West Windsor-Plainsboro Regional School District
Science Curriculum

Kindergarten - Basic Needs of Living Things

The Mission of the West Windsor-Plainsboro Science Department

Our mission is to cultivate science learners who have the foundational knowledge to make ethical, scientifically literate decisions and the ability to apply scientific practices in order to contribute to the needs of society and a changing world.

- **Vision**

  We envision a K-12 science experience that supports and challenges every student in their science learning journey. We will:

  - *Capitalize on diversity by reaching and exciting students at all levels and interests by differentiating learning within classrooms and by offering a robust program of studies.*
  - *Emphasize authentic science and engineering practices and leverage the interdisciplinary nature of science with arts, technology, math, reading, and writing.*
  - *Integrate scientific knowledge and 21st century competencies to prepare students to make informed decisions and take action to address real world problems.*

Unit 1:	
Content Area: Basic Needs of Living Things	
Course & Grade Level: Kindergarten	
Summary and Rationale	
Where do plants and animals live and why do they live there? In this unit of study, students develop an understanding of what plants and animals need to survive and the relationship between their needs and where they live. Students compare and contrast what plants and animals need to survive and the relationship between the needs of living things and where they live. The crosscutting concepts of *patterns* and *systems and system models* are called out as organizing concepts for these disciplinary core ideas. Students are expected to demonstrate grade-appropriate proficiency in *developing and using models*, *analyzing and interpreting data*, and *engaging in argument from evidence*. Students are also expected to use these practices to demonstrate understanding of the core ideas. This unit is based on K-LS1-1, K-ESS3-1, and K-ESS2-2.	
Recommended Pacing	
days	
New Jersey Student Learning Standards for	
Standard: Standards for	
K-LS1-1	**Use observations to describe patterns of what plants and animals (~~including humans~~) need to survive.** *[Clarification Statement: Examples of patterns could include that animals need to take in food but plants do not; the different kinds of food needed by different types of animals; the requirement of plants to have light; and, that all living things need water.]*
K-ESS3-1	**Use a model to represent the relationship between the needs of different plants and animals (including humans) and the places they live.** *[Clarification Statement: Examples of relationships could include that deer eat buds and leaves, therefore, they usually live in forested areas; and, grasses need sunlight so they often grow in meadows. Plants, animals, and their surroundings make up a system.]*
K-ESS2-2	**Construct an argument supported by evidence for how plants and animals (including humans) can change the environment to meet their needs.** *[Clarification Statement: Examples of plants and animals changing their environment could include a squirrel digs in the ground to hide its food and tree roots can break concrete.]*
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.**
K-ESS3-3	**Communicate solutions that will reduce the impact of climate change and humans on the land, water, air, and/or other living things in the local environment.** *[Clarification Statement: Examples of human impact on land could include cutting trees to produce paper and using resources to produce bottles. Examples of solutions could include reusing paper and recycling cans and bottles.]*

New Jersey Student Learning Standards for Career Readiness, Life Literacies and Key Skills
Standard: 9.1 Personal Financial Literacy

CPI #	Cumulative Progress Indicator (CPI)
9.1.2.CR.1	Recognize ways to volunteer in the classroom, school and community.
9.1.2.FP.2	Differentiate between financial wants and needs.
Standard: 9.2 Career Awareness, Exploration, Preparation, and Training	
CPI #	**Cumulative Progress Indicator (CPI)**
9.1.2.CAP.1	Make a list of different types of jobs and describe the skills associated with each job.
Standard: 9.4 Life Literacies and Key Skills: Critical Thinking and Problem-solving: Critical thinkers must first identify a problem then develop a plan to address it to effectively solve the problem.	
CPI #	**Cumulative Progress Indicator (CPI)**
9.4.2.CT.1	Gather information about an issue, such as climate change, and collaboratively brainstorm ways to solve the problem (e.g. K-2-ETS1-!, 6.3.2.GeoGI.2).
9.4.2.CT.2	Identify possible approaches and resources to execute a plan (e.g., 1.2.2.CR1b, 8.2.2.ED.3).
9.4.2.CT.3	Use a variety of types of thinking to solve problems (e.g., inductive, deductive).
Standard: 8.1 Computer Science: Computing Systems: Individuals use computing devices to perform a variety of tasks accurately and quickly. Computing devices interpret and follow the instructions they are given literally.	
CPI #	**Cumulative Progress Indicator (CPI)**
8.1.2.CS.	Select and operate computing devices that perform a variety of tasks accurately and quickly based on user needs and preferences.
Interdisciplinary Standards	
Standard: Text Types and Purposes	
CPI #	**Cumulative Progress Indicator (CPI)**
W.K.1	Use a combination of drawing, dictating, and writing to compose opinion pieces in which they tell a reader the topic or the name of the book they are writing about and state an opinion or preference about the topic or book. (K-ESS2-2)
W.K.2	Use a combination of drawing, dictating, and writing to compose informative/explanatory texts in which they name what they are writing about and supply some information about the topic. (K-ESS2-2)
Standard: Research to Build and Present Knowledge	
CPI #	**Cumulative Progress Indicator (CPI)**
W.K.7	Participate in shared research and writing projects (e.g., explore a number of books by a favorite author and express opinions about them). (K-LS1-1)
Standard: Presentation of Knowledge and Ideas	
CPI #	**Cumulative Progress Indicator (CPI)**
SL.K.5	Add drawings or other visual displays to descriptions as desired to provide additional detail. (K-ESS3-1)
SL.K.6.	Speak audibly and express thoughts, feelings, and ideas clearly
Standard: Key Ideas and Details	
CPI #	**Cumulative Progress Indicator (CPI)**
R.K.1	With prompting and support, ask and answer questions about key details in a text. (K-ESS2-2)

Standard: Describe and compare measurable attributes.	
CPI #	**Cumulative Progress Indicator (CPI)**
K.MD.A.2	Directly compare two objects with a measurable attribute in common, to see which object has "more of"/"less of" the attribute, and describe the difference. (K-LS1-1)
Standard: Mathematical Practice Standards	
CPI #	**Cumulative Progress Indicator (CPI)**
MP.2	Reason abstractly and quantitatively. (K-ESS3-1)
MP.4	Model with mathematics. (K-ESS3-1
K.CC	Counting and Cardinality (K-ESS3-1)
Standard: Geography, People, and the Environment: Human Population Patterns	
CPI #	**Cumulative Progress Indicator (CPI)**
6.1.2.GeoPP.1 :	Explain the different physical and human characteristics that might make a location a good place to live (e.g., landforms, climate and weather, resource availability).
Standard: Geography, People, and the Environment: Human Environment Interaction	
CPI #	**Cumulative Progress Indicator (CPI)**
6.1.2.Geo.HE. 1:	Explain how seasonal weather changes, climate, and other environmental characteristics affect people's lives in a place or region.
6.1.2.Geo.HE. 2	Describe how human activities affect the culture and environmental characteristics of places or regions (e.g., transportation, housing, dietary needs)

What It Looks Like in the Classroom

Many students come to class with experience caring for living things such as family pets, houseplants, gardens, and even younger siblings. Teachers can begin IS1 with activities that allow students to share these experiences with one another. By the end of Unit 4, they should be able to relate these anecdotes to a few key principles about living organisms.

The DCIs for this unit are developmentally appropriate for kindergarten. Students learn that plants need water and light to live and grow and that animals need food. Animals obtain food from plants or other animals. Students also learn that organisms survive and thrive in places that have the resources they need. Simply knowing these core ideas is not sufficient for meeting the PE; K-LS1-1 requires that students identify patterns in the needs of different organisms. It is not possible to identify a pattern unless students observe and compare multiple observations of living things. The process of integrating multiple observations and looking for patterns constitutes analyzing data in the K–2 grade band.

Students can observe living things directly in the classroom, on the schoolyard, and through media. Media (including books, print articles, and digital resources) expose students to a wide variety of organisms. Classroom pets such as birds, rodents, reptiles, fish, or even ant farms allow students to notice consistent patterns over time (i.e., the fish needs to be fed every day or the rodent spends most of its waking time eating). *(Note: With pets, teachers must be mindful of district policies and allergies.)* Students can observe plants, insects, and other critters on their schoolyard. They can also grow their own seeds in cups or in an outdoor garden space.

Once students have identified patterns about what plants need to survive, they can test out their idea by taking several identical plants that have already sprouted and deprive them of water, light, both, or neither. Based on their model of what plants need, which do they predict will survive? Students will plan their own investigation of

this question in grade two (2-LS2-1).

While all plants and all animals share common features, there are also important differences between types of organisms. Different plants require different amounts of water (such as a fern that requires lots of water versus a cactus that requires very little). Different animals prefer different types of foods. For example, some animals only eat plants while others only eat animals, and others eat both. Students can use their background knowledge and observations from media to match specific animals to the food sources that they eat. Teachers can then ask questions such as, "What will happen if a deer that eats only grass tries to live in a desert where cacti are the main plants?"

Students should begin to group plants and animals together based upon their similar environmental needs (water, sunlight) and the availability of their preferred food sources. For example, students might read a story about the grasslands of Africa where a gazelle eats grass and then a lion eats the gazelle. Students should be able to explain [SEP-6] why each animal lives in that particular spot in Africa. Their answers should identify a specific need that is met by that location (either an environmental condition such as, "the grass lives there because it gets the sunlight and water that it needs," or a food source such as, "the lion lives there because it eats the gazelles there."). Once students master the relationships of simple groups of organisms like the African grassland, teachers can focus on living things close to their school. What plants grow well in the weather in their city? What animals will eat those plants, and what animals will eat those animals?

Students will build on their model of the relationship between the needs of organisms and their environmental conditions in grade three when they explore what happens when the environment changes (3-LS4-4) and in grade five when they examine the specific flow of energy and matter (5-LS2-1).

Guiding Questions:

- ✓ *How can you tell if something is alive?*
- ✓ *What do animals and plants need to survive?*
- ✓ *Where do organisms live and why do they live there?*

Example Instructional Sequence

The unit should begin with observable phenomena. The purpose of presenting phenomena to students is to start them thinking and wondering about what they observe. After students have observed the event, they can work individually, with partners, or in a small group to develop questions about what they saw. The questions will lead them into investigational opportunities throughout the unit that will help them answer their questions.

