

Berkeley Heights Public School Berkeley Heights, New Jersey

Science Curriculum Guide

Grades K-5

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This curriculum may be modified through varying techniques, strategies, and materials as per an individual student's Individualized Educational Plan (IEP).

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I. Mission Statement

The Berkeley Heights School District recognizes the importance of and is committed to all students developing 21st century skills that crosscut science, technology, engineering, mathematics and literacy. Creating inquiry-based classroom environments that foster direct involvement with science content, as it integrates across the curriculum, provides an arena for children to build upon their natural inquisitiveness and their inherent drive to find out about the world around them. A high quality integrated science education provides students with the skills and knowledge they need to be well informed citizens, to be prepared for future college and careers, and to understand and appreciate the world around them.

Our vision is that all students will...

- Be curious about how the world works.
- Be scientifically honest, willing to reevaluate ideas when new data are presented.
- Respect the world around them and work to protect both the local and global environment.
- Understand that science is not a static body of knowledge but is continually evolving as new information emerges.
- Be able to evaluate scientific ideas from an historical perspective with a vision for the future.
- Be adept in the use of technology, choosing the appropriate technology for the problems and tasks with which they are confronted.
- Be able to apply knowledge, skills, and processes from science, technology, engineering, mathematics and literacy to solve complex, real-world problems.
- Be persistent in solving problems.
- Be able to use reason and relevant data to support conclusions and opinions.
- Be able to effectively communicate scientific ideas and information orally, visually, and in writing using a variety of medium.
- Be able to work effectively independently and interdependently to solve problems.

II. Best Instructional Practices for Science Teaching

Effective classroom teachers:

- 1. Help students develop scientific processes in an integrated manner.*
An effective and integrated science experience will foster student's natural curiosity about the world around them, encourage students to be open to new ideas and promotes appropriate skepticism.
- 2. Make science part of everyday life in the classroom.*
Support an interdisciplinary thematic approach to teaching science whereas instruction of the core concepts is integrated in all content areas including art, media, music, physical education, technology, engineering, literacy, and world language.
- 3. Help students to use scientific thinking skills.*
An essential element for a student to be a scientific investigator is knowing how to find answers to questions. The skills of scientific inquiry include questioning, hypothesizing, observing, experimenting, measuring, interpreting data, drawing conclusions, and communicating findings.
- 4. Provide materials to encourage scientific exploration.*
Provide hands-on interactive activities that balance both the learning of content and process whereas students develop the skills essential to scientific inquiry including observing, questioning, hypothesizing, predicting, investigating, interpreting, and communicating. Include materials that are interesting to explore as part of the physical environment to create a setting in which students spontaneously ask questions and conduct both formal and informal investigations.
- 5. Provide tools for scientific investigations.*
An important part of science is becoming familiar with the purposeful use of tools and beginning to recognize the way tools relate to mathematical and scientific thinking. Some tools such as scales, measuring cups, thermometers, calculators, and rulers are for measuring. Other tools such as magnifiers, microscopes, and digital devices aid observation.
- 6. Serve as scientific role models.*
Encourage and model the skills, attitudes, and values of scientific inquiry by being observant and pointing out specific events when they happen. Inviting students to talk about their experiences or discoveries and encouraging discussions and asking questions, teachers help students think like scientists.
- 7. Create collaborative classroom environments.*
Science instruction in an integrated manner blends itself to collaboration reinforcing 21st-century communication skills.

8. *Design, develop, implement and evaluate learning experiences and assessments that meet the needs of students in the digital age.* Reinforce and support the development of student understandings, skills, and attitudes in the digital age utilizing digital devices such as ipads, chromebooks, interactive boards, etc. as they are integral in capturing data, evaluating projects, researching and communicating ideas and understandings.

III. Next Generation Science Standards

The Berkeley Heights Science Curriculum is aligned to the Next Generation Science Standards. The NGSS are designed to promote hands-on experience and experimentation to deepen students' understanding of core concepts, rather than reward students simply for memorizing facts and formulas. These standards are addressed at every grade level, and are supported by research findings about how students learn science. The science and engineering practices from the Framework:

1. Asking questions and defining problems
2. Developing and using models
3. Planning and carrying out investigations
4. Analyzing and interpreting data
5. Using mathematics and computational thinking
6. Constructing explanations and designing solutions
7. Engaging in argument from evidence
8. Obtaining, evaluating, and communicating information

Next Generation Science Standards K-5

(Links to website embedded)

K-ESS2-1 Earth's Systems

Use and share observations of local weather conditions to describe patterns over time.

K-ESS2-2 Earth's Systems

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

K-ESS3-1 Earth and Human Activity

Use a model to represent the relationship between the needs of different plants and animals (including humans) and the places they live.

K-ESS3-2 Earth and Human Activity

Ask questions to obtain information about the purpose of weather forecasting to prepare for, and respond to, severe weather.

K-ESS3-3 Earth and Human Activity

Communicate solutions that will reduce the impact of humans on the land, water, air, and/or other living things in the local environment.

1-PS4-1 Waves and Their Applications in Technologies for Information Transfer

Plan and conduct investigations to provide evidence that vibrating materials can make sound and that sound can make materials vibrate.

1-PS4-2 Waves and Their Applications in Technologies for Information Transfer

Make observations to construct an evidence-based account that objects in darkness can be seen only when illuminated.

1-PS4-3 Waves and Their Applications in Technologies for Information Transfer

Plan and conduct investigations to determine the effect of placing objects made with different materials in the path of a beam of light.

1-PS4-4 Waves and Their Applications in Technologies for Information Transfer

Use tools and materials to design and build a device that uses light or sound to solve the problem of communicating over a distance.

1-LS1-1 From Molecules to Organisms: Structures and Processes

Use materials to design a solution to a human problem by mimicking how plants and/or animals use their external parts to help them survive, grow, and meet their needs.

1-LS1-2 From Molecules to Organisms: Structures and Processes

Read texts and use media to determine patterns in behavior of parents and offspring that help offspring survive.

1-LS3-1 Heredity: Inheritance and Variation of Traits

Make observations to construct an evidence-based account that young plants and animals are like, but not exactly like, their parents.

1-ESS1-1 Earth's Place in the Universe

Use observations of the sun, moon, and stars to describe patterns that can be predicted.

1-ESS1-2 Earth's Place in the Universe

Make observations at different times of year to relate the amount of daylight to the time of year.

2-PS1-1 Matter and Its Interactions

Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties.

2-PS1-2 Matter and Its Interactions

Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose.

2-PS1-3 Matter and Its Interactions

Make observations to construct an evidence-based account of how an object made of a small set of pieces can be disassembled and made into a new object.

2-PS1-4 Matter and Its Interactions

Construct an argument with evidence that some changes caused by heating or cooling can be reversed and some cannot.

2-LS2-1 Ecosystems: Interactions, Energy, and Dynamics

Plan and conduct an investigation to determine if plants need sunlight and water to grow.

2-LS2-2 Ecosystems: Interactions, Energy, and Dynamics

Develop a simple model that mimics the function of an animal in dispersing seeds or pollinating plants.

2-LS4-1 Biological Evolution: Unity and Diversity

Make observations of plants and animals to compare the diversity of life in different habitats.

2-ESS1-1 Earth's Place in the Universe

Use information from several sources to provide evidence that Earth events can occur quickly or slowly.

2-ESS2-1 Earth's Systems

Compare multiple solutions designed to slow or prevent wind or water from changing the shape of the land.*

2-ESS2-2 Earth's Systems

Develop a model to represent the shapes and kinds of land and bodies of water in an area.

2-ESS2-3 Earth's Systems

Obtain information to identify where water is found on Earth and that it can be solid or liquid.

K-2-ETS1-1 Engineering Design

Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.

K-2-ETS1-2 Engineering Design

Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.

K-2-ETS1-3 Engineering Design

Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.

3-PS2-1 Motion and Stability: Forces and Interactions

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 Motion and Stability: Forces and Interactions

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

3-PS2-3 Motion and Stability: Forces and Interactions

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 Motion and Stability: Forces and Interactions

Define a simple design problem that can be solved by applying scientific ideas about magnets.

3-LS1-1 From molecules to Organisms: Structures and Processes

Develop models to describe that organisms have unique and diverse life cycles but all have in common birth, growth, reproduction, and death.

3-LS2-1 Ecosystems: Interactions, Energy, and Dynamics

Construct an argument that some animals form groups that help members survive.

3-LS3-1 Heredity: Inheritance and Variation of Traits

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.

3-LS3-2 Heredity: Inheritance and Variation of Traits

Use evidence to support the explanation that traits can be influenced by the environment.

3-LS4-1 Biological Evolution: Unity and Diversity

Analyze and interpret data from fossils to provide evidence of the organisms and the environments in which they lived long ago.

3-LS4-2 Biological Evolution: Unity and Diversity

Use evidence to construct an explanation for how the variations in characteristics among individuals of the same species may provide advantages in surviving, finding mates, and reproducing.

3-LS4-3 Biological Evolution: Unity and Diversity

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.

3-LS4-4 Biological Evolution: Unity and Diversity

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.

3-ESS2-1 Earth's Systems

Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season.

3-ESS2-2 Earth's Systems

Obtain and combine information to describe climates in different regions of the world.

3-ESS3-1 Earth and Human Activity

Make a claim about the merit of a design solution that reduces the impacts of a weather-related hazard.

4-PS3-1 Energy

Use evidence to construct an explanation relating the speed of an object to the energy of that object.

4-PS3-2 Energy

Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.

4-PS3-3 Energy

Ask questions and predict outcomes about the changes in energy that occur when objects collide.

4-PS3-4 Energy

Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.

4-PS4-1 Waves and Their Applications in Technologies for Information Transfer

Develop a model of waves to describe patterns in terms of amplitude and wavelength and that waves can cause objects to move.

4-PS4-2 Waves and Their Applications in Technologies for Information Transfer

Develop a model to describe that light reflecting from objects and entering the eye allows objects to be seen.

4-PS4-3 Waves and Their Applications in Technologies for Information Transfer

Generate and compare multiple solutions that use patterns to transfer information.

4-LS1-1 From Molecules to Organisms: Structures and Processes

Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.

4-LS1-2 From Molecules to Organisms: Structures and Processes

Use a model to describe that animals receive different types of information through their senses, process the information in their brain, and respond to the information in different ways.

4-ESS1-1 Earth's Place in the Universe

Identify evidence from patterns in rock formations and fossils in rock layers to support an explanation for changes in a landscape over time.

4-ESS2-1 Earth's Systems

Make observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation.

4-ESS2-2 Earth's Systems

Analyze and interpret data from maps to describe patterns of Earth's features.

4-ESS3-1 Earth and Human Activity

Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment.

4-ESS3-2 Earth and Human Activity

Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans.

5-PS1-1 Matter and Its Interactions

Develop a model to describe that matter is made of particles too small to be seen.

5-PS1-2 Matter and Its Interactions

Measure and graph quantities to provide evidence that regardless of the type of change that occurs when heating, cooling, or mixing substances, the total weight of matter is conserved.

5-PS1-3 Matter and Its Interactions

Make observations and measurements to identify materials based on their properties.

5-PS1-4 Matter and Its Interactions

Conduct an investigation to determine whether the mixing of two or more substances results in new substances.

5-PS2-1 Motion and Stability: Forces and Interactions

Support an argument that the gravitational force exerted by Earth on objects is directed down.

5-PS3-1 Energy

Use models to describe that energy in animals' food (used for body repair, growth, motion, and to maintain body warmth) was once energy from the sun.

5-LS1-1 From Molecules to Organisms: Structures and Processes

Support an argument that plants get the materials they need for growth chiefly from air and water.

5-LS2-1 Ecosystems: Interactions, Energy, and Dynamics

Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.

5-ESS1-1 Earth's Place in the Universe

Support an argument that the apparent brightness of the sun and stars is due to their relative distances from the Earth.

5-ESS1-2 Earth's Place in the Universe

Represent data in graphical displays to reveal patterns of daily changes in length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky.

5-ESS2-1 Earth's Systems

Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.

5-ESS2-2 Earth's Systems

Describe and graph the amounts and percentages of water and fresh water in various reservoirs to provide evidence about the distribution of water on Earth.

5-ESS3-1 Earth and Human Activity

Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.

3-5-ETS1-1 Engineering Design

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-ETS1-2 Engineering Design

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.

3-5-ETS1-3 Engineering Design

Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

IV. Program Delivery- Resources and Materials

Our Science classrooms are effective standards-based environments that foster understanding of big ideas and help students make connections between present, past and future. Below are the varied units of study that students explore during their course of study in the Berkeley Heights Elementary Schools.

Kindergarten	<i>New Jersey Model Curriculum</i> Weather, Pushes and Pulls, Effects of the Sun, Basic Needs of Living Things, Basic Needs of Human Beings
First Grade	<i>Knowing Science</i> Patterns of Changes in the Sky, Light and Sound, Communicating with Light and Sound, Characteristics of Living Things, Mimicking Organisms to Solve Problems
Second Grade	<i>Knowing Science</i> Changes to Earth's Land, Changes to Matter, Earth's Land and Water, Properties of Matter, Relationships in Habitats
Third Grade	<i>FOSS Science Systems</i> Weather and Climate, Force and Motion, Electrical and Magnetic Forces, Traits, Continuing the Cycle, Organisms and Environment, Using Evidence to Understand Changes in the Environment
Fourth Grade	<i>FOSS Science Systems</i> Weathering and Erosion, Earth Processes, Structure and Function, How Organisms Process Information, Transfer of Energy, Force and Motion, Using Engineering Design with Force and Motion Systems, Waves and Information
Fifth Grade	<i>FOSS Science Systems</i> Properties of Matter, Changes to Matter, Energy and Matter in Ecosystems, Water on the Earth, Earth Systems, Interactions within the Earth, Moon, and Sun Systems

V. Modification & Accommodations

Modifications and Accommodations for Students with IEPs, students with 504s, English Language Learners and Gifted and Talented students may include but are not limited to the following:

Special Education

- Individualized Education Plans (IEP's)
- Exemplars of varied performance levels
- Multimedia presentations
- Sheltered instruction
- Consultation with ESL teachers
- Manipulatives
- Tiered/Scaffolded Lessons
- Mnemonic devices
- Visual aids
- Modeling
- Guided note-taking
- Study Guides
- Modified homework
- Differentiated pre-typed class notes and example problems
- Use of the special education teacher to re-instruct in flexible small groups for the struggling learner
- Manipulatives
- Flipped Instruction
- Word banks
- Reduced choice on assessments
- Preferential seating
- Choice activities
- Modified time requirements
- Modified notes
- Modified lesson, assessment and study guide format
- Provide an enriched curriculum and activities
- Independent projects
- Contracts/behavior support plans
- Open-ended responses
- Project-based learning
- Group activities
- Guided Notes

- Functional learning incorporated into each lesson
- Exploration Activities
- Assessment read aloud
- Small group assessments
- Organizational Support
- Oral questioning assessments to supplement written response
- Pre-writing Structural Supports for extended writing tasks
- Ongoing teacher feedback as part of the writing process
- Interactive Study Guides
- Multi-sensory approach to instruction
- Written and spoken step-by-step directions
- Content-focused assessment (not grading for spelling/grammar)
- Graphic organizers
- Non-verbal cues to begin task/remain on task/refocus
- Individual monitoring for understanding/reinforced instruction
- Printed copies of class readings for application of Active Reading Strategies

Gifted & Talented

- Provide one-to-one teacher support
- Curriculum Compacting
- Advanced problems to extend the critical thinking skills of the advanced learner
- Supplemental reading material for independent study
- Elevated questioning techniques using Webb's Depth of Knowledge matrix
- Curriculum Compacting
- Flexible grouping

- Tiered assignments
- Topic selection by interest
- Manipulatives
- Tiered Lessons
- Flipped Instruction
- Multimedia Presentations
- Open-ended responses
- Project-based learning
- Group activities
- Guided Notes
- Conclusions and analysis of exploratory activities
- Career based learning incorporated into each lesson
- Exploration Activities
- Student choice

ELL's

- Exemplars of varied performance levels
- Multimedia presentations
- Sheltered instruction
- Consultation with ESL teachers
- Manipulatives
- Tiered/Scaffolded Lessons
- Mnemonic devices
- Visual aids
- Modeling
- Guided note-taking
- Study Guides
- Modified homework
- Differentiated pre-typed class notes and example problems
- Individualized instruction plans
- Manipulatives
- Flipped Instruction
- Words banks
- Reduced choice on assessments
- Preferential seating
- Choice activities
- Modified time requirements
- Modified notes
- Modify lesson, assessment and study guide format
- Provide an enriched curriculum and activities

- Contracts/management plans
- Open-ended responses
- Project-based learning
- Group activities
- Guided Notes
- Exploration Activities
- Assessment read aloud
- Small group assessments
- Oral questioning assessments to supplement written response
- Pre-writing Structural Supports for extended writing tasks
- Ongoing teacher feedback as part of the writing process
- Interactive Study Guides
- Multi-sensory approach to instruction
- Written and spoken step-by-step directions
- Graphic organizers
- Non-verbal cues to begin task/remain on task/refocus
- Individual monitoring for understanding/reinforced instruction
- Printed copies of class readings for application of Active Reading Strategies

