Cedar Grove School District

Cedar Grove, NJ

2017 | Grade 5

Science

Approved by the Cedar Grove Board of Education

Superintendent of Schools
Mr. Michael J. Fetherman

Board of Education
Mrs. Christine Dye, President
Mr. Frank Mandala, Vice-President
Mr. Peter Prvulovic
Mr. David Schoner
Mr. Vincent Vollero

Science – Grade 5

Course Description

This curriculum was written in accordance with the

NEW JERSEY STUDENT LEARNING STANDARDS for SCIENCE.

These standards can be viewed at http://www.state.nj.us/education/cccs/2016/science/

Grade 5 - Science

Unit 1: Introduction to Science Practices | Instructional Time: 20 Days

In this unit of study, students become familiar with the process of answering questions in scientific inquiry. Students learn how to formulate and test questions using scientific processes. Students also learn how to gather and analyze qualitative and quantitative data using science journals, tables and graphs. Students understand the need for standardized measurement units to accurately measure distance, volume, and mass. Students will become familiar with common laboratory tools and practices including safety and reliability in their use. Students will engage in the science and engineering practices.

Student Learning Objectives

New Jersey Student Learning Standards for Science/NGSS

5-ETS1-1	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	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	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.

Enduring Understandings	Essential Questions
• Scientists and engineers practice in a variety of fields to solve real world problems. • Science is a continual process of systematically answering questions • How scientists and engineers answer questions. • How scientists and engineers gather, analyze and communicate information. • Tools that scientists and engineers use. • Identifying reliable sources and conducting research	• How do scientists and engineers answer questions? • Why do scientists gather, classify, sequence, and interpret information and visual data? • How do scientists and engineers communicate information? • What tools do scientists and engineers use to gather, analyze and communicate information?
Concepts	**Formative Assessment**
• Forming hypothesis • The metric system is the standardized unit of measurement • Observing scale, proportion, and quantity • Analyzing patterns	• Submission of written hypothesis • Design and submit experiment including control and variables • Record, identify, and analyze qualitative and quantitative observations • Discussion of patterns and scale

Suggested Learning Activities

Become a Scientist Research Project. Students complete a short-term research project on one of the branches of scientific study. Students research the Greek or Latin word meaning of their scientist, and write a one paragraph summary of what and how their scientist studies.

Scientific Equipment. Students rotate and identify commonly used lab equipment and/or complete a simple task such as looking at a sample under a microscope

Penny Drops Lab. An investigation in surface tension and scientific process. Students are challenged to make a paperclip float. Conduct classroom demonstration of surface tension with floating paperclip and dancing pepper activities. Students conduct lab investigation and write up about how many drops of water can fit on a penny.

Metric conversions and scale analysis. Students measure their own foot and compare it to much smaller and much larger scale objects.

Measurement Stations. Students hypothesize then accurately measure lengths of various animals. Students utilize equal-pan balances to investigate the masses of miscellaneous objects. Students practice liquid volume measurement with graduated cylinders and measuring objects based on water displacement

Performance Expectations		
Science and Engineering Practices	**DCI**	**Crosscutting Concepts**
• Asking questions (for science) and defining problems (for engineering) • Developing and using models • Planning and carrying out investigations • Analyzing and interpreting data • Using mathematics and computational thinking • Constructing explanations (for science) and designing solutions (for engineering) • Engaging in argument from evidence • Obtaining, evaluating, and communicating information	**ETS1.A:** Defining and Delimiting Engineering Problems **ETS1.B:** Developing Possible Solutions	• Patterns • Scale, proportion, and quantity • Influence of Science, Engineering, and Technology on Society and the Natural World

Cross-Curricular Connections	
English/Language Arts Standards	**Mathematics Standards**
• **NJSLSA.W1**. Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence. • **NJSLSA.W2**. Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content. • **NJSLSA.W4.** Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. • **NJSLSA.W6.** Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others. • **NJSLSA.W7.** Conduct short as well as more sustained research projects, utilizing an inquiry-based research process, based on focused questions, demonstrating understanding of the subject under investigation. • **NJSLSA.W8**. Gather relevant information from multiple print and digital sources, assess the credibility and accuracy of each source, and integrate the information while avoiding plagiarism.	• Reason abstractly and quantitatively. (5-PS1-1) (5-PS1-3) **MP.2** • Model with mathematics. (5-PS1-1) **MP.4** • Use appropriate tools strategically. (5-PS1-3) **MP.5**

21st Century Career Ready Practices
• **CRP1.** Act as a responsible and contributing citizen and employee. • **CRP2.** Apply appropriate academic and technical skills. • **CRP4.** Communicate clearly and effectively and with reason. • **CRP6.** Demonstrate creativity and innovation. • **CRP7.** Employ valid and reliable research strategies. • **CRP8.** Utilize critical thinking to make sense of problems and persevere in solving them. • **CRP11.** Use technology to enhance productivity. • **CRP12.** Work productively in teams while using cultural global competence.

