Science4Us

It's never too early to learn science!

## K- 2, Next Generation Science Standards (NGSS), Grade Band Endpoints and Crosscutting Concepts

**General Practices for K-12 Science Classrooms**

1. Asking questions (for science) and defining problems (for engineering)
2. Developing and using models
3. Planning and carrying out investigations
4. Analyzing and interpreting data
5. Using mathematics and computational thinking
6. Constructing explanations (for science) and designing solutions (for engineering)
7. Engaging in argument from evidence
8. Obtaining, evaluating, and communicating information

**Disciplinary Core Ideas: Physical Science**

| Core Idea | Grade Band Endpoint | Science4Us Connections |
|---|---|---|
| PS1.A | By the end of grade 2. Different kinds of matter exist (e.g., wood, metal, water), and many of them can be either solid or liquid, depending on temperature. Matter can be described and classified by its observable properties (e.g., visual, aural, textural), by its uses, and by whether it occurs naturally or is manufactured. Different properties are suited to different purposes. A great variety of objects can be built up from a small set of pieces (e.g., blocks, construction sets). Objects or samples of a substance can be weighed, and their size can be described and measured. (Boundary: volume is introduced only for liquid measure.) | Students are exposed to multiple modules that review matter components including Materials and Mixtures and Observing Matter.<br><br>Materials and Mixtures, Observing Matter: Kindergarten |

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| PS1.B | By the end of grade 2. Heating or cooling a substance may cause changes that can be observed. Sometimes these changes are reversible (e.g., melting and freezing), and sometimes they are not (e.g., baking a cake, burning fuel). | Students can reviewing changes in matter via the States of Matter and the Changes in Matter modules.<br><br>States of Matter: 1st Grade<br>Changes in Matter: 2nd Grade |
| PS2.A | By the end of grade 2. Objects pull or push each other when they collide or are connected. Pushes and pulls can have different strengths and directions. Pushing or pulling on an object can change the speed or direction of its motion and can start or stop it. An object sliding on a surface or sitting on a slope experiences a pull due to friction on the object due to the surface that opposes the object's motion. | Student complete activities catering to friction, push and pull in the Force module.<br><br>Force: 1st Grade |
| PS2.C | By the end of grade 2. Whether an object stays still or moves often depends on the effects of multiple pushes and pulls on it (e.g., multiple players trying to pull an object in different directions). It is useful to investigate what pushes and pulls keep something in place (e.g., a ball on a slope, a ladder leaning on a wall) as well as what makes something change or move. | Again, students will be exposed to push and pull concepts in Force as well as direction and motion in the Motion module.<br><br>Force: 1st Grade<br>Motion: 2nd Grade |
| PS3.B | By the end of grade 2. Sunlight warms Earth's surface. | Students review the heat from the sun (conduction, radiation, etc.) in the Heat Energy module.<br><br>Heat Energy: 2nd Grade |
| PS3.C | By the end of grade 2. A bigger push or pull makes things go faster. Faster speeds during a collision can cause a bigger change in shape of the colliding objects. | Student complete activities catering to friction, push and pull in the Force module.<br><br>Force: 2nd Grade |
| PS3.D | By the end of grade 2. When two objects rub against each other, this interaction is called friction. Friction between two surfaces can warm of both of them (e.g., rubbing hands together). There are ways to reduce the friction between two objects. | Student complete activities catering to friction, push and pull in the Force module.<br><br>Force: 2nd Grade |

