

Kindergarten Science & Engineering Learning Expectations Public Schools of Brookline

Overview

The Science & Engineering Learning Expectations (LEs) outline the content that students will learn and skills (practices) that students will be able to do from preK through Grade 8. They have been designed with careful consideration to how students will build their knowledge from grade to grade (learning progressions). As they progress through the grades, students will reinforce what they have learned before, continually learning certain overarching concepts in new ways and with increased sophistication.

Organization of the Learning Expectations

The Learning Expectations are organized into three strands: 1) Earth Science, 2) Life Science, and 3) Physical Science.

While the traditional Physical Science, Life Science, and Earth Science strands are referenced, it is important to be aware that none of these strands are totally separate. In fact, scientists often work in inter-disciplinary teams, across disciplines and/or alongside engineers to answer their questions and solve problems.

In addition, Science Practices (Inquiry and Nature of Science), Engineering and Environmental Education content has been woven throughout the Learning Expectations, illustrating the vital interconnections between these topics. This approach allows students to learn about these disciplines in the context of the science concepts they are learning, instead of as stand-alone, disconnected units.

Guide to This Document

This document shows the progression of Science concepts in the form of Big Ideas (left column) and Learning Expectations (right column). The Big Ideas identify the content that students will learn and the Learning Expectations illustrate what students will know and be able to do in order demonstrate that they have acquired this knowledge.

**Kindergarten Earth Science Learning Expectations
[Discovering Nature & Exploring Water Units]**

EARTH SYSTEMS	
Big Ideas	Learning Expectations
<p>Our Earth</p> <ul style="list-style-type: none"> • Our world is made up of living and nonliving things. • Animals (including humans) and plants are living things. • Nonliving things on Earth include water, land (rocks, soil, and sand), air and manmade objects. • Air is all around us—wind is moving air. • Plants and animals (including humans) depend on the land, water, and air to live and grow. • 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. 	<ul style="list-style-type: none"> • Use all senses (and scientific tools such as magnifiers) to observe and sort living and nonliving things discovered on the school grounds. Record observations using words or pictures in science notebooks. • Using photographs or models, sort things based on whether they are living or nonliving. Explain. • Gather and share evidence showing that wind is moving air. • Illustrate and describe the things that plants and animals (including humans) need to live and grow. Give examples based on observations made on the school grounds. • Record observations about changes observed in nature from day to day and over the seasons; also notice and record what stays the same.
<p>Roles of Water on Earth</p> <ul style="list-style-type: none"> • Water is found in the ocean, rivers, lakes, and ponds. [Social Studies Connection] • Living things need water to live and grow. • Water has many unique properties and can exist in many forms. • Water flows and can make things move. 	<ul style="list-style-type: none"> • Gather evidence of water on the school grounds and in local parks; record observations using words or pictures in science notebooks. • Gather evidence, using photographs and books, to show that water is found in many places (e.g., in the ocean, rivers, lakes, ponds, etc.). [Social Studies Connection] • Gather evidence to show that plants and animals (including humans) need water to live and grow. • Based on first-hand observations, make claims about the basic physical properties of water based on evidence. • Compare water, ice and snow. Explain how they are alike and how they are different. Observe what happens when ice and/or snow melt, and when water is frozen. Record observations in science notebooks. • Share evidence to support the claim that water moves (flows) and can make things move.
<p>Human Interactions with Earth [Social Studies Connection]</p>	<ul style="list-style-type: none"> • Share observations and make claims based on evidence to explain how some human choices impact the world around

<ul style="list-style-type: none"> 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. 	<ul style="list-style-type: none"> them. Illustrate or describe three things that we can do to “reduce, reuse, recycle” and explain why is it important for us all to do these things
EARTH IN THE UNIVERSE	
Big Ideas	Learning Expectations
<ul style="list-style-type: none"> Some things in nature change over time and some stay the same. Patterns of the appearance of the sun, moon and stars in the sky can be observed, described and predicted. Seasonal patterns of sunrise and sunset can be observed, described, and predicted. 	<ul style="list-style-type: none"> Gather evidence to show simple patterns of objects in the sky (e.g., the sun rises in the east and sets in the west, stars are visible at night). Gather evidence to predict simple seasonal patterns (amount of daylight is less in the winter, temperature changes, etc.). Observe, describe and predict patterns of change in the sun, moon, and stars.