Grade 5-Science

Unit 2: Structure and Properties of Matter | Instructional Time: 25 Days

In Unit 2, students describe that matter is made of particles too small to be seen by developing a model. The crosscutting concept of scale, proportion, and quantity is called out as an organizing concept for these disciplinary core ideas. Students demonstrate grade-appropriate proficiency in developing and using models, planning and carrying out investigations, and use these practices to demonstrate understanding of the core ideas.

Student Learning Objectives

New Jersey Student Learning Standards for Science/NGSS

5-PS1-3	Make observations and measurements to identify materials based on their properties.
5-PS1-1	Develop a model to describe that matter is made of particles too small to be seen.
5-PS1-2	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-PS1-4	Conduct an investigation to determine whether the mixing of two or more substances result in new substances.

Enduring Understandings	Essential Questions
• People use all of their senses to detect matter. • Matter can change state when external forces are applied. • Matter has different properties that can be observed and tested • Matter can be organized according to its chemical and physical properties	• How are particles in matter organized? • How do the particles in matter affect its properties? • What are some properties of metals and nonmetals? • How can we classify matter?

Concepts	Formative Assessment

• Standard units are used to measure and describe physical quantities such as weight, time, temperature, and volume.
• Measurements of a variety of properties can be used to identify materials.
• Natural objects exist from the very small to the immensely large.
• 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.
• A model showing that gases are made from matter particles that are too small to see and are moving freely around in space can explain many observations, including the inflation and shape of a balloon and the effects of air on larger particles or objects.
	Students who understand the concepts can:
	• Measure and describe physical quantities such as weight, time, temperature, and volume.
	• Make observations and measurements to produce data that can serve as the basis for evidence for an explanation of a phenomenon.
	• Make observations and measurements to identify materials based on their properties. Examples of materials to be identified could include:
	  ○ Baking soda and other powders
	  ○ Metals
	  ○ Minerals
	  ○ Liquids
	• Examples of properties could include:
	  ○ Color
	  ○ Hardness
	  ○ Reflectivity
	  ○ Electrical conductivity
	  ○ Thermal conductivity
	  ○ Response to magnetic forces
	  ○ Solubility
	• Develop a model to describe phenomena.
	• Develop a model to describe that matter is made of particles too small to be seen. (*Assessment does not include the atomic-scale mechanism of evaporation and condensation or defining the unseen particles*.) Examples of evidence could include:
	  ○ Adding air to expand a basketball

	○ Compressing air in a syringe ○ Dissolving sugar in water ○ Evaporating salt water

Suggested Learning Activities

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.

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 a balloon, 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.

Although engineering design is not explicitly called out in this unit, students could incorporate engineering design in a number of ways as they explore the particle nature of matter. Students can design ways/tools to measure a given physical property, such as hardness, reflectivity, electrical or thermal conductivity, or response to magnetic forces. The engineering design process can be used to analyze students' models using criteria. Then students can improve their designs based on analysis.

Students will incorporate technology through the use of student-centered research projects. Students will research specific topics and present their findings using Google Slides, Prezi, posters, etc. These projects will vary in intensity and scope, and will also be done independently or in cooperative groupings based on interest, level, or other means of grouping.

Performance Expectations

Science and Engineering Practices	DCI	Crosscutting Concepts
Planning and Carrying Out Investigations • Make observations and measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon. (***5-PS1-3***) **Developing and Using Models** • Use models to describe phenomena. (**5-PS1-1**)	**PS1.A: Structure and Properties of Matter** • Measurements of a variety of properties can be used to identify materials. (**5-PS1-3**) • 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 other means. A model showing that gases are made from matter particles that are too small to see and are moving freely around in space	**Scale, Proportion, and Quantity** • Standard units are used to measure and describe physical quantities such as weight, time, temperature, and volume. (**5-PS1-3**) • Natural objects exist from the very small to the immensely large. (**5-PS1-1**)

	can explain many observations, including the inflation and shape of a balloon and the effects of air on larger particles or objects. (**5-PS1-1**)	

