Willingboro Public Schools

"Where Excellence is the Expectation"

Willingboro Public Schools
Grade 6 Science

Revised June, 2022
Jennifer Brandon - Supervisor of Science

SCIENCE CURRICULUM AND INSTRUCTION:

The Willingboro Public Schools Science program is dedicated to delivering our students an innovative hands-on science program. Our program supports the State's vision that scientifically literate students will gain the knowledge and understanding of scientific concepts as required for personal decision-making, participation in civic and cultural affairs, and economic productivity.

Students are encouraged to ask questions about the world around them and practice science skills.

- Students' science experiences teach them to connect science concepts to their experience, see how human nature influences science, and explore how science and technology affects their lives.
- The science classes include activities that engage students in applying their science skills and understandings to examine social issues, solve real problems and make decisions.
- Students have the opportunity to use a variety of equipment and technology in their scientific investigations.
- Students learn how to find out and make up their own minds by experimenting and investigating how the world works rather than just memorizing facts.
- Students are learning how to conduct scientific inquiry and use data to explain their conclusions.
- The process of investigation and explanation is just as important as knowing "the" answer.

Teachers plan instruction that builds on what students know and think to increase students' scientific understanding.

- Teachers use the New Jersey Student Learning Standards in Science to plan lessons that are challenging, engaging and age appropriate.
- There are resources and opportunities for students to do at-home science activities like participating in the STEM Conference.

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Course Sequence/Table of Contents:

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This was modeled after the NJSLS Document

Overview	Content Standards - Arranged by Disciplinary Core Idea (DCI) *Students who demonstrate understanding can:*	Unit Focus
Unit 1 **Ecology**	**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. [Clarification Statement: Emphasis is on cause and effect relationships between resources and growth of individual organisms and the numbers of organisms in ecosystems during periods of abundant and scarce resources.] • **MS-LS2-2** Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems. [Clarification Statement: Emphasis is on predicting consistent patterns of interactions in different ecosystems in terms of the relationships among and between organisms and abiotic components of ecosystems. Examples of types of interactions could include competitive, predatory, and mutually beneficial.] • **MS-LS2-3** Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem. [Clarification Statement: Emphasis is on describing the conservation of matter and flow of energy into and out of various ecosystems, and on defining the boundaries of the system.] [Assessment Boundary: Assessment does not include the use of chemical reactions to describe the processes.] • **MS-LS2-4** Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations. [Clarification Statement: Emphasis is on recognizing patterns in data and making warranted inferences about changes in populations, and on evaluating empirical evidence supporting arguments about changes to ecosystems.] • **MS-LS2-5** Evaluate competing design solutions for maintaining biodiversity and ecosystem services. [Clarification Statement: Examples of ecosystem services could include water purification, nutrient recycling, and prevention of soil erosion. Examples of design solution constraints could include scientific, economic, and social considerations.] **MS-LS1: From Molecules to Organisms: Structures and Processes**	The Ecology unit begins by focusing on what happens when a new species is introduced into an ecosystem. Students consider this issue as they model ecological relationships within an ecosystem. They simulate the effect of competition, predation, and other factors on population size. Introduced species are changing environments all around us. They can cause problems for people and affect biodiversity. Examples explored include Nile perch, zebra mussels, and local examples, such as starlings, kudzu, and others identified by students and teachers. Students generate and answer questions such as: How do introduced organisms interact with their environments, what are the effects of these interactions, and what can be done to prevent harmful interactions?

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Overview	Content Standards - Arranged by Disciplinary Core Idea (DCI) *Students who demonstrate understanding can:*	Unit Focus
	• **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. [Clarification Statement: Emphasis is on tracing movement of matter and flow of energy.] [Assessment Boundary: Assessment does not include the biochemical mechanisms of photosynthesis.] • **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. [Clarification Statement: Emphasis is on describing that molecules are broken apart and put back together and that in this process, energy is released.] [Assessment Boundary: Assessment does not include details of the chemical reactions for photosynthesis or respiration.]	
Unit 1: ***Suggested Open Educational Resources***	• FOSS Next Generation Science Curriculum Resources ○ Think Link ○ Student Resource Books • Generation Genius	
Unit 2 **Energy and Waves**	**MS-PS3: Energy** • **MS-PS3-3** Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer. [Clarification Statement: Examples of devices could include an insulated box, a solar cooker, and a Styrofoam cup.] [Assessment Boundary: Assessment does not include calculating the total amount of thermal energy transferred.] • **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. [Clarification Statement: Examples of experiments could include comparing final water temperatures after different masses of ice melted in the same volume of water with the same initial temperature, the temperature change of samples of different materials with the same mass as they cool or heat in the environment, or the same material with different masses when a specific amount of	In this unit, students ask questions, plan and carry out investigations, engage in argument from evidence, analyze and interpret data, construct explanations, define problems and design solutions as they make sense of the difference between energy and temperature and between energy and forces.. Students develop their understanding of important qualitative ideas about the conservation of energy. Students understand that moving objects have kinetic energy and that objects, may also contain stored (potential) energy, depending on their relative positions. Students are additionally expected to use these practices to demonstrate understanding of the core ideas.

Overview	**Content Standards - Arranged by Disciplinary Core Idea (DCI)** *Students who demonstrate understanding can:*	**Unit Focus**
	energy is added.] [Assessment Boundary: Assessment does not include calculating the total amount of thermal energy transferred.] ● **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. [Clarification Statement: Examples of empirical evidence used in arguments could include an inventory or other representation of the energy before and after the transfer in the form of temperature changes or motion of object.] [Assessment Boundary: Assessment does not include calculations of energy.] **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. [Clarification Statement: Emphasis is on describing waves with both qualitative and quantitative thinking.] [Assessment Boundary: Assessment does not include electromagnetic waves and is limited to standard repeating waves.] ● **MS-PS4-2** Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials. [Clarification Statement: Emphasis is on both light and mechanical waves. Examples of models could include drawings, simulations, and written descriptions.] [Assessment Boundary: Assessment is limited to qualitative applications pertaining to light and mechanical waves.] ● **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. [Clarification Statement: Emphasis is on a basic understanding that waves can be used for communication purposes. Examples could include using fiber optic cable to transmit light pulses, radio wave pulses in wifi devices, and conversion of stored binary patterns to make sound or text on a computer screen.] [Assessment Boundary: Assessment does not include binary counting. Assessment does not include the specific mechanism of any given device.]	

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Overview	Content Standards - Arranged by Disciplinary Core Idea (DCI) *Students who demonstrate understanding can:*	Unit Focus
	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.	
Suggested Open Educational Resources	• FOSS Next Generation Science Curriculum Resources ○ Think Link ○ Student Resource Books • Generation Genius	
Unit 3 **Weather and Climate / Space Science**	**MS-ESS2: Earth's Systems** • **MS-ESS2-5** Collect data to provide evidence for how the motions and complex interactions of air masses result in changes in weather conditions. [Clarification Statement: Emphasis is on how air masses flow from regions of high pressure to low pressure, causing weather (defined by temperature, pressure, humidity, precipitation, and wind) at a fixed location to change over time, and how sudden changes in weather can result when different air masses collide. Emphasis is on how weather can be predicted within probabilistic ranges. Examples of data can be provided to students (such as weather maps, diagrams, and visualizations) or obtained through laboratory experiments (such as with condensation).] [Assessment Boundary: Assessment does not include recalling	Weather and Climate: This lesson plan enables students to learn the differences between weather and climate. Students collect local weather data for a defined period of time, and then compare these data with longer term climate data for their community. Weather conditions vary from day to day, month to month, and across seasons. Sometimes weather conditions can be severe, causing damage to property and loss of life. Weather patterns are influenced by the movement of water in the atmosphere. This movement is determined by winds, landforms, and ocean temperatures and currents. Weather data are collected by a variety of instruments. These data can be used to forecast upcoming weather conditions (e.g., when different air masses collide at warm and cold fronts). Since many factors interact to

Overview	Content Standards - Arranged by Disciplinary Core Idea (DCI) *Students who demonstrate understanding can:*	Unit Focus
	the names of cloud types or weather symbols used on weather maps or the reported diagrams from weather stations.] ● **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. [Clarification Statement: Emphasis is on how patterns vary by latitude, altitude, and geographic land distribution. Emphasis of atmospheric circulation is on the sunlight-driven latitudinal banding, the Coriolis effect, and resulting prevailing winds; emphasis of ocean circulation is on the transfer of heat by the global ocean convection cycle, which is constrained by the Coriolis effect and the outlines of continents. Examples of models can be diagrams, maps and globes, or digital representations.] [Assessment Boundary: Assessment does not include the dynamics of the Coriolis effect.] **ESS3: Earth and Human Activity** ● **MS-ESS3-5** Ask questions to clarify evidence of the factors that have caused climate change over the past century. [Clarification Statement: Examples of factors include human activities (such as fossil fuel combustion, cement production, and agricultural activity) and natural processes (such as changes in incoming solar radiation or volcanic activity). Examples of evidence can include tables, graphs, and maps of global and regional temperatures, atmospheric levels of gases such as carbon dioxide and methane, and the rates of human activities. Emphasis is on the major role that human activities play in causing the rise in global temperatures.] **MS-ETS1: Engineering Design** ● **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. **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	influence the weather at a particular location, weather can only be predicted probabilistically. Climates are described by the same conditions used to describe weather, and represent the average weather in a location over a long period of time. Climate patterns vary by latitude, altitude, and geographic land distribution. Oceans have an important effect on climate. They absorb energy from the Sun, with the water nearest the equator warming up much more than water at higher latitudes. Variations in density due to variations in temperature and salinity drive a global pattern of interconnected ocean currents that redistribute thermal energy. The atmosphere also has currents that move air and water from one place to another. Air and water are also driven by energy from the Sun and, as with ocean currents, are influenced by the Coriolis effect, which is a result of the Earth's rotation. The resulting pattern of prevailing winds affects regional weather and climate. The way that Earth's atmosphere interacts with the Sun's energy and the oceans thus helps determine Earth's average temperature and its different climate zones. The impacts of climate change are widespread and diverse. Climate is influenced by many factors and varies by location. Climate also changes over time. Human activities, such as the release of greenhouse gases into the atmosphere, have contributed to current global warming. This is causing changes to climates around the world.

Overview	**Content Standards - Arranged by Disciplinary Core Idea (DCI)** *Students who demonstrate understanding can:*	**Unit Focus**
	of the sun and moon, and seasons. [Clarification Statement: Examples of models can be physical, graphical, or conceptual.] ● **MS-ESS1-2** Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system. [Clarification Statement: Emphasis for the model is on gravity as the force that holds together the solar system and Milky Way galaxy and controls orbital motions within them. Examples of models can be physical (such as the analogy of distance along a football field or computer visualizations of elliptical orbits) or conceptual (such as mathematical proportions relative to the size of familiar objects such as students' school or state).] [Assessment Boundary: Assessment does not include Kepler's Laws of orbital motion or the apparent retrograde motion of the planets as viewed from Earth.] ● **MS-ESS1-3** Analyze and interpret data to determine scale properties of objects in the solar system. [Clarification Statement: Emphasis is on the analysis of data from Earth-based instruments, space based telescopes, and spacecraft to determine similarities and differences among solar system objects. Examples of scale properties include the sizes of an object's layers (such as crust and atmosphere), surface features (such as volcanoes), and orbital radius. Examples of data include statistical information, drawings and photographs, and models.] [Assessment Boundary: Assessment does not include recalling facts about properties of the planets and other solar system bodies.]	
Unit 3: *Suggested Open Educational Resources*	● FOSS Next Generation Science Curriculum Resources ○ Think Link ○ Student Resource Books ● Generation Genius	

Unit 1 Ecology: Life and Physical Sciences

Overview

The Ecology unit begins by focusing on what happens when a new species is introduced into an ecosystem. Students consider this issue as they model ecological relationships within an ecosystem. They simulate the effect of competition, predation, and other factors on population size. Introduced species are changing environments all around us. They can cause problems for people and affect biodiversity. Examples explored include Nile perch, zebra mussels, and local examples, such as starlings, kudzu, and others identified by students and teachers. Students generate and answer questions such as: How do introduced organisms interact with their environments, what are the effects of these interactions, and what can be done to prevent harmful interactions?

Essential Questions

Overarching Driving Questions:

How do introduced organisms interact with their environments, what are the effects of these interactions, and what can be done to prevent harmful interactions?

- What are the effects of introduced species, and what can be done about them?
- Why are certain species more common than others, and why do some species become more common over time?
- How do different species in the same ecosystem interact with each other and with the physical environment?
- What happens to organisms and relationships among them when an ecosystem is disrupted?
- What are the effects of introduced species, and what can be done about them?
- How have introduced Nile perch changed Lake Victoria? What are the trade-offs of introducing Nile perch into this environment? (Activity 1)
- What effect can an introduced species have on an environment? What, if anything, can or should be done to control introduced species? (Activity 2)
- What patterns do you detect in the two locations, and how might the information in these patterns be useful to scientists? (Activity 3)
- What patterns do you observe when you investigate your own environment, and what might be causing these patterns? (Activity 4)
- How do the habitat requirements of individual organisms determine where a species will be found in nature? (Activity 5)
- Do zebra mussel populations change or stay the same in their native range? (Activity 6)
- What is an owl's place and role in a food web? (Activity 7)
- How do matter and energy move in an ecosystem? (Activity 8)
- How does the availability of food affect a population? (Activity 9)
- How do interactions with living or non- living factors in ecosystems affect populations? (Activity 10)

Enduring Understandings

Anchoring Phenomenon: Invasive Species

- People have introduced many kinds of species into new ecosystems either on purpose or accidentally, and they can cause problems for both people and the environment
- There are different organisms and different numbers of organisms in different places.
- A variety of species tend to be found together and linked through feeding relationships.
- Physical and biological factors can disrupt an ecosystem to a small or large degree.
- People have introduced many kinds of species into new ecosystems either on purpose or accidentally, and they can cause problems for both people and the environment.
- Populations are found in places that have the right kind of features in the environment.
- Populations fluctuate in size, and determining the causes for those changes is an important question in ecology.
- What an organism eats helps ecologists understand their role in an ecosystem.
- We can look at what all the organisms in an ecosystem eat and connect them through energy and matter relationships.
- When a population's prey increases in abundance, its size may grow; when its prey is scarce, its size may decrease.
- There are patterns to the ways organisms interact in an ecosystem, and these patterns occur in all ecosystems.
- Decomposers break down dead organisms and return the matter to the environment.
- Ecologists can use models to try to predict the impact of an introduced species.
- Physical disruption can impact the flow of energy and cycling of matter in an ecosystem.

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• What is the role of decomposers in the cycling of matter in an ecosystem? (Activity 11) • How does a new species affect the flow of energy and cycling of matter through an ecosystem? (Activity 12) • How can an abiotic disruption such as fire affect the flow of energy and cycling of matter in an ecosystem? (Activity 13) • What do the scientific data tell you about how the Hudson River changed after introduction of the zebra mussel? (Activity 14) • How can humans control or eliminate an invasive species? (Activity 15) • What effect can certain introduced species have on an environment? What, if anything, can or should humans do to control these species? (Activity 16)	• Ecologists have a large amount of data to examine the effects of Zebra Mussels. • Patterns occur in the living environment, even among different ecosystems - including one's own backyard. • The transect method can be used to detect these patterns.