The questions students share about this unit will be used to guide them in identifying patterns of what plants and animals need to survive. For example, a pattern may include the types of food that specific organisms eat or that animals consume food but plants do not. Furthermore, students' questions and investigations will also guide them in developing models that reflect their understanding of the inter-relationship between an organism and its environment.

- Prior to starting the unit, display pictures of living and non-living things. Direct students to sort the pictures into two groups: living and non-living. Ask students to explain how they decided which pictures represented living things and which represented non-living things.
- Watch the PBS video "Is It Alive?" Stop after each picture and ask students if it's alive or not. Ask them to explain how they can tell. (This activity will also provide an opportunity to pre-assess students' understandings and/or misconceptions. It will also provide an opportunity for students to think about what having life means.)
- Watch the TeacherTube video "Living or Non-Living?" (This activity provides similar experiences for students as the PBS video. The difference is that after each picture and question, the narrator provides the answer with reasoning.)

In this unit's progression of learning, students first learn that scientists look for patterns and order when making observations about the world and those patterns in the natural world can be observed and used as evidence.

Students conduct firsthand and media-based observations of a variety living things and use their observations as evidence to support the concepts

- ✓ Plants do not need to take in food, but do need water and light to live and grow.
- ✓ All animals need food in order to live and grow, that they obtain their food from plants or from other animals, that different kinds of food are needed by different kinds of animals, and that all animals need water.

After determining what plants need to survive, kindergarteners learn that plants are systems, with parts, or structures, that work together, enabling plants to meet their needs in a variety of environments. The vast majority of plants have similar structures, such as roots, stems, and leaves, but the structures may look different depending on the type or variety of plant. Although there are many varieties of plants, their structures function in similar ways, allowing the plants to obtain the water and light they need to survive. In other words, each variety of plant has structures that are well-suited to the environment in which it lives. As students learn about different types of plants and the environments in which they live, they use models, such as diagrams, drawings, physical replicas, or dioramas, to represent the relationships between the needs of plants and the places they live in the natural world. For example, grasses need sunlight, so they often grow in meadows. Cacti, which live in places subject to drought, have thick, wide stems and modified leaves (spines) that keep water within the plant during long periods without rain.

After determining what animals need to survive, kindergarteners learn that animals are systems that have parts, or structures, that work together, enabling animals to meet their needs in a variety of environments. Many animals have similar structures, such as mouths or mouthparts, eyes, legs, wings, or fins, but the structures may look different, depending on the type or species of animal. Although there are many types of animals, their structures function in similar ways, allowing them to obtain the water and food they need to survive. In other words, each type of animal has structures that are well-suited to the environment in which they live. As students learn about different types of animals and the environments in which they live, they use models, such as diagrams, drawings, physical replicas, or dioramas, to represent the relationships between the needs of animals and the places they live in the natural world. For example, deer eat buds and leaves; therefore, they usually live in forested areas; pelicans eat fish, therefore they live near the shorelines of oceans or seas.

The final portion of the learning progression focuses on the understanding that plants and animals are system with parts, or structures, that work together. Students use what they have learned about plants and animals to make further observations to determine ways in which plants and animals change their environment to meet their needs. For example:

- ✓ Tree roots can break rocks and concrete in order to continue to grow, plants will expand their root systems in search of water that might be found deeper in the earth, and plants can be found growing around and through man-made structures in search of light.
- ✓ A squirrel digs in the ground to hide food, and birds collect small twigs to build nests in trees. Students need opportunities to make observations, and then, with adult guidance, to use their observations as evidence to support a claim for how an animal can change its environment to meet its needs.

Students need opportunities make observations; then, with adult guidance, they can use their observations as evidence to support a claim about how living things can change its environment to meet its needs.

Connecting with English Language Arts/literacy and Mathematics

English Language Arts

After students observe plants and animals in a variety of settings (e.g., ant farms, fish in an aquarium, plants growing, and insects in a jar), the teacher asks them to share their thoughts about what the plants and animals need using expressions like, “I think…” and “I agree with….” To help summarize patterns in the needs of plants

and animals, teachers can list all of the "needs" the class has discussed on the board using words and pictures/symbols (e.g., sun, water, food). Students, individually or with a partner, draw a picture of a plant on one half of a piece of paper, and an animal on the other half. Then they draw and/or write the needs of the plant and of the animal next to each picture. Students can verbally complete the sentence frame, "Plants are different from animals because _____." This concept is important because scientists distinguish plants from animals based on what they need: animals need to consume food while plants do not, although plants do need nutrients. Students can represent this idea with a Venn diagram.

ELA/Literacy Standards: W.K.2, 8; SL.K.1, 4, 5; L.K.5c

Mathematics

Kindergarten students use attributes to sort objects (K.MD.3). For example, a large portion of IS1 involves sorting plants and animals based on patterns in their needs. Students can sort organisms based on whether they are a plant or an animal, whether they live on water or land, and whether an animal eats only plants, only animals, or both.

With adult support, kindergarteners use simple measurements to describe various attributes of plants and animals. Kindergarteners can use simple, nonstandard units to measure the height of plants or the amount of water given to plants. For example, they might use Unifix cubes to measure height or count the number of scoops of water given to a plant on a daily or weekly basis. Students should work in groups to measure and record their data. They also measurements to describe various attributes of animals. Kindergarteners can use simple, nonstandard units to measure such attributes as height, length, or weight. They can also count numbers of appendages or other body parts. They might use Unifix cubes to measure height or length and wooden blocks to measure weight. Students should work in groups to measure and record their data.

With adult guidance and questioning, students can then learn to analyze their data. As students use data to compare the amount of growth that occurs in plants that get varying amounts of water or sunlight, they are given the opportunity to reason abstractly and quantitatively. For example, students can measure and compare the height of a sunflower grown in the shade compared to the height of a sunflower grown in the sun, or they can count and compare the number of leaves on bean plants that receive different amounts of water daily. These investigations will give students evidence to support claims about the needs of plants. Students should also have opportunities to solve one-step addition/subtraction word problems based on their collected data.

Math Standards: MP. 2, K.CC.1-3, K.MD.2-3

Modifications

(Note: Teachers identify the modifications that they will use in the unit. See NGSS Appendix D: All Standards, All Students/Case Studies for vignettes and explanations of the modifications.)

- Structure lessons around questions that are authentic, relate to students' interests, social/family background and knowledge of their community.
- Provide students with multiple choices for how they can represent their understandings (e.g. multisensory techniques-auditory/visual aids; pictures, illustrations, graphs, charts, data tables, multimedia, modeling).
- Provide opportunities for students to connect with people of similar backgrounds (e.g. conversations via digital tool such as SKYPE, experts from the community helping with a project, journal articles, and biographies).
- Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures (e.g. multiple representation and multimodal experiences).
- Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understanding.
- Use project-based science learning to connect science with observable phenomena.
- Structure the learning around explaining or solving a social or community-based issue.

- Provide ELL students with multiple literacy strategies.
- Collaborate with after-school programs or clubs to extend learning opportunities.
- Restructure lesson using UDL principles (http://www.cast.org/our-work/about-udl.html#.VXmoXcfD_UA).

Future Learning

Students will build on their model of the relationship between the needs of organisms and their environmental conditions in grade three when they explore what happens when the environment changes (3-LS4-4) and in grade five when they examine the specific flow of energy and matter (5-LS2-1).

Connections to Other Units

Teachers and students can decorate the four corners of their classrooms to look like the landscape of regional environments. They can read stories (fictional and informational) set in those environments. They can modify the decorations as the seasons change (connecting to IS3).

Sample of Open Education Resources

Read-Aloud Lesson: Where Do Polar Bears Live? Students identify and recall characteristics that allow polar bears to survive in the extremely cold Arctic environment.

"Good Night" & Where Do Polar Bears Live? This is a Paired Text activity that uses the “Where Do Polar Bears Live” read aloud and the non-fiction text “Good Night” which addresses hibernation.

The Needs of Living Things This lesson plan has one level for Grades K-2 and another level for Grades 3-5. Students will learn about what plants and animals need to survive and how habitats support those needs. They will also learn about how organisms can change their environment.

Living Things and Their Needs: This is an excellent resource that provides a Teacher Guide, videos, reading resources, and student activity sheets. The objective of the lessons is for students to learn about living organisms and what they need to survive. These lessons can easily be taught as an interdisciplinary set of learning experiences.

How do living things Interact: This unit plan is about unit plan about living things and environmental interactions

5E Science Lesson Plan: This Prezi presentation describes lesson ideas that support students’ understanding of living organisms. Lessons also provide an opportunity for students to identify patterns that help them determine similarities and differences between plants and animals.

Curious George: Paper Towel Plans: This video from Curious George shows students helping bean seeds sprout outside of soil by meeting their essential needs for moisture, temperature, air, and light. The children place the beans and a wet paper towel inside a zippered plastic bag and leave them undisturbed in a warm, well-lighted place. After two weeks, the students return and observe that the beans have sprouted and, like apple seeds, will one day grow to be fully developed plants.

From Seed to Fruit | Everyday Learning: Seed to Fruit takes children through the different stages of growth in the life of a cherry tomato plant. Planting a seed in a cup and watching it grow over time is a wonderful way to introduce the life cycle to young children. This resource is part of the KET Everyday Science for Preschoolers collection. This video is available in both English and Spanish audio, along with corresponding closed captions.

Think Garden: The Importance of Water: This video from KET's Think Garden collection explores why plants need water to survive, and how they tell us they're thirsty. Learn about the signs plants give when they've had

too much or too little water and the part water plays in the process of photosynthesis. See a quick, easy-to-understand animation explaining the water cycle and transpiration process. Also find out how to improve water quality with rain gardens and how to conserve water with rain barrels. This video is available in both English and Spanish audio, along with corresponding closed captions.

Think Garden: Plant Structure: This video from KET's Think Garden collection examines plant structure by taking a closer look at the root and shoots systems. Learn about roots, stems, leaves, flowers, seeds, and fruit through engaging illustrations and animations.

