Montague Township Schol

Science Curriculum

Grades K-8

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New Jersey Student Learning Standards 2020 - Science Introduction

New Jersey Department of Education - December 2020

Science

Scientific and technological advances have proliferated and now permeate most aspects of life in the 21st century. It is increasingly important that all members of our society develop an understanding of scientific and engineering concepts and processes. Learning how to construct scientific explanations and how to design evidence-based solutions provides students with tools to think critically about personal and societal issues and needs. Students can then contribute meaningfully to decision-making processes, such as discussions about climate change, new approaches to health care, and innovative solutions to local and global problems.

Mission

All students will possess an understanding of scientific concepts and processes required for personal decisionmaking, participation in civic life, and preparation for careers in STEM fields (for those that chose).

Vision

Prepare students to become scientifically literate individuals who can effectively:

- Apply scientific thinking, skills, and understanding to real-world phenomena and problems;
- Engage in systems thinking and modeling to explain phenomena and to give a context for the ideas to be learned;
- Conduct investigations, solve problems, and engage in discussions;
- Discuss open-ended questions that focus on the strength of the evidence used to generate claims;
- Read and evaluate multiple sources, including science-related magazine and journal articles and web-based resources to gain knowledge about current and past science problems and solutions and develop well reasoned claims; and
- Communicate ideas through journal articles, reports, posters, and media presentations that explain and argue.

Spirit and Intent

The New Jersey Student Learning Standards for Science (NJSLS-S) describe the expectations for what students should know and be able to do as well as promote three-dimensional science instruction across the three science domains (i.e., physical sciences, life science, Earth and space sciences). From the earliest grades, the expectation is that students will engage in learning experiences that enable them to investigate phenomena, design solutions to problems, make sense of evidence to construct arguments, and critique and discuss those arguments (in appropriate ways relative to their grade level).

The foundation of the NJSLS-S reflects three dimensions — science and engineering practices, disciplinary core ideas, and crosscutting concepts. The performance expectations are derived from the interplay of these three dimensions. It is essential that these three components are integrated into all learning experiences. Within each standard document, the three dimensions are intentionally presented as integrated components to foster sensemaking and designing solutions to problems. Because the NJSLS-S is built on the notions of coherence and contextuality, each of the science and engineering practices and crosscutting concepts appear multiple times across topics at every grade level. Additionally, the three dimensions should be an integral part of every curriculum unit and should not be taught in isolation.

Three Dimensions of NJSLS-S

The performance expectations reflect the three dimensions and describe what students should know and be able to do. In layman's terms, they are "the standards." They are written as statements that can be used to guide assessment and allow for flexibility in the way that students are able to demonstrate proficiency. The example below is provided to illustrate the interconnected nature of the NJSLS-S components.

Disciplinary Core Ideas and Performance Expectations	
Disciplinary Core Idea	**Performance Expectation**
Patterns of the apparent motion of the sun, the moon, and stars in the sky can be observed, described, predicted, and explained with models.	Develop and use a model of the Earth-sun moon system to describe the cyclic patterns of lunar phases, eclipses of the sun and moon, and seasons.
Science and Engineering Practices	
Developing and Using Models Develop and use a model to describe phenomena.	
Crosscutting Concepts	
Scale, Proportion, and Quantity Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small.	

Becoming familiar with the science practices and crosscutting concepts is a critically important first step in designing learning experiences reflective of the three dimensions. A description of each of the science and engineering practices and the cross-cutting concepts can be found in the next sections. Further, for students to develop proficiency of the NJSLS-S, they will need to engage in learning experiences that are meaningful, cumulative, and progressive. Learning experiences designed to be meaningful, go beyond reading about science concepts and provide opportunities for students to be active learners and make sense of ideas. Cumulative learning experiences provide opportunities for students to use and build on ideas that they have learned in previous units. Progressive learning experiences provide multiple occasions for students to engage in ways that enable them to improve their construction of explanations and solutions over time by iteratively assessing them, elaborating on them, and holding them up to critique and evidence.

Asking Questions and Defining Problems

A practice of science is to ask and refine questions that lead to descriptions and explanations of how the natural and designed world works and which can be empirically tested.

