



Science Department

Grade 6 Science Curriculum

Earth Science

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Standards in Action: Climate Change Earth's climate is now changing faster than at any point in the history of modern civilization, primarily as a result of human activities. Global climate change has already resulted in a wide range of impacts across New Jersey and in many sectors of its economy. The addition of academic standards that focus on climate change is important so that all students will have a basic understanding of the climate system, including the natural and human-caused factors that affect it. The underpinnings of climate change span across physical, life, as well as Earth and space sciences. The goal is for students to understand climate science as a way to inform decisions that improve quality of life for themselves, their community, and globally and to know how engineering solutions can allow us to mitigate impacts, adapt practices, and build resilient systems. The topic of climate change can easily be integrated into science classes. At each grade level in which systems thinking, managing uncertainty, and building arguments based on multiple lines of data are included, there are opportunities for students to develop essential knowledge and skills that will help them understand the impacts of climate change on humans, animals, and the environment. For example, in the earlier grades, students can use data from first hand investigations of the school-yard habitat to justify recommendations for design improvements to the school-yard habitat for plants, animals, and humans. In the middle grades, students use resources from New Jersey Department of Environmental Protection, the National Oceanic and Atmospheric Administration (NOAA), and National Aeronautics and Space Administration (NASA), to inform their actions as they engage in designing, testing, and modifying an engineered solution to mitigate the impact of climate change on their community. In high school, students can construct models they develop of a proposed solution to mitigate the negative health effects of unusually high summer temperatures resulting from heat islands in cities across the globe and share in the appropriate setting. (NJDOE, Standards Draft Approval, 2020)

Course Description

The 6th Grade Earth Science course is designed to engage students in a variety of topics that directly relate to Earth and its place in the universe, including geology, weather and climate, and astronomy. These topics demonstrate the interconnectedness of the components and illustrate change over time. In addition, students will begin to develop laboratory and investigatory skills as it relates to grade level appropriate labs and experiments, which support a student's natural curiosity for the world around them. Students will also be introduced to the metric system and further develop skills for data collection and analysis, which are taught concurrently with the content of the course. Finally, students will continue to develop CER writing skills with a focus on developing scientific and technical writing skills which will translate into writing laboratory reports and research.

Timeframe

Unit	Allotted Time
Weather & Climate	10 weeks
Changing Earth	10 weeks
Astronomy	10 weeks

Alignment

The curriculum aligns with the NJSLA Science Standards and supports student mastery of content on the grade 8 NJSLA Science Assessment.

UNIT 1: Weather & Climate

Timeframe (approximate)	Key Concepts
2 weeks Water Cycle	• Water continually cycles among land, ocean, and atmosphere via transpiration, evaporation, condensation, and crystallization, and precipitation, as well as downhill flows on land. • Global movements of water and its changes in form are propelled by sunlight and gravity. • The cycling of water through Earth's systems is driven by energy from the sun and the force of gravity. • Within Earth's systems, the transfer of energy drives the motion and/or cycling of water.
5 weeks	• The motions and complex interactions of air masses result in changes in weather conditions. • The complex patterns of the changes in and movement of water in the

Weather Patterns & Forecasting	atmosphere, determined by winds, landforms, and ocean temperatures and currents, are major determinants of local weather patterns. • Examples of data that can be used to provide evidence for how the motions and complex interactions of air masses result in changes in weather conditions include weather maps, diagrams, and visualizations; other examples can be obtained through laboratory experiments. • Air masses flow from regions of high pressure to regions of low pressure, causing weather (defined by temperature, pressure, humidity, precipitation, and wind) at a fixed location to change over time. • Because patterns of the changes and the movement of water in the atmosphere are so complex, weather can only be predicted probabilistically. • Sudden changes in weather can result when different air masses collide. • Cause-and effect-relationships may be used to predict changes in weather. • Unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates. • Patterns of atmospheric and oceanic circulation that determine regional climates vary by latitude, altitude, and geographic land distribution. • Atmospheric circulation that, in part, determines regional climates is the result of sunlight-driven latitudinal banding, the Coriolis effect, and resulting prevailing winds. • Ocean circulation that, in part, determines regional climates is the result of the transfer of heat by the global ocean convection cycle, which is constrained by the Coriolis effect and the outlines of continents. • Models that can be used to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates can be diagrams, maps, and globes, or digital representations. • Examine the feedback between systems as energy from the sun is transferred between systems and circulates through the ocean and atmosphere.
3 weeks Human Impact on Climate Change	• Introductory concepts of Earth's climate system and how it is affected by both natural and human activities. • Human activities, such as pollution and deforestation, contribute to climate change. • Impacts of climate change on the environment, including effects on local ecosystems and weather patterns in New Jersey. • Recommendations for improving habitats and reducing climate impacts through engineering solutions and practices that can help mitigate the

