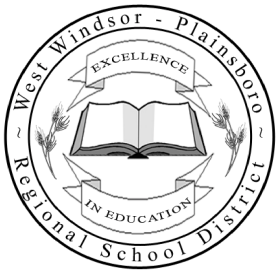


West Windsor-Plainsboro Regional School District
Science Curriculum
Grade 3 - Force, Motion, and Magnets

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.
  - Cultivate an inclusive and diverse community where all learners are welcomed, valued, respected, and celebrated.

Force, Motion and Magnets

Unit Summary

How do equal and unequal forces on an object affect the object?

In this unit of study, students are able to determine the effects of balanced and unbalanced forces on the motion of an object. The crosscutting concepts of patterns and cause and effect are identified as organizing concepts for these disciplinary core ideas. In the third-grade performance expectations, students are expected to demonstrate grade-appropriate proficiency by planning and carrying out investigations. Students are expected to use these practices to demonstrate understanding of the core ideas.

How can we use our understanding about magnets to solve problems?

In this unit of study, students determine the effects of balanced and unbalanced forces on the motion of an object and the cause-and-effect relationships of electrical or magnetic interactions to define a simple design problem that can be solved with magnets. The crosscutting concept of cause and effect, and the interdependence of science, engineering, and technology, and the influence of engineering, technology, and science on society and the natural world are called out as organizing concepts for these disciplinary core ideas. Students are expected to demonstrate grade-appropriate proficiency in asking questions and defining problems. Students are also expected to use these practices to demonstrate understanding of the core ideas.

This unit is based on 3-PS2-3, 3-PS2-4, and 3-5-ETS1-1.

Student Learning Performance Objectives

Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object. *[Clarification Statement: Examples could include an unbalanced force on one side of a ball can make it start moving; and, balanced forces pushing on a box from both sides will not produce any motion at all.]* [Assessment Boundary: Assessment is limited to one variable at a time: number, size, or direction of forces. Assessment does not include quantitative force size, only qualitative and relative. Assessment is limited to gravity being addressed as a force that pulls objects down.*]* **(3-PS2-1)**

Make observations and/or measurements of an object's motion to provide evidence that a pattern can be used to predict future motion. *[Clarification Statement: Examples of motion with a predictable pattern could include a child swinging in a swing, a ball rolling back and forth in a bowl, and two children on a see-saw.]* [Assessment Boundary: Assessment does not include technical terms such as period and frequency.*]* **(3-PS2-2)**

Ask questions to determine cause and effect relationships of electric or magnetic interactions between two objects not in contact with each other. *[Clarification Statement: Examples of an electric force could include the force on hair from an electrically charged balloon and the electrical forces between a charged rod and pieces of paper; examples of a magnetic force could include the force between two permanent magnets, the force between an electromagnet and steel paperclips, and the force exerted by one magnet versus the force exerted by two magnets. Examples of cause and effect relationships could include how the distance between objects affects strength of the force and how the orientation of magnets affects the direction of the magnetic force.] [Assessment Boundary: Assessment is limited to forces produced by objects that can be manipulated by students, and electrical interactions are limited to static electricity.]* **(3-PS2-3)**

Define a simple design problem that can be solved by applying scientific ideas about magnets.* *[Clarification Statement: Examples of problems could include constructing a latch to keep a door shut and creating a device to keep two moving objects from touching each other.]* **(3-PS2-4)**

Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost. (3-5-ETS1-1)

English Language Arts

In order to integrate the CCSS for English language arts, students will need opportunities to read about inherited traits of animals and plants in a variety of texts and resources. During discussions, teachers might pose questions such as “What kinds of traits are passed on from parent to offspring?” or “What environmental factors might influence the traits of a specific organism?” Students should be able to refer specifically to the text when answering questions, articulate the main idea, and describe the key ideas using supporting details in their explanations. Additionally, they should describe the relationship between scientific ideas or concepts, using language that pertains to time, sequence, and cause and effect.

During this unit, students also need opportunities to write informative/explanatory texts to convey ideas and information gathered through investigations and from other resources. For example, after reading texts about a given organism, students should be expected to use key details and appropriate facts about that organism to compose an informative piece of writing. This piece should list some of the organism’s traits that were passed on from its parents, describe how those traits enable the organism to interact in its environment to meet its needs, and describe any influence the environment has on the organism’s traits. Students should also have the opportunity to report orally on a given topic related to traits and the way they are influenced by the environment. They should share relevant facts, details, and information while speaking clearly and at an understandable pace.

Mathematics

This unit also has connections to the CCSS for mathematics. Students can use rulers to measure the growth of organisms, then generate and plot the data they collected on line plots, making sure the horizontal scale is marked off in appropriate units (whole numbers, halves, or quarters). For example, students might chart out data in line plots to document the growth (over time) of each of a number of plants grown from a single parent. As students analyze their data, they will observe that the offspring are not the same exact height as each other or as the parent, but that the height of all plants is very similar when the plants are grown under the same conditions. Students might also make similar line plots to compare the same type of plants grown with varying amounts of water or sunlight, then compare these data to the growth data of the parent plant. Analyzing this data will help students understand that environmental factors influence/affect the traits of organisms. As students collect, organize, and analyze their data, they have opportunities to reason abstractly and model with mathematics.

English Language Arts	**Mathematics**
Ask and answer questions to demonstrate understanding of a text, referring explicitly to the text as the basis for the answers. (3-LS3-1),(3-LS3-2) **RI.3.1** Determine the main idea of a text; recount the key details and explain how they support the main idea. (3-LS3-1),(3-LS3-2) **RI.3.2** Describe the relationship between a series of historical events, scientific ideas or concepts, or steps in	Reason abstractly and quantitatively. (3-LS3-1),(3-LS3-2) **MP.2** Model with mathematics. (3-LS3-1),(3-LS3-2) **MP.4** Generate measurement data by measuring lengths using rulers marked with halves and fourths of an inch Show the data by making a line plot, where the horizontal scale is marked off in appropriate

technical procedures in a text, using language that pertains to time, sequence, and cause/effect. (3-LS3-1),(3-LS3-2) **RI.3.3** Write informative/explanatory texts to examine a topic and convey ideas and information clearly. (3-LS3-1),(3-LS3-2),(3-LS4-2) **W.3.2** Report on a topic or text, tell a story, or recount an experience with appropriate facts and relevant, descriptive details, speaking clearly at an understandable pace. (3-LS3-1),(3-LS3-2) **SL.3.4**	units—whole numbers, halves, or quarters. (3-LS3-1),(3-LS3-2) **3.MD.B.4**

21st Century Life and Careers/Technology Standards (as applied at grade level):

- 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.
- 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.
- Communicate clearly and effectively and with reason.
- Utilize critical thinking to make sense of problems and persevere in solving them.
- Employ valid and reliable research strategies.
- Demonstrate creativity and innovation.
- Apply appropriate academic and technical skills.

Career Readiness Standards

- 3-5-ETS1-2. Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.
- 9.4.5.CI.3: Participate in a brainstorming session with individuals with diverse perspectives to expand one's thinking about a topic of curiosity (e.g., 8.2.5.ED.2, 1.5.5.CR1a).
- 9.4.5.CI.4: Research the development process of a product and identify the role of failure as a part of the creative process (e.g., W.4.7, 8.2.5.ED.6).
- 9.4.5.IML.2: Create a visual representation to organize information about a problem or issue (e.g., 4.MD.B.4, 8.1.5.DA.3).
- 9.4.5.CT.4: Apply critical thinking and problem-solving strategies to different types of problems such as personal, academic, community and global (e.g., 6.1.5.CivicsCM.3).

Social Studies

6.1.2.CivicsCM.2: Use examples from a variety of sources to describe how certain characteristics can help individuals collaborate and solve problems (e.g., open-mindedness, compassion, civility, persistence).

Investigation Lessons:

- Investigation 1: Introduction to Motion

- Investigation 2: Forces & Motion
- Investigation 3: Gravity - Falling Objects
- Investigation 4: Flicking Force
- Investigation 5: Introduction to Magnets
- Investigation 6: Magnets and Magnetic Materials
- Investigation 7: Multiple Magnets
- Investigation 8: Mystery Science - How Can You Unlock a Door Using a Magnet?
- Investigation 9: Electromagnets
- Investigation 10: Static Electricity
- Investigation 11: Unit Project Info

**PADLET with Force, Motion, and Magnets Resources

Unit Project Choice Board (Investigation #11)

Grade/ Grade Band: 3rd	**Topic:** Introduction to Motion	**Investigation #**1 (1 day)

Brief Lesson Description: In this lesson, students will observe various natural phenomena in the form of videos, pictures, and hands-on materials. They will write down what they notice and wonder about each station. This lesson is a discovery of what the unit is and how forces interact.

Performance Expectation(s):
3-PS2-2. Make observations and/or measurements of an object's motion to provide evidence that a pattern can be used to predict future motion.

Specific Learning Outcomes: Students will begin to understand different forces and motion.

Narrative / Background Information

Background for the Teacher:
Study Jams- Force and Motion
A force is a push or pull on an object. Most of the knowledge that is known about forces was discovered by Sir Isaac Newton, a famous
mathematician and scientist. He developed three laws involving forces and motion. In this activity, we will explore Newton's First Law of
Motion: an object at rest tends to stay at rest and an object in motion tends to stay in motion, unless acted upon by an outside, unbalanced
force.

Balanced forces occur when an object is not moving. For example, when a book is resting on a table it has balanced forces on it. (The force
of gravity pushing down on the book is equal to the force the desk is exerting to push the book up.) Balanced forces also occur when a moving object is not changing in the speed or direction of its motion. When unbalanced forces occur, an object will change positions or motions.

Prior Student Knowledge:
In Kindergarten through second grade, students should have learned pushes and pulls can have different strengths and directions and can
change the speed or direction of its motion or start or stop it. The concept of push and pulls may need to be reviewed.

Science & Engineering Practices:	**Disciplinary Core Ideas:**	**Crosscutting Concepts**
Planning and Carrying Out Investigations Planning and carrying out investigations to answer questions or test solutions to problems in 3–5 builds on K–2 experiences and progresses to include investigations that control variables and provide evidence to support explanations or design solutions. ● Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair	PS2.A: 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.) {3-PS2-1) -The patterns of an object's motion in various situations can be	Cause and Effect ● Cause and effect relationships are routinely identified.

tests in which variables are controlled and the number of trials considered.	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.) {3-PS2-2)	

Possible Preconceptions/Misconceptions:

1. An object that is not moving has no forces acting on it.
2. An object that is moving at a constant speed in a straight line has unbalanced forces exerted on it.

LESSON PLAN – 5-E Model

Grade/ Grade Band: 3rd	**Topic:** Forces and Motion	**Investigation #**2 **(3 days)**

Brief Lesson Description: In this lesson, students will learn that a force is a push or pull on an object. They will learn how to create a model to represent balanced and unbalanced forces in everyday situations.

Performance Expectation(s):

3-PS2-1. Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object.

3-PS2-2. Make observations and/or measurements of an object's motion to provide evidence that a pattern can be used to predict future motion.

9.4.5.CI.3: Participate in a brainstorming session with individuals with diverse perspectives to expand one's thinking about a topic of curiosity (e.g., 8.2.5.ED.2, 1.5.5.CR1a).

Specific Learning Outcomes: Students will create a model to represent balanced and unbalanced forces.

Narrative / Background Information

Background for the Teacher:

Video: https://www.youtube.com/watch?v=jT_cDQYLNbs - For teachers - At the beginning, lists some common misconceptions. Explain balanced and unbalanced forces. At the end, this goes more in depth than we need for 3rd graders, but is helpful for teachers.

Science & Engineering Practices:	**Disciplinary Core Ideas:**	**Crosscutting Concepts**
Planning and Carrying Out Investigations Planning and carrying out investigations to answer questions or test solutions to problems in 3–5 builds on K–2 experiences and	PS2.A: 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	Cause and Effect ● Cause and effect relationships are routinely identified.

progresses to include investigations that control variables and provide evidence to support explanations or design solutions. ● Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered.	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.) {3-PS2-1) -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.) {3-PS2-2)	

Possible Preconceptions/Misconceptions:

1. An object that is not moving has no forces acting on it.
2. An object that is moving at a constant speed in a straight line has unbalanced forces exerted on it.

