Willingboro
Public Schools

"Where Excellence is the Expectation"

Willingboro Public Schools
Grade 7 Science

Revised June, 2022
Jennifer Brandon - Supervisor of Science

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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.

Course Sequence/Table of Contents:

Click here for the Grade 7 Science Pacing Guide.

Within each unit, please find:

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Overview	Content Standards - Arranged by Disciplinary Core Idea (DCI) *Students who demonstrate understanding can:*	Unit Focus
Unit 1 **From Cells to Body Systems to Organisms**	**MS-LS1: From Molecules to Organisms: Structures and Processes** ● **MS-LS1-1** Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells. [Clarification Statement: Emphasis is on developing evidence that living things are made of cells, distinguishing between living and non-living things, and understanding that living things may be made of one cell or many and varied cells.] ● **MS-LS1-2** Develop and use a model to describe the function of a cell as a whole and ways parts of cells contribute to the function. [Clarification Statement: Emphasis is on the cell functioning as a whole system and the primary role of identified parts of the cell, specifically the nucleus, chloroplasts, mitochondria, cell membrane, and cell wall.] [Assessment Boundary: Assessment of organelle structure/function relationships is limited to the cell wall and cell membrane. Assessment of the function of the other organelles is limited to their relationship to the whole cell. Assessment does not include the biochemical function of cells or cell parts.] ● **MS-LS1-3** Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells. [Clarification Statement: Emphasis is on the conceptual understanding that cells form tissues and tissues form organs specialized for particular body functions. Examples could include the interaction of subsystems within a system and the normal functioning of those systems.] [Assessment Boundary: Assessment does not include the mechanism of one body system independent of others. Assessment is limited to the circulatory, excretory, digestive, respiratory, muscular, and nervous systems.] ● **MS-LS1-4** Use arguments based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively. [Clarification Statement: Examples of	In their study of public health, and preventing the spread and the treatment of infectious diseases, students will develop evidence and understand that living organisms are made of cells and that special structures are responsible for particular functions within organisms. Students develop a basic understanding of the role of cells in body systems, how those systems work to support the life of the organism, how interactions between body systems can be affected by disease, medications, and other factors, and how body systems function and interact in a healthy person and when a person is sick. Students will investigate organisms as different as humans, plants, and many of the microorganisms that make people sick are all made of cells. Examples include cells from various animal tissues like blood cells, plant cells, protozoa, and bacteria, including specific microorganisms that cause certain infectious diseases. Students generate and answer questions such as: How are the cells of various organisms alike? How are they different? How do these similarities and differences relate to the functions of these cells? In addition, students will examine the issue of the use of genetic information to make medical and health-related decisions. They will understand that most people have features more like their biological relatives than most other people, but even within a family, each person is unique. Examples explored include physical traits like eye color, genetic conditions like Marfan syndrome, the role of genes and the environment, and behavioral traits in humans and model organisms. Students generate and answer questions such as: What explains the similarities and differences between related individuals, from parents, to siblings, to identical twins?

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	behaviors that affect the probability of animal reproduction could include nest building to protect young from cold, herding of animals to protect young from predators, and vocalization of animals and colorful plumage to attract mates for breeding. Examples of animal behaviors that affect the probability of plant reproduction could include transferring pollen or seeds, and creating conditions for seed germination and growth. Examples of plant structures could include bright flowers attracting butterflies that transfer pollen, flower nectar and odors that attract insects that transfer pollen, and hard shells on nuts that squirrels bury.] • **MS-LS1-5** Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms. [Clarification Statement: Examples of local environmental conditions could include availability of food, light, space, and water. Examples of genetic factors could include large breed cattle and species of grass affecting growth of organisms. Examples of evidence could include drought decreasing plant growth, fertilizer increasing plant growth, different varieties of plant seeds growing at different rates in different conditions, and fish growing larger in large ponds than they do in small ponds.] [Assessment Boundary: Assessment does not include genetic mechanisms, gene regulation, or biochemical processes.] • **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.]	

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Overview	Content Standards - Arranged by Disciplinary Core Idea (DCI) *Students who demonstrate understanding can:*	Unit Focus
	MS-LS3: Heredity: Inheritance and Variation of Traits ● **MS-LS3-1** Develop and use a model to describe why structural changes to genes (mutations) located on chromosomes may affect proteins and may result in harmful, beneficial, or neutral effects to the structure and function of the organism. [Clarification Statement: Emphasis is on conceptual understanding that changes in genetic material may result in making different proteins.] [Assessment Boundary: Assessment does not include specific changes at the molecular level, mechanisms for protein synthesis, or specific types of mutations.] ● **MS-LS3-2** Develop and use a model to describe why asexual reproduction results in offspring with identical genetic information and sexual reproduction results in offspring with genetic variation. [Clarification Statement: Emphasis is on using models such as Punnett squares, diagrams, and simulations to describe the cause and effect relationship of gene transmission from parent(s) to offspring and resulting genetic variation.]	
Unit 1: ***Suggested Open Educational Resources***	● FOSS Next Generation Science Curriculum Resources ○ Think Link ○ Student Resource Books ● Generation Genius	
Unit 2 **Geological Processes**	**MS-ESS2: Earth's Systems** ● **MS-ESS2-1** Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process. [Clarification Statement: Emphasis is on the processes of melting, crystallization, weathering, deformation, and sedimentation, which act together to form minerals and rocks through the cycling of Earth's materials.] [Assessment Boundary: Assessment does not include the identification and naming of minerals.] ● **MS-ESS2-2** Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales. [Clarification Statement:	In this unit, students will study how natural hazards associated with geological processes have implications for the storage of nuclear waste. The Anchoring Phenomenon is that the Earth's surface changes over time. Examples explored include the role of water in changing earth's surface, the frequency, locations, and effects of earthquakes and volcanoes and their associated natural hazards, and the uneven distribution of natural resources on earth. Students generate and answer questions such as: How and why does Earth's surface change? Why are some places much more likely than others to have

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	Emphasis is on how processes change Earth's surface at time and spatial scales that can be large (such as slow plate motions or the uplift of large mountain ranges) or small (such as rapid landslides or microscopic geochemical reactions), and how many geoscience processes (such as earthquakes, volcanoes, and meteor impacts) usually behave gradually but are punctuated by catastrophic events. Examples of geoscience processes include surface weathering and deposition by the movements of water, ice, and wind. Emphasis is on geoscience processes that shape local geographic features, where appropriate.] ● **MS-ESS2-3** Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions. [Clarification Statement: Examples of data include similarities of rock and fossil types on different continents, the shapes of the continents (including continental shelves), and the locations of ocean structures (such as ridges, fracture zones, and trenches).] [Assessment Boundary: Paleomagnetic anomalies in oceanic and continental crust are not assessed.] **MS-ESS3: Earth and Human Activity** ● **MS-ESS3-1** Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes. [Clarification Statement: Emphasis is on how these resources are limited and typically nonrenewable, and how their distributions are significantly changing as a result of removal by humans. Examples of uneven distributions of resources as a result of past processes include but are not limited to petroleum (locations of the burial of organic marine sediments and subsequent geologic traps), metal ores (locations of past volcanic and hydrothermal activity associated with subduction zones), and soil (locations of active weathering and/or deposition of rock).] ● **MS-ESS3-2** Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects. [Clarification Statement: Emphasis is on how some natural hazards, such as	earthquakes or volcanoes? What happens where Earth's plates meet? How do geologic processes affect where resources are found?

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	volcanic eruptions and severe weather, are preceded by phenomena that allow for reliable predictions, but others, such as earthquakes, occur suddenly and with no notice, and thus are not yet predictable. Examples of natural hazards can be taken from interior processes (such as earthquakes and volcanic eruptions), surface processes (such as mass wasting and tsunamis), or severe weather events (such as hurricanes, tornadoes, and floods). Examples of data can include the locations, magnitudes, and frequencies of the natural hazards. Examples of technologies can be global (such as satellite systems to monitor hurricanes or forest fires) or local (such as building basements in tornado-prone regions or reservoirs to mitigate droughts).]	
Suggested Open Educational Resources	● FOSS Next Generation Science Curriculum Resources ○ Think Link ○ Student Resource Books ● Generation Genius	
Unit 3 **Force, Motion, Fields, and Interactions**	**MS-PS2: Motion and Stability: Forces and Interactions** ● **MS-PS2-1** Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects. [Clarification Statement: Examples of practical problems could include the impact of collisions between two cars, between a car and stationary objects, and between a meteor and a space vehicle.] [Assessment Boundary: Assessment is limited to vertical or horizontal interactions in one dimension.] ● **MS-PS2-2** Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object. [Clarification Statement: Emphasis is on balanced (Newton's First Law) and unbalanced forces in a system, qualitative comparisons of forces, mass and changes in motion (Newton's Second Law), frame of reference, and specification of units.] [Assessment Boundary: Assessment is limited to forces and changes in motion in one-dimension in an inertial reference frame and to	In this unit, students will study how natural hazards associated with geological processes have implications for the storage of nuclear waste. The Anchoring Phenomenon is that the Earth's surface changes over time. Examples explored include the role of water in changing earth's surface, the frequency, locations, and effects of earthquakes and volcanoes and their associated natural hazards, and the uneven distribution of natural resources on earth. Students generate and answer questions such as: How and why does Earth's surface change? Why are some places much more likely than others to have earthquakes or volcanoes? What happens where Earth's plates meet? How do geologic processes affect where resources are found?