504's

- Exemplars of varied performance levels
- Multimedia presentations
- Sheltered instruction
- Tiered/Scaffolded Lessons
- Mnemonic devices
- Visual aids
- Modeling
- Guided note-taking
- Study Guides
- Differentiated pre-typed class notes and example problems
- Manipulatives
- Words banks
- Reduced choice on assessments
- Preferential seating
- Modified time requirements
- Modified notes
- Modify lesson, assessment and study guide format
- Modified homework

- Independent projects
- Contracts/management plans
- Open-ended responses
- Project-based learning
- Group activities
- Guided Notes
- Exploration Activities
- Assessment read aloud
- Small group assessments
- Organizational Support
- Oral questioning assessments to supplement written response
- Pre-writing Structural Supports for extended writing tasks
- Ongoing teacher feedback as part of the writing process
- Interactive Study Guides
- Multi-sensory approach to instruction
- Written and spoken step-by-step directions
- Content-focused assessment (not grading for spelling/grammar)
- Graphic organizers
- Non-verbal cues to begin task/remain on task/refocus
- Individual monitoring for understanding/reinforced instruction
- Printed copies of class readings for application of Active Reading Strategies

Students at Risk of Failure

- Exemplars of varied performance levels
- Multimedia presentations
- Tiered/Scaffolded Lessons
- Modeling
- Guided note-taking
- Study Guides
- Differentiated pre-typed class notes and example problems
- Individualized instruction plans

- Words banks
- Reduced choice on assessments
- Preferential seating
- Choice activities
- Modified time requirements
- Modified notes
- Modified lesson, assessment and study guide format
- Modified homework
- Provide an enriched curriculum and activities
- Contracts/management plans
- Open-ended responses
- Project-based learning
- Group activities
- Guided Notes
- Exploration Activities
- Assessment read aloud
- Small group assessments
- Oral questioning assessments to supplement written response
- Pre-writing Structural Supports for extended writing tasks
- Ongoing teacher feedback as part of the writing process
- Interactive Study Guides
- Multi-sensory approach to instruction
- Written and spoken step-by-step directions
- Graphic organizers
- Non-verbal cues to begin task/remain on task/refocus
- Individual monitoring for understanding/reinforced instruction
- Printed copies of class readings for application of Active Reading Strategies

VI. SCOPE AND SEQUENCE

GRADE	UNIT OF STUDY	INSTRUCTIONAL DAYS	NGSS/NJSLS
K	<u>Earth Science</u> Weather	15 Days	K-ESS2-1, K-ESS3-2, and K-2-ETS1-1.
	Effects of the Sun	15 Days	K-PS3-1, K-PS3-2, K-2 ETS1-1, K-2-ETS1-2, and K-2-ETS1-3.
	<u>Physical Science</u> Pushes and Pulls	15 Days	K-PS2-1, K-PS2-2, and K-2: ETS1-3.K-ESS2-1
	<u>Life Science</u> Basic Needs of Living Things Basic needs of Humans	20 Days 15 Days	K-LS1-1, K-ESS3-1, and K-ESS2-2. K-ESS3-3 and K-2 ETS1-1.
1st	<u>Earth Science</u> Patterns of change in the Sky	15 Days	1-ESS1-1 and 1-ESS1-2
	<u>Physical Science</u> Light and Sound Communicating with Light and Sound	20 Days 25 Days	1-PS4-2, 1-PS4-3 and 1-PS4-1 1-PS4-4, K-2-ETS1-1 and K-2-ETS1-2
	<u>Life Science</u> Characteristics of Living Things Mimicking Organisms to Solve Problems	15 Days 25 Days	1-LS3-1 and 1-LS1-2 1-LS1-2 and K-2-ETS1-2
2nd	<u>Earth Science</u> Earth's Land and Water Changes to Earth's Land	40 Days	K-2-ETS1-1, K-2-ETS1-2 2-ESS1-1 2-ESS2-1, 2-ESS2-2, 2-ESS2-3
	<u>Physical Science</u> Properties of Matter Changes to Matter	35 Days	K-2-ETS1-3 2-PS1-1, 2-PS1-2, 2-PS1-3, 2-PS1-4
	<u>Life Science</u> Relationships in Habitats	15 Days	K-2-ETS1-1 2-LS2-1, 2LS2-2 2-LS4-1
3rd	<u>Earth Science</u> Weather and Climate	30 Days	3-ESS2-1, 3-ESS2-2, 3-ESS3-1, 3-5-ETS1-1,2,3
	<u>Physical Science</u> Forces and Motion Electrical and Magnetic Force	30 Days	3-PS2-1, 3-PS2-2 3-PS2-3, 3-PS2-4, 3-5-ETS1-1
	<u>Life Science</u> Traits Continuing the Cycle Organisms and the Environment Using Evidence to Understand Changes in the Environment	30 Days	3-LS1-1, 3-LS2-1, 3-LS3-1, 3-LS3-2, 3-LS4-1, 3-LS4-2, 3-LS4-3, 3-LS4-4, 3-5-ETS1-1.

4th	<u>Earth Science</u> Weathering and Erosion Earth Processes	20 Days	4-ESS1-1 4-ESS2-1, 4-ESS2-2 4-ESS3-2 3-5-ETS1-2, 3-5-ETS1-3
	<u>Life Science</u> Structure and Function How Organisms Process Information	20 Days	4-LS1-1, 4-LS1-2 4-PS4-2
	<u>Physical Science</u> Transfer of Energy Forces and Motion Using Engineering Design with Force and Motion Systems Waves and Information	60 Days	4-PS3-1, -PS3-2, 4PS3-3, 4PS3-4 4-PS4-1, 4-PS4-3 4-ESS3-1 3-5-ETS1-1, 3-5-ETS1-2, 3-5-ETS1-3
5th	<u>Earth Science</u> Earth Systems Interactions within the Earth, Sun and Moon Systems	30 Days	5-ESS1-1, 5-ESS1-2 5-ESS2-1, 5-ESS2-2 5-ESS3-1
	<u>Physical Science</u> Properties of Matter Changes to Matter	30 Days	5-PS1-1, 5-PS1-2, 5-PS1-3, 5-PS1-4 5-PS2-1 5-PS3-1
	<u>Life Science</u> Energy and Matter in Ecosystems Weather on the Earth	30 Days	5-PS3-1 5-LS1-1 5-LS2-1

VII. CURRICULUM BY GRADE

KINDERGARTEN

Unit 1:	15
Weather / Effects of the Sun	
Unit 2:	17
Basic Needs of Living Things	
Unit 3:	18
Pushes and Pulls	
Unit 4:	19
Basic Needs of Humans	

GRADE 1

Unit 1:	21
Patterns and Cycles in the Sky	
Unit 2:	22
Sound, Light, and Shadow	
Unit 3:	24
Communicating with Sound and Light Waves	
Unit 4:	25
Structures and Functions of Plants and Animals: Habitats	
Unit 5:	26
Structures and Functions of Plants and Animals: Biomimicry	

GRADE 2

Unit 1:	28
Properties and Changes to Matter	
Unit 2:	30
Interdependent Relationships in Habitats	
Unit 3:	32
Earth Systems: Land and Water	
Unit 4:	34
Processes That Shape the Earth	

GRADE 3	
Unit 1:	36
Weather and Climate	
Unit 2:	39
Forces and Motion	
Unit 3:	44
Traits, Continuing the Life Cycle, Organisms and Environment, Using Evidence to Understand the Environment	
 GRADE 4	
Unit 1:	58
Transfer of Energy: Force and Motion	
Unit 2:	60
Waves and Information	
Unit 3:	62
Structures and Functions and How Organisms Process Information	
Unit 4:	63
Weathering and Erosion and Earth Processes	
 GRADE 5	
Units 1 and 2:	65
Properties and Changes of Matter	
Unit 3:	70
Energy and Matter in an Ecosystem	
Units 4 and 5:	74
Earth Systems and Water on Earth	
Unit 6:	80
Interaction Within the Earth, Sun and Moon System	

KINDERGARTEN

Unit 1: Weather and Effects of the Sun

Unit Understandings (Summary of Unit):

- In this unit of study, students are expected to develop an understanding of patterns and variations in local weather and the use of weather forecasting to prepare for and respond to severe weather. Students also gain an understanding of the effects of the sun on the Earth's surface. In the kindergarten performance expectations, students are expected to demonstrate grade-appropriate proficiency in asking questions, analyzing and interpreting data, and obtaining, evaluating, and communicating information.

Alignment to NGSS and NJ Student Learning Standards:

This unit is based on K-ESS2-1, K-ESS3-2, K-PS3-1, K-PS3-2.

Technology: 8.2.2.A.1, 8.2.2.A.2, 8.2.2.A.3, 8.2.2.B.1, 8.2.2.B.2, 8.2.2.B.3, 8.2.2.B.4

Career: 9.3.ST.2

Interdisciplinary Connections: RI.K.1, W.K.1, W.K.2, W.K.7

Essential Questions:

- What is the weather like today and how is it different from yesterday?
- How do you prepare for severe weather? (Floods / Tornadoes / Ice Storms)
- How does the sunlight effect objects? How can the effects of the sun be reduced?

Enduring Understandings: (Big Ideas)

- 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.
- Weather scientists forecast severe weather so that communities can prepare for and respond to these events. (Some kinds of severe weather are more likely than others in a given region)
- Sunlight warms Earth's surface and people design things to change the effects.

Unit Learning Targets:

Students will...

1.K-ESS2-1 - Use and share observations of local weather conditions to describe patterns over time. [Clarification Statement: Examples of qualitative observations could include descriptions of the weather (such as sunny, cloudy, rainy, or warm); examples of quantitative observations could include numbers of sunny, windy, and rainy days in a month. Examples of patterns could include that it is usually cooler in the morning than in the afternoon or the number of sunny days versus cloudy days in different months.] [Assessment Boundary : Assessment of quantitative observations is limited to whole numbers and relative measures such as warmer/cooler.]

2.K-ESS3-2 - Ask questions to obtain information about the purpose of weather forecasting to prepare for, and respond to, severe weather. * [Clarification Statement: Emphasis is on local forms of severe weather.]

3.K-PS3-1 - Make observations to determine the effect of sunlight on Earth's surface. [Clarification Statement: Examples of Earth's surface could include sand, soil, rocks, and water.] [Assessment Boundary: Assessment of temperature is limited to relative measures such as warmer/cooler.] [Assessment Boundary: Assessment of temperature is limited to relative measures such as warmer/cooler.] [Assessment Boundary: Assessment of temperature is limited to relative measures such as warmer/cooler.]

4. K-PS3-2 - Use tools and materials to design and build a structure that will reduce the warming effect of sunlight on an area.* [Clarification Statement: Examples of structures could include umbrellas, canopies, and tents that minimize the warming effect of the sun.

KINDERGARTEN

Unit 2: Basic Needs of Living Things

Unit Understandings (Summary of Unit):

In this unit of study, students are expected to develop an understanding of what plants and animals (including humans) need to survive and the relationship between their needs and where they live. In the kindergarten performance expectations, students are expected to demonstrate grade-appropriate proficiency in developing and using models, analyzing and interpreting data, and engaging in argument from evidence.

Alignment to NGSS and NJ Student Learning in Science:

This unit is based on LS1-1, K-ESS3-1

Technology: 8.2.2.A.3, 8.2.2.B.1, 8.2.2.B.2, 8.2.2.B.3, 8.2.2.B.4

Career: 9.3.ST.2

Interdisciplinary Connections: RI.K.1, W.K.2, SL.K.3, SL.K.5

Essential Questions:

- What do plants / animals need to survive?
- Where do organisms live and why do they live there?
- How can plants / animals change [use] their environment to meet their needs?

Enduring Understandings: (Big Ideas)

observations to describe patterns in what animals need to survive. Examples of patterns could include:

- Animals have need such as food, water, space, and favorable weather/climate to survive.
- Plants have needs such as food, water, space, and sunlight to survive.
- Plants and Animals get the things they need to survive from the places they live.
- Types of food, space, and climate vary in different habitats [Understand the relationships between the needs of different animals and the places they live in the natural world.]

Unit Learning Targets:

Students will...

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

[Clarification Statement: Examples of patterns could include that animals need to take in food but plants do not; the different kinds of food needed by different types of animals; the requirement of plants to have light; and that all living things need water.]

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

[Clarification Statement:

Examples of relationships could include that deer eat buds and leaves, therefore, they usually live in forested areas; and grasses need sunlight so they often grow in meadows. Plants, animals, and their surroundings make up a system.]

KINDERGARTEN

Unit 3: Pushes and Pulls

Unit Understandings (Summary of Unit):

- In this unit of study, students are able to apply an understanding of the effects of different strengths or different directions of pushes and pulls on the motion of an object. Students also make observations to analyze the effect of a design solution on the motion of an object.

Alignment to NGSS and NJ Student Learning in Science:

This unit is based on **K-ESS2-1** and **K-ESS3-2**.

Technology: 8.2.2.C.1, 8.2.2.C.2, 8.2.2.C.3, 8.2.2.C.5, 8.2.2.E.1

Career: 9.3.ST-SM.2, 9.3.ST-SM.3

Interdisciplinary Connections: RI.K.1, W.K.7, SL.K.3

Essential Questions:

- What causes an object to move?
- What happens if you push or pull an object harder?

Enduring Understandings: (Big Ideas)

- Students apply an understanding of the effects of different strengths or different directions of pushes and pulls on the motion of an object to analyze a design solution. That pushes and pulls can speed up, slow down, or change the direction of an object.
- That size, weight, and shape of an object affects its motion.

Unit Learning Targets:

Students will...

1. K-PS2-1 - Plan and conduct an investigation to compare the effects of different strengths or different directions of pushes and pulls on the motion of an object.

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

2. K-PS2-2 - Analyze data to determine if a design solution works as intended to change the speed or direction of an object with a push or a pull.

[Clarification Statement: Examples of problems requiring a solution could include having a marble or other object move a certain distance, follow a particular path, and knock down other objects. Examples of solutions could include tools such as a ramp to increase the speed of the object and a structure that would cause an object such as a marble or ball to turn.]

[Assessment Boundary: Assessment does not include friction as a mechanism for change in speed.]

KINDERGARTEN

Unit 4: Basic Needs of Humans

Unit Understandings (Summary of Unit):

In this unit of study, students are expected to develop an understanding of what plants and animals (including humans) need to survive and the relationship between their needs and where they live. In the kindergarten performance expectations, students are expected to demonstrate grade-appropriate proficiency in developing and using models, analyzing and interpreting data, and engaging in argument from evidence.

Alignment to NGSS and NJ Student Learning in Science:

This unit is based on LS1-1, K-ESS3-1

Technology: 8.2.2.A.3, 8.2.2.B.1, 8.2.2.B.2, 8.2.2.B.3, 8.2.2.B.4

Career: 9.3.ST.2

Interdisciplinary Connections: RI.K.1, W.K.2, SL.K.3, SL.K.5

Essential Questions:

- What do plants / animals need to survive?
- Where do organisms live and why do they live there?
- How can plants / animals change [use] their environment to meet their needs?

Enduring Understandings: (Big Ideas)

observations to describe patterns in what animals need to survive. Examples of patterns could include:

- Animals have need such as food, water, space, and favorable weather/climate to survive.
- Plants have needs such as food, water, space, and sunlight to survive.
- Plants and Animals get the things they need to survive from the places they live.
- Types of food, space, and climate vary in different habitats [Understand the relationships between the needs of different animals and the places they live in the natural world.]

Unit Learning Targets:

Students will...

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

[Clarification Statement: Examples of patterns could include that animals need to take in food but plants do not; the different kinds of food needed by different types of animals; the requirement of plants to have light; and that all living things need water.]

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

[Clarification Statement:

Examples of relationships could include that deer eat buds and leaves, therefore, they usually live in forested areas; and grasses need sunlight so they often grow in meadows. Plants, animals, and their surroundings make up a system.]

GRADE 1

UNIT 1: Patterns and Cycles in the Sky

Unit Understandings (Summary of Unit):

- In this unit of study, students are able to observe, describe, and predict some patterns in the movement of objects in the sky such as the sun, and phases of the moon. In the first grade performance expectations, students are expected to demonstrate grade-appropriate proficiency in planning and carrying out investigations and analyzing and interpreting data. Students are expected to use these practices to demonstrate understanding of the core ideas.

Alignment to NGSS and NJ Student Learning in Science:

- 1-ESS1-1 - Use observations of the sun, moon, and stars to describe patterns that can be predicted.

[**Clarification Statement:** Examples of patterns could include that the sun and moon appear to rise in one part of the sky, move across the sky, and set; and stars, other than our sun, are visible at night but not during the day.]

[**Assessment Boundary:** Assessment of star patterns is limited to stars being seen at night and not during the day.]

- 1-ESS1-2 - Make observations at different times of year to relate the amount of daylight to the time of year.

[**Clarification Statement:** Emphasis is on relative comparisons of the amount of daylight in the winter to the amount in the spring or fall.]

[Assessment Boundary: Assessment is limited to relative amounts of daylight, not quantifying the hours or time of daylight.]

[This is an ongoing standard that will need to be revisited periodically throughout the school year]

Career: 9.3.ST.2

Interdisciplinary Connections: W.1.7, W.1.8

Essential Questions:

- What objects are in the sky and how do they seem to move?
- What patterns do you see in the sky?
- How does the amount of daylight change throughout the year?