LESSON PLAN – 5-E Model

Grade/ Grade Band: 3rd	**Topic:** Gravity- Falling Objects	**Investigation #**3 (1 day)

Brief Lesson Description: Children are introduced to the term, "gravity". By conducting an experiment with a ping pong ball and a golf ball, they explore what effect gravity has on weight.

Performance Expectation(s):

3-PS2-1. Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object.

Specific Learning Outcomes:

• Students will understand that gravitational force acts continuously on an object as it falls .
• Two objects dropped from the same height should hit the ground at the same time.
• All things fall to the ground because of the pull of gravity.

Narrative / Background Information

Background for Teacher:

See info in the Explain section below

Prior Student Knowledge:

Students have been exposed to the term "gravity."		
Science & Engineering Practices: ● Asking questions (science) and defining problems (engineering) ● Developing and using models	**Disciplinary Core Ideas:** **3-PS2-1** Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object.	**Crosscutting Concepts** Cause and Effect ● Patterns ● Cause and effect: Mechanism and explanation
Possible Preconceptions/Misconceptions: A heavier object will hit the ground before a lighter object. A larger object will hit the ground before a smaller object.		
LESSON PLAN – 5-E Model		

Grade/ Grade Band: 3rd	**Topic:** Flicking Force	**Investigation #**4 **(1 day)**
Brief Lesson Description: Students will predict and observe what happens when force is applied to an object, and compare the relative effects of a force of the same strength on objects of different weights by flicking the ping pong ball then the golf ball *gently* with a finger and measuring the distance the ball covered with a ruler. Students will repeat this procedure using a harder flick.		
Performance Expectation(s): 3-PS2-1. Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object 9.4.5.CI.3: Participate in a brainstorming session with individuals with diverse perspectives to expand one's thinking about a topic of curiosity (e.g., 8.2.5.ED.2, 1.5.5.CR1a).		
Specific Learning Outcomes: Students plan and conduct an investigation to explore forces on the motion of an object. Students make predictions on the effect of different forces on a moving object.		
Narrative / Background Information Background for Teachers Force is anything that tends to change the state of rest or motion of an object (NY Public Library Science Desk Reference, 274). Forces cause changes in the speed or direction of the motion of an object. The greater the force placed on an object, the greater the change in motion. (Newton's Second Law of Motion) The more massive an object is, the less effect a given force will have upon the motion of the object. This activity uses *working definitions.* A working definition is a definition determined by students. It may or may not be completely correct; however, it should be used and corrected by the students as they gain more experience with and understanding of the concept. The strength of a working definition is that it is an indicator of student understanding and can be used by the teacher to guide further experiences.		
Prior Student Knowledge: Basic understanding of force and movement.		

Science & Engineering Practices:	Disciplinary Core Ideas:	Crosscutting Concepts:
● Asking questions (science) and defining problems (engineering) ● Planning and carrying out investigations. ● Analyzing and interpreting data ● Using mathematics and computational thinking ● Engaging in argument from evidence ● Obtaining, evaluating, and communicating information of motion.	PS2.A: 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.) {3-PS2-1)	Cause and effect: Mechanism and problems (engineering)
Possible Preconceptions/Misconceptions: Possible preconception is the harder you hit an object the farther it goes.		
LESSON PLAN – 5-E Model		

Grade/ Grade Band: 3rd	**Topic:** Introduction to Magnets	**Investigation #** 5 (1-2 days)
Brief Lesson Description: Students will work in small groups to complete four activities that serve as an introduction and review of the idea that magnets attract and repel other magnets.		
Performance Expectation(s): 3-PS2-3. Ask questions to determine cause and effect relationships of electric or magnetic interactions between two objects not in contact with each other.		
Specific Learning Outcomes: Students will investigate and confirm their understanding of how magnets attract and repel other magnets.		
Narrative / Background Information		
Background Information for Teachers: 1. Natural magnets are found in some rocks which contain iron. Magnets can also be made of iron, steel, nickel, cobalt, rare earth Materials and the alloys of these metals. 2. Every magnet has a magnetic field that interacts with the magnetic fields of objects containing iron or other magnetic materials. Most magnetic materials that students will use are made of some form of iron. 3. Magnets usually have two poles, a north-seeking, and a south-seeking pole. 4. The magnetic power of a magnet is strongest near its poles and weakest midway between the poles. 5. When two magnets are placed near one another, they react according to the poles that are near one another. Unlike poles attract and like poles repel. 6. When quantified, the magnetic powers of attraction and repulsion are mathematically equal. 7. Magnets can attract magnetic materials through all nonmagnetic and most magnetic materials. 8. Magnetic fields vary in strength. 9. Two magnets together have a single magnetic field and are considered one magnet. 10. It is possible to magnetize an iron or steel object by stroking it with a magnet. 11. Since magnetic force is greater than that of gravity, magnetism can be used to defy gravity in various ways. 12. An electromagnet can be constructed using a battery, an insulated wire, and a nail. 13. It is possible to measure the magnetic force (attraction and repulsion) in newton's using a spring scale.		

Prior Student Knowledge:
Basic understanding of concepts taught in investigations 1-4 (forces, motion, gravity, inertia, etc) Students should have learned pushes and pulls can have different strengths and directions, and can change the speed or direction of its motion or start or stop it. Also, students should have previous experience in developing simple scientific questions that can be tested.

Science & Engineering Practices:	**Disciplinary Core Ideas:**	**Crosscutting Concepts:**
● Asking questions (science) and defining problems (engineering) ● Obtaining, evaluating, and communicating information	*PS2.B: Types of Interactions* ● Objects in contact exert forces on each other. (3-PS2-1) ● 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. (3-PS2-3},(3-PS2-4)	● Patterns

Possible Preconceptions/Misconceptions:
A magnet will always attract another magnet.

LESSON PLAN – 5-E Model

Grade/ Grade Band: 3rd	**Topic:** Magnets and Magnetic Materials	**Investigation #** 6 (1 day)

Brief Lesson Description: Students make predictions, test and sort objects into magnetic and nonmagnetic sets.

Performance Expectation(s):
3-PS2-3. Ask questions to determine cause and effect relationships of electric or magnetic interactions between two objects not in contact with each other.
3-PS2-4. Define a simple design problem that can be solved by applying scientific ideas about magnets.

9.4.5.CI.3: Participate in a brainstorming session with individuals with diverse perspectives to expand one's thinking about a topic of curiosity (e.g., 8.2.5.ED.2, 1.5.5.CR1a).

Specific Learning Outcomes: Students make predictions and test various items for their magnetic interaction. Students observe that magnetic objects are affected by the strength of the magnet and the distance from the magnet.

Narrative / Background Information

Background Information for Teachers:
All substances display magnetic properties, but most show them to a very small degree and we consider them nonmagnetic. Very
sophisticated equipment is needed to detect magnetic characteristics at these low levels. On the other hand, a few metallic elements
such as iron, nickel, cobalt, rare earth materials, plus some of their alloys like steel and strontium ferrite display magnetic properties
strong enough to be considered magnetic or more properly ferromagnetic.

Prior Student Knowledge:
Basic understanding of concepts taught in investigations 6 (introduction to magnets)

Science & Engineering Practices:	**Disciplinary Core Ideas:**	**Crosscutting Concepts:**
• Asking questions (science) and defining problems (engineering) • Obtaining, evaluating, and communicating information • Planning and carrying out investigations • Analyzing and interpreting data • Using mathematics and computational thinking • Constructing explanations (science) and designing solutions (engineering) • Engaging in argument from evidence	*PS2.B: Types of Interactions* • 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. (3-PS2-3},(3-PS2-4)	• Cause and effect: Mechanism and explanation

Possible Preconceptions/Misconceptions:
A magnet will always attract another magnet and all metals are magnetic. Magnets are only attracted to copper, aluminum or brass.

LESSON PLAN – 5-E Model

Grade/ Grade Band: 3rd	**Topic:** Multiple Magnets	**Investigation #** 7 (1-2 days)

Brief Lesson Description: This lesson will explore the strength of one magnet versus the strength exerted by two or more magnets.

Performance Expectation(s):
3-PS2-3. Ask questions to determine cause and effect relationships of electric or magnetic interactions between two objects not in contact with each other.

Specific Learning Outcomes:
Students will begin to understand the concept of a controlled experiment.
Students will conduct an experiment in a systematic way.
Students will determine that the strength of combined magnets is stronger than that of one magnet.

Students will gain an understanding that the strength of magnets does not go up exponentially when more magnets are added.

Narrative / Background Information

Background Information for Teachers:

Magnets have many uses- holding cabinets or refrigerator doors closed, controlling roller coasters, etc. These magnets must be strong, but not too strong. How strong does the magnet need to be? How strong is too strong? Someone had to do some experiments to find the answers to these questions.

A "fair test" is another way of doing a "controlled experiment". All things in the experiment remain the same except for the thing that you
are trying to investigate.

In this experiment, students explore how the strength of a magnet changes when it is combined with other magnets. The only variable that
is changed in this experiment is the number of magnets used. Make sure to ask students how to make their experiment a "fair test".

As more magnets are stacked together, the strength will increase until the length of the stack is equal to the diameter. After this point, any further magnets added will provide a negligible increase in performance.

Prior Student Knowledge:

Magnets can be placed on top of each other. Magnetic force can travel through wood.

Science & Engineering Practices:	**Disciplinary Core Ideas:**	**Crosscutting Concepts:**
● Asking questions (science) and defining problems (engineering) ● Developing and using models ● Analyzing and interpreting data ● Obtaining, evaluating, and communicating information	*PS2.B: Types of Interactions* ● 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. (3-PS2-3},(3-PS2-4) ● Objects in contact exert forces on each other. {3-PS2-1)	● Cause and effect: Mechanism and Explanation ● Patterns

Possible Preconceptions/Misconceptions:

Misconception- each time you add a magnet, the power will be doubled or follow a pattern.
Misconception- all magnets have equal strength.
Misconception- the strength of magnets cannot pass through other objects.

LESSON PLAN – 5-E Model

Grade/ Grade Band: 3rd	**Topic:** How Can You Unlock a Door Using a Magnet? Mystery Science Activity	**Investigation #** 8 (1-2 days)

Brief Lesson Description: In this lesson, students investigate magnetic attraction and repulsion. In the activity, Invent a Magnetic Lock, students apply their scientific ideas about magnets to create a useful product: a magnetic lock that can open a paper door. Students engage in the engineering design process to test and improve their designs.

Performance Expectation(s):

3-PS2-4. Define a simple design problem that can be solved by applying scientific ideas about magnets.* [Clarification Statement: Examples of problems could include constructing a latch to keep a door shut and creating a device to keep two moving objects from touching each other.]

9.4.5.CI.3: : Participate in a brainstorming session with individuals with diverse perspectives to expand one's thinking about a topic of curiosity (e.g., 8.2.5.ED.2, 1.5.5.CR1a).

9.4.5.CI.4: Research the development process of a product and identify the role of failure as a part of the creative process (e.g., W.4.7, 8.2.5.ED.6).

Specific Learning Outcomes:

Students will design a lock to a secret room using a magnet and its properties.

Narrative / Background Information

Prior Student Knowledge:

Students will have an understanding that magnets can attract and repel other magnets and attract magnetic materials, thus allowing them to move objects. They will also understand that magnetism works through other objects.

Tips:

Sort Materials Into Two Piles

Each student will first make a paper door using cardstock, scissors, and a post-it note. Then, students will design a lock for their door using a magnet, paperclip, paper fastener, stickers, and index cards. You may want to sort your materials into two piles for easier distribution.

Be Prepared for Some Troubleshooting

In this activity, students are asked to create something new -- an essential part of the engineering process, but one that may confuse or frustrate them. Below are some of the more common difficulties we found during our own testing, and the solutions we came up with.

Brads won't puncture paper: Students may have trouble puncturing the paper with the brad. If this happens, use a sharp pencil to poke a small hole in the paper, then insert the brad.

Items won't turn on the brad: The hole probably isn't big enough. Twist the brad in a full circle a few times to enlarge the hole. (See picture on Mystery Science Site.)