Unit 1 Ecology: Life and Physical Sciences

NJSLS Science Content Standards - Arranged by Disciplinary Core idea (DCI)

Students who demonstrate understanding can:

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. [Clarification Statement: Emphasis is on cause and effect relationships between resources and growth of individual organisms and the numbers of organisms in ecosystems during periods of abundant and scarce resources.]
- **MS-LS2-2** Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems. [Clarification Statement: Emphasis is on predicting consistent patterns of interactions in different ecosystems in terms of the relationships among and between organisms and abiotic components of ecosystems. Examples of types of interactions could include competitive, predatory, and mutually beneficial.]
- **MS-LS2-3** Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem. [Clarification Statement: Emphasis is on describing the conservation of matter and flow of energy into and out of various ecosystems, and on defining the boundaries of the system.] [Assessment Boundary: Assessment does not include the use of chemical reactions to describe the processes.]
- **MS-LS2-4** Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations. [Clarification Statement: Emphasis is on recognizing patterns in data and making warranted inferences about changes in populations, and on evaluating empirical evidence supporting arguments about changes to ecosystems.]
- **MS-LS2-5** Evaluate competing design solutions for maintaining biodiversity and ecosystem services. [Clarification Statement: Examples of ecosystem services could include water purification, nutrient recycling, and prevention of soil erosion. Examples of design solution constraints could include scientific, economic, and social considerations.]

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

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Unit 1 Ecology: Life and Physical Sciences

NJSLS Science Content Standards - Arranged by Disciplinary Core idea (DCI)

- **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. [Clarification Statement: Emphasis is on tracing movement of matter and flow of energy.] [Assessment Boundary: Assessment does not include the biochemical mechanisms of photosynthesis.]
- **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. [Clarification Statement: Emphasis is on describing that molecules are broken apart and put back together and that in this process, energy is released.] [Assessment Boundary: Assessment does not include details of the chemical reactions for photosynthesis or respiration.]

Science and Engineering Practices

Developing and Using Models

- Modeling in 6–8 builds on K–5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems.
  - Develop a model to describe phenomena. (MS-LS2-3)
  - Develop a model to describe unobservable mechanisms. (MS-LS1-7)

Analyzing and Interpreting Data

- Analyzing data in 6–8 builds on K–5 experiences and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis.
  - Analyze and interpret data to provide evidence for phenomena. (MS-LS2-1)

Constructing Explanations and Designing Solutions

- Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories.
  - Construct an explanation that includes qualitative or quantitative relationships between variables that predict phenomena. (MS-LS2-2)
  - 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-LS1-6)

Engaging in Argument from Evidence

- Engaging in argument from evidence in 6–8 builds on K–5 experiences and progresses to constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed world(s).
  - Construct 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. (MS-LS2-4)
  - Evaluate competing design solutions based on jointly developed and agreed-upon design criteria. (MS-LS2-5)

Disciplinary Core Ideas

LS1.C: Organization for Matter and Energy Flow in Organisms

- Plants, algae (including phytoplankton), and many microorganisms use the energy from light to make sugars (food) from carbon dioxide from the atmosphere and water through the process of photosynthesis, which also releases oxygen. These sugars can be used immediately or stored for growth or later use. (MS-LS1-6)
- Within individual organisms, food moves through a series of chemical reactions in which it is broken down and rearranged to form new molecules, to support growth, or to release energy. (MS-LS1-7)

LS2.A: Interdependent Relationships in Ecosystems

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Unit 1 Ecology: Life and Physical Sciences

NJSLS Science Content Standards - Arranged by Disciplinary Core idea (DCI)

- Organisms, and populations of organisms, are dependent on their environmental interactions both with other living things and with nonliving factors. (MS-LS2-1)
- In any ecosystem, organisms and populations with similar requirements for food, water, oxygen, or other resources may compete with each other for limited resources, access to which consequently constrains their growth and reproduction. (MS-LS2-1)
- Growth of organisms and population increases are limited by access to resources. (MS-LS2-1)
- Similarly, predatory interactions may reduce the number of organisms or eliminate whole populations of organisms. Mutually beneficial interactions, in contrast, may become so interdependent that each organism requires the other for survival. Although the species involved in these competitive, predatory, and mutually beneficial interactions vary across ecosystems, the patterns of interactions of organisms with their environments, both living and nonliving, are shared. (MS-LS2-2)

LS2.B: Cycle of Matter and Energy Transfer in Ecosystems

- Food webs are models that demonstrate how matter and energy is transferred between producers, consumers, and decomposers as the three groups interact within an ecosystem. Transfers of matter into and out of the physical environment occur at every level. Decomposers recycle nutrients from dead plant or animal matter back to the soil in terrestrial environments or to the water in aquatic environments. The atoms that make up the organisms in an ecosystem are cycled repeatedly between the living and nonliving parts of the ecosystem. (MS-LS2-3)

LS2.C: Ecosystem Dynamics, Functioning, and Resilience

- Ecosystems are dynamic in nature; their characteristics can vary over time. Disruptions to any physical or biological component of an ecosystem can lead to shifts in all its populations. (MS-LS2-4)
- Biodiversity describes the variety of species found in Earth's terrestrial and oceanic ecosystems The completeness or integrity of an ecosystem's biodiversity is often used as a measure of its health. (MS-LS2-5)

LS4.D: Biodiversity and Humans

- Changes in biodiversity can influence humans' resources, such as food, energy, and medicines, as well as ecosystem services that humans rely on—for example, water purification and recycling. (secondary to MS-LS2-5)

ETS1.B: Developing Possible Solutions

- There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem. (secondary to MS-LS2-5)

PS3.D: Energy in Chemical Processes and Everyday Life

- The chemical reaction by which plants produce complex food molecules (sugars) requires an energy input (i.e., from sunlight) to occur. In this reaction, carbon dioxide and water combine to form carbon-based organic molecules and release oxygen. (secondary to MS-LS1-6)
- Cellular respiration in plants and animals involve chemical reactions with oxygen that release stored energy. In these processes, complex molecules containing carbon react with oxygen to produce carbon dioxide and other materials. (secondary to MS-LS1- 7)

Crosscutting Concepts

Patterns

- Patterns can be used to identify cause and effect relationships. (MS-LS2-2)

Cause and Effect

- Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-LS2-1)

Energy and Matter

- The transfer of energy can be tracked as energy flows through a natural system. (MS-LS2-3)
- Matter is conserved because atoms are conserved in physical and chemical processes. (MS-LS1-7)
- Within a natural system, the transfer of energy drives the motion and/or cycling of matter. (MS-LS1-6)

Stability and Change

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Unit 1 Ecology: Life and Physical Sciences

NJSLS Science Content Standards - Arranged by Disciplinary Core idea (DCI)

- Small changes in one part of a system might cause large changes in another part. (MS-LS2-4), (MS-LS2-5)

Connections to Engineering, Technology, and Applications of Science

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

- The use of technologies and any limitations on their use are driven by individual or societal needs, desires, and values; by the findings of scientific research; and by differences in such factors as climate, natural resources, and economic conditions. Thus, technology use varies from region to region and over time. (MS-LS2-5)

Connections to Nature of Science

Scientific Knowledge Assumes an Order and Consistency in Natural Systems

- Science assumes that objects and events in natural systems occur in consistent patterns that are understandable through measurement and observation. (MS-LS2-3)

Science Addresses Questions About the Natural and Material World

- Scientific knowledge can describe the consequences of actions but does not necessarily prescribe the decisions that society takes. (MS-LS2-5)

Scientific Knowledge is Based on Empirical Evidence

- Science disciplines share common rules of obtaining and evaluating empirical evidence. (MS-LS2-4)
- Science knowledge is based upon logical connections between evidence and explanations. (MS-LS1-6)

Student Learning Objectives

Students will….

- work together to examine data showing the effects of the introduction of the Nile perch into Lake Victoria, Africa.
- engage in the practice of analyzing and interpreting data to look for patterns among living and nonliving components in ecosystems, and hypothesize what might be causing those patterns.
- explore how ecologists use the transect method to collect ecological data and also explore the core idea of populations of organisms being dependent on their environmental interactions both with other living things and with nonliving factors.
- explore patterns and relationships in their local environment by planning and carrying out an investigation using the transect method learned in the previous activity.
- decide how to organize their data to allow them to look for patterns among biotic and abiotic components in the ecosystem.
- plan and conduct an investigation to explore a species' habitat requirements by looking at how individuals respond to and interact with different physical components in the environment.
- construct an argument from evidence for the habitat requirements of the species and where it is likely to be in nature.
- observe Blackworms behavior and response in water.
- observe Blackworms behavior and response to different habitats and record data.
- devise an investigation to determine the best habitat using provided materials.
- analyze data on population size to detect patterns over periods of time,and discover that there can be periods of relative stability and periods of small and large changes in population size.

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- consider what might cause changes in population size, including both biotic and abiotic changes in the environment.
- investigate and collect data on an owl's diet to determine the owl's place and role in a food web.
- construct a simple model of a food web to begin understanding how matter and energy move in, through, and out of an ecosystem.
- dissect an owl pellet.
- identify bones found using a bone chart, attempt to reconstruct skeletons from bones, and create an owl food web based on bones extracted.
- continue revising their owl food webs to model the flow of energy and to explain how disruptions to the ecosystem affect the food web.
- demonstrate the flow of energy through a food web.
- discuss the effect of a volcanic eruption on an ecosystem food web.
- plan and carry out an investigation to determine the effect of resource availability on population growth in Paramecium.
- collect, analyze, and interpret data to provide evidence that greater food availability results in greater population growth.
- prepare a wet mount slide with a Paramecium sample.
- observe paramecium; record observations of behavior and food intake.
- explore and explain the types of interactions among biotic and abiotic components in ecosystems.
- consider the causes and effects of these interactions and learn that these types of interactions occur as patterns across all ecosystems.
- carry out an investigation on decomposers to explore how matter cycles in an ecosystem to add to their understanding of how the biotic and abiotic components of an ecosystem interact.
- revise and expand their food web models, which already capture how energy flows through an ecosystem, to explain how matter cycles from the abiotic components of an ecosystem, through the biotic components, and back to the abiotic components
- explain the role of decomposers in an ecosystem.
- develop a model for an ecosystem and then introduce a new species to explain how this new component in the system affects the flow of energy and cycling of matter throughout the ecosystem.
- explore how abiotic changes in the environment can impact ecosystems, and explain how these abiotic disruptions affect the flow of energy and cycling of matter in ecosystems.
- use computers to analyze a large data set on the effects of the zebra mussel on the Hudson River ecosystem.
- analyze and interpret data to argue how the introduction of the zebra mussel affected populations of other organisms as well as the abiotic environment.
- explore potential solutions to the invasive zebra mussel problem.
- design possible solutions to the effect of Zebra Mussels on ecosystems and humans.

Integrated Accommodations and Modifications		
Special Education Students	**English Language Learners**	**At Risk**
• Utilize modifications & accommodations delineated in the student's IEP • Provide additional manipulatives to support instruction • Allow for alternative strategies to solve algorithms or tasks	WIDA Can Do Descriptors https://wida.wisc.edu/teach/can-do/descriptors • Modify Assignments • Use testing and portfolio assessment	• Pair visual prompts with verbal presentations • Ask students to restate information, directions, and assignments. • Provide repetition and practice • Model skills / techniques to be mastered. • Provide extended time to complete class work

• Provide the steps needed to complete the task • Model frequently • Provide repetition and practice. • Use visuals to demonstrate/model the processes • Restate, reread, and clarify directions/questions • Ask students to restate information, directions, and assignments. • Provide copy of class notes • Distribute study guide for classroom tests. • Provide preferential seating to be mutually determined by the student and teacher • Provide extra textbooks for home. • Provide regular parent/ school communication • Allow extended time to complete assignment • Establish procedures for accommodations / modifications for assessments • Allow student to take/complete tests in an alternate setting as needed Appendix A: Special Education Accommodations and Modifications	• Utilize Native Language Translation (peer, online assistive technology, translation device, bilingual dictionary) • Repeat, rephrase, paraphrase key concepts and directions • Allow for extended time for assignment completion as needed • Highlight key vocabulary • Define essential vocabulary in context • Use graphic organizers, visuals, manipulatives and other concrete materials • Use gestures, facial expressions and body language • Read aloud • Build on what students already know and prior experience	• Provide copy of class notes • Provide preferential seating to be mutually determined by the student and teacher • Allow the use of a computer to complete assignments. • Establish expectations for correct spelling on assignments • Provide extra textbooks for home. • Provide Peer Support • Increase one on one time

Gifted and Talented Students	**504 Plan**
• Utilize advanced, accelerated, or compacted content • Provide assignments that emphasize higher- level thinking skills. • Allow for individual student interest • Gear assignments to development in areas of affect, creativity, cognition, and research skills • Allow for a variety in types of resources • Provide problem-based assignments with planned scope and sequence • Utilize inquiry-based instruction • Adjust the pace of lessons • Utilize Choice Boards • Provide Problem-Based Learning • Establish flexible Grouping	• Pair visual prompts with verbal presentations • Ask students to restate information, directions, and assignments. • Provide repetition and practice • Model skills / techniques to be mastered. • Provide extended time to complete class work • Provide copy of class notes • Break long assignments into smaller parts • Assist student in setting short term goals • Allow for preferential seating to be mutually determined by the student and teacher • Provide extra textbooks for home. • Model and reinforce organizational systems (i.e. color-coding) • Write out homework assignments, check student's recording of assignments
Interdisciplinary Connections	**Computer Science and Design Thinking**

Connections to NJSLS - English Language Arts	Computer Science and Design Thinking Practices
Reading • RST.6-8.1 Cite specific textual evidence to support analysis of science and technical texts. (MS-LS2-1), (MS-LS2-2), (MS-LS2-4), (MS-LS1-6) • RST.6-8.2 Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions. (MS-LS1-6) • RST.6-8.7 Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table). (MS-LS2-1) • RST.6-8.8 Distinguish among facts, reasoned judgment based on research findings, and speculation in a text. (MS-LS2-5) • RI.8.8 Trace and evaluate the argument and specific claims in a text, assessing whether the reasoning is sound and the evidence is relevant and sufficient to support the claims. (MS-LS-4), (MS-LS2-5) *Writing* • WHST.6-8.1 Write arguments focused on discipline-specific content. (MS-LS2-4) • WHST.6-8.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. (MS-LS2-2), (MS-LS1-6) • WHST.6-8.9 Draw evidence from literary or informational texts to support analysis, reflection, and research. (MS-LS2-2), (MS-LS2-4), (MS-LS1-6) *Speaking and Listening* • SL.8.1 Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher led) with diverse partners on grade 8 topics, texts, and issues, building on others' ideas and expressing their own clearly. (MS-LS2-2) • SL.8.4 Present claims and findings, emphasizing salient points in a focused, coherent manner with relevant evidence, sound valid reasoning, and well-chosen details; use appropriate eye contact, adequate volume, and clear pronunciation. (MS-LS2-2)	1. ✓ Fostering an Inclusive Computing and Design Culture 2. ✓ Collaborating Around Computing and Design 3. ✓ Recognizing and Defining Computational Problems 4. ✓ Developing and Using Abstractions 5. ✓ Creating Computational Artifacts 6. ✓ Testing and Refining Computational Artifacts 7. ✓ Communicating About Computing and Design Computer Science and Design Thinking Standards **8.1 Computer Science** *Data and Analysis* • People use digital devices and tools to automate the collection, use, and transformation of data. The manner in which data is collected and transformed is influenced by the type of digital device(s) available and the intended use of the data. ◦ 8.1.8.DA.1: Organize and transform data collected using computational tools to make it usable for a specific purpose. • Computer models can be used to simulate events, examine theories and inferences, or make predictions. ◦ 8.1.8.DA.5: Test, analyze, and refine computational models. ◦ 8.1.8.DA.6: Analyze climate change computational models and propose refinements. *Algorithms & Programming* • Programmers create variables to store data values of different types and perform appropriate operations on their values. ◦ 8.1.8.AP.2: Create clearly named variables that represent different data types and perform operations on their values. **8.2 Design Thinking** *Engineering Design* • Engineering design is a systematic, creative, and iterative process used to address local and global problems. The process includes generating ideas, choosing the best solution, and making, testing, and redesigning models or prototypes.