Engineering questions clarify problems to determine criteria for successful solutions and identify constraints to solve problems about the designed world.

Both scientists and engineers also ask questions to clarify the ideas of others.

Planning and Carrying Out Investigations

Scientists and engineers plan and carry out investigations in the field or laboratory, working collaboratively as well as individually. Their investigations are systematic and require clarifying what counts as data and identifying variables or parameters.

Engineering investigations identify the effectiveness, efficiency, and durability of designs under different

conditions. **Analyzing and Interpreting Data**

Scientific investigations produce data that must be analyzed in order to derive meaning. Because data patterns and trends are not always obvious, scientists use a range of tools—including tabulation, graphical interpretation, visualization, and statistical analysis—to identify the significant features and patterns in the data. Scientists identify sources of error in the investigations and calculate the degree of certainty in the results. Modern technology makes the collection of large data sets much easier, providing secondary sources for analysis.

Engineering investigations include analysis of data collected in the tests of designs. This allows comparison of different solutions and determines how well each meets specific design criteria—that is, which design best solves the problem within given constraints. Like scientists, engineers require a range of tools to identify patterns within data and interpret the results. Advances in science make analysis of proposed solutions more efficient and effective.

Developing and Using Models

A practice of both science and engineering is to use and construct models as helpful tools for representing ideas and explanations. These tools include diagrams, drawings, physical replicas, mathematical representations, analogies, and computer simulations.

Modeling tools are used to develop questions, predictions and explanations; analyze and identify flaws in systems; and communicate ideas. Models are used to build and revise scientific explanations and proposed engineered systems.

Measurements and observations are used to revise models and designs.

Constructing Explanations and Designing Solutions

The products of science are explanations and the products of engineering are solutions.

The goal of science is the construction of theories that provide explanatory accounts of the world. A theory becomes accepted when it has multiple lines of empirical evidence and greater explanatory power of phenomena than previous theories.

The goal of engineering design is to find a systematic solution to problems that is based on scientific knowledge and models of the material world. Each proposed solution results from a process of balancing competing criteria of desired functions, technical feasibility, cost, safety, aesthetics, and compliance with legal requirements. The optimal choice depends on how well the proposed solutions meet criteria and constraints.

Engaging in Argument from Evidence

Argumentation is the process by which explanations and solutions are reached.

In science and engineering, reasoning and argument based on evidence are essential to identifying the best explanation for a natural phenomenon or the best solution to a design problem. Scientists and engineers use argumentation to listen to, compare, and evaluate competing ideas and methods based on merits.

Scientists and engineers engage in argumentation when investigating a phenomenon, testing a design solution,

resolving questions about measurements, building data models, and using evidence to identify strengths and weaknesses of claims.

Using Mathematics and Computational Thinking

In both science and engineering, mathematics and computation are fundamental tools for representing physical variables and their relationships. They are used for a range of tasks such as constructing simulations; statistically analyzing data;

and recognizing, expressing, and applying quantitative relationships.

Mathematical and computational approaches enable scientists and engineers to predict the behavior of systems and test the validity of such predictions. Statistical methods are frequently used to identify significant patterns and establish correlational relationships.

Obtaining, Evaluating, and Communicating Information

Scientists and engineers must be able to communicate clearly and persuasively the ideas and methods they

generate. Critiquing and communicating ideas individually and in groups is a critical professional activity.

Communicating information and ideas can be done in multiple ways: using tables, diagrams, graphs, models, and equations as well as orally, in writing, and through extended discussions. Scientists and engineers employ multiple sources to acquire information that is used to evaluate the merit and validity of claims, methods, and design.