	effects of climate change and adapt to its impacts. • Climate change that affects humans, animals, and the environment, and how science and technology can help address these challenges. • Steps to reduce the impact of Climate Change. • Decision-making for real-world solutions regarding climate change mitigation.
Unit 1	
Weather & Climate	
Summary and Rationale	
Students make sense of how Earth's geosystems operate by modeling the flow of energy and the cycling of matter within and among different systems. A systems approach is also important here, examining the feedback between systems as energy from the Sun is transferred between systems and circulates through the ocean and atmosphere. The crosscutting concepts of cause and effect, systems and system models, and energy and matter are called out as frameworks for understanding the disciplinary core ideas. In this unit, students are expected to demonstrate proficiency in developing and using models and planning and carrying out investigations as they make sense of the disciplinary core ideas. Students will collect authentic evidence from primary sources and complete a data analysis to interpret weather and describe patterns. Ultimately, students should be able to provide a cohesive answer, with specific evidence, related to what factors interact and influence weather and climate?	
Recommended Pacing	
10 weeks	
Standards	
MS-ESS2-4	Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity. [Clarification Statement: Emphasis is on the ways water changes its state as it moves through the multiple pathways of the hydrologic cycle. Examples of models can be conceptual or physical.] [Assessment Boundary: A quantitative understanding of the latent heats of vaporization and fusion is not assessed.]
MS-ESS2-5	Collect data to provide evidence for how the motions and complex interactions of air masses result in changes in weather conditions. [Clarification Statement: Emphasis is on how air masses flow from regions of high

	pressure to low pressure, causing weather (defined by temperature, pressure, humidity, precipitation, and wind) at a fixed location to change over time, and how sudden changes in weather can result when different air masses collide. Emphasis is on how weather can be predicted within probabilistic ranges. Examples of data can be provided to students (such as weather maps, diagrams, and visualizations) or obtained through laboratory experiments (such as with condensation).] [Assessment Boundary: Assessment does not include recalling the names of cloud types or weather symbols used on weather maps or the reported diagrams from weather stations.]
MS_ESS2-6	Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates. [Clarification Statement: Emphasis is on how patterns vary by latitude, altitude, and geographic land distribution. Emphasis of atmospheric circulation is on the sunlight-driven latitudinal banding, the Coriolis effect, and resulting prevailing winds; emphasis of ocean circulation is on the transfer of heat by the global ocean convection cycle, which is constrained by the Coriolis effect and the outlines of continents. Examples of models can be diagrams, maps, and globes, or digital representations.] [Assessment Boundary: Assessment does not include the dynamics of the Coriolis effect.]

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), (MS-ESS2-6)
- Develop a model to describe unobservable mechanisms. (MS-ESS2-4)

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.

- Collect data to produce data to serve as the basis for evidence to answer scientific questions or test design solutions under a range of conditions. (MS-ESS2-5)

Analyzing and Interpreting Data

Analyzing data in 6–8 builds on K–5 experiences and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis.

- Analyze and interpret data to provide evidence for phenomena. (MS-ESS2-3)

Constructing Explanations and Designing Solutions

Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific 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 nature operate today as they did in the past and will continue to do so in the future. (MS-ESS2-2)

Connections to Nature of Science

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)

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 Large-Scale 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)

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

- Water continually cycles among land, ocean, and atmosphere via transpiration, evaporation, condensation and crystallization, and precipitation, as well as downhill flows on land. (MS-ESS2-4)
- The complex patterns of the changes and the movement of water in the atmosphere, determined by winds, landforms, and ocean temperatures and currents, are major determinants of local weather patterns. (MS-ESS2-5)
- Global movements of water and its changes in form are propelled by sunlight and gravity. (MS-ESS2-4)
- Variations in density due to variations in temperature and salinity drive a global pattern of interconnected ocean currents. (MS-ESS2-6)
- 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)

ESS2.D: Weather and Climate

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

Crosscutting Concepts

Patterns

- 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-ESS2-5)

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)

Systems and System Models

- Models can be used to represent systems and their interactions—such as inputs, processes and outputs—and energy, matter, and information flows within systems. (MS-ESS2-6)

Energy and Matter

- Within a natural or designed system, the transfer of energy drives the motion and/or cycling of matter. (MS-ESS2-4)

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)