The magnet doesn't make the lock move: Every lock will work differently, but it's typically friction that causes this problem. If a piece of your lock is supposed to move, be sure it can move easily. If it's attached too tightly, your magnet may not be able to move it.

Pieces keep getting stuck against one another: (See pictures on Mystery Science Site.)

- If your lock keeps getting stuck, try rounding the edges of the moving parts.
- If the lock is getting stuck because a piece of paper is bending the wrong way, you can make the paper stiffer by folding it and adding stickers or paper clips to hold it together.

Walls keep falling down: If you need help getting your wall to stay up, clip the 1-inch fold on the back to a clipboard, or slide it under the edge of a heavy book. (See picture on Mystery Science Site.)

Science & Engineering Practices:	**Disciplinary Core Ideas:**	**Crosscutting Concepts:**
• Asking questions (science) and defining problems (engineering) • Developing and using models • Planning and carrying out investigations • Obtaining, evaluating, and communicating information	*PS2.B: Types of Interactions* • 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 depends on the properties of the objects and their distances apart and, for forces between two magnets, on their orientation relative to each other. (3-PS2-3},(3-PS2-4)	• Cause and effect: Mechanism and Explanation • Patterns • Scale, proportion, and quantity • Systems and system models

Possible Preconceptions/Misconceptions:
Misconception: A magnet needs to touch another object to attract it.
Misconception: Paper block magnetic fields as opposed to increasing the distance between the magnet and the object.

LESSON PLAN – 5-E Model

Grade/ Grade Band: 3rd	**Topic:** Electromagnets	**Investigation #**9 (1-2 days)

Brief Lesson Description: In this lesson, students will build and explore electromagnets and its properties.

Performance Expectation(s):
3-PS2-3. Ask questions to determine cause and effect relationships of electric or magnetic interactions between two objects not in contact with each other
3-PS2-4. Define a simple design problem that can be solved by applying scientific ideas about magnets.

Specific Learning Outcomes:
Students will understand that when an electric current flows through a wire, a magnetic field is produced around it.
Students observe that the strength of the electromagnet can be increased by increasing the number of coils wrapped around the iron bolt. Students observe that wrapping the coils tightly together also increases the strength of the electromagnet.
Students will also observe that the electromagnet can be turned on and off.

Narrative / Background Information

Background Information for Teachers:
When an electric current flows through a wire, a magnetic field is produced around it. The magnetic field produced by a single wire (not coiled on the iron bolt) is very weak. By coiling the wire, the magnetic field is made proportionally larger. By wrapping the coils around a magnetic core, such as the iron bolt, we can concentrate and strengthen the magnetic field even more. The magnetic field is strongest near the poles. The magnetic poles of the electromagnet are located at the ends of the bolt.

The strength of an electromagnet can be increased in two ways. One way is by adding more coils around the bolt. The other way is by increasing the amount of electric current through the wire. This can be accomplished by putting more batteries in the electromagnet circuit. By increasing both the amount of electric current through a wire and the number of coils, engineers have developed very powerful electromagnets, such as the ones used to lift large piles of metal in scrap yards or to lilt cargo in metal containers from ships. Much smaller electromagnets are used in everyday things such as telephones, clocks, doorbells, and appliances. The main advantage of electromagnets over permanent magnets is that their magnetic field can be turned on and off by simply turning the electricity on and off.

Teacher Preparation:
• Wire preparation- Strip 3-5 cm (1-2 in.) of the varnish coating from both ends of a 30-inch section of wire (one section per group). It may be rubbed off with an emery board or bolt file. Do not rub the wire too hard or it will break.
• Prepare materials for groups of 3-4 in a distribution center.
• Make sure the batteries have a good charge.

Prior Student Knowledge:
Basic knowledge of batteries and what they are used for.
Basic knowledge of magnets and magnetic fields.

Science & Engineering Practices:	**Disciplinary Core Ideas:**	**Crosscutting Concepts:**
● Asking questions (science) and defining problems (engineering) ● Developing and using models ● Planning and carrying out investigations ● Analyzing and interpreting data ● Constructing explanations (science) and designing solutions (engineering) ● Engaging in argument from evidence ● Obtaining, evaluating, and communicating information	● PS2.B: Types of Interactions 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. (3-PS2-3), (3-PS2-4)	● Cause and effect: Mechanism and explanation ● Energy and matter: Flows, cycles, and conservation

Possible Preconceptions/Misconceptions:
Magnetism and electricity are two different forces.

LESSON PLAN – 5-E Model

Grade/ Grade Band: 3rd	**Topic:** Static Electricity	**Investigation #**10 (1 - 2 days)

Brief Lesson Description: Students will learn about and observe the effects of static electricity.

Performance Expectation(s): 3-PS2-3 Ask questions to determine cause and effect relationships of electric or magnetic interactions between two objects not in contact with each other.

Specific Learning Outcomes: Students should be able to:

- Describe static electricity and how it affects different objects.
- Describe different manifestations of the electrostatic force that occur as a result of the transfer of electric charge.
- Describe how to charge an insulator (such as a balloon).
- Explain what physical change occurs when an object is charged.
- Recognize that charged objects can stick to neutral insulators.

Narrative / Background Information Background for Teachers

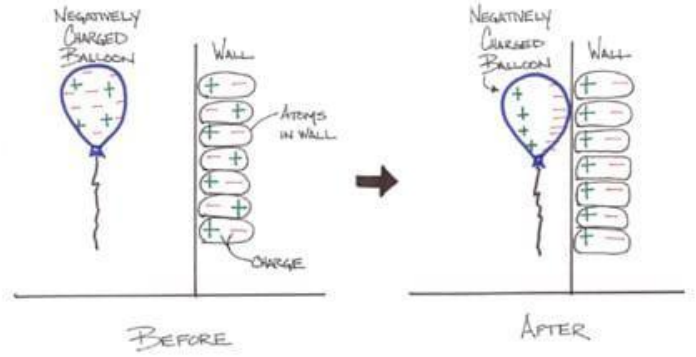
In an atom, the protons and neutrons that make up the nucleus are held together very tightly and rarely does the nucleus experience a change. However, some of the electrons that are associated with the atom are loosely held to their orbital. These electrons, which typically reside in the outer orbits, can move from one atom to another. When an atom loses electrons, it has more positive particles than negative particles, which results in a positive net charge for the atom. An atom that acquires electrons has more negative particles than positive particles and, thus, has a negative net charge.

If the atoms in a material hold the electrons in the outer orbits tightly, the electrons are less likely to move to another atom. Such materials are known as *insulators*. Alternatively, materials whose atoms willingly give up and accept electrons are known as *conductors*. Conductors permit electrons to move through the material easily.

It is possible to transfer (or move) electrons from one material to another. One way to do this is by rubbing two objects together. The longer that two objects are rubbed together, the larger the quantity of electron movement from one object to the other, which results in a charge build up on each object. *Static electricity* occurs when an imbalance of positive charges and negative charges exists.

Positive and negative charges behave similarly to the north and south poles of magnets: Opposite poles attract and like poles repel. In the case of charges, a positive and negative charge pull towards each other. Positive charges repel other positive charges, and negative charges push away other negative charges. An object that has a positive or negative charge build up (net charge) attracts an object that is neutral. For instance, when you rub a balloon on your hair or a piece of wool cloth, the balloon acquires additional electrons. If you hold the balloon against a wall, the balloon sticks. This is because the negatively charged electrons on the balloon push away the negatively charged electrons in the wall (like charges repel) and attract the positive charges in the wall (opposites attract). Since the electrons in the wall can move freely away from their nuclei, the increased separation between the electrons in the balloon and the electrons in the wall weakens their repulsion, allowing the attraction between the electrons in the balloon and the closer positive charges in the wall to overcome the repulsion,causing the balloon to "stick" to the wall. Additionally, when an object with charge build-up attracts a

neutral object, the electrons tend to move to areas where the electrical charge is positive until the atoms in both objects are neutral or balanced. When a large number of electrons move in an effort to balance the atoms, sometimes it causes a spark. This spark is a result of static electricity.



Troubleshooting Tips

When rubbing a balloon in hair, it works best if the hair is dry and clean. Otherwise, a piece of wool material works best. (Wool is **not** included in the kit.) You can also try carpet or sweater. (Make sure to test out options before teaching lesson.)

Humidity dissipates charge, so this activity does not work as well on humid or rainy days.

Prior Student Knowledge:
Basic understanding of static electricity.
Students may have experienced getting shocks from others when walking across a carpet.

Science & Engineering Practices:	**Disciplinary Core Ideas:**	**Crosscutting Concepts:**
● Asking questions (science) and defining problems (engineering) ● Planning and carrying out investigations. ● Analyzing and interpreting data ● Using mathematics and computational thinking ● Engaging in argument from evidence ● Obtaining, evaluating, and communicating information of motion.	PS2.A: 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.) {3-PS2-1)	Cause and effect: Mechanism and problems (engineering)

Possible Preconceptions/Misconceptions:
Misconceptions: That static electricity is not a form of electricity.

LESSON PLAN – 5-E Model

Grade/ Grade Band: 3rd	**Topic:** Unit Project	**Investigation #** 11 (multiple days)
Brief Lesson Description: Students will do research and create a project to present/teach about a concept learned from this unit. Their project can be based on a completed lesson or can be an extension of a concept..		
Performance Expectation(s): 3-PS2-1. Plan and conduct an investigation to provide evidence of balanced and unbalanced forces on the motion of an object. 3-PS2-2. Ask questions to determine the cause and effect relationships of electric or magnetic interactions between two objects not in contact with each other. 3-PS2-4. Design a simple design problem that can be solved by applying scientific ideas about magnets. 3-5-ETS1-2. Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem. 9.4.5.CT.4: Apply critical thinking and problem-solving strategies to different types of problems such as personal, academic, community and global (e.g., 6.1.5.CivicsCM.3). 9.4.5.IML.2: Create a visual representation to organize information about a problem or issue (e.g., 4.MD.B.4, 8.1.5.DA.3).		
Specific Learning Outcomes: Students will design, conduct and share conclusions about an investigation about a concept learned during the force and motion unit. They will plan their investigation in steps and prepare a presentation to share their project with the class.		
Narrative / Background Information		
Background Information for Teachers: Students will use concepts learned and recorded observations from Investigations 1-12 to plan, design, and create their project. Project choices may be used from the choice board or created independently. Students will choose their project and record their plan. Plans are submitted to the teacher for approval and guidance as needed. **Prior Student Knowledge:** Basic understanding of concepts taught in investigations 1-12 (forces, motion, gravity, inertia, etc). Vocabulary learned in the investigations should be used in student investigations and presentations.		
Science & Engineering Practices: ● Asking questions (science) and defining problems (engineering) ● Obtaining, evaluating, and communicating information	**Disciplinary Core Ideas:** *PS2.B: Types of Interactions* ● Taken from Investigations 1-12	**Crosscutting Concepts:** ●
Possible Preconceptions/Misconceptions:		
LESSON PLAN – 5-E Model		

West Windsor-Plainsboro Regional School District
Science Curriculum
Grade 3 - Organisms: Traits, Cycles, and Environment

