# Bi-Borough Science Curriculum
# Kindergarten

## Developed 2017

In Accordance with New Jersey Student Learning Standards for Science


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## BI-BOROUGH SCIENCE CURRICULUM - KINDERGARTEN

## UNIT ONE -

*Earth & Space Science*- Weather and Climate
(First Trimester- September, October, November)

## INTRODUCTION TO THE UNIT

*(Excerpt taken from "What it Looks Like in the Classroom", NJ Model Curriculum, Grade K, Unit/s- "Weather", "Effects of Sun")*

In this unit of study, students are expected to develop an understanding of patterns and variations in local weather and the use of weather forecasting to prepare for and respond to severe weather. Throughout the unit, students will look for patterns and cause-and-effect relationships as they observe and record weather events. Students will have opportunities to ask scientific questions, analyze and interpret data, and communicate their findings to others.

In this unit of study, students learn that problem situations can be solved through engineering, and that in order to design a solution, we must first define the problem. As described in the narrative above, students define problems by asking specific questions, making observations, and gathering information that will help them understand the types of problems they might face when weather conditions exist in and around their homes, schools, and communities.

In this unit's progression of learning, students first develop an understanding that patterns in the natural world can be observed and documented, and that, like scientists, they can use these patterns as evidence to describe phenomena and make predictions. In order to observe patterns in weather, kindergartners will learn that weather is the combination of sunlight, wind, precipitation, and temperature in a particular region at a particular time. By observing and recording daily weather events—such as sunny, cloudy, rainy, and windy— students can analyze both *qualitative* and *quantitative* data. Recording and analyzing data over time will reveal recognizable weather patterns that can be used to make predictions.

Examples of weather patterns may include:

- Snow and colder temperatures generally occur in the winter.
- Clouds may bring rain or snow.
- Rain occurs more often in the spring.
- Warmer/hotter temperatures occur in the summer.
- It is generally cooler in the morning and warmer in the afternoon.

At this grade level, it is developmentally appropriate to describe temperature in relative terms; therefore, vocabulary words such as hot, warm, cool, cold, and warmer/cooler should be used to describe temperature, rather than accurately measuring and describing temperature in degrees.

Students also learn that weather events have causes that generate observable patterns over time, and that these patterns help weather scientists predict severe weather. Kindergarteners need opportunities to learn about severe weather, especially those types that tend to occur in the local region in which they live. By using a variety of media and technology, such as computers, radio, and television, and by reading grade-appropriate texts about weather and weather events, students can learn about types of severe weather that are common to their region. In addition, they come to understand that people depend on technology to help us predict and solve problems, and without it, our lives would be very different.

In order to apply their learning, students need opportunities to ask questions about weather forecasting and how it can help us prepare for and respond to different types of severe weather. When kindergartners ask questions, make observations, gather weather information, and look for patterns of change in the weather, it prepares them to think about how to best prepare for and respond to local severe weather. As part of this unit of study, students are challenged to investigate how people prepare for and solve problems caused by severe weather. With adult guidance, students should define weather problems by asking questions, making observations, and gathering information about severe weather situations.

Some questions students might want to consider include the following:

- What kinds of severe weather events tend to occur in New Jersey (e.g., thunderstorms, hurricanes, flooding, snowstorms)?
- What do people do in response to these types of severe weather events?
- What kinds of tools can people use to solve problems caused by severe weather conditions (e.g., umbrellas, sandbags, salt, gravel, shovels, snow blowers)?
- What other solutions might people use for problems caused by severe weather (e.g., closing schools and businesses; sending out emergency workers to restore

utilities; sending out early warnings; stockpiling food, water, and other supplies; having a portable generator)?
- What kinds of problems would we face if we had a lot of rain in a short period of time?
- What problems might we have if our community experienced flooding?
- What kinds of problems might occur if strong winds caused damage (e.g., knocked over trees, damaged power lines, damaged homes and businesses)?
- What kinds of precautions do people take during a hurricane? A snowstorm? A thunderstorm? Why?

In addition, in this unit of study, students investigate the effects of the sun on the surface of the Earth. Throughout the unit, students make observations in order to describe patterns of change. With adult support, they design and build a structure that will reduce the warming effect of sunlight, and then conduct tests to determine if the structure works as intended.

Scientists use different ways to study the world. In this unit's progression of learning, students work like scientists to investigate the warming effect of sunlight on the surface of the Earth. They will conduct simple investigations in order to make observations and collect data that can be used to make comparisons. Students should test a variety of materials that are found naturally on the surface of the Earth, including sand, soil, rocks, and water. Samples of each of these materials can be placed on two separate paper plates or shallow plastic containers; one container can be placed in direct sunlight, and the other can be placed out of direct sunlight. After a period of time, students should compare the relative temperature of each. Students should record their observations, then analyze and compare the data to determine if there is a pattern. They should draw the conclusion that the sun has the same warming effect on all the materials found on the surface of the Earth.

As students come to understand that the sun warms the surface of the Earth, they should engage in the engineering design process as follows:
Students are challenged to design and build a structure that will reduce the warming effects of the sun.
Students brainstorm a list of objects that reduce the warming effects of the sun (e.g., shade trees, umbrellas, large hats, canopies).
As a class, students determine what the design should be able to do (criteria). For example:
- The structure must reduce the warming effects of the sun.

- The structure should be built using materials provided by the teacher.
- The structure should be easy to carry and fit through the doorway of the classroom.

Groups of students then use simple drawings or diagrams to design a structure, and use given tools and 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 outside. (Groups can place their structures in a sunny area, then compare the relative temperature of the ground under the structure and the ground in direct sunlight.).