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Constructing Explanations and Designing Solutions Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories. Construct 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 nature operate today as they did in the past and will continue to do so in the future. (MS-ESS2-2)	- The complex patterns of the changes and the movement of water in the atmosphere, determined by winds, landforms, and ocean temperatures and currents, are major determinants of local weather patterns. (MS-ESS2-5) - Global movements of water and its changes in form are propelled by sunlight and gravity. (MS-ESS2-4) - Variations in density due to variations in temperature and salinity drive a global pattern of interconnected ocean currents. (MS-ESS2-6) - 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) ESS2.D: Weather and Climate - Weather and climate are influenced by interactions involving sunlight, the ocean, the atmosphere, ice, landforms, and living things. These interactions vary with latitude, altitude, and local and regional geography, all of which can affect oceanic and atmospheric flow patterns. (MS-ESS2-6) - Because these patterns are so complex, weather can only be predicted probabilistically. (MS-ESS2-5) - The ocean exerts a major influence on weather and climate by absorbing energy from the sun, releasing it over time, and globally redistributing it through ocean currents. (MS-ESS2-6)	<i>Connections to Nature of Science</i> 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)
Interdisciplinary Connections		
RST.6-8.1	Cite specific textual evidence to support analysis of science and technical texts.	

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.
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.
SL.8.5	Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest.
MP.2	Reason abstractly and quantitatively.
6.NS.C.5	Understand that positive and negative numbers are used together to describe quantities having opposite directions or values (e.g., temperature above/below zero, elevation above/below sea level, credits/debits, positive/negative electric charge); use positive and negative numbers to represent quantities in real-world contexts, explaining the meaning of 0 in each situation.
6.SP.B.5	Reporting the number of observations. Describing the nature of the attribute under investigation, including how it was measured and its units of measurement. Giving quantitative measures of center (median and/or mean) and variability (interquartile range and/or mean absolute deviation), as well as describing any overall pattern and any striking deviations from the overall pattern with reference to the context in which the data were gathered.
Integration of Technology	
8.1	All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and create and communicate knowledge.
8.2	All students will develop an understanding of the nature and impact of technology, engineering, technological design, computational thinking and the designed world as they relate to the individual, global society, and the environment.
Career Readiness, Life Literacies and Key Skills	
9.4.8.CI.1	Assess data gathered on varying perspectives on causes of climate change (e.g., cross-cultural, 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.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).
Enduring Understandings:	Essential Questions:
Water Cycle: Energy from the Sun is transferred between systems and circulates through the ocean and atmosphere. Weather & Climate: Weather patterns result from complex interactions among air masses, landforms, ocean temperatures, and winds, which can be analyzed through models and data. Human Impact: Climate change affects ecosystems, weather patterns, and human communities, necessitating informed actions and technological solutions.	Water Cycle 1. How does energy from the sun and gravity influence the water cycle? 2. In what ways does the water cycle connect different Earth's systems, such as land, ocean, and atmosphere? 3. How do the processes of evaporation, condensation, precipitation, and runoff affect weather and climate? Weather & Climate 1. What factors interact and influence weather and climate? 2. How do interactions among different air masses produce changing weather conditions? 3. What roles do landforms, ocean temperatures, and wind patterns play in determining local weather? 4. Why can weather only be predicted within a range of probabilities rather than with certainty? 5. How do Earth's rotation and uneven heating create patterns of atmospheric and oceanic circulation? 6. In what ways do models help us understand and predict weather and climate patterns? 7. How do longitudinal and latitude lines influence the biome and climate of the weather and patterns? Human Impact 1. How does human activity alter natural processes within Earth's climate system? 2. What are the observable impacts of climate change on local environments and weather patterns?

	3. How can science and technology be used to reduce the effects of climate change? 4. In what ways can individuals and communities contribute to mitigating climate change?
Evidence of Learning (Assessments)	
Upon completion of the unit, students will be able to engage in assessment tasks to show their ability to: • Develop a model to describe the cycling of water through Earth’s systems driven by energy from the sun and the force of gravity. • Model the ways water changes its state as it moves through the multiple pathways of the hydrologic cycle. • Collect data to serve as the basis for evidence for how the motions and complex interactions of air masses result in changes in weather conditions. • Interpret data collected in a grade level/developmentally appropriate manner that allows for interpretation and analysis. • Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates. Students will utilize the following assessments and activities to demonstrate learning: • Gizmo lab sheets/ end of lab assessments • IXL skills/quizzes • Wayground assessments • Quizzes • Benchmark tests • Projects	
Objectives (SLO)	
Students will know: • Describe how water moves through land, ocean, and atmosphere via processes like evaporation, condensation, precipitation, and runoff. • Explain how sunlight and gravity drive the water cycle and influence water movement on Earth. • Illustrate the main steps of the water cycle and how energy from the sun powers these processes. • Recognize the importance of the water cycle in supporting life and maintaining Earth's systems. • Understand how air masses and weather	Students will be able to: • Develop a model to describe the cycling of water through Earth’s systems driven by energy from the sun and the force of gravity. • Collect data to provide evidence for how the motions and complex interactions of air masses result in changes in weather conditions. • Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates.