Disciplinary Core Ideas
Disciplinary Core Ideas in Physical Science Disciplinary Core Ideas in Life Science

PS1: Matter and Its Interactions

- PS1.A: Structure and Properties of Matter
- PS1.B: Chemical Reactions
- PS1.C: Nuclear Processes

PS2: M K-2-ETS1-2 Motion and Stability: Forces and Interactions

- PS2.A: Forces and Motion
- PS2.B: Types of Interactions
- PS2.C: Stability and Instability in Physical Systems

PS3: Energy

- PS3.A: Definitions of Energy
- PS3.B: Conservation of Energy and Energy Transfer
- PS3.C: Relationship Between Energy and Forces
- PS3.D: Energy in Chemical Processes and Everyday Life

PS4: Waves and Their Applications in Technologies for Information Transfer

- PS4.A: Wave Properties
- PS4.B: Electromagnetic Radiation
- PS4.C: Information Technologies and Instrumentation

LS1: From Molecules to Organisms: Structures and Processes

- LS1.A: Structure and Function
- LS1.B: Growth and Development of Organisms
- LS1.C: Organization for Matter and Energy Flow in Organisms
- LS1.D: Information Processing

LS2: Ecosystems: Interactions, Energy, and Dynamics

- LS2.A: Interdependent Relationships in Ecosystems
- LS2.B: Cycles of Matter and Energy Transfer in Ecosystems
- LS2.C: Ecosystem Dynamics, Functioning, and Resilience
- LS2.D: Social Interactions and Group Behavior

LS3: Heredity: Inheritance and Variation of Traits

- LS3.A: Inheritance of Traits
- LS3.B: Variation of Traits

LS4: Biological Evolution: Unity and Diversity

- LS4.A: Evidence of Common Ancestry and Diversity
- LS4.B: Natural Selection
- LS4.C: Adaptation
- LS4.D: Biodiversity and Humans

Disciplinary Core Ideas in Earth and Space Science Disciplinary Core Ideas in Engineering, Technology, and the Application of Science

ESS1: Earth's Place in the Universe

- ESS1.A: The Universe and Its Stars
- ESS1.B: Earth and the Solar System
- ESS1.C: The History of Planet Earth

ESS2: Earth's Systems

ETS1: Engineering Design

- ETS1.A: Defining and Delimiting an Engineering Problem
- ETS1.B: Developing Possible Solutions
- ETS1.C: Optimizing the Design Solution

- ESS2.A: Earth Materials and Systems
- ESS2.B: Plate Tectonics and Large-Scale System Interactions
- ESS2.C: The Roles of Water in Earth's Surface Processes
- ESS2.D: Weather and Climate
- ESS2.E: Biogeology

ESS3: Earth and Human Activity

- ESS3.A: Natural Resources
- ESS3.B: Natural Hazards
- ESS3.C: Human Impacts on Earth Systems
- ESS3.D: Global Climate Change

ETS2: Links Among Engineering, Technology, Science, and Society

- ETS2.A: Interdependence of Science, Engineering, and Technology
- ETS2.B: Influence of Engineering, Technology, and Science on Society and the Natural World

Patterns

Observed patterns of forms and events guide organization and classification, and they prompt questions about relationships and the factors that influence them.

Cause and Effect: Mechanism and Explanation

Events have causes, sometimes simple, sometimes multifaceted. A major activity of science is investigating and explaining causal relationships and the mechanisms by which they are mediated. Such mechanisms can then be tested across given contexts and used to predict and explain events in new contexts.

Scale, Proportion, and Quantity

In considering phenomena, it is critical to recognize what is relevant at different measures of size, time, and energy and

to recognize how changes in scale, proportion, or quantity affect a system's structure or performance.

Systems and System Models

Defining the system under study—specifying its boundaries and making explicit a model of that system— provides tools for understanding and testing ideas that are applicable throughout science and engineering.

Energy and Matter

Flows, Cycles, and Conservation Tracking fluxes of energy and matter into, out of, and within systems helps one understand the systems' possibilities and limitations.

Structure and Function

The way in which an object or living thing is shaped and its substructure determine many of its properties and

functions. **Stability and Change**

For natural and built systems alike, conditions of stability and determinants of rates of change or evolution of a system are critical elements of study.