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	change in one variable at a time. Assessment does not include the use of trigonometry.] ● **MS-PS2-3** Ask questions about data to determine the factors that affect the strength of electric and magnetic forces. [Clarification Statement: Examples of devices that use electric and magnetic forces could include electromagnets, electric motors, or generators. Examples of data could include the effect of the number of turns of wire on the strength of an electromagnet, or the effect of increasing the number or strength of magnets on the speed of an electric motor.] [Assessment Boundary: Assessment about questions that require quantitative answers is limited to proportional reasoning and algebraic thinking.] ● **MS-PS2-4** Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects. [Clarification Statement: Examples of evidence for arguments could include data generated from simulations or digital tools; and charts displaying mass, strength of interaction, distance from the Sun, and orbital periods of objects within the solar system.] [Assessment Boundary: Assessment does not include Newton's Law of Gravitation or Kepler's Laws.] ● **MS-PS2-5** Conduct an investigation and evaluate the experimental design to provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contact. [Clarification Statement: Examples of this phenomenon could include the interactions of magnets, electrically-charged strips of tape, and electrically-charged pith balls. Examples of investigations could include first-hand experiences or simulations.] [Assessment Boundary: Assessment is limited to electric and magnetic fields and limited to qualitative evidence for the existence of fields.] **MS-PS3: Energy** ● **MS-PS3-1** Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object. [Clarification Statement: Emphasis is on descriptive relationships between kinetic energy and mass separately from kinetic energy and speed.	

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Overview	Content Standards - Arranged by Disciplinary Core Idea (DCI) *Students who demonstrate understanding can:*	Unit Focus
	Examples could include riding a bicycle at different speeds, rolling different sizes of rocks downhill, and getting hit by a wiffle ball versus a tennis ball.] ● **MS-PS3-2** Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system. [Clarification Statement: Emphasis is on relative amounts of potential energy, not on calculations of potential energy. Examples of objects within systems interacting at varying distances could include: the Earth and either a roller coaster cart at varying positions on a hill or objects at varying heights on shelves, changing the direction/orientation of a magnet, and a balloon with static electrical charge being brought closer to a classmate's hair. Examples of models could include representations, diagrams, pictures, and written descriptions of systems.] [Assessment Boundary: Assessment is limited to two objects and electric, magnetic, and gravitational interactions.] **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.	
Unit 3:	● FOSS Next Generation Science Curriculum Resources ○ Think Link ○ Student Resource Books ● Generation Genius	

Overview	**Content Standards - Arranged by Disciplinary Core Idea (DCI)** *Students who demonstrate understanding can:*	**Unit Focus**
Suggested Open Educational Resources		

Unit 1 From Cells to Body Systems to Organisms: Life and Physical Sciences

Overview

In their study of public health, and preventing the spread and the treatment of infectious diseases, students will develop evidence and understand that living organisms are made of cells and that special structures are responsible for particular functions within organisms. Students develop a basic understanding of the role of cells in body systems, how those systems work to support the life of the organism, how interactions between body systems can be affected by disease, medications, and other factors, and how body systems function and interact in a healthy person and when a person is sick. Students will investigate organisms as different as humans, plants, and many of the microorganisms that make people sick are all made of cells. Examples include cells from various animal tissues like blood cells, plant cells, protozoa, and bacteria, including specific microorganisms that cause certain infectious diseases. Students generate and answer questions such as: How are the cells of various organisms alike? How are they different? How do these similarities and differences relate to the functions of these cells? In addition, students will examine the issue of the use of genetic information to make medical and health-related decisions. They will understand that most people have features more like their biological relatives than most other people, but even within a family, each person is unique. Examples explored include physical traits like eye color, genetic conditions like Marfan syndrome, the role of genes and the environment, and behavioral traits in humans and model organisms. Students generate and answer questions such as: What explains the similarities and differences between related individuals, from parents, to siblings, to identical twins?

Essential Questions	Enduring Understandings
Overarching Driving Questions: *How are the cells of various organisms alike?* *How are they different?* *How do these similarities and differences relate to the functions of these cells?* *What explains the similarities and differences between related individuals, from parents, to siblings, to identical twins?* • How will one know if they have found life elsewhere in the solar system? • How do the functions of cells support an entire organism? • What are humans made of? • What is the evidence that a body is actually a system of interacting subsystems composed of groups of interacting cells? • How do organisms receive and respond to information from their environment? • How did scientists discover that microbes could cause and spread disease? • How do scientists figure out the source of an infectious disease outbreak? (Activity 1) • What can cause an infectious disease? (Activity 2) • How can tools such as microscopes help scientists provide evidence about living organisms? (Activity 3) • How did the cell theory lead to the germ theory of disease? (Activity 4) • What structures and functions do living cells have in common? • What evidence can you gather that cells are alive? (Activity 5)	**Anchoring Phenomena:** Public health, preventing the spread and the treatment of infectious diseases. • Cells are the smallest unit of life that can be said to be alive. • All living things are made up of cells, either one cell or many different numbers and types of cells. • Nonliving things can be composed of cells. • Cells that can be observed at one scale may not be observable at another scale. • Engineering advances have led to important discoveries in the field of cell biology, and scientific discoveries have led to the development of entire industries and engineered systems. • The cell functions as a whole system. • Within cells, special structures are responsible for particular functions. • Complex natural structures/systems can be analyzed to determine how they function. • In multicellular organisms, the body is a system of multiple, interacting subsystems. • Systems may interact with other systems. • Systems may have subsystems and be part of larger complex systems. • Scientists and engineers are guided by habits of mind such as intellectual honesty, tolerance of ambiguity, skepticism, and openness to new ideas. • Sense receptors respond to different inputs (electromagnetic, mechanical, chemical).

• How do the structures in animal and plant cells relate to their functions? (Activity 6) • What is the function of a cell membrane? (Activity 7) • How do the parts of a cell work together? (Activity 8) • What is the difference between unicellular and multicellular organisms? • How do the cells of multicellu- lar organisms compare with the cells of single-celled organisms? (Activity 9) • What is the relationship between cells, tissues, organs, and organ systems within a multicellular organism? (Activity 10) • How do living organisms obtain and use the matter and energy they need to survive? • How does food provide energy and matter for organisms? (Activity 11) • What structures in plant cells convert energy from the sun into energy stored in food? (Activity 12) • What is the evidence that plants both produce and break down sugars? (Activity 13) • How can knowledge of cells be used to identify and treat microbial diseases? • How can knowledge of cell structure and function be used to treat disease? (Activity 14) • What microbe caused the outbreak? (Activity 15) • What determines whether a person will have a genetic condition and how they will be affected? • What questions should Joe ask his doctor and the genetic counselor? (Activity 1) • What does an individual with a genetic condition need to know about the science related to their condition? • How do organisms inherit traits from their biological parents? • How are simple inherited traits passed from parents to their offspring and then to the next generation? (Activity 2) • What do cells have to do with sexual and asexual reproduction? (Activity 3) • What happens when two parents with different traits have offspring? Why? (Activity 4) • How can we model and predict the ratios of traits observed in the offspring of parents with two versions of a trait? (Activity 5) • What causes the patterns that can be observed when two parents with different traits have offspring? (Activity 6) • What causes the differences between genetically identical organisms? (Activity 7) • How do sex cells transmit genetic information for determining traits to their offspring? (Activity 8) • What causes variation between offspring of the same parents? (Activity 9)	• Cause-and-effect relationships may be used to predict response to stimuli in natural systems. • Some diseases can be spread from person to person. An infectious disease can be transmitted from person to person. • Microscopic living organisms are the cause of some infectious diseases. • Microscopes provide evidence of organisms at scales too small to be observed by the human eye. • The idea that all living organisms are made of cells led to the germ theory of disease. • Even though organisms may look different on the outside, their cells have a lot in common. • Cells are alive and respire. • Cells of all organisms have similar structures, and these structures function similarly in each organism. • The cell membrane is an example of a cell structure that functions similarly in different organisms. • Models can be used to demonstrate and describe cell structures and their functions. • Some organisms are just one cell, while other organisms have many cells. • Microscopes provide evidence that living things are made of one or many cells and that cells of different organisms share certain structures. • Animals and plants have levels of organization, including cells, tissues, organs, organ systems, and organisms. • Living organisms need food to survive. • Food is rearranged through chemical reactions that support growth and/or release energy for cells. • Plant cells contain structures for photosynthesis, a process that uses sunlight to synthesize food. • Experiments can provide evidence of photosynthesis and respiration in plants. • Infectious diseases can be diagnosed and treated. • Knowledge of cell structure and function has helped scientists develop drugs that treat diseases caused by unicellular organisms. • An understanding of cells and infectious agents can help identify the source and transmission of infectious diseases • Some health conditions can be passed from parents to offspring. • Organisms tend to resemble their biological relatives, yet each individual is unique. • In some way, information is passed from parents to offspring. • Cells transmit the genetic information that determines traits to offspring cells. • Patterns can be observed in the offspring from a cross, and these patterns provide evidence of how genes are passed on and interact.