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: Organisms: Traits, Cycles, and Environment	
Content Area: Organisms: Traits, Cycles, and Environment	
Course & Grade Level: 3rd Grade Science	
Summary and Rationale	
What kinds of traits are passed on from parent to offspring? ***What environmental factors might influence the traits of a specific organism?*** In this unit of study, students acquire an understanding that organisms have different inherited traits and that the environment can also affect the traits that an organism develops. The crosscutting concepts of *patterns* and *cause and effec*t are called out as organizing concepts for these disciplinary core ideas. Students are expected to demonstrate grade-appropriate proficiency *in analyzing and interpreting data, constructing explanations*, and *designing solutions*. Students are also expected to use these practices to demonstrate understanding of the core ideas. This unit is based on 3-LS3-1 and 3-LS3-2.	
Recommended Pacing	
25 days	
New Jersey Student Learning Standards for	
Standard: Standards for	
CPI #	**Cumulative Progress Indicator (CPI)**
3-LS3-1	**Analyze and interpret data to provide evidence that plants and animals have traits inherited from parents and that variation of these traits exists in a group of similar organisms.** *[Clarification Statement: Patterns are the similarities and differences in traits shared between offspring and their parents, or among siblings. Emphasis is on organisms other than humans.] [Assessment Boundary: Assessment does not include genetic mechanisms of inheritance and prediction of traits. Assessment is limited to non-human examples.]*
3-LS3-2	**Use evidence to support the explanation that traits can be influenced by the environment.** *[Clarification Statement: Examples of the environment affecting a trait could include normally tall plants grown with insufficient water are stunted; and, a pet dog that is given too much food and little exercise may become overweight.]*
New Jersey Student Learning Standards for English Language Arts Companion Standards	
Cumulative Progress Indicator (CPI)	
Ask and answer questions to demonstrate understanding of a text, referring explicitly to the text as the basis for the answers. (3-ESS2-2) **RI.3.1** Compare and contrast the most important points and key details presented in two texts on the same topic. (3-ESS2-2) **RI.3.9** Write opinion pieces on topics or texts, supporting a point of view with reasons. (3-ESS3-1) **W.3.1** Conduct short research projects that build knowledge about a topic. (3-ESS3-1) **W.3.7** Recall information from experiences or gather information from print and digital sources; take brief notes on sources and sort evidence into provided categories. (3-ESS2-2) **W.3.9**	
New Jersey Student Learning Standards for Career Readiness, Life Literacies and Key Skills	
CPI #	**Cumulative Progress Indicator (CPI)**

9.4.5.CI.3	Participate in a brainstorming session with individuals with diverse perspectives to expand one's thinking about a topic of curiosity (e.g., 8.2.5.ED.2, 1.5.5.CR1a).
9.4.5.CT.1	Identify and gather relevant data that will aid in the problem-solving process (e.g., 2.1.5.EH.4, 4-ESS3-1, 6.3.5.CivicsPD.2).
9.4.5.CT.2	Identify a problem and list the types of individuals and resources (e.g., school, community agencies, governmental, online) that can aid in solving the problem (e.g., 2.1.5.CHSS.1, 4-ESS3-1).
9.4.5.CT.4	Apply critical thinking and problem-solving strategies to different types of problems such as personal, academic, community and global (e.g., 6.1.5.CivicsCM.3).
9.4.5.DC.1	Explain the need for and use of copyrights.
9.4.5.DC.2	Provide attribution according to intellectual property rights guidelines using public domain or creative commons media.
9.4.5.DC.4	Model safe, legal, and ethical behavior when using online or offline technology (e.g., 8.1.5.NI.2).
9.4.5.IML.1	Evaluate digital sources for accuracy, perspective, credibility and relevance (e.g., Social Studies Practice - Gathering and Evaluating Sources).
9.4.5.IML.2	Create a visual representation to organize information about a problem or issue (e.g., 4.MD.B.4, 8.1.5.DA.3).
9.4.5.IML.6	Use appropriate sources of information from diverse sources, contexts, disciplines, and cultures to answer questions (e.g., RI.5.7, 6.1.5.HistoryCC.7, 7.1.NM. IPRET.5).
9.4.5.TL.3	Format a document using a word processing application to enhance text, change page formatting, and include appropriate images, graphics, or symbols.

Interdisciplinary Standards - Connecting with English Language Arts/Literacy, Mathematics, and SS

English Language Arts

In order to integrate the CCSS for English language arts, students will need opportunities to read about inherited traits of animals and plants in a variety of texts and resources. During discussions, teachers might pose questions such as "What kinds of traits are passed on from parent to offspring?" or "What environmental factors might influence the traits of a specific organism?" Students should be able to refer specifically to the text when answering questions, articulate the main idea, and describe the key ideas using supporting details in their explanations. Additionally, they should describe the relationship between scientific ideas or concepts, using language that pertains to time, sequence, and cause and effect.

During this unit, students also need opportunities to write informative/explanatory texts to convey ideas and information gathered through investigations and from other resources. For example, after reading texts about a given organism, students should be expected to use key details and appropriate facts about that organism to compose an informative piece of writing. This piece should list some of the organism's traits that were passed on from its parents, describe how those traits enable the organism to interact in its environment to meet its needs, and describe any influence the environment has on the organism's traits. Students should also have the opportunity to report orally on a given topic related to traits and the way they are influenced by the environment. They should share relevant facts, details, and information while speaking clearly and at an understandable pace.

Mathematics

This unit also has connections to the CCSS for mathematics. Students can use rulers to measure the growth of organisms, then generate and plot the data they collected on line plots, making sure the horizontal scale is marked off in appropriate units (whole numbers, halves, or quarters). For example, students might chart out data in line plots to document the growth (over time) of each of a number of plants grown from a single parent. As students

analyze their data, they will observe that the offspring are not the same exact height as each other or as the parent, but that the height of all plants is very similar when the plants are grown under the same conditions. Students might also make similar line plots to compare the same type of plants grown with varying amounts of water or sunlight, then compare these data to the growth data of the parent plant. Analyzing this data will help students understand that environmental factors influence/affect the traits of organisms. As students collect, organize, and analyze their data, they have opportunities to reason abstractly and model with mathematics.

English Language Arts

Ask and answer questions to demonstrate understanding of a text, referring explicitly to the text as the basis for the answers. (3-LS3-1),(3-LS3-2) RI.3.1

Determine the main idea of a text; recount the key details and explain how they support the main idea. (3-LS3-1),(3-LS3-2) RI.3.2

Describe the relationship between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text, using language that pertains to time, sequence, and cause/effect. (3-LS3-1),(3-LS3-2) RI.3.3

Write informative/explanatory texts to examine a topic and convey ideas and information clearly. (3-LS3-1),(3-LS3-2),(3-LS4-2) W.3.2

Report on a topic or text, tell a story, or recount an experience with appropriate facts and relevant, descriptive details, speaking clearly at an understandable pace. (3-LS3-1),(3-LS3-2) SL.3.4

Mathematics

Reason abstractly and quantitatively. (3-LS3-1),(3-LS3-2) MP.2

Model with mathematics. (3-LS3-1),(3-LS3-2) MP.4

Generate measurement data by measuring lengths using rulers marked with halves and fourths of an inch. Show the data by making a line plot, where the horizontal scale is marked off in appropriate units—whole numbers, halves, or quarters. (3-LS3-1),(3-LS3-2) 3.MD.B.4

Social Studies

Standard 6.1 U.S. History: America in the World. All students will acquire the knowledge and skills to think analytically about how past and present interactions of people, cultures, and the environment shape the American heritage. Such knowledge and skills enable students to make informed decisions that reflect fundamental rights and core democratic values as productive citizens in local, national, and global communities.

Grade/ Grade Band: 3	**Topic:** Traits of Organisms	**Investigation #1** (1 day)
Brief Lesson Description: Students will classify pictures of organisms and list traits that organisms share. Students will provide a rationale for why they classified certain organisms together.		
Performance Expectation(s): **3-LS3-1-** Analyze and interpret data to provide evidence that plants and animals have traits inherited from parents and that variation of these traits exist in a group of similar organisms. **9.4.5.CI.3 -** Participate in a brainstorming session with individuals with diverse perspectives to expand one's thinking about a topic of curiosity (e.g., 8.2.5.ED.2, 1.5.5.CR1a).		
Specific Learning Outcomes: Students will classify pictures of organisms and analyze them according to traits. Students will provide evidence to support how/why they grouped the organisms the way they did.		
Narrative / Background Information		
Prior Student Knowledge: Traits can be used to describe people and characters. Students may be familiar with different animal groups.		
Science & Engineering Practices: ○ Asking questions (science) ○ Analyzing and interpreting data ○ Constructing explanations (science) ○ Engaging in argument from evidence	**Disciplinary Core Ideas:** **LS3.A:** Inheritance of Traits - Many characteristics of organisms are inherited from their parents. (3-LS3-1) **LS3.B:** Variation of Traits - Different organisms vary in how they look and function because they have different inherited information. (3-LS3-1**)**	**Crosscutting Concepts:** ○ Patterns ○ Cause and effect: Mechanism and explanation
Possible Preconceptions/Misconceptions: There is only one possible way to classify/group/sort organisms. Students may group by animal type instead of by trait (all dogs vs. dog breeds). Students may also have questions about what a trait is or which trait is more "important" (e.g. color vs size) - leads to discussion about various traits		
LESSON PLAN – 5-E Model		

Grade/ Grade Band: 3	**Topic:** Parents & Offspring	**Investigation #2** (2 - 3 days)
Brief Lesson Description: Students will look at pictures of parents and offspring to identify traits that are similar and different. Students will explain that traits can be passed down from parents to offspring.		
Performance Expectation(s): **3-LS3-1**. Analyze and interpret data to provide evidence that plants and animals have traits inherited from parents and that variation of these traits exists in a group of similar organisms.		
Specific Learning Outcomes: Students will identify similar and different traits in organisms to show that offspring express some traits from each of their parents.		
Narrative / Background Information		
Prior Student Knowledge: A trait is an observable characteristic inherited from parents. Students may recognize different breeds of dogs and their characteristics. Plants can be categorized by type and color.		

Science & Engineering Practices:	Disciplinary Core Ideas:	Crosscutting Concepts:
○ Asking questions (science) ○ Analyzing and interpreting data ○ Constructing explanations (science) ○ Engaging in argument from evidence	**LS3.A:** Inheritance of Traits - Many characteristics of organisms are inherited from their parents. (3-LS3-1) **LS3.B:** Variation of Traits - Different organisms vary in how they look and function because they have different inherited information. (3-LS3-1**)**	○ Patterns ○ Cause and effect: Mechanism and explanation

Possible Preconceptions/Misconceptions:
All offspring look exactly like their parents and/or like other offspring.
Plants do not have parents and offspring.

LESSON PLAN – 5-E Model

Grade/ Grade Band: 3	**Topic-** Lima Bean Dissection	**Investigation #3 -** Part A (2 days)

Brief Lesson Description: Day 1 - Students will create journals and observe a dry lima bean and insert beans into hot water. Day 2 - Students will notice what happened when the bean was soaked in water overnight, what is inside the bean, and discover the parts of a bean that begins the life cycle.

Performance Expectation(s):
3-LS3-2. Use evidence to support the explanation (the claim) that traits can be influenced by the environment.
Secondary, **3-LS1-1**. Develop models to describe that organisms have unique and diverse life cycles but all have in common birth, growth, reproduction, and death.

Specific Learning Outcomes:
Students will use observations and evidence from the lima bean dissection to demonstrate that seeds contain the basic parts to become plants.

Narrative / Background Information

Prior Student Knowledge: Seeds come in all different sizes, we eat lima beans.

Science & Engineering Practices:	Disciplinary Core Ideas:	Crosscutting Concepts:
○ Developing and using models ○ Constructing explanations (science) ○ Engaging in argument from evidence	**LS3.A**: Inheritance of Traits - Other characteristics result from individuals' interactions with the environment, which can range from diet to learning. Many characteristics involve both inheritance and environment. (3- LS3-2) **LS3.B**: Variation of Traits The environment also affects the traits that an organism develops. (3-LS3-2) **LS1.B:** Growth and Development of Organisms - Reproduction is essential to the continued existence of every kind of organism. Plants and animals have unique and diverse life cycles. (3-LS1-1)	○ Scale, proportion, and quantity ○ Energy and matter: Flows, cycles, and conservation ○ Structure and function

Possible Preconceptions/Misconceptions:
All seeds look the same and contain the same parts inside

LESSON PLAN – 5-E Model

Grade/ Grade Band: 3	**Topic-** Life Cycles	**Investigation #3 -** Part B (2 - 3 days)

Brief Lesson Description: Students will research the life cycle of a different organism.

Performance Expectation(s):
3-LS1-1. Develop models to describe that organisms have unique and diverse life cycles but all have in common birth, growth, reproduction, and death.
9.4.5.IML.6. Use appropriate sources of information from diverse sources, contexts, disciplines, and cultures to answer questions (e.g., RI.5.7, 6.1.5.HistoryCC.7, 7.1.NM. IPRET.5).

Specific Learning Outcomes:
Students will conduct research on an organism of their choosing
Students will compare and contrast the life cycle of their organism to the plant

Narrative / Background Information

Prior Student Knowledge: Organisms grow and change over time. All living things go through a life cycle.