- SL.8.5 Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest. (MS-LS2-3), (MS-LS1-7)

Connections to NJSLS - Mathematics

- MP.4 Model with mathematics. (MS-LS2-5)
- 6.RP.A.3 Use ratio and rate reasoning to solve real-world and mathematical problems. (MS-LS2-5)
- 6.EE.C.9 Use variables to represent two quantities in a real-world problem that change in relationship to one another; write an equation to express one quantity, thought of as the dependent variable, in terms of the other quantity, thought of as the independent variable. Analyze the relationship between the dependent and independent variables using graphs and tables and relate these to the equation. (MS-LS2-3), (MS-LS1-6)
- 6.SP.B.5 Summarize numerical data sets in relation to their context. (MS-LS2-2)

    - 8.2.8.ED.1: Evaluate the function, value, and aesthetics of a technological product or system, from the perspective of the user and the producer.
    - 8.2.8.ED.2: Identify the steps in the design process that could be used to solve a problem.
    - 8.2.8.ED.3: Develop a proposal for a solution to a real-world problem that includes a model (e.g., physical prototype, graphical/technical sketch).
    - 8.2.8.ED.4: Investigate a malfunctioning system, identify its impact, and explain the step-by-step process used to troubleshoot, evaluate, and test options to repair the product in a collaborative team
- Engineering design requirements and specifications involve making trade-offs between competing requirements and desired design features.
    - 8.2.8.ED.5: Explain the need for optimization in a design process.
    - 8.2.8.ED.6: Analyze how trade-offs can impact the design of a product.
    - 8.2.8.ED.7: Design a product to address a real-world problem and document the iterative design process, including decisions made as a result of specific constraints and trade-offs (e.g., annotated sketches)

Interaction of Technology and Humans

- Economic, political, social and cultural aspects of society drive development of new technological products, processes, and systems.
    - 8.2.8.ITH.1: Explain how the development and use of technology influences economic, political, social, and cultural issues.
- Technology interacts with society, sometimes bringing about changes in a society's economy, politics, and culture, and often leading to the creation of new needs and wants. New needs and wants may create strains on local economies and workforces. Improvements in technology are intended to make the completion of tasks easier, safer, and/or more efficient
    - 8.2.8.ITH.3: Evaluate the impact of sustainability on the development of a designed product or system.
    - 8.2.8.ITH.4: Identify technologies that have been designed to reduce the negative consequences of other technologies and explain the change in impact.
    - 8.2.8.ITH.5: Compare the impacts of a given technology on different societies, noting factors that may make a technology appropriate and sustainable in one society but not in another.

Nature of Technology

- Technology advances through the processes of innovation and invention which relies upon the imaginative and inventive nature of people. Sometimes a technology developed for one purpose is adapted to serve other purposes.

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	Engineers use a systematic process of creating or modifying technologies that is fueled and constrained by physical laws, cultural norms, and economic resources. Scientists use systematic investigation to understand the natural world. ○ 8.2.8.NT.1: Examine a malfunctioning tool, product, or system and propose solutions to the problem. ○ 8.2.8.NT.2: Analyze an existing technological product that has been repurposed for a different function. ○ 8.2.8.NT.3: Examine a system, consider how each part relates to other parts, and redesign it for another purpose. ○ 8.2.8.NT.4: Explain how a product designed for a specific demand was modified to meet a new demand and led to a new product. *Effects of Technology on the Natural World* ● Resources need to be utilized wisely to have positive effects on the environment and society. Some technological decisions involve tradeoffs between environmental and economic needs, while others have positive effects for both the economy and environment. ○ 8.2.8.ETW.1: Illustrate how a product is upcycled into a new product and analyze the short- and long-term benefits and costs. ○ 8.2.8.ETW.2: Analyze the impact of modifying resources in a product or system (e.g., materials, energy, information, time, tools, people, capital). ○ 8.2.8.ETW.3: Analyze the design of a product that negatively impacts the environment or society and develop possible solutions to lessen its impact. ○ 8.2.8.ETW.4: Compare the environmental effects of two alternative technologies devised to address climate change issues and use data to justify which choice is best. *Ethics and Culture* ● Technological disparities have consequences for public health and prosperity. ○ 8.2.8.EC.1: Explain ethical issues that may arise from the use of new technologies. ○ 8.2.8.EC.2: Examine the effects of ethical and unethical practices in product design and development.
Career Readiness, Life Literacies and Key Skills	

Career Readiness, Life Literacies and Key Skills Practices

- Act as a responsible and contributing community member and employee.
- Attend to financial well-being.
- Consider the environmental, social and economic impacts of decisions.
- Demonstrate creativity and innovation.
- Utilize critical thinking to make sense of problems and persevere in solving them.
- Model integrity, ethical leadership and effective management.
- Plan education and career paths aligned to personal goals.
- Use technology to enhance productivity, increase collaboration and communicate effectively.
- Work productively in teams while using cultural/global competence.

Career Readiness, Life Literacies and Key Skills Standards
9.1 Personal Financial Literacy
Civic Financial Responsibility

- Individuals can use their talents, resources, and abilities to give back.
  - 9.1.8.CR.2: Compare various ways to give back through strengths, passions, goals, and other personal factors.

9.2 Career Awareness, Exploration, Preparation, and Training
Career Awareness and Planning

- Different types of jobs require different knowledge and skills.
  - 9.1.2.CAP.1: Make a list of different types of jobs and describe the skills associated with each job.
- An individual's passions, aptitude and skills can affect his/her employment and earning potential.
  - 9.2.5.CAP.1: Evaluate personal likes and dislikes and identify careers that might be suited to personal likes.
  - 9.2.5.CAP.2: Identify how you might like to earn an income.
  - 9.2.5.CAP.3: Identify qualifications needed to pursue traditional and non-traditional careers and occupations.
  - 9.2.5.CAP.4: Explain the reasons why some jobs and careers require specific training, skills, and certification (e.g., life guards, child care, medicine, education) and examples of these requirements..
- An individual's strengths, lifestyle goals, choices, and interests affect employment and income
  - 9.2.8.CAP.2: Develop a plan that includes information about career areas of interest.
  - 9.2.8.CAP.3: Explain how career choices, educational choices, skills, economic conditions, and personal behavior affect income.
- There are a variety of resources available to help navigate the career planning process
  - 9.2.8.CAP.12: Assess personal strengths, talents, values, and interests to appropriate jobs and careers to maximize career potential.

9.4 Life Literacies and Key Skills
Creativity and Innovation

- Gathering and evaluating knowledge and information from a variety of sources, including global perspectives, fosters creativity and innovative thinking.

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  - 9.4.8.CI.1: Assess data gathered on varying perspectives on causes of climate change (e.g., crosscultural, gender-specific, generational), and determine how the data can best be used to design multiple potential solutions (e.g., RI.7.9, 6.SP.B.5, 7.1.NH.IPERS.6, 8.2.8.ETW.4).
  - 9.4.8.CI.2: Repurpose an existing resource in an innovative way (e.g., 8.2.8.NT.3).
  - 9.4.8.CI.3: Examine challenges that may exist in the adoption of new ideas (e.g., 2.1.8.SSH, 6.1.8.CivicsPD.2).
  - 9.4.8.CI.4: Explore the role of creativity and innovation in career pathways and industries.

Critical Thinking and Problem-solving

- Multiple solutions often exist to solve a problem.
  - 9.4.8.CT.1: Evaluate diverse solutions proposed by a variety of individuals, organizations, and/or agencies to a local or global problem, such as climate change, and use critical thinking skills to predict which one(s) are likely to be effective (e.g., MS-ETS1-2).
  - 9.4.8.CT.2: Develop multiple solutions to a problem and evaluate short- and long-term effects to determine the most plausible option (e.g., MS-ETS1-4, 6.1.8.CivicsDP.1)
- An essential aspect of problem solving is being able to self-reflect on why possible solutions for solving problems were or were not successful.
  - 9.4.8.CT.3: Compare past problem-solving solutions to local, national, or global issues and analyze the factors that led to a positive or negative outcome.

Digital Citizenship

- Detailed examples exist to illustrate crediting others when incorporating their digital artifacts in one's own work.
  - 9.4.8.DC.1: Analyze the resource citations in online materials for proper use.
  - 9.4.8.DC.2: Provide appropriate citation and attribution elements when creating media products (e.g., W.6.8)
- Digital technology and data can be leveraged by communities to address effects of climate change.
  - 9.4.8.DC.8: Explain how communities use data and technology to develop measures to respond to effects of climate change (e.g., smart cities).

Global and Cultural Awareness

- Awareness of and appreciation for cultural differences is critical to avoid barriers to productive and positive interaction
  - 9.4.8.GCA.1: Model how to navigate cultural differences with sensitivity and respect (e.g., 1.5.8.C1a).
  - 9.4.8.GCA.2: Demonstrate openness to diverse ideas and perspectives through active discussions to achieve a group goal.

Information and Media Literacy

- Increases in the quantity of information available through electronic means have heightened the need to check sources for possible distortion, exaggeration, or misrepresentation.
  - 9.4.8.IML.1: Critically curate multiple resources to assess the credibility of sources when searching for information.
  - 9.4.8.IML.2: Identify specific examples of distortion, exaggeration, or misrepresentation of information.
- Digital tools make it possible to analyze and interpret data, including text, images, and sound. These tools allow for broad concepts and data to be more effectively communicated.
  - 9.4.8.IML.3: Create a digital visualization that effectively communicates a data set using formatting techniques such as form, position, size, color, movement, and spatial grouping (e.g., 6.SP.B.4, 7.SP.B.8b).
  - 9.4.8.IML.4: Ask insightful questions to organize different types of data and create meaningful visualizations.
- Sources of information are evaluated for accuracy and relevance when considering the use of information.
  - 9.4.8.IML.8: Apply deliberate and thoughtful search strategies to access high-quality information on climate change (e.g., 1.1.8.C1b).
- There is a need to produce and publish media that has information supported with quality evidence and is intended for authentic audiences.
  - 9.4.8.IML.12: Use relevant tools to produce, publish, and deliver information supported with evidence for an authentic audience.

Technology Literacy

- Some digital tools are appropriate for gathering, organizing, analyzing, and presenting information, while other types of digital tools are appropriate for creating text, visualizations, models, and communicating with others
  - 9.4.8.TL.2: Gather data and digitally represent information to communicate a real-world problem (e.g., MS-ESS3-4, 6.1.8.EconET.1, 6.1.8.CivicsPR.4).

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- 9.4.8.TL.3: Select appropriate tools to organize and present information digitally.
- 9.4.8.TL.4: Synthesize and publish information about a local or global issue or event (e.g., MS-LS4-5, 6.1.8.CivicsPI.3).

Climate Change
MS-LS2-4 Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.
SEL Competencies
• **Self - Awareness** • **Self - Management** • **Social Awareness** • **Responsible Decision Making** • **Relationship Skills** **https://www.nj.gov/education/safety/wellness/selearning/index.shtml**

District/School Formative Assessment Plan	District/School Summative Assessment Plan
Formative assessment informs instruction and is ongoing throughout a unit to determine how students are progressing against the standards. Teachers are encouraged to incorporate Formative Assessments into all lessons. During instruction, teachers will collect ongoing information on students' mastery of content through a variety of methods: • Pre-Assessment • Questioning: using Socratic method, probing questions, a hierarchical system in complexity (Bloom's Taxonomy) • Exit tickets, rotational activities (stations), quizzes, and small group activities • Classwork, homework, group work (formative assessment) • Teacher's observation, class discussion, and Student Notebook	*Summative assessment is an opportunity for students to demonstrate mastery of the skills taught during a particular unit.* **Benchmark Assessments:** • Assessment 1.1: Mid-Unit Assessment • Assessment 1.2: End of Unit Assessment • Assessment 1.3: End of Unit Performance Assessment **Standardized Assessments:** • NJSLA **Other Summative Assessments:** Teachers are encouraged to design and implement their own assessments (topic/module tests and quizzes) individually and/or with their department or grade-level partners, as per Uniform Grading Profile.
Targeted Academic Vocabulary	

ecosystems, species, invasive species, biotic, abiotic, habitat, resources, food, energy from food, food chain, food web, impacts, biodiversity, decomposer, photosynthesis, cellular respiration, competition, predation, population

District/School Tasks	District/School Primary and Supplementary Resources
• Common Formative Assessments • Common District Summative Assessments • See above Assessment Sections for more information	**District-Mandated Resources** • Lab-Aides Curriculum **Assessment Resources:** • Available on Lab-Aides.com • For additional resources, log in to https://edconnectnj.schoolnet.com **Other Resources:** • Generation Genius: "What is Science? (Science and Engineering Practices)" (good for the beginning of the school year). • Generation Genius: "Ecosystems", "Food Webs", "Biodiversity of Life on Earth" • Warm-Up Activities: Amistad Activity, SEL Activity, Holocaust Activity, Climate Change Activity, LGBTQ+/Disabilities • Current Events, Articles: Readworks, Newsela, Scholastic Magazine (Science World) • Simulations, Videos, Games: Scholastic Study Jams, The Science Spot, PBS Learning Media, PhET, Gizmos • Activities and Lessons: Discovery Education Techbook, Steve Spangler, Kesler Science, Science Buddies, Generation Genius • Youtube Channels (MooMooMath and Science,TedEd, CrashCourse, Sick Science, Teacher's Pet, etc.) • Resources for Carbon Cycle, Linking study of Photosynthesis to Climate Change Study (Climate Change Resource) **Project Ideas:** • Create or maintain a Biodiversity garden on school grounds • Conduct a biodiversity survey on school grounds or in neighborhoods • Conduct an invasive species survey on school grounds or in neighborhoods

Instructional Best Practices and Exemplars

See Appendix A for Instructional Best Practices and Exemplars
Pacing Guide
Grade 6 Pacing Guide

Unit 2 Energy and Waves: Life and Physical Science

Overview

In this unit, students ask questions, plan and carry out investigations, engage in argument from evidence, analyze and interpret data, construct explanations, define problems and design solutions as they make sense of the difference between energy and temperature and between energy and forces.. Students develop their understanding of important qualitative ideas about the conservation of energy. Students understand that moving objects have kinetic energy and that objects, may also contain stored (potential) energy, depending on their relative positions. Students are additionally expected to use these practices to demonstrate understanding of the core ideas.