• What other factors besides genes cause the differences between genetically related organisms? • How do inherited behaviors and structures increase the likelihood of successful reproduction? • How do animal behaviors and other traits affect the probability of successful reproduction? (Activity 10) • How do specialized plant structures and traits affect the probability of successful reproduction in plants? (Activity 11) • How do mutations cause changes? • How does a gene produce a trait? (Activity 12) • How can a change in a gene, like the gene linked to Marfan syndrome, lead to a change in the function of a person's body? (Activity 13) • What determines whether a person will have a genetic condition and how they will be affected? • What have you learned that could help Joe understand and make choices about his situation if he does have Marfan syndrome? (Activity 14)	• We can use models to predict the ratios of traits in offspring. • Similar patterns of inheritance have been found for many traits in a variety of organisms, and are useful in understanding heredity. • The location of genetic information on chromosomes, and the behavior of chromosomes during formation of eggs and sperm, explain the patterns of inheritance observed for many traits. • In addition to differences in genes inherited from parents, environmental differences can lead to variation. • Even genetically identical organisms aren't exactly the same. • Environmental factors can lead to differences between organisms, even when those organisms share the same genetic information. • Both genetic and environmental factors can cause variation. • Specialized structures and behaviors are important for organisms to survive and reproduce. • Genetic factors can affect traits, including animal behavior and structures, needed for successful reproduction of animals. • Genetic factors can affect traits, including animal behaviors and animal and plant structural features (including plant color and scent and animals' ability to detect color and scent), needed for successful reproduction of plants. • Mutations can cause changes in an organism's structure and function, including the changes observed in hereditary health conditions. • A gene codes for a protein, and the structure of that protein is important for proper function. In Marfan syndrome, the gene affects a protein called fibrillin. • A change in a gene can change the structure and function of a protein, such as fibrillin. This explains how the gene affects a person's body. • Understanding how genetic and environmental factors interact helps people understand and manage genetic conditions.

Unit 1 From Cells to Body Systems to Organisms: Life and Physical Sciences
NJSLS Science Content Standards - Arranged by Disciplinary Core idea (DCI)
Students who demonstrate understanding can:

Unit 1 From Cells to Body Systems to Organisms: Life and Physical Sciences

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

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

- **MS-LS1-1** Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells. [Clarification Statement: Emphasis is on developing evidence that living things are made of cells, distinguishing between living and non-living things, and understanding that living things may be made of one cell or many and varied cells.]
- **MS-LS1-2** Develop and use a model to describe the function of a cell as a whole and ways parts of cells contribute to the function. [Clarification Statement: Emphasis is on the cell functioning as a whole system and the primary role of identified parts of the cell, specifically the nucleus, chloroplasts, mitochondria, cell membrane, and cell wall.] [Assessment Boundary: Assessment of organelle structure/function relationships is limited to the cell wall and cell membrane. Assessment of the function of the other organelles is limited to their relationship to the whole cell. Assessment does not include the biochemical function of cells or cell parts.]
- **MS-LS1-3** Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells. [Clarification Statement: Emphasis is on the conceptual understanding that cells form tissues and tissues form organs specialized for particular body functions. Examples could include the interaction of subsystems within a system and the normal functioning of those systems.] [Assessment Boundary: Assessment does not include the mechanism of one body system independent of others. Assessment is limited to the circulatory, excretory, digestive, respiratory, muscular, and nervous systems.]
- **MS-LS1-4** Use arguments based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively. [Clarification Statement: Examples of behaviors that affect the probability of animal reproduction could include nest building to protect young from cold, herding of animals to protect young from predators, and vocalization of animals and colorful plumage to attract mates for breeding. Examples of animal behaviors that affect the probability of plant reproduction could include transferring pollen or seeds, and creating conditions for seed germination and growth. Examples of plant structures could include bright flowers attracting butterflies that transfer pollen, flower nectar and odors that attract insects that transfer pollen, and hard shells on nuts that squirrels bury.]
- **MS-LS1-5** Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms. [Clarification Statement: Examples of local environmental conditions could include availability of food, light, space, and water. Examples of genetic factors could include large breed cattle and species of grass affecting growth of organisms. Examples of evidence could include drought decreasing plant growth, fertilizer increasing plant growth, different varieties of plant seeds growing at different rates in different conditions, and fish growing larger in large ponds than they do in small ponds.] [Assessment Boundary: Assessment does not include genetic mechanisms, gene regulation, or biochemical processes.]
- **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.]

MS-LS3: Heredity: Inheritance and Variation of Traits

- **MS-LS3-1** Develop and use a model to describe why structural changes to genes (mutations) located on chromosomes may affect proteins and may result in harmful, beneficial, or neutral effects to the structure and function of the organism. [Clarification Statement: Emphasis is on conceptual understanding that changes in genetic material may result in making different proteins.] [Assessment Boundary: Assessment does not include specific changes at the molecular level, mechanisms for protein synthesis, or specific types of mutations.]
- **MS-LS3-2** Develop and use a model to describe why asexual reproduction results in offspring with identical genetic information and sexual reproduction results in offspring with genetic variation. [Clarification Statement: Emphasis is on using models such as Punnett squares, diagrams, and simulations to describe the cause and effect relationship of gene transmission from parent(s) to offspring and resulting genetic variation.]

Unit 1 From Cells to Body Systems to Organisms: Life and Physical Sciences

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

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 and use a model to describe phenomena. (MS-LS1-2), (MS-LS3-1), (MS-LS3-2)
    - Develop a model to describe unobservable mechanisms. (MS-LS1-7)

Planning and Carrying Out Investigations

- 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.
    - Conduct an investigation to produce data to serve as the basis for evidence that meet the goals of an investigation. (MS-LS1-1)

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 knowledge, principles, and theories.
    - Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students' own experiments) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (MS-LS1-5), (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).
    - Use an oral and written argument supported by evidence to support or refute an explanation or a model for a phenomenon. (MS-LS1-3)
    - Use an oral and written argument supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem. (MS-LS1-4)

Disciplinary Core Ideas

LS1.A: Structure and Function

- All living things are made up of cells, which is the smallest unit that can be said to be alive. An organism may consist of one single cell (unicellular) or many different numbers and types of cells (multicellular). (MS-LS1-1)
- Within cells, special structures are responsible for particular functions, and the cell membrane forms the boundary that controls what enters and leaves the cell. (MS-LS1-2) In multicellular organisms, the body is a system of multiple interacting subsystems. These subsystems are groups of cells that work together to form tissues and organs that are specialized for particular body functions. (MS-LS1-3)

LS1.B: Growth and Development of Organisms

- Animals engage in characteristic behaviors that increase the odds of reproduction. (MS-LS1-4) Plants reproduce in a variety of ways, sometimes depending on animal behavior and specialized features for reproduction. (MS-LS1-4)
- Genetic factors as well as local conditions affect the growth of the adult plant. (MS-LS1-5)
- Organisms reproduce, either sexually or asexually, and transfer their genetic information to their offspring. (secondary to MSLS3-2)

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

Unit 1 From Cells to Body Systems to Organisms: Life and Physical Sciences

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

- 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)

LS3.A: Inheritance of Traits

- Genes are located in the chromosomes of cells, with each chromosome pair containing two variants of each of many distinct genes. Each distinct gene chiefly controls the production of specific proteins, which in turn affects the traits of the individual. Changes (mutations) to genes can result in changes to proteins, which can affect the structures and functions of the organism and thereby change traits. (MS-LS3-1)
- Variations of inherited traits between parent and offspring arise from genetic differences that result from the subset of chromosomes (and therefore genes) inherited. (MS-LS3-2)

LS3.B: Variation of Traits

- In sexually reproducing organisms, each parent contributes half of the genes acquired (at random) by the offspring. Individuals have two of each chromosome and hence two alleles of each gene, one acquired from each parent. These versions may be identical or may differ from each other. (MS-LS3-2)
- In addition to variations that arise from sexual reproduction, genetic information can be altered because of mutations. Though rare, mutations may result in changes to the structure and function of proteins. Some changes are beneficial, others harmful, and some neutral to the organism. (MS-LS3-1)

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

Cause and Effect

- Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability. (MS-LS1-4), (MS-LS1-5)
- Cause and effect relationships may be used to predict phenomena in natural systems. (MS-LS3-2)

Scale, Proportion, and Quantity

- Phenomena that can be observed at one scale may not be observable at another scale. (MS-LS1-1)

Systems and System Models

- Systems may interact with other systems; they may have subsystems and be a part of larger complex systems. (MS-LS1-3)

Energy and Matter

- 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)

Structure and Function

- Complex and microscopic structures and systems can be visualized, modeled, and used to describe how their function depends on the relationships among its parts, therefore complex natural structures/systems can be analyzed to determine how they function. (MS-LS1-2)
- Complex and microscopic structures and systems can be visualized, modeled, and used to describe how their function depends on the shapes, composition, and relationships among its parts, therefore complex natural structures/systems can be analyzed to determine how they function. (MS-LS3-1)

Unit 1 From Cells to Body Systems to Organisms: Life and Physical Sciences

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

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-LS1-1)

Connections to Nature of Science

Science is a Human Endeavor

- Scientists and engineers are guided by habits of mind such as intellectual honesty, tolerance of ambiguity, skepticism, and openness to new ideas. (MS-LS1-3)

Scientific Knowledge is Based on Empirical Evidence

- Science knowledge is based upon logical connections between evidence and explanations. (MS-LS1-6)

Student Learning Objectives

Students will be able to...