Science & Engineering Practices:	**Disciplinary Core Ideas:**	**Crosscutting Concepts:**
○ Asking questions (science) ○ Developing and using models ○ Constructing explanations (science) ○ Engaging in argument from evidence ○ Obtaining, evaluating, and communicating information	**LS1.B:** Growth and Development of Organisms - Reproduction is essential to the continued existence of every kind of organism. Plants and animals have unique and diverse life cycles. (3-LS1-1)	○ Patterns ○ Cause and effect: Mechanism and explanation ○ Systems and system models ○ Stability and change

Possible Preconceptions/Misconceptions:
Not everything that is living has a life cycle – life cycles are extremely different

LESSON PLAN – 5-E Model

Grade/ Grade Band: 3	**Topic:** Forming Groups to Survive	**Investigation # 4** (2 - 3 Days)

Brief Lesson Description: Working in collaborative groups, students will observe animal social behaviors and formulate a theory as to why some form groups to survive.

Performance Expectation(s): Construct an argument that some animals form groups that help members survive. (3-LS2-1)

Specific Learning Outcomes: Students will formulate a theory as to how living in a group helps some animals' survival.

Narrative / Background Information

Prior Student Knowledge: Research from Investigations 1, 2, and 3.

Science & Engineering Practices:	**Disciplinary Core Ideas:**	**Crosscutting Concepts:**
○ Asking questions ○ Constructing explanations ○ Engaging in argument from evidence ○ Obtaining, evaluating, and communicating information	**LS2.D.1: Social Interactions and Group Behavior** Being part of a group helps animals obtain food, defend themselves, and cope with changes. Groups may serve different functions and vary dramatically in size.	○ Patterns ○ Cause and effect: cause and effect relationships routinely identified, tested, and used to explain change. ○ Stability and change

Possible Preconceptions/Misconceptions:
Animals don't survive better in groups - Animals don't live in groups. All animals survive better in a group.

LESSON PLAN – 5-E Model

Grade/ Grade Band: 3	**Topic:** Fossil Investigation	**Investigation # 5** (3 - 4 Days)

Brief Lesson Description: Students will first draw conclusions about environments from long ago based on evidence found when observing and sorting fossils. Then, students will compare fossils of organisms that existed long ago to living organisms, describing how the environments of such organisms were similar and different.

Performance Expectation(s): Analyze and interpret data from fossils to provide evidence of the organisms and the environments in which they lived long ago. [Clarification Statement: Examples of data could include type, size, and distributions of fossil organisms. Examples of fossils and environments could include marine fossils found on dry land, tropical plant fossils found in Arctic areas, and fossils of extinct organisms.] [*Assessment Boundary: Assessment does not include identification of specific fossils or present plants and animals. Assessment is limited to major fossil types and relative ages.*] **(3-LS4-1)**

Specific Learning Outcomes:
Students will be able to observe various fossils and determine when and where the organism lived based on its traits. They should be able to determine if it was a plant or animal. They can determine the mode of transportation. (For example: If it could fly it would have wing-like structures, if it could swim it would have fins or webbed feet, etc.) They can notice how deep the fossil was in the ground which tells us how long ago it lived. They can observe what kind of environment the organisms lived in.

Narrative / Background Information

Prior Student Knowledge:
Fossils are found in rocks - tell us about organisms from long ago

Science & Engineering Practices:	**Disciplinary Core Ideas:**	**Crosscutting Concepts:**
○ Asking questions (science) ○ Analyzing and interpreting data ○ Constructing explanations (science) ○ Engaging in argument from evidence ○ Obtaining, evaluating, and communicating information	**LS4.A: Evidence of Common Ancestry and Diversity** Some kinds of plants and animals that once lived on Earth are no longer found anywhere.	○ Patterns ○ Cause and effect: Mechanism and explanation ○ Structure and function ○ Stability and change

Possible Preconceptions/Misconceptions:
Plants do not become extinct.
Dinosaurs are the only animals to become fossils.
Plants don't become fossilized.
Fossilized organisms are not related to organisms that currently live on Earth.

LESSON PLAN – 5-E Model

Grade/ Grade Band: 3	**Topic:** Environmental Changes	**Investigation # 6** (can be done in 2 days)

Brief Lesson Description: In this lesson students will be learning about the interdependence of the environment and the organisms in an ecosystem through the use of the story The Great Kapok Tree. Students explore how people and climate change affect different ecosystems.

Performance Expectation(s):
Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change. [Clarification Statement: Environmental changes should include changes to landforms, distribution of water, climate, and availability of resources. Changes in the environment could range in time from a season to decades. Data should be provided. **(3-LS4-4)**
Write informative/explanatory texts to examine a topic and convey ideas and information clearly. (ELA W3.2)
Identify a problem and list the types of individuals and resources (e.g., school, community agencies, governmental, online) that can aid in solving the problem (e.g., 2.1.5.CHSS.1, 4-ESS3-1). (9.4.5.CT.2)
Apply critical thinking and problem-solving strategies to different types of problems such as personal, academic, community and global (e.g., 6.1.5.CivicsCM.3). (9.4.5.CT.4)

Specific Learning Outcomes: Animals and plants depend on each other for survival. Changes in the environment affect the survival of the plants and animals that live there.

Narrative / Background Information

Prior Student Knowledge: Connection to biomes (weather/climate unit). Plants and animals depend on their surroundings to get what they need to live. (Traits of Organisms) Some knowledge of extinction, understanding of habitat. (2nd grade Habitats unit) Variations in characteristics among individuals provide advantages (or disadvantages) in their survival. (Traits of Organisms)		
Science & Engineering Practices: ○ Constructing explanations (science) and designing solutions (engineering) ○ Engaging in argument from evidence ○ Obtaining, evaluating, and communicating information	**Disciplinary Core Ideas:** **LS4.C: Adaptation** For any particular environment, some kinds of organisms survive well, some survive less well, and some cannot survive at all.	**Crosscutting Concepts:** ○ Patterns ○ Cause and effect: Mechanism and explanation
Possible Preconceptions/Misconceptions: Students may believe that dinosaurs are the only animals to become extinct, that extinction doesn't happen anymore, that humans are the only things that cause extinction, or that humans never cause extinction.		
LESSON PLAN – 5-E Model		

Grade/ Grade Band: 3	**Topic:** Adaptation of Traits Due to Environment Changes	**Investigation # 7** - (3-4 days)
Brief Lesson Description: Students will complete their research about their organism by investigating the adaptations their organism has developed over time to survive in the environment in which it lives. They will also discuss whether their organism could survive in a variety of other environments. Lastly students will complete the Mystery Science activity called *How Long Can People (and Animals) Survive in Space?* to learn about short term effects on organisms caused by environmental changes.		
Performance Expectation(s): 3-LS3-2 - Use evidence to support the explanation that traits can be influenced by the environment.* [Clarification Statement: Examples of the environment affecting a trait could include normally tall plants grown with insufficient water are stunted; and a pet dog that is given too much food and little exercise may become overweight) **Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all.** [Clarification Statement: Examples of evidence could include needs and characteristics of the organisms and habitats involved. The organisms and their habitat make up a system in which the parts depend on each other.] **(3-LS4-3)** **Apply critical thinking and problem-solving strategies to different types of problems such as personal, academic, community and global (e.g., 6.1.5.CivicsCM.3). (9.4.5.CT.4)**		
Specific Learning Outcomes: Sw define all adaptation vocabulary words (offspring, inherit, traits, adaptation, camouflage, defense). Sw evaluate the conditions under which various species can survive. Sw design a situation in which an animal needs adaptations for survival. Explain some of the reasons that animals and plants survive well, less well, or do not survive.		
Narrative / Background Information		
Prior Student Knowledge: Students are familiar with the concepts of traits, parents, and offspring as well as different environments. Environments can change and therefore affect organisms living there and sometimes cause them to go extinct. They may make connections to the climate/weather unit since environments may change. They should know the various biomes/ecosystems from the weather/climate unit.		

Science & Engineering Practices:	Disciplinary Core Ideas:	Crosscutting Concepts:
○ Asking questions (science) and defining problems (engineering) ○ Analyzing and interpreting data to make sense of phenomena using logical reasoning ○ Constructing explanations (science) and designing solutions (engineering) ○ Engaging in argument from evidence	**LS3.A: Inheritance of Traits** ● Other characteristics result from individuals' interactions with the environment, which can range from diet to learning. Many characteristics involve both inheritance and environment. . **LS3.B: Variation of Traits** ● The environment also affects the traits that an organism develops **LS2.C: Ecosystem Dynamics, Functioning, and Resilience** ● When the environment changes in ways that affect a place's physical characteristics, temperature, or availability of resources, some organisms survive and reproduce, others move to new locations, yet others move into the transformed environment, and some die. **LS4.D: Biodiversity and Humans** ● Populations live in a variety of habitats, and change in those habitats affects the organisms living there.	○ Cause and effect relationships are routinely identified and used to explain change. ○ Patterns ○ Stability and change
Possible Preconceptions/Misconceptions: Organisms can control when and how they adapt. Organisms adapt so that they (themselves) can survive, rather than their species.		
LESSON PLAN – 5-E Model		

Grade/ Grade Band: 3	**Topic:** Overabundance	**Investigation # 8** - (2-3 days)
Brief Lesson Description: Students will explore the solution to overpopulation of species by introducing a natural predator in order to evaluate whether they agree with this solution. Students will conduct a debate regarding this solution.		
Performance Expectation(s): Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change.* [Clarification Statement: Examples of environmental changes could include changes in land characteristics, water distribution, temperature, food, and other organisms.] [Assessment Boundary: Assessment is limited to a single environmental change. Assessment does not include the greenhouse effect or climate change.] **(3-LS4-4)**		
Specific Learning Outcomes: Sw understand that every action has a reaction and that it is important to evaluate the positive and negative effects that can be caused.		
Narrative / Background Information		
Prior Student Knowledge: Students know that some organisms need to work together in order to survive. Students know that environments can change and therefore affect organisms living there.		

Science & Engineering Practices:	Disciplinary Core Ideas:	Crosscutting Concepts:
○ Asking questions (science) and defining problems (engineering) ○ Analyzing and interpreting data to make sense of phenomena using logical reasoning ○ Constructing explanations (science) and designing solutions (engineering) ○ Engaging in argument from evidence	**LS3.A: Inheritance of Traits** ● Other characteristics result from individuals' interactions with the environment, which can range from diet to learning. Many characteristics involve both inheritance and environment. . **LS3.B: Variation of Traits** ● The environment also affects the traits that an organism develops **LS2.C: Ecosystem Dynamics, Functioning, and Resilience** ● When the environment changes in ways that affect a place's physical characteristics, temperature, or availability of resources, some organisms survive and reproduce, others move to new locations, yet others move into the transformed environment, and some die. **LS4.D: Biodiversity and Humans** ● Populations live in a variety of habitats, and change in those habitats affects the organisms living there.	○ Cause and effect relationships are routinely identified and used to explain change. ○ Patterns ○ Stability and change
Possible Preconceptions/Misconceptions: Organisms can control when and how they adapt. Organisms adapt so that they (themselves) can survive, rather than their species.		
LESSON PLAN – 5-E Model		

West Windsor-Plainsboro Regional School District
Science Curriculum
Grade 3 - Weather and Climate