Appendix A: NJSLS-S and Foundations for the Unit

Use observations to describe patterns of what plants and animals (including humans) need to survive. *[Clarification Statement: Examples of patterns could include that animals need to take in food but plants do not; the different kinds of food needed by different types of animals; the requirement of plants to have light; and, that all living things need water.]* **(K-LS1-1)**

Use a model to represent the relationship between the needs of different plants and animals (including humans) and the places they live. *[Clarification Statement: Examples of relationships could include that deer eat buds and leaves, therefore, they usually live in forested areas; and, grasses need sunlight so they often grow in meadows. Plants, animals, and their surroundings make up a system.]* **(K-ESS3-1)**

Construct an argument supported by evidence for how plants and animals (including humans) can change the environment to meet their needs. *[Clarification Statement: Examples of plants and animals changing their environment could include a squirrel digs in the ground to hide its food and tree roots can break concrete.]* **(K-ESS2-2)**

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Planning and Carrying Out Investigations • Make observations (firsthand or from media) to collect data that can be used to make comparisons. (K-PS3-1) **Analyzing and Interpreting Data** • Use observations (firsthand or from media) to describe patterns in the natural world in order to answer scientific questions. (K-LS1-1) **Developing and Using**	**LS1.C: Organization for Matter and Energy Flow in Organisms** • 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. (K-LS1-1) **ESS3.A: Natural Resources** • Living things need water, air, and resources from the land, and they live in places that have the things they need. Humans use natural resources for	**Patterns** • Patterns in the natural and human designed world can be observed and used as evidence. (K-LS1-1) **Systems and System Models** • Systems in the natural and designed world have parts that work together. (K-ESS3-1), (K-ESS2-2) - ***Connections to Nature of Science*** **Scientific Knowledge is Based on Empirical Evidence** • Scientists look for patterns and order when making observations about the world. (K-LS1-1)

Models ● Use a model to represent relationships in the natural world. (K-ESS3-1) **Engaging in Argument from Evidence** ● Construct an argument with evidence to support a claim. (K-ESS2-2)	everything they do. (K-ESS3-1) **ESS2.E: Biogeology** ● Plants and animals can change their environment. (K-ESS2-2)	

Living and Nonliving

Grade/ Grade Band: K	**Topic:** Basic Needs of Living Things	**Lesson #** 1 **in a series of** 10 **lessons**

Brief Lesson Description:

In this lesson students will evaluate objects to determine if they are living or nonliving. They will decide what category the thing is in and then propose evidence that supports their claim. The teacher will facilitate this process by keeping a list of ideas for characteristics that support classifying something in each category.

Performance Expectation(s):

K-LS1-1. Use observations to describe patterns of what plants and animals (including humans) need to survive. [Clarification Statement: Examples of patterns could include that animals need to take in food but plants do not; the different kinds of food needed by different types of animals; the requirement of plants to have light; and, that all living things need water.]

Specific Learning Outcomes:

At the end of this lesson students will be able to:

- Confidently sort organisms into living and nonliving categories using a set of life system categories.
- Collaboratively articulate an argument from evidence to support each of their claims.

Narrative / Background Information

Prior Student Knowledge:

Students are expected to know what animals and plants are in general terms.

Science & Engineering Practices:	**Disciplinary Core Ideas:**	**Crosscutting Concepts:**
Planning and Carrying Out Investigations ● Make observations (firsthand or from media) to collect data that can be used to make comparisons. (K-PS3-1) **Analyzing and Interpreting Data** ● Use observations (firsthand or from media) to describe patterns in the natural world in order to answer scientific questions. (K-LS1-1) **Developing and Using Models** ● Use a model to represent relationships in the natural world. (K-	**LS1.C: Organization for Matter and Energy Flow in Organisms** - 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. (K-LS1-1)	**Patterns (K-2) -** Patterns in the natural and human designed world can be observed, used to describe phenomena, and used as evidence.

ESS3-1) o Distinguish between a model and the actual object, process and/or events the model represents. **Engaging in Argument from Evidence** ● Construct an argument with evidence to support a claim. (K-ESS2-2) o Identify arguments that are supported by evidence. o Distinguished between explanations that account for all gathered evidence and those that do not. o Analyze why some evidence is relevant to a scientific question and some is not. o Distinguish between opinions and evidence in one's own explanations. o Listen actively to arguments to indicate agreement or disagreement based on evidence, and/or to retell the main points of the argument. Construct an argument with evidence to support a claim.		

Possible Preconceptions/Misconceptions:

- Anything that moves is alive.
- Plants are less alive than animals.
- Seeds are dead.

LESSON PLAN – 5-E Model

Characteristics of Plants: What do they need to survive?

Grade/ Grade Band: K	**Topic:** Basic Needs of Living Things	**Lesson # 2 in a series of 10 lessons**

Brief Lesson Description:
Kindergarteners identify the five basic needs of plants, with more emphasis on water and light. The lesson uses living and dead plants as examples for students to explore plant needs.

Performance Expectation(s):

K-LS1-1. Use observations to describe patterns of what plants and animals (including humans) need to survive. [Clarification Statement: Examples of patterns could include that animals need to take in food but plants do not; the different kinds of food needed by different types of animals; the requirement of plants to have light; and, that all living things need water.]

Specific Learning Outcomes:

At the end of this lesson students will be able to:

• Argue from evidence that the needs of a plant include **water, light**, nutrients, air, and space to grow.

Narrative / Background Information

Prior Student Knowledge: Most plants grow in the soil and need water.

Science & Engineering Practices:	**Disciplinary Core Ideas:**	**Crosscutting Concepts:**
Planning and Carrying Out Investigations • Make observations (firsthand or from media) to collect data that can be used to make comparisons. (K-PS3-1) **Analyzing and Interpreting Data** • Use observations (firsthand or from media) to describe patterns in the natural world in order to answer scientific questions. (K-LS1-1) **Developing and Using**	**LS1.C: Organization for Matter and Energy Flow in Organisms** • 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. (K-LS1-1) **ESS3.A: Natural Resources** • Living things need water, air, and resources from the land, and they live in places that have the things they need. Humans use natural	**Patterns** • Patterns in the natural and human designed world can be observed and used as evidence. (K-LS1-1) **Scientific Knowledge is Based on Empirical Evidence** • Scientists look for patterns and order when making observations about the world. (K-LS1-1)

Models ● Use a model to represent relationships in the natural world. **Engaging in Argument from Evidence** ● Construct an argument with evidence to support a claim. (K-ESS2-2)	resources for everything they do. (K-ESS3-1)	
Possible Preconceptions/Misconceptions: ● Plants need to be planted in soil to grow. ● Plants' roots are smaller than their stems. ● The only/ most important role of a plant is to supply oxygen. (The most important local effect plants have on animals is to provide food.) ● Plants do not need oxygen - they can live without air. (They generate more oxygen than they use, but use gases such as carbon dioxide and oxygen.)		

LESSON PLAN – 5-E Model

Characteristics of Plants: What are some plant parts?

Grade/ Grade Band: K	**Topic:** Basic Needs of Living Things	**Lesson # 3 in a series of 10 lessons**
Brief Lesson Description: At a developmental level of instruction, kindergartners collect information by observing and recording the external features of plants. They identify the four basic parts of a plant, and describe the function of each part.		
Performance Expectation(s): **K-LS1-1.** Use observations to describe patterns of what plants and animals (including humans) need to survive. [Clarification Statement: Examples of patterns could include that animals need to take in food but plants do not; the different kinds of food needed by different types of animals; the requirement of plants to have light; and, that all living things need water.]		
Specific Learning Outcomes: **At the end of this lesson students will be able to:** ● Construct a model of a plant, showing and naming its parts (leaves, stem, roots, flower), and discuss the relationship of each structure to its function.		
Narrative / Background Information		
Prior Student Knowledge: Needs of a plant include **water, light**, nutrients, air, and space to grow.		
Science & Engineering Practices: **Planning and Carrying Out Investigations** ● Make observations (firsthand or from media) to collect data that can be used to	**Disciplinary Core Ideas:** **LS1.C: Organization for Matter and Energy Flow in Organisms** ● All animals need food in order to live and grow. They obtain their food from plants	**Crosscutting Concepts:** **Patterns** ● Patterns in the natural and human designed world can be observed and used as evidence. (K-LS1-1) **Systems and System Models** ● Systems in the natural and designed world have parts that work together. (K-ESS3-1), (K-ESS2-2)

make comparisons. (K-PS3-1) **Analyzing and Interpreting Data** ● Use observations (firsthand or from media) to describe patterns in the natural world in order to answer scientific questions. (K-LS1-1) **Developing and Using Models** ● Use a model to represent relationships in the natural world. **Engaging in Argument from Evidence** ● Construct an argument with evidence to support a claim. (K-ESS2-2)	or from other animals. Plants need water and light to live and grow. (K-LS1-1) **ESS3.A: Natural Resources** ● Living things need water, air, and resources from the land, and they live in places that have the things they need. Humans use natural resources for everything they do. (K-ESS3-1)	**Structure and Function** ● The shape and stability of structures of natural and designed objects are related to their function(s). (K-2- ETS1-2) **Scientific Knowledge is Based on Empirical Evidence** ● Scientists look for patterns and order when making observations about the world. (K-LS1-1)

Possible Preconceptions/Misconceptions:

- **Plants need to be planted in soil to grow.**
- **Plants' roots are much smaller than their stems.**
- **The only/ most important role of a plant is to supply oxygen. (The most important local effect plants have on animals is to provide food.)**
- **Plants do not need oxygen - they can live without air. (They generate more oxygen than they use, but use gases such as carbon dioxide and oxygen.)**
- **Plants do not need food. (Plants use water, nutrients and light to make their own food.)**

Characteristics of Plants: How do plants grow and change?

Grade/ Grade Band: K	**Topic:** Basic Needs of Living Things	**Lesson # 4 in a series of 10 lessons** (may last a number of days from ~ 6-12 depending on plant growth)

Brief Lesson Description:

At a developmental level of instruction, kindergartners collect information by observing and recording the external features of plants. They identify the four basic parts of a plant, and describe the function of each part. Kindergarten students care for plants by identifying and providing for their needs.

Performance Expectation(s):

K-LS1-1. Use observations to describe patterns of what plants and animals (including humans) need to survive. [Clarification Statement: Examples of patterns could include that animals need to take in food but plants do not; the different kinds of food needed by different types of animals; the requirement of plants to have light; and, that all living things need water.]

