>The Attraction is Obvious: Designing Maglev Systems</i>
	3-PS2-4. Define a simple design problem that can be solved by applying scientific ideas about magnets.	<i>The Attraction is Obvious: Designing Maglev Systems</i>
Life Science		
Disciplinary Core Idea	Performance Expectations	Relevant EiE Units
3-LS1 From Molecules to Organisms: Structures and Processes	3-LS1-1. Develop models to describe that organisms have unique and diverse life cycles but all have in common birth, growth, reproduction, and death.	
3-LS2 Ecosystems: Interactions, Energy, and Dynamics	3-LS2-1. Construct an argument that some animals form groups that help members survive.	
3-LS3 Heredity: Inheritance and Variation of Traits	3-LS3-1. Analyze and interpret data to provide evidence that plants and animals have traits inherited from parents and that variation of these traits exists in a group of similar organisms.	
	3-LS3-2. Use evidence to support the explanation that traits can be influenced by the environment.	
3-LS4 Biological Evolution: Unity and Diversity	3-LS4-1. Analyze and interpret data from fossils to provide evidence of the organisms and the environments in which they lived long ago.	
	3-LS4-2. Use evidence to construct an explanation for how the variations in characteristics among individuals of the same species may provide advantages in surviving, finding mates, and reproducing.	
	3-LS4-3. Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all.	<i>A Slick Solution: Cleaning an Oil Spill</i> <i>Just Passing Through: Designing Model Membranes</i>
	3-LS4-4. Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change.	<i>A Slick Solution: Cleaning an Oil Spill</i> <i>The Best of Bugs: Designing Hand Pollinators</i>
Earth Science		
Disciplinary Core Idea	Performance Expectations	Relevant EiE Units
3-ESS2 Earth's Systems	3-ESS2-1. Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season.	
	3-ESS2-2. Obtain and combine information to describe climates in different regions of the world.	
3-ESS3 Earth and Human Activity	3-ESS3-1. Make a claim about the merit of a design solution that reduces the impacts of a weather-related hazard.	<i>A Stick in the Mud: Evaluating a Landscape</i>

4th Grade

Physical Science		
Disciplinary Core Idea	Performance Expectations	Relevant EiE Units
4-PS3 Energy	4-PS3-1. Use evidence to construct an explanation relating the speed of an object to the energy of that object.	<i>Catching the Wind: Designing Windmills</i>
	4-PS3-2. Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.	<i>Sounds Like Fun: Seeing Animal Sounds</i> <i>Lighten Up: Designing Lighting Systems</i> <i>Now You're Cooking: Designing Solar Ovens</i> <i>An Alarming Idea: Designing Alarm Circuits</i>
	4-PS3-3. Ask questions and predict outcomes about the changes in energy that occur when objects collide.	
	4-PS3-4. Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.	<i>Now You're Cooking: Designing Solar Ovens</i> <i>An Alarming Idea: Designing Alarm Circuits</i>
4-PS4 Waves and Their Applications in Technologies for Information Transfer	4-PS4-1. Develop a model of waves to describe patterns in terms of amplitude and wavelength and that waves can cause objects to move.	<i>Sounds Like Fun: Seeing Animal Sounds</i>
	4-PS4-2. Develop a model to describe that light reflecting from objects and entering the eye allows objects to be seen.	
	4-PS4-3. Generate and compare multiple solutions that use patterns to transfer information.	<i>Sounds Like Fun: Seeing Animal Sounds</i>
Life Science		
Disciplinary Core Idea	Performance Expectations	Relevant EiE Units
4-LS1 From Molecules to Organisms: Structures and Processes	4-LS1-1. Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.	<i>The Best of Bugs: Designing Hand Pollinators</i> <i>Thinking Inside the Box: Designing Plant Packages</i> <i>No Bones About It: Designing Knee Braces</i> <i>Just Passing Through: Designing Model Membranes</i>
	4-LS1-2. Use a model to describe that animals receive different types of information through their senses, process the information in their brain, and respond to the information in different ways.	
Earth Science		
Disciplinary Core Idea	Performance Expectations	Relevant EiE Units
4-ESS1 Earth's Place in the Universe	4-ESS1-1. Identify evidence from patterns in rock formations and fossils in rock layers to support an explanation for changes in a landscape over time.	
4-ESS2 Earth's Systems	4-ESS2-1. Make observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation.	<i>A Stick in the Mud: Evaluating a Landscape</i>
	4-ESS2-2. Analyze and interpret data from maps to describe patterns of Earth's features.	<i>A Stick in the Mud: Evaluating a Landscape</i>
4-ESS3 Earth and Human Activity	4-ESS3-1. Obtain and combine information to describe that energy and fuels are derived from natural resources and that their uses affect the environment.	<i>Catching the Wind: Designing Windmills</i> <i>Now You're Cooking: Designing Solar Ovens</i>
	4-ESS3-2. Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans.	<i>A Stick in the Mud: Evaluating a Landscape</i>