patterns interact to cause changes in weather conditions. • Use weather maps and models to identify the movement of water and air in the atmosphere. • Explain how high and low-pressure systems influence local weather, including temperature, wind, and precipitation. • Recognize that weather prediction is based on probabilities and cause-and-effect relationships. • Describe how Earth's rotation and uneven heating create regional climate patterns through atmospheric and oceanic circulation. • Use diagrams and models to explain how global movement of water and air affects weather and climate. • Collect and analyze local weather data to identify patterns. • Understand the difference between weather and climate. • Use scientific tools and methods to conduct experiments and investigations. • Describe how natural and human activities influence Earth's climate system. • Interpret how human activities influence weather and climate. • Explain how pollution and deforestation contribute to climate change. • Recognize the effects of climate change on local ecosystems, weather patterns, and communities in New Jersey. • Use data to support ideas for protecting habitats and reducing climate impacts. • Explore engineering and technological solutions to help mitigate and adapt to climate change. • Understand how science and technology can help communities respond to climate challenges and improve quality of life.	
Suggested Resources/Technology Tools	
Resources for the course are teacher designed and based upon class needs, curriculum and aligned to standards. Gizmos https://apps.explorellearning.com/gizmos/ Labs: <i>Phases of Water, Water Cycle, Comparing Climates, Observing Weather, Water Pollution, Weather Maps, Fighting Floods STEM case, Causes of Seasons STEM case, Rabbit Population,</i>	

Household Energy Use, Microbiologist Mission: Reducing River Runoff and Pollution STEM case, Sound Off STEM case reduce noise pollution, Greenhouse Gases, Carbon Cycle.

Wayground <https://wayground.com>

Weather Forecasting <https://www.weatherwizkids.com/weather/weather-forecasting/>

National Forecast https://www.wpc.ncep.noaa.gov/national_forecast/natfcst.php?day=2

Water Cycle interactive game/vocabulary <https://www.discoverwater.org/water-cycle/>

Water Cycle reading <https://www.usgs.gov/water-science-school/water-cycle>

Ocean Current game, reading, video <https://spaceplace.nasa.gov/ocean-currents/en/>

Earth's Atmosphere <https://spaceplace.nasa.gov/atmosphere/en/>

Air Pressure game https://web.extension.illinois.edu/treehouse/activity_pressure.cfm

Human Impact Deforestation lessons:

<https://mynasadata.larc.nasa.gov/phenomenon/deforestation/lesson-plans>

World Population Map <https://worldpopulationhistory.org/map/1/mercator/1/0/25/#>

<https://worldpopulationhistory.org/wp-content/uploads/03-Lesson-Plan.pdf>

Carbon Footprint calculator: <https://www.footprintcalculator.org/en/quiz/0/food/category>

National Oceanic and Atmospheric Administration <https://www.noaa.gov/>

IXL 6th grade skills: water cycle DD.1-3, air masses EE.1-4, weather/climate FF.1-7, Z.1 human impact on groundwater

Hands-on labs: water distribution, water cycle model, sunlight & temperature investigation, soap bubble investigation, use thermometers, rain gauges, wind vanes, and barometers to measure weather elements to record daily temperature, rainfall, wind speed/direction, humidity.

Tier 1 Modifications and Accommodations

Including special education students, Multilingual Language Learners (MLLs), students at risk of school failure, gifted and talented students, and students with 504 plans;

Teachers can choose from any of the suggested modifications that follow based upon teaching style, instructional method and needs of individual students.

General Modifications for students struggling to learn:

- Focus on building relationships in the classroom.
- Control the stressors for the student and manage alternate pathways for completion of assignments.
- Provide feedback utilizing a growth mindset and praise what is done correctly based upon effort, attitude and strategy.
- Boost engagement with material by providing opportunities of differentiation, group work and alternative assignments/assessments where appropriate.
- IXL level

MLL

- Provide additional wait time for student responses to questions to allow students the ability to undergo the process of translation between languages, composition of response and attempted response.
- Simplification of sentence structure and repetition of questions/sentences exactly as stated before trying to rephrase to allow MLL students to hear the sentence and try to comprehend it.