Students make and use observations to determine if the designs worked as intended, then compare the strengths and weaknesses of how each design performed.
While engaging in this process, students should use evidence from their observations to describe how their structures reduced the warming effect of sunlight.

Through this process, students learn that the shape and stability of structures of designed objects are related to their function. They will use tools and materials to design and build their structures. Because there is always more than one possible solution to a problem, students will test and compare their designs, then analyze data to determine if their structures work as intended.

## NEW JERSEY STUDENT LEARNING STANDARDS

## Science

### Disciplinary Core Ideas

**PS3.B: Conservation of Energy and Energy Transfer**

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

**ESS2.D: Weather and Climate**

Weather is the combination of sunlight, wind, snow or rain, and temperature in a particular region at a particular time. People measure these conditions to describe and record the weather and to notice patterns over time. (K-ESS2-1)

**ESS3.B: Natural Hazards**

Some kinds of severe weather are more likely than others in a given region. Weather scientists forecast severe weather so that the communities can prepare for and respond to these events. (K-ESS3-2)

**ETS1.A: Defining and Delimiting an Engineering Problem**

Asking questions, making observations, and gathering information are helpful in thinking about problems. (secondary to K-ESS3-2)

### 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)

### Science and Engineering Practices

**Asking Questions and Defining Problems**

Asking questions and defining problems in grades K–2 builds on prior experiences and progresses to simple descriptive questions that can be tested.

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

**Planning and Carrying Out Investigations**

Planning and carrying out investigations to answer questions or test solutions to problems in K–2 builds on prior experiences and progresses to simple investigations, based on fair tests, which provide data to support explanations or design solutions.

- Make observations (firsthand or from media) to collect data that can be used to make comparisons. (K-PS3-1)

### 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 questions. (K-ESS2-1)

### Constructing Explanations and Designing Solutions

Constructing explanations and designing solutions in K–2 builds on prior experiences and progresses to the use of evidence and ideas in constructing evidence-based accounts of natural phenomena 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)

### 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.

- Read grade-appropriate texts and/or use media to obtain scientific information to describe patterns in the natural world. (K-ESS3-2)

## Connections to Engineering, Technology, and Applications of Science

### Interdependence of Science, Engineering, and Technology

- People encounter questions about the natural world every day. (K-ESS3-2)

### Influence of Engineering, Technology, and Science on Society and the Natural World

- People depend on various technologies in their lives; human life would be very different without technology. (K-ESS3- 2)

## Connections to Nature of Science

### Scientific Investigations Use a Variety of Methods

- Scientists use different ways to study the world. (K-PS3-1)

### Science Knowledge is Based on Empirical Evidence

- Scientists look for patterns and order when making observations about the world. (K-ESS2-1)

## NEW JERSEY STUDENT LEARNING STANDARDS

## Connections to:

**Technology** http://www.state.nj.us/education/cccs/2014/tech/

- **8.1** Educational Technology: All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.
- **8.2** Technology Education, Engineering, Design, and Computational Thinking -

  Programming: All students will develop an understanding of the nature and impact of technology, engineering, technological design, computational thinking and the designed world as they relate to the individual, global society, and the environment.

**ELA** http://www.state.nj.us/education/aps/cccs/lal/

Reading - Informational Text

- **RI.K.1** With prompting and support, ask and answer questions about key details in a text (e.g., who, what, where, when, why, how) (K-ESS3-2)
- **RI.K.3** With prompting and support, describe the connection between two individuals, events, ideas, or pieces of information in a text

Writing

- **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),(K-ESS3-3)
- **W.K.7** Participate in shared research and writing projects (K-LS1-1)
- **W.K.8** With guidance and support from adults, recall information from experiences or gather information from provided sources to answer a question.

Speaking and Listening

- **SL.K.1** Participate in collaborative conversations with diverse partners about kindergarten topics and texts with peers and adults in small

and larger groups

- **SL.K.2** Confirm understanding of a text read aloud or information presented orally or through other media by asking and answering questions about key details and requesting clarification if something is not understood
- **SL.K.3** Ask and answer questions in order to seek help, get information, or clarify something that is not understood
- **SL.K.5** (Presentation of knowledge or skills) 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

**Mathematics** http://www.state.nj.us/education/aps/cccs/math/

Mathematical Practices

- **MP.2** Reason abstractly and quantitatively. (K-ESS2-1)
- **MP.4** Model with mathematics. (K-ESS2-1),(K-ESS3-2)

Counting and Cardinality

- **K.CC** Counting and Cardinality (K-ESS3-2)
- **K.CC.A** Know number names and the count sequence. (K-ESS2-1)

Measurement and Data

- **K.MD.A.1** Describe measurable attributes of objects, such as length or weight. Describe several measurable attributes of a single object (K-ESS2-1)
- **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-PS3-1),(K- PS3-2)
- **K.MD.B.3** Classify objects into given categories; count the number of objects in each category and sort the categories by count (K-ESS2-1)

**21st Century Life and Careers** http://www.state.nj.us/education/aps/cccs/career/

- **9.3.12.AC.2** Use architecture and construction skills to create and manage a project
- **9.3.12.AC-DES.1** Justify design solutions through the use of research documentation and analysis of data
- **9.3.12.AC-DES.2** Use effective communication skills and strategies (listening, speaking, reading, writing and graphic communications) to work with clients and colleagues
- **9.3.12.AC-DES.6** Apply the techniques and skills of modern drafting, design,

engineering, and construction to projects

## BIG IDEA/COMMON THREAD

Patterns and variations exist in local weather. The purpose of weather forecasting is to prepare for, and respond to, severe weather.