Kindergarten Life Science Learning Expectations [Discovering Nature Unit]

Big Ideas	Learning Expectations
<p><u>Characteristics of Living Things</u></p> <ul style="list-style-type: none"> All things on Earth are either living or nonliving. Animals (including humans) and plants are living things. Living things share certain characteristics (e.g., they grow and reproduce). 	<ul style="list-style-type: none"> Sort living and nonliving things. Explain the characteristics that make them different. Explore the school grounds and gather evidence of nonliving and living things. Sort living things in several different ways based on a number of observable features. Explain how they were sorted. Identify physical characteristics and simple behaviors of living things (e.g., movement or eating).
<p><u>Structure & Function of Living Things</u></p> <ul style="list-style-type: none"> All living things (plants and animals) have parts. These parts (e.g., feet, tails, etc.) can look similar or different depending on the living thing and where it lives. 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. Animals (including humans) have body parts that gather different kinds of information needed for growth and survival—for example, eyes for gathering light (so they can see), ears for sounds, and skin for temperature 	<ul style="list-style-type: none"> After observing the structures of many types of animals and plants (e.g., feet, fur, wings, etc.), explain how the structures help the living things survive and meet their needs. Sort animals and plants based on their structures (e.g., fur, antlers, wings, etc.). Compare how they are similar and how they are different. Explain why this might be (e.g., where they live, what they eat, etc.).

<p>or touch. Animals respond to the information gathered with their senses with behaviors that help them survive (e.g., find food, run from a predator).</p> <ul style="list-style-type: none"> • 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. 	
<p>Needs of Living Things</p> <ul style="list-style-type: none"> • All animals need food in order to live and grow. They get their food from plants or other animals. • Plants need light, air, and water to live and grow. • 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). 	<ul style="list-style-type: none"> • Ask questions and gather evidence about what plants and animals (including themselves) need to survive, recognizing that those needs are sometimes met in different ways. • Analyze observations and information, and share findings about how animals and plants meet their needs (e.g., cows eat grass), including the places they live and how they can change the environment (e.g., ants build anthills; plant roots can break cement). • Record the needs (food, water, air and a place to live) of an animal that they have observed. • Plan and carry out investigations collaboratively to investigate whether plants need water and light
<p>Ecosystems</p> <ul style="list-style-type: none"> • Animals depend on their surroundings to get what they need to live and grow. • Different plants survive better in different places because they have varied needs for sunlight, water, and minerals. • 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. • Animals can move around, but plants cannot. Plants often depend on animals for pollination or to move their seeds around. • The places where plants and animals live often change, sometimes slowly and sometimes rapidly. Living things can survive only where their needs are met. If some places are too hot or too cold, or have too little water, food or air, plants and animals may not be able to live there. 	<ul style="list-style-type: none"> • When observing plants and animals outside, record where they live and think about why. • Contribute ideas to discussions about what specific animals or plants need and where those needs might be met (e.g., “The worm likes dirt.”). • Record evidence of changes in appearance that animals and plants go through as the seasons change.
<p>Biodiversity</p> <ul style="list-style-type: none"> • Many different types of plants and animals live on Earth and within any specific area. They exist in different places on land, in soil, and in water. 	<ul style="list-style-type: none"> • Record and share observations to show that many different types of plants and animals live on the school grounds or in a local park. As a group, create a bar graph to represent this data. • Using pictures of different kinds of animals and plants living in different places, compare how they are alike and how they are different. Predict how their

	basic needs are the same. Explain why.
Heredity <ul style="list-style-type: none"> 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. 	<ul style="list-style-type: none"> Using pictures, compare the ways in which many plants and animals look like their parents (e.g., tell how puppies are like dogs, ducklings are like ducks, etc.).