Standards in Action: Climate Change

Earth's climate is now changing faster than at any point in the history of modern civilization, primarily as a result of human activities. Global climate change has already resulted in a wide range of impacts across New Jersey and in many sectors of its economy. The addition of academic standards that focus on climate change is important so that all students will have a
basic understanding of the climate system, including the natural and human-caused factors that affect it. The underpinnings of climate change span across physical, life, as well as Earth and space sciences. The goal is for students to understand climate science as a way to inform decisions that improve quality of life for themselves, their community, and globally and to know how engineering solutions can allow us to mitigate impacts, adapt practices, and build resilient systems.

The topic of climate change can easily be integrated into science classes. At each grade level in which systems thinking, managing uncertainty, and building arguments based on multiple lines of data are included, there are opportunities for students to develop essential knowledge and skills that will help them understand the impacts of climate change on humans, animals, and the environment. For example, in the earlier grades, students can use data from firsthand investigations of the school-yard habitat to justify recommendations for design improvements to the school-yard habitat for plants, animals, and humans. In the middle grades, students use resources from New Jersey Department of Environmental Protection, the National Oceanic and Atmospheric Administration (NOAA), and National Aeronautics and Space Administration (NASA), to inform their actions as they engage in designing, testing, and modifying an engineered solution to mitigate the impact of climate change on their community. In high school, students can construct models they develop of a proposed solution to mitigate the negative health effects of unusually high summer temperatures resulting from heat islands in cities across the globe and share in the appropriate setting.

Grade Level Standards Overview - NJSLS-S 2020

Kindergarten

K-PS2: Motion and Stability: Forces and Interactions

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

K-LS1: From Molecules to Organisms Structures and Processes

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

KESS2: Earth Systems

● K-ESS2-1 Use and share observations of local weather conditions to describe patterns over time. ● K-ESS2-2 Construct an argument supported by evidence for how plants and animals (including humans) can change the environment to meet their needs.

KESS3: Earth and Human Activity

- K-ESS3-1 Use a model to represent the relationship between the needs of different plants and animals (including) humans and the places they live.
- K-ESS3-2 Ask questions to obtain information about the purpose of weather forecasting to prepare for, and respond to, severe weather.
- K-ESS3-3 Communicate solutions that will reduce the impact of climate change and humans on the land, water, air, and/or other living things in the local environment.

Grade One

1-PS4: Waves and their Applications in Technologies for Information Transfer

- 1-PS4-1 Plan and conduct investigations to provide evidence that vibrating materials can make sound and that sound can make materials vibrate.
- 1-PS4.2. Make observations to construct an evidence-based account that objects can be seen only when illuminated.
- 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.

- 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.

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

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

1-LS3: Heredity: Inheritance and Variation of Traits

- 1-LS3-1 Make observations to construct an evidence-based account that young plants and animals are like, but 8

not exactly like, their parents

1-ESS1: Earth's Place in the Universe

● 1-ESS1-1. Use observations of the sun, moon, and stars to describe patterns that can be predicted. ● 1-ESS1-2. Make observations at different times of the year to relate the amount of daylight to the time of the year.

Grade Two

2-PS1: Matter and Its Interactions

- 2-PS1-1. Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties.
- 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.
- 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.
- 2-PS1-4. Construct an argument with evidence that some changes caused by heating or cooling can be reversed and some cannot.

2-LS2: Ecosystems: Interactions, Energy and Dynamics

● 2-LS2-1. Plan and Conduct an investigation to determine if plants need sunlight and water to grow. ● 2-LS2-2. Develop a simple model that mimics the function of an animal in dispersing seeds or pollinating plants. ● 2-LS4-1. Make observations of plants and animals to compare the diversity of life in different habitats.

2-ESS1: Earth's Place in the Universe

- 2-ESS1-1. Use information from several sources to provide evidence that Earth events can occur quickly or slowly.

2-ESS2: Earth's Systems

- 2-ESS2-1. Compare multiple solutions designed to slow or prevent wind or water from changing the shape of the land.

● 2-ESS2-2. Develop a model to represent the shapes and kinds of land and bodies of water in an area. ● 2-ESS2-3. Obtain information to identify where water is found on Earth and that it can be solid or liquid.