- Conduct an investigation to produce data that provides evidence distinguishing between living and nonliving things.
- Conduct an investigation to produce data supporting the concept that living things may be made of one cell or many and varied cells.
- Distinguish between living and nonliving things.
- Observe different types of cells that can be found in the makeup of living things.
- Develop and use a model to describe the function of a cell as a whole.
- Develop and use a model to describe how parts of cells contribute to the cell's function.
- Develop and use models to describe the relationship between the structure and function of the cell wall and cell membrane.

Integrated Accommodations and Modifications		
Special Education Students	**English Language Learners**	**At Risk**

Back to Contents Page

• 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 Appendix A: Special Education Accommodations and Modifications	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

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	• 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

• Utilize Choice Boards • Provide Problem-Based Learning • Establish flexible Grouping	• 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. (MS-LS1-3), (MS-LS1-4), (MS-LS1-5), (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-LS1-5), (MS-LS1-6) • RST.6-8.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 6–8 texts and topics. (MS-LS3-1), (MS-LS3-2) • 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-LS3-1), (MS-LS3-2) • RI.6.8 Trace and evaluate the argument and specific claims in a text, distinguishing claims that are supported by reasons and evidence from claims that are not. (MS-LS1-3), (MS-LS1-4) *Writing* • WHST.6-8.1 Write arguments focused on discipline content. (MS-LS1-3), (MS-LS1-4) • WHST.6-8.2 Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content. (MS-LS1-5), (MS-LS1-6) • 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-LS1-1)	**Computer Science and Design Thinking Practices** 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** *Impacts of Computing* • Advancements in computing technology can change individuals' behaviors. Society is faced with trade-offs due to the increasing globalization and automation that computing brings ○ 8.1.8.IC.1: Compare the trade-offs associated with computing technologies that affect individuals' everyday activities and career options. ○ 8.1.8.IC.2: Describe issues of bias and accessibility in the design of existing technologies *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.

- 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-LS1-8)
- WHST.6-8.9 Draw evidence from informational texts to support analysis, reflection, and research. (MS-LS1-5), (MS-LS1-6)

Speaking and Listening

- SL.8.5 Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest. (MS-LS1-2), (MS-LS1-7), (MS-LS3-1), (MS-LS3-2)

Connections to NJSLS - Mathematics

- MP.4 Model with mathematics. (MS-LS3-2)
- 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-LS1-1), (MS-LS1-2), (MS-LS1-3), (MS-LS1-6)
- 6.SP.A.2 Understand that a set of data collected to answer a statistical question has a distribution which can be described by its center, spread, and overall shape. (MS-LS1-4), (MS-LS1-5)
- 6.SP.B.4 Summarize numerical data sets in relation to their context. (MS-LS1-4), (MS-LS1-5)
- 6.SP.B.5 Summarize numerical data sets in relation to their context. (MS-LS3-2)

- 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.
  - 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.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).

	○ 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.

Economic and Government Influences

- There are government agencies and policies that affect the financial industry and the broader economy
  - 9.1.8.EG.5: Interpret how changing economic and societal needs influence employment trends and future education.

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.
- Income and benefits can vary depending on the employer and type of job or career.
    - 9.2.5.CAP.5: Identify various employee benefits, including income, medical, vacation time, and lifestyle benefits provided by different types of jobs and careers.
- 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.
    - 9.2.8.CAP.4: Explain how an individual's online behavior (e.g., social networking, photo exchanges, video postings) may impact opportunities for employment or advancement.
- Developing and implementing an action plan is an essential step for achieving one's personal and professional goals
    - 9.2.8.CAP.5: Develop a personal plan with the assistance of an adult mentor that includes information about career areas of interest, goals and an educational plan
- There are 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 communities are used by individuals to share information, organize, and engage around issues and topics of interest.
    - 9.4.8.DC.7: Collaborate within a digital community to create a digital artifact using strategies such as crowdsourcing or digital surveys.
- 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.
- The mode of information can convey a message to consumers or an audience.
    - 9.4.8.IML.6: Identify subtle and overt messages based on the method of communication.
- 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.1: Construct a spreadsheet in order to analyze multiple data sets, identify relationships, and facilitate data-based decision-making.
    - 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., MSLS4-5, 6.1.8.CivicsPI.3).

Climate Change

- **MS-LS1-5** Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms

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

cell, microscopic, microscope, multicellular, unicellular, organelle, cell membrane, cell wall, chloroplast, photosynthesis, nucleus, microbe, germ, bacteria, virus, contagious, infectious, DNA, RNA, inherit, sexual reproduction, asexual reproduction, sex cells, egg, sperm, chromosomes, genes, genetic, mutation, traits, variation, identical, physical, phenotype, genotype, expression, Punnett square, behavior, environmental factors,tissues, organ, organ system, organism, health, disease,

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: "Reproduction of Living Things", "Biotechnology", "Genes and Mutations", "Plant and Animal Cells", "Multicellular Organisms", "Bacteria and Viruses", • 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.) • Practicing Positive Self-Talk for Grade 7 (SEL Resource) • Peppered Moth Simulation (Climate Change Resource) • Scientists with Disabilities (Disabilities Awareness Resource) **Project Ideas:** • 3D Models of cells or major organs (brain, heart, lungs, stomach, etc)
Instructional Best Practices and Exemplars	
See Appendix A for Instructional Best Practices and Exemplars	
Pacing Guide	
Grade 7 Pacing Guide	

Unit 2 Geological Processes: Life and Physical Sciences

Overview

In this unit, students will study how natural hazards associated with geological processes have implications for the storage of nuclear waste. The Anchoring Phenomenon is that the Earth's surface changes over time. Examples explored include the role of water in changing earth's surface, the frequency, locations, and effects of earthquakes and volcanoes and their associated natural hazards, and the uneven distribution of natural resources on earth. Students generate and answer questions such as: How and why does Earth's surface change? Why are some places much more likely than others to have earthquakes or volcanoes? What happens where Earth's plates meet? How do geologic processes affect where resources are found?

Essential Questions	Enduring Understandings
Overarching Driving Questions: *How and why does Earth's surface change?* *Why are some places much more likely than others to have earthquakes or volcanoes?* *What happens where Earth's plates meet?* *How do geologic processes affect where resources are found?* ● Where should deep underground sites for storing nuclear waste be developed in the United States? ● What factors must be considered when deciding where to store nuclear waste? (Activity 1) ● How can we use evidence to decide where to store nuclear waste? (Activity 18) ● How does water interact with earth materials? (Activity 2) ● How can a natural hazard create challenges for storing nuclear waste? (Activity 3) ● Why do some locations have earthquakes and volcanoes, and others do not? ● What natural hazards are caused by earthquakes and volcanic eruptions? (Activity 4) ● How can models help us understand what happens during a volcanic eruption? (Activity 5) ● What patterns can we see when examining the locations of earthquakes and volcanoes? (Activity 6) ● How can GPS data help us understand Earth's surface? (Activity 7) ● What is beneath Earth's surface? (Activity 8) ● Why do some locations have earthquakes and volcanoes, and others do not? ● How can models help us understand earthquakes? (Activity 9)	**Anchoring Phenomenon: Nuclear waste must be protected from natural hazards** ● Radioactive nuclear waste must be stored in ways that protect people from its harmful effects and prevent it from leaking into the air and water in the environment. One way to do this is to store the waste deep underground. ● Radioactive nuclear waste must be stored in ways that protect people from its harmful effects and prevent it from leaking into the air and water in the environment. One way to do this is to store the waste deep underground. ● If nuclear waste should be stored deep underground, why should it be stored in areas with little rainfall? Water that falls and flows on the surface can gradually travel deep underground through the soil into the rock layers below Earth's surface. This water can travel several miles underground through permeable rock layers, but it is slowed or stopped by impermeable layers. Underground water-bearing earth materials are called aquifers. People can remove water from aquifers to use as a natural resource for a variety of human activities; therefore, aquifers need to be protected from contamination. ● What natural hazards can rainfall cause? On Earth's surface, rainfall can cause rapid changes to the shape of the land during a landslide. Some areas with high amounts of rainfall are more susceptible to landslides due to the properties of the earth materials (rock) that make up the area. This means that some areas have a high likelihood of failure when rainwater flows down a slope. Landslides can cause a variety of natural hazards that can be mitigated through the use of technology and engineering. ● What other natural hazards should we be concerned about when deciding where to store nuclear waste? Earthquakes and volcanic activity can cause natural hazards that must be considered. Earthquakes can cause sudden, intense