Cross-Curricular Connections	
English/Language Arts Standards	**Mathematics Standards**
• Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently. (5-PS1-1) **RI.5.7** • Conduct short research projects that use several sources to build knowledge through investigation of different aspects of a topic. (5-PS1-3) **W.5.7** • Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase information in notes and finished work, and provide a list of sources. (5-PS1-3) **W.5.8** • Draw evidence from literary or informational texts to support analysis, reflection, and research. (5-PS1-3) **W.5.9**	• Reason abstractly and quantitatively. (5-PS1-1) (5-PS1-3) **MP.2** • Model with mathematics. (5-PS1-1) **MP.4** • Use appropriate tools strategically. (5-PS1-3) **MP.5** • Explain patterns in the number of zeros of the product when multiplying a number by powers of 10, and explain patterns in the placement of the decimal point when a decimal is multiplied or divided by a power of 10. Use whole-number exponents to denote powers of 10. (5-PS1-1) **5.NBT.A.1** • Apply and extend previous understandings of division to divide unit fractions by whole numbers and whole numbers by unit fractions. (5-PS1- 1) **5.NF.B.7** • Recognize volume as an attribute of solid figures and understand concepts of volume measurement. (5-PS1-1) **5.MD.C.3** • Measure volumes by counting unit cubes, using cubic cm, cubic in, cubic ft., and improvised units. (5-PS1-1) **5.MD.C.4**

21st Century Career Ready Practices
• **CRP4.** Communicate clearly and effectively and with reason. • **CRP6.** Demonstrate creativity and innovation. • **CRP7.** Employ valid and reliable research strategies. • **CRP8.** Utilize critical thinking to make sense of problems and persevere in solving them. • **CRP12**. Work productively in teams while using cultural global competence.

Grade 5-Science

Unit 3: Physical and Chemical Changes | Instructional Time: 25 Days

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.

Student Learning Objectives

New Jersey Student Learning Standards for Science/NGSS

5-PS1-4	Conduct an investigation to determine whether the mixing of two or more substances results in new substances.
5-PS1-2	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.

Enduring Understandings	Essential Questions
• All matter consists of mixtures, compounds, and elements. • Matter which is changed physically retains its chemical properties • Matter which is changed chemically undergoes changes to the chemical structure	• What happens to the amount of matter when it changes state? • What happens when different types of matter are mixed? • How does matter change when it interacts with other matter?

Concepts	Formative Assessment

• Cause-and-effect relationships are routinely identified, tested, and used to explain change.
• When two or more different substances are mixed, a new substance with different properties may be formed.
• Standard units are used to measure and describe physical quantities such as weight, time, temperature, and volume.
• The amount (weight) of matter is conserved when it changes form, even in transitions in which it seems to vanish.
• No matter what reaction or change in properties occurs, the total weight of the substances does not change. (Note: Mass and weight are not distinguished at this grade level.)
• Science assumes consistent patterns in natural systems.
	• Identify, test, and use cause-and-effect relationships to explain change.
	• Conduct an investigation collaboratively to produce data that can serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials is considered.
	• Conduct an investigation to determine whether the mixing of two or more substances results in new substances.
	• Measure and describe physical quantities such as weight, time, temperature, and volume.
	• Measure and graph quantities such as weight to address scientific and engineering questions and problems.
	• Measure and graph quantities to provide evidence that regardless of the type of change that occurs when substances are heated, cooled, or mixed, the total weight is conserved. (*Note: Assessment does not include distinguishing between mass and weight.*)
	• Examples of reactions or changes could include:
	  ○ Phase
	  ○ changes
	  ○ Dissolving
	  ○ Mixing

Suggested Learning Activities

Student will investigate how temperature affects the ability of a solid to be mixed into a liquid.

Students will investigate, create, and separate a variety of mixtures to show that mass is conserved when different types of mater are mixed. Students will also try to identify the type of mixture made from a combination of

substances.

Students will examine what happens when two or more different substances are mixed and produce a new substance.

Students will investigate how volume and temperature affects how quickly a substance is able to completely dissolve in water.

Students will incorporate technology through the use of student-centered research projects.

Students will research specific topics and present their findings using Google Slides, Prezi, posters, etc. These projects will vary in intensity and scope, and will also be done independently or in cooperative groupings based on interest, level, or other means of grouping.

Performance Expectations

Science and Engineering Practices	DCI	Crosscutting Concepts
Planning and Carrying Out Investigations • Conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered. **(5-PS1-4**) **Using Mathematics and Computational Thinking** • Measure and graph quantities such as weight to address scientific and engineering questions and problems. (**5-PS1-2**)	**PS1.A: Structure and Properties of Matter** • The amount (weight) of matter is conserved when it changes form, even in transitions in which it seems to vanish. (**5-PS1-2**) **PS1.B: Chemical Reactions** • When two or more different substances are mixed, a new substance with different properties may be formed. (**5-PS1-4**)	**Cause and Effect** • Cause and effect relationships are routinely identified and used to explain change. (**5-PS1-4**) Scale, Proportion, and Quantity • Standard units are used to measure and describe physical quantities such as weight, time, temperature, and volume. (**5-PS1-2**) - **Connections to Nature of Science** **Scientific Knowledge Assumes an Order and Consistency in Natural Systems** • Science assumes consistent patterns in natural systems. (**5-PS1-2**)