Kindergarten Physical Science Learning Expectations

MATTER [Building Structures Unit]	
Big Ideas	Learning Expectations
Properties of Matter <ul style="list-style-type: none"> Things are made of different materials (e.g., wood, metal, water, clay, cloth, paper, cardboard, etc.) Many of them can be either solid or liquid, depending on temperature. Things can be described and sorted in many ways by their observable properties (e.g., shape, size, color, weight, how it feels, how it sounds, what it is made of, what it is used for, whether it occurs naturally or is manufactured, etc.). Different properties are suited to different purposes. Objects or samples of a substance can be weighed and their size can be described and measured. A great variety of objects (including structures) can be built up from a small set of pieces. 	<ul style="list-style-type: none"> Investigate collaboratively and provide evidence to show that materials (e.g., wood, metal, glass, paper, plastic) and objects can be described and sorted by their observable properties . Explain the difference between an object (which has a specific shape and/or function) and the material it is made of (e.g. glass, plastic, wood, metal). Describe how different objects have different properties (such as size, texture, shape and color), giving examples. Based on personal experiences, give examples of different ways the five senses can be used to observe the physical properties of objects. Working in groups and independently, sort a variety of objects by their observable properties (e.g., weight, shape, color, size, etc.) using different ways. Explain how they are sorted each time. As a group, brainstorm why certain things are made of specific materials (e.g., Why is a sneaker made out of fabric and/or plastic? What if it were made out of brick or paper?). Based on observations gathered during simple investigations, gather and share evidence to support claims about the properties of water. Give examples of larger objects that are made of smaller pieces. Explain. Collaborate with others to build a structure or pathway that uses smaller pieces to solve a problem (e.g., transport or support an object).
Forms of Matter <ul style="list-style-type: none"> Heating, cooling, mixing, cutting, wetting, or bending an object or 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). 	<ul style="list-style-type: none"> Based on observations, describe what happens when water is frozen and then heated.

ENERGY [Sound Unit]	
Big Ideas	Learning Expectations
<p>Forms of Energy: Sound</p> <ul style="list-style-type: none"> • 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. • Sound can make things vibrate and vibrations can make sound. • People use a variety of devices to communicate (send and receive information) over long distances. • Different objects make different sounds. • Sounds can be loud/soft and high/low. 	<ul style="list-style-type: none"> • Gather and record evidence from first-hand investigations to show that sound can cause things to vibrate (talking into a piece of paper) and the vibrating things create sound (e.g., tuning forks, plucking a stretched string). • Design and share solutions that use sound to send a signal over a distance (e.g., paper cup and string “telephone”, drum beats, etc.). [Engineering Connection] • Give examples of different ways that people can observe the world using their senses. • Describe, and compare sounds made by many different types of things indoors and outdoors. • Investigate how different sounds are created and record this information. • Using various materials, gather evidence to support the claim that vibration causes sound. • Identify and sort sounds; explain how they are the same and how they are different. • Using many types of materials, demonstrate how sounds can be high or low. Explain observed patterns.
FORCE & MOTION [Building Structures Unit]	
Big Ideas	Learning Expectations
<ul style="list-style-type: none"> • The materials used (and their characteristics) and the way materials are put together affect the stability of a structure. 	<ul style="list-style-type: none"> • Recognize that there are several things to keep in mind when building stable structures (such as heavy walls might fall over, the taller a structure gets—the harder it is to keep it standing). • Notice that when building structures, certain shapes work best in certain places. • Become more intentional about building (such as choosing blocks because of their shapes or size, placing blocks or other building materials in certain ways) to make structures stronger. • Take part in building in a small group, including working together to plan and revise the design if necessary.