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• What happens where Earth's plates meet? (Activity 10) • How can our understanding of geological processes at plate boundaries allow us to predict and prepare for natural hazards? (Activity 11) • Have Earth's plates moved in the past? • What evidence can we use to help us understand the movement of Earth's plates over time? (Activity 12)How did Wegener's idea of continental drift lead to the theory of plate tectonics? (Activity 13) • What drives plate motion? (Activity 14) • Why are natural resources found in different places around Earth? • How do rocks form? (Activity 15) • How do geological processes affect where we find rock and mineral resources? (Activity 16) • How can monitoring natural resources help guide decisions about their use? (Activity 17) • Where should deep underground sites for storing nuclear waste be developed in the United States? • What factors must be considered when deciding where to store nuclear waste? (Activity 1) • How can we use evidence to decide where to store nuclear waste? (Activity 18)	ground-shaking. Volcanic eruptions generate igneous rock through the melting and cooling of magma both above and below ground. The hazards associated with these geological processes pose significant risks to the storage of nuclear waste; however, some of these risks can be mitigated by monitoring and advancements in engineering. Why do some locations have earthquakes and volcanoes, and others do not? • Earthquakes and volcanoes do not happen everywhere on Earth's surface. Earthquakes and volcanoes appear in patterns where plates meet. At these boundaries, Earth's plates are slowly colliding or spreading apart, and these plate motions cause earthquakes and volcanoes. Earthquakes also occur at plate boundaries where Earth's plates are sliding past each other. GPS is used to measure plate movement and direction, as well as monitor movement in areas where earthquakes and volcanoes happen. • Evidence from earthquakes and volcanoes is used to understand the interior structure of Earth. Earth's internal energy drives the interactions at plate boundaries. Interactions between plates at boundaries cause the formation of mountain ranges and volcanoes, and cause earthquakes. • The edges of South America and Africa appear as though they could fit together. • Evidence from fossils and rocks, continental plates, and sea floor structures supports the theory that the plates have moved slowly over great distances in the past. Slow movement of the plates has resulted in large-scale changes to Earth's surface over time, such as the movement of the continents, the generation of new sea floor at ocean ridges, and the destruction of old sea floor at trenches. • What makes Earth's plates move? Scientists think the movement of the plates is driven by gravity and energy in Earth's interior. • Natural resources are distributed unevenly. • In addition to considering geological processes and related hazards in deciding where to store nuclear waste, decision-makers also must consider the availability of valuable natural resources at a potential storage site. Natural resources are formed by geological processes that constantly recycle earth materials to form new rock and may also result in the formation of valuable natural resources, such as metal ores. Natural resources are generated in areas where these geological processes are happening or have happened in the past, thus resulting in their uneven distribution. The supply of natural resources may be limited based on how quickly or slowly the associated geological process that forms them happens. As such, the use of natural resources must be monitored to minimize depletion.

	• Radioactive nuclear waste must be stored in ways that protect people from its harmful effects and prevent it from leaking into the air and water in the environment. One way to do this is to store the waste deep underground. • Considerations that must be addressed in deciding on a site to store nuclear waste include the geological processes that happen in the area and the risk of associated natural hazards, the distribution of valuable natural resources in the area, as well as proximity to large human populations

Unit 2 Geological Processes: 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-ESS2-1** Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process. [Clarification Statement: Emphasis is on the processes of melting, crystallization, weathering, deformation, and sedimentation, which act together to form minerals and rocks through the cycling of Earth's materials.] [Assessment Boundary: Assessment does not include the identification and naming of minerals.]
- **MS-ESS2-2** Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales. [Clarification Statement: Emphasis is on how processes change Earth's surface at time and spatial scales that can be large (such as slow plate motions or the uplift of large mountain ranges) or small (such as rapid landslides or microscopic geochemical reactions), and how many geoscience processes (such as earthquakes, volcanoes, and meteor impacts) usually behave gradually but are punctuated by catastrophic events. Examples of geoscience processes include surface weathering and deposition by the movements of water, ice, and wind. Emphasis is on geoscience processes that shape local geographic features, where appropriate.]
- **MS-ESS2-3** Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions. [Clarification Statement: Examples of data include similarities of rock and fossil types on different continents, the shapes of the continents (including continental shelves), and the locations of ocean structures (such as ridges, fracture zones, and trenches).] [Assessment Boundary: Paleomagnetic anomalies in oceanic and continental crust are not assessed.]

MS-ESS3: Earth and Human Activity

- **MS-ESS3-1** Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes. [Clarification Statement: Emphasis is on how these resources are limited and typically nonrenewable, and how their distributions are significantly changing as a result of removal by humans. Examples of uneven distributions of resources as a result of past processes include but are not limited to petroleum (locations of the burial of organic marine sediments and subsequent geologic traps), metal ores (locations of past volcanic and hydrothermal activity associated with subduction zones), and soil (locations of active weathering and/or deposition of rock).]
- **MS-ESS3-2** Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects. [Clarification Statement: Emphasis is on how some natural hazards, such as volcanic eruptions and severe weather, are preceded by phenomena that allow for reliable predictions, but others, such as earthquakes, occur suddenly and with no notice, and thus are not yet predictable. Examples of natural hazards can be taken from interior processes (such as earthquakes and volcanic eruptions), surface processes (such as mass wasting and tsunamis), or severe weather events (such as hurricanes, tornadoes, and floods). Examples of data can include the locations, magnitudes, and frequencies of the natural hazards. Examples of technologies can be global (such as satellite systems to monitor hurricanes or forest fires) or local (such as building basements in tornado-prone regions or reservoirs to mitigate droughts).]

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Unit 2 Geological Processes: Life and Physical Sciences

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

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 and use a model to describe phenomena. (MS-ESS2-1)

Analyzing and Interpreting Data

- Analyzing data 6–8 builds on grades K–5 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-ESS2-3)
    - Analyze and interpret data to determine similarities and differences in findings. (MS-ESS3-2)

Constructing Explanations and Designing Solutions

- Constructing explanations and designing solutions in 6–8 builds on grades 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 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-ESS2-2), (MS-ESS3-1)

Disciplinary Core Ideas

ESS1.C: The History of Planet Earth

- Tectonic processes continually generate new ocean sea floor at ridges and destroy old sea floor at trenches. (HS.ESS1.C GBE) (secondary to MS-ESS2-3)

ESS2.A: Earth's Materials and Systems

- All Earth processes are the result of energy flowing and matter cycling within and among the planet's systems. This energy is derived from the sun and Earth's hot interior. The energy that flows and matter that cycles produce chemical and physical changes in Earth's materials and living organisms. (MS-ESS2-1) The planet's systems interact over scales that range from microscopic to global in size, and they operate over fractions of a second to billions of years. These interactions have shaped Earth's history and will determine its future. (MS-ESS2-2)

ESS2.B: Plate Tectonics and LargeScale System Interactions

- Maps of ancient land and water patterns, based on investigations of rocks and fossils, make clear how Earth's plates have moved great distances, collided, and spread apart. (MS-ESS2-3)

ESS3.A: Natural Resources

- Humans depend on Earth's land, ocean, atmosphere, and biosphere for many different resources. Minerals, fresh water, and biosphere resources are limited, and many are not renewable or replaceable over human lifetimes. These resources are distributed unevenly around the planet as a result of past geologic processes. (MS-ESS3-1)

ESS2C: The Roles of Water in Earth;s Surface Processes

- Water's movements—both on the land and underground—cause weathering and erosion, which change the land's surface features and create underground formations. (MS-ESS2-2)

ESS3.B: Natural Hazards

- Mapping the history of natural hazards in a region, combined with an understanding of related geologic forces can help forecast the locations and likelihoods of future events. (MS-ESS3-2)

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Unit 2 Geological Processes: Life and Physical Sciences

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

Crosscutting Concepts

Patterns

- Graphs, charts, and images can be used to identify patterns in data. (MS-ESS3-2)
- Patterns in rates of change and other numerical relationships can provide information about natural systems. (MS-ESS2-3)

Cause and Effect

- Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-ESS3-1)

Scale Proportion and Quantity

- Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small. (MS-ESS2-2)

Stability and Change

- Explanations of stability and change in natural or designed systems can be constructed by examining the changes over time and processes at different scales, including the atomic scale. (MS-ESS2-1)

Connections to Engineering, Technology, and Applications of Science

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

- 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-ESS3-1)
- The uses 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-ESS3-2)

Scientific Knowledge is Open to Revision in Light of New Evidence

- Science findings are frequently revised and/or reinterpreted based on new evidence. (MS-ESS2-3)

Student Learning Objectives

Students will be able to...

- Construct a scientific explanation based on valid and reliable evidence from rock strata obtained from sources (including the students' own experiments).
- Construct a scientific explanation based on rock strata 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.
- Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process.
- Construct a scientific explanation for how geoscience processes have changed Earth's surface at varying time and spatial scales based on valid and reliable evidence obtained from sources (including the students' own experiments).