Specific Learning Outcomes:

At the end of this lesson the student will be able to:

- Carry out an investigation to confirm the needs of a plant, by caring for those needs (**water, light,** nutrients, air and space) during plant growth.
- Make, or draw, a model showing the stages of growth of a plant from seed to mature seedling.
- Collect analyze and interpret data on plant growth.

Narrative / Background Information

Prior Student Knowledge: Students are expected to know that the needs of plants include **water, light**, nutrients, air, and space to grow. Recognize that stems, roots, leaves, flowers, and seeds are parts of plants.

Science & Engineering Practices:	Disciplinary Core Ideas:	Crosscutting Concepts:
Planning and Carrying Out Investigations • Make observations (firsthand or from media) to collect data that can be used to make comparisons. (K-PS3-1) **Analyzing and Interpreting Data** • Use observations (firsthand or from media) to describe patterns in the natural world in order to answer scientific questions. (K-LS1-1) **Developing and Using Models** • Use a model to represent relationships in the natural world. **Engaging in Argument from Evidence** • Construct an argument with evidence to support a claim. (K-ESS2-2)	**LS1.C: Organization for Matter and Energy Flow in Organisms** • 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. (K-LS1-1)	**Patterns** • Patterns in the natural and human designed world can be observed and used as evidence. (K-LS1-1) **Systems and System Models** • Systems in the natural and designed world have parts that work together. (K-ESS3-1), (K-ESS2-2) **Structure and Function** • The shape and stability of structures of natural and designed objects are related to their function(s). (K-2- ETS1-2) **Scientific Knowledge is Based on Empirical Evidence** • Scientists look for patterns and order when making observations about the world. (K-LS1-1)

Possible Preconceptions/Misconceptions:

- **Plants need to be planted in soil to grow.**
- **Plants' roots are smaller than their stems.**
- **The only/ most important role of a plant is to supply oxygen. (The most important local effect plants have on animals is to provide food.)**
- **Plants do not need oxygen - they can live without air. (They generate more oxygen than they use, but use gases such as carbon dioxide and oxygen.)**
- **Plants do not need to take in food, but do need water and light to live and grow.**

LESSON PLAN – 5-E Model

Characteristics of Animals: What do animals need to survive?

Grade/ Grade Band: K	**Topic:** Basic Needs of Living Things	**Lesson #** __5___ **in a series of** __10___ **lessons**

Brief Lesson Description: At a developmental level of instruction, kindergartners collect information by observing, identifying, and recording the external features of humans and other animals. They identify the external features of animals, and describe the function of each feature.

Students argue that plants and animals need the same things to survive. They then explore what animals need to survive making connections between where they live and what they eat and need to survive.

Performance Expectation(s): K-LS1-1. Use observations to describe patterns of what plants and animals (including humans) need to survive. [Clarification Statement: Examples of patterns could include that animals need to take in food but plants do not; the different kinds of food needed by different types of animals; the requirement of plants to have light; and, that all living things need water.]

Specific Learning Outcomes:

At the end of this lesson the student will be able to:

- Argue from evidence that the needs of animals include food, water, air ,and shelter in a specific habitat type suitable to that animal.
- Create a visual model (drawing) that shows an example of an animal using a structure, or behavior, to meet a life need.

Narrative / Background Information

Prior Student Knowledge: Students are expected to be familiar with various types of animals and how they interact with their environment in general terms. They are also expected to recall the basic needs of animals from previous lessons including food, water, shelter and space.

Science & Engineering Practices:	**Disciplinary Core Ideas:**	**Crosscutting Concepts:**
Planning and Carrying Out Investigations • Make observations (firsthand or from media) to collect data that can be used to make comparisons. (K-PS3-1) **Analyzing and Interpreting Data**	**LS1.C: Organization for Matter and Energy Flow in Organisms** • 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. (K-LS1-1) **ESS3.A: Natural**	**Patterns** • Patterns in the natural and human designed world can be observed and used as evidence. (K-LS1-1) **Systems and System Models** • Systems in the natural and designed world have parts that work together. (K-ESS3-1), (K-ESS2-2) **Structure and Function** • The shape and stability of structures of natural and designed objects are related to their function(s). (K-2- ETS1-2) **Scientific Knowledge is Based on Empirical Evidence**

• Use observations (firsthand or from media) to describe patterns in the natural world in order to answer scientific questions. (K-LS1-1) **Developing and Using Models** • Use a model to represent relationships in the natural world. **Engaging in Argument from Evidence** • Construct an argument with evidence to support a claim. (K-ESS2-2)	**Resources** • Living things need water, air, and resources from the land, and they live in places that have the things they need. Humans use natural resources for everything they do. (K-ESS3-1)	• Scientists look for patterns and order when making observations about the world. (K-LS1-1)
Possible Preconceptions/Misconceptions: • All animals need to drink water (some animals get water from food). • Animals can eat a variety of food (some animals can only eat one type of food). • All animals need permanent shelter. • All animals need to breathe (all animals need oxygen).		

LESSON PLAN – 5-E Model

Characteristics of Animals: Structures

Grade/ Grade Band: K	**Topic:** Basic Needs of Living Things	**Lesson #** __6___ **in a series of** __10___ **lessons**
Brief Lesson Description: Students explore the similarities and differences between the structures of animals, such as mouthparts, eyes, legs, wings, or fins. They then explore how although there are many types of animals, their structures function in similar ways.		
Performance Expectation(s): K-LS1-1. Use observations to describe patterns of what plants and animals (including humans) need to survive. [Clarification Statement: Examples of patterns could include that animals need to take in food but plants do not; the different kinds of food needed by different types of animals; the requirement of plants to have light; and, that all living things need water.]		
Specific Learning Outcomes: **At the end of this lesson the student will be able to:** • Argue from evidence that animals use different structures to meet the same life needs. • Collect data on similarities and differences between different groups of animals. • Use animal models (such as pictures or physical models) to sort and group animals according to how they meet their needs for food and shelter.		
Narrative / Background Information		

Prior Student Knowledge: Students are expected to know that birds generally use feathers for flight and that mammals use fur for warmth. They are also expected to know that birds have beaks that they eat with instead of toothed jaws.

Science & Engineering Practices:	**Disciplinary Core Ideas:**	**Crosscutting Concepts:**
Planning and Carrying Out Investigations • Make observations (firsthand or from media) to collect data that can be used to make comparisons. (K-PS3-1) **Analyzing and Interpreting Data** • Use observations (firsthand or from media) to describe patterns in the natural world in order to answer scientific questions. (K-LS1-1) **Developing and Using Models** • Use a model to represent relationships in the natural world. **Engaging in Argument from Evidence** • Construct an argument with evidence to support a claim. (K-ESS2-2)	**LS1.C: Organization for Matter and Energy Flow in Organisms** • 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. (K-LS1-1) **ESS3.A: Natural Resources** • Living things need water, air, and resources from the land, and they live in places that have the things they need. Humans use natural resources for everything they do. (K-ESS3-1)	**Patterns** • Patterns in the natural and human designed world can be observed and used as evidence. (K-LS1-1) **Systems and System Models** • Systems in the natural and designed world have parts that work together. (K-ESS3-1), (K-ESS2-2) **Structure and Function** • The shape and stability of structures of natural and designed objects are related to their function(s). (K-2- ETS1-2) **Scientific Knowledge is Based on Empirical Evidence** • Scientists look for patterns and order when making observations about the world. (K-LS1-1)

Possible Preconceptions/Misconceptions:
Birds use feathers only for flight (they also provide warmth and protection from the elements).
All animals have bony jaws or beaks (slugs, for example, have only soft mouthparts).

LESSON PLAN – 5-E Model

Characteristics of Animals: How do animals grow and change?

Grade/ Grade Band: K	**Topic:** Basic Needs of Living Things	**Lesson # 7 in a series of 10 lessons** **will last a number of days (15-20 days) depending on growth of caterpillar**
Brief Lesson Description:		

At a developmental level of instruction, kindergartners collect information by observing, identifying, and recording the external features of the caterpillars and butterflies. They will identify the external features of caterpillars and butterflies, and describe the function of each feature as they present themselves.

They then explore what caterpillars and butterflies need to survive based on what we have already learned about plants and animals.

Performance Expectation(s):

K-LS1-1. Use observations to describe patterns of what plants and animals (including humans) need to survive. [Clarification Statement: Examples of patterns could include that animals need to take in food but plants do not; the different kinds of food needed by different types of animals; the requirement of plants to have light; and, that all living things need water.]

Specific Learning Outcomes:

At the end of this lesson the student will be able to:

- Carry out an investigation to confirm the needs of a caterpillar/butterfly, by caring for those needs (food, water, shelter and air) during the life cycle. Record and interpret data on caterpillar growth.
- Make a model using clay, playdough or model magic to display the different stages from egg to butterfly illustrating the relationship of the structures of each stage with their functions.
- Collect, analyze, interpret, and log data when changes occur.

Narrative / Background Information

Prior Student Knowledge: Students are expected to enter this lesson with mastery of prior learning from this unit, such as the necessities of life for animals including food, water, shelter and space.