Essential Questions	Enduring Understandings
<u>Overarching Driving Questions:</u> *What is energy?* *Why are some devices more efficient than others?* *What can people do to reduce energy use?* *How can people manipulate energy transfer and transformation to use energy more efficiently?* ● How can you use energy more efficiently? ● Why do some light bulbs get hotter than others? ● What does it take to reduce energy use in a home? (Activity 1) ● Why does my cell phone break when it falls from my hand while I am walking but is less likely to break when it falls from my pocket when I am sitting? ● How can you track the transfer of energy in a system? (Activity 2) ● How is energy transformed on a roller coaster? (Activity 3) ● How can kinetic energy of motion be transformed into another kind of kinetic energy: thermal energy? (Activity 4) ● What are the similarities and differences among different types of energy? ● How can you use the law of conservation of energy to describe energy transformations? (Activity 5) ● How can you use the law of conservation of energy to describe energy transformations? (Activity 6) ● What is happening when a substance gets warmer or cooler? ● What happens to thermal energy when hot and cold water are combined? (Activity 7) ● What affects how much thermal energy can be stored in or released from an object? (Activity 8)	**<u>Unit Issue: Energy-efficiency and energy use.</u>** **<u>Anchoring Phenomena:</u>** Some energy transfers and transformations are more efficient than others. When a device uses energy, some of the energy is changed into a form that is not useful. This "wasted" energy reduces the efficiency of the device. Examples: Some appliances (such as refrigerators) and devices (such as certain lightbulbs) use less energy than others; some devices transform energy from the sun. If we want to be able to use energy more efficiently, we need to understand how it behaves. ● Some devices are less efficient than others. Some devices are more efficient than others. ● Objects are more likely to break if they are dropped from higher up. ● There are many types of energy that we encounter on a daily basis. ● Substances get warmer or colder depending on their environment. ● There is energy in food, fuel, weather systems, and many other situations. ● All types of energy can be classified as either kinetic (energy of motion) or potential (energy of position)—a simple system helps us understand how energy can be transformed. ● Energy can be transformed over and over again. ● One kind of kinetic energy can be transformed into another kind of kinetic energy—thermal energy. ● Energy is conserved—whenever it is transferred or transformed, the total energy at the start is the same as the total energy at the end. ● There are many kinds of energy transformations, and all of them follow the law of conservation of energy ● Energy can be transferred from one object to another.

• Do we mean the same thing when we talk about energy transfer and transformation in other fields of science? • How does an understanding of energy help scientists explain phenomena in all fields of science? (Activity 9) • Why do some light bulbs get hotter than others? • How can you increase or decrease the rate of thermal energy transfer? (Activity 10) • What properties of matter affect how it interacts with solar energy? (Activity 11) • What are the different ways that thermal energy is transferred? (Activity 12) • How can you engineer a device to maximize its ability to transfer solar energy? (Activity 13) • How can we measure the efficiency of a light bulb? (Activity 14) • How can different features in a home affect the energy-efficiency of the home? (Activity 15)	• We can quantify the transfer of energy. • Energy in living systems is the same as energy in physical systems and has the same behavior—it can be transformed and transferred. • We can do things to speed up or slow down energy transfer. • The sun's energy is transferred to materials differently depending on their properties. • Thermal energy can be transferred three different ways. • We can use different materials to maximize energy transfer from the sun to serve a purpose. • Sometimes energy transformations are not useful to us. • We can do things to change the efficiency of desirable energy transformations.

Unit 2 Energy and Waves: Life and Physical Sciences

NJSLS Science Content Standards - Arranged by Disciplinary Core idea (DCI)

Students who demonstrate understanding can:

MS-PS3: Energy

- **MS-PS3-3** Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer. [Clarification Statement: Examples of devices could include an insulated box, a solar cooker, and a Styrofoam cup.] [Assessment Boundary: Assessment does not include calculating the total amount of thermal energy transferred.]
- **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. [Clarification Statement: Examples of experiments could include comparing final water temperatures after different masses of ice melted in the same volume of water with the same initial temperature, the temperature change of samples of different materials with the same mass as they cool or heat in the environment, or the same material with different masses when a specific amount of energy is added.] [Assessment Boundary: Assessment does not include calculating the total amount of thermal energy transferred.]
- **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. [Clarification Statement: Examples of empirical evidence used in arguments could include an inventory or other representation of the energy before and after the transfer in the form of temperature changes or motion of object.] [Assessment Boundary: Assessment does not include calculations of energy.]

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. [Clarification Statement: Emphasis is on describing waves with both qualitative and quantitative thinking.] [Assessment Boundary: Assessment does not include electromagnetic waves and is limited to standard repeating waves.]

Unit 2 Energy and Waves: Life and Physical Sciences

NJSLS Science Content Standards - Arranged by Disciplinary Core idea (DCI)

- **MS-PS4-2** Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials. [Clarification Statement: Emphasis is on both light and mechanical waves. Examples of models could include drawings, simulations, and written descriptions.] [Assessment Boundary: Assessment is limited to qualitative applications pertaining to light and mechanical waves.]
- **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. [Clarification Statement: Emphasis is on a basic understanding that waves can be used for communication purposes. Examples could include using fiber optic cable to transmit light pulses, radio wave pulses in wifi devices, and conversion of stored binary patterns to make sound or text on a computer screen.] [Assessment Boundary: Assessment does not include binary counting. Assessment does not include the specific mechanism of any given device.]

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.

Science and Engineering Practices

Asking Questions and Defining Problems

- Asking questions and defining problems in grades 6–8 builds on K–5 experiences and progresses to specifying relationships between variables and clarifying arguments and models.
  - Define a design problem that can be solved through the development of an object, tool, process or system and includes multiple criteria and constraints, including scientific knowledge that may limit possible solutions. (MS-ETS1-1)

Planning and Carrying Out Investigations

- Planning and carrying out investigations to answer questions or test solutions to problems in 6–8 builds on K–5 experiences and progresses to include investigations that use multiple variables and provide evidence to support explanations or design solutions.
  - Plan an investigation individually and collaboratively, and in the design: identify independent and dependent variables and controls, what tools are needed to do the gathering, how measurements will be recorded, and how many data are needed to support a claim. (MS-PS3-4)

Developing and Using Models

- Modeling in 6–8 builds on K–5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems.
  - Develop and use a model to describe phenomena. (MS-PS4-2)
  - Develop a model to describe unobservable mechanisms. (MS-PS3-2)
  - Develop a model to generate data to test ideas about designed systems, including those representing inputs and outputs. (MS-ETS1-4)

Using Mathematics and Computational Thinking

- Mathematical and computational thinking at the 6–8 builds on K–5 and progresses to identifying patterns in large data sets and using mathematical concepts to support explanations and arguments.
  - Use mathematical representations to describe and/or support scientific (MS-PS4-1)

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Unit 2 **Energy and Waves:** Life and Physical Sciences
NJSLS Science Content Standards - Arranged by Disciplinary Core idea (DCI)

Analyzing and Interpreting Data

- Analyzing data in 6–8 builds on K–5 experiences and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis.
  - Analyze and interpret data to determine similarities and differences in findings. (MS-ETS1-3)

Obtaining, Evaluating, and Communicating Information

- Obtaining, evaluating, and communicating information in 6–8 builds on K–5 and progresses to evaluating the merit and validity of ideas and methods.
  - Integrate qualitative scientific and technical information in written text with that contained in media and visual displays to clarify claims and findings. (MS-PS4-3)

Constructing Explanations and Designing Solutions

- Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific knowledge, principles, and theories.
  - Apply scientific ideas or principles to design, construct, and test a design of an object, tool, process or system. (MS-PS3-3)

Engaging in Argument from Evidence

- Engaging in argument from evidence in 6–8 builds on K–5 experiences and progresses to constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed worlds.
  - Evaluate competing design solutions based on jointly developed and agreed-upon design criteria. (MS-ETS1-2)
  - Construct, use, and present oral and written arguments supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon. (MS-PS3-5)

Disciplinary Core Ideas

PS1.A: Structure and Properties of Matter

- Substances are made from different types of atoms, which combine with one another in various ways. Atoms form molecules that range in size from two to thousands of atoms. (MS-PS1-1)
- Each pure substance has characteristic physical and chemical properties (for any bulk quantity under given conditions) that can be used to identify it. (MS-PS1-2), (MS-PS1-3)
- Gases and liquids are made of molecules or inert atoms that are moving about relative to each other. (MS-PS1-4)
- In a liquid, the molecules are constantly in contact with others; in a gas, they are widely spaced except when they happen to collide. In a solid, atoms are closely spaced and may vibrate in position but do not change relative locations. (MS-PS1-4)
- Solids may be formed from molecules, or they may be extended structures with repeating subunits (e.g., crystals). (MS-PS1-1)
- The changes of state that occur with variations in temperature or pressure can be described and predicted using these models of matter. (MS-PS1-4)

PS1.B: Chemical Reactions

- Substances react chemically in characteristic ways. In a chemical process, the atoms that make up the original substances are regrouped into different molecules, and these new substances have different properties from those of the reactants. (MS-PS1-2), (MS-PS1-3), (MS-PS1-5)
- The total number of each type of atom is conserved, and thus the mass does not change. (MS-PS1-5)
- Some chemical reactions release energy, others store energy. (MS-PS1-6)

PS3.A: Definitions of Energy

Unit 2 Energy and Waves: Life and Physical Sciences

NJSLS Science Content Standards - Arranged by Disciplinary Core idea (DCI)

- The term "heat" as used in everyday language refers both to thermal energy (the motion of atoms or molecules within a substance) and the transfer of that thermal energy from one object to another. In science, heat is used only for this second meaning; it refers to the energy transferred due to the temperature difference between two objects. (secondary to MS-PS1-4)
- The temperature of a system is proportional to the average internal kinetic energy and potential energy per atom or molecule (whichever is the appropriate building block for the system's material). The details of that relationship depend on the type of atom or molecule and the interactions among the atoms in the material. Temperature is not a direct measure of a system's total thermal energy. The total thermal energy (sometimes called the total internal energy) of a system depends jointly on the temperature, the total number of atoms in the system, and the state of the material. (secondary to MS-PS1-4)

PS4.A: Wave Properties

- A simple wave has a repeating pattern with a specific wavelength, frequency, and amplitude. (MS-PS4-1)
- A sound wave needs a medium through which it is transmitted. (MS-PS4-2)

PS4.B: Electromagnetic Radiation

- When light shines on an object, it is reflected, absorbed, or transmitted through the object, depending on the object's material and the frequency (color) of the light. (MS-PS4-2)
- The path that light travels can be traced as straight lines, except at surfaces between different transparent materials (e.g., air and water, air and glass) where the light path bends. (MS-PS4-2)
- A wave model of light is useful for explaining brightness, color, and the frequency-dependent bending of light at a surface between media. (MS-PS4-2)
- However, because light can travel through space, it cannot be a matter wave, like sound or water waves. (MS-PS4-2)

PS4.C: Information Technologies and Instrumentation

- Digitized signals (sent as wave pulses) are a more reliable way to encode and transmit information. (MS-PS4-3)

ETS1.A: Defining and Delimiting Engineering Problems

- The more precisely a design task's criteria and constraints can be defined, the more likely it is that the designed solution will be successful. Specification of constraints includes consideration of scientific principles and other relevant knowledge that are likely to limit possible solutions. (MS-ETS1-1)

ETS1.B: Developing Possible Solutions

- A solution needs to be tested, and then modified on the basis of the test results, in order to improve it. There are systematic processes for evaluating solutions with respect to how well they meet criteria and constraints of a problem. (MS-ETS1-4), (secondary to MS-PS3-3)
- There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem. (MSETS1-2), (MS-ETS1-3)
- Sometimes parts of different solutions can be combined to create a solution that is better than any of its predecessors. (MSETS1-3)
- Models of all kinds are important for testing solutions. (MS-ETS1-4)

ETS1.C: Optimizing the Design Solution

- Although one design may not perform the best across all tests, identifying the characteristics of the design that performed the best in each test can provide useful information for the redesign process—that is, some of those characteristics may be incorporated into the new design. (MS-ETS1-3)
- The iterative process of testing the most promising solutions and modifying what is proposed on the basis of the test results leads to greater refinement and ultimately to an optimal solution. (MS-ETS1-4),

Crosscutting Concepts

Patterns

- Graphs and charts can be used to identify patterns in data. (MS-PS4-1)

Scale, Proportion, and Quantity

Unit 2 Energy and Waves: Life and Physical Sciences

NJSLS Science Content Standards - Arranged by Disciplinary Core idea (DCI)

- Proportional relationships (e.g. speed as the ratio of distance traveled to time taken) among different types of quantities provide information about the magnitude of properties and processes. (MS-PS3-4)

Energy and Matter

- The transfer of energy can be tracked as energy flows through a designed or natural system. (MS-PS3-3)
- Energy may take different forms (e.g. energy in fields, thermal energy, energy of motion). (MS-PS3-5)

Structure and Function

- Structures can be designed to serve particular functions by taking into account properties of different materials, and how materials can be shaped and used. (MS-PS4-2) Structures can be designed to serve particular functions. (MS-PS4-3)

Connections to Engineering, Technology, and Applications of Science

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

- Technologies extend the measurement, exploration, modeling, and computational capacity of scientific investigations. (MS-PS4-3)
- All human activity draws on natural resources and has both short and long-term consequences, positive as well as negative, for the health of people and the natural environment. (MS-ETS1-1)
- The uses of technologies and limitations on their use are driven by individual or societal needs, desires, and values; by the findings of scientific research; and by differences in such factors as climate, natural resources, and economic conditions. (MS-ETS1-1)

Connections to Nature of Science

Scientific Knowledge is Based on Empirical Evidence

- Science knowledge is based upon logical and conceptual connections between evidence and explanations (MS-PS3-4), (MS-PS3-5)

Student Learning Objectives

Students will…

- learn about energy.
- examine types of energy.
- explore energy transformation, energy chains within systems and household energy conservation.
- understand energy efficiency.
- inspect types of alternate energy sources and judge benefits and drawbacks for each one.
- explore concepts about energy transfer by analyzing qualitative data on energy use in two hypothetical homes in different environments.
- consider how certain features of a home may cause the homeowner to use more or less energy.
- plan and carry out an investigation to examine the relationship between gravitational potential energy and kinetic energy of motion.
- determine the effect of release height on gravitational potential energy.