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| PS4.A | By the end of grade 2. Waves, which are regular patterns of motion, can be made in water by disturbing the surface. When waves move across the surface of deep water, the water goes up and down in place; it does not move in the direction of the wave—observe, for example, a bobbing cork or seabird—except when the water meets the beach. Sound can make matter vibrate, and vibrating matter can make sound. | Students can review the properties of sound (vibrations, wave, particles and pitch) in the Sound Energy module.<br><br>Sound Energy: 1st Grade |
| PS4.B | By the end of grade 2. Objects can be seen only when light is available to illuminate them. Very hot objects give off light (e.g., a fire, the sun).<br>Some materials allow light to pass through them, others allow only some light through, and others block all the light and create a dark shadow on any surface beyond them (i.e., on the other side from the light source), where the light cannot reach. Mirrors and prisms can be used to redirect a light beam. (Boundary: The idea that light travels from place to place is developed through experiences with light sources, mirrors, and shadows, but no attempt is made to discuss the speed of light.) | Shadows, light, reflections, transparency, etc. is reviewed in the Light Energy module.<br><br>Light Energy: Kindergarten |
| PS4.C | By the end of grade 2. People use their senses to learn about the world around them. Their eyes detect light, their ears detect sound, and they can feel vibrations by touch.<br>People also use a variety of devices to communicate (send and receive information) over long distances. | In Science Skills, students learn about their 5 senses to review and record information. The senses are also used throughout the modules.<br><br>All grade levels<br><br>A review of sound waves can be found in the Sound Energy module.<br><br>Sound Energy: 1st Grade |

**Disciplinary Core Ideas: Life Science**

| Core Idea | Grade Band Endpoint | Science4Us Connections |
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| LS1.A | By the end of grade 2. All organisms have external parts. Different animals use their body parts in different ways to see, hear, grasp objects, protect themselves, move from place to place, and seek, find, and take in food, water and air. Plants also have different parts (roots, stems, leaves, flowers, fruits) that help them survive, grow, and produce more plants. | Students review animal/human parts in the Animal module. Plant parts are discussed in the Plant module.<br><br>Animals: Kindergarten<br>Plants: 1st Grade |
| LS1.B | By the end of grade 2. Plants and animals have predictable characteristics at different stages of development. Plants and animals grow and change. Adult plants and animals can have young. In many kinds of animals, parents and the offspring themselves engage in behaviors that help the offspring to survive. | There are multiple modules to review characteristics of animals and plants including life cycles and the passing on of traits and adaptations: Plants, Animals, Living and Nonliving and Habitats<br><br>Living and Nonliving, Animals: Kindergarten<br>Plants: 2nd Grade<br>Habitats: 2nd Grade |
| LS1.C | By the end of grade 2. All animals need food in order to live and grow. They obtain their food from plants or from other animals. Plants need water and light to live and grow. | The basic needs of living things is reviewed in the Living and Nonliving module.<br><br>Living and Nonliving: Kindergarten |
| LS1.D | By the end of grade 2. Animals have body parts that capture and convey different kinds of information needed for growth and survival—for example, eyes for light, ears for sounds, and skin for temperature or touch. Animals respond to these inputs with behaviors that help them survive (e.g., find food, run from a predator). Plants also respond to some external inputs (e.g., turn leaves toward the sun). | Body parts of animals are reviewed in the Animals module and senses are discussed in Science Tools. Adaptations of animals and plants can be found in Habitats.<br><br>Animals: Kindergarten<br>Habitats: 2nd Grade |

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| LS2.A | By the end of grade 2. Animals depend on their surroundings to get what they need, including food, water, shelter, and a favorable temperature. Animals depend on plants or other animals for food. They use their senses to find food and water, and they use their body parts to gather, catch, eat, and chew the food. Plants depend on air, water, minerals (in the soil), and light to grow. Animals can move around, but plants cannot, and they often depend on animals for pollination or to move their seeds around. Different plants survive better in different settings because they have varied needs for water, minerals, and sunlight. | Students can learn about the flow of energy in the Food Web module, review basic needs of animals and plants in the Living and Nonliving module and see adaptations in the Habitats module.<br><br>Living and Nonliving: Kindergarten<br>Food Webs, Habitats: 2nd Grade |
| LS2.B | By the end of grade 2. Organisms obtain the materials they need to grow and survive from the environment. Many of these materials come from organisms and are used again by other organisms. | The Food Webs module allows students to demonstrate how living things are connected.<br><br>Food Webs: 2nd Grade |
| LS2.C | By the end of grade 2. The places where plants and animals live often change, sometimes slowly and sometimes rapidly. When animals and plants get too hot or too cold, they may die. If they cannot find enough food, water, or air, they may die. | The Habitats module will review how animals and plants can thrive in their environments.<br><br>Habitats: 2nd Grade |
| LS2.D | By the end of grade 2. Being part of a group helps animals obtain food, defend themselves, and cope with changes. Groups may serve different functions and vary dramatically in size. | Students will learn more about animal groups in the Animal module.<br><br>Animals: Kindergarten |
| LS3.A | By the end of grade 2. Organisms have characteristics that can be similar or different. Young animals are very much, but not exactly, like their parents and also resemble other animals of the same kind. Plants also are very much, but not exactly, like their parents and resemble other plants of the same kind. | Life cycles are discussed and reviewed in the Animal and Plant modules.<br><br>Animals: Kindergarten<br>Plants: 1st Grade |