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: Weather & Climate
Content Area: Organisms: Elementary Science NGSS Grade 3 - Weather and Climate
Course & Grade Level: 3rd Grade Science
Summary and Rationale
What is the typical weather near our home? ***How can we protect people from weather-related hazards?*** In this unit of study, students organize and use data to describe typical weather conditions expected during a particular season. By applying their understanding of weather-related hazards, students are able to make a claim about the merit of a design solution that reduces the impacts of such hazards. The crosscutting concepts of *patterns, cause and effect*, and the *influence of engineering, technology, and science on society and the natural world* are called out as organizing concepts for these disciplinary core ideas. Students demonstrate grade-appropriate proficiency in a*sking questions and defining problems, analyzing and interpreting data, engaging in argument from evidence*, and *obtaining, evaluating, and communicating information*. Students are also expected to use these practices to demonstrate understanding of the core ideas. This unit is based on 3-ESS2-1, 3-ESS2-2, 3-ESS3-1, and 3-5-ETS1-1.
Recommended Pacing
27 days
New Jersey Student Learning Standards for Science
Standard: Standards for
Cumulative Progress Indicator (CPI)
Develop a model using an analogy, to describe how weather and climate are related**.** *[Note: This SLO is based on the disciplinary core ideas found in the Framework. It is intended to serve as a scaffold to 3-ESS2-1.]*
Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season. *[Clarification Statement: Examples of data could include average temperature, precipitation, and wind direction.] [Assessment Boundary: Assessment of graphical displays is limited to pictographs and bar graphs. Assessment does not include climate change.]*
Obtain and combine information to describe climates in different regions of the world.
Make a claim about the merit of a design solution that reduces the impacts of climate change and/or a weather-related hazard. [Clarification Statement: Examples of design solutions to weather-related hazards could include barriers to prevent flooding, wind resistant roofs, and lightning rods.]
New Jersey Student Learning Standards for English Language Arts Companion Standards
Standard:
Cumulative Progress Indicator (CPI)
Ask and answer questions to demonstrate understanding of a text, referring explicitly to the text as the basis for the answers. (3-ESS2-2) **RI.3.1** Compare and contrast the most important points and key details presented in two texts on the same topic. (3-ESS2-2) **RI.3.9** Write opinion pieces on topics or texts, supporting a point of view with reasons. (3-ESS3-1) **W.3.1** Conduct short research projects that build knowledge about a topic. (3-ESS3-1) **W.3.7** Recall information from experiences or gather information from print and digital sources; take brief notes on sources and sort evidence into provided categories. (3-ESS2-2) **W.3.9**

New Jersey Student Learning Standards for Career Readiness, Life Literacies and Key Skills
Cumulative Progress Indicator (CPI)
Participate in a brainstorming session with individuals with diverse perspectives to expand one's thinking about a topic of curiosity (e.g., 8.2.5.ED.2, 1.5.5.CR1a).
Identify and gather relevant data that will aid in the problem-solving process (e.g., 2.1.5.EH.4, 4-ESS3-1, 6.3.5.CivicsPD.2).
Identify a problem and list the types of individuals and resources (e.g., school, community agencies, governmental, online) that can aid in solving the problem (e.g., 2.1.5.CHSS.1, 4-ESS3-1).
Apply critical thinking and problem-solving strategies to different types of problems such as personal, academic, community and global (e.g., 6.1.5.CivicsCM.3).
Explain the need for and use of copyrights.
Provide attribution according to intellectual property rights guidelines using public domain or creative commons media.
Model safe, legal, and ethical behavior when using online or offline technology (e.g., 8.1.5.NI.2).
Evaluate digital sources for accuracy, perspective, credibility and relevance (e.g., Social Studies Practice - Gathering and Evaluating Sources).
Create a visual representation to organize information about a problem or issue (e.g., 4.MD.B.4, 8.1.5.DA.3).
Use appropriate sources of information from diverse sources, contexts, disciplines, and cultures to answer questions (e.g., RI.5.7, 6.1.5.HistoryCC.7, 7.1.NM. IPRET.5).
Format a document using a word processing application to enhance text, change page formatting, and include appropriate images, graphics, or symbols.
Interdisciplinary Standards
Mathematics Reason abstractly and quantitatively. (3-ESS2-1),(3-ESS2-2),(3-ESS3-1) **MP.2** Model with mathematics. (3-ESS2-1),(3-ESS2-2), (3-ESS3-1) **MP.4** Use appropriate tools strategically. (3-ESS2-1) **MP.5** Measure and estimate liquid volumes and masses of objects using standard units of grams (g), kilograms (kg), and liters (l). Add, subtract, multiply, or divide to solve one-step word problems involving masses or volumes that are given in the same units, e.g., by using drawings (such as a beaker with a measurement scale) to represent the problem. (3-ESS2-1) **3.MD.A.2** Draw a scaled picture graph and a scaled bar graph to represent a data set with several categories. Solve one- and two-step "how many more" and "how many less" problems using information presented in bar graphs. (3-ESS2-1) **3.MD.B.3** **Social Studies** Standard 6.1 U.S. History: America in the World. All students will acquire the knowledge and skills to think analytically about how past and present interactions of people, cultures, and the environment shape the American heritage. Such knowledge and skills enable students to make informed decisions that reflect fundamental rights and core democratic values as productive citizens in local, national, and global communities.
Quick Links

Unit Sequence
Part A: *Can we predict the kind of weather that we will see in the spring, summer, autumn, or winter?*

Concepts	Formative Assessments
● Patterns of change can be used to make predictions. ● People record patterns of the weather across different times and areas so that they can make predictions about what kind of weather might happen next.	*Students who understand the concepts can:* ● Make predictions using patterns of change. ● Represent data in tables, bar graphs, and pictographs to reveal patterns that indicate relationships. ● Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season. *(Assessment of graphical displays is limited to pictographs and bar graphs. Assessment does not include climate change.)* Examples of data could include: ✓ Average temperature ✓ Precipitation ✓ Wind direction

Part B: *How can climates in different regions of the world be described?*	
Concepts	**Formative Assessments**
● Patterns of change can be used to make predictions. ● Climate describes the range of an area's typical weather conditions and the extent to which those conditions vary over years.	*Students who understand the concepts can:* ● Make predictions using patterns of change. ● Obtain and combine information from books and other reliable media to explain phenomena.

Part C: *How can we protect people from natural hazards such as flooding, fast wind, or lightning?*	
Concepts	**Formative Assessments**
● Cause-and-effect relationships are routinely identified, tested, and used to explain change. ● Science affects everyday life. ● People's needs and wants change over time, as do their demands for new and improved technologies. ● A variety of natural hazards result from natural processes (e.g., *flooding, fast wind, or lightning).* ● Humans cannot eliminate natural hazards but can take steps to reduce their impacts. ● Engineers improve technologies or develop new ones to increase their benefits (e.g., better artificial limbs), decrease known risks (e.g., seatbelts in cars), and meet societal demands (e.g., cell phones). ● Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). ● Different proposals for solutions can be	*Students who understand the concepts can:* ● Identify and test cause-and-effect relationships to explain change. ● Make a claim about the merit of a solution to a problem by citing relevant evidence about how it meets the criteria and constraints of the problem. ● Make a claim about the merit of a design solution that reduces the impacts of a weather-related hazard. Examples of design solutions to weather-related hazards could include: ✓ Barriers to prevent flooding ✓ Wind-resistant roofs ✓ Lightning rods ● Define a simple design problem that can be solved through the development of an object, tool, process, or system and include several criteria for success and constraints on materials, time, or cost. ● Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.

compared on the basis of how well each one meets the criteria for success or how well each takes the constraints into account.	

What It Looks Like in the Classroom

In this unit of study, students organize and use data to describe typical weather conditions expected during a particular season. They notice patterns as they analyze and interpret weather data, and they use this data to determine cause-and-effect relationships. By applying their understanding of weather-related hazards, students make claims about the merit of a design solution that reduces the impacts of such hazards, using evidence to support their claims.

Initially, students learn that scientists record patterns of weather across different times and locations in order to make predictions about future weather conditions. To understand how scientists use weather data, students need time, tools, and resources (both print and digital) to collect weather data. They can use a variety of tools (e.g., thermometers, anemometers, rain gauges) to collect firsthand data and multiple resources (e.g., Weather Bug, NOAA) to gather weather data that has been collected over longer periods of time. Multiple units of measurement (e.g., m, cm, °C, km/hr) should be used when recording weather conditions such as temperature, types and amounts of precipitation, and wind direction and speed. To organize the data they collect, students create graphical displays (bar graphs and pictographs) and tables. Once a sufficient amount of data is collected, students need opportunities to analyze data, looking for patterns of change that can be used to make predictions about typical weather conditions for a particular region and time of year. As they collect and analyze data over time, students learn that certain types of weather tend to occur in a given area and that combinations of weather conditions lead to certain types of weather (e.g., it is always cloudy when it rains or snows, but not all types of clouds bring precipitation).

Weather is a combination of sunlight, wind, precipitation, and temperature in a particular region at a particular time. Climate describes the range of an area's typical weather conditions and the extent to which those conditions vary over the years. After learning to analyze and use data to make weather predictions, students use long-term patterns in weather to describe climates in a variety of regions around the world. To accomplish this, students use books and other reliable media to obtain information and weather data collected over a long period of time for a variety of regions. With guidance, students analyze the available data and information in order to describe the climate (e.g., average temperatures, average precipitation, average amount of sunlight) in each region.

Science affects everyday life. Whenever people encounter problems, engineers use scientific knowledge to develop new technologies or improve existing ones to solve our day-to-day problems.

After studying weather and climate, students investigate how weather-related hazards can be reduced. Students learn that there are a variety of natural hazards that result from severe weather. Severe weather, such as high winds, flooding, severe thunderstorms, tornadoes, hurricanes, ice or snowstorms, dust storms, or drought, has the potential to disrupt normal day-to-day routines and cause damage or even loss of life. While humans cannot eliminate natural hazards, they can take steps to reduce their impact. Students can use trade books and media resources to research types of severe weather hazards and their effects on communities and find examples of how communities solve problems caused by severe weather. As a class, students determine the types of severe weather that are common to the local area and discuss the effects on the community. (Define the problem.) In pairs or small groups, students can research ways that the community reduces the effects of severe weather. (Determine ways in which the problem is solved.) Given criteria, groups can determine how well each solution reduces the effects of severe weather. Groups can also prepare a presentation that

- Describes the solution that the group thinks is best for reducing the effects of a given type of weather hazard,
- Lists evidence to support their thinking, and
- Lists at least one possible constraint, such as materials, time, or cost.

Connecting with English Language Arts/Literacy and Mathematics

English Language Arts/Literacy

As students engage in the science described in this unit of study, they use books and other reliable media resources to collect weather and climate information for a given region. They compare information found in two different texts and use information to answer questions about weather and climate. To integrate writing, students can take brief notes as they conduct research and sort evidence into provided categories. Opinion pieces and short research projects should be included to build knowledge about weather and climate.

Mathematic

Like literacy, mathematics is integrated in a variety of ways. Students use appropriate tools and units of measure when collecting and recording weather and climate data. They model with mathematics when organizing data into scaled bar graphs, pictographs, and tables. Throughout the unit, students reason abstractly and quantitatively as they analyze and compare weather data. They will use that information to answer questions and solve multistep problems.

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).

Prior Learning

Kindergarten Unit 3: Weather

- Weather is the combination of sunlight, wind, snow or rain, and temperature in a particular region at a particular time. People measure these conditions to describe and record the weather and to notice patterns over time.
- Some kinds of severe weather are more likely than others in a given region. Weather scientists forecast severe weather so that the communities can prepare for and respond to these events.
- Asking questions, making observations, and gathering information are helpful in thinking about problems. *(secondary)*

Future Learning

Grade 4 Unit 1: Weathering and Erosion

- Rainfall helps to shape the land and affects the types of living things found in a region. Water, ice, wind, living organisms, and gravity break rocks, soils, and sediments into smaller particles and move them around.

Grade 4 Unit 5: Transfer of Energy

- A variety of hazards result from natural processes (e.g., earthquakes, tsunamis, volcanic eruptions). Humans cannot eliminate the hazards but can take steps to reduce their impacts.

Grade 4 Unit 7: Using Engineering Design with Force and Motion Systems

- Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account. *(secondary)*

Grade 5 Unit 5: Earth Systems

- Earth's major systems are the geosphere (solid and molten rock, soil, and sediments), the hydrosphere (water and ice), the atmosphere (air), and the biosphere (living things, including humans). These systems interact in multiple ways to affect Earth's surface materials and processes. The ocean supports a variety of ecosystems and organisms, shapes landforms, and influences climate. Winds and clouds in the atmosphere interact with the landforms to determine patterns of weather.

Connections to Other Units
The Disciplinary Core Ideas in this unit are not related to other units in this grade.