- Construct a scientific explanation for how geoscience processes have changed Earth's surface at varying time and spatial scales based on 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.
- Collect evidence about processes that change Earth's surface in time and spatial scales that can be large (such as slow plate motions or the uplift of large mountain ranges).
- Collect evidence about processes that change Earth's surface in small time and spatial scales. (such as rapid landslides or microscopic geochemical reactions), and how many geoscience processes (such as earthquakes, volcanoes, and meteor impacts) usually behave gradually but are punctuated by catastrophic events.
- Analyze and interpret data such as distributions of fossils and rocks, continental shapes, and seafloor structures to provide evidence of past plate motions.
- Analyze how science findings have been revised and/or reinterpreted based on new evidence about past plate motions.

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.	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

• 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	• 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

Reading

- RST.6-8.1 Cite specific textual evidence to support analysis of science and technical texts. (MS-ESS2-2), (MS-ESS2-3), (MS-ESS3-1), (MS-ESS3-2)
- 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-ESS2-3), (MS-ESS3-2)
- 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-ESS2-3), (MS-ESS2-5)
- WHST.6-8.2 Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content. (MS-ESS2-2)

Writing

- WHST.6-8.2 Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content. (MS-ESS3-1)
- WHST.6-8.9 Draw evidence from informational texts to support analysis, reflection, and research. (MS-ESS3-1)

Speaking and Listening

- SL.8.5 Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest. (MS-ESS2-1), (MS-ESS2-2),

Connections to NJSLS - Mathematics

- MP.2 Reason abstractly and quantitatively. (MS-ESS2-2), (MS-ESS2-3), (MS-ESS3-2)
- 6.EE.B.6 Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand

Computer Science and Design Thinking Practices

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

Impacts of Computing

- Advancements in computing technology can change individuals' behaviors. Society is faced with trade-offs due to the increasing globalization and automation that computing brings
  - 8.1.8.IC.1: Compare the trade-offs associated with computing technologies that affect individuals' everyday activities and career options.
  - 8.1.8.IC.2: Describe issues of bias and accessibility in the design of existing technologies

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.

that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set. (MS-ESS2-2), (MS-ESS2-3), (MS-ESS3-1), (MS-ESS3-2)

- 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-ESS2-2), (MS-ESS2-3), (MS-ESS3-1), (MS-ESS3-2)

- 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.
  - 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.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). ○ 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.

Economic and Government Influences

- There are government agencies and policies that affect the financial industry and the broader economy
  - 9.1.8.EG.5: Interpret how changing economic and societal needs influence employment trends and future education.

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.
- Income and benefits can vary depending on the employer and type of job or career.

- 9.2.5.CAP.5: Identify various employee benefits, including income, medical, vacation time, and lifestyle benefits provided by different types of jobs and careers.

- 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.
  - 9.2.8.CAP.4: Explain how an individual's online behavior (e.g., social networking, photo exchanges, video postings) may impact opportunities for employment or advancement.
- Developing and implementing an action plan is an essential step for achieving one's personal and professional goals
  - 9.2.8.CAP.5: Develop a personal plan with the assistance of an adult mentor that includes information about career areas of interest, goals and an educational plan
- There are 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 communities are used by individuals to share information, organize, and engage around issues and topics of interest.
  - 9.4.8.DC.7: Collaborate within a digital community to create a digital artifact using strategies such as crowdsourcing or digital surveys.
- 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.
- The mode of information can convey a message to consumers or an audience.
    - 9.4.8.IML.6: Identify subtle and overt messages based on the method of communication.
- 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.1: Construct a spreadsheet in order to analyze multiple data sets, identify relationships, and facilitate data-based decision-making.
    - 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., MSLS4-5, 6.1.8.CivicsPI.3).

Climate Change

- Addressed in Unit 1

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
geological processes, nuclear waste, natural hazards, earthquakes, volcanoes, landslides, tectonic plates, continental plates, boundaries, mountain, trench, continental drift, natural resources, permeable rock, impermeable layers, aquifer, magma, igneous rock, rock cycle, metal ore, eruption, fossil, gravity, mitigation.

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 ● Warm-Up Activities: Amistad Activity, SEL Activity, Holocaust Activity, Climate Change Activity, LGBTQ+/Disabilities

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	• 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.) • Practicing Positive Self-Talk for Grade 7 (SEL Resource) • The Importance of Embracing Questions (SEL Resource) • Virtual Field Trip to Hawaii **Project Ideas:** • Research famous scientists and possible STEM Careers: Learning for Justice: STEM at Work **(Amistad Law Resource)**
Instructional Best Practices and Exemplars	
See Appendix A for Instructional Best Practices and Exemplars	
Pacing Guide	
Grade 7 Pacing Guide	

Unit 3 Force, Motion, Fields, and Interactions: Life and Physical Sciences

Overview

In this unit, students examine car and driver safety, specifically how people can reduce the risk of motor vehicle accidents. Some cars and driving behaviors result in fewer accidents and less damage than others. Examples explored include speed is a factor in the majority of accidents, and cars following closely behind another car are less able to avoid a collision.

In addition, the students will examine how the characteristics of fields can be incorporated into engineering design solutions. Objects can be observed to interact with other objects even when they are not in contact with one another. Examples explored include static electricity, the behavior of magnets, and the observation that objects fall toward the earth. Students generate and answer questions such as: How do objects interact at a distance? What is a field? How does a field store energy? How do people use fields to design solutions to problems?

Essential Questions	Enduring Understandings
Overarching Driving Questions: *How does the speed of a car affect its energy?* *What happens when objects collide?* *How can we apply an understanding of force and motion to develop solutions for improving car and driving safety?* *What is a field? How does a field store energy? How do people use fields to design solutions to problems?* ● What choices can people make to keep themselves safe while driving? ● How do you decide which car is safer? (Activity 1) ● How can we predict the amount of impact of a car accident? ● How can you measure and graph the speed of a moving object? (Activity 2) ● What is the relationship between an object's speed and its kinetic energy? (Activity 3) ● How does the mass of a car affect its kinetic energy? (Activity 4) ● What is the mathematical relationship between kinetic energy and speed of an object, and kinetic energy and mass of an object? (Activity 5) ● What causes a car's motion to change? ● What causes an object to change direction? (Activity 6) ● What causes an object to change speed? (Activity 7) ● What is the mathematical relationship between force, acceleration, and mass? (Activity 8) ● What relationships between force and motion did Newton discover? (Activity 9) ● What happens when cars collide?	**Anchoring Phenomena:** Car and driver safety, specifically how people can reduce the risk of motor vehicle accidents. ● Some cars and driving behaviors are safer than others. Car safety encompasses the design of the car and both the condition and the driving behaviors of the driver. ● Some car accidents cause more damage than others. ● An object's speed can be calculated by measuring the distance an object travels in a particular direction over a certain amount of time. A motion graph can be used to quantitatively describe how an object moves. ● Kinetic energy is motion energy and is related to the mass and speed of an object. ● Kinetic energy is proportional to the object's speed. If the mass of a car remains constant, a change in the car's speed results in a change in kinetic energy. ● Kinetic energy is proportional to the mass of the moving object. If there are two cars going at the same speed but with different masses, the more massive vehicle has more kinetic energy. ● Whereas both speed and mass affect kinetic energy, mass has a linear relationship, and speed has a nonlinear relationship. (Kinetic energy increases with the square of speed.) ● Inertia is the resistance of an object to changes in its motion. An object's motion is determined by the sum of forces acting on it. ● If the forces are balanced, an object's motion will not change. If the forces are unbalanced, an object's motion will change. ● Acceleration is a change in motion. A larger force will result in a larger acceleration.