Kindergarten through Grade Two

K-2-ETS1: Engineering Design

- K-2-ETS1-1 Ask questions, make observations, and gather information about a situation people want to change (e.g., climate change) to define a simple problem that can be solved through the development of a new or improved object or tool.
- K-2-ETS1-2 Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it

function as needed to solve a given problem.

- K-2-ETS1-3 Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.

Grade Three

3-PS2: Motion Stability: Forces and Interactions

- 3-PS2-1. Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object.
- 3-PS2-2. Make observations and/or measurements of an object's motion to provide evidence that a pattern can be used to predict future motion.

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

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

- 3-LS1-1. Develop models to describe that organisms have unique and diverse life cycles, but all have in common birth, growth, reproduction, and death.

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

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

3-LS3: Heredity: Inheritance and Variation of Traits

- 3-LS3-1. Analyze and interpret data to provide evidence that plants and animals have traits inherited from parents and that variation of these traits exist in a group of similar organisms.
- 3-LS3-2. Use evidence to support the explanation that traits can be influenced by the environment.

3-LS4: Biological Evolution: Unity and Diversity

- 3-LS4-1. Analyze and interpret data from fossils to provide evidence of the organisms and the environments in which they lived long ago.
- 3-LS4-2 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. Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some can not survive at all.
- 3-LS4-4. 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: Earth's System

- 3-ESS2-1. Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season.
- 3-ESS2-2. Obtain and combine information to describe climates in different regions of the world.

3-ESS3: Earth and Human Activity

- 3-ESS3-1. Make a claim about the merit of a design solution that reduces the impacts of climate change and/or a weather-related hazard.

Grade Four

4-PS3: Energy

- 4-PS3-1. Use evidence to construct an explanation relating the speed of an object to the energy of that object.
- 4-PS3-2. Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.
- 4-PS3-3. Ask questions and predict outcomes about changes in energy that occur when objects collide. ● 4-PS3-4. Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.

4-PS4: Waves and their Applications in Technologies for Information Transfer

- 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.
- 4-PS4-2. Develop a model to describe that light reflecting from objects and entering the eye allows objects 10 to be seen.
- 4-PS4-3. Generate and compare multiple solutions that use patterns to transfer information.

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

- 4-LS1-1. Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.
- 4-LS1-2. Use a model to describe that animals receive different types of 7 information through their senses, process the information in their brain, and respond to the information in different ways.

4-ESS1: Earth's Place in the Universe

- 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.

4-ESS2: Earth's Systems

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

4-ESS3: Earth and Human Activity

- 4-ESS3-1. Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment.
- 4-ESS3-2. Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans.

Grade Five

5-PS1: Matter and its Interactions

- 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-PS1-3. Make observations and measurements to identify materials based on their properties. ● 5-PS1-4. Conduct an investigation to determine whether the mixing of two or more substances results in a new substances.

5-PS2: Motion and Stability: Forces and Interactions

- 5-PS2-1 Support an argument that the gravitational force exerted by Earth on objects is directed down.

5-PS3: Energy

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

- 5-LS1-1. Support an argument that plants get the materials they need for growth chiefly from air and water.

5-LS2: Ecosystems: Interactions, Energy and Dynamics

- 5-LS2-1. Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.

5-ESS1: Earth's Place in the Universe

- 5-ESS1-1 Support an argument that differences in the apparent brightness of the sun compared to other stars is due to their relative distances from Earth.
- 5-ESS1-2 Represent data in graphical displays to reveal patterns of daily changes in length and direction of 11

  shadows, day and night, and the seasonal appearance of some stars in the night sky.

5-ESS2: Earth's Systems

- 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: Earth and Human Activity

- 5-ESS3-1. Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources, environment, and address climate change issues.

Grade Three through Grade Five

3-5-ETS1: Engineering Design

- 3-5-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.

Grade Six through Grade Eight

MS-PS1: Matter and its Interactions

- MS-PS1-1 Develop models to describe the atomic composition of simple molecules and extended structures. ● MS-PS1-2 Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.
- MS-PS1-3 Gather and make sense of information to describe that synthetic materials come from natural resources and impact society.
- MS-PS1-4 Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed.
- MS-PS1-5 Develop and use a model to describe how the total number of atoms does not change in a chemical reaction and thus mass is conserved.
- MS-PS1-6 Undertake a design project to construct, test, and modify a device that either releases or absorbs thermal energy by chemical processes.