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| LS3.B | By the end of grade 2. Individuals of the same kind of plant or animal are recognizable as similar but can also vary in many ways. | Students can practice the life cycle of a plant from germination to adult in the Plant module.<br><br>Plants: 1st Grade |
| LS4.A | By the end of grade 2. Some kinds of plants and animals that once lived on Earth (e.g., dinosaurs) are no longer found anywhere, although others now living (e.g., lizards) resemble them in some ways. | The History of Earth module will review the facts of how Earth has changed over time.<br><br>History of Earth: 2nd Grade |
| LS4.C | By the end of grade 2. Living things can survive only where their needs are met. If some places are too hot or too cold or have too little water or food, plants and animals may not be able to live there. | The needs and essentials of living things are reviewed in Living and Nonliving and the Habitats modules.<br><br>Living and Nonliving: Kindergarten<br>Habitats: 2nd Grade |
| LS4.D | By the end of grade 2. There are many different kinds of living things in any area, and they exist in different places on land and in water. | This concept is reviewed in the Habitats module.<br><br>Habitats: 2nd Grade |

**Disciplinary Core Idea: Earth and Space Science**

| Core Idea | Grade Band Endpoint | Science4Us Connections |
|---|---|---|
| ESS1.A | By the end of grade 2. Patterns of the motion of the sun, moon, and stars in the sky can be observed, described, and predicted. At night one can see the light coming from many stars with the naked eye, but telescopes make it possible to see many more and to observe them and the moon and planets in greater detail. | In the Exploring the Universe module, students will review tools to observe objects in the sky.<br><br>Exploring the Universe: 2nd Grade |
| ESS1.B | By the end of grade 2. Seasonal patterns of sunrise and sunset can be observed, described, and predicted. | In the Earth in Space module, students review the concept of patterns including seasons and the moon.<br><br>Earth in Space: 1st Grade |
| ESS1.C | By the end of grade 2. Some events on Earth occur in cycles, like day and night, and others have a beginning and an end, like a volcanic eruption. Some events, like an earthquake, happen very quickly; others, such as the formation of the Grand Canyon, occur very slowly, over a time period much longer than one can observe. | In the Earth in Space module, students will review cycles including the day-night cycle. In the Features module, students review the features of the Earth's surface.<br><br>Earth in Space: 1st Grade<br>Features: 1st Grade |
| ESS2.A | By the end of grade 2. Wind and water can change the shape of the land. The resulting landforms, together with the materials on the land, provide homes for living things. | In the Features and Materials modules, students will review the materials found on the Earth and how land forms.<br><br>Features: 1st Grade<br>Materials: Kindergarten |

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| ESS2.B | By the end of grade 2. Rocks, soils, and sand are present in most areas where plants and animals live. There may also be rivers, streams, lakes, and ponds. Maps show where things are located. One can map the shapes and kinds of land and water in any area. | In the module, Materials, students are introduced to rocks, soil and sand and in Features, students learn about the natural structures that are found on Earth and how they are made.<br><br>Materials: Kindergarten<br>Features: 1st Grade |
| ESS2.C | By the end of grade 2. Water is found in the ocean, rivers, lakes, and ponds. Water exists as solid ice and in liquid form. It carries soil and rocks from one place to another and determines the variety of life forms that can live in a particular location. | The Features modules shares how weathering and erosion play a factor in Earth's features and the phases of matter are reviewed in the States of Matter module.<br><br>Features: 1st Grade<br>States of Matter: 1st Grade |
| ESS2.D | By the end of grade 2. Weather is the combination of sunlight, wind, snow or rain, and temperature in a particular region at a particular time. People measure these conditions to describe and record the weather and to notice patterns over time. | The Weather module focuses on types of precipitation including patterns.<br><br>Weather: Kindergarten |
| ESS2.E | By the end of grade 2. Plants and animals (including humans) depend on the land, water, and air to live and grow. They in turn can change their environment (e.g., the shape of land, the flow of water). | There are several modules that address this band including the Living and Nonliving module which discusses essentials, the Habitats module which reviews how ecosystems work and also the History of Earth module which demonstrates how living things can change the land over time.<br><br>Living and Nonliving: Kindergarten<br>Habitats: 2nd Grade<br>History of Earth: 2nd Grade |