Enduring Understandings: (Big Ideas)

Patterns in the natural world can be observed, used to describe phenomena, and used as evidence.

- The Sun appears to rise in one part of the sky, move across the sky, and set.
- Seasonal patterns determine the amount of daylight [Longer days in the summer, less in winter]
- Moon has a pattern which can be observed through its changing phases.
- Stars other than our Sun are visible at night but not during the day.

Unit Learning Targets:

Students will...

1. Make observations of the sun as it moves across the sky in predictable patterns. (1-ESS1-1.A)
2. Identify patterns in constellations. (1-ESS1-1.A)
3. Represent the predictable pattern changes in how the moon appears in the sky. (1-ESS1-1.A)
4. Show seasonal changes in clothing and nature the cyclical pattern that occurs year after year. (1-ESS1-1.B)
5. Collect and analyze data on weather and temperature. (1-ESS1-2.B), (1.MD.C.4)

GRADE 1

UNIT 2: Sound Waves and Communication (Sound, Light, and Shadow)

Unit Understandings (Summary of Unit):

- In this unit of study, students explore the relationship between sound and vibrating materials and the light, object, shadow relationship. Students are expected to experiment with different vibrating materials and determining how pitch is different. Students are expected to develop understanding of the availability of light and the ability to see objects. The idea that light travels from place to place can be understood by students at this level by placing objects made with different materials in the path of a beam of light and determining the effect of the different materials.

Alignment to NGSS and NJ Student Learning in Science:

- 1-PS4-1 - PLAN and CONDUCT investigations to provide evidence that vibrating materials can make sound and that sound can make materials vibrate.

[Clarification Statement: Examples of vibrating materials that make sound could include striking a tuning fork and plucking a stretched string. Examples of how sound can make matter vibrate could include holding a piece of paper near a speaker making sound and holding an object near a vibrating tuning fork.]

- 1-PS4-2 - Make observations to construct an evidence-based account that objects can be seen only when illuminated.

[Clarification Statement: Examples of observations could include those made in a completely dark room, a pinhole box, and a video of a cave explorer with a flashlight. Illumination could be from an external light source or by an object giving off its own light.]

- 1-PS4-3 - Plan and conduct an investigation to determine the effect of placing objects made with different materials in the path of a beam of light.

[Clarification Statement: Examples of materials could include those that are transparent (such as clear plastic), translucent (such as wax paper), opaque (such as cardboard), or reflective (such as a mirror).]

[Assessment Boundary: Assessment does not include the speed of light.]

Technology: 8.2.5.A.4, 8.2.5.A.2, 8.2.2.B.1, 8.2.2.C.1, 8.2.2.C.2, 8.2.2.C.5, 8.2.2.D.1, 8.2.2.D.3

Career: 9.3.ST-ET.1, 9.3.ST-ET.4, 9.3.ST-ET.5, 9.3.ST-ET.6

Interdisciplinary Connections: W.1.7, W.1.8, SL.1.1

Essential Questions: Foundations for Inquiry

- What happens when materials vibrate?
- How can you stop a sound?
- Can you see when there is no light?
- What happens when different materials are placed in the path of a beam of light?

Enduring Understandings: (Big Ideas)

- Sound can make matter vibrate, and vibrating matter can make sound. When the object stops vibrating, it stops making sound.
- Objects can be seen if light is available to illuminate them or if they give off their own light.
- Some materials allow light to pass through them, others allow only some light through, and others block all the light and create a dark shadow on any surface beyond them, where the light cannot reach.
- Mirrors can be used to redirect a light beam.

Unit Learning Targets:

Students will...

1. Describe how vibrating materials make sound. (1-PS4-1.A)
2. Compare and contrast pitches of sounds. (1-PS4-1.A)
3. Identify light sources in our world. (1-PS4-2.B)
4. Explain the importance of light in our world. (1-PS4-2.B)
5. Compare and contrast opacity of materials as it relates to light passing through (translucent, transparent, opaque). (1-PS4-2.B), (1-PS4-3.B)
6. Identify the three things needed to make a shadow (light source, object, place for the shadow to fall). (1-PS4-2.B), (1-PS4-3.B)
7. Change the size of the shadow by manipulating the light source or the object. (1-PS4-2.B), (1-PS4-3.B)

GRADE 1**UNIT 3: Light Waves and Communication (Communicating with Sound, Light, & Shadow)**

Unit Understandings (Summary of Unit):

- In this unit of study, students are expected to apply understanding of light and sound waves in order to communicate and receive messages.

Alignment to NGSS and NJ Student Learning in Science:

- 1-PS4-4 - USE tools and materials to DESIGN and BUILD a device that uses light or sound to solve the problem of communicating over a distance.

[Clarification Statement: Examples of devices could include a light source to send signals, paper cup and string “telephones”, and a pattern of drum beats.]

[Assessment Boundary: Assessment does not include technological details for how communication devices work.]

Technology: 8.2.5.A.4, 8.2.5.A.2, 8.2.2.B.1, 8.2.2.C.1, 8.2.2.C.2, 8.2.2.C.5, 8.2.2.D.1, 8.2.2.D.3

Career: 9.3.ST-ET.1, 9.3.ST-ET.4, 9.3.ST-ET5, 9.3.ST-ET.6

Interdisciplinary Connections: W.1.7, W.1.8, SL.1.1

Essential Questions:

- What is communication?
- What are some ways people communicate?
- How can light and sound be used to communicate?

Enduring Understandings: (Big Ideas)

- Lighthouse, flashing lights, morse code, and new technologies use light to communicate information.
- People also use a variety of devices to communicate (send and receive information) over long distances.

Unit Learning Targets:

Students will...

1. Define communication as sending and receiving messages that both parties understand. (1-PS4-4.C)
2. Apply understanding of how light and sound can be used to communicate. (1-PS4-4.C)
3. Design a tool that communicates a message using light and/or sound. (1-PS4-4.C)

GRADE 1

UNIT 4: Structures and Functions of Plants and Animals (Habitats and life cycles)

Unit Understandings (Summary of Unit):

- In this unit students are expected to develop understanding of how plants and animals use their external parts to help them survive, grow, and meet their needs, as well as how the behaviors of parents and offspring help offspring survive.

Alignment to NGSS and NJ Student Learning in Science:

- 1-LS1-2 - Read texts and use media to determine patterns in behavior of parents and offspring that help offspring survive.

[Clarification Statement: Examples of patterns of behaviors could include the signals that offspring make (such as crying, cheeping, and other vocalizations) or the responses of the parents (such as feeding, comforting, and protecting the offspring).]

- 1-LS3-1 - Make observations to construct an evidence-based account that young plants and animals are like, but not exactly like, their parents.

[Clarification Statement: Examples of patterns could include features plants or animals share. Examples of observations could include leaves from the same kind of plant are the same shape but can differ in size; and, a particular breed of dog looks like its parents but is not exactly the same.]

[Assessment Boundary: Assessment does not include inheritance, animals that undergo metamorphosis or hybrids.]

Technology: 8.2.2.A.1, 8.2.2.A.2

Career: 9.3.ST-ET.4, 9.3.ST-ET.6, 9.3.ST-ET.6

Interdisciplinary Connections: RI.1.1, RI.1.2, RI.1.10, W.1.7, W.1.8

Essential Questions:

- How do plants and animals use their external parts to meet their needs?
- How are parents and their offspring similar and different?
- How do parents help their offspring survive?

Enduring Understandings: (Big Ideas)

- Young plants and animals are very much, but not exactly, like their parents.
- Animal parents and their offspring exhibit behaviors that help them survive such as feeding, communicating, and protecting from danger.
- All plants and animals have external parts that help them to survive.

Unit Learning Targets:

Students will...

1. Identify that plants and animals have adaptations that help them survive in the environment (camouflage, teeth, and spines). (1-LS1-1.A)
2. Identify some ways in which animals and plants are adapted to living in different environments. (1-LS1-1.D)
3. Compare and contrast parents and offspring of plants and animals. (1-LS1-2.B), (1-LS1-3.A)
4. Explain how animal and plants can be associated with their environment by an examination of their structural characteristics of plants or animals. (1-LS1-1.A)
5. Compare and describe the structural characteristics of plants and animals. (1-LS3-1.B)

GRADE 1

UNIT 5: Structures and Functions of Plants and Animals (Biomimicry)

Unit Understandings (Summary of Unit):

- In this unit students are expected to apply understanding of how plants and animals use their external parts to help them survive, grow, and meet their needs, as well as how the behaviors of parents and offspring help offspring survive. Students will also develop possible solutions to human problems using animal and plant adaptations.

Alignment to NGSS and NJ Student Learning in Science:

- 1-LS1-1. Use materials to design a solution to a human problem by mimicking how plants and/or animals use their external parts to help them survive, grow, and meet their needs.*

[**Clarification Statement:** Examples of human problems that can be solved by mimicking plant or animal solutions could include designing clothing or equipment to protect bicyclists by mimicking turtle shells, acorn shells, and animal scales; stabilizing structures by mimicking animal tails and roots on plants; keeping out intruders by mimicking thorns on branches and animal quills; and, detecting intruders by mimicking eyes and ears.]

Technology: 8.2.2.A.1, 8.2.2.A.2, 8.2.2.A.4, 8.2.2.A.5, 8.2.2.B.1, 8.2.2.B.3, 8.2.2.C.1, 8.2.2.C.2, 8.2.2.C.3, 8.2.2.D.1

Career: 9.3.ST-ET.4, 9.3.ST-ET.5, 9.3.ST-ET.6

Interdisciplinary Connections: W.1.7

Essential Questions:

- How do plants and animals use their external parts to meet their needs?
- How can we look at how animals and plants use their parts to create tools we can use to solve a problem.

Enduring Understandings: (Big Ideas)

- Animal parents and their offspring exhibit behaviors that help them survive such as feeding, communicating, and protecting from danger.
- All plants and animals have external parts that help them to survive.
- Human problems can be solved by mimicking plants and animals external parts them to meet their needs.

Unit Learning Targets:

Students will...

1. Analyze parts of animals and plants to understand their functions. (1-LS1-1.A), (1-LS1-1.D)
2. Design a tool to solve a problem mimicking a plant or animal part. (1-LS1-1)

GRADE 2

Unit 1: Properties and Changes to Matter

Unit Understandings (Summary of Unit):

- In this unit of study, students describe and classify matter using observable properties. Certain properties are easily observed, but other students will uncover through investigations. They will understand that different kinds of matter exist, and that temperature plays a role in the type of matter—many can be either solid or liquid. Through investigations students will begin to develop the skills themselves to choose the best material for certain tasks. Students will understand that heating or cooling a substance may cause change. Some of the changes can be reversed, but some cannot.

Alignment to NGSS and NJ Student Learning in Science:

- 2-PS1-1. Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties. [Clarification Statement: Observations could include color, texture, hardness, and flexibility. Patterns could include the similar properties that different materials share.]
- 2-PS1-2. Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose.* [Clarification Statement: Examples of properties could include, strength, flexibility, hardness, texture, and absorbency.] [Assessment Boundary: Assessment of quantitative measurements is limited to length.]
- 2-PS1-3. Make observations to construct an evidence-based account of how an object made of a small set of pieces can be disassembled and made into a new object. [Clarification Statement: Examples of pieces could include blocks, building bricks, or other assorted small objects.]

Technology: 8.2.2.C.1

Career: 9.3.ST-ET.2, 9.3.ST-ET.5, 9.3.ST-SM.2

Interdisciplinary Connections: SL.1, SL.2, RI.2.1, RI.2.3, RI.2.8

Essential Questions:

- How are materials similar and different from one another?
- How do the properties of materials determine their use?
- How does matter change? Are changes reversible?

Enduring Understandings: (Big Ideas)

- Different kinds of matter exist and many of them can be either solid or liquid, depending on temperature.
- Every human-made product is designed by applying some knowledge of the natural world and is built using materials derived from the natural world.
- Objects may break into smaller pieces and be put together into larger pieces or change shapes.
- Heating or cooling a substance may cause changes that can be observed. Sometimes these changes are
- reversible, and sometimes they are not.

Unit Learning Targets:

Lesson 3 – Matter Matters – Exploring the Properties of Matter

The objectives for this lesson are:

- Define matter
- Describe solids, liquids, and gases as three forms of matter
- Compare one state of matter to another

- Give real life examples of the various states of matter

Lesson 4 – The Building Blocks of Matter

The objectives for this lesson are:

- Follow directions to model how matter is constructed
- Explain why various kinds of matter have different properties
- Cite real-life examples of various kinds of matter

Lesson 5 – When States of Matter Change

The objectives for this lesson are:

- Compare the appearance and properties of the three phases of water
- Describe how water can change from one state to another
- Explain that that a change in temperature causes water to change states

Lesson 6 – Sorting by Weight (Classification)

The objectives for this lesson are:

- Estimate whether an object is heavier or lighter than a “standard” weight

Lesson 13 – Introduction to Density

The objectives for this lesson are:

- Participate in sequencing and weighing a collection of materials that vary in density
- Discuss their ideas about why a given amount of one material weighs more or less than the same amount of another material

Lesson 14 – More about Density

The objectives for this lesson are:

- Actively participate in weighing materials that vary in density
- Explain in their own words why the same volume of various substances differs in weight and why equal weights of various substances have different volumes

GRADE 2

Unit 2: Interdependent Relationships in Habitats

Unit Understandings (Summary of Unit):

- In this unit of study, students explore and compare the diversity of life in different habitats. Students will be able to use a cause-effect relationship to compare why animals and plants exist in different places on land and in water. In habitats, will explore how animals and plants rely on each other to live and grow. They will investigate what plants and animals need in order to grow. Students will develop an understanding of how animals depend on plants for food, and how plants depend on animals to pollinate.
plants or disperse their seeds. Finally, they will develop a model that mimics how an animal functions in the dispersal of seeds or in the process of pollination.

Alignment to NGSS and NJ Student Learning in Science:

- 2-LS4-1. Make observations of plants and animals to compare the diversity of life in different habitats. [Clarification Statement: Emphasis is on the diversity of living things in each of a variety of different habitats.] [Assessment Boundary: Assessment does not include specific animal and plant names in specific habitats.]
- 2-LS2-1. Plan and conduct an investigation to determine if plants need sunlight and water to grow. [Assessment Boundary: Assessment is limited to testing one variable at a time.]
- 2-LS2-2. Develop a simple model that mimics the function of an animal in dispersing seeds or pollinating plants.

Technology: 8.2.2.C.1, 8.2.2.C.2, 8.2.2.C.3

Career: 9.3.ST-ET.1, 9.3.ST-ET.4, 9.3.ST-SM.2

Interdisciplinary Connections: RI.2.1, RI.2.2, RI.2.4. RI.2.7

Essential Questions:

- How do living things in a habitat depend on one another?
- How many types of living things live in a place?
- What do plants need to grow?

Enduring Understandings: (Big Ideas)

- There are many different kinds of living things in any area, and they exist in different places on land and in water.
- The characteristics of the habitat determine the types of organisms that live there.
- Plants depend on water and light to grow.
- Plants depend on animals for pollination or to move their seeds around.

Unit Learning Targets:

Lesson 15 – Plant Munchies — What Plants Need to Survive

The objectives for this lesson are:

- Review and compare characteristics of living and nonliving things
- Understand that all living things, including plants, require the same basic needs of food, water, air, and shelter or space to live and grow
- Know that all of a plant's basic needs must be met in order for it to live and grow
- Describe the roles that a plant's roots, stems, and leaves play in its food production and survival
- Plan and carry out a guided inquiry about the basic needs of plants
- Record observations from the inquiry
- Communicate ideas about their observations both verbally and in writing
- Work collaboratively
- Draw conclusions about the basic needs of plants, plant structures, and how they relate to food production

Lesson 16 – Habitat, Sweet Habitat

The objectives for this lesson are:

- Compare characteristics of the following ecosystems: woodland forest and rainforest; desert and polar (tundra); and fresh and saltwater
- Distinguish between living and nonliving parts of each ecosystem
- Give examples of animals and plants that live in each ecosystem
- Understand that within each ecosystem there are many habitats which are able to support the plants and animals suited specifically to living there
- Locate main idea and details in content-based nonfiction text using text features

Lesson 17 – Adaptations and Interdependency

The objectives for this lesson are:

- Identify general reasons for living in a group
- Differentiate between structural and behavioral adaptations
- Classify adaptations in terms of basic needs: taking in water and nutrients, breathing, defense and protection from predators, finding shelter, and managing body temperature
- Give examples of external structures and information processing systems which are suited to a particular ecosystem
- Explain interdependent relationships between animals and plants in any given ecosystem (pollination, seed dispersal, food, and shelter)
- Locate main idea and details in content-based nonfiction text using text features

Lesson 19 – Habitats Change

The objectives for this lesson are:

- Explain interdependency within a food web or habitat as a “system”
- Give cause and effect examples of natural changes in a habitat: rain or snowfall, flood, drought, wildfire, or other natural disaster
- Give cause and effect examples of human impact on habitats and classify them as positive or negative
- Give examples of how they can be good stewards within their local habitat

GRADE 2

Unit 3: Earth Systems: Land and Water

Unit Understandings (Summary of Unit):

- In this unit of study, students look for patterns as they identify where water is found on Earth and explore the shapes and kinds of land and bodies of water found in an area. Students will develop models to identify and represent the shapes and kinds of land and bodies of water in an area.