Cross-Curricular Connections

English/Language Arts Standards	Mathematics Standards
• **W.5.7** Conduct short research projects that use several sources to build knowledge through investigation of different aspects of a topic • **W.5.8** Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase information in notes and finished work and provide a list of sources	• **MP.2** Reason abstractly and quantitatively • **MP.4** Model with mathematics • **MP.5** use appropriate tools strategically

21st Century Career Ready Practices

- **CRP4.** Communicate clearly and effectively and with reason.
- **CRP6.** Demonstrate creativity and innovation.
- **CRP7.** Employ valid and reliable research strategies.
- **CRP8.** Utilize critical thinking to make sense of problems and persevere in solving them.
- **CRP12.** Work productively in teams while using cultural global competence.

Grade 5-Science

Unit 4: Plant and Animal Needs | Instructional Time: 30 Days

Within Unit 4, students develop an understanding that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction. The crosscutting concepts of systems and system models are called out as organizing concepts for this disciplinary core idea. Students are expected to demonstrate grade-appropriate proficiency in engaging in argument from evidence. Students are also expected to use this practice to demonstrate understanding of the core idea.

Students use data and conceptual models to understand how the environment and genetic factors determine the growth of an individual organism. They connect this idea to the role of animal behaviors in animal survival and reproduction and to the dependence of some plants on animal behaviors for their reproduction. Students provide evidence to support their understanding of the structures and behaviors that increase the likelihood of successful survival and reproduction by organisms. The crosscutting concepts of cause and effect and structure and function provide a framework for understanding the disciplinary core ideas. Students demonstrate grade-appropriate proficiency in analyzing and interpreting data, using models, conducting investigations, and communicating information. Students are also expected to use these practices to demonstrate understanding of the core ideas.

Student Learning Objectives

New Jersey Student Learning Standards for Science/NGSS

5-LS1-1	Support an argument that plants get the materials they need for growth chiefly from air and water
5-LS2-1	Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.
5-PS3-1	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.

Enduring Understandings	Essential Questions
• Plants and animals require certain materials to survive • Organisms are made of at least one building block call a cell. • Cells can work together in plants and animals to create systems which support the processes needed for life	• What do plants need to survive? • How do animals get energy from food? • How do plants use energy?

Concepts	Formative Assessment

• A system can be described in terms of its components and their interactions.
• Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction.
• Animals have characteristic behaviors to increase their likelihood of success in their environment
	Students who understand the concepts are able to:
	• Describe a system in terms of its components and their interactions.
	• Construct an argument with evidence, data, and/or a model.
	• Construct an argument to support the claim that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction. (Assessment is limited to macroscopic structures within plant and animal systems.) Examples of structures could include:
	  ○ Thorns
	  ○ Stems
	  ○ Roots
	  ○ Colored petals
	  ○ Heart
	  ○ Stomach
	  ○ Lung
	  ○ Brain
	  ○ Skin

	• Conduct experiments, collect evidence, and analyze empirical data. • Use evidence from experiments and other scientific reasoning to support oral and written explanations of how environmental and genetic factors influence the growth of organisms. • Identify and describe possible causes and effects of local environmental conditions on the growth of organisms. • Identify and describe possible causes and effects of genetic conditions on the growth of organisms.

Suggested Learning Activities

During this unit of study, students spend time observing plants and animals in order to gather evidence that organisms are living systems. A system is made up of structures and processes that interact and enable the system to function. Every plant and animal can be described in terms of its internal and external structures and their interactions, and these structures each have specific functions that support survival, growth, behavior, and reproduction for the organism. Using a variety of plants and animals as examples, students need multiple opportunities to: Describe the internal and external structures of a plant or animal and the function of each of those structures. Description should explain how each structure serves various functions in growth, survival, behavior, and/or reproduction. (Note: This is limited to macroscopic structures within plant and animal systems, and could include such structures as thorns, stems, roots, and colored petals for plants, and heart, stomach, lung, brain, and skin for animals.) Describe the interactions that occur among the structures within the plant or animal system. As students observe the structures of an animal or plant, explain the function of each, and describe how these structures help the animal grow, survive, and/or reproduce, they should use evidence from their observations to support their explanations.

Instruction should result in students being able to use arguments based on empirical evidence and scientific reasoning to support an explanation of how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants. Students may observe examples of plant structures that could affect the probability of plant reproduction, including bright flowers attracting butterflies that transfer pollen, flower nectar and odors that attract pollen-transferring insects, and hard shells on nuts that squirrels bury. Possible activities could include plant experiments (e.g., comparing the growth of plants or germination of seeds in various conditions and record the data they collect in a table), using microscopes/magnifiers to view plant structures, going on nature walks, both virtual and actual (e.g., butterfly garden/botanical garden).