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• What happens when objects interact? (Activity 10) • What additional relationship between force and motion did Newton discover? (Activity 11) • How can the motion of interacting objects change due to a collision? (Activity 12) • How can you design a successful solution to help a driver avoid a collision? • What are the effects of speed and mass on braking distance? (Activity 13) • How does a car's stopping distance change in different situations? (Activity 14) • How can you design a system to help drivers keep a safe distance behind another car in different situations? (Activity 15) • How do engineers solve problems related to gravity? • What approaches can be used to solve a problem? (Activity 1) • How do engineers use a design process to solve problems? (Activity 2) • What determines the strength of gravitational forces? • How is energy transferred with a transporter set in motion by gravity?(Activity 3) • What determines the amount of gravitational force between objects? (Activity 4) • How do magnetic forces work? • How can we visualize a magnetic field? (Activity 5) • How can engineers solve problems using magnetism and gravity? • How can magnetic fields be used to design a transporter prototype? (Activity 6) • What are fields? • What factors affect the strength of a field? (Activity 7) • What is static electricity? • How can we generate more static electricity? • What are the effects of static electricity? (Activity 8) • What determines the amount and direction of electrostatic force? (Activity 9) • What effect does an electric charge have on the space around it? (Activity 10) • How can engineers solve problems using electric fields? • How can the Moon transporter use an electric field? (Activity 11) • How are electric fields and magnetic fields related? • What is the relationship between electric and magnetic fields? (Activity 12) • How can an electromagnet be used to design a rescue device? (Activity 13) • How do electric and electromagnetic fields work? (Activity 14) • How can engineers solve problems using electricity, magnetism, and gravity? • Which is the best design for the Moon transporter? (Activity 15)	• How an object's acceleration changes due to an unbalanced force is also dependent on the object's mass. The more mass an object has, the more inertia it has, and the greater the force it takes to change its motion. • When a car accident happens, often both cars are damaged as a result of the collision. • During a collision, interacting cars exert forces on each other. These forces are equal in size and opposite in direction. • Engineers design car features that can make cars safer and promote safer driving behaviors. • A car's braking distance is the distance the car travels from the moment the driver applies the brakes until the car comes to a full stop. The mass of the car and the speed at which it is traveling affect the braking distance of a car. When coming to a stop to avoid a collision where one car might hit the back of another car, drivers need to react to the changes in road conditions and make a decision to apply the brakes. The stopping distance of a car can depend on road conditions (e.g., slick vs. dry) and driving behavior (e.g., distracted drivers and the speed at which the driver is traveling). Therefore, the total stopping distance required for a car to come to a stop and avoid collision is different in different situations. One problem drivers face is leaving enough distance between their car and the car in front of them to ensure they can safely come to a stop in different situations. Designed solutions to this problem must address precisely defined criteria and constraints, as well as take into account scientific principles. • Gravity, magnetism, electricity, and electromagnetism are used in designed systems. Gravity and magnetism both affect objects at a distance. • Engineers solve all sorts of problems. For every problem to be solved, there are different tools and scientific concepts that can be used to help design solutions. One scientific concept used in many design solutions is gravity. Gravity can be used when engineering a transportation system on the Moon. • When designing solutions to transportation problems, the amount of energy stored in the system is important to consider. By changing a transporter's mass or height, the energy stored in the system changes. This change is due to gravitational potential energy. • Scientific investigations to learn more about gravity can be conducted on the two variables that seem to affect gravitational force: mass and distance. Beyond simple classroom investigations, observations of objects interacting gravitationally gives evidence that gravity is a force at a distance. That is, gravitational force is able to affect interacting objects even if those two objects are not touching. • Magnets are attracted to or repelled by other magnets.

	• While gravitational fields and magnetic fields are similar in that they can exert a force at a distance, they also have some important differences. Magnetic fields exist only around magnetized objects, whereas gravitational fields exist around all objects with mass. Also, gravitational fields are only and always attractive, whereas magnetic fields can be attractive or repulsive depending on the relative orientations of the interacting magnetized objects. An important aspect of fields is that they can store potential energy. An object in a field has potential energy due to its location in that field. If an object changes its location in a field, then the potential energy of the object due to the field has either increased or decreased depending on if energy was transferred to or from that object. • The ability for objects to interact without being in physical contact is evidence for, and can be explained by, fields. While gravitational fields exist around all objects with mass, there are other types of familiar fields, like magnetic fields. A field, such as a magnetic field, can be mapped using tools that sense a field's direction and/or strength. For instance, a compass placed in a magnetic field will point in the direction of the field at that location. • What happens if an object is experiencing a force at a distance due to more than one field? The object will move in the direction of the stronger force until the two forces are balanced. Balanced forces from magnetic and gravitational fields can be used to design a hovering transporter. Depending on how much mass needs to be moved, the magnetic field needs to be strong enough to balance the gravitational force on the transporter. Designing a hovering transporter includes analyzing data from tests to create new improved solutions. • When a balloon is rubbed on hair, the hair will be attracted to the balloon even as the balloon is pulled away. • Gravitational and magnetic fields are not the only types of fields. Electric phenomena are due to electric fields. The everyday experience of static electricity demonstrates the properties of an electric field. Objects with static electricity can be attracted to or repelled from other objects due to electric fields. • An object becomes charged when there is a difference between the number of positive and negative charges on it. A more highly charged object will have a larger effect on nearby charges. Also, the closer that object gets to nearby charges, the larger effect it will have. • Electric fields are a result of electric charges. Charges can be either negative or positive. Two electric charges with the same charge will repel each other, whereas two electric charges with opposite charge will attract each other. Like gravity and magnetism, electric fields also store potential energy. • Engineers can use electric fields in the hover transporter design in a manner similar to the magnetic hover transporter. Electric charges can be built up on the transporter and track, which provides an electrostatic force that balances the

	force of gravity. By testing and manipulating the charge on the transporter and track, the transporter's design can be optimized. If the repulsion gets strong enough, charges can actually be forced off of the charged object, causing discharge. This is one of the reasons why electric fields are not as practical as magnetic fields in this application. A field, such as a magnetic field, can be mapped using tools that sense a field's direction and/or strength. For instance, a compass placed in a magnetic field will point in the direction of the field at that location. ● Metals that are not magnetic can be affected by moving magnets, and moving charges can generate magnetic fields. ● Since electric fields can cause electric charges to move, electric fields can cause charges to move through wires to make electric current. As electric current moves through a wire, a magnetic field is produced around the wire. Likewise, if a magnetic field is moved near a wire, electric charges start to move, creating electric current. This relationship between electric current and magnetism allows for the creation of electromagnets. ● Electromagnets create a magnetic field only when there is an electric current flowing. Unlike permanent magnets, electromagnets can have their magnetic field turned on and off. This is a useful property used by engineers for all types of design tasks. A stronger electromagnet can be built by winding coils with a high number of turns of wire per length of coil and/or increasing the current through the wire. ● It is because of the relationship between magnetism and electricity that scientists often refer to an "electromagnetic field" instead of the separate magnetic and electric fields. This larger, moreencompassing field interacts with both magnetic and electric fields and shares properties with each. Electromagnetic fields are used in many devices and products that we use every day. In fact, a certain type of transportation, known as magnetic levitation, uses electromagnetism to hover trains above their track and move them at high speeds along the track all while in a gravitational field. Fields, such as electromagnetic and gravitational, are useful in designing a transporter on the Moon where one of the constraints is that combustion cannot be used. ● To choose the best design from proposed solutions, scientists and engineers systematically compare possible solutions to see how they meet the criteria and constraints of the challenge. It is these systematic processes that allow engineers and scientists to develop, test, and improve solutions before deciding on a final design.

Unit 3 Force, Motion, Fields, and Interactions: Life and Physical Sciences

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

Students who demonstrate understanding can:

MS-PS2: Motion and Stability: Forces and Interactions

- **MS-PS2-1** Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects. [Clarification Statement: Examples of practical problems could include the impact of collisions between two cars, between a car and stationary objects, and between a meteor and a space vehicle.] [Assessment Boundary: Assessment is limited to vertical or horizontal interactions in one dimension.]
- **MS-PS2-2** Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object. [Clarification Statement: Emphasis is on balanced (Newton's First Law) and unbalanced forces in a system, qualitative comparisons of forces, mass and changes in motion (Newton's Second Law), frame of reference, and specification of units.] [Assessment Boundary: Assessment is limited to forces and changes in motion in one-dimension in an inertial reference frame and to change in one variable at a time. Assessment does not include the use of trigonometry.]
- **MS-PS2-3** Ask questions about data to determine the factors that affect the strength of electric and magnetic forces. [Clarification Statement: Examples of devices that use electric and magnetic forces could include electromagnets, electric motors, or generators. Examples of data could include the effect of the number of turns of wire on the strength of an electromagnet, or the effect of increasing the number or strength of magnets on the speed of an electric motor.] [Assessment Boundary: Assessment about questions that require quantitative answers is limited to proportional reasoning and algebraic thinking.]
- **MS-PS2-4** Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects. [Clarification Statement: Examples of evidence for arguments could include data generated from simulations or digital tools; and charts displaying mass, strength of interaction, distance from the Sun, and orbital periods of objects within the solar system.] [Assessment Boundary: Assessment does not include Newton's Law of Gravitation or Kepler's Laws.]
- **MS-PS2-5** Conduct an investigation and evaluate the experimental design to provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contact. [Clarification Statement: Examples of this phenomenon could include the interactions of magnets, electrically-charged strips of tape, and electrically-charged pith balls. Examples of investigations could include first-hand experiences or simulations.] [Assessment Boundary: Assessment is limited to electric and magnetic fields and limited to qualitative evidence for the existence of fields.]

MS-PS3: Energy

- **MS-PS3-1** Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object. [Clarification Statement: Emphasis is on descriptive relationships between kinetic energy and mass separately from kinetic energy and speed. Examples could include riding a bicycle at different speeds, rolling different sizes of rocks downhill, and getting hit by a wiffle ball versus a tennis ball.]
- **MS-PS3-2** Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system. [Clarification Statement: Emphasis is on relative amounts of potential energy, not on calculations of potential energy. Examples of objects within systems interacting at varying distances could include: the Earth and either a roller coaster cart at varying positions on a hill or objects at varying heights on shelves, changing the direction/orientation of a magnet, and a balloon with static electrical charge being brought closer to a classmate's hair. Examples of models could include representations, diagrams, pictures, and written descriptions of systems.] [Assessment Boundary: Assessment is limited to two objects and electric, magnetic, and gravitational interactions.]