## ENDURING UNDERSTANDINGS

- Sunlight warms Earth's surface
- Weather is the combination of sunlight, wind, snow or rain, and temperature in a particular region and time
- People record weather patterns over time
- In a region, some kinds of severe weather are more likely than others
- Forecasts allow communities to prepare for severe weather

## ESSENTIAL QUESTIONS

- How can we observe and record patterns in weather conditions over time?
- How does weather forecasting help to keep people safe?
- How does sunlight affect the earth's surface?

## ASSESSMENT

- Teacher observations, conferences
- Hands-on lab experiences
- Student science notebook/journal entries
- Formative assessments*

*Formative assessment refers to a range of formal and informal assessment procedures conducted by teachers during the learning process in order to modify teaching and learning activities to improve student attainment.

## UNIT OBJECTIVES

**Students will be able to …**

- Make observations to determine the effect of sunlight on Earth's surface. (K-PS3-1.)

  [Clarification Statement: Examples of Earth's surface could include sand, soil, rocks, and water]

  [Assessment Boundary: Assessment of temperature is limited to relative measures such as warmer/cooler.]

Disciplinary Core Ideas

- Understand that sunlight warms the Earth's surface.

Crosscutting Concepts

- Recognize that events have causes that generate observable patterns.

Science and Engineering Practices

- Make observations (firsthand or from media) to collect data that can be used to make comparisons.

**K-PS3-1**

| Concepts | Students Can... |
|---|---|
| • Sunlight warms Earth's surface.<br>• Events have causes that generate observable patterns.<br>• Scientists use different ways to study the world. | • Make observations to determine the effect of sunlight on Earth's surface.<br>Examples of Earth's surface could include:<br>▪ Sand<br>▪ Soil<br>▪ Rocks<br>▪ Water<br>• Understand that sunlight warms the earth's surface<br>• Observe patterns in events generated by cause-and-effect relationships.<br>• Make observations to make comparisons. |

**Students will be able to …**

- Use tools and materials to design and build a structure that will reduce the warming effect of sunlight on an area. (K-PS3-2. ) *

  * See Appendix A, K-2 Engineering Design

  [Clarification Statement: Examples of structures could include a small replica of an umbrella, canopy, or tent that minimize the warming effect of the sun.]

Disciplinary Core Ideas

- Understand that sunlight warms the Earth's surface.

Crosscutting Concepts

- Recognize that events have causes that generate observable patterns.

Science and Engineering Practices

- 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**

| Concepts | Students Can... |
|---|---|
| • Sunlight warms Earth's surface.<br>• Events have causes that generate observable patterns.<br>• The shape and stability of structures determines their function.<br>• Designs can be conveyed through sketches, drawings, or physical models.<br>• It is useful to compare and test designs because there is always more than one possible solution to a problem. | • Understand that sunlight warms the earth's surface, and structures may reduce the warming effect of sunlight.<br>• Observe patterns in events generated by cause-and-effect relationships.<br>• Use tools and materials provided to design and build a solution to reducing the effect of sunlight on an object or area. |

**Students will be able to…**

- Use and share observations of local weather conditions to describe patterns over time. (K-ESS2-1)

  [Clarification Statement: Examples of qualitative observations could include descriptions of the weather (such as sunny, cloudy, rainy, and warm); examples of quantitative observations could include numbers of sunny, windy, and rainy days in a month. Examples of patterns: cooler in the morning than in the afternoon, number of sunny days versus cloudy days in different months.]
  [Assessment Boundary: Assessment of quantitative observations limited to whole numbers and relative measures such as warmer/cooler.]

Disciplinary Core Ideas

- Understand that weather is the combination of sunlight, wind, snow or rain, and temperature in a particular region at a particular time.
- Understand that people measure and record these weather conditions to notice patterns over time.

Crosscutting Concepts

- Recognize that patterns in the natural world can be observed, used to describe phenomena, and used as evidence.

Science and Engineering Practices

- Use observations (firsthand or from media) to describe patterns in the natural world in order to answer scientific questions.

**K-ESS2-1**

| Concepts | Students Can... |
|---|---|
| • Weather is the combination of sunlight, wind, snow, or rain and temperature in a particular region at a particular time.<br>• People measure and record these weather conditions to notice patterns over time.<br>• Patterns in the natural world can be observed, used to describe phenomena, and used as evidence.<br>• Scientists look for patterns and order when making observations about the world. | • Understand that weather is the combination of sunlight, wind, snow, or rain and temperature in a particular region.<br>• Understand that people measure and record weather conditions to notice patterns over time.<br>• Observe and use patterns in the natural world as evidence and to describe scientific concepts.<br>• Use and share observations of local weather conditions to describe patterns over time.<br>  ○ Examples of *qualitative* |

| | |
|---|---|
| | *observations* could include descriptions of the weather, such as sunny, cloudy, windy, rainy, and warm.<br>○ Examples of *quantitative observations* could include numbers of sunny, cloudy, windy, and rainy days in a month.<br>○ Examples of *patterns* could include that it is usually cooler in the morning than in the afternoon. |

**Students will be able to…**

Ask questions to obtain information about the purpose of weather forecast in to prepare for, and respond to, severe weather. (K-ESS3-2) *

* See Appendix A, K-2 Engineering Design

[Clarification Statement: Emphasis is on local forms of severe weather.]