MS-PS2: Motion and Stability: Forces and Interactions

- MS-PS2-1 Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects.
- MS-PS2-2 Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object.
- MS-PS2-3 Ask questions about data to determine the factors that affect the strength of electric and magnetic forces.
- MS-PS2-4 Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects.
- MS-PS2-5 Conduct an investigation and evaluate the experimental design to provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contact

MS-PS3: Energy

- MS-PS3-1 Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object.
- MS-PS3-2 Develop a model to describe that when the arrangement of objects interacting at a distance changes,

different amounts of potential energy are stored in the system.

- MS-PS3-3 Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer.
- MS-PS3-4 Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample.
- MS-PS3-5 Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object.

MS-PS4: Waves and Their Applications in Technologies for Information Transfer

- MS-PS4-1 Use mathematical representations to describe a simple model for waves that includes how the amplitude of a wave is related to the energy in a wave.
- MS-PS4-2 Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials.
- MS-PS4-3 Integrate qualitative scientific and technical information to support the claim that digitized signals are a more reliable way to encode and transmit information than analog signals.

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

- MS-LS1-1 Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells.
- MS-LS1-2 Develop and use a model to describe the function of a cell as a whole and ways parts of cells contribute to the function.
- MS-LS1-3 Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells.
- MS-LS1-4 Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively.
- MS-LS1-5 Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.
- MS-LS1-6 Construct a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms.
- MS-LS1-7 Develop a model to describe how food is rearranged through chemical reactions forming new molecules that support growth and/or release energy as this matter moves through an organism. ● MS-LS1-8 Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for

immediate behavior or storage as memories.

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

- MS-LS2-1 Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.
- MS-LS2-2 Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.
- MS-LS2-3 Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.
- MS-LS2-4 Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.
- MS-LS2-5 Evaluate competing design solutions for maintaining biodiversity and ecosystem services.

MS-LS3: Heredity: Inheritance and Variation of Traits

- MS-LS3-1 Develop and use a model to describe why structural changes to genes (mutations) located on chromosomes may affect proteins and may result in harmful, beneficial, or neutral effects to the structure and function of the organism.
- MS-LS3-2 Develop and use a model to describe why asexual reproduction results in offspring with identical genetic information and sexual reproduction results in offspring with genetic variation.

MS- LS4: Biological Evolution: Unity and Diversity

- MS-LS4-1 Analyze and interpret data for patterns in the fossil record that document the existence, diversity, extinction, and change of life forms throughout the history of life on Earth under the assumption that natural laws operate today as in the past.

● MS-LS4-2 Apply scientific ideas to construct an explanation for the anatomical similarities and differences among modern organisms and between modern and fossil organisms to infer evolutionary relationships. ● MS-LS4-3 Analyze displays of pictorial data to compare patterns of similarities in the embryological development across multiple species to identify relationships not evident in the fully formed anatomy.

● MS-LS4-4 Construct an explanation based on evidence that describes how genetic variations of traits in a population increase some individuals' probability of surviving and reproducing in a specific environment. ● MS-LS4-5 Gather and synthesize information about the technologies that have changed the way humans influence the inheritance of desired traits in organisms.

- MS-LS4-6 Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time.

MS-ESS1: Earth's Place in the Universe

- MS-ESS1-1 Develop and use a model of the Earth-sun-moon system to describe the cyclic patterns of lunar phases, eclipses of the sun and moon, and seasons.
- MS-ESS1-2 Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system.

● MS-ESS1-3 Analyze and interpret data to determine scale properties of objects in the solar system. ● MS-ESS1-4 Construct a scientific explanation based on evidence from rock strata for how the geologic time scale is used to organize Earth's 4.6-billion-year-old history.

MS-ESS2: Earth's Systems

- MS-ESS2-1 Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process.
- MS-ESS2-2 Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales.
- MS-ESS2-3 Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions.
- MS-ESS2-4 Develop a model to describe the cycling of water through Earth's systems driven by energy from the

sun and the force of gravity.