Students may observe examples of animal behaviors that affect the probability of plant reproduction, which could include observing how animals can transfer pollen or seeds and how animals can create conditions for seed germination and growth. Students could then observe examples of animal behaviors (using videos, Internet resources, books, etc.) that could affect the probability of successful animal reproduction. These behaviors could include nest building to protect young from cold, herding of animals to protect young from predators, and colorful plumage and vocalizations to attract mates for breeding. Students may be able to identify and describe possible cause-and-effect relationships in factors that contribute to the reproductive success of plants and animals. Students may use evidence from experiments or other sources to identify the role of pollinators in plant reproduction.

Instruction that results in students being able to construct an evidence-based scientific explanation for how environmental and genetic factors influence the growth of organisms could begin with students conducting experiments and collecting data on the environmental conditions that effect the growth of organisms. This unit of study could end with students using an oral and/or written argument, supported by evidence and scientific reasoning from their experiments, to explain how environmental conditions and genetic factors affect the growth of an organism.

Students will incorporate technology through the use of student-centered research projects. Students will research specific topics and present their findings using Google Slides, Prezi, posters, etc. These projects will vary in intensity and scope, and will also be done independently or in cooperative groupings based on interest, level, or other means of grouping.

Performance Expectations

Science and Engineering Practices	DCI	Crosscutting Concepts
Engaging in Argument from Evidence • Construct an argument with evidence, data, and/or a model. (**4-LS1-1**) • Engaging in Argument from Evidence • Use an oral and written argument supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem. (**MSLS1-4**) **Constructing Explanations and Designing Solutions** • Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students' own experiments) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (**MS-LS1-5**)	**LS1.A: Structure and Function** • Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction. (**4- LS1-1**) **LS1.B: Growth and Development of Organisms** • Animals engage in characteristic behaviors that increase the odds of reproduction. (**MS-LS1-4**) • Plants reproduce in a variety of ways, sometimes depending on animal behavior and specialized features for reproduction. (**MS-LS1-4**) • Genetic factors as well as local conditions affect the growth of the adult plant. (**MS-LS1-5**)	**Systems and System Models** • A system can be described in terms of its components and their interactions. (**4-LS1-1**) **Cause and Effect** • Cause and effect relationships may be used to predict phenomena in natural systems. (**MSLS1-4**),(**MS-LS1-5**) • Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability. (**MSLS1-4**),(**MS-LS1-5**) **Structure and Function** • Complex and microscopic structures and systems can be visualized, modeled, and used to describe how their function depends on the relationships among its parts; therefore complex natural structures/systems can be analyzed to determine how they function. (**MS-LS1-4**), (**MSLS1-5**)

Cross-Curricular Connections	
English/Language Arts Standards	**Mathematics Standards**
English Language Arts Students use the evidence from their observations of plants and animals to support the claim that all organisms are systems with structures that function in growth, survival, behavior, and/or reproduction. Students need opportunities to observe plants and animals closely, taking notes and drawing pictures, so that they can describe various structures and their functions. • Cite specific, empirical, textual evidence to support analysis of how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants, respectively. • Trace and evaluate the argument and specific claims in a text about how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants, respectively. Distinguish claims that are supported by empirical evidence and scientific reasoning from claims that are not. • Write an argument focused on how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants, respectively.	Mathematics Students describe the symmetry that can be observed in an organism's structures. For example, the leaves of many plants and the bodies of many animals display bilateral symmetry. Students should be encouraged to draw each organism that they observe, pointing out any structures that are symmetrical. Students should also trace lines of symmetry in their drawings to support their thinking. In addition, students can conduct research to determine whether the symmetry serves a function in the growth, reproduction, or survival of the organism. Understand that a set of data collected to answer a statistical question about how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants, respectively, has a distribution which can be described by its center (mean), spread (range), and overall shape (shape of the distribution of data). • Summarize numerical data sets, collected to answer a statistical question about how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants, respectively, that have a distribution that can be described by its center (mean), spread (range), and overall shape (shape of the distribution of data)

	in relation to their context.

21st Century Career Ready Practices

- **CRP1**. Act as a responsible and contributing citizen and employee.
- **CRP2**. Apply appropriate academic and technical skills.
- **CRP3.** Attend to personal health and financial well-being.
- **CRP4.** Communicate clearly and effectively and with reason.
- **CRP5**. Consider the environmental, social and economic impacts of decisions.
- **CRP6.** Demonstrate creativity and innovation.
- **CRP7.** Employ valid and reliable research strategies.
- **CRP8.** Utilize critical thinking to make sense of problems and persevere in solving them.
- **CRP9.** Model integrity, ethical leadership and effective management.
- **CRP10.** Plan education and career paths aligned to personal goals.
- **CRP11**. Use technology to enhance productivity.
- **CRP12**. Work productively in teams while using cultural global competence.