Disciplinary Ideas

- Understand that kinds of severe weather are more likely than others in a given region.
- Understand that weather scientists forecast severe weather so that the communities can prepare for and respond to these events.

Crosscutting Concepts

- Recognize that events have causes that generate observable patterns.

Science and Engineering Practices

- Ask questions based on observations to find more information about the designed world.

**K-ESS3-2**

| Concepts | Students Can... |
|---|---|
| • Some kinds of severe weather are more likely than others in a given region.<br>• Weather scientists forecast severe weather so that communities can prepare for and respond to these events.<br>• Events have causes that generate observable patterns.<br>• People depend on various technologies in their lives; human life would be very different without technology.<br>• Before beginning to design a solution, it is important to clearly understand the problem.<br>• A situation that people want to change or create can be approached as a problem to be | • Understand that weather scientists forecast severe weather in order for communities to prepare for events.<br>• Observe patterns in events generated by cause-and-effect relationships.<br>• Ask questions and obtain information through books and other media to describe patterns in the natural world and design world. |

| | |
|---|---|
| solved through engineering. | |

## SUGGESTED ACTIVITIES

- Record and chart daily weather patterns: temperature, cloud cover, precipitation (rain/snow). Compare the weather of different seasons.

- Make a paper plate sundial

- Make a pinwheel

- Design and build a sun structure to measure the effects of sun on the earth's surface
    - Using UV beads to test if the sun penetrated the surface
    - http://www.oradellschool.org/osnj/STAFF/Faculty%20and%20Staff/Ms.%20Denise%20Kuehner/Links%20for%20activities/

- Cloud observations

- Shaving cream rain clouds (http://onelittleproject.com/shaving-cream-rain-clouds/)

- Create a class weather vane

## UNIT VOCABULARY

**cloudy-** having many clouds in the sky

**cold-** having a very low temperature

**forecast-** using information to predict the weather

**hot-** having a very high temperature

**hurricane-** an extremely large, powerful, and destructive storm

**precipitation**- general name for water in any form falling from clouds. This includes rain, drizzle, hail, snow and sleet.

**rainy-** having a lot of rain

**shelter-** a structure that covers or protects people or things

**snowstorm-** a storm with a large amount of falling snow

**snowy-** having a lot of snow

**storm-** an occurrence of bad weather in which there is a lot of rain, snow, etc., and often strong winds

**sunny-** having plenty of bright sunlight

**temperature-** the measurement of how hot or cold something is

**thermometer-** the instrument which measures temperature

**thunderstorm-** a storm with lightning and thunder

**weather -** the temperature and other outside conditions (such as rain, cloudiness, etc.) at a particular time and place

**windy-** having a lot of wind

## RESOURCES

Exploring Science, National Geographic

Trade Books:
Snowflake Bentley by Jacqueline Briggs Martin
It Looked Like Spilt Milk by Charles G. Shaw
The Cloud Book by Tomie DePaola
Little Cloud by Eric Carle
Thunder Cake by Patricia Polacco
Sun Up, Sun Down by Gail Gibbons
Weather Words and What They Mean by Gail Gibbons
Hurricanes! by Gail Gibbons
Who Likes the Rain? by Etta Kaner
Who Likes the Sun? by Etta Kaner
Who Likes the Snow? by Etta Kaner
Who Likes the Wind? by Etta Kaner

Supplies: As per lab manuals

Websites:
http://ngss.nsta.org/AccessStandardsByTopic.aspx - The NGSS Standards, by topic
www.discoveryeducation.com - videos and lesson ideas
https://phet.colorado.edu - online simulations
https://concord.org/stem-resources - online simulations (requires Java)
http://learningcenter.nsta.org/ - background information for teachers and lesson ideas
http://ngss.nsta.org/Classroom-Resources.aspx - lesson ideas
http://sciencespot.net/Pages/refdeskNextGen.html - lesson ideas
http://www.weatherwizkids.com/ activity ideas, daily weather, experiments
http://eo.ucar.edu/webweather/ - activity ideas

## 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/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
- See NGSS Appendix D

http://www.nextgenscience.org/sites/ngss/files/Appendix%20D%20Diversity%20and%20Equity%206-14-13.pdf

## BI-BOROUGH SCIENCE CURRICULUM - KINDERGARTEN

## UNIT TWO -

*Physical Science*- Forces and Interactions: Pushes and Pulls
(Second Trimester- December, January, February)

## INTRODUCTION

*(Excerpt taken from "What it Looks Like in the Classroom", NJ Model Curriculum, Grade K, Unit- "Pushes and Pulls")*

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.

## NEW JERSEY STUDENT LEARNING STANDARDS

## Science

### Disciplinary Core Ideas

**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)

**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.

**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)

### Science and Engineering Practices

**Planning and Carrying Out Investigations**

Planning and carrying out investigations to answer questions or test solutions to problems in K–2 builds on prior experiences and progresses to simple investigations, based on fair tests, which provide data to support explanations or

design solutions.
- With guidance, plan and conduct an investigation in collaboration with peers. (K-PS2-1)

### Analyzing and Interpreting Data

Analyzing data in K–2 builds on prior experiences and progresses to collecting, recording, and sharing observations.
- Analyze data from tests of an object or tool to determine if it works as intended. (K-PS2-2)

## Connections to the Nature of Science

**Scientific Investigations Use a Variety of Methods**

- Scientists use different ways to study the world. (K-PS2-1)

## NEW JERSEY STUDENT LEARNING STANDARDS

## Connections to:

**Technology** http://www.state.nj.us/education/cccs/2014/tech/

- **8.1** Educational Technology: All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.
- **8.2** Technology Education, Engineering, Design, and Computational Thinking -

  Programming: All students will develop an understanding of the nature and impact of technology, engineering, technological design, computational thinking and the designed world as they relate to the individual, global society, and the environment.