Alignment to NGSS and NJ Student Learning in Science:

- 2-ESS2-2. Develop a model to represent the shapes and kinds of land and bodies of water in an area. [Assessment Boundary: Assessment does not include quantitative scaling in models.]
- 2-ESS2-3. Obtain information to identify where water is found on Earth and that it can be solid or liquid.

Technology: 8.2.2.A.1, 8.2.2.C.1

Career: 9.3.ST-ET.2, 9.3.ST-ET.5, 9.3.ST-SM.2

Interdisciplinary Connections: SL1, SL2, SL3, SL4, SL5, SL6

Essential Questions:

- How can we identify where water is found on Earth and if it is solid or liquid?
- What types of landform can be found on Earth?
- In what ways can you represent the shapes and kinds of land and bodies of water in an area?

Enduring Understandings: (Big Ideas)

- Water is found in the ocean, rivers, lakes, and ponds. Water exists as solid ice and in liquid form.

- Earth's surface is covered with various landform (i.e. mountains, plateaus, plains) with specific characteristics.
- Maps show where things are located. One can map the shapes and kinds of land and water in any area.
- Globes and 3D models are created to represent landforms and bodies of water found on Earth.

Unit Learning Targets:

Lesson 21 – Earth's Dynamic Surface

The objectives for this lesson are:

- Build a model that shows that ocean basins are water sitting on top of Earth's crust
- Build a model that shows that continents are crust that reach above sea level
- Describe the crust as a series of tectonic plates floating on the mantle which fit together like a puzzle pieces
- Explain that plates move over a distance due to a push or pull (force) from the mantle
- Communicate at least one reason scientists believe that the continents were once joined together (evidence)

Lesson 23 – Shaping the Earth's Surface

The objectives for this lesson are:

- Explain that wind and moving water change the Earth's land features over time by eroding particles of rock and soil (sediments)
- Explain that wind and moving water move lighter materials such as sand farther and faster than heavier materials like rocks
- Using experimental evidence, compare the force that fast winds exert on an object to the force that slow winds exert on an object
- Using experimental evidence, compare the force that a high flow rate of water exerts on an object to the force that a low flow rate exerts on an object
- Suggest solutions humans can devise to slow or stop erosion

GRADE 2

Unit 4: Processes that Shape the Earth

Unit Understandings (Summary of Unit):

- In this unit of study, students are able to apply their understanding of the idea that wind and water can change the shape of land to compare design solutions to slow or prevent such change. Students are expected to demonstrate grade-appropriate appropriate proficiency in asking questions and defining problems, developing and using models, and constructing explanations and designing solutions.

Alignment to NGSS and NJ Student Learning in Science:

- 2-ESS1-1. Use information from several sources to provide evidence that Earth events can occur quickly or slowly. [Clarification Statement: Examples of events and timescales could include volcanic explosions and earthquakes, which happen quickly and erosion of rocks, which occurs slowly.] [Assessment Boundary: Assessment does not include quantitative measurements of timescales.]
- 2-ESS2-1. Compare multiple solutions designed to slow or prevent wind or water from changing the shape of the land.*[Clarification Statement: Examples of solutions could include different designs of dikes and windbreaks to hold back wind and water, and different designs for using shrubs, grass, and trees to hold back the land.]

Technology: 8.2.2.A.5, 8.2.2.B.2, 8.2.2.C.1

Career: 9.3.ST-ET.2, 9.3.ST-ET.5, 9.3.ST-SM.2

Interdisciplinary Connections: RI.2.1, RI.2.3, RI.2.9. SL.2.2

Essential Questions:

- What evidence can we find to prove that the Earth changes quickly and slowly?
- How can we slow or prevent wind or water from changing the shape of the land?

Enduring Understandings: (Big Ideas)

- Different forces cause the Earth to change quickly (volcanoes/ earthquakes) or slowly (wind/water)
- Scientists and Engineers develop solutions to prevent negative changes to the surface of the Earth.

Unit Learning Targets:

Lesson 22 – Earthquakes!

The objectives for this lesson are:

- Explain that when tectonic plates move they rub against each other and cause an earthquake
- Identify the representative features of a model (the force applied represents an earthquake, the location of applied force is an epicenter and the sugar cube stacks are buildings in the model)
- Describe how a force in one location affects objects in another location because the force causes the surface that the objects rest on to vibrate or shake
- Compare the impact of a strong force and a weak force on an object at rest
- Compare the effect of distance between an object at rest on a surface and a force applied to the surface
- Design and modify ‘buildings’ in their models to withstand the ‘earthquake’ forces

Lesson 23 – Shaping the Earth’s Surface

The objectives for this lesson are:

- Explain that wind and moving water change the Earth’s land features over time by eroding particles of rock and soil (sediments)
- Explain that wind and moving water move lighter materials such as sand farther and faster than heavier materials like rocks
- Using experimental evidence, compare the force that fast winds exert on an object to the force that slow winds exert on an object
- Using experimental evidence, compare the force that a high flow rate of water exerts on an object to the force that a low flow rate exerts on an object
- Suggest solutions humans can devise to slow or stop erosion.

GRADE 3

Unit 1: Weather and Climate

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 asking 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.

Unit Understandings (Summary of Unit): 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.

Alignment to NGSS and NJ Student Learning in Science:

This unit is based on 3-ESS2-1, 3-ESS2-2, 3-ESS3-1, and 3-5-ETS1-1.

Technology: 8.2.5.B.1, 8.2.5.C.1, 8.2.5.C.2, 8.2.5.C.3, 8.2.5.C.4, 8.2.5.C.5, 8.2.5.C.6

Career: 9.3.ST.1, 9.3.ST.2, 9.3.ST-ET.1, 9.3.ST-ET.2, 9.3.ST-ET.3, 9.3.ST-ET.4, 9.3.ST-ET.5, 9.3.ST-ET.6, 9.3.ST-SM.2, 9.3.ST-SM.3

Interdisciplinary Connections: RI.3.1, RI.3.9, W.3.1, W.3.7, W.3.8

Essential Questions:

- *What is the typical weather near our home?*
- *How can we protect people from weather-related hazards?*

Enduring Understandings: (Big Ideas)

- Can we predict the kind of weather that we will see in the spring, summer, autumn, or winter?
- 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

Unit Learning Targets: Student Learning Objective (SLO)

Students will...

1. *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.]*
2. *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)*
3. *Obtain and combine information to describe climates in different regions of the world. (3-ESS2-2)*
4. *Make a claim about the merit of a design solution that reduces the impacts of 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)*

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, tornados, 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
- Lists at least one possible constraint, such as materials, time, or cost.

GRADE 3

Unit 2A: Forces and Motion

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.

Unit Understandings (Summary of Unit):

In this unit of study, students look for cause-and-effect relationships as they investigate the effects of balanced and unbalanced forces on the motion of an object. They learn that objects in contact exert forces on each other, and these forces have both strength and direction. When forces are balanced, there is no change in the motion or the position of an object. In other words, an object at rest typically has multiple forces acting on it, but the forces balance out to equal a zero net force on the object. For example, if two children stand with their hands together and push against each other, the pushing force each exerts balances to a net zero effect if neither child moves. Pushing a box from both sides also demonstrates a balanced force if the forces do not produce any change in motion or position of the box.

When forces are unbalanced, however, there is a change in the motion and/or position of the object the forces are acting on. If the same two children from the example above were pushing against each other, and one child moves his/her hands, arms, or feet forward while the other child moves backward, this would demonstrate an unbalanced force. The first child is pushing with greater force than the second.

Through planning and conducting investigations, students will come to understand that forces that result in changes in an object's speed or direction of motion are unbalanced. Students can observe everyday examples on the playground, with seesaws and swings and by kicking and throwing soccer balls. As they conduct investigations and make observations, students should identify the cause-and-effect relationships at work and identify the objects that are exerting forces on one another. They should also use

qualitative descriptions when identifying the relative strength (greater than, less than, equal) and direction of the forces, even if an object is at rest.

Investigating the effects of forces on objects will also give students opportunities to observe that patterns exist everywhere. Patterns are found in shapes, structures, natural environments, and recurring events. Scientists and engineers analyze patterns to make predictions, develop questions, and create solutions. As students have opportunities to observe forces interacting with objects, they will ask questions and analyze and interpret data in order to identify patterns of change in the motion of objects and to make predictions about an object's future motion. When students are on the playground, they can observe multiple patterns of change in the back-and-forth motion of a child swinging on a swing or in the up-and-down motion of a seesaw. In the classroom, students can observe a variety of objects, such as marbles rolling back and forth in bowls or tops spinning across the floor.

Throughout this unit, as students plan and carry out investigations, it is extremely important that they routinely identify cause-and-effect relationships and look for patterns of change as objects interact. As students interact with objects, such as when they push a door closed, bounce a ball, or roll a ball down a ramp, they may ask, "What caused the changes that I observed? How can I change the way in which the object moved?" Students need to have many experiences in order to deepen their understanding of the cause-and-effect relationships between balanced and unbalanced forces on the motion of an object, and they should be guided to plan and conduct fair tests, testing only one variable at a time.

Alignment to NGSS and NJ Student Learning in Science:

This unit is based on 3-PS2-1 and 3-PS2-2

Technology: 8.2.5.B.1, 8.2.5.C.1, 8.2.5.C.2, 8.2.5.C.3, 8.2.5.C.4, 8.2.5.C.5, 8.2.5.C.6

Career: 9.3.ST.1, 9.3.ST.2, 9.3.ST-ET.1, 9.3.ST-ET.2, 9.3.ST-ET.3, 9.3.ST-ET.4, 9.3.ST-ET.5, 9.3.ST-ET.6, 9.3.ST-SM.2, 9.3.ST-SM.3

Interdisciplinary Connections: RI.3.1, RI.3.3, W.3.8, W.3.7, W.3.8, SL.3.3

Essential Questions:

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

Enduring Understandings: Big Idea(s)

Students are able to determine the effects of balanced and unbalanced forces on the motion of an object.

Unit Learning Targets: Student Learning Objective (SLO)

Students will...

1. 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)

2. 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)

GRADE 3

Unit 2B: Electrical and Magnetic Forces

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.

Unit Understandings (Summary of Unit):

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.

Alignment to NGSS and NJ Student Learning in Science:

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

Technology: 8.2.5.B.1, 8.2.5.C.1, 8.2.5.C.2, 8.2.5.C.3, 8.2.5.C.4, 8.2.5.C.5, 8.2.5.C.6

Career: 9.3.ST.1, 9.3.ST.2, 9.3.ST-ET.1, 9.3.ST-ET.2, 9.3.ST-ET.3, 9.3.ST-ET.4, 9.3.ST-ET.5, 9.3.ST-ET.6, 9.3.ST-SM.2, 9.3.ST-SM.3

Interdisciplinary Connections: RI.3.1, RI.3.3, W.3.8, W.3.7, W.3.8, SL.3.3

Essential Questions:

- How can we use our understandings about magnets be used to solve problems?

Enduring Understandings: Big Idea(s)

- Determine the cause and effect relationships of electric or magnetic interactions between two objects not in contact with each other.
- After investigating electrical and magnetic forces, students will engage in a portion of the engineering design process in order to define a simple design problem that can be solved by applying scientific ideas about magnets. This process should include the following steps:
 - As a class, create a list of the properties of magnets. (See content descriptions above)
 - Brainstorm a list of everyday objects that use magnets, and discuss the function of the magnet(s) in each object. For example, electric can openers have a strong magnet that attaches a can to the device as it cuts through (opens) the top of the can.
 - In small groups or pairs, students discuss possible everyday problems that might be solved using magnets. For example, they could construct a latch to keep a door shut.
 - As a class, determine possible criteria that might be used to determine how successful the devices might be, and discuss possible constraints (on materials, time, or cost) that might affect each group's design solution.
 - Small groups or pairs should have the opportunity to create a presentation (poster, PowerPoint, drawings, or actual physical model, if time permits) to share both the design problem and solution with the class.
 - In this unit, students are not expected to build and test their design solutions or to optimize their designs; however, they can compare different proposals for solutions

on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account. The overall goal is for students to understand that engaging in engineering design will help them understand that scientific discoveries about the natural world can often lead to new and improved technologies, which are developed through the engineering design process, and that as people's needs and wants change over time, so do their demands for new and improved technologies.

- Engineering design is an important part of this unit of study. Students are expected to define a simple design problem that can be solved by applying scientific ideas and determine possible success criteria and constraints on time, materials, and cost. They should also compare different proposals for solutions based on how well the proposed solutions meet the criteria for success or how well each takes the constraints into account.

Unit Learning Targets: Student Learning Objective (SLO)

Students will...

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 paper clips, 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)**

Notes:

Elementary-school students are usually aware of the behavior of magnets but may not explain the behavior in terms of forces (i.e., they may think of a magnet sticking to or moving towards another magnet but may not recognize this as the effect of a pull or force). Students of all ages may think of gravity and magnetism interchangeably. They may refer to magnetism as a "type of gravity," but they may also explain gravity in terms of the earth acting like a magnet on objects. Students may think that magnets do not work in a place where there is no air, just like they think about gravity. Students of all ages may also confuse electrostatic and magnetic effects. For example, they may predict that north magnetic poles repel positively charged objects.

Students do not readily recognize the magnetic effect of an electric current. Some think of the wire, rather than the electric current as being the cause of the magnetic effect. Students may think that insulation around the wire prevents the existence of magnetic forces when current flows ([NSDL, 2015](#)).

GRADE 3**Unit 3A: Traits**

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 effect* 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.

Unit Understandings (Summary of Unit):

- Cause-and-effect relationships are routinely identified and used to explain change.
- Other characteristics, which can range from diet to learning, result from individuals' interaction with the environment.
- Many characteristics involve both inheritance and environment.
- The environment also affects the traits that an organism develops

Alignment to NGSS and NJ Student Learning in Science:

This unit is based on 3-LS3-1 and 3-LS3-2.

Career: 9.3.ST.1, 9.3.ST.2, 9.3.ST-ET.1, 9.3.ST-ET.2, 9.3.ST-ET.3, 9.3.ST-ET.4, 9.3.ST-ET.5, 9.3.ST-ET.6, 9.3.ST-SM.2, 9.3.ST-SM.3

Interdisciplinary Connections: RI.3.1, RI.3.2, RI.3.3, RI.3.7, W.3.2, W.3.4, SL.3.5

Essential Questions:

- What kinds of traits are passed on from parent to offspring?
- What environmental factors might influence the traits of a specific organism?

Enduring Understandings: Big Idea(s)

- Similarities and differences in patterns can be used to sort and classify natural phenomena (e.g., inherited traits that occur naturally).
- Many characteristics of organisms are inherited from their parents.
- Different organisms vary in how they look and function because they have different inherited information.
- *Students who understand the concepts are able to:*
- Sort and classify natural phenomena using similarities and differences. (*Clarification: Patterns are the similarities and differences in traits shared between offspring and their parents or among siblings, with an emphasis on organisms other than humans.*)
- Analyze and interpret data to make sense of phenomena using logical reasoning.
- 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. (*Assessment does not include genetic mechanisms of inheritance and prediction of traits, and is limited to nonhumans.*)
- Scientists sort and classify organisms based on similarities and differences in characteristics or traits. Students can easily observe external traits of animals such as body coverings; type, shape, and number of external features; and type, shape, and color of eyes. Similarly, they can observe external traits of plants such as the type of root system or the shape, color, and average size of leaves. The characteristics that organisms inherit influence how they look and how they function within their environment. As students observe parents and their offspring, they will notice that parents and offspring share many traits. As they observe a larger number of organisms from the same group, they will notice similarities and differences in the

traits of individuals within a group. Students can observe similarities and differences in the traits of organisms and use these observations as evidence to support the idea that offspring inherit traits from parents, but these traits do vary within a group of similar organisms.

- Sometimes, variations among organisms within a group are due to fact that individuals inherit traits from different parents. However, traits can also be influenced by an individual's interaction with the environment. For example, all lions have the necessary inherited traits that allow them to hunt, such as sharp claws, sharp teeth, muscular body type, and speed. However, being a successful hunter also depends on the interaction that individual lions have with their parents and their environment. A lion cub raised in captivity without parents will have the same type of claws, teeth, and muscular body as all other lions, but it may never have the opportunity to learn to use its traits to hunt. Additionally, the environment can affect an organism's physical development. For example, any plant that lacks sufficient nutrients or water will not thrive and grow as it should. It will most likely be smaller in size, have fewer leaves, and may even look sickly. Likewise, too much food and lack of exercise can result in an overweight dog.
- 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.

Unit Learning Targets: Student Learning Objective (SLO)

Students will...

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-LS3-1)

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.] (3-LS3-2)*

GRADE 3

Unit 3B: Continuing the Life Cycle

In this unit of study, students develop an understanding of the similarities and differences in organisms' life cycles. In addition, students use evidence to construct an explanation for how the variations in characteristics among individuals of the same species may provide advantages in surviving, finding mates, and reproducing. The crosscutting concepts of *patterns* and *cause and effect* are called out as organizing concepts for these disciplinary core ideas. Students demonstrate grade-appropriate proficiency in *developing and using models and constructing explanations and designing solutions*. Students are also expected to use these practices to demonstrate understanding of the core ideas.