5th Grade

Physical Science		
Disciplinary Core Idea	Performance Expectations	Relevant EiE Units
5-PS1 Matter and Its Interactions	5-PS1-1. Develop a model to describe that matter is made of particles too small to be seen.	
	5-PS1-2. Measure and graph quantities to provide evidence that regardless of the type of change that occurs when heating, cooling, or mixing substances, the total weight of matter is conserved.	
	5-PS1-3. Make observations and measurements to identify materials based on their properties.	<i>Solid as a Rock: Replicating an Artifact</i> <i>A Work in Process: Improving a Play Dough Process</i> <i>The Attraction is Obvious: Designing Maglev Systems</i> <i>Now You're Cooking: Designing Solar Ovens</i> <i>An Alarming Idea: Designing Alarm Circuits</i> <i>Lighten Up: Designing Lighting Systems</i>
	5-PS1-4. Conduct an investigation to determine whether the mixing of two or more substances results in new substances.	<i>A Work in Process: Improving a Play Dough Process</i>
5-PS2 Motion and Stability: Forces and Interactions	5-PS2-1. Support an argument that the gravitational force exerted by Earth on objects is directed down.	<i>A Long Way Down: Designing Parachutes</i> <i>Marvelous Machines: Making Work Easier</i>
5-PS3 Energy	5-PS3-1. Use models to describe that energy in animals' food (used for body repair, growth, motion, and to maintain body warmth) was once energy from the sun.	<i>A Slick Solution: Cleaning an Oil Spill</i>
Life Science		
Disciplinary Core Idea	Performance Expectations	Relevant EiE Units
5-LS1 From Molecules to Organisms: Structures and Processes	5-LS1-1. Support an argument that plants get the materials they need for growth chiefly from air and water.	<i>Thinking Inside the Box: Designing Plant Packages</i>
5-LS2 Ecosystems: Interactions, Energy, and Dynamics	5-LS2-1. Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.	<i>A Slick Solution: Cleaning an Oil Spill</i>
Earth Science		
Disciplinary Core Idea	Performance Expectations	Relevant EiE Units
5-ESS1 Earth's Place in the Universe	5-ESS1-1. Support an argument that the apparent brightness of the sun and stars is due to their relative distances from Earth.	
	5-ESS1-2. Represent data in graphical displays to reveal patterns of daily changes in length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky.	
5-ESS2 Earth's Systems	5-ESS2-1. Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.	
	5-ESS2-2. Describe and graph the amounts and percentages of water and fresh water in various reservoirs to provide evidence about the distribution of water on Earth.	
5-ESS3 Earth and Human Activity	5-ESS3-1. Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.	<i>Water, Water Everywhere: Designing Water Filters</i> <i>Now You're Cooking: Designing Solar Ovens</i> <i>A Slick Solution: Cleaning an Oil Spill</i>

Engineering Design		
Disciplinary Core Idea	Performance Expectations	Relevant EiE Units
3-5-ETS1 Engineering Design	3-5-ETS1-1. Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.	<i>All EiE Units</i>
	3-5-ETS1-2. Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.	<i>All EiE Units</i>
	3-5-ETS1-3. Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.	<i>All EiE Units</i>

3rd - 5th Grade

EiE Suggested Units by Grade for NGSS

EiE teaches engineering skills and content by linking with the science topics most commonly taught in elementary school. EiE is not intended to replace an elementary science curriculum, but should be taught alongside related science content. This table is designed to help users understand the units that are most appropriate for and integrate best with each grade level based on science state standards. The units indicated are only suggestions. EiE is designed for grades 1–5, but because some units can be modified to the kindergarten level we have provided kindergarten suggestions. Our reasoning for unit selection is based on the following criteria:

- Academic and age appropriateness
- Modifiability
- Standards alignment
- Materials management
- Unit content complexity for grade levels
- Unit repetition across grade levels

EiE also integrates with language arts, math, and social studies content, so it is important to comprehensively review your curriculum, standards, and goals to determine what unit(s) integrate best for your situation.