Science & Engineering Practices:	Disciplinary Core Ideas:	Crosscutting Concepts:
Planning and Carrying Out Investigations • Make observations (firsthand or from media) to collect data that can be used to make comparisons. (K-PS3-1) **Analyzing and Interpreting Data** • Use observations (firsthand or from media) to describe patterns in the natural world in order to answer scientific questions. (K-LS1-1) **Developing and Using Models** • Use a model to represent relationships in the natural world.	**LS1.C: Organization for Matter and Energy Flow in Organisms** • 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. (K-LS1-1)	**Patterns** • Patterns in the natural and human designed world can be observed and used as evidence. (K-LS1-1) **Systems and System Models** • Systems in the natural and designed world have parts that work together. (K-ESS3-1), (K-ESS2-2) **Structure and Function** • The shape and stability of structures of natural and designed objects are related to their function(s). (K-2- ETS1-2) **Scientific Knowledge is Based on Empirical Evidence** • Scientists look for patterns and order when making observations about the world. (K-LS1-1)

Engaging in Argument from Evidence • Construct an argument with evidence to support a claim. (K-ESS2-2)		
Possible Preconceptions/Misconceptions: • **Caterpillars will form a cocoon (painted lady butterflies will emerge from a chrysalis, a specialized exoskeleton, while a cocoon is spun from silk by most moths).** • **Caterpillars and butterflies are separate animals.** • **Caterpillars do not have legs.**		
LESSON PLAN – 5-E Model		

How Animals and Plants Affect their Environment

Grade/ Grade Band: K	**Topic:** Basic Needs of Living Things	**Lesson # 8 in a series of 10 lessons**
Brief Lesson Description: In this lesson students explore how plants and animals change their environment by seeing a series of short video clips and looking at pictures.		
Performance Expectation(s): Construct an argument supported by evidence for how plants and animals (including humans) can change the environment to meet their needs. *[Clarification Statement: Examples of plants and animals changing their environment could include a squirrel digs in the ground to hide its food and tree roots can break concrete.]* (K-ESS2-2)		
Specific Learning Outcomes: **At the end of this lesson the student will be able to:** • Argue from evidence that plants and animals change the environment that they live in to meet their needs for light, air, water and space, and air, food, water and space/shelter. • Create a model (physical or drawing) showing how either a plant or animal interacts with its environment to change the environment to better meet its needs.		
Narrative / Background Information		
Prior Student Knowledge: Students are expected to know that animals need shelter and to be generally familiar with activities such as birds building nests to hold or shelter their young.		
Science & Engineering Practices: **Planning and Carrying Out Investigations** • Make observations (firsthand or from media) to collect data that can be used to	**Disciplinary Core Ideas:** **LS1.C: Organization for Matter and Energy Flow in Organisms** • All animals need food in order to live and grow. They obtain their food from plants	**Crosscutting Concepts:** **Patterns** • Patterns in the natural and human designed world can be observed and used as evidence. (K-LS1-1) **Systems and System Models** • Systems in the natural and designed world

make comparisons. (K-PS3-1) **Analyzing and Interpreting Data** • Use observations (firsthand or from media) to describe patterns in the natural world in order to answer scientific questions. (K-LS1-1) **Developing and Using Models** • Use a model to represent relationships in the natural world. **Engaging in Argument from Evidence** • Construct an argument with evidence to support a claim. (K-ESS2-2)	or from other animals. Plants need water and light to live and grow. (K-LS1-1) **ESS3.A: Natural Resources** • Living things need water, air, and resources from the land, and they live in places that have the things they need. Humans use natural resources for everything they do. (K-ESS3-1)	have parts that work together. (K-ESS3-1), (K-ESS2-2) **Structure and Function** • The shape and stability of structures of natural and designed objects are related to their function(s). (K-2- ETS1-2) **Scientific Knowledge is Based on Empirical Evidence** • Scientists look for patterns and order when making observations about the world. (K-LS1-1)
Possible Preconceptions/Misconceptions: • **All animals live in homes that exist naturally or that humans need to "take care of them".** • **Plants are dependent on people to provide water and an appropriate place to live.**		
LESSON PLAN – 5-E Model		

Human Habitats

Grade/ Grade Band: K	**Topic:** Human Habitats	**Lesson #** 9 **in a series of** 10 **lessons**
Brief Lesson Description: Students will understand that habitats are different depending on where you live by considering the impact of climate. Students will understand how environment (specifically climate) impacts human habitats		
Performance Expectation(s): K-ESS3-3 Communicate solutions that will reduce the impact of climate change and humans on the land, water, air, and/or other living things in the local environment. K-LS1-1 Use observations to describe patterns to understand what plants and animals (including humans) need to survive		
Specific Learning Outcomes: At the end of this lesson the student will be able to: • Explain why human habitats are different depending on where you live by considering the impact of		

weather and environment on human habitats.
- Understand that when humans create their habitats they impact the habitats of other animals

Prior Student Knowledge:

- Based on the previous lesson, students should know that the sun heats objects, and objects are cooler if they are not in direct sunlight.
- Different places in the world have different weather
- Humans and animals take action to protect themselves from weather

Science & Engineering Practices:

Analyzing and Interpreting Data

- Use observations (firsthand or from media) to describe patterns in the natural world in order to answer scientific questions. (K-ESS2-1)
- Analyze data from tests of an object or tool to determine if it works as intended. (K-2-ETS1-3)

Asking Questions and Defining Problems

- Ask questions based on observations to find more information about the designed world. (K- ESS3-2)

Constructing Explanations and Designing Solutions

- Use tools and materials provided to design and build a device that solves a specific problem or a solution to a specific problem. (K-PS3-2)

Developing and Using Models

- Use a model to represent relationships in the natural world. (K-ESS3-1)
  - Distinguish between a model and the actual object, process and/or events the model represents.

Engaging in Argument from Evidence

- Construct an argument with

Disciplinary Core Ideas:

PS3.B: Conservation of Energy and Energy Transfer

- Sunlight warms Earth's surface. (K-PS3-1),(K-PS3-2)

ETS1.A: Defining and Delimiting an Engineering Problem

- Asking questions, making observations, and gathering information are helpful in thinking about problems. (K-2-ETS1-1)
- A situation that people want to change or create can be approached as a problem to be solved through engineering. (K-2-ETS1-1)

ETS1.B: Developing Possible Solutions

- 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. (K-2-ETS1-2)

ETS1.C: Optimizing the Design Solution

- Because there is always more than one possible solution to a problem, it is useful to compare and test designs. (K-2-ETS1-3)

Crosscutting Concepts:

Patterns

- Patterns in the natural world can be observed, used to describe phenomena, and used as evidence. (K-ESS2-1)

Cause and Effect

- Events have causes that generate observable patterns. (K-PS3-1),(K-PS3-2),(K-ESS3-2)

evidence to support a claim. (K-ESS2-2) o Identify arguments that are supported by evidence. **Planning and Carrying Out Investigations** ● Make observations (firsthand or from media) to collect data that can be used to make comparisons. (K-PS3-1)		
Possible Preconceptions/Misconceptions: ● The weather is the same everywhere in the world ● All houses are the same ● House design is closely related to wealth		
LESSON PLAN – 5-E Model		

Reducing Impacts of Human Activity on the Earth

Grade/ Grade Band: K	**Topic:** Basic Needs of Living Things	**Lesson # 10 in a series of 10 lessons**

Brief Lesson Description:
Students will remember that they learned plants and animals have an impact on the environment/habitat. In this lesson, students will understand that things that people do to live comfortably can affect the world around them as well. But they can make choices that reduce their impacts on the land, water, air, and other living things.

Essential Questions:

1. What do living things need from the places they live to survive?
2. What is the difference between want and need
3. How do the lives of people affect the world's land, water, air, and other living things?
4. How can people reduce their impact on the world's land, water, air, and other living things?

Performance Expectation(s):
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. (K-ESS3-3)

K-2-ETS1-1 Ask questions, and gather information about a situation people want to change (e.g., climate change) to define a simple problem that can be solved through the development of a new or improved object or tool.

K-ESS3-3 Communicate solutions that will reduce the impact of climate change and humans on the land, water, air, and/or other living things in the local environment. [Clarification Statement: Examples of human impact on the land could include cutting trees to produce paper and using resources to produce bottles. Examples of solutions could include reusing paper and recycling cans and bottles.]

Specific Learning Outcomes:

At the end of this lesson the student will be able to:

- Understand that living things get what they need from the Earth to survive.
- Define the difference between want and need.
- Understand that plants, animals and humans can cause environmental changes to the Earth.
- Understand there are both negative and positive ways in which humans impact the environment.
- Environmental changes can affect the needs of plants, animals and humans.
- There are practical ways to protect the environment.
- Scientists, including biologists, zoologists, geologists, and climatologists, study how living things affect the land, air, and water.

Narrative / Background Information

Prior Student Knowledge: Students are expected to know how plants and animals change their environment.

Science and Engineering Practices:	Disciplinary Core Ideas:	Crosscutting Concepts:
Developing and Using Models ● Modeling in K–2 builds on prior experiences and progresses to include using and developing models (i.e., diagram, drawing, physical replica, diorama, dramatization, or storyboard) that represent concrete events or design solutions. ● Use a model to represent relationships in the natural world. (K-ESS3-1) **Analyzing and Interpreting Data** ● Analyzing data in K–2 builds on prior experiences and progresses to collecting, recording, and sharing observations. ● Use observations (firsthand or from media) to describe patterns in the natural world in order to answer scientific	**LS1.C: Organization for Matter and Energy Flow in Organisms** ● 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. (K-LS1-1) **ESS2.E: Biogeology** ● Plants and animals can change their environment (K-ESS2-2) **ESS3.A: Natural Resources** ● Living things need water, air, and resources from the land, and they live in places that have the things they need. Humans use natural resources for everything they do. (K-ESS3-1) **<u>ESS3.C: Human Impacts on Earth Systems</u>** ● Things that people do to live comfortably can	**Patterns** ● Patterns in the natural and human designed world can be observed and used as evidence. (K-LS1-1) **Cause and Effect** ● Events have causes that generate observable patterns. (K-ESS3-3) **Systems and System Models** ● Systems in the natural and designed world have parts that work together. (K-ESS3-1), (K-ESS2-2)

questions. (K-LS1-1) **Engaging in Argument from Evidence** ● Engaging in argument from evidence in K–2 builds on prior experiences and progresses to comparing **i**deas and representations about the natural and designed world(s). ● Construct an argument with evidence to support a claim. (K-ESS2-2) **Obtaining, Evaluating, and Communicating Information** ● Obtaining, evaluating, and communicating information in K–2 builds on prior experiences and uses observations and texts to communicate new information. ● Communicate solutions with others in oral and/or written forms using models and/or drawings that provide detail about scientific ideas. (K-ESS3-3) **Asking Questions and Defining Problems** ● Ask questions based on observations to find more information about the natural and/or designed world(s). (K-2-ETS1-1) ● Define a simple problem that can be solved through the development of a new or improved object or tool. (K-2-ETS1-1)	affect the world around them. But they can make choices that reduce their impacts on the land, water, air, and other living things. (K-ESS3-3) **ETS1.B: Developing Possible Solutions** ● 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. *(secondary to K-ESS3-3)*	

West Windsor-Plainsboro Regional School District
Science Curriculum
Kindergarten - Pushes and Pulls

The Mission of the West Windsor-Plainsboro Science Department

Our mission is to cultivate science learners who have the foundational knowledge to make ethical, scientifically literate decisions and the ability to apply scientific practices in order to contribute to the needs of society and a changing world.