Grade 5-Science

Unit 5: Matter in Ecosystems | Instructional Time: 25 Days

In this unit, students will develop and use models and communicate about cycles and relationships within ecosystems as they work to move matter. 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. Students will be involved in making observations to engage in scientific experiences and argument to help them understand the interactions, balance, and cycling of matter within ecosystems.

Student Learning Objectives

New Jersey Student Learning Standards for Science/NGSS

5-LS1-1	Support an argument that plants get the materials they need for growth chiefly from air and water
5-LS2-1	Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.
5-PS3-1	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.
5-ESS3-1	Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.

Enduring Understandings	Essential Questions
• Nearly all ecosystems can trace their energy to the sun • Ecosystems rely on the balance between organisms and other factors to be successful	• How does energy flow in an ecosystem? • How do changes affect ecosystems? • How is matter cycled through ecosystems?

Concepts	Formative Assessment
• Matter is transported into, out of, and within systems. • Plants acquire their material for growth chiefly from air and water. • Science explanations describe the mechanisms for natural events. • A system can be described in terms of its components and their interactions. • 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 plants parts and animals) and therefore operate as *decomposers*. • Decomposition eventually restores (recycles) some materials back to the soil. • Organisms can survive only in environments in which their particular needs are met. • Energy can be transferred in various ways and between objects. • The energy released from food was once energy from the sun, which was captured by plants in the chemical process that forms plant matter (from air	• Describe how matter is transported into, out of, and within systems. • Support an argument with evidence, data, or a model. • Support an argument that plants get the materials they need for growth chiefly from air and water. • Describe a system in terms of its components and interactions. • Develop a model to describe phenomena. • Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment. • Emphasis is on the idea that matter that is not food—such as air, water, decomposed materials in soil—is changed into matter that is food. • Describe how energy can be transferred in various ways and between objects. • Use models to describe phenomena. • 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.

and water). • Food provides animals with the materials they need for body repair and growth and the energy they need for motion and to maintain body warmth	

Suggested Learning Activities

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.
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.

Students will incorporate technology through the use of student-centered research projects. Students will research specific topics and present their findings using Google Slides, Prezi, posters, etc. These projects will vary in intensity and scope, and will also be done independently or in cooperative groupings based on interest, level, or other means of grouping.

Performance Expectations

Science and Engineering Practices	DCI	Crosscutting Concepts
• Developing and Using Models • Obtaining, Evaluation, and Communicating Information	• **LS2.A** Interdependent Relationships in Ecosystems • **LS2.B** Cycles of Matter and Energy Transfer in Ecosystems • **PS3.D** Energy in Chemical Processes and Everyday Life	• Systems and System Models • Energy can be transferred in various ways and between objects

Cross-Curricular Connections

English/Language Arts Standards	Mathematics Standards
• **R1.5.1** Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text. • **R1.5.7** Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a questions quickly or to solve a problem efficiently • **R1.5.9** Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably • **W.5.7** Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase information in notes and finished work, and provide a list of sources. • **SL.5.5** Include multimedia components and visual displays in presentations when appropriate to enhance the development of main ideas or themes.	• **MP2.** Reason abstractly and quantitatively. • **MP4.** Model with mathematics • **5.G.2** Represent real world an mathematical problems by graphing points in the first quadrant of the coordinate plane, and interpret coordinate values of points in the context of the situations

21st Century Career Ready Practices

- **CRP1.** Act as a responsible and contributing citizen and employee.
- **CRP2.** Apply appropriate academic and technical skills.
- **CRP3**. Attend to personal health and financial well-being.

- **CRP4**. Communicate clearly and effectively and with reason.
- **CRP5.** Consider the environmental, social and economic impacts of decisions.
- **CRP6.** Demonstrate creativity and innovation.
- **CRP7**. Employ valid and reliable research strategies.
- **CRP8**. Utilize critical thinking to make sense of problems and persevere in solving them.
- **CRP9.** Model integrity, ethical leadership and effective management.
- **CRP10.** Plan education and career paths aligned to personal goals.
- **CRP11.** Use technology to enhance productivity.
- **CRP12.** Work productively in teams while using cultural global competence.

Grade 5-Science

Unit 6: Interactions of Earth's Major Systems | Instructional Time: 30 Days

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 which the students will use to engage in scientific experiences and observations in order to answer questions about the Earths Systems. 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.