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- determine the effect of mass on gravitational potential energy.
- expand on their understanding of energy transfer and transformations by exploring what is happening to energy during a roller coaster ride.
- use a model to help them explain the repeated transformations of gravitational potential and kinetic energy along the ride, and the transfer of kinetic energy from the roller coaster cars to thermal energy and sound in the tracks.
- differentiate between transferred energy and transformed energy
- develop arguments to explain that energy cannot be "lost" during energy transformations.
- explore many types of energy transformations and transfers that people encounter regularly in their everyday lives.
- present arguments that a change in the kinetic energy of an object results in an energy transfer either to or from that object.
- predict the results of mixing water of different temperatures.
- apply their understanding of energy transfer to plan and carry out an investigation to determine the factors that influence the change in temperature of cold water when a hot object is immersed in it.
- conduct an investigation on thermal energy transfer in water, documenting this transfer by measuring temperature changes.
- observe the effects of thermal energy being spontaneously transferred from a hot region into a cold one until thermal equilibrium is reached.
- obtain information from text about how scientists in several different disciplines use their understanding of energy to explain scientific phenomena and energy transfers and transformations in examples from the lifesciences, earth sciences, and physical sciences.
- explore the idea that thermal energy transfer can be maximized or minimized by engineering systems that are either good thermal conductors or insulators respectively, and use an engineering design process to design, construct, and test their systems.
- discuss the difference between "criteria" and "constraints".
- investigate the behavior of electromagnetic energy when it hits a surface. They see that the energy can be transmitted, reflected, and absorbed.
- discuss properties of solar energy.
- look at a system and understand how thermal energy enters or exits that system through three different methods of energy transfer: conduction, convection, and radiation.
- design, build, test, and optimize a device to maximize thermal energy transfer: a solar oven. The success of their devices is determined by how well students apply what they have learned about thermal energy transfer and how well students are able to redesign the devices based on performance evaluations in early tests.
- apply their understanding of the concepts of energy transfer and transformation to compare the efficiencies of two different types of light bulbs, by measuring the amount of thermal energy produced by the two bulbs, applying the law of conservation of energy, and calculating how much of the electrical energy supplied was converted into light energy.
- obtain more information about factors that can affect energy use in the home, and apply their understanding of energy transfer and energy transformation to develop a home energy efficiency plan to use less energy.
- experiment with producing noises of varied intensity and frequency as they begin to build an understanding of the properties of sound. Students then create a model of a sound wave using a metal spring.
- determine how instrument structure is related to function.
- create sounds using instruments by altering the pitch and volume.
- learn more about longitudinal waves as they obtain, evaluate, and communicate information read in text and interpreted in diagrams and graphs.
- explore topics such as the nature of sound waves, why a medium is required, and how and why the speed of sound changes in various media.
- use mathematics and computational thinking as they analyze and interpret data related to the risk of noise-induced hearing loss. In doing so, students plot a line graph and determine the relationship between relative intensity of sound and the maximum allowed exposure time. They use the graph to estimate a safe time for exposure to a certain level of sound.
- model how noise interference affects the transmission and reception of analog and digital signals. They find that the structure of digitized signals, sent as wave pulses, function as a more reliable way to encode and transmit information. They examine the structure and function of the model used in the activity.
- explore the history of the development of the hearing aid and discover that it was a collaborative effort by scientists, audiologists, engineers, and industry leaders.

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- apply what they learned about longitudinal waves in a previous activity to transverse waves in a long metal spring. They use a model to identify patterns to deduce the inverse relationship between frequency and wavelength, and the direct relationship between amplitude and energy.
- investigate the reflection of sound and light waves. They find that some surfaces are good reflectors of sound, whereas others are good absorbers of sound. These characteristics are applied to acoustic design in an application of the crosscutting concept of structure and function.
- design a procedure to investigate angle of incidence and angle of reflection.
- experiment with the transmission of light rays by planning and carrying out an investigation of the refraction of light through water. Looking for patterns in their data, students search for a qualitative relationship between the angle of incidence, angle of refraction, and index of refraction.
- observe that visible light can be separated into different colors. Students then conduct an investigation to collect evidence that indicates that different colors of light carry different amounts of energy.
- conduct an investigation to test how different films affect the transmission and absorption of light. As they analyze and interpret the data they have collected, they learn that there are invisible waves at both ends of the visible spectrum and that these waves, like visible light, transfer energy when absorbed.
- use textual and visual information that extends their understanding of the electromagnetic spectrum.
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Integrated Accommodations and Modifications		
Special Education Students	**English Language Learners**	**At Risk**
• Utilize modifications & accommodations delineated in the student's IEP • Provide additional manipulatives to support instruction • Allow for alternative strategies to solve algorithms or tasks • Provide the steps needed to complete the task • Model frequently • Provide repetition and practice. • Use visuals to demonstrate/model the processes • Restate, reread, and clarify directions/questions • Ask students to restate information, directions, and assignments. • Provide copy of class notes • Distribute study guide for classroom tests. • Provide preferential seating to be mutually determined by the student and teacher • Provide extra textbooks for home.	WIDA Can Do Descriptors https://wida.wisc.edu/teach/can-do/descriptors • Modify Assignments • Use testing and portfolio assessment • Utilize Native Language Translation (peer, online assistive technology, translation device, bilingual dictionary) • Repeat, rephrase, paraphrase key concepts and directions • Allow for extended time for assignment completion as needed • Highlight key vocabulary • Define essential vocabulary in context • Use graphic organizers, visuals, manipulatives and other concrete materials • Use gestures, facial expressions and body language	• Pair visual prompts with verbal presentations • Ask students to restate information, directions, and assignments. • Provide repetition and and practice • Model skills / techniques to be mastered. • Provide extended time to complete class work • Provide copy of class notes • Provide preferential seating to be mutually determined by the student and teacher • Allow the use of a computer to complete assignments. • Establish expectations for correct spelling on assignments • Provide extra textbooks for home. • Provide Peer Support • Increase one on one time

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• Provide regular parent/ school communication • Allow extended time to complete assignment • Establish procedures for accommodations / modifications for assessments • Allow student to take/complete tests in an alternate setting as needed Appendix A: Special Education Accommodations and Modifications	• Read aloud • Build on what students already know and prior experience	

Gifted and Talented Students	504 Plan
• Utilize advanced, accelerated, or compacted content • Provide assignments that emphasize higher- level thinking skills. • Allow for individual student interest • Gear assignments to development in areas of affect, creativity, cognition, and research skills • Allow for a variety in types of resources • Provide problem-based assignments with planned scope and sequence • Utilize inquiry-based instruction • Adjust the pace of lessons • Utilize Choice Boards • Provide Problem-Based Learning • Establish flexible Grouping	• Pair visual prompts with verbal presentations • Ask students to restate information, directions, and assignments. • Provide repetition and practice • Model skills / techniques to be mastered. • Provide extended time to complete class work • Provide copy of class notes • Break long assignments into smaller parts • Assist student in setting short term goals • Allow for preferential seating to be mutually determined by the student and teacher • Provide extra textbooks for home. • Model and reinforce organizational systems (i.e. color-coding) • Write out homework assignments, check student's recording of assignments
Interdisciplinary Connections	**Computer Science and Design Thinking**

Connections to NJSLS - English Language Arts	**Computer Science and Design Thinking Practices**
Reading ● RST.6-8.1 Cite specific textual evidence to support analysis of science and technical texts. (MS-ETS1-1), (MS-ETS1-2), (MS-ETS1-3), (MS-PS3-5), (MS-PS4-3) ● RST.6-8.2 Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions. (MS-PS4-3) ● RST.6-8.3 Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks. (MS-PS3-3), (MS-PS3-4) ● RST.6-8.7 Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table). (MS-ETS1-3), ● RST.6-8.9 Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic. (MS-ETS1-2), (MS-ETS1-3), (MS-PS4-3) *Writing* ● WHST.6-8.1 Write arguments focused on discipline content. (MS-PS3-5) ● WHST.6-8.7 Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration. (MS-ETS1-2), (MS-PS3-3), (MS-PS3-4) ● WHST.6-8.8 Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation. (MS-ETS1-1) ● WHST.6-8.9 Draw evidence from informational texts to support analysis, reflection, and research. (MS-ETS1-2), (MS-PS4-3) *Speaking and Listening* ● SL.8.5 Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest. (MS-ETS1-4), (MS-PS4-1), (MS-PS4-2)	8. ✓ Fostering an Inclusive Computing and Design Culture 9. ✓ Collaborating Around Computing and Design 10. ✓ Recognizing and Defining Computational Problems 11. ✓ Developing and Using Abstractions 12. ✓ Creating Computational Artifacts 13. ✓ Testing and Refining Computational Artifacts 14. ✓ Communicating About Computing and Design Computer Science and Design Thinking Standards **8.1 Computer Science** *Data and Analysis* ● People use digital devices and tools to automate the collection, use, and transformation of data. The manner in which data is collected and transformed is influenced by the type of digital device(s) available and the intended use of the data. ● 8.1.8.DA.1: Organize and transform data collected using computational tools to make it usable for a specific purpose. ● Computer models can be used to simulate events, examine theories and inferences, or make predictions. ● 8.1.8.DA.5: Test, analyze, and refine computational models. ● 8.1.8.DA.6: Analyze climate change computational models and propose refinements. **8.2 Design Thinking** *Engineering Design* ● Engineering design is a systematic, creative, and iterative process used to address local and global problems. The process includes generating ideas, choosing the best solution, and making, testing, and redesigning models or prototypes. ○ 8.2.8.ED.1: Evaluate the function, value, and aesthetics of a technological product or system, from the perspective of the user and the producer. ○ 8.2.8.ED.2: Identify the steps in the design process that could be used to solve a problem.

Connections to NJSLS - Mathematics ● MP.2 Reason abstractly and quantitatively. (MS-PS3-4), (MS-PS3-5), (MS-PS4-1), (MS-ETS1-1), (MS-ETS1-2), (MS-ETS1-3), (MS-ETS1-4) ● MP.4 Model with mathematics. (MS-PS4-1) ● 6.RP.A.1 Understand the concept of ratio and use ratio language to describe a ratio relationship between two quantities. (MS-PS4-1), (MS-PS3-5) ● 6.RP.A.3 Use ratio and rate reasoning to solve real-world and mathematical problems. (MS-PS4-1) ● 6.SP.B.5 Summarize numerical data sets in relation to their context. (MS-PS3-4) ● 7.RP.A.2 Recognize and represent proportional relationships between quantities. (MS-PS3-5), (MS-PS4-1) ● 7.EE.3 Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies. (MS-ETS1-1), (MS-ETS1-2), (MS-ETS1-3) ● 7.SP Develop a probability model and use it to find probabilities of events. Compare probabilities from a model to observed frequencies; if the agreement is not good, explain possible sources of the discrepancy. (MS-ETS1-4) ● 8.F.A.3 Interpret the equation $y = mx + b$ as defining a linear function, whose graph is a straight line; give examples of functions that are not linear. (MS-PS3-5), (MS-PS4-1)	○ 8.2.8.ED.3: Develop a proposal for a solution to a real-world problem that includes a model (e.g., physical prototype, graphical/technical sketch). ○ 8.2.8.ED.4: Investigate a malfunctioning system, identify its impact, and explain the step-by-step process used to troubleshoot, evaluate, and test options to repair the product in a collaborative team ● Engineering design requirements and specifications involve making trade-offs between competing requirements and desired design features. ○ 8.2.8.ED.5: Explain the need for optimization in a design process. ○ 8.2.8.ED.6: Analyze how trade-offs can impact the design of a product. ○ 8.2.8.ED.7: Design a product to address a real-world problem and document the iterative design process, including decisions made as a result of specific constraints and trade-offs (e.g., annotated sketches) *Interaction of Technology and Humans* ● Technology interacts with society, sometimes bringing about changes in a society's economy, politics, and culture, and often leading to the creation of new needs and wants. New needs and wants may create strains on local economies and workforces. Improvements in technology are intended to make the completion of tasks easier, safer, and/or more efficient ○ 8.2.8.ITH.3: Evaluate the impact of sustainability on the development of a designed product or system. ○ 8.2.8.ITH.4: Identify technologies that have been designed to reduce the negative consequences of other technologies and explain the change in impact. *Nature of Technology* ● Technology advances through the processes of innovation and invention which relies upon the imaginative and inventive nature of people. Sometimes a technology developed for one purpose is adapted to serve other purposes. Engineers use a systematic process of creating or modifying technologies that is fueled and constrained by physical laws, cultural norms, and economic resources. Scientists use systematic investigation to understand the natural world. ○ 8.2.8.NT.1: Examine a malfunctioning tool, product, or system and propose solutions to the problem. ○ 8.2.8.NT.2: Analyze an existing technological product that has been repurposed for a different function. ○ 8.2.8.NT.3: Examine a system, consider how each part relates to other parts, and redesign it for another purpose. ○ 8.2.8.NT.4: Explain how a product designed for a specific demand was modified to meet a new demand and led to a new product.

	Effects of Technology on the Natural World ● Resources need to be utilized wisely to have positive effects on the environment and society. Some technological decisions involve tradeoffs between environmental and economic needs, while others have positive effects for both the economy and environment. ○ 8.2.8.ETW.1: Illustrate how a product is upcycled into a new product and analyze the short- and long-term benefits and costs. ○ 8.2.8.ETW.2: Analyze the impact of modifying resources in a product or system (e.g., materials, energy, information, time, tools, people, capital). ○ 8.2.8.ETW.3: Analyze the design of a product that negatively impacts the environment or society and develop possible solutions to lessen its impact. ○ 8.2.8.ETW.4: Compare the environmental effects of two alternative technologies devised to address climate change issues and use data to justify which choice is best.

Career Readiness, Life Literacies and Key Skills

Career Readiness, Life Literacies and Key Skills Practices

- Act as a responsible and contributing community member and employee.
- Attend to financial well-being.
- Consider the environmental, social and economic impacts of decisions.
- Demonstrate creativity and innovation.
- Utilize critical thinking to make sense of problems and persevere in solving them.
- Model integrity, ethical leadership and effective management.
- Plan education and career paths aligned to personal goals.
- Use technology to enhance productivity, increase collaboration and communicate effectively.
- Work productively in teams while using cultural/global competence.

Career Readiness, Life Literacies and Key Skills Standards
9.1 Personal Financial Literacy
Civic Financial Responsibility

- Individuals can use their talents, resources, and abilities to give back.
  - 9.1.8.CR.2: Compare various ways to give back through strengths, passions, goals, and other personal factors.

9.2 Career Awareness, Exploration, Preparation, and Training
Career Awareness and Planning

- Different types of jobs require different knowledge and skills.

- 9.1.2.CAP.1: Make a list of different types of jobs and describe the skills associated with each job.
- An individual's passions, aptitude and skills can affect his/her employment and earning potential.
  - 9.2.5.CAP.1: Evaluate personal likes and dislikes and identify careers that might be suited to personal likes.
  - 9.2.5.CAP.2: Identify how you might like to earn an income.
  - 9.2.5.CAP.3: Identify qualifications needed to pursue traditional and non-traditional careers and occupations.
  - 9.2.5.CAP.4: Explain the reasons why some jobs and careers require specific training, skills, and certification (e.g., life guards, child care, medicine, education) and examples of these requirements..
- An individual's strengths, lifestyle goals, choices, and interests affect employment and income
  - 9.2.8.CAP.2: Develop a plan that includes information about career areas of interest.
  - 9.2.8.CAP.3: Explain how career choices, educational choices, skills, economic conditions, and personal behavior affect income.
- There are a variety of resources available to help navigate the career planning process
  - 9.2.8.CAP.12: Assess personal strengths, talents, values, and interests to appropriate jobs and careers to maximize career potential.

