

1st Grade 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.

1st Grade Earth Science Learning Expectations
[Connections to Future Liquids & Solids, Unit, Social Studies, Math—Curriculum to Be Determined]

EARTH SYSTEMS	
Big Ideas	Learning Expectations
<p><u>Weather and Climate</u></p> <ul style="list-style-type: none"> 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. 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. People’s lives depend on many different technologies, and life would be very different without them 	<ul style="list-style-type: none"> Observe, record and share findings about how weather changes over a week, month and from season to season (e.g., graph sunny, cloudy, rainy, windy days, snow, etc.). Look for and describe patterns. Develop, use and share representations of weather conditions to describe changes over time and identify patterns. Display and discuss weather data (i.e., sunlight, wind, snow or rain, and temperature) comparing typical weather with severe weather in a season (e.g., a snowstorm in winter, heat wave in summer, thunderstorm in spring or fall) or a given region (tornados in Plains states, hurricanes in Gulf or Atlantic states). Ask questions and discuss how forecasting severe weather can help keep people safe.
<p><u>Human Interactions with Earth [Social Studies Connection]</u></p> <ul style="list-style-type: none"> Living things need water, air, and resources from the land to live and grow. 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 the earth to make cooking pans. 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. Only a small part of the water on Earth is usable by humans and we need to take good care of it 	<ul style="list-style-type: none"> Begin to demonstrate some water conservation practices at school. Illustrate different ways that humans can affect water on Earth. Describe three things that we can do to conserve water and keep it clean; share these ideas at home. Explain how people in some places have to filter their water before they can drink or use it. Create and describe mixtures of solid substances and water. Brainstorm and then try out ways to separate them (sand and water). Make claims based on the evidence. Explain how this process is similar to some simple water purification processes.

1st Grade Life Science Learning Expectations [Insects Unit]

Big Ideas	Learning Expectations
<p>Characteristics of Living Things</p> <ul style="list-style-type: none"> Scientists sort living things based on features they share in order to learn more about them. Insects are animals that share certain features. Although insects vary greatly in size, color and the detailed shapes of their body parts, all insects have three main body parts: head, thorax and abdomen; six legs; two antennae; an exoskeleton; and usually wings. 	<ul style="list-style-type: none"> Provide evidence to show that insects are living things (animals). Compare how they are similar to and different from humans. Explain the common features of an insect and give several examples. Compare insects and spiders, explaining how they are the same and how they are different.
<p>Structure & Function of Living Things</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. Animals (including us) 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 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). 	<ul style="list-style-type: none"> After observing and drawing the structures of many types of insects inside (including the mealworm and the painted lady butterfly) and on the school grounds, explain how the structures help the insects survive and meet their needs. Explain how they are similar and different. Provide evidence to show that insects have parts that allow them to respond to external inputs (e.g., stems bend toward light, antennae for feeling and smelling, eyes for seeing, ears for hearing, legs for moving, etc.). Design or identify an object (to fulfill a need or solve a problem) whose function replicates the function of a structure present in an insect (e.g., pliers act as a model of beetle mouthparts). [Engineering Connection]
<p>Needs of Living Things</p> <ul style="list-style-type: none"> All living things have needs that must be met for them to stay alive. Animals need food, water, air, a space to live in (shelter), and the right temperature in order to live and grow. 	<ul style="list-style-type: none"> Record and compare the basic needs of at least two insects based on observations. Explain how the basic needs of insects can be met in different ways. Compare and contrast the basic needs of insects and humans.
<p>Ecosystems</p> <ul style="list-style-type: none"> Like other animals, insects depend on their surroundings to get what they need to live and grow, including food, water, shelter, and a favorable temperature. Like other animals, insects depend on plants or other animals for food. They use their senses to find food and water, and they use their body parts to 	<ul style="list-style-type: none"> Gather evidence and make claims about how insects depend on plants, their environment, and other living things to survive. When observing insects outside, notice & record where they live and think about why. For instance, observe different types of plants and record if any insects are associated with them. Make claims based on this evidence.