- Rephrase idioms and teach their meanings as when learning a new language, translations are often very literal. IE “Take a stab at it.” Ensure students understand what is meant.
- Use directed reading activities. Ensure preview of text before assigned/read, provide pre-reading questions about the main idea and offer help utilizing key words.
- Allow the use of Google Translate where appropriate.
- Utilize bilingual reading texts provided by the STC program.

G/T

Utilize differentiation in the areas of acceleration, enrichment, and grouping. Examples include, but are not limited to:

- interdisciplinary and problem-based assignments with planned scope and sequence
- advance, accelerated, or compacted content
- abstract and advanced higher-level thinking
- allowance for individual student interests
- assignments geared to development in areas of affect, creativity, cognition, and research skills
- complex, in-depth assignments
- diverse enrichment that broadens learning
- variety in types of resources
- internships, mentorships and independent study where applicable

504/IEP

Modifications and accommodations must be aligned to the stated plan and uphold expectations of the plan lawfully. Every student requires a different set of accommodations based upon need. Examples specific to science practice include, but are not limited to:

- Note taker or lab assistant
- Group lab assignments
- Use of scribe
- Adjustable tables and lab equipment within reach
- Classrooms, labs and field trips in accessible locations
- Additional time and separate room for test taking
- Additional time for in-class assignments
- Additional time in lab
- Visual and tactile instructional demonstrations
- Computer with voice output, spelling and grammar checker
- Seating in the front of the class
- Tactile drawings and graphs, and three-dimensional models
- Assignments in electronic format
- Large-print handouts, lab signs and equipment labels
- Computer equipped to enlarge screen characters and images
- Auditory lab warning signals
- Adaptive lab equipment (talking calculators, talking thermometers, light probes, tactile timers)
- Staples on sticks to indicate units of measurement
- Visual warning system for lab emergencies

Career Readiness, Life Literacies, and Key Skills NJSLs

Please select all standards that apply to this unit of study:

- ☐ Act as a responsible and contributing citizen and employee.
- ☐ Apply appropriate academic and technical skills.
- ☐ Attend to personal health and financial well being.
- ☐ Communicate clearly and effectively and with reason.

- ☐ Consider the environmental, social and economic impacts of decisions.
- ☐ Demonstrate creativity and innovation.
- ☐ Employ valid and reliable research strategies.
- ☐ 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.
- ☐ Work productively in teams while using cultural global competence.

Suggestions on integrating these standards can be found at:

<https://www.nj.gov/education/standards/clicks/>

LINKS TO CAREERS:

Careers in Meteorology and Atmospheric Science:

- www.ametsoc.org (American Meteorological Society)
- <http://www.iamas.org> (International Association of Meteorology and Atmospheric Sciences)
- www.wmo.int (World Meteorological Organization)
- <https://www.noaa.gov> (National Oceanic and Atmospheric Administration)

UNIT 2: Changing Earth

Timeframe (approximate)	Key Concepts
Earth's Crust & Changes Within Earth's Crust 3 Weeks	• Energy drives the process that results in the cycling of Earth's materials. • Tectonic processes continually generate new seafloor at ridges and destroy old seafloor at trenches. • Convection currents of magma drive plate tectonics and are responsible for natural events such as earthquakes and volcanoes • Convergent, divergent and transform plate boundaries are the result of forces deep within the Earth • Areas of subduction contribute to both the destruction of old crust and the creation of new crust. • Rock formations and the fossils they contain are used to establish relative ages of major events in Earth's history.
Earth's Surface & Changes to the Earth's Surface 3 Weeks	• Geoscience processes have changed Earth's surface at varying time and spatial scales. • Geoscience processes shape local geographic features. • Energy drives the process that results in the cycling of Earth's materials. • The processes of melting, weathering, erosion, deformation, and sedimentation act together to change the surface of the Earth. • Plate tectonics influence Earth surface through the creation of mountains and valleys • All Earth processes are the result of energy flowing and matter cycling within and among the planet's systems. • Water movements - both on the land and underground - cause weathering and erosion, which change the land's surface features and create underground formations.
Geological Time & Changes Over Time 2 Weeks	• The geologic time scale is used to organize Earth's 4.6 billion-year-old history. • The geologic time scale interpreted from rock strata provides a way to organize Earth's history. • Geoscience processes have changed Earth's surface at varying time and spatial scales. • Processes change Earth's surface at time and spatial scales that can be large or small; many geoscience processes usually behave gradually but are punctuated by catastrophic events. • Geoscience processes shape local geographic features. Processes change Earth's surface at time and spatial scales that can be large or small; many geoscience processes usually behave gradually but are punctuated by catastrophic events.