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| ESS3.A | By the end of grade 2. Living things need water, air, and resources from the land, and they try to live in places that have the things they need. Humans use natural resources for everything they do: for example, they use soil and water to grow food, wood to burn to provide heat or to build shelters, and materials such as iron or copper extracted from Earth to make cooking pans. | There are several modules that address this band including the Living and Nonliving module which discusses essentials, the Habitats module which reviews how ecosystems work and also the History of Earth module which demonstrates how living things can change the land over time.<br><br>Living and Nonliving: Kindergarten<br>Habitats: 2nd Grade<br>History of Earth: 2nd Grade |
| ESS3.B | By the end of grade 2. Some kinds of severe weather are more likely than others in a given region. Weather scientists forecast severe weather so that communities can prepare for and respond to these events. | The Weather module reviews extreme weather conditions.<br><br>Weather: Kindergarten |
| ESS3.C | By the end of grade 2. Things that people do to live comfortably can affect the world around them. But they can make choices that reduce their impacts on the land, water, air, and other living things—for example, by reducing trash through reuse and recycling. | The Eco Awareness module shows students how to be more aware of their actions on Earth.<br><br>Eco Awareness: 2nd Grade |

**Disciplinary Core Idea: Engineering, Technology and Applications of Science**

| Core Idea | Grade Band Endpoint | Science4Us Connections |
|---|---|---|
| ETS1.A | By the end of grade 2. A situation that people want to change or create can be approached as a problem to be solved through engineering. Such problems may have many acceptable solutions. Asking questions, making observations, and gathering information are helpful in thinking about problems. Before beginning to design a solution, it is important to clearly understand the problem. | Students are able to review the steps of not only the scientific method within the Session 7 online and offline investigations, but also offline in the investigations.<br><br>STEM activities are found offline in Session 6. Students are guided through the engineering design process as they ask a question, communicate results and add in technology and math connections.<br><br>Both Investigations and STEM activities are found throughout all of the 28 instructional modules. |
| ETS1.B | By the end of grade 2. Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem's solutions to other people. To design something complicated, one may need to break the problem into parts and attend to each part separately but must then bring the parts together to test the overall plan. | |
| ETS1.C | By the end of grade 2. Because there is always more than one possible solution to a problem, it is useful to compare designs, test them, and discuss their strengths and weaknesses. | |
| ETS2.A | By the end of grade 2. People encounter questions about the natural world every day. There are many types of tools produced by engineering that can be used in science to help answer these questions through observation or measurement. Observations and measurements are also used in engineering to help test and refine design ideas. | |
| ETS2.B | By the end of grade 2. People depend on various technologies in their lives; human life would be very different without technology. Every human-made product is designed by applying some knowledge of the natural world and is built by using materials derived from the natural world, even when the materials are not themselves natural—for example, spoons made from refined metals. Thus, developing and using technology has impacts on the natural world. | |

**Grade Band Endpoints Reviewed from: http://www.nap.edu/read/13165/chapter/1**

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**NGSS Crosscutting Concepts***
**Section 2: Crosscutting Concepts Matrix**
**Found throughout the Science4Us Program**

| **1. Patterns –** Observed patterns in nature guide organization and classification and prompt questions about relationships and causes underlying them. |
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| K-2 Crosscutting Statement |
| • Patterns in the natural and human designed world can be observed, used to describe phenomena, and used as evidence |

| **2. Cause and Effect:** Mechanism and Prediction – Events have causes, sometimes simple, sometimes multifaceted. Deciphering causal relationships, and the mechanisms by which they are mediated, is a major activity of science and engineering. |
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| K-2 Crosscutting Statements |
| • Events have causes that generate observable patterns.<br>• Simple tests can be designed to gather evidence to support or refute student ideas about causes. |