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.

Unit 3 Force, Motion, Fields, and Interactions: Life and Physical Sciences

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

- **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 from grades K–5 experiences and progresses to specifying relationships between variables and clarifying arguments and models.
  - Ask questions that can be investigated within the scope of the classroom, outdoor environment, and museums and other public facilities with available resources and, when appropriate, frame a hypothesis based on observations and scientific principles. (MS-PS2-3)
  - 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)

Developing and Using Models

- Modeling in 6–8 builds on K–5 and progresses to developing, using and revising models to describe, test, and predict more abstract phenomena and design systems.
  - 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)

Analyzing and Interpreting Data

- Analyzing data in 6–8 builds on K–5 and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis.
  - Construct and interpret graphical displays of data to identify linear and nonlinear relationships. (MS-PS3-1)
  - Analyze and interpret data to determine similarities and differences in findings. (MS-ETS1-3)

Constructing Explanations and Designing Solutions

- Constructing explanations and designing solutions in 6–8 builds from grades 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.
  - Apply scientific ideas or principles to design an object, tool, process or system. (MS-PS2-1)

Engaging in Argument from Evidence

- Engaging in argument from evidence in 6–8 builds from grades 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.
  - Construct 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 or a solution to a problem. (MS-PS2-4)
  - Evaluate competing design solutions based on jointly developed and agreed-upon design criteria. (MS-ETS1-2)

Disciplinary Core Ideas

PS2.A: Forces and Motion

- For any pair of interacting objects, the force exerted by the first object on the second object is equal in strength to the force that the second object exerts on the first, but in the opposite direction (Newton's third law). (MS-PS2-1)
- The motion of an object is determined by the sum of the forces acting on it; if the total force on the object is not zero, its motion will change. The greater the mass of the object, the greater the force needed to achieve the same change in motion. For any given object, a larger force causes a larger change in motion. (MS-PS2-2)

Unit 3 Force, Motion, Fields, and Interactions: Life and Physical Sciences

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

- All positions of objects and the directions of forces and motions must be described in an arbitrarily chosen reference frame and arbitrarily chosen units of size. In order to share information with other people, these choices must also be shared. (MS-PS2-2)

PS2.B: Types of Interactions

- Electric and magnetic (electromagnetic) forces can be attractive or repulsive, and their sizes depend on the magnitudes of the charges, currents, or magnetic strengths involved and on the distances between the interacting objects. (MS-PS2-3)
- Gravitational forces are always attractive. There is a gravitational force between any two masses, but it is very small except when one or both of the objects have large mass—e.g., Earth and the sun. (MS-PS2-4)
- Forces that act at a distance (electric, magnetic, and gravitational) can be explained by fields that extend through space and can be mapped by their effect on a test object (a charged object, or a ball, respectively). (MS-PS2-5)

PS3.A: Definitions of Energy

- Motion energy is properly called kinetic energy; it is proportional to the mass of the moving object and grows with the square of its speed. (MS-PS3-1)
- A system of objects may also contain stored (potential) energy, depending on their relative positions. (MS-PS3-2)

PS3.C: Relationship Between Energy and Forces

- When two objects interact, each one exerts a force on the other that can cause energy to be transferred to or from the object. (MS-PS3-2)

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. (MS-ETS1-4)
- 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

Cause and Effect

- Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-PS2-3), (MS-PS2-5)

Scale, Proportion, and Quantity

- 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-PS3-1),

Systems and System Models

- Models can be used to represent systems and their interactions— such as inputs, processes and outputs—and energy and matter flows within systems. (MS-PS2-1), (MS-PS2-4), (MS-PS3-2)

Stability and Change

- Explanations of stability and change in natural or designed systems can be constructed by examining the changes over time and forces at different scales. (MS-PS2-2)

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Unit 3 Force, Motion, Fields, and Interactions: Life and Physical Sciences

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

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-PS2-2), (MS-PS2-4)

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

- 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)

Student Learning Objectives

Students will be able to...

- Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects.
- Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object.
- Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object.
- Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system.

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	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 copy of class notes

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• 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 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

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-PS2-1), (MS-PS2-3), (MS-PS3-1)
- RST.6-8.3 Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks. (MS-PS2-1), (MS-PS2-2), (MS-PS2-5)
- 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-PS3-1)

Writing

- WHST.6-8.1 Write arguments focused on discipline-specific content. (MS-PS2-4)
- 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-PS2-1), (MS-PS2-2), (MS-PS2-5)

Speaking and Listening

- SL.8.5 Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest. (MS-PS3-2)

Connections to NJSLS - Mathematics

- 6.SP.B.5 Summarize numerical data sets in relation to their context. (MS-LS2-2)
- MP.2 Reason abstractly and quantitatively. (MS-PS2-1), (MS-PS2-2), (MS-PS2-3), (MS-PS3-1)
- 6.NS.C.5 Understand that positive and negative numbers are used together to describe quantities having opposite directions or values; use positive and negative numbers to represent quantities in realworld contexts, explaining the meaning of 0 in each situation. (MS-PS2-1)

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

Impacts of Computing

- Advancements in computing technology can change individuals' behaviors. Society is faced with trade-offs due to the increasing globalization and automation that computing brings
    - 8.1.8.IC.1: Compare the trade-offs associated with computing technologies that affect individuals' everyday activities and career options.
    - 8.1.8.IC.2: Describe issues of bias and accessibility in the design of existing technologies

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.

- 6.RP.A.1 Understand the concept of ratio and use ratio language to describe a ratio relationship between two quantities. (MS-PS3-1)
- 6.RP.A.2 Understand the concept of a unit rate a/b associated with a ratio a:b with $b \neq 0$, and use rate language in the context of a ratio relationship. (MS-PS3-1)
- 7.RP.A.2 Recognize and represent proportional relationships between quantities. (MS-PS3-1),
- 6.EE.A.2 Write, read, and evaluate expressions in which letters stand for numbers. (MS-PS2-1), (MS-PS2-2)
- 7.EE.B.3 Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form, 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-PS2-1), (MS-PS2-2)
- 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-PS2-1), (MS-PS2-2)
- 8.EE.A.1 Know and apply the properties of integer exponents to generate equivalent numerical expressions. (MS-PS3-1)
- 8.EE.A.2 Use square root and cube root symbols to represent solutions to equations of the form $x^2 = p$ and $x^3 = p$, where p is a positive rational number. Evaluate square roots of small perfect squares and cube roots of small perfect cubes. Know that $\sqrt{2}$ is irrational. (MS-PS3-1)
- 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-PS3-1)

- 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.
  - 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.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). ○ 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.

Economic and Government Influences

- There are government agencies and policies that affect the financial industry and the broader economy
  - 9.1.8.EG.5: Interpret how changing economic and societal needs influence employment trends and future education.

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.
- Income and benefits can vary depending on the employer and type of job or career.

- 9.2.5.CAP.5: Identify various employee benefits, including income, medical, vacation time, and lifestyle benefits provided by different types of jobs and careers.

- 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.
  - 9.2.8.CAP.4: Explain how an individual's online behavior (e.g., social networking, photo exchanges, video postings) may impact opportunities for employment or advancement.
- Developing and implementing an action plan is an essential step for achieving one's personal and professional goals
  - 9.2.8.CAP.5: Develop a personal plan with the assistance of an adult mentor that includes information about career areas of interest, goals and an educational plan
- There are 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 communities are used by individuals to share information, organize, and engage around issues and topics of interest.
  - 9.4.8.DC.7: Collaborate within a digital community to create a digital artifact using strategies such as crowdsourcing or digital surveys.
- 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.
- The mode of information can convey a message to consumers or an audience.
  - 9.4.8.IML.6: Identify subtle and overt messages based on the method of communication.
- 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.1: Construct a spreadsheet in order to analyze multiple data sets, identify relationships, and facilitate data-based decision-making.
  - 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., MSLS4-5, 6.1.8.CivicsPI.3).

Climate Change

Addressed in Unit 1

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

Energy, force, motion, speed, velocity, acceleration, distance, time, direction, kinetic energy, potential energy, height, mass, proportional, linear, nonlinear, inertia, balanced forces, unbalanced forces, fields, gravity, magnetism, electricity, static electricity, electromagnetism, electron, flow, engineering, criteria, constraints.

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: "Atoms and Molecules", "Energy and Circuits", Electromagnetic Spectrum", "Electric and Magnetic Fields", "Gravitational Forces Between Objects", "Engineering Design Process", "Potential and Kinetic Energy", "Newton's Laws of Motion" ● 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.) • Albert Einstein Archives (Holocaust Law Resource) • How Jewish refugees Contributed to and Revolutionized Science in the US (Holocaust Law) • Practicing Positive Self-Talk for Grade 7 (SEL Resource) **Project Ideas:** • Visualizing magnetic fields with iron filings
Instructional Best Practices and Exemplars	
See Appendix A for Instructional Best Practices and Exemplars	
Pacing Guide	
Grade 7 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:

Classroom Philosophy, Schedule, Structure, and Expectations

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