	• 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. • Interactions among Earth’s systems have shaped Earth’s history and will determine its future. • Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small. • The geologic time scale interpreted from rock strata provides a way to organize Earth’s history. • Analyses of rock strata and the fossil record provide only relative dates, not an absolute scale. • Rock formations and the fossils they contain are used to establish relative ages of major events in Earth’s history. • Maps of ancient land and water patterns, based upon investigations of rocks and fossils, make clear how Earth’s plates have moved great distances, collided, and spread apart. • Patterns in rates of change and other numerical relationships can provide information about past plate motions. • The distribution of fossils and rocks, continental shapes, and seafloor structures provide evidence of past plate motions. • 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) provide evidence of plate motions.
Earth’s Resources & Human Impact 2 Weeks	• The uneven distribution of Earth’s resources is the result of past and current geoscience processes. • Human impact upon the Earth can include the consumption of resources such as water, land, minerals, and fossil fuels, and the pollution of such resources. • Increases in human population and per-capita consumption of natural resources impact Earth’s systems. • Harvesting Earth’s resources perpetuates changes to Earth’s surface.
Unit 2	
The Changing Earth	
Summary and Rationale	
Students examine geological and geoscience data and concepts in order to understand processes and events in Earth’s history. Important crosscutting concepts in the unit are <i>scale, proportion and quantity, stability and change, and patterns</i> in relation to the different ways geologic processes operate over geologic time. An important aspect of the history of the Earth is that geologic events and conditions have affected the evolution of life, but different life forms have also played important roles in altering	

Earth's systems. Students understand how Earth's geosystems operate by modeling the flow of energy and cycling of matter within and among different systems. Students investigate the controlling properties of important materials and construct explanations based on the analysis of real geoscience data. Students are expected to demonstrate proficiency in <i>analyzing and interpreting data and constructing explanations</i>. They are also expected to use these practices to demonstrate understanding of the core ideas.	
Recommended Pacing	
10 Weeks	
Standards	
MS-ESS1-4	Construct a scientific explanation based on evidence from rock strata for how the geologic time scale is used to organize Earth's 4.6-billion-year-old history. [Clarification Statement: Emphasis is on how analyses of rock formations and the fossils they contain are used to establish relative ages of major events in Earth's history. Examples of Earth's major events could range from being very recent (such as the last Ice Age or the earliest fossils of homo sapiens) to very old (such as the formation of Earth or the earliest evidence of life). Examples can include the formation of mountain chains and ocean basins, the evolution or extinction of particular living organisms, or significant volcanic eruptions.] [Assessment Boundary: Assessment does not include recalling the names of specific periods or epochs and events within them.]
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-ESS3-1	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).]
MS-ESS3-3	Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment. [Clarification Statement: Examples of the design process include examining human environmental impacts, assessing the kinds of solutions that are feasible, and designing and evaluating solutions that could reduce that impact. Examples of human impacts can include water usage (such as the

	withdrawal of water from streams and aquifers or the construction of dams and levees), land usage (such as urban development, agriculture, or the removal of wetlands), and pollution (such as of the air, water, or land).]
MS-ESS3-4	Construct an argument supported by evidence for how increases in human population and per capita consumption of natural resources impact Earth's systems. [Clarification Statement: Examples of evidence include grade-appropriate databases on human populations and the rates of consumption of food and natural resources (such as freshwater, mineral, and energy). Examples of impacts can include changes to the appearance, composition, and structure of Earth's systems as well as the rates at which they change. The consequences of increases in human populations and consumption of natural resources are described by science, but science does not make the decisions for the actions society takes.]

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Developing and Using Models Modeling in 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), (MS-ESS2-6) - Develop a model to describe unobservable mechanisms. (MS-ESS2-4) Planning and Carrying Out Investigations Planning and carrying out investigations in in 6–8 builds on K–5 experiences and progresses to include investigations that use multiple variables and provide evidence to support explanations or solutions. - Collect data to produce data to serve as the basis for evidence to answer scientific questions or test design solutions under a range of conditions. (MS-ESS2-5) Analyzing and Interpreting Data Analyzing data in in 6–8 builds on K–5 experiences and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis. - Analyze and interpret data to provide evidence for phenomena. (MS-ESS2-3)	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) <i>(secondary to MS-ESS2-3)</i> 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 Large-Scale 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) ESS2.C: The Roles of Water in Earth’s Surface Processes - Water continually cycles among land, ocean, and atmosphere via transpiration, evaporation, condensation and crystallization, and precipitation, as well as downhill flows on land. (MS-ESS2-4)	Patterns - 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-ESS2-5) 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) Systems and System Models - Models can be used to represent systems and their interactions—such as inputs, processes and outputs—and energy, matter, and information flows within systems. (MS-ESS2-6) Energy and Matter - Within a natural or designed system, the transfer of energy drives the motion and/or cycling of matter. (MS-ESS2-4) 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)