<p>gather, catch, eat and chew the food.</p> <ul style="list-style-type: none"> Animals can move around, but plants cannot. Plants often depend on insects and other animals for pollination or to move their seeds around. Only a few types of insects are destructive or harmful. Insects are important for other living things. Many birds, fish, reptiles and small mammals depend on insects for food. Insects are needed for many types of plants to survive. 	<ul style="list-style-type: none"> Contribute ideas to discussions about what specific insects need and where those needs might be met (e.g., “The ant likes dirt.”). Give examples of how insects depend on plants or other animals for food. Explain how insects can help plants survive. Illustrate how insects are important to us.
<p>Adaptations</p> <ul style="list-style-type: none"> The places where insects (and other 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, insects may not be able to live there. Like other living things, insects have features that help them survive in their environment. [These features include physical features (e.g., mouthparts, antennae, wings, etc.) and behaviors (e.g., migration, behaviors to protect their young, hibernation, communication, etc.). Insect mouthparts give us clues on what it eats (leaf eaters such as grasshoppers have chewing mouthparts, insects like butterflies that drink liquids have straw-like, sucking mouthparts, blood-feeding insects like mosquitos and lice have piercing-sucking mouthparts). 	<ul style="list-style-type: none"> Explain what happens to insects throughout the seasons using evidence gathered on the school grounds and from books. Compare two different types of insects and explain how looking at the mouthparts can give us clues about what they eat.
<p>Growth, Development & Heredity</p> <ul style="list-style-type: none"> All living things have a life cycle that includes a beginning (birth for animals, germination for plants), growth, developing into adults, having young, and death. These life cycles can be unique and diverse. Metamorphosis (evident in some insects, amphibians, and sea creatures) and is a successful strategy for survival. In many kinds of animals, parents and the offspring themselves engage in behaviors that help the offspring to survive. Living things have characteristics that can be similar or different. Most 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. Individuals of the same kind of plant or animal are similar but can also vary in many ways. For instance, not all ladybugs or ants are exactly the same. 	<ul style="list-style-type: none"> Compare the life cycle of the painted lady butterfly, the darkling beetle, and humans. Explain how metamorphosis helps insects and other living things survive. Gather and share evidence of insect behaviors that help the offspring to survive. Use evidence to explain that insects and plants grow and change as young organisms mature into adults (e.g., human babies grow into adults, kittens into cats, and sprouting seeds into mature plants) and not all individuals of the same kind of living thing look exactly the same. For a variety of insects, compare photos of young insects and adults. Explain how they are alike and how they are different. For one type of insect, give examples on how different individuals look similar, but can also vary in many ways.
<p>Biodiversity</p> <ul style="list-style-type: none"> Many different types of insects live on Earth and within any specific area, and they come in many colors and shapes. They exist in different places on land, in soil, and in water. 	<ul style="list-style-type: none"> Gather and share evidence to show that many different types of insects live on the school grounds, in a local park etc. As a group, graph the results. Use informational texts to find examples of different kinds of insects living in different places. Compare how they are alike and how they are different.

	Gather evidence to show how their basic needs are the same.
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1st Grade Physical Science Learning Expectations