- **Vision**

  We envision a K-12 science experience that supports and challenges every student in their science learning journey. We will:
  - *Capitalize on diversity by reaching and exciting students at all levels and interests by differentiating learning within classrooms and by offering a robust program of studies.*
  - *Emphasize authentic science and engineering practices and leverage the interdisciplinary nature of science with arts, technology, math, reading, and writing.*
  - *Integrate scientific knowledge and 21st century competencies to prepare students to make informed decisions and take action to address real world problems.*

Unit 1:	
Content Area: Pushes & Pulls	
Course & Grade Level: Kindergarten	
Summary and Rationale	
What happens if you push or pull an object harder? During this unit of study, students apply an understanding of the effects of different strengths or different directions of pushes and pulls on the motion of an object to analyze a design solution. The crosscutting concept of *cause and effect* is called out as the organizing concept for this disciplinary core idea. Students are expected to demonstrate grade-appropriate proficiency in *planning and carrying out investigations* and *analyzing and interpreting data*. Students are also expected to use these practices to demonstrate understanding of the core ideas. This unit is based on K-PS2-1, K-PS2-2, and K-2 ETS1-3.	
Recommended Pacing	
days	
New Jersey Student Learning Standards for	
Next Generation Science Standards for K.Forces and Interactions: Push and Pull	
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.** *[Clarification Statement: Examples of pushes or pulls could include a string attached to an object being pulled, a person pushing an object, a person stopping a rolling ball, and two objects colliding and pushing on each other.] [Assessment Boundary: Assessment is limited to different relative strengths or different directions, but not both at the same time. Assessment does not include non-contact pushes or pulls such as those produced by magnets.]*
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.** *[Clarification Statement: Examples of problems requiring a solution could include having a marble or other object move a certain distance, follow a particular path, and knock down other objects. Examples of solutions could include tools such as a ramp to increase the speed of the object and a structure that would cause an object such as a marble or ball to turn.] [Assessment Boundary: Assessment does not include friction as a mechanism for change in speed.]*
(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.**

New Jersey Student Learning Standards for Career Readiness, Life Literacies and Key Skills	
Standard: 9.1 Personal Financial Literacy	
CPI #	**Cumulative Progress Indicator (CPI)**
9.1.2.CR.1	Recognize ways to volunteer in the classroom, school and community.
Standard: 9.2 Career Awareness, Exploration, Preparation, and Training	
CPI #	**Cumulative Progress Indicator (CPI)**
9.1.2.CAP.1	Make a list of different types of jobs and describe the skills associated with each job.

Standard: 9.4 Life Literacies and Key Skills: Critical Thinking and Problem-solving: Critical thinkers must first identify a problem then develop a plan to address it to effectively solve the problem.	
CPI #	**Cumulative Progress Indicator (CPI)**
9.4.2.CT.1	Gather information about an issue, such as climate change, and collaboratively brainstorm ways to solve the problem (e.g. K-2-ETS1-!, 6.3.2.GeoGI.2).
9.4.2.CT.2	Identify possible approaches and resources to execute a plan (e.g., 1.2.2.CR1b, 8.2.2.ED.3).
9.4.2.CT.3	Use a variety of types of thinking to solve problems (e.g., inductive, deductive).
Standard: 8.1 Computer Science: Computing Systems: Individuals use computing devices to perform a variety of tasks accurately and quickly. Computing devices interpret and follow the instructions they are given literally.	
CPI #	**Cumulative Progress Indicator (CPI)**
8.1.2.CS.	Select and operate computing devices that perform a variety of tasks accurately and quickly based on user needs and preferences.
Interdisciplinary Standards (fill-in Science, or SS, or Math, etc..)	
Standard: K.MD Describe and compare measurable attributes.	
CPI #	**Cumulative Progress Indicator (CPI)**
K.MD.A.1	Describe measurable attributes of objects, such as length or weight. Describe several measurable attributes of a single object. (K-PS2-1)
Standards for Mathematical Practices	
CPI #	**Cumulative Progress Indicator (CPI)**
MP.2	Reason abstractly and quantitatively. (K-PS2-1), (K-2-ETS1-1),(K-2-ETS1-3)
MP.4	Model with mathematics. (K-2-ETS1-1), (K-2-ETS1-3)
MP.5	Use appropriate tools strategically. (K-2-ETS1-1), (K-2-ETS1-3)
Standard: RI.K Reading Informational Text Key Ideas and Details	
CPI #	**Cumulative Progress Indicator (CPI)**
RI.K.1	With prompting and support, ask and answer questions about key details in a text. (K-PS2-2)
Standard: Research to Build and Present Knowledge	
CPI #	**Cumulative Progress Indicator (CPI)**
W.K.7	Participate in shared research and writing projects (e.g., explore a number of books by a favorite author and express opinions about them). (K-PS2-1)
Standard: SL K. Comprehension and Collaboration	
CPI #	**Cumulative Progress Indicator (CPI)**
SL.K.3	Ask and answer questions in order to seek help, get information, or clarify something that is not understood. (K-PS2-2)
SL.K.5	Add drawings or other visual displays to descriptions as desired to provide additional detail.

Unit Sequence	
Part A: *Why do scientists like to play soccer?*	
Concepts	**Formative Assessment**
• People use different ways to study the world. • Simple tests can be designed to gather evidence to support or refute student ideas about causes. • 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. • When objects touch or collide, they push on one another and can change motion. • A bigger push or pull makes things speed up or slow down more quickly.	*Students who understand the concepts are able to:* ● With guidance, design simple tests to gather evidence to support or refute ideas about cause-and-effect relationships. ● With guidance, plan and conduct an investigation in collaboration with peers. ● With guidance, collaboratively 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. *(Assessment is limited to different relative strengths or different directions, but not both at the same time. Assessment does not include noncontact pushes or pulls such as those produced by magnets.)* Some examples of pushes and pulls on the motion of an object could include: ✓ A string attached to an object being pulled. ✓ A person pushing an object. ✓ A person stopping a rolling ball. ✓ Two objects colliding and pushing on each other.

Unit Sequence	
Part B: *How can you design a simple way to change the speed or direction of an object using a push or pull from another object?*	
Concepts	**Formative Assessment**
• Simple tests can be designed to gather evidence to support or refute student ideas about causes. • 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. • 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.	*Students who understand the concepts are able to:* • With guidance, design simple tests to gather evidence to support or refute ideas about cause-and-effect relationships. • Analyze data from tests of an object or tool to determine if it works as intended. • Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs. • Analyze data to determine whether a design solution works as intended to change the speed or direction of an object with a push or a pull.

• Because there is always more than one possible solution to a problem, it is useful to compare and test designs.	• Examples of problems requiring a solution could include having a marble or other object move a certain distance, follow a particular path, and knock down other objects. • Examples of solutions could include tools such as a ramp to increase the speed of the object and a structure that would cause an object such as a marble or ball to turn. *(Assessment does not include friction as a mechanism for change in speed.)*

What It Looks Like in the Classroom

In this unit of study, students plan and carry out investigations in order to understand the effects of different strengths and different directions of pushes and pulls on the motion of an object. Students will also engage in a portion of the ***engineering design process*** to determine whether a design solution works as intended to change the speed or direction of an object.

Scientists often design simple tests in order to gather evidence that can be used to understand cause-and-effect relationships. In this unit's progression of learning, kindergarteners need adult guidance to collaboratively plan and conduct simple investigations to discover and compare the effects of pushes and pulls on the motion of an object. Students will need opportunities to push and pull a variety of objects, such as balls, toy cars, pull toys, cans, tops, and boxes. Students should push/pull these objects first with varying strengths, and then in a variety of directions. They should also explore the effects of pushing objects into one another, as well as into walls and other stationary objects. Students should record their observations using pictures and words, and should participate in class discussions on the effects of varying the strength or direction of a push or pull on an object.

As students engage in these types of simple force and motion investigations, they will learn that:

✓ 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.

✓ When objects touch or collide, the object's motion can be changed.

✓ The force of the push or pull will make things speed up or slow down more quickly.

To enhance students' experiences, teachers can schedule time for students to investigate these force and motion concepts using playground equipment, such as swings, seesaws, and slides. Teachers can also use trade books and multimedia resources to enrich students' understanding. As students participate in discussions, they should be encouraged to ask questions, share observations, and describe cause-and-effect relationships between forces (pushes and pulls) and the motion of objects.

As students come to understand the force and motion concepts outlined above, they should engage in the ***engineering design process*** as follows.

- Students are challenged to design a simple way to change the speed or direction of an object using a push or pull from another object.
- As a class, students determine what the design should be able to do (criteria). For example:
  - ✓ An object should move a second object a certain distance;
  - ✓ An object should move a second object so that the second object follows a particular path;

- ✓ An object should change the direction of the motion of a second object; and/or
- ✓ An object should knock down other specified objects.

- Students determine the objects that will move/be moved (balls, ramps, blocks, poker chips) and the types of structures (ramps or barriers) and materials (rubber bands, paper tubes, cardboard, foam, wooden blocks) that can be used to meet this challenge.
- Groups of students then develop a simple drawing or diagram and use given materials to build their design. Groups should be given a predetermined amount of time to draw and build their designs.
- Groups share their designs with the class, using their drawings or diagrams, and then test their designs.
- Students make and use observations to determine which of the designs worked as intended, based on the criteria determined by the class.

While engaging in this process, students should use evidence from their observations to describe how forces (pushes and pulls) cause changes in the speed or direction of an object.

In this unit of study, students learn that problem situations can be solved through engineering, and that because there is always more than one possible solution to a problem, it is useful to compare and test designs. Students will use what they have learned about the effect of pushes and pulls of varying strength and direction on the motion of an object to determine whether a design solution works as intended. This process is outlined in greater detail in the previous section.