- MS-ESS2-5 Collect data to provide evidence for how the motions and complex interactions of air masses result in changes in weather conditions.
- MS-ESS2-6 Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates.

MS-ESS3: Earth and Human Activity

- MS-ESS3-1 Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes. ● MS-ESS3-2 Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.
- MS-ESS3-3 Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.
- MS-ESS3-4 Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems.
- MS-ESS3-5. Ask questions to clarify evidence of the factors that have caused climate change over the past century.

MS-ETS1: Engineering Design

- MS-ETS1-1 Define the criteria and constraints of a design problem with sufficient precision to ensure a successful

solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.

- MS-ETS1-2 Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
- MS-ETS1-3 Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
- MS-ETS1-4 Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.

Grade Level Unit Pacing Guides

Kindergarten

Unit Instructional Days Standards
Unit 1: Weather 10, then ongoing K-ESS2-1, K-ESS3-2, K-2ETS1-1
Unit 2: Pushes and Pulls 15 K-PS2-1, K-PS2-2, and K-2: ETS1-3.
Unit 3: Effects of the Sun 15 K-PS3-1, K-PS3-2, K-2ETS1-1, K-2-ETS1-2, and K-2-ETS1-3.
Unit 4: Basic Needs of Living Things 20 K-LS1-1, K-ESS3-1, K-ESS2-2

Unit 5: Basic Needs of Humans 15 K-Ess3-3, K-2ETS1-1

Grade One

Unit Instructional Days Standards
Unit 1: Patterns of Change in the Sky 15 1-ESS1-1, 1-ESS1-2
Unit 2: Characteristics of Living Things 15 1-LS3-1, 1-LS1-2
Unit 3: Mimicking Organisms to Solve Problems 25 1-LS1-1, K-2ETS1-2
Unit 4: Light and Sound 20 1-PS4-2, 1-PS4-3, 1-PS4-1
Unit 5: Communicating with Light and Sound 25 1-PS4-4, K-2ETS1-1, K-2ETS1-2

Grade Two

Unit Instructional Days	**Standards**
Unit 1: Relationships in Habitats 15	2-LS4-1, 2-LS2-1, 2-LS2-2, K-2ETS1-1
Unit 2: Properties of Matter 20	2-PS1-1, 2-PS1-2, K-2ETS1-3
Unit 3: Changes to Matter 15	2-PS1-3, 2-PS1-4
Unit 4: The Earth's Land and Water 20	2-ESS2-3, 2-ESS2-2
Unit 5: Changes to Earth's Land 20	2-ESS1-1, 2-ESS2-1, K-2ETS1-1, K-2ETS1-2

Grade Three

Unit Instructional Days	**Standards**
Unit 1: Weather and Climate 15	3-ESS2-1, 3-ESS2-2, 3-ESS3-1, 3-5-ETS1-1.

Unit 2: Force and Motion 15	3-PS2-1, 3-PS2-2.
Unit 3: Electrical and Magnetic Forces 15	3-PS2-1, 3-PS2-2.
Unit 4: Traits 15	3-LS3-1, 3-LS3-2.
Unit 5: Continuing the Cycle 10	3-LS1-1, 3-LS4-2.

Unit 6: Organisms and the Environment 15 3-LS2-1, 3-LS4-3.

Unit 7: Using Evidence to Understand Change in Environments 15 3-LS4-1, 3-LS4-4, 3-5-ETS1-1.

Grade Four

Unit Instructional Days Standards
Unit 1: Weathering and Erosion 10 4-ESS2-1, 4-ESS1-1
Unit 2: Earth Processes 10 4-ESS2-2, 4-ESS3-2, 3-5-ETS1-2, 3-5-ETS1-3
Unit 3: Structures and Functions 10 4-LS1-1
Unit 4: How Organisms Process Information 10 4-LS1-2, 4-PS4-2.
Unit 5: Transfer of Energy 15 4-PS3-2, 4-ESS3-1.
Unit 6: Force and Motion 15 4-PS3-1, 4-PS3-3. Unit 7: Using Engineering Design with Force and Motion Systems 15 4-PS3-4, 3-5-ETS1-1, 3-5-ETS1-2, 3-5-ETS1-3 Unit 8: Waves and Information 15 4-PS4-1, 4-PS4-3, 3-5-ETS1-2, 3-5-ETS1-3.