**ELA** http://www.state.nj.us/education/aps/cccs/lal/

Reading - Informational

- **RI.K.1** With prompting and support, ask and answer questions about key details in a text. (e.g., who, what, where, when, why, how). (K-PS2-2)

Writing

- **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.
- **W.K.7** Participate in shared research and writing projects (K-PS2-1)

Speaking and Listening

- **SL.K.1** Participate in collaborative conversations with diverse partners about kindergarten topics and texts with peers and adults in small and larger groups
- **SL.K.2** Confirm understanding of a text read aloud or information presented orally or through other media by asking and answering questions about key details and requesting clarification if something is not understood
- **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** (Presentation of knowledge or skills) 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

**Mathematics** http://www.state.nj.us/education/aps/cccs/math/

Mathematical Practices

- **MP.2** Reason abstractly and quantitatively. (K-PS2-1)
- **MP.5** Uses appropriate tools strategically.

Measurement and Data

- **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)
- **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-PS2-1)

**21st Century Life and Careers** http://www.state.nj.us/education/aps/cccs/career/

- **9.3.12.AC.2** Use architecture and construction skills to create and manage a project.
- **9.3.12.AC-DES.1** Justify design solutions through the use of research documentation and analysis of data.
- **9.3.12.AC-DES.2** Use effective communication skills and strategies (listening, speaking, reading, writing and graphic communications) to work with clients and colleagues.

- **9.3.12.AC-DES.6** Apply the techniques and skills of modern drafting, design, engineering, and construction to projects.

## BIG IDEA/COMMON THREAD

Different strengths or different directions of pushes and pulls have an effect on the motion of an object.

## ENDURING UNDERSTANDINGS

Pushes and pulls can have different strengths and directions, can change the speed or direction of its motion, or can start or stop an object.

## ESSENTIAL QUESTIONS

- What happens if you push or pull an object harder?
- How can you design a simple way to change the speed or direction of an object?

## ASSESSMENT

- Teacher observations, conferences
- Hands-on lab experiences
- Student science notebook/journal entries
- Formative assessments*

*Formative assessment refers to a range of formal and informal assessment procedures conducted by teachers during the learning process in order to modify teaching and learning activities to improve student attainment.

## UNIT OBJECTIVES

**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. (K-PS2-1)

  [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.]

Disciplinary Ideas

- Understand 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, they push on one another and can change motion.

Crosscutting Concepts

- Recognize that simple tests can be designed to gather evidence to support or refute student ideas about causes.

Science and Engineering Practices

- Plan and carry out investigations to answer questions or test solutions to problems in K–2 builds on prior experiences and progresses to simple investigations, based on fair tests, which provide data to support explanations or design solutions. With guidance, plan and conduct an investigation in collaboration with peers.

**K-PS2-1**

| Concepts | Students Can... |
|---|---|
| ● Pushes and pulls can have different strengths and directions.<br>● Pushing or pulling on an object can change the speed or direction of its motion and can start or stop it.<br>● When objects touch or collide, they push on one another and can change motion.<br>● A bigger push or pull makes things speed up or slow down more quickly.<br>● Simple tests can be designed to gather evidence to support or refute student ideas about causes | ● Notice the effects of pushes and pulls<br>● With guidance, design simple tests to gather evidence to support or refute ideas about cause-and-effect relationships.<br>● With guidance, collaboratively plan and conduct an investigation with peers to compare the effects of different strengths or different directions of pushes and pulls on the motion of an object.<br>● Some examples of pushes and pulls on the motion of an object could include:<br>○ A string attached to an object being pulled.<br>○ A person pushing an object.<br>○ A person stopping a rolling ball.<br>○ Two objects colliding and pushing on each other. |

**Students will be able to…**

- 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. (K-PS2-2)
  [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.]

Disciplinary Ideas

- Understand 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.

Crosscutting Concepts

- Recognize that simple tests can be designed to gather evidence to support or refute student ideas about causes.

Science and Engineering Practices

- Analyze data from tests of an object or tool to determine if it works as intended.

**K-PS2-2**

| Concepts | Students Can... |
|---|---|
| • Pushes and pulls can have different strengths and directions.<br>• Pushing or pulling on an object can change the speed or direction of its motion and can start or stop it.<br>• Simple tests can be designed to gather evidence to support or refute student ideas about cause<br>• Because there is always more than one possible solution to a problem, | • Determine whether a design solution works as intended to change the speed or direction of an object with a push or a pull.<br>  ○ 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.<br>  ○ Examples of solutions could |

| | |
|---|---|
| it is useful to compare and test designs. | 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.<br>● With guidance, design simple tests to gather evidence to support or refute ideas about cause-and-effect relationships.<br>● Analyze data from tests of an object/s designed to solve the same problem to compare the strengths and weaknesses of how each performs. |

## SUGGESTED ACTIVITIES

- "Cross the Finish Line" (p.12) Students will blow into a straw and record how many puffs it takes to cross a paperclip and a wooden block over a finish line.
    - http://www.harmonydc.org/Curriculum/pdf/kindersample.pdf

- Students bring their own objects in and explore how they move- sort objects by the way they move (push, pull, roll, slide, battery-powered, etc.)