Student Learning Objectives

New Jersey Student Learning Standards for Science/NGSS

5-ESS2-1	Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact
5-ESS2-2	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	Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment

Enduring Understandings	Essential Questions
• The Earth is a dynamic planet of interacting systems. • The Earth has layers with distinct properties. • The cycling of materials within and between systems is a driving force of change on Earth.	• How do scientists define Earth's major systems? • How does the geosphere affect other systems? • How does the hydrosphere affect other systems? • How does the atmosphere affect other systems? • How does the biosphere affect other systems?
Concepts	**Formative Assessment**
• A system can be described in terms of its components and their interactions. • 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. • The ocean supports a variety of ecosystems and organisms, shapes landforms, and influences climate. • Winds and clouds in the atmosphere interact with landforms to determine patterns of weather.	• Describe a system in terms of its components and interactions. • Develop a model using an example to describe a scientific principle. • Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.

Suggested Learning Activities

Students will create a model of the Earth and its layers with respect to the relative volumes, temperatures, and physical and chemical properties of each layer.

Students will create percentage graphs and informational graphics to display the components of the geosphere, biosphere, hydrosphere, and/or atmosphere.

Once students become familiar with the Earth's systems, students will also investigate and understand the relationships between the systems. Students will understand that interactions between systems shape our Earth and influence the living and nonliving components of Earth.

Once students have an understanding of the interactions between Earth's major systems, they should gather information about the ways in which humans use science ideas to protect Earth's resources and environment. Students will conduct research to paraphrase and summarize information as they take notes, then use their information to support their finished work.
Students will incorporate technology through the use of student-centered research projects. Students will research specific topics and present their findings using Google Slides, Prezi, posters, etc. These projects will vary in intensity

and scope, and will also be done independently or in cooperative groupings based on interest, level, or other means of grouping.

Performance Expectations

Science and Engineering Practices	DCI	Crosscutting Concepts
• Developing and using models • Obtaining, Evaluating, and Communicating Information	• **ESS2.A** Earth Materials and Systems • **ESS3.C** Human Impacts on Earth Systems	• Systems and System Models

Cross Curricular Connections

English/Language Arts Standards	Mathematics Standards
• Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text. (5-ESS3-1) **RI.5.1** • Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently. (5-ESS2-1),(5-ESS3-1) **RI.5.7** • Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase information in notes and finished work, and provide a list of sources. (5-ESS3-1) **W.5.8** • Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably. (5-ESS3-1) **RI.5.9** • Draw evidence from literary or informational texts to support analysis, reflection, and research. (5-ESS3-1) **W.5.9** • Include multimedia components (e.g., graphics, sound) and visual displays in presentations when appropriate to enhance the development of main ideas or themes. (5-ESS2-2),(5-ESS2-1) **SL.5.5**	• Reason abstractly and quantitatively. (5-ESS2-1),(5-ESS3-1) **MP.2** • Model with mathematics. (5-ESS2-1),(5-ESS3-1) **MP.4** • Represent real world and mathematical problems by graphing points in the first quadrant of the coordinate plane, and interpret coordinate values of points in the context of the situation. (5-ESS2-1) **5.G.A.2**

21st Century Career Ready Practices

- **CRP1.** Act as a responsible and contributing citizen and employee.
- **CRP2.** Apply appropriate academic and technical skills.
- **CRP3.** Attend to personal health and financial well-being.
- **CRP4**. Communicate clearly and effectively and with reason.
- **CRP5.** Consider the environmental, social and economic impacts of decisions.
- **CRP6**. Demonstrate creativity and innovation.
- **CRP7.** Employ valid and reliable research strategies.
- **CRP8.** Utilize critical thinking to make sense of problems and persevere in solving them.
- **CRP9.** Model integrity, ethical leadership and effective management.
- **CRP10.** Plan education and career paths aligned to personal goals.
- **CRP11**. Use technology to enhance productivity.
- **CRP12**. Work productively in teams while using cultural global competence.

Grade 5-Science

Unit 7: Interactions Within the Earth, Sun, and Moon Systems

Instructional Time: 25 Days

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.

Student Learning Objectives

New Jersey Student Learning Standards for Science/NGSS

5-PS2-1	Support an argument that the gravitational force exerted by Earth on objects is directed down.
5-ESS1-1	Support an argument that the apparent brightness of the sun and stars is due to their relative distances from the Earth
5-ESS1-2	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.

Enduring Understandings	**Essential Questions**
• The gravitational force of Earth acting on an object near Earth's surface pulls that object toward the planet's center. • The sun is a star that appears larger and brighter than other stars because it is closer.	• What are the differences in the apparent brightness of the sun compared to that of other stars due to their relative distances from Earth? • What are the similarities and differences in patterns that can be used to sort, classify, communicate, and analyze simple rates of change for natural phenomena.