Unit Understandings (Summary of Unit):

- In third grade, students learn that the changes an organism goes through during its life form an observable pattern. Although different types of organisms have unique and diverse life cycles, they follow a pattern of birth, growth, reproduction, and death. While observing and studying life cycles, students should look closely for patterns of change and use these observed patterns to make predictions. They should also sort and classify a variety of organisms using the similarities and differences they observe. For example, flowering plants begin as seeds. With the right conditions, the seeds germinate and grow, from small seedlings to adult plants. Adult plants then produce flowers that, once pollinated, will produce seeds from which the next generation will grow.
- Animals, likewise, go through observable patterns of change, which allow students to sort and classify them based on the stages of their life cycles. Some animals, for example, undergo complete metamorphosis; others go through incomplete metamorphosis; while others do not undergo metamorphosis at all. Some animals

begin their life cycles with a live birth, while others hatch from eggs. Students should develop models to describe the unique and diverse life cycles of organisms. They can draw diagrams, build physical models, or create presentations to show the patterns of change that make up the life cycles of given organisms. As students become familiar with the stages in the life cycles of different types of plant and animals, they will come to understand that reproduction is essential to the continued existence of every kind of organism.

- In Unit 4: Traits, students learned that organisms have traits that are inherited from their parents. This process occurs during reproduction. While observing and identifying traits of a specific species or type of organism, students also learned that there are differences in characteristics within the same species. In this unit, students learn that these differences in characteristics among individuals of the same species sometimes provide advantages in survival, finding mates, and reproducing. For example, when comparing plants from the same species, those with larger or more abundant thorns may be less likely to be eaten by a predator. Likewise, animals with better camouflage coloration may be more likely to survive and therefore more likely to leave offspring. As students read about, observe, and discuss variations in organisms' characteristics, they should identify cause-and-effect relationships that help explain why any variation might give an advantage in surviving or reproducing to some members of a species over others.

Alignment to NGSS and NJ Student Learning in Science:

Career: 9.3.ST.1, 9.3.ST.2, 9.3.ST-ET.1, 9.3.ST-ET.2, 9.3.ST-ET.3, 9.3.ST-ET.4, 9.3.ST-ET.5, 9.3.ST-ET.6, 9.3.ST-SM.2, 9.3.ST-SM.3

Interdisciplinary Connections: RI.3.1, RI.3.2, RI.3.3, RI.3.7, W.3.2, W.3.4, SL.3.5

Essential Questions:

- Do all living things have the same life cycle?
- Are there advantages to being different?

Enduring Understandings: Big Idea(s)

- Science findings are based on recognizing patterns.
- Similarities and differences in patterns can be used to sort and classify natural phenomena.
- Patterns of change can be used to make predictions.

- Reproduction is essential to the continued existence of every kind of organism.
- Plants and animals have unique and diverse life cycles.
- *Students who understand the concepts are able to:*
- Sort and organisms (inherited traits) using similarities and differences in patterns.
- Make predictions using patterns of change.
- Develop models to describe phenomena.
- Develop models to describe that organisms have unique and diverse life cycles but all have in common birth, growth, reproduction, and death. (I.e., Changes organisms go through during their life form a pattern.) (*Assessment of plant life cycles is limited to those of flowering plants. Assessment does not include details of human reproduction.*)
- Cause-and-effect relationships are routinely identified and used to explain change.
- Sometimes the differences in characteristics between individuals of the same species provide advantages in surviving, finding mates, and reproducing.
- *Students who understand the concepts are able to:*
- Identify cause-and-effect relationships in order to explain change.
- Use evidence (e.g., observations, patterns) to construct an explanation.
- Use evidence to construct an explanation for how the variations in characteristics among individuals of the same species may provide advantages in surviving, finding mates, and reproducing. Examples of cause-and-effect relationships could include:
- Plants that have larger thorns than other plants may be less likely to be eaten by predators.
- Animals that have better camouflage coloration than other animals may be more likely to survive and therefore more likely to leave offspring.

Unit Learning Targets: Student Learning Objective (SLO)

Students will...

Develop models to describe that organisms have unique and diverse life cycles but all have in common birth, growth, reproduction, and death. [*Clarification Statement: Changes*

organisms go through during their life form a pattern.] [Assessment Boundary: Assessment of plant life cycles is limited to those of flowering plants. Assessment does not include details of human reproduction.] (3-LS1-1)

Use evidence to construct an explanation for how the variations in characteristics among individuals of the same species may provide advantages in surviving, finding mates, and reproducing. *[Clarification Statement: Examples of cause and effect relationships could be plants that have larger thorns than other plants may be less likely to be eaten by predators; and, animals that have better camouflage coloration than other animals may be more likely to survive and therefore more likely to leave offspring.] (3-LS4-2)*

GRADE 3

Unit 3C: Organisms and Environment

In this unit of study, students develop an understanding of the idea that when the environment changes, some organisms survive and reproduce, some move to new locations, some move into the transformed environment, and some die. The crosscutting concepts of *cause and effect* and the *interdependence of science, engineering, and technology* are called out as organizing concepts for these disciplinary core ideas. Students demonstrate grade-appropriate proficiency in *engaging in argument from evidence*. Students are also expected to use this practice to demonstrate understanding of the core ideas.

Unit Understandings (Summary of Unit):

- Cause-and-effect relationships are routinely identified and used to explain change.
- Knowledge of relevant scientific concepts and research findings is important in engineering.
- For any particular environment, some kinds of organisms survive well, some survive less well, and some cannot survive at all.
- Organisms and their habitat make up a system in which the parts depend on each other.
- *Students who understand the concepts are able to:*

- Identify cause-and-effect relationships in order to explain change.
- Construct an argument with evidence.
- Construct an argument with evidence (e.g., needs and characteristics of the organisms and habitats involved) that in a particular habitat, some organisms can survive well, some can survive less well, and some cannot survive at all.

Alignment to NGSS and NJ Student Learning in Science:

This unit is based on 3-LS2-1 and 3-LS4-3.

Career: 9.3.ST.1, 9.3.ST.2, 9.3.ST-ET.1, 9.3.ST-ET.2, 9.3.ST-ET.3, 9.3.ST-ET.4, 9.3.ST-ET.5, 9.3.ST-ET.6, 9.3.ST-SM.2, 9.3.ST-SM.3

Interdisciplinary Connections: RI.3.1, RI.3.2, RI.3.3, RI.3.7, W.3.2, W.3.4, SL.3.5

Essential Questions:

- *Why don't we see alligators in the arctic?*

Enduring Understandings: Big Idea(s)

- Organisms and their habitats make up a system in which they are interdependent. Environmental factors affect the growth and survival of every type of organism, and organisms in turn affect the environment. The focus of this unit of study is identifying cause-and-effect relationships between the environment and organisms' ability to survive and reproduce.
- In this unit, students first learn that all organisms have a variety of behaviors and traits that enable them to survive. One of these behaviors includes forming groups. Groups serve different functions and can vary dramatically in size. Animals may form groups to obtain food, to defend themselves, and/or to cope with changes in their environment. Students should have opportunities to conduct research on animals that form groups in order to understand how being part of a group is beneficial to survival and reproduction. Students might begin with studying animals that are indigenous to the local environment (e.g., squirrels, coyotes, deer, birds, or fish), and then investigate other animals of interest, such as (but not limited to) lions, sea turtles, or penguins. For each animal that is studied, students should identify the social structure of the group and how this structure supports individuals in their need to obtain food, defend themselves, and reproduce.
- Topics to focus on might be the roles of males and females within a group as well as the interactions between parents and offspring. For example, within some groups of animals, the offspring leave the nest or pack early while others remain for longer periods of time. Those that stay within the group for longer periods of time may do so

because of the benefits provided by the group structure. As students compare group structures of different animals and the functions that define each, they should also think about how the size of the group and the roles of individuals within the group affect the animals' overall ability to obtain food, defend themselves, and reproduce. Students will construct arguments with evidence, using cause-and-effect relationships to show why some animals form groups and how this is advantageous to survival and reproduction.

- In this unit, students also learn that for any particular environment, some kinds of organisms survive well, some survive less well, and some cannot survive at all. As students explore the components of a given environment, they learn that each environment has a particular climate as well as finite sources of water and space. Each environment will support organisms (both plants and animals) with structures and behaviors that are best suited to the climate and resources available. Students will need opportunities to investigate the organisms (plants and animals) that live in certain environments and determine what traits and behaviors allow these organisms to survive and reproduce in that environment. In addition, students should identify some examples of organisms that would survive less well, or not at all, in that environment, and give evidence to support their thinking. Students construct arguments with evidence, using cause-and-effect relationships, to show how the needs and characteristics of the organisms are not well suited for the given environment.

Unit Learning Targets: Student Learning Objective (SLO)

Students will...

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

Notes:

- Evidence indicate that poor reasoners tend to retain non scientific beliefs such as "evolutionary change occurs as a result of need" because they fail to examine alternative hypotheses and their predicted consequences, and they fail to

comprehend conflicting evidence. Thus, they are left with no alternative but to believe their initial intuitions or the misstatements they hear (NSDL, 2015).

GRADE 3

Unit of Study: Using Evidence to Understand the Environment

In this unit of study, students develop an understanding of the types of organisms that lived long ago and also about the nature of their environments. Students develop an understanding of the idea that when the environment changes, some organisms survive and reproduce, some move to new locations, some move into the transformed environment, and some die. The crosscutting concepts of *systems and system models*; *scale, proportion, and quantity*; 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*, *analyzing and interpreting data*, and *engaging in argument from evidence*. Students are also expected to use these practices to demonstrate understanding of the core ideas

Unit Understandings (Summary of Unit):

- A system can be described in terms of its components and their interactions.
- People's needs and wants change over time, as do their demands for new and improved technologies.
- Populations live in a variety of habitats, and change in those habitats affects the organisms living there.
- 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, others move into the transformed environment, and some die.
- 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
- *Students who understand the concepts are able to:*
- Describe a system in terms of its components and interactions.
- 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 a problem.
- 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. (Assessment is limited to a single environmental change and does not include the greenhouse effect or climate change.) Examples of environmental changes could include changes in
 - Land characteristics,
 - Water distribution,
 - Temperature,
 - Food, or
 - Other organisms.
- Define a simple design problem that can be solved through the development of an object, tool, process, or system and that includes several criteria for success and constraints on materials, time, or cost.
- Define a simple design problem reflecting a need or want that includes specified criteria for success and constraints on materials, time, or cost.

Alignment to NGSS and NJ Student Learning in Science:

This unit is based on 3-LS4-1, 3-LS4-4, and 3-5-ETS1-1.

Career: 9.3.ST.1, 9.3.ST.2, 9.3.ST-ET.1, 9.3.ST-ET.2, 9.3.ST-ET.3, 9.3.ST-ET.4, 9.3.ST-ET.5, 9.3.ST-ET.6, 9.3.ST-SM.2, 9.3.ST-SM.3

Interdisciplinary Connections: RI.3.1, RI.3.2, RI.3.3, RI.3.7, W.3.2, W.3.4, SL.3.5

Essential Questions:

- What do fossils tell us about the organisms and the environments in which they lived?

Enduring Understandings: Big Idea(s)

- In this unit, students will study fossils or organisms that lived long ago. Students will use that understanding to make a claim about the merit of a solution to problem created by some environmental change. (Assessment is limited to one change.) Additionally, they will learn that solutions are limited by available resources (constraints), and that the success of a solution is determined by considering the desired features of a solution (criteria). This process is outlined in greater detail in the previous section.
- Students gather evidence from fossils to learn about the types of organisms that lived long ago and the nature of their environments. As they learn about organisms from long ago, they come to understand that when the environment changes, some organisms survive and reproduce, some move to new locations, some move into the transformed environment, and some die.
- To begin the progression of learning in this unit, students need multiple opportunities to study fossils. If actual fossils are not available, pictures and diagrams found in books and other media sources can be used. Students should observe fossils of a variety of organisms, both plant and animal, and they should observe diagrams of fossils within layers of rock. As students examine each fossil, they should be asked to identify whether the organism lived on land or in water and to give evidence to support their thinking. As students examine diagrams of fossils in layers of rock, they should be asked to identify the type of environment that existed when the layers of rock were formed. Students should consider the types of organisms that are fossilized in the rock layers in order to provide evidence to support their thinking.
- If the type of environment in which the fossil was found is different from the type of environment that might have existed when the organism lived (e.g., marine fossils found on dry land, or tropical plant fossils found in Arctic areas), this would provide the opportunity to ask students to think about the types of changes that might have occurred in the environment and what effects these changes might have had on the organisms that lived in the environment as it changed over time. As students observe and analyze fossils, they learn that fossils provide evidence about the types of organisms that lived long ago and the nature of their environments. They also learn that some kinds of plants and animals that once lived on Earth are no longer found anywhere, and that this could be a result of changes that occurred in the

- In this unit, students will study fossils or organisms that lived long ago. Students will use that understanding to make a claim about the merit of a solution to problem created by some environmental change. (Assessment is limited to one change.) Additionally, they will learn that solutions are limited by available resources (constraints), and that the success of a solution is determined by considering the desired features of a solution (criteria). This process is outlined in greater detail in the previous section
- Students gather evidence from fossils to learn about the types of organisms that lived long ago and the nature of their environments. As they learn about organisms from long ago, they come to understand that when the environment changes, some environment.
- During this unit, students also learn that populations of organisms live in a variety of habitats, and change in those habitats affects the organisms living there. When the environment changes in ways that affect a place's physical characteristics, temperature, or availability of resources, some organisms will survive and reproduce, some will move to new locations, others will move into the transformed environment, and others will die.
- Students will need the opportunity to engage in a portion of the engineering design process in order to investigate the merit of solutions to problems caused when the environment changes. This process should include the following steps:
- Students brainstorm a list of environmental changes that might affect the organisms that live in the environment. This could include changes in
 - Land characteristics,
 - Water distribution,
 - Temperature,
 - Food,
 - Other organisms.
- As a class or in small groups, students define a problem that occurs when the environment changes. For example, if the distribution of water changes, the available water may no longer support the types of organisms that are found in the environment.

- As a class, determine criteria that can be used to weigh a possible solution's viability. For example, the response (solution) to the problem should not result in the extinction of a species.
- Small groups conduct research, using books and other reliable media sources, to determine possible solutions/ways in which organisms can solve the problem. For example, if the available water supply is no longer adequate for the organisms in the environment, there are a number of ways in which organisms respond (i.e., solve the problem); these include:
 - organisms survive and reproduce, some move to new locations, some move into the transformed environment, and some die.
- To begin the progression of learning in this unit, students need multiple opportunities to study fossils. If actual fossils are not available, pictures and diagrams found in books and other media sources can be used. Students should observe fossils of a variety of organisms, both plant and animal, and they should observe diagrams of fossils within layers of rock. As students examine each fossil, they should be asked to identify whether the organism lived on land or in water and to give evidence to support their thinking. As students examine diagrams of fossils in layers of rock, they should be asked to identify the type of environment that existed when the layers of rock were formed. Students should consider the types of organisms that are fossilized in the rock layers in order to provide evidence to support their thinking.
- If the type of environment in which the fossil was found is different from the type of environment that might have existed when the organism lived (e.g., marine fossils found on dry land, or tropical plant fossils found in Arctic areas), this would provide the opportunity to ask students to think about the types of changes that might have occurred in the environment and what effects these changes might have had on the organisms that lived in the environment as it changed over time. As students observe and analyze fossils, they learn that fossils provide evidence about the types of organisms that lived long ago and the nature of their environments. They also learn that some kinds of plants and animals that once lived on Earth are no longer found anywhere, and that this could be a result of changes that occurred in the environment.
 - Plants do not grow as large as before (shorter plant, smaller or fewer leaves);
 - Fewer seeds germinate, thereby resulting in a smaller population;
 - Herd animals may move to another environment where the water supply is adequate;

- Populations of some species may decrease, either through lower rate of reproduction or death;
- Some populations completely die out; or
- Other organisms (plants and animals) that require less water to survive may move into the environment.
- Students make claims about the merit of each of the various responses (solutions) by organisms based on how well the responses meet criteria; students use research data as evidence to support their thinking.
- At every stage, communicating with peers is an important part of the design process. Students should identify cause-and-effect relationships throughout the process and use these relationships to explain the changes that might occur in the environment and in the populations of organisms that live there.

Unit Learning Targets: Student Learning Objective (SLO)

Students will...

- 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)
- 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)
- 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)

Grade 4

Unit 1: Transfer of Energy and Force and Motion

Unit Understandings (Summary of Unit):

In this unit of study, fourth-grade students are expected to develop an understanding that energy can be transferred from place to place by sound, light, heat, and electrical currents. Students are able to use evidence to construct an explanation of the relationship between the speed of an object and the energy of that object. Students also obtain and combine information to describe that energy and fuels are derived from natural resources and that their uses affect the environment.

Alignment to NGSS and NJ Student Learning in Science:

❑ 4-PS3-1 Use evidence to construct an explanation relating the speed of an object to the energy of that object.

Assessment Boundary: Assessment does not include quantitative measures of changes in the speed of an object or on any precise or quantitative definition of energy.

❑ 4-PS3-2 Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.

[Assessment Boundary: Assessment does not include quantitative measurements of energy.]

❑ 4-PS3-3 Ask questions and predict outcomes about the changes in energy that occur when objects collide.

Clarification Statement: Emphasis is on the change in the energy due to the change in speed, not on the forces, as objects interact.