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Constructing Explanations and Designing Solutions Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories. Construct 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 nature operate today as they did in the past and will continue to do so in the future. (MS-ESS2-2)	- The complex patterns of the changes and the movement of water in the atmosphere, determined by winds, landforms, and ocean temperatures and currents, are major determinants of local weather patterns. (MS-ESS2-5) - Global movements of water and its changes in form are propelled by sunlight and gravity. (MS-ESS2-4) - Variations in density due to variations in temperature and salinity drive a global pattern of interconnected ocean currents. (MS-ESS2-6) - 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) ESS2.D: Weather and Climate - Weather and climate are influenced by interactions involving sunlight, the ocean, the atmosphere, ice, landforms, and living things. These interactions vary with latitude, altitude, and local and regional geography, all of which can affect oceanic and atmospheric flow patterns. (MS-ESS2-6) - Because these patterns are so complex, weather can only be predicted probabilistically. (MS-ESS2-5) - The ocean exerts a major influence on weather and climate by absorbing energy from the sun, releasing it over time, and globally redistributing it through ocean currents. (MS-ESS2-6)	<i>Connections to Nature of Science</i> 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)

Interdisciplinary Connections	
RST.6-8.1	Cite specific textual evidence to support analysis of science and technical text. (MS-ESS2-2), (MS-ESS2-3), (MS-ESS2-5)
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 flow chart, diagram, model, graph, or table). (MS ESS2-3)
RST.6-8.9	Compare and contrast the information gained from experiments, simulations, videos, 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/explorative texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content. (MS-ESS2-2)
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),(MS-ESS2-6)
MP.2	Reason abstractly and quantitatively. (MS-ESS2-2),(MS-ESS2-3),(MS-ESS2-5)
6.EE.B6	Use variables to represent numbers and write expressions when solving real-world or mathematical problems; understanding 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)
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)
Integration of Technology	
Influence of Science, Engineering, and Technology on Society and the Natural World	Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects. (MS-ESS3-2)
8.1 Educational Technology	All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and create and communicate knowledge.
8.2 Technology Education,	All students will develop an understanding of the nature and impact of technology, engineering, technological design, computational thinking and

Engineering, Design and Computational Thinking - Programming	the designed world as they relate to the individual, global society, and the environment.
Career Readiness, Life Literacies and Key Skills	
9.4.8.CI.1	Assess data gathered on varying perspectives on causes of climate change (e.g., cross-cultural, 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.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)
Enduring Understandings	Essential Questions
Tectonic processes continually generate new ocean sea floor at ridges and destroy old seafloor at trenches. 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. - Water's movements—both on the land and underground—cause weathering and erosion, which change the land's surface features and create underground format Earth's systems and Geological Time Scale 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. The uneven distribution of Earth's resources is the result of past and current geoscience processes. - Increases in human population and per-capita consumption of natural	Earth's Crust & Changes to Earth's Crust - What do rock layers tell about Earth's history? - How does water change Earth's crust? - What forces drive Earth's systems? - How do convection currents power the changing Earth? - What is the theory of plate tectonics? - What types of changes are happening on the ocean floors? - How is new crust created and older crust destroyed? - What causes volcanic eruptions and earthquakes? - What tools have been used to predict earthquakes and volcanoes? - In what ways can volcanic eruptions be constructive instead of destructive? - What changes occur within the Earth's crust? - What evidence do we have to support changes in the Earth? Earth's Surface & Changes to Earth's Surface - How are rocks and minerals recycled to form Earth's materials? - How does soil form? - What evidence do we have to support

resources impact Earth's systems.	changes in the Earth? 4. Geological Time & Changes Over Time 1. What evidence do we have to establish the relative age of historical events? 2. How is Earth's history interpreted and recorded in the Geologic Time Scale? 3. What evidence do we have to support changes in the Earth? 4. What are the effects of catastrophic changes to the Earth? 5. What do fossils tell about Earth's past? Earth's Resources & Human Impact 1. How do people affect Earth's resources? 2. What resources does the Earth provide? 3. What does it mean to be a good steward of the Earth? 4. How can humans protect Earth's resources? 5. How can people conserve Earth's resources? 6. How has the consumption of natural resources changed the Earth? 7. How has the consumption of natural resources changed the Earth? 8. What evidence do we have to support changes in the Earth?
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Evidence of Learning (Assessments)

Upon completion of the unit, students will be able to engage in assessment tasks to show their ability to:

- Construct a scientific explanation, in CER format, based on valid and reliable evidence from rock strata obtained from sources (including the student's 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 at 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 at time and spatial scales that can be 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.
- Analyze and interpret data such as distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of past plate motions.
- Analyze how scientific findings have been revised and / or reinterpreted based on new evidence about past plate motions.
- Conduct investigations and generate authentic lab reports.
- Examine geoscience data in order to understand the processes and events in Earth's history.