9.4 Life Literacies and Key Skills

Creativity and Innovation

- Gathering and evaluating knowledge and information from a variety of sources, including global perspectives, fosters creativity and innovative thinking.
  - 9.4.8.CI.1: Assess data gathered on varying perspectives on causes of climate change (e.g., crosscultural, gender-specific, generational), and determine how the data can best be used to design multiple potential solutions (e.g., RI.7.9, 6.SP.B.5, 7.1.NH.IPERS.6, 8.2.8.ETW.4).
  - 9.4.8.CI.2: Repurpose an existing resource in an innovative way (e.g., 8.2.8.NT.3).
  - 9.4.8.CI.3: Examine challenges that may exist in the adoption of new ideas (e.g., 2.1.8.SSH, 6.1.8.CivicsPD.2).
  - 9.4.8.CI.4: Explore the role of creativity and innovation in career pathways and industries.

Critical Thinking and Problem-solving

- Multiple solutions often exist to solve a problem.
  - 9.4.8.CT.1: Evaluate diverse solutions proposed by a variety of individuals, organizations, and/or agencies to a local or global problem, such as climate change, and use critical thinking skills to predict which one(s) are likely to be effective (e.g., MS-ETS1-2).
  - 9.4.8.CT.2: Develop multiple solutions to a problem and evaluate short- and long-term effects to determine the most plausible option (e.g., MS-ETS1-4, 6.1.8.CivicsDP.1)
- An essential aspect of problem solving is being able to self-reflect on why possible solutions for solving problems were or were not successful.
  - 9.4.8.CT.3: Compare past problem-solving solutions to local, national, or global issues and analyze the factors that led to a positive or negative outcome.

Digital Citizenship

- Detailed examples exist to illustrate crediting others when incorporating their digital artifacts in one's own work.
  - 9.4.8.DC.1: Analyze the resource citations in online materials for proper use.
  - 9.4.8.DC.2: Provide appropriate citation and attribution elements when creating media products (e.g., W.6.8)
- Digital technology and data can be leveraged by communities to address effects of climate change.
  - 9.4.8.DC.8: Explain how communities use data and technology to develop measures to respond to effects of climate change (e.g., smart cities).

Global and Cultural Awareness

- Awareness of and appreciation for cultural differences is critical to avoid barriers to productive and positive interaction
  - 9.4.8.GCA.1: Model how to navigate cultural differences with sensitivity and respect (e.g., 1.5.8.C1a).
  - 9.4.8.GCA.2: Demonstrate openness to diverse ideas and perspectives through active discussions to achieve a group goal.

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Information and Media Literacy

- Increases in the quantity of information available through electronic means have heightened the need to check sources for possible distortion, exaggeration, or misrepresentation.
  - 9.4.8.IML.1: Critically curate multiple resources to assess the credibility of sources when searching for information.
  - 9.4.8.IML.2: Identify specific examples of distortion, exaggeration, or misrepresentation of information.
- Digital tools make it possible to analyze and interpret data, including text, images, and sound. These tools allow for broad concepts and data to be more effectively communicated.
  - 9.4.8.IML.3: Create a digital visualization that effectively communicates a data set using formatting techniques such as form, position, size, color, movement, and spatial grouping (e.g., 6.SP.B.4, 7.SP.B.8b).
  - 9.4.8.IML.4: Ask insightful questions to organize different types of data and create meaningful visualizations.
- Sources of information are evaluated for accuracy and relevance when considering the use of information.
  - 9.4.8.IML.8: Apply deliberate and thoughtful search strategies to access high-quality information on climate change (e.g., 1.1.8.C1b).
- There is a need to produce and publish media that has information supported with quality evidence and is intended for authentic audiences.
  - 9.4.8.IML.12: Use relevant tools to produce, publish, and deliver information supported with evidence for an authentic audience.

Technology Literacy

- Some digital tools are appropriate for gathering, organizing, analyzing, and presenting information, while other types of digital tools are appropriate for creating text, visualizations, models, and communicating with others
  - 9.4.8.TL.2: Gather data and digitally represent information to communicate a real-world problem (e.g., MS-ESS3-4, 6.1.8.EconET.1, 6.1.8.CivicsPR.4).
  - 9.4.8.TL.3: Select appropriate tools to organize and present information digitally.
  - 9.4.8.TL.4: Synthesize and publish information about a local or global issue or event (e.g., MS-LS4-5, 6.1.8.CivicsPI.3).

Climate Change

- **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.
- **Anchoring Phenomenon:** Energy efficiency

SEL Competencies

- **Self - Awareness**
- **Self - Management**
- **Social Awareness**
- **Responsible Decision Making**
- **Relationship Skills**

https://www.nj.gov/education/safety/wellness/selearning/index.shtml

District/School Formative Assessment Plan	District/School Summative Assessment Plan

Formative assessment informs instruction and is ongoing throughout a unit to determine how students are progressing against the standards. Teachers are encouraged to incorporate Formative Assessments into all lessons. During instruction, teachers will collect ongoing information on students' mastery of content through a variety of methods: ● Questioning: using Socratic method, probing questions, a hierarchical system in complexity (Bloom's Taxonomy) ● Exit tickets, rotational activities (stations), quizzes, and small group activities ● Classwork, homework, group work (formative assessment) ● Pre-Assessment, teacher's observation, class discussion, and journal	*Summative assessment is an opportunity for students to demonstrate mastery of the skills taught during a particular unit.* **Benchmark Assessments:** ● Assessment 1.1: Mid-Unit Assessment ● Assessment 1.2: End of Unit Assessment ● Assessment 1.3: End of Unit Performance Assessment **Standardized Assessments:** ● NJSLA **Other Summative Assessments:** Teachers are encouraged to design their own assessments (topic/module tests and quizzes) individually and/or with their department or grade-level partners, as per Uniform Grading Profile.

Targeted Academic Vocabulary
Energy, energy efficiency, energy conversion, energy transfer, energy transformation, energy conservation, heat/thermal energy, kinetic, potential, gravitational-potential energy, motion, law of conservation of energy, food/chemical energy, fuel, solar, light, wave, sound, amplitude, volume, intensity, frequency, wavelength, wave properties, encode, digital, analog, seismic, transverse, electromagnetic, reflection, reflect, absorb, transmit, light spectrum, color

District/School Tasks	**District/School Primary and Supplementary Resources**
● Common Formative Assessments ● Common District Summative Assessments ● See above Assessment Sections for more information	**District-Mandated Resources** ● Lab-Aides Curriculum **Assessment Resources:** ● Available on Lab-Aides.com ● For additional resources, log in to https://edconnectnj.schoolnet.com **Other Resources:** ● Generation Genius: "Electricity and Circuits", "Electromagnetic Spectrum", "engineering Design Process", "Intro to Thermal Energy", "Kinetic vs Potential Energy", "Heat: Transfer of Thermal Energy", "Digital vs Analog Signals", "How to be a Scientist: College and Careers" ● Flocabulary

	• Warm-Up Activities: Amistad Activity, SEL Activity, Holocaust Activity, Climate Change Activity, LGBTQ+/Disabilities • Current Events, Articles: Readworks, Newsela, Scholastic Magazine (Science World) • Simulations, Videos, Games: Scholastic Study Jams, The Science Spot, PBS Learning Media, PhET, Gizmos • Activities and Lessons: Discovery Education Techbook, Steve Spangler, Kesler Science, Science Buddies, Generation Genius • Youtube Channels (MooMooMath and Science,TedEd, CrashCourse, Sick Science, Teacher's Pet, etc.) **Project Ideas:** • Testing different SPF strengths of sunscreen (using colored construction paper) over time • PBL: Building simple battery or solar powered circuits (shoebox door "alarm", lights, working radio, etc)

Instructional Best Practices and Exemplars
See Appendix A for Instructional Best Practices and Exemplars

Pacing Guide
Grade 6 Pacing Guide

Unit 3 Earth and Space Science: Life and Physical Sciences

Overview

Weather and Climate: This lesson plan enables students to learn the differences between weather and climate. Students collect local weather data for a defined period of time, and then compare these data with longer term climate data for their community.

Weather conditions vary from day to day, month to month, and across seasons. Sometimes weather conditions can be severe, causing damage to property and loss of life. Weather patterns are influenced by the movement of water in the atmosphere. This movement is determined by winds, landforms, and ocean temperatures and currents. Weather data are collected by a variety of instruments. These data can be used to forecast upcoming weather conditions (e.g., when different air masses collide at warm and cold fronts). Since many factors interact to influence the weather at a particular location, weather can only be predicted probabilistically.

Climates are described by the same conditions used to describe weather, and represent the average weather in a location over a long period of time. Climate patterns vary by latitude, altitude, and geographic land distribution. Oceans have an important effect on climate. They absorb energy from the Sun, with the water nearest the equator warming up much more than water at higher latitudes. Variations in density due to variations in temperature and salinity drive a global pattern of interconnected ocean currents that redistribute thermal energy. The atmosphere also has currents that move air and water from one place to another. Air and water are also driven by energy from the Sun and, as with ocean currents, are influenced by the Coriolis effect, which is a result of the Earth's rotation. The resulting pattern of prevailing winds affects regional weather and climate. The way that Earth's atmosphere interacts with the Sun's energy and the oceans thus helps determine Earth's average temperature and its different climate zones.

The impacts of climate change are widespread and diverse. Climate is influenced by many factors and varies by location. Climate also changes over time. Human activities, such as the release of greenhouse gases into the atmosphere, have contributed to current global warming. This is causing changes to climates around the world.

Essential Questions

Overarching Driving Questions:

How does the weather affect people and how do people affect the climate?
What kinds of future space missions should we fund and conduct?

- Is the climate changing?
- What is climate change, and how does it affect us?
- Why do different parts of the world have different climates?
- What role does the atmosphere play in weather and climate?
- Has Earth's atmosphere always been the same as it is today?
- What is contributing to the current global warming?
- Is the growth of Sunbeam City affecting its weather, atmosphere, and water availability?
- How can we predict weather?
- How is daily weather data different from seasonal weather data?
- How have severe weather events affected your region?
- What percent of Earth's surface is covered in water?

Enduring Understandings

Anchoring Phenomenon:

Weather seems to be getting more extreme.
Some celestial bodies are moving and some only appear to move.

- The impacts of climate change are widespread and diverse.
- Climate is influenced by many factors and varies by location. Climate also changes over time.
- Human activities, such as the release of greenhouse gases into the atmosphere, have contributed to current global warming. This is causing changes to climates around the world.
- Weather conditions vary from day to day, month to month, and across seasons.
- Sometimes weather conditions can be severe, causing damage to property and loss of life.
- Weather patterns are influenced by the movement of water in the atmosphere. This movement is determined by winds, landforms, and ocean temperatures and currents.

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● What is the pattern of prevailing winds around Earth? ● How will you design instruments to measure wind speed and direction? ● How can weather maps be used to forecast weather? ● What causes differences in weather and climate? ● How is daily weather data different from seasonal weather data? ● How have severe weather events affected your region? ● Does the distribution of climates show any regional or global patterns? ● What percent of Earth's surface is covered in water? ● How do different surfaces on Earth gain and lose thermal energy? ● How do ocean temperatures vary over the surface of Earth? ● How does water behave when it mixes? ● How do oceans affect climate? ● Why do different parts of the world have different climates? ● What is the pattern of prevailing winds around Earth? ● How can a weather map be used to forecast weather? ● What role does the atmosphere play in weather and climate? ● How can we learn more about space? ● What have we learned from missions to space? ● Which mission to Titan should we fund, and why? ● How can we use observations and models to understand the Moon phases? ● How can we predict changes in the Moon's appearance? ● What causes the cycle of the Moon's phases that we observe from Earth? ● How does the Moon's orbit around Earth cause the Moon's phases to repeat around every 29 days? ● Why don't we see lunar and solar eclipses more often? ● Why does the Sun's path through the sky change over the year, and how does that change relate to seasons? ● What do you observe about the length of daylight and the position of the Sun in the sky over the course of a year? ● What does Earth's orbit around the Sun have to do with seasons? ● Why does Earth's tilt cause different places on Earth to receive different amounts of energy from the Sun? ● Why does Earth have seasons? ● What are the other objects in our universe, and how far away are they? ● What types of objects are found in space? ● How can a scale model help us understand distances between objects in our Solar System? ● How can you make a scale model showing the sizes of all of the planets? ● What features make each planet in our Solar System unique? ● What determines how objects move in space?	● Weather data are collected by a variety of instruments. These data can be used to forecast upcoming weather conditions (e.g., when different air masses collide at warm and cold fronts). ● Since many factors interact to influence the weather at a particular location, weather can only be predicted probabilistically. ● Climates are described by the same conditions used to describe weather, and represent the average weather in a location over a long period of time. ● Climate patterns vary by latitude, altitude, and geographic land distribution. ● Oceans have an important effect on climate. They absorb energy from the Sun, with the water nearest the equator warming up much more than water at higher latitudes. ● Variations in density due to variations in temperature and salinity drive a global pattern of interconnected ocean currents that redistribute thermal energy. ● The atmosphere also has currents that move air and water from one place to another. ● Air and water are also driven by energy from the Sun and, as with ocean currents, are influenced by the Coriolis effect, which is a result of the Earth's rotation. The resulting pattern of prevailing winds affects regional weather and climate. ● The way that Earth's atmosphere interacts with the Sun's energy and the oceans thus helps determine Earth's average temperature and its different climate zones. ● Space is vast and mysterious. ● Astronomers learn about objects in space by making observations. ● While we are able to learn a lot about space just from making observations with Earth-based technologies, sending spacecraft to collect data from out in space has been invaluable to helping us better understand our universe. ● The Moon appears to change its shape over time. ● The earliest astronomers did not have any specialized technologies to help them observe the universe, but even they were able to observe and recognize naturally occurring astronomical patterns that allowed them to predict phenomena such as full moons and lunar eclipses. ● Without even traveling off of Earth's surface, we too can observe how the Moon's phases change over time and model why these phases have the appearances we observe from Earth. ● These observations can help us understand that the Moon orbits Earth and that its orbital plane around Earth is tilted relative to Earth's orbital plane around the Sun such that only at very specific times do the Sun, Earth, Moon align correctly to create solar or lunar eclipses.

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• What determines the amount of gravitational force between objects? • How does gravity affect the motions of objects in space? • How can models help us understand the role of gravity in the motion of space objects?	• The Sun has a different path through the sky during different seasons. • The Sun's path through the sky changes over the course of the year. These changes correspond to the amount of daylight hours people experience at different places on Earth. • To help understand why this is, we can model how Earth rotates on its axis while it orbits the Sun. By doing this, we can observe that Earth's axis is tilted relative to its orbital plane around the Sun. This tilt not only changes the Sun's apparent path through the sky over the course of the year, but it is also responsible for the differential heating of Earth's surfaces over that same period, which is what causes the seasons. If the Earth had no tilt, there would be no seasons. • There are other objects in the sky besides the Moon and the Sun. • With an understanding of the Sun– Earth–Moon system, we can look out farther in our Solar System and see that there are other objects that appear to move relative to the background stars. Some of these objects are planets, some are asteroids, and some are moons of other planets. • Advances in technology over time have allowed us to look more closely at these other bodies, especially those in our Solar System. • Using mathematical techniques with these technologies has allowed scientists to determine how far away these planets are and how big they are. • To get a better sense of the size and scale of these planets, we can analyze our collected data to make representations of the scale properties of these planets. We can look at both their sizes and their distances scaled down to more-understandable scales, thus allowing us to get a better sense of the magnitude of space. • While many objects look the same from night to night, some objects appear to move. • If we continue to watch the planets from night to night and year to year, we will notice that their movements follow certain patterns. Gravity causes these predictable motions within our Solar System. Anything with mass attracts other things to it because of its gravitational field. • This gravitational field changes based on how massive the objects are and how far away they are from each other. More massive objects produce stronger gravitational fields, and if an object moves closer to another object, the gravitational pull between the two objects increases. This property not only allows planets to stay in motion around the Sun, but it is also responsible for the formation of our entire Solar System. • Our Solar System is one of many in our Galaxy, the Milky Way. In fact, all of the individual stars we see in the night sky are in our Galaxy. A galaxy is a group of stars gravitationally orbiting a massive center.