[Assessment Boundary: Assessment does not include quantitative measurements of energy.]

❑ 4-PS3-4 Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.

*Clarification Statement: Examples of devices could include electric circuits that convert electrical energy into motion, light, or sound energy; or, a passive solar heater that converts light into heat. Examples of constraints could include the materials, cost, and time to design the device.

[Assessment Boundary: Devices should be limited to those that convert motion energy to electric energy or use stored energy to cause motion or produce light or sound.]

❑ 4-ESS3-1 Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment.

Clarification Statement: Examples of renewable energy resources could include wind energy, water behind dams, or sunlight; nonrenewable energy resources are fossil fuels or fissile materials.

Examples of environmental effects could include loss of habitat due to dams, loss of habitat due to surface mining, and air pollution from the burning of fossil fuels.

Technology: 8.2.5.D.5

Career: 9.3.ST-ET.2, 9.3.ST-SM.1, 9.3.ST-SM.2, 9.3.ST-SM.3

Interdisciplinary Connections: SL.1.C, RI.4.1, RI.4.3, RI.4.9, W.4.2, W.4.7, W.4.8, W.4.9

Essential Questions:

- What is energy? / How is energy transferred? / How can energy be used to solve a problem?

Enduring Understandings:

- ❑ Energy is present whenever there are moving objects, sound, light, or heat.
- ❑ Energy can be moved from place to place by sound, light, or electric currents.
- ❑ Energy and fuels that humans use are derived from natural sources. Some resources are renewable over time, and others are not. The use of energy and fuels from natural sources affects the environment in multiple ways.

Unit Learning Targets:

Students will...

Review of Distance and Motion

- Develop a definition of distance.
- Determine that distance is the separation between two objects.
- Measure the distance between two objects.
- Gather data about an object's initial and final positions.
- Measure the distance an object travels in two dimensions.
- Measure in seconds how long it takes an object to travel a specified distance.
- Analyze and interpret data to support that the faster an object moves over a specified distance, the less time it takes.

Energy and Motion

- Develop and use models to determine that energy can be transferred from one object to another.
- Argue from evidence that the more massive an object, the more the energy required to move it.

Energy and Forces

- Construct an argument, using evidence, that when forces are balanced, energy is stored.
- Construct an argument, using evidence, that when forces are unbalanced, energy is transformed into motion.

Producing Electrical Energy

- Construct an explanation about how mechanical energy is converted into electrical energy.
- Construct an explanation why electricity is our most prominent form of energy because it can be stored and transferred easily and over long distances.
- Design projects related to the production or the use of electrical energy.
- Carry out an investigation on one of six types of energy sources.
- Students communicate information to create an oral presentation on one of six types of energy sources.

Grade 4
Unit 2: Waves and Information
<p>Unit Understandings (Summary of Unit): In this unit of study, students are able to use a model of waves to describe patterns of waves in terms of amplitude and wavelength and to show that waves can cause objects to move. Small groups then work collaboratively to design and build a device or design a process for communicating information over a distance.</p>
<p>Alignment to NGSS and NJ Student Learning in Science:</p> <p><input type="checkbox"/> 4-PS4-1 Develop a model of waves to describe patterns in terms of amplitude and wavelength and that waves can cause objects to move. <i>[Clarification Statement: Examples of models could include diagrams, analogies, and physical models using wire to illustrate wavelength and amplitude of waves.] [Assessment Boundary: Assessment does not include interference effects, electromagnetic waves, non-periodic waves, or quantitative models of amplitude and wavelength.]</i></p> <p><input type="checkbox"/> 4-PS4-3 Generate and compare multiple solutions that use patterns to transfer information. <i>[Clarification Statement: Examples of solutions could include drums sending coded information through sound waves, using a grid of 1's and 0's representing black and white to send information about a picture, and using Morse code to send text.]</i></p> <p><input type="checkbox"/> 3-5-EST-1-2 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.</p> <p><input type="checkbox"/> 3-5-ETS1-3 Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.</p> <p>Technology: 8.2.5.A.3, 8.2.5.D.3 Career: 9.3.ST.3, 9.3.ST.5, 9.3.ST.6, 9.3.ST-ET.2, 9.3.ST-ET.5, 9.3.ST-SM.2, 9.3.ST-SM.3 Interdisciplinary Connections: RI.4.1, RI.4, RI.07, RI.4.9, SL.1.A, SL.1.C, SL.1.D, SL.4.5</p>
<p>Essential Questions: What kinds of patterns are made by waves? / What happens when waves interact with objects? How can patterns be used to communicate information?</p>
<p>Enduring Understandings: (Big Ideas)</p> <ul style="list-style-type: none"> <input type="checkbox"/> Waves are repeating patterns of motion that transfer energy such as ocean waves and sound waves. <input type="checkbox"/> Waves of the same type can differ in amplitude (height of the wave) and wavelength (spacing between wave peaks). Waves of different amplitudes transfer different amounts of energy. <input type="checkbox"/> Patterns can be used to communicate information across a distance. <input type="checkbox"/> Digitized information can be transmitted over long distances without significant degradation. High-tech devices, such as computers or cell phones, can receive and decode information—that is, convert it from digitized form to voice and vice versa.

Unit Learning Targets:

Students will...

Amplitude and Wavelength

- Construct explanation of waves using scientific vocabulary.
- Design models of waves graphically.
- Engage in argument that waves are caused by repetitive motion. Design a wave generator. Develop a model of waves to describe patterns in terms of amplitude and wavelength and that waves can cause objects to move.
- Develop a model to describe that light reflecting from objects and entering the eye allows objects to be seen.
- Generate and compare multiple solutions that use patterns to transfer information.

How We See

- Investigate and engage in argument from evidence that light travels in a straight line. Investigate and engage in argument that light bends.
- Investigate and engage in argument that light reflects off objects.
- Design and construct a simple model of the human eye.

Using Waves to Transfer Information

- Obtain, evaluate and communicate how code is used for information transfer.
- Design a code to send information to a recipient and have recipient decode the coded message from the sender.
- Analyze and interpret the role of waves in transmitting information.

Grade 4

Unit 3: Structures and Functions and How Organisms Process Information

Unit Understandings (Summary of Unit):

In this unit of study, students are expected to develop an understanding that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction. Animals have body parts that capture and convey different kinds of information needed for growth and survival.

Alignment to NGSS and NJ Student Learning in Science:

□ 4-LS1-1 Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction. *[Clarification Statement: Examples of structures could include thorns, stems, roots, colored petals, heart, stomach, lung, brain, and*

skin.] [Assessment Boundary: Assessment is limited to macroscopic structures within plant and animal systems.]

❑ **4-LS1-2** Use a model to describe that animals receive different types of information through their senses, process the information in their brain, and respond to the information in different ways.

[Clarification Statement: Emphasis is on systems of information transfer.] [Assessment Boundary: Assessment does not include the mechanisms by which the brain stores and recalls information or the mechanisms of how sensory receptors function.]

❑ **4-PS4-2** Develop a model to describe that light reflecting from objects and entering the eye allows objects to be seen. [Assessment Boundary: Assessment does not include knowledge of specific colors reflected and seen, the cellular mechanisms of vision, or how the retina works.]

Technology: 8.2.5.D.3

Career: 9.3.ST-ET.2, 9.3.ST-SM.2, 9.3.ST-SM.3, 9.3.ST.3

Interdisciplinary Connections: RI.01, RI.04, RI.07, W.4.1, SL.4.5

Essential Questions:

- How do animals gather and process information?
- How do internal and external structures support the survival, growth, behavior, and reproduction of plants and animals?

Enduring Understandings: (Big Ideas)

- ❑ Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction.
- ❑ Different sense receptors are specialized for particular kinds of information, which may be then processed by the animal's brain.
- ❑ Animals are able to use their perceptions and memories to guide their actions.

Unit Learning Targets:

Students will...

Animal Classification

- Observe differences and similarities of living and nonliving things using evidence to support claims.
- Compare traits of vertebrates and invertebrates.
- Investigate how animals' physical structures and body coverings may be used to classify them.
- Construct a model comparing observable characteristics of each major vertebrate group (Physical Structures, Survival, and Crayfish).
- Analyze and interpret the physical structures of animals with basic needs.
- Analyze and interpret animal senses with survival behaviors.
- Construct explanations and argue from evidence how the physical structures and behaviors of crayfish support their basic needs.

Plant Structures and Survival

- Investigate how the physical structures of plants (roots, stems, leaves, flowers, and fruits) support their basic needs.

- Analyze and interpret how the physical structures of plants connect to their specific functions and construct an explanation of how these structures work together as a system in the plant. Observe and compare characteristics of plant structures in a variety of plants.
- Draw evidence from literary or informational texts to support analysis, reflection, and research.

Plant and Animal Seasonal Responses

- Construct an explanation for how adaptations of plants allow them to respond to seasonal changes.
- Carry out a guided inquiry about the effects of temperature on plants.
- Construct an explanation for how adaptations of animals allow them to respond to seasonal changes.
- Compare seasonal behaviors of migration, hibernation and staying active.
- Carry out a guided inquiry about the effects of temperature on animals.
- Recognize and understand that conducting science investigations requires safe practices. Draw evidence from nonfiction reading texts.

Grade 4

Unit 4: Weathering and Erosion and Earth Processes

Unit Understandings (Summary of Unit):

In this unit of study, students are expected to develop understanding of the effects of weathering and the rate of erosion by water, ice, wind, or vegetation. In order to describe patterns of Earth's features, students analyze and interpret data from maps. Students apply their knowledge of natural Earth processes to generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans.

Alignment to NGSS and NJ Student Learning in Science:

☐ 4-ESS2-1 Make observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation. [Clarification Statement: Examples of variables to test could include angle of slope in the downhill movement of water, amount of vegetation, speed of wind, relative rate of deposition, cycles of freezing and thawing of water, cycles of heating and cooling, and volume of water flow.] [Assessment Boundary: Assessment is limited to a single form of weathering or erosion.]

☐ 4-ESS1-1 Identify evidence from patterns in rock formations and fossils in rock layers to support an explanation for changes in a landscape over time. [Clarification Statement: Examples of evidence from patterns could include rock layers with marine shell fossils above rock layers with plant fossils and no shells, indicating a change from land to water over time; and, a canyon with different rock layers in the walls and a river in the bottom, indicating that over time a river cut through the rock.] [Assessment Boundary: Assessment does not include specific knowledge of the mechanism of rock formation or memorization of specific rock formations and layers. Assessment is limited to relative time.]

☐4-ESS2-2. Analyze and interpret data from maps to describe patterns of Earth’s features.

[Clarification Statement: Maps can include topographic maps of Earth’s land and ocean floor, as well as maps of the locations of mountains, continental boundaries, volcanoes, and earthquakes.]

☐4-ESS3-2. Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans.* [Clarification Statement: Examples of solutions could include designing an earthquake resistant building and improving monitoring of volcanic activity.] [Assessment Boundary: Assessment is limited to earthquakes, floods, tsunamis, and volcanic eruptions.]

Career: 9.3.ST.3, 9.3.ST.5, 9.3.ST.6, 9.3.ST-ET.2, 9.3.ST-ET.5, 9.3.ST-SM.2, 9.3.ST-SM.3

Interdisciplinary Connections: RI.4.1, RI.3., RI.4.7, RI.4.9, W.4.7, W.4.8

Essential Questions:

- What do the shapes of landforms and rock formations tell us about the past?
- How can evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation be observed or measured?
- What can rock formations tell us about the past?

Enduring Understandings: (Big Ideas)

- ☐ Fossils and Rock layers are evidence that the surface of the Earth has been changed over time.
- ☐ The locations of mountain ranges, deep ocean trenches, ocean floor structures, earthquakes, and volcanoes occur in patterns.
- ☐ Water, ice, wind, living organisms, and gravity break rocks, soils, and sediments into smaller particles and move them around.
- ☐ A variety of hazards result from natural processes (e.g., earthquakes, floods, tsunamis, volcanic eruptions).
- ☐ Humans cannot eliminate the hazards, but they can take steps to reduce their impacts. Research on a problem should be carried out before beginning to design a solution.

Unit Learning Targets:

Students will...

Beneath Our Feet

- Create a model of Earth’s layers and use that model to explain the characteristics of each.
- Create models of Earth’s internal structure.
- Communicate how and why geologists use core sampling.
- Draw evidence from nonfiction reading texts.

Fossils Tell a Story

- Construct an explanation and argue from evidence how fossils provide evidence about organisms that lived long ago.
- Explain how fossils provide evidence about the nature of the environment at any time in history.
- Create models to better understand plate tectonics and fossil records.
- Communicate how Earth’s history is represented through geologic time.

- Draw evidence from to nonfiction reading texts.

What is Soil?

- Construct a model that can be used to identify and describe soil layers.
- Observe properties of soil samples.
- Draw evidence from nonfiction reading texts.

Weathering and Erosion

- Compare the processes of weathering and erosion.
- Create models to represent and understand various types of weathering and erosion.
- Communicate the impacts of weathering and erosion on humans.
- Draw evidence from nonfiction reading texts.

Patterns in Earth's Features

- Communicate examples of Earth's continental and oceanic landforms.
- Compare types of maps that show Earth's features.
- Explain how topographic maps represent contour and elevation.
- Draw evidence from nonfiction reading texts.

Volcanoes, Tsunamis, Earthquakes

Communicate the ways in which tectonic plates move.

Explain how volcanoes, earthquakes, and tsunamis form and their relationship to each other.

GRADE 5

Unit 1: Properties and Changes of Matter

Overview:

Unit 1: In this unit of study, students are able to describe that matter is made of particles too small to be seen by developing a model. Students also develop an understanding of the idea that regardless of the type of change that matter undergoes, the total weight of matter is conserved. Students determine whether the mixing of two or more substances results in new substances.

Unit 2: In this unit of study, students develop an understanding of the idea that regardless of the type of change that matter undergoes, the total weight of matter is conserved. Students determine whether the mixing of two or more substances results in new substances. The crosscutting concepts of cause and effect and scale, proportion, and quantity are called out as organizing concepts for these disciplinary core ideas. Students are expected to demonstrate grade-appropriate proficiency in planning and carrying out

investigations and using mathematics and computational thinking. Students are expected to use these practices to demonstrate understanding of the core ideas.

Unit Understandings (Summary of Unit):

Unit 1:

The concepts and practices in this unit are foundational for understanding the relationship between changes to matter and its weight. During this unit of study, students will observe, measure, and identify materials based on their properties and begin to get a conceptual understanding of the particle nature of matter (i.e., all matter is made of particles too small to be seen).

In the first portion of the unit, students will focus on measuring and describing a variety of physical properties, including color, hardness, reflectivity, electrical conductivity, thermal conductivity, response to magnetic forces and solubility. These observations and measurements are used to produce data that serves as the basis for evidence that can be used to identify materials. Students need opportunities to observe, measure, and describe a variety of types of matter, such as baking soda and other powders; metals; minerals; and liquids. Standard units should be used to measure the properties of weight, time, temperature, and volume; however, at this grade level, mass and weight are not distinguished. In addition, students are not expected to understand density as a physical property, and no attempt should be made to define unseen particles or explain the atomic-scale mechanism of evaporation and condensation.

In the second portion of the unit, students make observations, gather evidence, and develop models in order to understand that matter is made up of particles too small to be seen. Matter of any type can be subdivided into small particles. In planning and carrying out simple investigations, students will produce data to be used as evidence to support the idea that even though matter is made of particles too small to be seen, matter can still exist and can be detected by means other than seeing. This evidence will be used to support students' thinking as they develop models that depict matter. For example, a model that represents solids at the particle level would show particles tightly packed, while a model that represents gases would show particles moving freely around in space. Observing such phenomena as adding air to expand a basketball, compressing air in a syringe, dissolving sugar in water, or evaporating salt water could help students to understand matter at the particle level and to build models that represent this phenomenon.

Unit 2

In this unit of study, students will use mathematical and computational thinking to understand the cause and effect relationship between physical changes in matter and

conservation of weight. Throughout the unit, students need multiple opportunities to observe and document changes in matter due to physical changes, and to analyze data to explain changes that do or do not occur in the physical properties of matter.

Students begin by planning and conducting investigations to determine whether or not a new substance is made when two or more substances are mixed (see the Sample Open Education Resources). As they work with a variety of substances, they should:

- Measure, observe, and document physical properties (e.g., color, mass, volume, size, shape, hardness, reflectivity, conductivity, and response to magnetic forces) of two or three substances.
- Mix the original substances.
- Measure, observe, and document the physical properties of the substance produced when the original substances are mixed.
- Compare data from the original substances to data from the substance produced, and determine what changes, if any, have occurred.
- Use observations and data as evidence to explain whether or not a new substance was produced, and to explain any changes that occurred when the original substances were mixed.

With each set of substances that students investigate, it is important that they use balances to measure the mass of the original substances and the mass of the substance made when the original substances are mixed. These data should be documented so that students can analyze the data. As they compare the data, they should recognize that when two or more substances are mixed, the mass of the resulting substance equals the sum of the masses of the original substances. In other words, the total mass is conserved.

Conservation of mass is a critical concept that is developed over time; therefore, students need multiple opportunities to investigate this phenomenon. Students should measure the mass of each substance, document the data they collect in a table or chart, and use the data as evidence that regardless of the changes that occur when mixing substances, the total weight of matter is conserved.