Connecting with English Language Arts/literacy and Mathematics

English Language Arts

In order to integrate English Language Arts into this unit, students need the opportunity to participate in shared research that will enhance their understanding of the effect of forces (pushes and pulls) on objects. This could include exploring simple books and other media or digital resources. With prompting and support, students should ask and answer questions about key details in texts in order to seek help, get information, or clarify something that they do not understand. With support from adults, students will also recall information from experiences to answer questions and clarify their thinking. With support and/or collaboration, they can use digital tools to produce and publish simple informative writing or to document their observations of the simple force and motion systems they design and build.

Mathematics

During this unit of study, students will make connections to Mathematics in a number of ways. Kindergartners can use simple nonstandard units to measure the distances that two different objects travel when pushed or pulled or the distances that an object travels when varying the strength of a push or a pull. If using two objects, students can compare them using a measurable attribute, such as weight, to see which object has “more of” or “less of” the attribute, and describe the effect that increased weight has on the distance that an object travels. As students conduct multiple trials with the two objects (or with a single object, varying the strength of the push or pull), they can document the distance traveled in a simple graph. Then they can analyze the data in order to describe the cause-and-effect relationship between forces and motion of objects. As students collect and analyze data, they are learning to reason abstractly and quantitatively and use appropriate tools strategically.

Modifications

(Note: Teachers identify the modifications that they will use in the unit. See NGSS Appendix D: All Standards, All Students/Case Studies for vignettes and explanations of the modifications.)

- Structure lessons around questions that are authentic, relate to students' interests, social/family background and knowledge of their community.
- Provide students with multiple choices for how they can represent their understandings (e.g. multisensory techniques-auditory/visual aids; pictures, illustrations, graphs, charts, data tables, multimedia, modeling).
- Provide opportunities for students to connect with people of similar backgrounds (e.g. conversations via digital tool such as SKYPE, experts from the community helping with a project, journal articles, and biographies).
- Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures (e.g. multiple representation and multimodal experiences).
- Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understandings.
- Use project-based science learning to connect science with observable phenomena.
- Structure the learning around explaining or solving a social or community-based issue.
- Provide ELL students with multiple literacy strategies.
- Collaborate with after-school programs or clubs to extend learning opportunities.
- Restructure lesson using UDL principals (http://www.cast.org/our-work/about-udl.html#.VXmoXcfD_UA).

Research on Student Learning

Students tend to think of force as a property of an object ("an object has force," or "force is within an object") rather than as a relation between objects. In addition, students tend to distinguish between active objects and those objects that support or block or otherwise act passively. Students tend to call the active actions "force" but do not consider passive actions as "forces" (NSDL, 2015).

Future Learning

Grade 3 Unit 2: Forces and Motion

- Each force acts on one particular object and has both strength and a direction. An object at rest typically has multiple forces acting on it, but they add to give zero net force on the object. Forces that do not sum to zero can cause changes in the object's speed or direction of motion. *(Boundary: Qualitative and conceptual, but not quantitative addition of forces are used at this level.)*
- The patterns of an object's motion in various situations can be observed and measured; when that past motion exhibits a regular pattern, future motion can be predicted from it. (Boundary: Technical terms, such as magnitude, velocity, momentum, and vector quantity, are not introduced at this level, but the concept that some quantities need both size and direction to be described is developed.)
- Each force acts on one particular object and has both strength and direction. An object at rest typically has multiple forces acting on it, but they add to give zero net force on the object. Forces that do not sum

to zero can cause changes in the object's speed or direction of motion. (Boundary: Qualitative and conceptual, but not quantitative, addition of forces is used at this level.)

- The patterns of an object's motion in various situations can be observed and measured; when that past motion exhibits a regular pattern, future motion can be predicted from it. (Boundary: Technical terms, such as magnitude, velocity, momentum, and vector quantity, are not introduced at this level, but the concept that some quantities need both size and direction to be described is developed.)
- Objects in contact exert forces on each other.
- Electric and magnetic forces between a pair of objects do not require that the objects be in contact. The sizes of the forces in each situation depend on the properties of the objects and their distances apart and, for forces between two magnets, on their orientation relative to each other.

Grade 4 Unit 5: Transfer of Energy

- Energy can be moved from place to place by moving objects or through sound, light, or electric currents.

Connections to Other Units
N/A

Appendix A: NGSS and Foundations for the Unit
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. *[Clarification Statement: Examples of pushes or pulls could include a string attached to an object being pulled, a person pushing an object, a person stopping a rolling ball, and two objects colliding and pushing on each other.]* [Assessment Boundary: Assessment is limited to different relative strengths or different directions, but not both at the same time. Assessment does not include non-contact pushes or pulls such as those produced by magnets.*]* **(K-PS2-1)**
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. *[Clarification Statement: Examples of problems requiring a solution could include having a marble or other object move a certain distance, follow a particular path, and knock down other objects. Examples of solutions could include tools such as a ramp to increase the speed of the object and a structure that would cause an object such as a marble or ball to turn.]* [Assessment Boundary: Assessment does not include friction as a mechanism for change in speed.*]* **(K-PS2-2)**
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. (K-2-ETS1-1)

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Planning and Carrying Out Investigations • With guidance, plan and conduct an investigation in collaboration with peers. (K-PS2-1) **Analyzing and Interpreting Data**	**PS2.A: Forces and Motion** • Pushes and pulls can have different strengths and directions. (K-PS2-1), (K-PS2-2) • Pushing or pulling on an object can change the speed or direction of its motion and can	**Cause and Effect** • Simple tests can be designed to gather evidence to support or refute student ideas about causes. (K-PS2-1), (K-PS2-2) **Structure and Function**

• Analyze data from tests of an object or tool to determine if it works as intended. (K-PS2-2) **Asking Questions and Defining Problems** • Ask questions based on observations to find more information about the natural and/or designed world(s). (K-2-ETS1-1) • Define a simple problem that can be solved through the development of a new or improved object or tool. (K-2-ETS1-1) **Developing and Using Models** • Develop a simple model based on evidence to represent a proposed object or tool. (K-2-ETS1-2)	start or stop it. (K-PS2-1), (K-PS2-2) **PS2.B: Types of Interactions** • When objects touch or collide, they push on one another and can change motion. (K-PS2-1) **PS3.C: Relationship Between Energy and Forces** • A bigger push or pull makes things speed up or slow down more quickly. *(secondary to K-PS2-1)* **ETS1.A: Defining Engineering Problems** • 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. *(secondary to K-PS2-2)* **ETS1.A: Defining and Delimiting Engineering Problems** • A situation that people want to change or create can be approached as a problem to be solved through engineering. (K-2-ETS1-1) • Asking questions, making observations, and gathering information are helpful in thinking about problems. (K-2-ETS1-1) • Before beginning to design a solution, it is important to clearly understand the problem. (K-2-ETS1-1)	• The shape and stability of structures of natural and designed objects are related to their function(s). (K-2-ETS1-1) - ***Connections to the Nature of Science*** **Scientific Investigations Use a Variety of Methods** • Scientists use different ways to study the world. (K-PS2-1)

<table>
<tr><td>Grade/ Grade Band: K</td><td>Topic: Strengths & Directions of Pushes & Pulls</td><td>Lesson # __1__ in a series of __5__ lessons</td></tr>
<tr><td colspan="3">Brief Lesson Description: Students will investigate pushes and pulls and search for objects around the room that can be pushed and/or pulled.</td></tr>
<tr><td colspan="3">Performance Expectation(s): 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. [Clarification Statement: Examples of pushes or pulls could include a string attached to an object being pulled, a person pushing an object, a person stopping a rolling ball, and two objects colliding and pushing on each other.] [Assessment Boundary: Assessment is limited to different relative strengths or different directions, but not both at the same time. Assessment does not include non-contact pushes or pulls such as those produced by magnets.]</td></tr>
<tr><td colspan="3">Specific Learning Outcomes:

At the end of this lesson students will be able to:
● Know the difference between a push and a pull
● Identify objects that can be moved and solve problems about how to move them</td></tr>
<tr><td colspan="3">Narrative / Background Information</td></tr>
<tr><td colspan="3">Prior Student Knowledge:
Students will have had previous experiences pushing/pulling a toy (car, ball, etc.) or getting pushed on a piece of playground equipment.</td></tr>
<tr><td>Science & Engineering Practices:

Planning and Carrying Out Investigations
• With guidance, plan and conduct an investigation in collaboration with peers. (K-PS2-1)

Analyzing and Interpreting Data
• Analyze data from tests of an object or tool to determine if it works as intended. (K-PS2-2)

Asking Questions and Defining Problems
• Ask questions based on observations to find more information about the natural and/or designed world(s). (K-2-ETS1-1)</td><td>Disciplinary Core Ideas:

PS2.A: Forces and Motion
• Pushes and pulls can have different strengths and directions. (K-PS2-1),(K-PS2-2)</td><td>Crosscutting Concepts:

Cause and Effect
• Simple tests can be designed to gather evidence to support or refute student ideas about causes. (K-PS2-1),(K-PS2-2)</td></tr>
</table>

Possible Preconceptions/Misconceptions:

- An object that moves can move by itself.
- Bikes move because they have wheels; people move because they have legs.
- If something is moving there must be a greater force on it.

LESSON PLAN – 5-E Model

Grade/ Grade Band: K	**Topic:** Changing Speed & Direction; Starting & Stopping	**Lesson #** __2__ **in a series of** __5__ **lessons**

Brief Lesson Description: Students will manipulate materials to create a structure that moves their marble the slowest.