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	• The motion of stars within our Galaxy and planets within our Solar System can be modeled and predicted through an understanding of gravity. • Humans have been able to learn all of this because of technologies developed over the centuries and missions launched by space-interested agencies. • Patterns of the apparent motion of the sun, the moon, and stars in the sky can be observed, described, predicted, and explained with models. (MS-ESS1-1) • Earth and its solar system are part of the Milky Way galaxy, which is one of many galaxies in the universe. (MS-ESS1-2) • The solar system consists of the sun and a collection of objects, including planets, their moons, and asteroids that are held in orbit around the sun by its gravitational pull on them. (MS-ESS1-2), (MSESS1-3) • This model of the solar system can explain eclipses of the sun and the moon. Earth's spin axis is fixed in direction over the short-term but tilted relative to its orbit around the sun. The seasons are a result of that tilt and are caused by the differential intensity of sunlight on different areas of Earth across the year. (MS-ESS1-1) • The solar system appears to have formed from a disk of dust and gas, drawn together by gravity. (MS-ESS1-2)

Unit 3 Weather and Climate: Life and Physical Sciences

NJSLS Science Content Standards - Arranged by Disciplinary Core idea (DCI)

Students who demonstrate understanding can:

MS-ESS2: Earth's Systems

- **MS-ESS2-5** Collect data to provide evidence for how the motions and complex interactions of air masses result in changes in weather conditions. [Clarification Statement: Emphasis is on how air masses flow from regions of high pressure to low pressure, causing weather (defined by temperature, pressure, humidity, precipitation, and wind) at a fixed location to change over time, and how sudden changes in weather can result when different air masses collide. Emphasis is on how weather can be predicted within probabilistic ranges. Examples of data can be provided to students (such as weather maps, diagrams, and visualizations) or obtained through laboratory experiments (such as with condensation).] [Assessment Boundary: Assessment does not include recalling the names of cloud types or weather symbols used on weather maps or the reported diagrams from weather stations.]
- **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. [Clarification Statement: Emphasis is on how patterns vary by latitude, altitude, and geographic land distribution. Emphasis of atmospheric circulation is on the sunlight-driven latitudinal banding, the Coriolis effect, and resulting prevailing winds; emphasis of ocean circulation is on the transfer of heat by the global ocean convection cycle, which is constrained by the Coriolis effect and the outlines of continents. Examples of models can be diagrams, maps and globes, or digital representations.] [Assessment Boundary: Assessment does not include the dynamics of the Coriolis effect.]

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Unit 3 Weather and Climate: Life and Physical Sciences

NJSLS Science Content Standards - Arranged by Disciplinary Core idea (DCI)

ESS3: Earth and Human Activity

- **MS-ESS3-5** Ask questions to clarify evidence of the factors that have caused climate change over the past century. [Clarification Statement: Examples of factors include human activities (such as fossil fuel combustion, cement production, and agricultural activity) and natural processes (such as changes in incoming solar radiation or volcanic activity). Examples of evidence can include tables, graphs, and maps of global and regional temperatures, atmospheric levels of gases such as carbon dioxide and methane, and the rates of human activities. Emphasis is on the major role that human activities play in causing the rise in global temperatures.]

MS-ETS1: Engineering Design

- **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.

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. [Clarification Statement: Examples of models can be physical, graphical, or conceptual.]
- **MS-ESS1-2** Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system. [Clarification Statement: Emphasis for the model is on gravity as the force that holds together the solar system and Milky Way galaxy and controls orbital motions within them. Examples of models can be physical (such as the analogy of distance along a football field or computer visualizations of elliptical orbits) or conceptual (such as mathematical proportions relative to the size of familiar objects such as students' school or state).] [Assessment Boundary: Assessment does not include Kepler's Laws of orbital motion or the apparent retrograde motion of the planets as viewed from Earth.]
- **MS-ESS1-3** Analyze and interpret data to determine scale properties of objects in the solar system. [Clarification Statement: Emphasis is on the analysis of data from Earth-based instruments, space based telescopes, and spacecraft to determine similarities and differences among solar system objects. Examples of scale properties include the sizes of an object's layers (such as crust and atmosphere), surface features (such as volcanoes), and orbital radius. Examples of data include statistical information, drawings and photographs, and models.] [Assessment Boundary: Assessment does not include recalling facts about properties of the planets and other solar system bodies.]

Science and Engineering Practices

Asking Questions and Defining Problems

- Asking questions and defining problems in grades 6–8 builds on grades K–5 experiences and progresses to specifying relationships between variables and clarifying arguments and models.
    - Ask questions to identify and clarify evidence of an argument. (MS-ESS3-5)

Developing and Using Models

- Modeling in 6–8 builds on K–5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems.
    - Develop and use a model to describe phenomena. (MS-ESS2-6)
    - Develop and use a model to describe phenomena. (MS-ESS1-1), (MS-ESS1-2)
    - Develop a model to generate data to test ideas about designed systems, including those representing inputs and outputs. (MS-ETS1-4)

Planning and Carrying Out Investigations

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Unit 3 Weather and Climate: Life and Physical Sciences

NJSLS Science Content Standards - Arranged by Disciplinary Core idea (DCI)

- Planning and carrying out investigations in 6–8 builds on K–5 experiences and progresses to include investigations that use multiple variables and provide evidence to support explanations or solutions.
    - Collect data to produce data to serve as the basis for evidence to answer scientific questions or test design solutions under a range of conditions. (MS-ESS2-5)

Analyzing and Interpreting Data

- Analyzing data in 6–8 builds on K–5 experiences and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis.
    - Analyze and interpret data to determine similarities and differences in findings. (MS-ESS1-3), (MS-ETS1-3)

Disciplinary Core Ideas

ESS1.B: Earth and the Solar System

- The solar system consists of the sun and a collection of objects, including planets, their moons, and asteroids that are held in orbit around the sun by its gravitational pull on them. (MS-ESS1-2), (MS-ESS1-3)
- This model of the solar system can explain eclipses of the sun and the moon. Earth's spin axis is fixed in direction over the short-term but tilted relative to its orbit around the sun. The seasons are a result of that tilt and are caused by the differential intensity of sunlight on different areas of Earth across the year. (MS-ESS1-1)
- The solar system appears to have formed from a disk of dust and gas, drawn together by gravity. (MS-ESS1-2)

ESS2.C: The Roles of Water in Earth's Surface Processes

- The complex patterns of the changes and the movement of water in the atmosphere, determined by winds, landforms, and ocean temperatures and currents, are major determinants of local weather patterns. (MS-ESS2-5)
- Variations in density due to variations in temperature and salinity drive a global pattern of interconnected ocean currents. (MS-ESS2-6)

ESS2.D: Weather and Climate

- Weather and climate are influenced by interactions involving sunlight, the ocean, the atmosphere, ice, landforms, and living things. These interactions vary with latitude, altitude, and local and regional geography, all of which can affect oceanic and atmospheric flow patterns. (MS-ESS2-6)
- Because these patterns are so complex, weather can only be predicted probabilistically. (MS-ESS2-5)
- The ocean exerts a major influence on weather and climate by absorbing energy from the sun, releasing it over time, and globally redistributing it through ocean currents. (MS-ESS2-6)

ESS3.D: Global Climate Change

- Human activities, such as the release of greenhouse gases from burning fossil fuels, are major factors in the current rise in Earth's mean surface temperature (global warming). Reducing the level of climate change and reducing human vulnerability to whatever climate changes do occur depend on the understanding of climate science, engineering capabilities, and other kinds of knowledge, such as understanding of human behavior and on applying that knowledge wisely in decisions and activities. (MS-ESS3-5)

ETS1.B: Developing Possible Solutions

- A solution needs to be tested, and then modified on the basis of the test results, in order to improve it. (MS-ETS1-4)
- There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem. (MS-ETS1-3)
- Sometimes parts of different solutions can be combined to create a solution that is better than any of its predecessors. (MS-ETS1-3)
- Models of all kinds are important for testing solutions. (MS-ETS1-4)

ETS1.C: Optimizing the Design Solution

Unit 3 Weather and Climate: Life and Physical Sciences

NJSLS Science Content Standards - Arranged by Disciplinary Core idea (DCI)

- Although one design may not perform the best across all tests, identifying the characteristics of the design that performed the best in each test can provide useful information for the redesign process—that is, some of those characteristics may be incorporated into the new design. (MS-ETS1-3)
- The iterative process of testing the most promising solutions and modifying what is proposed on the basis of the test results leads to greater refinement and ultimately to an optimal solution. (MS-ETS1-4)

Crosscutting Concepts

Cause and Effect

- Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-ESS2-5)

Systems and System Models

- Models can be used to represent systems and their interactions. (MS-ESS1-2)

Energy and Matter

- W

Stability and Change

- Stability might be disturbed either by sudden events or gradual changes that accumulate over time. (MS-ESS3-5)

Connections to Engineering, Technology, and Applications of Science

Interdependence of Science, Engineering, and Technology

- Engineering advances have led to important discoveries in virtually every field of science and scientific discoveries have led to the development of entire industries and engineered systems. (MS-ESS1-3)

Connections to Nature of Science

Scientific Knowledge Assumes an Order and Consistency in Natural Systems

- Science assumes that objects and events in natural systems occur in consistent patterns that are understandable through measurement and observation. (MS-ESS1-1), (MS-ESS1-2)

Student Learning Objectives

Students will be able to...

- Students will be able to explain that scientists record patterns of the weather
- Students will be able to make predictions about what kind of weather might happen next.
- Students will be able to demonstrate that climate describes a range of an area's typical temperature and precipitation conditions.
- Students will be able to explain weather conditions and the extent to which those conditions vary over years.
- Students will be able to communicate that a variety of natural hazards result from natural processes.
- Students will be able to understand that humans cannot eliminate natural hazards.

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Students will be able to…

- 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.
- Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system.
- Analyze and interpret data to determine scale properties of objects in the solar system.
- Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process.
- Construct an 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

Integrated Accommodations and Modifications		
Special Education Students	**English Language Learners**	**At Risk**
• Utilize modifications & accommodations delineated in the student's IEP • Provide additional manipulatives to support instruction • Allow for alternative strategies to solve algorithms or tasks • Provide the steps needed to complete the task • Model frequently • Provide repetition and practice. • Use visuals to demonstrate/model the processes • Restate, reread, and clarify directions/questions • Ask students to restate information, directions, and assignments. • Provide copy of class notes • Distribute study guide for classroom tests. • Provide preferential seating to be mutually determined by the student and teacher • Provide extra textbooks for home. • Provide regular parent/ school communication • Allow extended time to complete assignment • Establish procedures for accommodations / modifications for assessments • Allow student to take/complete tests in an alternate setting as needed	WIDA Can Do Descriptors https://wida.wisc.edu/teach/can-do/descriptors • Modify Assignments • Use testing and portfolio assessment • Utilize Native Language Translation (peer, online assistive technology, translation device, bilingual dictionary) • Repeat, rephrase, paraphrase key concepts and directions • Allow for extended time for assignment completion as needed • Highlight key vocabulary • Define essential vocabulary in context • Use graphic organizers, visuals, manipulatives and other concrete materials • Use gestures, facial expressions and body language • Read aloud • Build on what students already know and prior experience	• Pair visual prompts with verbal presentations • Ask students to restate information, directions, and assignments. • Provide repetition and practice • Model skills / techniques to be mastered. • Provide extended time to complete class work • Provide copy of class notes • Provide preferential seating to be mutually determined by the student and teacher • Allow the use of a computer to complete assignments. • Establish expectations for correct spelling on assignments • Provide extra textbooks for home. • Provide Peer Support • Increase one on one time

Appendix A: Special Education Accommodations and Modifications		

Gifted and Talented Students	504 Plan
• Utilize advanced, accelerated, or compacted content • Provide assignments that emphasize higher- level thinking skills. • Allow for individual student interest • Gear assignments to development in areas of affect, creativity, cognition, and research skills • Allow for a variety in types of resources • Provide problem-based assignments with planned scope and sequence • Utilize inquiry-based instruction • Adjust the pace of lessons • Utilize Choice Boards • Provide Problem-Based Learning • Establish flexible Grouping	• Pair visual prompts with verbal presentations • Ask students to restate information, directions, and assignments. • Provide repetition and practice • Model skills / techniques to be mastered. • Provide extended time to complete class work • Provide copy of class notes • Break long assignments into smaller parts • Assist student in setting short term goals • Allow for preferential seating to be mutually determined by the student and teacher • Provide extra textbooks for home. • Model and reinforce organizational systems (i.e. color-coding) • Write out homework assignments, check student's recording of assignments
Interdisciplinary Connections	**Computer Science and Design Thinking**
Connections to NJSLS - English Language Arts *Reading* • RST.6-8.1 Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions . (MS-ESS1-3), (MS-ESS1-4), (MS-ESS2-5), (MS-ESS3-5), (MS-ETS1-3) • RST.6-8.7 Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table). (MS-ESS1-3), (MS-ETS1-3) • RST.6-8.9 Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic. (MS-ESS2-5), (MS-ETS1-3) *Writing* • WHST.6-8.8 Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation. (MS-ESS2-5)	**Computer Science and Design Thinking Practices** 15. ✓ Fostering an Inclusive Computing and Design Culture 16. ✓ Collaborating Around Computing and Design 17. ✓ Recognizing and Defining Computational Problems 18. ✓ Developing and Using Abstractions 19. ✓ Creating Computational Artifacts 20. ✓ Testing and Refining Computational Artifacts 21. ✓ Communicating About Computing and Design Computer Science and Design Thinking Standards **8.1 Computer Science** *Data and Analysis* • People use digital devices and tools to automate the collection, use, and transformation of data. The manner in which data is collected and transformed

Speaking and Listening

- SL.8.5 Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest. (MS-ESS1-3), (MS-ESS2-6), (MS-ETS1-4)

Connections to NJSLS - Mathematics

- MP.2 Reason abstractly and quantitatively. (MS-ESS1-3), (MS-ESS2-5), (MS-ESS3-5), (MS-ETS1-3), (MS-ETS1-4)
- MP.4 Model with mathematics. (MS-ESS1-1), (MS-ESS1-2)
- 6.NS.C.5 Understand that positive and negative numbers are used together to describe quantities having opposite directions or values (e.g., temperature above/below zero, elevation above/below sea level, credits/debits, positive/negative electric charge); use positive and negative numbers to represent quantities in real-world contexts, explaining the meaning of 0 in each situation. (MS-ESS2-5)
- 6.RP.A.1 Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. (MS-ESS1-1), (MS-ESS1-2), (MS-ESS1-3)
- 7.RP.A.2 Recognize and represent proportional relationships between quantities. (MS-ESS1-1), (MS-ESS1-2), (MS-ESS1-3)
- 6.EE.B.6 Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set. (MS-ESS1-2), (MS-ESS3-5)
- 7.EE.3 Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies. (MS-ETS1-3)

is influenced by the type of digital device(s) available and the intended use of the data.