Concepts	**Formative Assessment**

• Cause-and-effect relationships are routinely identified and used to explain change.
• Natural objects exist from the very small to the immensely large.
• Stars range greatly in their distance from Earth.
• Similarities and differences in patterns can be used to sort, classify, communicate, and analyze simple rates of change for natural phenomena.
• 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. These include:
  ○ Day and night
  ○ Daily changes in the length and direction of shadows
  ○ Different positions of the sun, moon, and stars at different times of the day, month, and year.
	Students who understand the concepts are able to:
	• Identify cause-and-effect relationships in order to explain change.
	• Support an argument with evidence, data, or a model.
	• Support an argument that the gravitational force exerted by Earth on objects is directed down. ("Down" is a local description of the direction that points toward the center of the spherical Earth.)
	• Support an argument with evidence, data, or a model.
	• Support an argument that differences in the apparent brightness of the sun compared to that of other stars is due to their relative distances from Earth.
	• Sort, classify, communicate, and analyze simple rates of change for natural phenomena using similarities and differences in patterns.
	• Represent data in graphical displays (bar graphs, pictographs and/or pie charts) to reveal patterns that indicate relationships.
	• 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.
	  ○ The position and motion of Earth with respect

	to the sun. ○ Selected stars that are visible only in particular months.

Suggested Learning Activities

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.

Performance Expectations

Science and Engineering Practices	DCI	Crosscutting Concepts
Developing and Using Models	**PS2.B: Types of Interactions**	**Cause and Effect**

• Develop a model using an example to describe a scientific principle. (**5-ESS2-1**) **Engaging in Argument from Evidence** • Support an argument with evidence, data, or a model. (5-PS2-1), **(5-ESS1-1**) **Analyzing and Interpreting Data** • Represent data in graphical displays (bar graphs, pictographs and/or pie charts) to reveal patterns that indicate relationships. **(5-ESS1-2**)	• The gravitational force of Earth acting on an object near Earth's surface pulls that object toward the planet's center. (**5-PS2-1**) **ESS1.A: The Universe and its Stars** • 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. (**5-ESS1-1**) **ESS1.B: Earth and the Solar System** • 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. These include day and night; daily changes in the length and direction of shadows; and different positions of the sun, moon, and stars at different times of the day, month, and year. (**5-ESS1-2**)	• Cause and effect relationships are routinely identified and used to explain change. (**5-PS2-1**) **Scale, Proportion, and Quantity** • Natural objects exist from the very small to the immensely large. (**5-ESS1-1**) **Patterns** • Similarities and differences in patterns can be used to sort, classify, communicate and analyze simple rates of change for natural phenomena. (**5-ESS1-2**)

Cross-Curricular Connections

English Language Arts	Mathematics
• Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text. (5-PS2-1), (5-ESS1-1) **RI.5.1** • Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently. (5-ESS1-1) **RI.5.7** • Explain how an author uses reasons and evidence to support particular points in a text, identifying which reasons and evidence support which point(s). (5-ESS1-1) **RI.5.8** • Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably. (5-PS2-1), (5-ESS1-1) **RI.5.9** • Write opinion pieces on topics or texts, supporting a point of view with reasons and information. (5-PS2-1), (5-ESS1-1) **W.5.1** • Include multimedia components (e.g., graphics, sound) and visual displays in presentations when appropriate to enhance the development of main ideas or themes. (5-ESS1-2) **SL.5.5**	Reason abstractly and quantitatively. (5-ESS1-1),(5-ESS1-2) **MP.2** Model with mathematics. (5-ESS1-1,(5-ESS1-2)) **MP.4** Explain patterns in the number of zeros of the product when multiplying a number by powers of 10, and explain patterns in the placement of the decimal point when a decimal is multiplied or divided by a power of 10. Use whole-number exponents to denote powers of 10. (5-ESS1-1) **5.NBT.A.2** Represent real world and mathematical problems by graphing points in the first quadrant of the coordinate plane, and interpret coordinate values of points in the context of the situation. (5-ESS1-2) **5.G.A.2**

21st Century Career Ready Practices

- **CRP1.** Act as a responsible and contributing citizen and employee.

- **CRP2.** Apply appropriate academic and technical skills.
- **CRP3.** Attend to personal health and financial well-being.
- **CRP4**. Communicate clearly and effectively and with reason.
- **CRP5.** Consider the environmental, social and economic impacts of decisions.
- **CRP6**. Demonstrate creativity and innovation.
- **CRP7.** Employ valid and reliable research strategies.
- **CRP8.** Utilize critical thinking to make sense of problems and persevere in solving them.
- **CRP9.** Model integrity, ethical leadership and effective management.
- **CRP10.** Plan education and career paths aligned to personal goals.
- **CRP11**. Use technology to enhance productivity.
- **CRP12**. Work productively in teams while using cultural global competence.