MATTER [Future Liquids and Solids Unit]	
Big Ideas	Learning Expectations
<p>Properties of Matter</p> <ul style="list-style-type: none"> • Matter exists as different substances (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 they are made of, etc.), by their uses, and by whether they occur naturally or are manufactured. • Many kinds of liquids exist with different properties and uses. Many solids exist with different properties and uses. • All liquids have some properties in common. They pour or flow and take the shape of their containers. • All solids have some properties in common. They keep their own shape unless something is done to them. (e.g., cutting, hammering, etc.). • The same amount (volume) of water always fills the same container to the same height. But the same amount (volume) of water will fill containers of different sizes/shapes to different heights. • Some materials are better than others for a particular purpose because of their properties. • Knowledge about liquids and solids can be applied to making things. • Objects or samples of a substance can be weighed and their size can be described and measured. • Things can be done to materials to change them (freezing, mixing, heating, cutting, wetting, bending, etc.) 	<ul style="list-style-type: none"> • Compare the properties of solids and liquids (e.g., solids retain their shape, liquids can be poured). • Based on the properties of solids and liquids, make claims based on evidence about whether an object is either a solid or liquid at room temperature. • Based on hands-on investigations, demonstrate and record evidence in science notebooks that some materials are solid when they are cold and liquid when they are warm (e.g., butter, chocolate, water, cheese, ice cream). • Based on hands-on investigations and observations, explain how different kinds of liquids behave, their properties (compare and contrast) and how they interact when mixed. • Based on hands-on investigations and evidence collected in science notebooks, explain how different kinds of solids behave and describe their properties (compare and contrast). • Describe common properties of all liquids (and all solids) and explain what makes liquids different from solids. • Predict how common materials (salt, sugar, oil, corn oil, etc.) interact with water and other liquids. After performing hands-on investigations, make claims based on the evidence. Compare with the predictions. • Investigate and use the resulting data to make a claim that changing the size or shape of the container does not change the volume of liquid. • Based on their experiences and evidence collected in their science notebooks, give examples of how some properties of certain liquids are different and may affect their use. • Record what happens to water left in an open container as compared to water left in a closed container. Make a claim (as a group) based on

<p>Chemical Reactions</p> <ul style="list-style-type: none"> • 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). 	<p>observations.</p> <ul style="list-style-type: none"> • Based on observations, provide evidence to support the claim that some changes caused by heating or cooling can be reversed (e.g., melting chocolate, freezing liquids) and some cannot (cooking an egg).
<p>ENERGY [Light & Shadows Unit]</p>	
<p>Big Ideas</p>	<p>Learning Expectations</p>
<p>Forms of Energy: Light</p> <ul style="list-style-type: none"> • Light can come from different sources (the sun, light bulbs, flashlights, overhead projector, fire, etc.). • The sun is important because it supplies light to the Earth and warms Earth's surface. (modified PS3.B) • We can only see objects when light is available to illuminate them. Very hot objects give off light (e.g., a fire, the sun). • 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 can't reach. • A light source, an object and a surface are needed to create a shadow. • Shadows look like the shape of the object placed in front of the light source. • The shape and size of shadows change when the source of light moves and the object stays in the same place, or when the object moves and the source of light stays in the same place. • Mirrors can be used to redirect a light beam. • People use a variety of devices to communicate (send and receive information) over long distances. 	<ul style="list-style-type: none"> • Gather evidence from first-hand observations to show that the sun provides light and heat to the Earth. • Brainstorm and list ways in which the sun's light and heat are important to living things and affects natural objects on Earth's surface (e.g., rocks, water, soil, and sand). • Identify light sources at school, at home and outdoors. • Gather evidence to support the claim that when light is not present, objects cannot be seen (e.g., pinhole box, completely dark room) and that very hot objects give off their own light (e.g., fire, sun). • Using various light sources and different types of objects, demonstrate and explain how shadows are made when an object blocks the light and show what is necessary to make a shadow. • Demonstrate two ways that the size and/or shape of a shadow can be changed. Explain what's happening. • Predict the shape of shadows. Explain the reasoning behind the predictions. • Gather and evaluate evidence to show that some materials allow light to pass through, others only allow some light to pass through, and some materials block all of the light, creating a shadow. • Through first-hand investigations, gather and record evidence to show how mirrors can be used to redirect a light beam. • Design and share solutions that use light to send a signal over a distance (e.g., flashlight with removable cover to send signals, etc.) [Engineering Connection]