Kindergarten	Unit	Reasoning
	<i>To Get to the Other Side: Designing Bridges</i>	<ul style="list-style-type: none"> • It integrates strongly with physical science state standards and reinforces forces and interaction concepts. • It has been successfully modified for use in Kindergarten by experienced teachers. • The materials management is appropriate for young learners in grades K-2. • Concepts related to bridges tend to be familiar to younger students due to personal experience.
1st Grade	Unit	Reasoning
	<i>The Best of Bugs: Designing Hand Pollinators</i>	<ul style="list-style-type: none"> • It is academically and age appropriate for younger learners in grades 1–2 (Basic unit). • It integrates strongly with life science state standards and reinforces concepts about structures and functions of plants and insects. • The materials management is appropriate for young learners in grades K–2. • Concepts about how insects play a part in the pollination process come up again in grade 2.
	<i>Sounds Like Fun: Seeing Animal Sounds</i>	<ul style="list-style-type: none"> • It integrates strongly with physical science state standards and reinforces concepts of sound and vibration. • For this grade level, EiE strongly recommends using Basic modifications and handouts for this unit. Concepts of sound can be abstract for young students. Using the basic modifications and tactile representation option during the design challenge can help make these concepts more tangible.
2nd Grade	Unit	Reasoning
	<i>A Sticky Situation: Designing Walls</i>	<ul style="list-style-type: none"> • It is academically and age appropriate for younger learners in grades 1–2 (Basic unit). • It integrates strongly with physical science state standards and reinforces concepts about properties of materials. • The materials management is appropriate for young learners in grades K–2. • This unit gives young students an opportunity to analyze familiar objects (walls) and consider their various uses, such as for stability and protection.
	<i>Thinking Inside the Box: Designing Plant Packages</i>	<ul style="list-style-type: none"> • Designed for upper grades but it has been successfully modified for use in lower grades by experienced teachers (Basic modifications provided). • It integrates strongly with life science state standards and reinforces concepts about needs of plants. • This unit works well as a follow up to Designing Hand Pollinators, which EiE suggests for 1st grade.

3rd Grade	Unit	Reasoning
	<i>The Attraction is Obvious: Designing Maglev Systems</i>	<ul style="list-style-type: none"> • It is academically and age appropriate for older learners in grades 3–5 (Advanced unit). • It integrates strongly with physical science state standards and reinforces concepts about properties of magnets.
	<i>Just Passing Through: Designing Model Membranes</i>	<ul style="list-style-type: none"> • It is academically and age appropriate for older learners in grades 3–5 (Advanced unit). • It integrates with life science state standards and reinforces concepts about the survival needs of organisms.
4th Grade	Unit	Reasoning
	<i>A Stick in the Mud: Evaluating a Landscape</i>	<ul style="list-style-type: none"> • It is academically and age appropriate for older learners in grades 3–5 (Advanced unit). • It integrates strongly with earth science state standards and reinforces concepts of weathering and erosion, interpretation of patterns of Earth's features, and reduction of natural Earth processes on humans.
	<i>Now You're Cooking: Designing Solar Ovens</i>	<ul style="list-style-type: none"> • It is academically and age appropriate for older learners in grades 3–5 (Advanced unit). • It integrates strongly with physical science state standards and reinforces concepts related to heat transfer and energy conversion. It also integrates with earth sciences standards related to the use of natural resources as sources of energy.
	<i>An Alarming Idea: Designing Alarm Circuits</i>	<ul style="list-style-type: none"> • It is academically and age appropriate for older learners in grades 3–5 (Advanced unit). • It integrates strongly with physical science state standards and reinforces concepts related to electrical energy and energy conversion.
5th Grade	Unit	Reasoning
	<i>A Slick Solution: Cleaning Oil Spills</i>	<ul style="list-style-type: none"> • It is academically and age appropriate for older learners in grades 3–5 (Advanced unit). • It integrates strongly with physical, earth, and life science state standards. This unit reinforces concepts related to how animals use energy and how matter flows amongst producers, consumers, and decomposers (ecosystem webs). It also supports concepts of environmental awareness.
	<i>Water, Water Everywhere: Designing Water Filters</i>	<ul style="list-style-type: none"> • It is academically and age appropriate for older learners in grades 3–5 (Advanced unit). • It integrates with earth science state standards and reinforces concepts of environmental awareness.
	<i>A Long Way Down: Designing Parachutes</i>	<ul style="list-style-type: none"> • It is academically and age appropriate for older learners in grades 3–5 (Advanced unit). • It integrates with physical science state standards and reinforces concepts of gravitational force.

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