- Push and pull game
    - http://www.bbc.co.uk/schools/scienceclips/ages/5_6/pushes_pulls.shtml -

- Push Pull-Changing Direction: Students investigate the interactions between colliding objects using pushes and pulls. Students play a game of kickball and observe how the ball is pushed, pulled, started, stopped, or collided with other objects and how it changed position and speed. As a group, students will then brainstorm about other objects being pushed, pulled or colliding and then choose one of those objects to investigate.
    - http://ngss.nsta.org/Resource.aspx?ResourceID=129

- Marble Roll: This is an assessment probe from the book Uncovering Student Ideas in Primary Science Vol. 1 that is used to elicit children's descriptions of motion. The probe is designed to reveal how students describe the path of a moving object as it leaves a winding track.
    - http://ngss.nsta.org/Resource.aspx?ResourceID=211

- Roller Coaster: There are two parts to this lesson from the book More Picture Perfect Science Lessons. In the first part learners explore ways to change the speed and direction of a rolling object by building roller coasters out of pipe insulation after reading the book, Roller Coaster by Marla Frazee. In the second part students read I Fall Down by Vicki Cobb and then investigate the idea that

gravity affects all objects equally by conducting dropping races with everyday items.
    - http://ngss.nsta.org/Resource.aspx?ResourceID=227

- Ramps 2: Ramp Builder: This is a multi-day lesson plan that has students design, build, and test their own ramps. Students are introduced to a variety of materials and explore putting them together. Students engage in an inquiry-based learning experience to reinforce math, science, and technology. They create plans for ramps by evaluating a variety of materials provided to them.
    - http://ngss.nsta.org/Resource.aspx?ResourceID=457

- School wide Scavenger Hunt for Pushes and Pulls: School-wide push or pull hunt using common objects around school. Students and/or teacher takes photographs of objects. Student sort the objects into push or pull.

- Soda Bottle Bowling (Push): Children experiment with pushing a ball hard and with less force to knock over soda bottles. They can compare a big push to a small push. What kind of push made the ball move the fastest? They will see how when objects collide (ball and soda bottle), they push on one another and can change motion. (an investigation of colliding objects)

- Dominoes - Students create and design a domino run.

## UNIT VOCABULARY

**bump -** to hit against an object in a sudden and forceful way

**backward** - toward what is behind

**collide -** to hit or crash

**direction -** the line or course on which something moves.

**force -** a push or pull

**forward** - toward what is ahead

**gravity -** a force that pulls things to Earth

**motion -** the action or process of moving or being moved

**pull -** when you make things move towards you. Pulling is a force.

**push** - when you make things move away from you. Pushing is a force.

**ramp -** a sloping surface which can change the speed of an object

**rolling -** moving by turning over and over

**slope -** ground that slants downward or upward

**speed -** how fast things move

**start -** to begin moving

**stop -** to not move

## RESOURCES

*Exploring Science*, National Geographic

Trade Books:
Motion by Darlene Stile
Push and Pull by Lola M. Schaefer
And Everyone Shouted, "Pull!" by Clare Llewellyn
Move It! by Adrienne Mason
Newton and Me by Lynne Mayer
Give It a Push! Give It a Pull!: A Look at Forces by Jennifer Boothroyd

Supplies: As per lab manuals

Websites:
http://ngss.nsta.org/AccessStandardsByTopic.aspx - The NGSS Standards, by topic
www.discoveryeducation.com - videos and lesson ideas
www.opened.com - background information for teachers and lesson ideas
http://learningcenter.nsta.org/ - background information for teachers and lesson ideas
http://ngss.nsta.org/Classroom-Resources.aspx - lesson ideas
http://sciencespot.net/Pages/refdeskNextGen.html - lesson ideas
http://www.bbc.co.uk/schools/scienceclips/ages/5_6/pushes_pulls.shtml - push and pull game
https://jr.brainpop.com/ - videos for students, assessments, educational games

## 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 principles
    - http://www.cast.org/our-work/about-udl.html#.VXmoXcfD_UA
- See NGSS Appendix D

http://www.nextgenscience.org/sites/ngss/files/Appendix%20D%20Diversity%20and%20Equity%206-14-13.pdf

## BI-BOROUGH SCIENCE CURRICULUM - KINDERGARTEN

## UNIT THREE -

*Life Science*- Interdependent Relationships in Ecosystems:
Animals, Plants, and their Environment
(Third Trimester- March, April, May, June)

## INTRODUCTION

*(Excerpt taken from "What it Looks Like in the Classroom", NJ Model Curriculum, Grade K, Unit- "Basic Needs of Living Things')*

Begin: "Kid Questions"

- How can you tell if something is alive?
- What do living things need to survive?
- Where do organisms live and why do they live there?

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 a living thing can change its environment to meet its needs.

## NEW JERSEY STUDENT LEARNING STANDARDS

## Science

### 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 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)

**ESS3.C: Human Impacts on Earth Systems**

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. (secondary to K-ESS2-2),(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)

### Crosscutting Concepts

**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-ESS2-2),(K-ESS3-1)

## Science and Engineering Practices

### 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 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 ideas 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)

## 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)

## NEW JERSEY STUDENT LEARNING STANDARDS

## Connections to:

**Technology** http://www.state.nj.us/education/cccs/2014/tech/

- **8.1** Educational Technology: All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.

- **8.2** Technology Education, Engineering, Design, and Computational Thinking -

  Programming: All students will develop an understanding of the nature and impact of technology, engineering, technological design, computational thinking and the designed world as they relate to the individual, global society, and the environment.