Performance Expectation(s): 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. [Clarification Statement: Examples of pushes or pulls could include a string attached to an object being pulled, a person pushing an object, a person stopping a rolling ball, and two objects colliding and pushing on each other.] [*Assessment Boundary: Assessment is limited to different relative strengths or different directions, but not both at the same time. Assessment does not include non-contact pushes or pulls such as those produced by magnets.*]

Specific Learning Outcomes:

At the end of this lesson students will be able to:

- Determine that that pushes and pulls can change the speed and direction of objects
- Identify which pieces of their marble run structure changed the speed and direction of their marble

Narrative / Background Information

Prior Student Knowledge:

- Objects can be pushed or pulled.
- All objects fall.
- How to determine cause/effect relationships.
-

Science & Engineering Practices:	**Disciplinary Core Ideas:**	**Crosscutting Concepts:**
Planning and Carrying Out Investigations • With guidance, plan and conduct an investigation in collaboration with peers. (K-PS2-1) **Analyzing and Interpreting Data** • Analyze data from tests of an object or tool to determine if it works as intended. (K-PS2-2) **Asking Questions and Defining Problems** • Ask questions based on observations to find more	**PS2.A: Forces and Motion** • Pushes and pulls can have different strengths and directions. (K-PS2-1),(K-PS2-2) • Pushing or pulling on an object can change the speed or direction of its motion and can start or stop it. (K-PS2-1),(K-PS2-2)	**Cause and Effect** • Simple tests can be designed to gather evidence to support or refute student ideas about causes. (K-PS2-1),(K-PS2-2) **Structure and Function** • The shape and stability of structures of natural and designed objects are related to their function(s). (K-2-ETS1-1)

information about the natural and/or designed world(s). (K-2-ETS1-1) • Define a simple problem that can be solved through the development of a new or improved object or tool. (K-2-ETS1-1) **Developing and Using Models** • Develop a simple model based on evidence to represent a proposed object or tool. (K-2-ETS1-2)		

Possible Preconceptions/Misconceptions:

- A smaller marble will fall/roll more slowly; a larger marble will fall/roll more quickly.
- Forces cannot make something change speed or direction.
- Things fall because you let them go and they do not need a force, whereas you need a force to make things 'go up'.
- When a car brakes, the passengers experience a sudden forward force.

LESSON PLAN – 5-E Model

Grade/ Grade Band: K	**Topic:** Touch & Collide	**Lesson # __3__ in a series of __5__ lessons**

Brief Lesson Description: Students will play a game such as kickball to explore how collisions with an object can change its motion/direction.

Performance Expectation(s): 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.
[Clarification Statement: Examples of pushes or pulls could include a string attached to an object being pulled, a person pushing an object, a person stopping a rolling ball, and two objects colliding and pushing on each other.] [*Assessment Boundary: Assessment is limited to different relative strengths or different directions, but not both at the same time. Assessment does not include non-contact pushes or pulls such as those produced by magnets.*]

Specific Learning Outcomes:

At the end of this lesson students will be able to:

- Identify and explain a push and a pull.
- Explore motion and direction using a ball.
- Explore, understand, and explain how objects move or stop after they touch or collide with another object.

Narrative / Background Information

Prior Student Knowledge:

- Objects can be pushed or pulled.
- Experiences playing kickball or soccer.
- Children usually know how to stop something moving but do not attribute the stopping action to a

force in the opposite direction of the movement.

Science & Engineering Practices:	Disciplinary Core Ideas:	Crosscutting Concepts:
Planning and Carrying Out Investigations • With guidance, plan and conduct an investigation in collaboration with peers. (K-PS2-1) **Analyzing and Interpreting Data** • Analyze data from tests of an object or tool to determine if it works as intended. (K-PS2-2) **Asking Questions and Defining Problems** • Ask questions based on observations to find more information about the natural and/or designed world(s). (K-2-ETS1-1)	**PS2.B: Types of Interactions** • Pushes and pulls can have different strengths and directions. (K-PS2-1),(K-PS2-2) • When objects touch or collide, they push on one another and can change motion. (K-PS2-1)	**Cause and Effect** • Simple tests can be designed to gather evidence to support or refute student ideas about causes. (K-PS2-1),(K-PS2-2)

Possible Preconceptions/Misconceptions:

- Boys kick harder than girls; taller children kick harder than shorter children.

LESSON PLAN – 5-E Model

Grade/ Grade Band: K	**Topic:** Forces Make Things Speed Up or Slow Down	**Lesson #** __4__ **in a series of** __5__ **lessons**

Brief Lesson Description: Students will use scooters to explore how pushing on something harder or softer affect its speed and how far it travels.

Performance Expectation(s): 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.
[Clarification Statement: Examples of pushes or pulls could include a string attached to an object being pulled, a person pushing an object, a person stopping a rolling ball, and two objects colliding and pushing on each other.] [*Assessment Boundary: Assessment is limited to different relative strengths or different directions, but not both at the same time. Assessment does not include non-contact pushes or pulls such as those produced by magnets.*]

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.
[Clarification Statement: Examples of pushes or pulls could include a string attached to an object being pulled, a person pushing an object, a person stopping a rolling ball, and two objects colliding and pushing on each other.] [*Assessment Boundary: Assessment is limited to different relative strengths or different directions, but not both at the same time. Assessment does not include non-contact pushes or pulls such as those produced*

by magnets.]

Specific Learning Outcomes:

At the end of the lesson students will be able to:

- Demonstrate and discuss that force, push, and pull will impact speed.
- Demonstrates and discuss that force, push, and pull will impact distance.
- Measure distance traveled with different rates of force.

Narrative / Background Information

Prior Student Knowledge:

- Students know that if they push harder on a toy it will go faster/further, but they may not be able to understand why or explain why.

Science & Engineering Practices:	**Disciplinary Core Ideas:**	**Crosscutting Concepts:**
Planning and Carrying Out Investigations • With guidance, plan and conduct an investigation in collaboration with peers. (K-PS2-1) **Analyzing and Interpreting Data** • Analyze data from tests of an object or tool to determine if it works as intended. (K-PS2-2) **Asking Questions and Defining Problems** • Ask questions based on observations to find more information about the natural and/or designed world(s). (K-2-ETS1-1)	**PS3.C: Relationship Between Energy and Forces** • A bigger push or pull makes things speed up or slow down more quickly. *(secondary to K-PS2-1)*	**Cause and Effect** • Simple tests can be designed to gather evidence to support or refute student ideas about causes. (K-PS2-1),(K-PS2-2)

Possible Preconceptions/Misconceptions:

- If something stops moving, it's because the push wore off (there's nothing there to keep it moving).
- Forces cannot make an object stop moving.
- If an object is moving there must be a force acting on it
- If an object is stationary there are no forces acting on it

LESSON PLAN – 5-E Model

Grade/ Grade Band: K	**Topic:** Engineering Design Challenge:	**Lesson #** __5A__ **in a series of** __5__ **lessons**

	Option 1 - Milk Bottle Game	***This lesson will take place over a series of several days***
Brief Lesson Description: Students will create a contraption that launches a ping pong ball, with the goal of knocking down three cups.		
Performance Expectation(s): 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.* [Clarification Statement: Examples of problems requiring a solution could include having a marble or other object move a certain distance, follow a particular path, and knock down other objects. Examples of solutions could include tools such as a ramp to increase the speed of the object and a structure that would cause an object such as a marble or ball to turn.] [*Assessment Boundary: Assessment does not include friction as a mechanism for change in speed.*]		
Specific Learning Outcomes: **At the end of this lesson students will be able to:** ● 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. ● Follow the process established for STEM challenges (Ask, Imagine, Plan, Create, Improve). ● Work in collaboration with peers to design and build a solution to the problem presented.		
Narrative / Background Information		
Prior Student Knowledge: ● Experiences at the boardwalk or playing carnival games. ● Objects can be pushed, pulled, can change speed and direction. ● Cause and effect relationships.		
Science & Engineering Practices: **Planning and Carrying Out Investigations** • With guidance, plan and conduct an investigation in collaboration with peers. (K-PS2-1) **Analyzing and Interpreting Data** • Analyze data from tests of an object or tool to determine if it works as intended. (K-PS2-2) **Asking Questions and Defining Problems** • Ask questions based on observations to find more information about the natural and/or designed world(s). (K-2-ETS1-1) • Define a simple problem that can be solved through the development of a new or improved object or tool.	**Disciplinary Core Ideas:** **ETS1.A: Defining Engineering Problems** • 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. *(secondary to K-PS2-2)*	**Crosscutting Concepts:** **Cause and Effect** • Simple tests can be designed to gather evidence to support or refute student ideas about causes. (K-PS2-1),(K-PS2-2)

(K-2-ETS1-1) **Developing and Using Models** • Develop a simple model based on evidence to represent a proposed object or tool. (K-2-ETS1-2)		
Possible Preconceptions/Misconceptions: A force is put on a projectile when it is launched and the force gradually decreases causing the object to slow and eventually stop when the force is used up.		
LESSON PLAN – 5-E Model		

Grade/ Grade Band: K	**Topic:** Engineering Design Challenge: **Option 2 - Mini-Golf**	**Lesson #** __5B__ **in a series of** __5__ **lessons** *****This lesson will take place over a series of several days*****
Brief Lesson Description: Students will create a new hole for a mini golf course, making sure to follow guidelines and constraints.		
Performance Expectation(s): 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.* [Clarification Statement: Examples of problems requiring a solution could include having a marble or other object move a certain distance, follow a particular path, and knock down other objects. Examples of solutions could include tools such as a ramp to increase the speed of the object and a structure that would cause an object such as a marble or ball to turn.] [*Assessment Boundary: Assessment does not include friction as a mechanism for change in speed.*]		
Specific Learning Outcomes: **At the end of this lesson students will be able to:** ● 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. ● Follow the process established for STEM challenges (Ask, Imagine, Plan, Create, Improve). ● Work in collaboration with peers to design and build a solution to the problem presented.		
Narrative / Background Information		
Prior Student Knowledge: ● Experiences at a mini-golf course or watching golf on tv. ● Objects can be pushed, pulled, can change speed and direction.. ● Cause and effect relationships.		
Science & Engineering Practices: **Planning and Carrying Out Investigations** • With guidance, plan and conduct an investigation in collaboration with peers. (K-PS2-1) **Analyzing and Interpreting Data**	**Disciplinary Core Ideas:** **ETS1.A: Defining Engineering Problems** • 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.	**Crosscutting Concepts:** **Cause and Effect** • Simple tests can be designed to gather evidence to support or refute student ideas about causes. (K-PS2-1),(K-PS2-2)

• Analyze data from tests of an object or tool to determine if it works as intended. (K-PS2-2) **Asking Questions and Defining Problems** • Ask questions based on observations to find more information about the natural and/or designed world(s). (K-2-ETS1-1) • Define a simple problem that can be solved through the development of a new or improved object or tool. (K-2-ETS1-1) **Developing and Using Models** • Develop a simple model based on evidence to represent a proposed object or tool. (K-2-ETS1-2)	*(secondary to K-PS2-2)*	
Possible Preconceptions/Misconceptions:		
LESSON PLAN – 5-E Model		