In addition to observing changes that occur when substances are mixed, students should also have opportunities to investigate other types of physical changes. For example, students can observe changes in matter due to heating, cooling, melting, freezing, and/or dissolving. As before, students should measure, observe, and document the physical properties of the substance before and after a physical change, and use the data as

evidence to explain any changes that occur. The data should also provide evidence that regardless of the type of change that matter undergoes, the mass is conserved.

Alignment to NGSS and NJ Student Learning in Science:

- 5-PS1-1, 5-PS1-2, 5-PS1-3, 5-PS1-4.

Career: 9.3.ST.2, 9.3.ST.3, 9.3.ST-ET.2, 9.3.ST-ET.3, 9.3.ST-SM.2

Interdisciplinary Connections: RI.5.7, W.5.7, W.5.8, W.5.9, RI.5.1, RI.5.9, W.5.1

Essential Questions:

- What kind of model would best represent/describe matter as made of particles that are too small to be seen?
- How can properties be used to identify materials?
- When matter changes, does its weight change?
- If I have a frozen water bottle that weighs 500 mg, how much will it weigh if the water melts? (Unit 2)
- How can we make slime? (Unit 2)
- How can baking soda and vinegar burst a zip-lock bag? (Unit 2)

Enduring Understandings: (Big Ideas)

- Matter of any type can be subdivided into particles that are too small to see, but even then the matter still exists and can be detected by means other than seeing.
- Observations and measurements of a variety of properties can be used to identify materials.
- When two or more different substances are mixed, a new substance may be formed.
- Matter can change and the amount (weight) of matter is conserved when it changes.

Unit Learning Targets: Student Learning Objectives (SLO)

Students will...

1. Develop a model to describe that matter is made of particles too small to be seen.

[Clarification Statement: Examples of evidence supporting a model could include adding air to expand a basketball, compressing air in a syringe, dissolving sugar in water, and evaporating salt water.] [Assessment Boundary: Assessment does not include the atomic-scale mechanism of evaporation and condensation or defining the unseen particles.] 5-PS1-1.

2. Make observations and measurements to identify materials based on their properties.

[Clarification Statement: Examples of materials to be identified could include baking soda and other powders, metals, minerals, and liquids. Examples of properties could include color, hardness, reflectivity, electrical conductivity, thermal conductivity, response to magnetic forces, and solubility; density is not intended as an identifiable property.] [Assessment Boundary: Assessment does not include density or distinguishing mass and weight.] 5-PS1-3.

3. Measure and graph quantities to provide evidence that regardless of the type of change that occurs when heating, cooling, or mixing substances, the total weight of matter is conserved. [Clarification Statement: Examples of reactions or changes could include phase changes, dissolving, and mixing that form new substances.] [Assessment Boundary: Assessment does not include distinguishing mass and weight.] 5-PS1-2.

4. Conduct an investigation to determine whether the mixing of two or more substances results in new substances. 5-PS1-4.

NOTES: Elementary school students may think everything that exists is matter, including heat, light, and electricity. Alternatively, they may believe that matter does not include liquids and gases or that they are weightless materials.

Unit 2: Student thinking about chemical change tends to be dominated by the obvious features of the change. For example, some students think that when something is burned in a closed container, it will weigh more because they see the smoke that was produced. Further, many students do not view chemical changes as interactions. They do not understand that substances can be formed by the recombination of atoms in the original substances. Rather, they see chemical change as the result of a separate change in the original substance, or changes, each one separate, in several original substances.

Grade 5

Unit 2: Energy and Matter in an Ecosystem

Overview

Unit 3

In this unit of study, students develop an understanding of the idea that plants get the materials they need for growth chiefly from air and water. Using models, students can describe the movement of matter among plants, animals, decomposers, and the environment, and they can explain that energy in animals' food was once energy from the sun. The crosscutting concepts of energy and matter and systems and system models are called out as organizing concepts for these disciplinary core ideas. Students are expected to demonstrate grade-appropriate proficiency in developing and using models and engaging in argument from evidence. Students are also expected to use these practices to demonstrate understanding of the core ideas.

Unit Understandings (Summary of Unit):

In every habitat and ecosystem on Earth, plants and animals survive, grow, reproduce, die, and decay. What happens to the matter and energy that are part of each organism? Where does it come from and where does it go? In this unit of study, students make observations and use models to understand how energy flows and matter cycles through organisms and ecosystems.

Students should first understand that plants acquire their material for growth chiefly from air and water. Students will need opportunities to observe a variety of plants over time. As students document plants' continual need for water and air in order to grow, they recognize that this evidence supports the argument that plants acquire their material for growth chiefly from air and water (not from soil). In addition, as students observe that plants also need sunlight, they begin to recognize that plants use energy from the sun to transform air and water into plant matter.

Once students understand that plants acquire material for growth from air and water, they need opportunities to observe animals and plants interacting within an ecosystem. Terrariums, such as those built in 3-liter bottles, are ideal for this because they are large enough for small plants and animals to survive and grow, yet easy to build and maintain. In these terrariums, students should observe plants growing and providing a source of food for small herbivores, carnivores consuming other animals, and decomposers consuming dead plant material.

All of these interactions may not be observable within a single terrarium; however, a class could use a number of 3-liter bottles to set up different ecosystems, each with a few carefully chosen plants and animals. This will give students opportunities to observe different types of interactions within a variety of enclosed systems.

When students record their observations of these small systems, it is important that students be able to:

- Identify the living and nonliving components of a system.
- Describe the interactions that occur between the living and nonliving components of each system.
- Develop models (such as food chains or food webs) that describe the movement of matter among plants, animals, decomposers, and the environment.

As students continue to observe each terrarium, they learn that:

- The food of almost any kind of animal can be traced back to plants.
- Organisms are related in food webs in which some animals eat plants for food and other animals eat the animals that eat plants.

- Some organisms, such as fungi and bacteria, break down dead organisms (both plants or plant parts and animals) and therefore operate as decomposers.
- Decomposition eventually restores (recycles) some materials back to the soil.
- A healthy ecosystem is one in which multiple species of different types are each able to meet their needs in a relatively stable web of life.
- Organisms can survive only in environments in which their particular needs are met.
- Matter cycles between the air and soil and among plants and animals as these organisms live and die.
- Organisms obtain gases and water from the environment and release waste matter (gas, liquid, or solid) back into the environment.

Furthermore, students can conduct research to determine the effects of newly introduced species to an ecosystem.

After investigating the movement of matter in ecosystems, students revisit the concept of energy flow in systems. At the beginning of this unit of study, students learned that energy from the sun is transferred to plants, which then use that energy to change air and water into plant matter. After observing the interactions between the living and nonliving components of small ecosystems, students recognize that energy, like matter, is transferred from plants to animals. When animals consume plants, that food provides animals with the materials they need for body repair and growth and with the energy they need to maintain body warmth and for motion. Students can use diagrams or flowcharts to describe the flow of energy within an ecosystem, tracing the energy in animals' food back to the energy from the sun that was captured by plants.

Alignment to NGSS and NJ Student Learning in Science:

- **5-PS3-1 - 5-LS1-1 - 5-LS2-1**

Technology: 8.2.5.C.1, 8.2.5.B.1, 8.2.5.D.3, 8.2.5.D.5, 8.2.5.D.6, 8.2.5.D.7

Career: 9.3.ST1, 9.3.ST.3, 9.3.ST-SM.2, 9.3.ST-SM.4

Interdisciplinary Connections: RI.5.7, RI.5.9, SL.5.5, W.5.8

Essential Questions:

- What happens to the matter and energy that are part of each organism?
- Where do plants get the materials they need for growth?

- How does matter move among plants, animals, decomposers, and the environment?
- How can energy in animals' food be traced to the sun?

Enduring Understandings: (Big Ideas)

- Matter is transported into, out of, and within systems.
- Plants acquire their material for growth chiefly from air and water.
- The food of almost any kind of animal can be traced back to plants. Organisms are related in food webs in which some animals eat plants for food and other animals eat the animals that eat plants.
- Some organisms, such as fungi and bacteria, break down dead organisms.
- Organisms can survive only in environments in which their particular needs are met.

Unit Learning Targets: Student Learning Objectives (SLO)

Students will...

1. Use models to describe that energy in animals' food (used for body repair, growth, motion, and to maintain body warmth) was once energy from the sun. [Clarification Statement: Examples of models could include diagrams and flowcharts.] 5-PS3-1
2. Support an argument that plants get the materials they need for growth chiefly from air and water. [Clarification Statement: Emphasis is on the idea that plant matter comes mostly from air and water, not from the soil.] 5-LS1-1
3. Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment. [Clarification Statement: Emphasis is on the idea that matter that is not food (air, water, decomposed materials in soil) is changed by plants into matter that is food. Examples of systems could include organisms, ecosystems, and the Earth.] [Assessment Boundary: Assessment does not include molecular explanations.] 5-LS2-1

NOTES: Students can understand simple food links involving two organisms. Yet they often think of organisms as independent of each other but dependent on people to supply them with food and shelter. Upper elementary-school students may not believe food is a scarce resource in ecosystems, thinking that organisms can change their food at will according to the availability of particular sources. Students of all ages think that some populations of organisms are numerous in order to fulfill a demand for food by another population.

Some students of all ages have difficulty in identifying the sources of energy for plants and also for animals. [8] Students tend to confuse energy and other concepts such as food, force, and temperature. As a result, students may not appreciate the uniqueness and

importance of energy conversion processes like respiration and photosynthesis. Although specially designed instruction does help students correct their understanding about energy exchanges, some difficulties remain. Careful coordination between The Physical Setting and The Living Environment benchmarks about conservation of matter and energy and the nature of energy may help alleviate these difficulties.

Students of all ages see food as substances (water, air, minerals, etc.) that organisms take directly in from their environment. In addition, some students of all ages think food is a requirement for growth, rather than a source of matter for growth. They have little knowledge about food being transformed and made part of a growing organism's body.

Some students of all ages hold misconceptions about plant nutrition. They think plants get their food from the environment rather than manufacturing it internally, and that food for plants is taken in from the outside. These misconceptions are particularly resistant to change. [6] Even after traditional instruction, students have difficulty accepting that plants make food from water and air, and that this is their only source of food. Understanding that the food made by plants is very different from other nutrients such as water or minerals is a prerequisite for understanding the distinction between plants as producers and animals as consumers.

Students' meaning for "energy," both before and after traditional instruction, is considerably different from its scientific meaning. In particular, students believe energy is associated only with humans or movement, is a fuel-like quantity which is used up, or is something that makes things happen and is expended in the process. Students rarely think energy is measurable and quantifiable. Although students typically hold these meanings for energy at all ages, upper elementary-school students tend to associate energy only with living things, in particular with growing, fitness, exercise, and food

Grade 5

Unit 4 and 5: Earth Systems and Water on Earth

Overview:

Unit 4: In this unit of study, students describe and graph data to provide evidence about the distribution of water on Earth. Students are able to describe ways in which the geosphere, biosphere, hydrosphere, and/or atmosphere interact and how individuals and communities are working to protect Earth's environment.

Unit 5: In this unit of study, students are able to describe ways in which the geosphere, biosphere, hydrosphere, and atmosphere interact. The crosscutting concept of *systems and system models* is called out as an organizing concept for this disciplinary core idea. Students are expected to demonstrate grade-appropriate proficiency in *developing and using models, obtaining, evaluating, and communicating information*. Students are also expected to use these practices to demonstrate understanding of the core ideas.

Unit Understandings (Summary of Unit):

Unit 4:

During this unit of study, students need to understand that Earth is a system made up of subsystems, all of which have multiple components that interact. Throughout this unit, students will consider scale and proportion when examining the amount of water on the Earth, and they will consider the impact that humans have on one of Earth's most valuable resources.

To begin the progression of learning in this unit, students conduct research, using informational texts and online resources, to determine the distribution of freshwater and saltwater among Earth's oceans, rivers, lakes, glaciers, groundwater, and polar ice caps. Students organize their data into graphs or charts, showing the allocation of fresh water and saltwater on Earth. (Amounts should be described in terms of volume, as well as in percentages.) After comparing and analyzing data, students should be able to conclude the following:

- Nearly all of Earth's available water is in the ocean.
- Freshwater makes up less than 3% of the total amount of water on the Earth.
- Most freshwater is found in glaciers or underground.
- Only a tiny fraction of the freshwater on Earth is in streams, lakes, wetlands, and the atmosphere.

Next, students conduct research in order to determine ways in which individuals and communities help to protect the Earth's resources and environments. Using books and other reliable media resources, as well as first-hand observations in the local community, students gather information about the ways in which humans affect the environment. They should look for examples of human activities in agriculture, industry, and in their everyday lives, and should describe, both orally and in writing, the ways in which these activities affect the land, oceans, streams, groundwater, air, and other organisms (both plants and animals). Students will need the opportunity to share their findings with the class, and then

should conduct further research to find ways in which individual communities use science ideas to protect the Earth's resources and environments.

Working in pairs or small groups, students should gather relevant information from both observations and reliable resources to prepare a presentation that explains one way in which a community is minimizing the effects of human activities on Earth's resources and environment. The presentation should include both writing and speaking components, as well as a list of sources that were used to provide information. As a result of conducting research and creating a presentation, students should come to understand that the ecosystem is a system that includes both living and nonliving components that interact with one another. These interactions cause changes to the system and its components. Humans are just one of many components in an ecosystem, yet our activities affect all parts of the ecosystem, many times in adverse ways.

Unit 5

In this unit of study, students develop models to describe the interactions that occur within and between major Earth systems and conduct research to learn how humans protect the Earth's resources.

Foundational to this unit of study is the understanding of a system, its components, and the interactions that occur within the system. Initially, students may need opportunities to review familiar examples of systems, such as plants and animals, listing external and internal structures and processes and describing the interactions that occur within the system. Students can then begin to think about Earth's major systems, identifying the components and describing the interactions that occur within each. For example:

- The geosphere is composed of solid and molten rock, soil, and sediments. Some processes that occur between the components of the geosphere include erosion, weathering, deposition, sedimentation, compaction heating, cooling, and flow. These processes cause continual change to rock, soil, and sediments.
- The hydrosphere is composed of water in all its forms. Water, unlike the vast majority of earth materials, occurs naturally on the Earth as a solid, liquid, or gas, and it can be found on, above, and below the surface of the Earth. Some processes that occur in the hydrosphere include evaporation, condensation, precipitation, run-off, percolation, freezing, thawing, and flow. These processes cause water to change from one form to another in a continuous cycle.
- The atmosphere is a critical system made up of the gases that surround the Earth. The atmosphere helps to regulate Earth's climate and distribute heat

around the globe, and it is composed of layers with specific properties and functions. This system, composed mainly of nitrogen, oxygen, argon, and carbon dioxide, also contains small amounts of other gases, including water vapor, which is found in the lowest level of the atmosphere where weather-related processes occur. In addition to weather processes, radiation, conduction, convection, carbon cycling, and the natural greenhouse effect are processes that occur in the atmosphere.

- The biosphere comprises living things, including humans. Living organisms can be found in each of the major systems of the Earth (the atmosphere, hydrosphere, and geosphere). Some processes that occur within the biosphere include transpiration, respiration, reproduction, photosynthesis, metabolism, growth, and decomposition.

As students become more comfortable with describing each system in terms of its components and interactions, they should begin to think about and discuss the interactions that occur between systems. This should be a natural progression in their learning, since students will discover that any interactions that occur within a system affect components of other systems. Students should develop models that describe ways in which any two Earth systems interact and how these interactions affect the living and nonliving components of the Earth. Some examples include:

As students become more comfortable with describing each system in terms of its components and interactions, they should begin to think about and discuss the interactions that occur between systems. This should be a natural progression in their learning, since students will discover that any interactions that occur within a system affect components of other systems. Students should develop models that describe ways in which any two Earth systems interact and how these interactions affect the living and nonliving components of

- The influence of oceans on ecosystems, landform shape, or climate.
- The impact of the atmosphere on landforms or ecosystems through weather and climate.
- The influence of mountain ranges on wind and clouds in the atmosphere.
- The role of living organisms (both plants and animals) in the creation of soils.

As a class, students can brainstorm additional examples. They can use any type of model, such as diagrams or physical replicas, to describe the interactions that occur between any two systems, and they can choose to enhance the model with multimedia components or visual displays.

Once students have an understanding of the components and interactions that occur within and between Earth's major systems, they should gather information about the ways in which individual communities use science ideas to protect Earth's resources and environment. Students can work individually, in pairs, or in small groups to conduct research using books and other reliable media resources. They should paraphrase and summarize information as they take notes, then use their information to support their finished work. Students' research should help them determine:

- How human activities in agriculture, industry, and everyday life have had major effects on the land, vegetation, streams, ocean, air, and even outer space
- What individuals and communities are doing to help protect Earth's resources and the environment.

Students can share their work in a variety of ways and should provide a list of sources for the information in their finished work.

Although engineering design is not explicitly called out in this unit, students could incorporate engineering design in a number of ways as they explore human impact on the environment.