**ELA** http://www.state.nj.us/education/aps/cccs/lal/

Reading

- **RI.K.1** With prompting and support, ask and answer questions about key details in a text. (e.g., who, what, where, when, why, how). (K-ESS2-2)

Writing

- **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),(K-ESS3-3)
- **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)

Speaking and Listening

- **SL.K.1** Participate in collaborative conversations with diverse partners

about kindergarten topics and texts with peers and adults in small and larger groups

- **SL.K.2** Confirm understanding of a text read aloud or information presented orally or through other media by asking and answering questions about key details and requesting clarification if something is not understood
- **SL.K.3** Ask and answer questions in order to seek help, get information, or clarify something that is not understood
- **SL.K.5** (Presentation of knowledge or skills) 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

**Mathematics** http://www.state.nj.us/education/aps/cccs/math/

Mathematical Practices

- **MP.2** Reason abstractly and quantitatively. (K-ESS3-1)
- **MP.4** Model with mathematics. (K-ESS3-1)

Counting and Cardinality

- **K.CC** Counting and Cardinality (K-ESS3-1)

Measurement and Data

- **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)

**21st Century Life and Careers** http://www.state.nj.us/education/aps/cccs/career/

- **9.3.12.AC-DES.1** Justify design solutions through the use of research documentation and analysis of data.
- **9.3.12.AC-DES.2** Use effective communication skills and strategies (listening, speaking, reading, writing and graphic communications) to work with clients and colleagues.
- **9.3.12.AG-NR.2** Analyze the interrelationships between natural resources and humans.
- **9.3.12.AG-PL.2** Apply the principles of classification, plant anatomy and plant physiology to plant production and management.
- **9.3.12.ED.2** Demonstrate effective oral, written and multimedia

communication in multiple formats and contexts.

## BIG IDEA/COMMON THREAD

Plants and animals need basic elements to survive, and they rely on where they live.

## ENDURING UNDERSTANDINGS

- Animals obtain food they need from plants and/or other animals.
- Plants and animals can change their local environment.
- 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.
- Things people do can affect the environment, but they can make choices to reduce their impacts.
- Designs can be conveyed through sketches, drawings, or physical models.

## ESSENTIAL QUESTIONS

- Where do animals and plants live and why do they live there?
- How can people take care of the Earth?

## ASSESSMENT

- Teacher observations, conferences
- Hands-on lab experiences
- Student science notebook/journal entries
- Formative assessments*

  *Formative assessment refers to a range of formal and informal assessment procedures conducted by teachers during the learning process in order to modify teaching and learning activities to improve student attainment.

## UNIT OBJECTIVES

**Students will be able to …**

- Use observations to describe patterns of what plants and animals (including humans) need to survive. (K-LS1-1)

  [*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.]

Disciplinary Ideas

- Understand that 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.

Crosscutting Concepts

- Recognize that patterns in the natural and human designed world can be observed and used as evidence.

Science and Engineering Practices

- Use observations (firsthand or from media) to describe patterns in the natural world in order to answer scientific questions.

**K-LS1-1**

| Concepts | Students Can... |
|---|---|
| • Plants need water and light to live and grow.<br>• Patterns in the natural and human-designed world can be observed and used as evidence.<br>• Scientists look for patterns and order when making observations about the world. | • Use observations to describe patterns of what plants need to survive.<br>Examples of patterns could include:<br>○ All plants require light<br>○ All living things need water<br>• Use observations to describe patterns in what animals need to survive.<br>Examples of patterns could include:<br>○ Animals need to take in food, but |

| | |
|---|---|
| | plants do not<br>○ Different kinds of food are needed by different types of animals<br>○ All living things need water<br>● Observe and use patterns in the natural world as evidence.<br>● Use observations to describe patterns in the natural world in order to answer scientific questions. |

**Students will be able to …**

- Construct an argument supported by evidence for how plants and animals (including humans) can change the environment to meet their needs. (K-ESS2-2)

  [*Clarification Statement:* Examples of plants/animals changing their environment could include a squirrel digs in the ground to hide its food and tree roots can break concrete.]

Disciplinary Core Ideas

- Understand that plants and animals can change their environment.

Crosscutting Concepts

- Recognize that systems in the natural and designed world have parts that work together.

Science and Engineering Practices

- Construct an argument with evidence to support a claim.

**K-ESS2-2**

| Concepts | Students Can... |
|---|---|
| ● Plants can change their environments.<br>● People can make choices that reduce their impacts on the land, water, air, and other living things.<br>● Systems in the natural and designed world have parts that work together. | ● Understand that plants and animals can change their environment<br>● Observe that systems in the natural and designed world have parts that work together.<br>● Use a model to represent relationships between the needs of different plants and the places they live in the natural world.<br>Examples of relationships could include:<br>● Tree roots often break concrete to |

| | |
|---|---|
| | continue to grow<br>● Flowers will turn toward the sun |

**Students will be able to …**

- Use a model to represent the relationship between the needs of different plants or animals (including humans) and the places they live. (K-ESS3-1)
  [*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.]

Disciplinary Ideas

- Understand that 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.

Crosscutting Concepts

- Recognize that systems in the natural and designed world have parts that work together.

Science and Engineering Practices

- Use a model to represent relationships in the natural world.