Sample of Open Education Resources
Weather Science content for Kids and Teens: The National Weather Service has several education resources available at this website. NOAA Education Resources: The National Oceanic and Atmospheric Administration (NOAA) provides education resources at this website. *(Note: Students in grades Kindergarten, 4, and 5 make sense of weather and climate. Each model science unit related to Weather and Climate will include these two websites. Therefore, it is important that teachers of science in these grades to collaborate to prevent redundancy in the K-5 weather and climate curriculum.)*

Teacher Professional Learning Resources
Teaching NGSS in Elementary School—Third Grade Carla Zembal-Saul, Professor of Science Education at Penn State University, Mary Starr, Executive Director of Michigan Mathematics and Science Centers Network, Kathy Renfrew, K-5 Science Coordinator for VT Agency of Education and Kimber Hershberger, co-author of "What's Your Evidence?" introduced an overview of the NGSS for Third Grade. The web seminar began with explaining how to unpack the performance expectations. It continued with a focus on scientific practices in relation to the specific standard and performance expectations. Science talk - what it looks like and sounds like, and how to use it in the classroom, as well as claims, evidence and reasoning strategies were discussed. Visit the resource collection. Continue discussing this topic in the community forums. **NSTA Web Seminar: Teaching NGSS in K-5: Constructing Explanations from Evidence** Carla Zembal-Saul, Mary Starr, and Kathy Renfrew, provided an overview of the *NGSS* for K-5th grade. The web

seminar focused on the three dimensional learning of the *NGSS*, while introducing CLAIMS-EVIDENCE-REASONING (CER) as a framework for introducing explanations from evidence. The presenters highlighted and discussed the importance of engaging learners with phenomena, and included a demonstration on using a KLEWS chart to map the development of scientific explanations of those phenomena.

To view related resources, visit the resource collection.
Continue discussing this topic in the community forums.

NGSS Core Ideas: Earth's Systems
The presenter was Jill Wertheim from National Geographic Society. The program featured strategies for teaching about Earth science concepts that answer questions such as "What regulates weather and climate?" and "What causes earthquakes and volcanoes?"
Dr. Wertheim began the presentation by introducing a framework for thinking about content related to Earth systems. She then showed learning progressions for each concept within the Earth's Systems disciplinary core idea and shared resources and strategies for addressing student preconceptions. Dr. Wertheim also talked about changes in the way *NGSS* addresses these ideas compared to previous common approaches. Participants had the opportunity to submit questions and share their feedback in the chat.

Continue the discussion in the community forums.

Appendix A: NGSS and Foundations for the Unit
Develop a model using an analogy, to describe how weather and climate are related. (ESS2.D) *[Note: This SLO is based on the disciplinary core ideas found in the Framework. It is intended to serve as a scaffold to 3-ESS2-1.]*
Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season. *[Clarification Statement: Examples of data could include average temperature, precipitation, and wind direction.] [Assessment Boundary: Assessment of graphical displays is limited to pictographs and bar graphs. Assessment does not include climate change.]* **(3-ESS2-1)**
Obtain and combine information to describe climates in different regions of the world. (3-ESS2-2)
Make a claim about the merit of a design solution that reduces the impacts of climate change and/or a weather-related hazard. [Clarification Statement: Examples of design solutions to weather-related hazards could include barriers to prevent flooding, wind resistant roofs, and lightning rods.] **(3-ESS3-1)**
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 ● Plan and conduct investigations collaboratively to produce evidence to answer a question. (1-PS4-1),(2-LS2-1) **Analyzing and Interpreting Data** ● Represent data in tables and various graphical displays (bar graphs and pictographs) to reveal patterns that indicate relationships. (3-ESS2-1)	**ESS2.D: Weather and Climate** ● Scientists record patterns of the weather across different times and areas so that they can make predictions about what kind of weather might happen next. (3-ESS2-1) ● Climate describes a range of an area's typical weather conditions and the extent to which those conditions vary over years. (3-ESS2-2)	**Patterns** ● Patterns of change can be used to make predictions. (3-ESS2-1),(3-ESS2-2) **Cause and Effect** ● Cause and effect relationships are routinely identified, tested, and used to explain change. (3-ESS3-1) --- ***Connections to Engineering,***

Engaging in Argument from Evidence ● Make a claim about the merit of a solution to a problem by citing relevant evidence about how it meets the criteria and constraints of the problem. (3-ESS3-1) **Obtaining, Evaluating, and Communicating Information** ● Obtain and combine information from books and other reliable media to explain phenomena. (3-ESS2-2)	**ESS3.B: Natural Hazards** ● A variety of natural hazards result from natural processes. Humans cannot eliminate natural hazards but can take steps to reduce their impacts. (3-ESS3-1) *(Note: This Disciplinary Core Idea is also addressed by 4-ESS3-2.)*	***Technology, and Applications of Science*** **Influence of Engineering, Technology, and Science on Society and the Natural World** ● Engineers improve existing technologies or develop new ones to increase their benefits (e.g., better artificial limbs), decrease known risks (e.g., seatbelts in cars), and meet societal demands (e.g., cell phones). (3-ESS3-1) --- ***Connections to Nature of Science*** **Science is a Human Endeavor** ● Science affects everyday life. (3-ESS3-1)

Grade/ Grade Band: 3rd Grade	**Topic:** Introduction to being a Scientist	**Introductory lesson**(1- 2 days)
Brief Lesson Description: Students will discover that anyone can be a scientist		
Performance Expectation(s): CCSS.ELA-LITERACY.SL.3.1- Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on *grade 3 topics and texts*, building on others' ideas and expressing their own clearly.		
Specific Learning Outcomes: By the end of this introduction into science they will see themselves and their classmates as scientists of the world. No matter how large or small their studies can make a difference.		
Narrative / Background Information		
Prior Student Knowledge: Students have participated in science lessons, activities, and discussions in previous grades. They have observed and communicated what they have noticed in the world around them.		
Science & Engineering Practices: **Analyzing and Interpreting Data** ● Represent data in tables and various graphical displays (bar graphs and pictographs) to reveal patterns that indicate relationships. (3-ESS2-1) **Engaging in Argument from Evidence** ● Make a claim about the merit of a solution to a problem by citing relevant evidence about how it meets the criteria and constraints of the problem. (3-ESS3-1) **Obtaining, Evaluating, and Communicating Information** ● Obtain and combine information from books and other reliable media to explain phenomena. (3-ESS2-2)	**Disciplinary Core Ideas:** **ESS2.D: Weather and Climate** ● Scientists record patterns of the weather across different times and areas so that they can make predictions about what kind of weather might happen next. (3-ESS2-1) ● Climate describes a range of an area's typical weather conditions and the extent to which those conditions vary over years. (3-ESS2-2)	**Crosscutting Concepts:** **Patterns** ● Patterns of change can be used to make predictions. (3-ESS2-1),(3-ESS2-2) **Cause and Effect** ● Cause and effect relationships are routinely identified, tested, and used to explain change. (3-ESS3-1)
Possible Preconceptions/Misconceptions: ● Not everyone can be a scientist ● Only men can be scientists ● You have to be an adult to be a scientist		
LESSON PLAN – 5-E Model		

Grade/ Grade Band: 3rd Grade	**Topic:** Introduction to Weather	**Investigation #1 (1 day)**

Brief Lesson Description: In this lesson, students will share what they already know about weather. They will watch weather forecasts to determine the components of weather and they will discuss why weather is important enough to be part of our daily news. Students will discuss and determine how weather affects our daily lives. This lesson will serve as a pre-assessment to determine vocabulary and concepts that students already know and need to know.

Performance Expectation(s): Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season. *[Clarification Statement: Examples of data could include average temperature, precipitation, and wind direction.] [Assessment Boundary: Assessment of graphical displays is limited to pictographs and bar graphs. Assessment does not include climate change.]* **(3-ESS2-1)**

Specific Learning Outcomes: At the end of this lesson students will be able to identify that weather is the condition of the atmosphere and results from the interaction of the sun, air, water, and earth. They will also understand that meteorologists study weather patterns and use specific tools to measure the weather.

Narrative / Background Information

Prior Student Knowledge: This lesson will assess students' prior knowledge of weather concepts and vocabulary.

Science & Engineering Practices:	**Disciplinary Core Ideas:**	**Crosscutting Concepts:**
Analyzing and Interpreting Data ● Represent data in tables and various graphical displays (bar graphs and pictographs) to reveal patterns that indicate relationships. (3-ESS2-1) **Obtaining, Evaluating, and Communicating Information** ● Obtain and combine information from books and other reliable media to explain phenomena. (3-ESS2-2)	**ESS2.D: Weather and Climate** ● Scientists record patterns of the weather across different times and areas so that they can make predictions about what kind of weather might happen next. (3-ESS2-1)	**Patterns** ● Patterns of change can be used to make predictions. (3-ESS2-1),(3-ESS2-2) **Cause and Effect** ● Cause and effect relationships are routinely identified, tested, and used to explain change. (3-ESS3-1)

Possible Preconceptions/Misconceptions:

- Weather and climate are the same thing.
- Seasons are the same throughout the world.
- Weather happens in the sky or on the ground (muddy/snowy)

LESSON PLAN – 5-E Model

Grade/ Grade Band: 3rd Grade	**Topic:** Elements of Weather-Temperature	**Investigation #2a (2 days)**
Brief Lesson Description: In this lesson, students will explore the concept of temperature through hands-on exploration of thermometers and real-world data Students will be displaying data in a variety of ways (chart and bar graph).		
Performance Expectation(s): Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season. *[Clarification Statement: Examples of data could include average temperature, precipitation, and wind direction.] [Assessment Boundary: Assessment of graphical displays is limited to pictographs and bar graphs. Assessment does not include climate change.]* (3-ESS2-1) 9.4.5.IML.3 - Represent the same data in multiple visual formats in order to tell a story about the data.		
Specific Learning Outcomes: At the end of this lesson, students will understand that temperature is one of the elements of weather and meteorologists use thermometers to gather temperature information. Temperature can be reported in both fahrenheit and celsius. Students should have an understanding of benchmark temperatures in both systems.		
Narrative / Background Information		
Prior Student Knowledge: Students may have traveled and discovered for themselves that different places on Earth have different temperatures. Students may also notice that the temperature fluctuates throughout the day. (It is cooler in the morning and evening than it is in the afternoon). If students have traveled outside of the US they may be familiar with celsius.		
Science & Engineering Practices: **Analyzing and Interpreting Data** ● Represent data in tables and various graphical displays (bar graphs and pictographs) to reveal patterns that indicate relationships. (3-ESS2-1) **Obtaining, Evaluating, and Communicating Information** ● Obtain and combine information from books and other reliable media to explain phenomena. (3-ESS2-2)	**Disciplinary Core Ideas:** **ESS2.D: Weather and Climate** ● Scientists record patterns of the weather across different times and areas so that they can make predictions about what kind of weather might happen next. (3-ESS2-1)	**Crosscutting Concepts:** **Patterns** ● Patterns of change can be used to make predictions. (3-ESS2-1),(3-ESS2-2)
Possible Preconceptions/Misconceptions: ● There is only one unit we use to measure temperature. ● Temperature remains constant throughout the day.		
LESSON PLAN – 5-E Model		

Grade/ Grade Band: 3rd Grade	**Topic:** Elements of Weather- Clouds	**Investigation #2b (2 days)**
Brief Lesson Description: In this lesson, students will participate in a Mystery Science lesson in order to identify different types of clouds and patterns of cloud movement to make weather predictions.		
Performance Expectation(s): Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season. *[Clarification Statement: Examples of data could include average temperature, precipitation, and wind direction.] [Assessment Boundary: Assessment of graphical displays is limited to pictographs and bar graphs. Assessment does not include climate change.]* (3-ESS2-1)		
Specific Learning Outcomes: At the end of this lesson, students will be able to make reasonable weather predictions by identifying different types of clouds (cumulus, cumulonimbus, stratus, and stratonimbus).		
Narrative / Background Information		
Prior Student Knowledge: Students may have seen many types of clouds during different weather events. Students may also be able to name different types of clouds.		
Science & Engineering Practices: **Analyzing and Interpreting Data** ● Represent data in tables and various graphical displays (bar graphs and pictographs) to reveal patterns that indicate relationships. (3-ESS2-1) **Obtaining, Evaluating, and Communicating Information** ● Obtain and combine information from books and other reliable media to explain phenomena. (3-ESS2-2)	**Disciplinary Core Ideas:** **ESS2.D: Weather and Climate** ● Scientists record patterns of the weather across different times and areas so that they can make predictions about what kind of weather might happen next. (3-ESS2-1)	**Crosscutting Concepts:** **Patterns** ● Patterns of change can be used to make predictions. (3-ESS2-1),(3-ESS2-2) **Cause and Effect** ● Cause and effect relationships are routinely identified, tested, and used to explain change. (3-ESS3-1)
Possible Preconceptions/Misconceptions: ● The clouds are always dark when it rains. ● Clouds don't move.		
LESSON PLAN – 5-E Model		