  - 8.1.8.DA.1: Organize and transform data collected using computational tools to make it usable for a specific purpose.
- Computer models can be used to simulate events, examine theories and inferences, or make predictions.
  - 8.1.8.DA.5: Test, analyze, and refine computational models.
  - 8.1.8.DA.6: Analyze climate change computational models and propose refinements.

8.2 Design Thinking

Engineering Design

- Engineering design is a systematic, creative, and iterative process used to address local and global problems. The process includes generating ideas, choosing the best solution, and making, testing, and redesigning models or prototypes.
  - 8.2.8.ED.1: Evaluate the function, value, and aesthetics of a technological product or system, from the perspective of the user and the producer.
  - 8.2.8.ED.2: Identify the steps in the design process that could be used to solve a problem.
  - 8.2.8.ED.3: Develop a proposal for a solution to a real-world problem that includes a model (e.g., physical prototype, graphical/technical sketch).
  - 8.2.8.ED.4: Investigate a malfunctioning system, identify its impact, and explain the step-by-step process used to troubleshoot, evaluate, and test options to repair the product in a collaborative team
- Engineering design requirements and specifications involve making trade-offs between competing requirements and desired design features.
  - 8.2.8.ED.5: Explain the need for optimization in a design process.
  - 8.2.8.ED.6: Analyze how trade-offs can impact the design of a product.
  - 8.2.8.ED.7: Design a product to address a real-world problem and document the iterative design process, including decisions made as a result of specific constraints and trade-offs (e.g., annotated sketches)

Interaction of Technology and Humans

- Economic, political, social and cultural aspects of society drive development of new technological products, processes, and systems.
  - 8.2.8.ITH.1: Explain how the development and use of technology influences economic, political, social, and cultural issues.

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• 7.EE.B.4 Use variables to represent quantities in a real-world or mathematical problem and construct simple equations and inequalities to solve problems by reasoning about the quantities. (MS-ESS3-5) • 7.EE.B.6 Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities. (MS-ESS1-2) • 7.SP Develop a probability model and use it to find probabilities of events. Compare probabilities from a model to observed frequencies; if the agreement is not good, explain possible sources of the discrepancy. (MS-ETS1-4)	• Technology interacts with society, sometimes bringing about changes in a society's economy, politics, and culture, and often leading to the creation of new needs and wants. New needs and wants may create strains on local economies and workforces. Improvements in technology are intended to make the completion of tasks easier, safer, and/or more efficient ○ 8.2.8.ITH.2: Compare how technologies have influenced society over time. ○ 8.2.8.ITH.3: Evaluate the impact of sustainability on the development of a designed product or system. ○ 8.2.8.ITH.4: Identify technologies that have been designed to reduce the negative consequences of other technologies and explain the change in impact. ○ 8.2.8.ITH.5: Compare the impacts of a given technology on different societies, noting factors that may make a technology appropriate and sustainable in one society but not in another. *Nature of Technology* • Technology advances through the processes of innovation and invention which relies upon the imaginative and inventive nature of people. Sometimes a technology developed for one purpose is adapted to serve other purposes. Engineers use a systematic process of creating or modifying technologies that is fueled and constrained by physical laws, cultural norms, and economic resources. Scientists use systematic investigation to understand the natural world. ○ 8.2.8.NT.1: Examine a malfunctioning tool, product, or system and propose solutions to the problem. ○ 8.2.8.NT.2: Analyze an existing technological product that has been repurposed for a different function. ○ 8.2.8.NT.3: Examine a system, consider how each part relates to other parts, and redesign it for another purpose. ○ 8.2.8.NT.4: Explain how a product designed for a specific demand was modified to meet a new demand and led to a new product. *Effects of Technology on the Natural World* • Resources need to be utilized wisely to have positive effects on the environment and society. Some technological decisions involve tradeoffs between environmental and economic needs, while others have positive effects for both the economy and environment. ○ 8.2.8.ETW.1: Illustrate how a product is upcycled into a new product and analyze the short- and long-term benefits and costs. ○ 8.2.8.ETW.2: Analyze the impact of modifying resources in a product or system (e.g., materials, energy, information, time, tools, people, capital).

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	○ 8.2.8.ETW.3: Analyze the design of a product that negatively impacts the environment or society and develop possible solutions to lessen its impact. ○ 8.2.8.ETW.4: Compare the environmental effects of two alternative technologies devised to address climate change issues and use data to justify which choice is best.

Career Readiness, Life Literacies and Key Skills

Career Readiness, Life Literacies and Key Skills Practices

- Act as a responsible and contributing community member and employee.
- Attend to financial well-being.
- Consider the environmental, social and economic impacts of decisions.
- Demonstrate creativity and innovation.
- Utilize critical thinking to make sense of problems and persevere in solving them.
- Model integrity, ethical leadership and effective management.
- Plan education and career paths aligned to personal goals.
- Use technology to enhance productivity, increase collaboration and communicate effectively.
- Work productively in teams while using cultural/global competence.

Career Readiness, Life Literacies and Key Skills Standards
9.1 Personal Financial Literacy
Civic Financial Responsibility

- Individuals can use their talents, resources, and abilities to give back.
  - 9.1.8.CR.2: Compare various ways to give back through strengths, passions, goals, and other personal factors.

9.2 Career Awareness, Exploration, Preparation, and Training

Career Awareness and Planning

- Different types of jobs require different knowledge and skills.
  - 9.1.2.CAP.1: Make a list of different types of jobs and describe the skills associated with each job.
- An individual’s passions, aptitude and skills can affect his/her employment and earning potential.
  - 9.2.5.CAP.1: Evaluate personal likes and dislikes and identify careers that might be suited to personal likes.
  - 9.2.5.CAP.2: Identify how you might like to earn an income.
  - 9.2.5.CAP.3: Identify qualifications needed to pursue traditional and non-traditional careers and occupations.
  - 9.2.5.CAP.4: Explain the reasons why some jobs and careers require specific training, skills, and certification (e.g., life guards, child care, medicine, education) and examples of these requirements..
- An individual’s strengths, lifestyle goals, choices, and interests affect employment and income
  - 9.2.8.CAP.2: Develop a plan that includes information about career areas of interest.

  - 9.2.8.CAP.3: Explain how career choices, educational choices, skills, economic conditions, and personal behavior affect income.
- There are a variety of resources available to help navigate the career planning process
  - 9.2.8.CAP.12: Assess personal strengths, talents, values, and interests to appropriate jobs and careers to maximize career potential.

9.4 Life Literacies and Key Skills

Creativity and Innovation

- Gathering and evaluating knowledge and information from a variety of sources, including global perspectives, fosters creativity and innovative thinking.
  - 9.4.8.CI.1: Assess data gathered on varying perspectives on causes of climate change (e.g., crosscultural, gender-specific, generational), and determine how the data can best be used to design multiple potential solutions (e.g., RI.7.9, 6.SP.B.5, 7.1.NH.IPERS.6, 8.2.8.ETW.4).
  - 9.4.8.CI.2: Repurpose an existing resource in an innovative way (e.g., 8.2.8.NT.3).
  - 9.4.8.CI.3: Examine challenges that may exist in the adoption of new ideas (e.g., 2.1.8.SSH, 6.1.8.CivicsPD.2).
  - 9.4.8.CI.4: Explore the role of creativity and innovation in career pathways and industries.

Critical Thinking and Problem-solving

- Multiple solutions often exist to solve a problem.
  - 9.4.8.CT.1: Evaluate diverse solutions proposed by a variety of individuals, organizations, and/or agencies to a local or global problem, such as climate change, and use critical thinking skills to predict which one(s) are likely to be effective (e.g., MS-ETS1-2).
  - 9.4.8.CT.2: Develop multiple solutions to a problem and evaluate short- and long-term effects to determine the most plausible option (e.g., MS-ETS1-4, 6.1.8.CivicsDP.1)
- An essential aspect of problem solving is being able to self-reflect on why possible solutions for solving problems were or were not successful.
  - 9.4.8.CT.3: Compare past problem-solving solutions to local, national, or global issues and analyze the factors that led to a positive or negative outcome.

Digital Citizenship

- Detailed examples exist to illustrate crediting others when incorporating their digital artifacts in one's own work.
  - 9.4.8.DC.1: Analyze the resource citations in online materials for proper use.
  - 9.4.8.DC.2: Provide appropriate citation and attribution elements when creating media products (e.g., W.6.8)
- Digital technology and data can be leveraged by communities to address effects of climate change.
  - 9.4.8.DC.8: Explain how communities use data and technology to develop measures to respond to effects of climate change (e.g., smart cities).

Global and Cultural Awareness

- Awareness of and appreciation for cultural differences is critical to avoid barriers to productive and positive interaction
  - 9.4.8.GCA.1: Model how to navigate cultural differences with sensitivity and respect (e.g., 1.5.8.C1a).
  - 9.4.8.GCA.2: Demonstrate openness to diverse ideas and perspectives through active discussions to achieve a group goal.

Information and Media Literacy

- Increases in the quantity of information available through electronic means have heightened the need to check sources for possible distortion, exaggeration, or misrepresentation.
  - 9.4.8.IML.1: Critically curate multiple resources to assess the credibility of sources when searching for information.
  - 9.4.8.IML.2: Identify specific examples of distortion, exaggeration, or misrepresentation of information.
- Digital tools make it possible to analyze and interpret data, including text, images, and sound. These tools allow for broad concepts and data to be more effectively communicated.
  - 9.4.8.IML.3: Create a digital visualization that effectively communicates a data set using formatting techniques such as form, position, size, color, movement, and spatial grouping (e.g., 6.SP.B.4, 7.SP.B.8b).
  - 9.4.8.IML.4: Ask insightful questions to organize different types of data and create meaningful visualizations.

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- Sources of information are evaluated for accuracy and relevance when considering the use of information.
    - 9.4.8.IML.8: Apply deliberate and thoughtful search strategies to access high-quality information on climate change (e.g., 1.1.8.C1b).
- There is a need to produce and publish media that has information supported with quality evidence and is intended for authentic audiences.
    - 9.4.8.IML.12: Use relevant tools to produce, publish, and deliver information supported with evidence for an authentic audience.

Technology Literacy

- Some digital tools are appropriate for gathering, organizing, analyzing, and presenting information, while other types of digital tools are appropriate for creating text, visualizations, models, and communicating with others
    - 9.4.8.TL.2: Gather data and digitally represent information to communicate a real-world problem (e.g., MS-ESS3-4, 6.1.8.EconET.1, 6.1.8.CivicsPR.4).
    - 9.4.8.TL.3: Select appropriate tools to organize and present information digitally.
    - 9.4.8.TL.4: Synthesize and publish information about a local or global issue or event (e.g., MS-LS4-5, 6.1.8.CivicsPI.3).

Climate Change
MS-ESS3-5 Ask questions to clarify evidence of the factors that have caused climate change over the past century.
SEL Competencies

- **Self - Awareness**
- **Self - Management**
- **Social Awareness**
- **Responsible Decision Making**
- **Relationship Skills**

https://www.nj.gov/education/safety/wellness/selearning/index.shtml

District/School Formative Assessment Plan	**District/School Summative Assessment Plan**
Formative assessment informs instruction and is ongoing throughout a unit to determine how students are progressing against the standards. Teachers are encouraged to incorporate Formative Assessments into all lessons. During instruction, teachers will collect ongoing information on students' mastery of content through a variety of methods: ● Questioning: using Socratic method, probing questions, a hierarchical system in complexity (Bloom's Taxonomy) ● Exit tickets, rotational activities (stations), quizzes, and small group activities ● Classwork, homework, group work (formative assessment) ● Pre-Assessment, teacher's observation, class discussion, and journal	*Summative assessment is an opportunity for students to demonstrate mastery of the skills taught during a particular unit.* **Benchmark Assessments:** ● Assessment 1.1: Mid-Unit Assessment ● Assessment 1.2: End of Unit Assessment ● Assessment 1.3: End of Unit Performance Assessment **Standardized Assessments:** ● NJSLA **Other Summative Assessments:** Teachers are encouraged to design and their own assessments (topic/module tests and quizzes) individually and/or

	with their department or grade-level partners, as per Uniform Grading Profile.

Targeted Academic Vocabulary
Space, solar system, sun, moon, celestial, planet, star, solar, eclipse, lunar, phases of the moon, pattern, cyclic, rotation, orbit, tilt, pole, seasons, gravity, mass, galaxy, meteor, asteroid, comet, Milky Way Galaxy, universe, atmosphere, ocean currents, circulation, air mass, pressure, weather, humidity, temperature, precipitation, condensation, latitude, altitude, Coriolis effect,

District/School Tasks	District/School Primary and Supplementary Resources
• Common Formative Assessments • Common District Summative Assessments • See above Assessment Sections for more information	**District-Mandated Resources** • Lab-Aides Curriculum **Assessment Resources:** • Available on Lab-Aides.com • For additional resources, log in to https://edconnectnj.schoolnet.com **Other Resources:** • Generation Genius; "Solar and Lunar Eclipses", "Causes of Seasons", "Gravitational Forces between Objects", "Water Cycle", "The Solar System", "Climate Zones and Ocean Currents", "Air Masses and Weather Fronts", "Predicting Natural Disasters" • Warm-Up Activities: Amistad Activity, SEL Activity, Holocaust Activity, Climate Change Activity, LGBTQ+/Disabilities • Current Events, Articles: Readworks, Newsela, Scholastic Magazine (Science World) • Simulations, Videos, Games: Scholastic Study Jams, The Science Spot, PBS Learning Media, PhET, Gizmos • Activities and Lessons: Discovery Education Techbook, Steve Spangler, Kesler Science, Science Buddies, Generation Genius • Youtube Channels (MooMooMath and Science,TedEd, CrashCourse, Sick Science, Teacher's Pet, etc.) • NASA (galaxies, stars, planets, etc.) • NOAA • Tides

	Project Ideas: ● 3D Models of the Earth-Sun-Moon System ● Researching famous climate scientists and astronauts, etc (Suggested relevant famous scientists: Mae Carol Jemison, Niel DeGrasse Tyson, Mario Molina, Steven Hawking)
Instructional Best Practices and Exemplars	
See Appendix A for Instructional Best Practices and Exemplars	
Pacing Guide	
Grade 6 Pacing Guide	

Appendix A: **Instructional Best Practices and Exemplars**

Appendix A: Instructional Best Practices and Exemplars: Unit 1

Appendix A: Instructional Best Practices and Exemplars: Unit 2

Appendix A: Instructional Best Practices and Exemplars: Unit 3

Appendix B:

Exemplars and Explanations

Appendix B: Instructional Exemplars and Explanations: Unit 1

Appendix B: Instructional Exemplars and Explanations: Unit 2

Appendix B: Instructional Exemplars and Explanations: Unit 3

Appendix C:

<subject> Classroom Philosophy, Schedule, Structure, and Expectations