**K-ESS3-1**

| Concepts | Students Can... |
|---|---|
| ● Living things need water, air, and resources from the land, and they live in places that have the things they need.<br>● Systems in the natural and designed world have parts that work together.<br>● Models can be used to represent relationships in the natural world. | ● Understand that plants and animals can change their environment.<br>● Observe that systems in the natural and designed world have parts that work together.<br>● Use a model to represent the relationships between the needs of different animals and the places |

| | |
|---|---|
| | they live in the natural world.<br>Examples of relationships could include:<br>● Deer eat buds and leaves from their environment. |

**Students will be able to …**

- Communicate solutions that will reduce the impact of humans on the land, water, air, and/or other living things in the local environment. (K-ESS3-3)
  [*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.]

Disciplinary Ideas

- Understand that the 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.
- Understand that 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.

Crosscutting Concepts

- Recognize that events have causes that generate observable patterns.

Science and Engineering Practices

- Communicate solutions with others in oral and/or written forms using models and/or drawings that provide detail about scientific ideas.

**K-ESS3-3**

| Concepts | Students Can... |
|---|---|
| ● Things that people do to live comfortably can affect the world around them.<br>● People can make choices that reduce their impacts on the land, water, air, and other living things. | ● Communicate solutions that will reduce the impact of humans on the land, water, air, and/or other living things in the local environment, such as recycling.<br>● Observe patterns in events |

| | |
|---|---|
| • Events have causes that generate observable patterns.<br>• Designs can be conveyed through sketches, drawings, or physical models.<br>• A situation that people want to change or create can be approached as a problem to be solved through engineering.<br>• Asking questions, making observations, and gathering information are helpful in thinking about problems. | generated due to cause-and-effect relationships.<br>• Communicate solutions with others in oral and/or written forms (drawings).<br>• Ask questions, make observations, and gather information about a situation that people want to change.<br>• Define a simple problem that can be solved through the development of a new or improved object or tool. |

## SUGGESTED ACTIVITIES

- Science journal/notebook- to record data

- Planting seeds and experimenting with plant needs (growing a plant in the sunlight vs. the dark)

- Read-Aloud Lesson: Where Do Polar Bears Live? (http://www.readworks.org/lessons/gradek/where-do-polar-bears-live/paired-text-questions) Students identify and recall characteristics that allow polar bears to survive in the extremely cold Arctic environment.

- BrainPop Jr. - Animals, Plants, Habitats, Conservation

- The Needs of Living Things http://nj.pbslearningmedia.org/resource/tdc02.sci.life.colt.lp_stayalive/the-needs-of-living-things/ : Students learn about what plants and animals need to survive and how habitats support those needs. They also learn about how organisms can change their environment.

- Living Things and Their Needs http://www.bioedonline.org/lessons-and-more/teacher-guides/living-things-and-their-needs/ : This 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.

- Paper Towel Plants http://nj.pbslearningmedia.org/resource/lsps07.sci.life.gen.cgtowelplant/paper-towel-plants/ : 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-lit place.

- Compare and Contrast pictures of different animals- How are they alike/different?

- Design and/or build a bird feeder using natural or recycled materials
- Design and/or create something useful using recycled materials.

## UNIT VOCABULARY

**animal -** a living thing that has movement and basic needs of food, water, air, and space to live

**earth -** the planet on which we live; the world; soil

**environment -** the surroundings or conditions in which a person, animal, or plant lives or operates

**food -** any nutritious substance that people or animals eat or drink, or that plants absorb, in order to maintain life and growth

**habitat -** the natural home or environment of an animal, plant, or other organism

**natural resources -** something found in nature that can be used by people

**plant -** a living thing with basic needs of nutrients, sunlight, water, air, and space

**pollute -** contaminate water, air, or a place with harmful or poisonous substances

**recycle -** to make something new from something that has been used before

**survive** - continue to live

## RESOURCES

*Exploring Science*, National Geographic

Trade Books:
The Tiny Seed by Eric Carle
From Seed to Plant Gail Gibbons
Planting a Rainbow by Lois Ehlert
Oh Say Can You Seed by Bonnie Worth
The Giving Tree by Shel Silverstein
A House is a House for Me Eric Carle

Supplies: As per lab manuals

Websites:
http://ngss.nsta.org/AccessStandardsByTopic.aspx - The NGSS Standards, by topic
www.discoveryeducation.com - videos and lesson ideas
www.opened.com - background information for teachers and lesson ideas
http://learningcenter.nsta.org/ - background information for teachers and lesson ideas
http://ngss.nsta.org/Classroom-Resources.aspx - lesson ideas
http://sciencespot.net/Pages/refdeskNextGen.html - lesson ideas
http://brainpopjr.com

## 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 principles
    - http://www.cast.org/our-work/about-udl.html#.VXmoXcfD_UA
- See NGSS Appendix D
    - http://www.nextgenscience.org/sites/ngss/files/Appendix%20D%20Diversity%20and%20Equity%206-14-13.pdf

# Appendix A
# K-2 Engineering Design Standards

Students who demonstrate understanding can:
**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-2-ETS1-2.** Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.

**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.

## Disciplinary Core Ideas

### 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)

### 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)

## Science and Engineering Practices

### Asking Questions and Defining Problems

Asking questions and defining problems in K–2 builds on prior experiences and progresses to simple descriptive questions.

- Ask questions based on observations to find more information about the natural and/or designed world. (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

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.

- Develop a simple model based on evidence to represent a proposed object or tool. (K-2-ETS1-2)

### Analyzing and Interpreting Data

Analyzing data in K–2 builds on prior experiences and progresses to collecting, recording, and sharing observations.

- Analyze data from tests of
- an object or tool to determine if it works as intended. (K-2-ETS1-3)

## Crosscutting Concepts

### Structure and Function

- The shape and stability of structures of natural and designed objects are related to their function(s). (K-2- ETS1-2)