Grade/ Grade Band: 3rd Grade	**Topic:** Elements of Weather-Precipitation & Water Cycle	**Investigation #2c (2 days)**
Brief Lesson Description: Students will participate in a simulation by acting as a water molecule and traveling through different parts of the water cycle. As they go through this activity, they will record their movement on a diagram. Students will use a rain gauge to record and observe precipitation.		
Performance Expectation(s): Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season. *[Clarification Statement: Examples of data could include average temperature, precipitation, and wind direction.] [Assessment Boundary: Assessment of graphical displays is limited to pictographs and bar graphs. Assessment does not include climate change.]* (3-ESS2-1)		
Specific Learning Outcomes: By the end of this investigation, students will have a better understanding of the complexity of how water molecules move throughout the water cycle. Students will also learn about how meteorologists measure precipitation.		
Narrative / Background Information		
Prior Student Knowledge: Students may be familiar with parts of the water cycle (evaporation, condensation, precipitation) **OR** may have a limited understanding.		
Science & Engineering Practices: **Analyzing and Interpreting Data** ● Represent data in tables and various graphical displays (bar graphs and pictographs) to reveal patterns that indicate relationships. (3-ESS2-1) **Obtaining, Evaluating, and Communicating Information** ● Obtain and combine information from books and other reliable media to explain phenomena. (3-ESS2-2)	**Disciplinary Core Ideas:** **ESS2.D: Weather and Climate** ● Scientists record patterns of the weather across different times and areas so that they can make predictions about what kind of weather might happen next. (3-ESS2-1)	**Crosscutting Concepts:** **Patterns** ● Patterns of change can be used to make predictions. (3-ESS2-1),(3-ESS2-2) **Cause and Effect** ● Cause and effect relationships are routinely identified, tested, and used to explain change. (3-ESS3-1)
Possible Preconceptions/Misconceptions: ● All water molecules travel the same path in the water cycle.		
LESSON PLAN – 5-E Model		

Grade/ Grade Band: 3rd Grade	**Topic:** Elements of Weather- WInd & Air Pressure	**Investigation # 2d (2-3 days)**

Brief Lesson Description: In this lesson, students will design, build, and test a tool or device that will help them observe the wind. They will also learn how to create a barometer in order to predict weather patterns based on information they gather about air pressure.

Performance Expectation(s): Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season. *[Clarification Statement: Examples of data could include average temperature, precipitation, and wind direction.] [Assessment Boundary: Assessment of graphical displays is limited to pictographs and bar graphs. Assessment does not include climate change.]* (3-ESS2-1)
9.4.5.IML.3 - Represent the same data in multiple visual formats in order to tell a story about the data.

Specific Learning Outcomes: By the end of this lesson, students will understand how meteorologists gather wind data, as well as the relationship between wind and air pressure (differences in air pressure cause movement). Furthermore, they will be able to identify what air pressure may indicate about weather.

Narrative / Background Information

Prior Student Knowledge: Students may be familiar with wind and have observed it before. They might know some of the tools used to measure wind and air pressure.

Science & Engineering Practices:	**Disciplinary Core Ideas:**	**Crosscutting Concepts:**
Analyzing and Interpreting Data ● Represent data in tables and various graphical displays (bar graphs and pictographs) to reveal patterns that indicate relationships. (3-ESS2-1) **Engaging in Argument from Evidence** ● Make a claim about the merit of a solution to a problem by citing relevant evidence about how it meets the criteria and constraints of the problem. (3-ESS3-1) **Obtaining, Evaluating, and Communicating Information** ● Obtain and combine information from books and other reliable media to explain phenomena. (3-ESS2-2)	**ESS2.D: Weather and Climate** ● Scientists record patterns of the weather across different times and areas so that they can make predictions about what kind of weather might happen next. (3-ESS2-1)	**Patterns** ● Patterns of change can be used to make predictions. (3-ESS2-1),(3-ESS2-2) **Cause and Effect** ● Cause and effect relationships are routinely identified, tested, and used to explain change. (3-ESS3-1)

Possible Preconceptions/Misconceptions:
- Wind direction is determined by where the wind is blowing towards.
- Confusion of low pressure and high pressure weather conditions.

LESSON PLAN – 5-E Model

Grade/ Grade Band: 3rd Grade	**Topic:** Weather and Climate	**Investigation #3 (2-4 days)**
Brief Lesson Description: In this lesson, students will learn the difference between weather and climate. Students will also learn the 6 major climate zones and how climate change continues to affect the world and it's environments. Students will then research how climate change affects specific biomes, and spread the word about how everyone can help.		
Performance Expectation(s): 3-ESS2-2. Obtain and combine information to describe climates in different regions of the world. 9.4.5.DC.8: Propose ways local and global communities can engage digitally to participate in and promote climate action (e.g., 6.3.5.GeoHE.1).		
Specific Learning Outcomes: At the end of the lesson, students will be able to differentiate between the terms weather and climate. Students will also be able to identify different climates regions of the world. Students will notice and wonder the direct impact climate change has created across the globe.		
Narrative / Background Information		
Prior Student Knowledge: Students have knowledge of basic weather conditions (temperature, precipitation, wind) and understand that weather is different around the world. Students might also know or have heard of climate change before beginning this investigation.		
Science & Engineering Practices: **Obtaining, Evaluating, and Communicating Information** ● Obtain and combine information from books and other reliable media to explain phenomena. (3-ESS2-2)	**Disciplinary Core Ideas:** **ESS2.D: Weather and Climate** ● Climate describes a range of an area's typical weather conditions and the extent to which those conditions vary over years. (3-ESS2-2)	**Crosscutting Concepts:** **Patterns** ● Patterns of change can be used to make predictions. (3-ESS2-1),(3-ESS2-2)
Possible Preconceptions/Misconceptions: ● Weather is the same all over the world. ● Weather and climate are the same thing. ● Students may also not be aware of climate zones. ● Climate change is not a problem.		
LESSON PLAN – 5-E Model		

Grade/ Grade Band: 3rd Grade	**Topic:** Extreme Weather	**Investigation #4 (6-7 days)**

Brief Lesson Description: In this lesson, students will be introduced to what constitutes an extreme weather event, how they come about, how they affect people and how to prepare for them. They will be introduced to climate change and the connection to extreme weather conditions. Students will use pictures to obtain and combine information to describe extreme weather situations in different regions of the world.

Performance Expectation(s): Obtain and combine information to describe climates in different regions of the world. **(3-ESS2-2)**
Make a claim about the merit of a design solution that reduces the impacts of climate change and/or a weather-related hazard. [Clarification Statement: Examples of design solutions to weather-related hazards could include barriers to prevent flooding, wind resistant roofs, and lightning rods.] (3-ESS3-1)
9.4.5.DC.4: Model safe, legal, and ethical behavior when using online or offline technology (e.g., 8.1.5.NI.2).
9.4.5.IML.6: Use appropriate sources of information from diverse sources, contexts, disciplines, and cultures to answer questions (e.g., RI.5.7, 6.1.5.HistoryCC.7, 7.1.NM. IPRET.5).

Specific Learning Outcomes: SWBA to identify extreme weather phenomena and the related hazards that humans should be prepared for.

Narrative / Background Information

Prior Student Knowledge:
Students know that precipitation, wind, and temperature make up weather.
Students also know that there are different climate zones around the world, which have their own weather patterns.
Students may know that extreme weather affects people.

Science & Engineering Practices:	**Disciplinary Core Ideas:**	**Crosscutting Concepts:**
Planning and Carrying Out Investigations ● Plan and conduct investigations collaboratively to produce evidence to answer a question. (1-PS4-1),(2-LS2-1) **Analyzing and Interpreting Data** ● Represent data in tables and various graphical displays (bar graphs and pictographs) to reveal patterns that indicate relationships. (3-ESS2-1) **Engaging in Argument from Evidence** ● Make a claim about the merit of a solution to a problem by citing	**ESS3.B: Natural Hazards** ● A variety of natural hazards result from natural processes. Humans cannot eliminate natural hazards but can take steps to reduce their impacts. (3-ESS3-1) *(Note: This Disciplinary Core Idea is also addressed by 4-ESS3-2.)*	**Patterns** ● Patterns of change can be used to make predictions. (3-ESS2-1),(3-ESS2-2) **Cause and Effect** ● Cause and effect relationships are routinely identified, tested, and used to explain change. (3-ESS3-1)

relevant evidence about how it meets the criteria and constraints of the problem. (3-ESS3-1) **Obtaining, Evaluating, and Communicating Information** ● Obtain and combine information from books and other reliable media to explain phenomena. (3-ESS2-2)		

Possible Preconceptions/Misconceptions:

- There is no need or way to prepare for extreme weather conditions.
- Humans can control extreme weather conditions.
- Some students might not be aware that certain types of hazardous weather typically happen in certain areas of the world.
- Some students may not be able to differentiate between extreme weather events and seismic events (earthquakes, tsunamis, volcanoes).

LESSON PLAN – 5-E Model

Grade/ Grade Band: 3rd Grade	**Topic:** Engineering for Extreme Weather	**Investigation #5 (3-4 days)**

Brief Lesson Description: In this lesson, students will use what they know to design, build, and test a prototype solution to limit damage from wind and water.

Performance Expectation(s): Make a claim about the merit of a design solution that reduces the impacts of climate change and/or a weather-related hazard. [Clarification Statement: Examples of design solutions to weather-related hazards could include barriers to prevent flooding, wind resistant roofs, and lightning rods.] (3-ESS3-1)

9.4.5.CI.3 Participate in a brainstorming session with individuals with diverse perspectives to expand one's thinking about a topic of curiosity (e.g., 8.2.5.ED.2, 1.5.5.CR1a).

Specific Learning Outcomes: By the end of this lesson, students will have gone through the design process and will be able to reflect on the merit of various solutions to a problem, using evidence to support their thinking.

Narrative / Background Information

Prior Student Knowledge:
Students know various types of extreme weather events and understand that extreme weather conditions can negatively impact humans.

Science & Engineering Practices:

Planning and Carrying Out Investigations

- Plan and conduct investigations collaboratively to produce evidence to answer a question. (1-PS4-1),(2-LS2-1)

Analyzing and Interpreting Data

- Represent data in tables and various graphical displays (bar graphs and pictographs) to reveal patterns that indicate relationships. (3-ESS2-1)

Engaging in Argument from Evidence

- Make a claim about the merit of a solution to a problem by citing relevant evidence about how it meets the criteria and constraints of the problem. (3-ESS3-1)

Obtaining, Evaluating, and Communicating Information

- Obtain and combine information from books and other reliable media to explain phenomena. (3-ESS2-2)

Disciplinary Core Ideas:

ESS3.B: Natural Hazards

- A variety of natural hazards result from natural processes. Humans cannot eliminate natural hazards but can take steps to reduce their impacts. (3-ESS3-1) *(Note: This Disciplinary Core Idea is also addressed by 4-ESS3-2.)*

Crosscutting Concepts:

Cause and Effect

- Cause and effect relationships are routinely identified, tested, and used to explain change. (3-ESS3-1)

Connections to Engineering, Technology, and Applications of Science

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

- Engineers improve existing technologies or develop new ones to increase their benefits (e.g., better artificial limbs), decrease known risks (e.g., seatbelts in cars), and meet societal demands (e.g., cell phones). (3-ESS3-1)

Possible Preconceptions/Misconceptions:

- No structure can withstand an extreme weather event.
- It is not necessary to prepare for extreme weather.

LESSON PLAN – 5-E Model