- Students may design a way to promote local, sustainable agriculture, making healthy food available to more people in their communities while having minimizing the impact on the local environment.
- Students can design ways to capture and use rainwater throughout their community to lessen the impact on local freshwater reserves.
- Students can design and implement a variety of recycling projects that have a positive impact on the environment by increasing the reuse of materials that normally end up in landfills and decreasing our reliance on earth resources.
- Students can research and design ways to increase the use of environmentally friendly fertilizers and pesticides that do not harm the local environment. Students can create pamphlets, presentations, or even commercials that inform the local community of the impact that chemical fertilizers and pesticides have when used in and around homes and businesses and offer information on safer alternatives that are just as effective.

- Students will need time to conduct research, determine criteria for success, consider constraints on available resources, and design solutions based on the information they gather. Students will need access to reliable sources of information that will help them as they work through the design process.

Alignment to NGSS and NJ Student Learning in Science:

- 5 ESS2-1. 5-ESS2-2. 5-ESS3-1.

Technology: 8.2.5.A.2, 8.2.5.A.3, 8.2.5.B.2, 8.2.5.C.5, 8.2.5.D.3, 8.2.5.D.4, 8.2.5.D.6, 8.2.5.D.7

Career: 9.3.ST.2, 9.3.ST-ET.6, 9.3.ST-SM.2, 9.3.ST-SM.4

Interdisciplinary Connections: RI.5.7, RI.5.9, W.5.8, W.5.9, SL.5.5

Essential Questions:

- *How do individual communities use science ideas to protect Earth’s resources and environment? (Unit 4)*
- *Where is water found on the Earth? What percentage of the Earth’s water is freshwater? (Unit 4)*
- *How do individual communities use science ideas to protect Earth’s resources and environment?*
- *In what ways do the geosphere, biosphere, hydrosphere, and/or atmosphere interact? (Unit 5)*
- *How do individual communities use science ideas to protect Earth’s resources and environment? (Unit 5)*

Enduring Understandings: (Big Ideas)

- 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).
- The Earth’s major systems interact in multiple ways to affect Earth’s surface materials and processes.
- Nearly all of Earth’s available water is in the ocean. Most freshwater is in glaciers or underground; only a tiny fraction is in streams, lakes, wetlands, and the atmosphere.
- Human activities in agriculture, industry, and everyday life have had major effects on the land, vegetation, streams, ocean, air, and even outer space.
- Individuals and communities are doing things to help protect Earth’s resources and environments

Unit Learning Targets: Student Learning Objectives (SLO)

Students will...

1. Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact. [Clarification Statement: Examples could include the influence of the ocean on ecosystems, landform shape, and climate; the influence of the atmosphere on landforms and ecosystems through weather and climate; and the influence of mountain ranges on winds and clouds in the atmosphere. The geosphere, hydrosphere, atmosphere, and biosphere are each a system.] [Assessment Boundary: Assessment is limited to the interactions of two systems at a time.] 5-ESS2-1.
2. Describe and graph the amounts of saltwater and fresh water in various reservoirs to provide evidence about the distribution of water on Earth. [Assessment Boundary: Assessment is limited to oceans, lakes, rivers, glaciers, ground water, and polar ice caps, and does not include the atmosphere.] 5-ESS2-2.
3. Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment. 5-ESS3-1

Grade 5

Unit 6: Interaction Within the Earth, Sun and Moon System

Overview

Unit 6

In this unit of study, students develop an understanding of patterns of daily changes in length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky. The crosscutting concepts of *patterns*, *cause and effect*, and *scale*, *proportion*, and *quantity* are called out as organizing concepts for these disciplinary core ideas. Students are expected to demonstrate grade-appropriate proficiency in *analyzing and interpreting data* and *engaging in argument from evidence*. Students are also expected to use these practices to demonstrate an understanding of the core ideas.

Unit Understandings (Summary of Unit):

In this unit of study, students explore the effects of gravity and determine the effect that relative distance has on the apparent brightness of stars. They also collect and analyze

data in order to describe patterns of daily changes in length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky.

To begin the progression of learning in this unit, students explore the effects of gravity by holding up and releasing a variety of objects from a variety of heights and locations. Students should record and use their observations to describe the interaction that occurs between each object and the Earth. In addition, students should use their observations as evidence to support an argument that the gravitational force exerted by the Earth on objects is directed “down” (towards the center of the Earth), no matter the height or location from which an object is released.

Next, students investigate the effect of distance on the apparent brightness of stars. Using information from a variety of print or digital sources, students learn that natural objects vary in size, from very small to immensely large. Stars, which vary in size, also range greatly in their distance from the Earth. The sun, which is also a star, is much, much closer to the Earth than any other star in the universe. Once students understand these concepts, they should explore the effect of distance on the apparent brightness of the sun in relation to other stars. This can be accomplished by modeling the effect using a light source, such as a bright flashlight. As students vary the distance of the light from their eyes, they should notice that the farther away the light is, the less bright it appears. Observations should again be recorded and used as evidence to support the argument that the differences in the apparent brightness of the sun compared to that of other stars is due to their relative distances from the Earth.

To continue the progression of learning, students investigate the following observable patterns of change that occur due to the position and motion of the Earth, sun, moon, and stars.

Day and night: This pattern of change is a daily, cyclical pattern that occurs due to the rotation of the Earth every 24 hours. Students can observe model simulations using online or digital resources, or they can create models in class of the day/night pattern caused by the daily rotation of the Earth.

The length and direction of shadows: These two interrelated patterns of change are daily, cyclical patterns that can be observed and described through direct observation. Students need the opportunity to observe a stationary object at chosen intervals throughout the day and across a few days. They should measure and record the length of the shadow and record the direction of the shadow (using drawings and cardinal directions), then use the data to describe the patterns observed.

The position of the sun in the daytime sky: This daily, cyclical pattern of change can also be directly observed. Students will need the opportunity to make and record observations of the position of the sun in the sky at chosen intervals throughout the day and across a few days. Data should then be analyzed in order to describe the pattern observed.

The appearance of the moon in the night sky: This cyclical pattern of change repeats approximately every 28 days. Students can use media and online resources to find data that can be displayed graphically (pictures in a calendar, for example), which will allow them to describe the pattern of change that occurs in the appearance of the moon every four weeks.

The position of the moon in the night sky: This daily, cyclical pattern of change can be directly observed, but students would have to make observations of the position of the moon in the sky at chosen intervals throughout the night, which is not recommended. Instead, students can use media and online resources to learn that the moon, like the sun, appears to rise in the eastern sky and set in the western sky every night.

The position of the stars in the night sky: Because the position of the stars changes across the seasons, students will need to use media and online resources to learn about this pattern of change.

Whether students gather information and data from direct observations or from media and online sources, they should organize all data in graphical displays so that the data can be used to describe the patterns of change.

Alignment to NGSS and NJ Student Learning in Science:

- **This unit is based on 5-PS2-1, 5-ESS1-1, and 5-ESS1-2.**

Technology: 8.2.5.C.1, 8.2.5.C.5, 8.2.5.D.4

Career: 9.3.ST-ET.1, 9.3.ST-ET.4, 9.3.ST-SM.4

Interdisciplinary Connections: RI.5.1, RI.5.7, RI.5.8, RI.5.9, W.5.1, SL.5.5

Essential Questions:

- ***What patterns do we notice when observing the sky?***
- How does the movement of the Earth determine patterns in the sky?
- How does the proximity of stars, including the sun, affect how we see them in the sky?

Enduring Understandings: (Big Ideas)

- The orbits of Earth around the sun and of the moon around Earth, together with the rotation of Earth about an axis between its north and south poles, cause observable patterns.
- The sun is a star that appears larger and brighter than other stars because it is closer. Stars range greatly in their distance from Earth.

Unit Learning Targets: Student Learning Objectives (SLO)

Students will...

1. Support an argument that the gravitational force exerted by Earth on objects is directed down. *[Clarification Statement: "Down" is a local description of the direction that points toward the center of the spherical Earth.] [Assessment Boundary: Assessment does not include mathematical representation of gravitational force.]* 5-PS2-1

2. Support an argument that the apparent brightness of the sun and stars is due to their relative distances from the Earth. *[Assessment Boundary: Assessment is limited to relative distances, not sizes, of stars. Assessment does not include other factors that affect apparent brightness (such as stellar masses, age, stage).]* (5-ESS1-1)

3. Represent data in graphical displays to reveal patterns of daily changes in length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky. *[Clarification Statement: Examples of patterns could include the position and motion of Earth with respect to the sun and selected stars that are visible only in particular months.] [Assessment Boundary: Assessment does not include causes of seasons.]* (5-ESS1-2)

NOTES:

The ideas "the sun is a star" and "the earth orbits the sun" appear counterintuitive to elementary-school students. The ideas "the sun is a star" and "the earth orbits the sun" is challenging for students.

Explanations of the day-night cycle and the seasons are very challenging for students. To understand these phenomena, students should first master the idea of a spherical earth, itself a challenging task. Similarly, students must understand the concept of "light reflection" and how the moon gets its light from the sun before they can understand the phases of the moon. Finally, students may not be able to understand explanations of any of these phenomena before they reasonably understand the relative size, motion, and distance of the sun, moon, and the earth

VIII. Vocabulary

Kindergarten		
Earth Science Weather Forecast Meteorologist Severe Weather Temperature Cold(er,est) Warm(er,est) heat	Physical Science force motion push pull direction straight zigzag investigation predict data	Life Science living non-living stem roots seed animal grow need wants needs habitat survive shelter
Grade 1		
Earth Science axis (Earth's) constellation Earth Moon orbit phase (Moon) revolution rotation season star Sun sunrise sunset	Physical Science <u>Light Waves</u> light light source light ray opaque reflection transparent translucent shadow <u>Sound Waves</u> sound vibration pitch waves <u>Communicating with Light and Sound</u> code communication	Life Science adult air basic needs birth colony food growth habitat herd hibernate life cycle life span migrate nature offspring parent reproduce seed shelter stage <u>Biomimicry</u> structure function

Grade 2		
<u>Earth Science</u> civil engineer continents design erosion landform prevention sediment weathering	<u>Physical Science</u> chemical change cooling gas heating irreversible liquid matter physical change property reversible solid	<u>Life Science</u> adaptation basic needs behavior camouflage carnivore consumer decomposer drought ecosystem flood food chain food web fresh water habitat human impact natural disaster nutrients polar predator prey producer structure

Grade 3

Earth Science

absorb
aquifer
climate
condense
conserve
density
dew
energy source
evaporate
evidence
float
force
gravity
humidity
liquid
mass
measure
precipitation
runoff
surface tension
temperature
water cycle
water vapor

Physical Science

attract
balanced
change of motion
chemical reaction
constraint
criterion
data
direction
dissolve
friction
magnet
mixture
model
motion
observe
predict
pull
push
ramp
repel
rotate
slope
solution
standard unit
strength
suspend
unbalanced
variable

Life Science

characteristic
cotyledon
disperse
dormant
embryo
fibrous root
germination
herbivore
hydroponics
inherit
life cycle
modify
nutrient
omnivore
predator
prey
protect
reproduce
seed coat
seedling
shoot
species
stem
structure
sustain
tap root
trait
variation

GRADE 4

Earth Science

abrasion
basin
canyon
chemical reaction
chemical weathering
contour/contour line
delta
deposition
elevation
erosion
expand
floodplain
fossil
fossil fuel
geothermal power
imprint
interval
meander
mold
nonrenewable
petrification
physical weathering
preserved
renewable
satellite cone sea level
topographic map
sediment
sedimentary rock
silt
slope
soil
solar energy
superposition
valley
weathering

Physical Science

amplitude
compression cycle
frequency
circuit -closed,open,
parallel,series,short
conductor
contact point
electric current
electricity energy
electromagnet
filament
force
frequency
insulator
kinetic energy
pole
potential energy
reflection
refraction
series circuit
short circuit
solar cell
sound
transfer of energy
system
transfer wire
force
gravity
induced magnetism
magnetic force/field
trough wave
wavelength

Life Science

adaptation
algae
aquatic environment
carnivore
competition
consumer
controlled experiment
inherited trait
decomposer
ecosystem
energy
environmental factor
function
food chain
food web
freshwater environment
herbivore
life cycle
microorganism
molting
omnivore
organism
preferred environment
structure
producer
range of tolerance
reproduce
terrarium
tolerance

GRADE 5		
Earth Science	Physical Science	Life Science
asteroid barometer comet condensation conduction constellation convection current energy transfer evaporation force gas giant planet gravity lunar cycle mass matter meteorologist orbit precipitation radiation revolution rotation solar system terrestrial planet troposphere variable water cycle water vapor	chemical reaction density diatomaceous earth dilute mixture osmosis reactant saturated solution semipermeable membrane solute solution solvent	consumer decomposer producer biosphere ecosystem hydrosphere geosphere detritivore food chain food web fungus bacteria photosynthesis glucose chlorophyll circulatory system cytoplasm transpiration central nervous system neuron stimulus

IX. Assessment

There are multiple and varied forms of assessment at each grade level. What follows is a list of the key assessment tools used at each level.

- Teacher made tests, quizzes and projects
- Class Discussion
- Teacher Observation
- Recording of observations, journal keeping, presentations
- Performance assessments
- End of Unit assessments
- New Jersey Student Learning Assessment-Science (NJSLA-S)
 **may change with state requirements

X. 21st Century Connections

In today's global economy, students need to be lifelong learners who have the knowledge and skills to adapt to an evolving workplace and world. To address these demands, Standard 9, 21st Century Life and Careers, which includes the 12 Career Ready Practices, establishes clear guidelines for what students need to know and be able to do in order to be successful in their future careers and to achieve financial independence.

Mission: *21st century life and career skills enable students to make informed decisions that prepare them to engage as active citizens in a dynamic global society and to successfully meet the challenges and opportunities of the 21st century global workplace.*

Vision: To integrate 21st Century life and career skills across the K-12 curriculum and in Career and Technical Education (CTE) programs to foster a population that:

- Continually self-reflects and seeks to improve the essential life and career practices that lead to success.
- Uses effective communication and collaboration skills and resources to interact with a global society.
- Is financially literate and financially responsible at home and in the broader community.
- Is knowledgeable about careers and can plan, execute, and alter career goals in response to changing societal and economic conditions.
- Seeks to attain skill and content mastery to achieve success in a chosen career path.

The Standards: Standard 9 is composed of the Career Ready Practices and Standard 9.1, 9.2, and 9.3 which are outlined below:

- **The 12 Career Ready Practices**
These practices outline the skills that all individuals need to have to truly be adaptable, reflective, and proactive in life and careers. These are researched practices that are essential to career readiness.
- **9.1 Personal Financial Literacy**
This standard outlines the important fiscal knowledge, habits, and skills that must be mastered in order for students to make informed decisions about personal finance. Financial literacy is an integral component of a student's college and career readiness, enabling students to achieve fulfilling, financially-secure, and successful careers.
- **9.2 Career Awareness, Exploration, and Preparation**
This standard outlines the importance of being knowledgeable about one's interests and talents, and being well informed about postsecondary and career options, career planning, and career requirements.
- **9.3 Career and Technical Education**
This standard outlines what students should know and be able to do upon completion of a CTE Program of Study.

For students to be college and career ready they must have opportunities to understand career concepts and financial literacy. This includes helping students make informed

decisions about their future personal, educational, work, and financial goals. By integrating Standard 9 into instruction, New Jersey students will acquire the necessary academic and life skills to not only achieve individual success but also to contribute to the success of our society.

References

American School Counselor Association, A. S. (2004). ASCA National Standards for Students (Competencies and Indicators). Alexandria, VA.

Career Readiness Partner Council. (2014). What it Means to be Career Ready? https://cte.careertech.org/sites/default/files/CRPC_4pager.pdf

Advance CTE: State Leaders Connecting Learning to Work. (2014, June) The Common Career Technical Core. <https://www.careertech.org/cctc>

Folkers, D. R. (2011, October). Setting a New Standard with a Common Career Technical Core. *Techniques*.

Partnership for 21st Century Skills. <http://www.p21.org/>

XI. Web Links

Recommended websites as background information and content supplements by grade level and unit of study.

Grade 1

Supplemental materials, including any print-outs needed for the activities, can be accessed through the Knowing Science website: <http://www.knowingscience.com/TeacherResources>
<http://www.crickweb.co.uk/ks1science>
<http://www.watchknowlearn.org>

Grade 2

Supplemental materials, including any print-outs needed for the activities, can be accessed through the Knowing Science website: <http://www.knowingscience.com/TeacherResources>
www.onegeology.org/extra/kids/home.html
<http://switchzoo.com/games/habitatgame.htm>
http://www.harcourtschool.com/activity/food/food_menu.html

Grade 3

<https://www.fossweb.com/>
<https://billnye.com/home-demos/>
<https://www.epa.gov/students>
<http://www.eia.doe.gov>
<https://nj.pbslearningmedia.org/subjects/science/>
<http://www.teacherstryscience.org/kids>
[http:// new.learningscience.org](http://new.learningscience.org)

Grade 4

<https://www.fossweb.com/>
<https://billnye.com/home-demos/>
<https://www.epa.gov/students>
<http://www.eia.doe.gov>
<https://nj.pbslearningmedia.org/subjects/science/>
<http://www.teacherstryscience.org/kids>
[http:// new.learningscience.org](http://new.learningscience.org)

Grade 5

<https://billnye.com/home-demos/>
<https://www.fi.edu/heart-engine-of-life>
<https://www.youtube.com/user/funsciencedemos>
<https://scied.ucar.edu/games>
<https://journeynorth.org/monarchs>
<http://new.learningscience.org/wp/>