Grade Five

Unit Instructional Days	**Standards**

Unit 1: Properties of Matter 15	5-PS1-3, 5-PS1-1.
Unit 2: Changes to Matter 15	5-PS1-4, 5-PS1-2.
Unit 3: Energy and Matter and Ecosystems 15	5-LS1-1, 5-LS2-1, 5-PS3-1.
Unit 4: Water on the Earth 15	5-ESS2-2, 5-ESS3-1.
Unit 5: Earth Systems 20	5-ESS2-1, 5-ESS3-1

Unit 6: Interactions within the Earth, Sun and Moon System

Grade Six

20 5-PS2-1, 5-ESS1-1, 5-ESS1-2.

Unit Instructional Days Standards
Unit 1: Growth, Development, and Reproduction of Organisms 25 MS-LS1-4, MS-LS1-5
Unit 2: Matter and Energy in Organisms and Ecosystems 25 MS-LS2-1, MS-LS2-2, MS-LS2-3
Unit 3: Interdependent Relationships in Ecosystems 25 MS-LS2-4, MS-LS2-5, MS-ETS1-1, MS-ETS1-3
Unit 4: Forces and Motion 25 MS-PS2-1, MS-PS2-2, MS-ETS1-1, MS-ETS1-2, MS-ETS1-3, MS-ETS1-4
Unit 5: Types of Interactions 25 MS-PS2-3, MS-PS2-4, MS-PS2-5. Unit 6: Astronomy 20 MS-ESS1-1, MS-ESS1-2, MS-ESS1-3 Unit 7: Weather and Climate 20 MS-ESS2-4, MS-ESS2-5, MS-ESS2-6

Grade Seven

Unit Instructional Calendar	**Standards**
Unit 1: Structure and Properties of Matter Sept.	MS-PS1-1,MS-PS1-2

Unit 2: Interactions of Matter Oct.-Nov.	MS-PS1-3, MS-PS1-4, MS-PS1-5, MS-PS1-6, MS-ETS1-2, MS-ETS1-3, MS-ETS1-4
Unit 3: Earth Systems and Materials Nov.-Feb.	MS-ESS1-4, MS-ESS2-1, MS-ESS2-2, MS-ESS2-3
Unit 4: Structure and Function Feb.-March	MS-LS1-1, MS-LS1-2
Unit 5: Organization for Matter and Energy Flow in Organisms - Growth and Development - Energy Flow March-April	MS-LS1-6, MS-LS1-7
Unit 6: Inheritance and Variation of Traits April-May	MS-LS3-1, MS-LS3-2
Unit 7: Body Systems May-June	MS-LS1-3, MS-LS1-8

Grade Eight

Unit Instructional Calendar	**Standards**
Unit 1: Evidence of a Common Ancestry and Diversity Sept.-Oct.	MS-LS4-1, MS-LS4-2, MS-LS4-3
Unit 2: Selection and Adaptation Nov.-Dec.	MS-LS4-4, MS-LS4-5, MS-LS4-6
Unit 3: Natural Resources and Human Impacts on Earth Dec.-Jan.	MS-ESS3-1, MS-ESS3-2, MS-ESS3-3MS-ESS3-4, MS-ESS3-5, MS-ETS1-1, MS-ETS1-2, MS-ETS1-3
Unit 4: Relationships among Forms of Energy - Potential and Kinetic Energy Jan.-Feb.	MS-PS3-1, MS-PS3-2, MS-PS3-5

Unit 6: Thermal Energy March-April MS-PS3-3, MS-PS3-4, MS-ETS1-1, MS-ETS1-2, MS-ETS1-3, MS-ETS1-4.

Unit 7: The Electromagnetic Spectrum May-June MS-PS4-1, MS-PS4-2, MS-PS4-3