| **3. Scale, Proportion, and Quantity** – In considering phenomena, it is critical to recognize what is relevant at different size, time, and energy scales, and to recognize proportional relationships between different quantities as scales change. |
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| K-2 Crosscutting Statements |
| • Relative scales allow objects and events to be compared and described (e.g., bigger and smaller; hotter and colder; faster and slower).<br>• Standard units are used to measure length. |

| **4. Systems and System Models** – A system is an organized group of related objects or components; models can be used for understanding and predicting the behavior of systems. |
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| K-2 Crosscutting Statements |
| • Objects and organisms can be described in terms of their parts.<br>• Systems in the natural and designed world have parts that work together. |

| **5. Energy and Matter: Flows, Cycles, and Conservation** – Tracking energy and matter flows, into, out of, and within systems helps one understand their system's behavior |
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| K-2 Crosscutting Statement |
| • Objects may break into smaller pieces, be put together into larger pieces, or change shapes. |

| **6. Structure and Function** – The way an object is shaped or structured determines many of its properties and functions |
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| K-2 Crosscutting Statement |
| • The shape and stability of structures of natural and designed objects are related to their function(s). |

| **7. Stability and Change** – For both designed and natural systems, conditions that affect stability and factors that control rates of change are critical elements to consider and understand. |
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| K-2 Crosscutting Statements |
| • Some things stay the same while other things change.<br>• Things may change slowly or rapidly |

*** Adapted from: National Research Council (2011). A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas. Committee on a Conceptual Framework for New K-12 Science Education Standards.**
**Board on Science Education, Division of Behavioral and Social Sciences and Education. Washington, DC: The National Academy Press. Chapter 4: Crosscutting Concepts.**
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**NGSS Suggested Scope and Sequence, K-2**

| Grade Level | Module | Core Idea(s) |
|---|---|---|
| **Kindergarten** | Science Tools (I) | PS4.C |
| | Observing Matter (PS) | PS1.A |
| | Materials and Mixtures (PS) | PS1.A |
| | Living and Nonliving (LS) | LS1.B, LS2.A. LS4.C, ESS2.E, ESS3.A |
| | Animals (LS) | LS1.A, LS1.B, LS1.D, LS2.D, LS3.A |
| | Light Energy (PS) | PS4.B |
| | Materials (ES) | ESS2.A, ESS2.B |
| | Weather (ES) | ESS2.D, ESS3.B |

****Additional Suggested Modules** Energy Sources (PS), Location and Perspective (PS)

| Grade Level | Module | Core Idea(s) |
|---|---|---|
| **1st Grade** | Science Tools (I) | PS4.C |
| | States of Matter (PS) | PS1.B, ESS2.C |
| | Plants (LS) | LS1.A, LS1.B, LS3.A, LS3.B |
| | Heat Energy (PS) | PS3.B |
| | Sound Energy (PS) | PS4.A, PS4.C |
| | Motion (PS) | PS2.A, PS2.C |
| | Features (ES) | ESS1.C, ESS2.A, ESS2.B, ESS2.C |
| | Earth in Space (ES) | ESS1.B, ESS1.C |

****Additional Suggested Modules** Magnets (PS)

| Grade Level | Module | Core Idea(s) |
|---|---|---|
| **2nd Grade** | Science Tools (I) | PS4.C |
| | Changes in Matter (PS) | PS1.B |
| | Habitats (LS) | LS1.B, LS1.D, LS2.A, LS2.B, LS2.C, LS4.C, LS4.D, ESS2.E, ESS3.A |
| | Food Webs(LS) | LS2.A |
| | Force (PS) | PS2.C, PS3.B, PS3.D |
| | History of Earth (ES) | LS4.A, ESS2.E, ESS3.A |
| | Exploring the Universe (ES) | ESS1.A |
| | Eco Awareness (LS) | ESS3.C |

****Additional Suggested Modules** Electrical Energy (PS), Energy Transfer (PS), Simple Machines (PS)

**Book Key: I: Inquiry PS = Physical Science LS: Life Science ES: Earth and Space Science**