Students will utilize the following assessments and activities to demonstrate learning:

- Gizmo lab sheets/end of lab assessments
- IXL skills/quizzes
- Wayground assessments
- Quizzes
- Benchmark tests
- Projects

Objectives (SLO)

Students will know:

- Geoscience processes have changed Earth's surface at varying time and spatial scales.
- Processes change Earth's surface at time and spatial scales that can be large or small; many geoscience processes usually behave gradually but are punctuated by catastrophic events.
- Geoscience processes shape local geographic features.
- 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.
- Interactions among Earth's systems have shaped Earth's history and will determine its future.
- Time, space, and energy phenomena within Earth's systems can be observed at various scales using models to study systems that are too large or too small.
- Tectonic processes continually generate

Students will be able to:

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

new seafloor at ridges and destroy old sea floor at trenches. • 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. • Patterns in rates of change and other numerical relationships can provide information about past plate motions. • The distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of past plate motions. • 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) provide evidence of past plate motions	hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects. • Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment. • Construct an argument supported by evidence for how increases in human population and per capita consumption of natural resources impact Earth's systems.
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Suggested Resources / Technology Tools

Resources for the course are teacher designed and based upon class needs, curriculum and aligned to standards.

IXL

Gizmos

Wayground

Laboratory Exploration Manuals

USGS.gov

education.nationalgeographic.org

<https://www.nsta.org/science-standards>

sustainablejerseyschools.com/resources/resource-library/climate-change-curriculum/

https://nj.pbslearningmedia.org/resource/ess05.sci.ess.earthsys.lp_platetectonics/plate-tectonics

[https://www.esc.cam.ac.uk/research/research-groups/cambridge-volcano-seismology/kids-activities-and-teaching resources](https://www.esc.cam.ac.uk/research/research-groups/cambridge-volcano-seismology/kids-activities-and-teaching-resources)

<https://www.jpl.nasa.gov/edu/teach/activity/lava-layering-making-and-mapping-a-volcano/>

https://www.pbs.org/wgbh/nova/education/resources/subj_03_03.html

<https://www.readworks.org/article/Finding-Fault/52281b0d-a5cf-4c3f-85ea-1ca966c42f89#!articleTab:content/>

<https://www.readworks.org/article/Mount-Pinatubo-and-the-Ring-of-Fire/3d0036cc-d11d-449a-ac45-9989db214acd#!articleTab:content/>

[https://www.readworks.org/article/Our-Changing-Earth-Plate-Tectonics-and-Large-Scale-System Interactions/c3ea000a-8cd7-4bff-90f0-6298cfbcfc36](https://www.readworks.org/article/Our-Changing-Earth-Plate-Tectonics-and-Large-Scale-System-Interactions/c3ea000a-8cd7-4bff-90f0-6298cfbcfc36)

www.teachengineering.org

Tier 1 Modifications and Accommodations

Including special education students, Multilingual Language Learners (MLLs), students at risk of school failure, gifted and talented students, and students with 504 plans

Teachers can choose from any of the suggested modifications that follow based upon teaching style, instructional method and needs of individual students.

General Modifications for students struggling to learn:

- Focus on building relationships in the classroom.
- Control the stressors for the student and manage alternate pathways for completion of assignments.
- Provide feedback utilizing a growth mindset and praise what is done correctly based upon effort, attitude and strategy.
- Boost engagement with material by providing opportunities of differentiation, group work and alternative assignments/assessments where appropriate.

MLL

- Provide additional wait time for student responses to questions to allow students the ability to undergo the process of translation between languages, composition of response and attempted response.
- Simplification of sentence structure and repetition of questions/sentences exactly as stated before trying to rephrase to allow MLL students to hear the sentence and try to comprehend it.
- Rephrase idioms and teach their meanings as when learning a new language, translations are often very literal. IE “Take a stab at it.” Ensure students understand what is meant.
- Use directed reading activities. Ensure preview of text before assigned/read, provide pre-reading questions about the main idea and offer help utilizing key words.
- Allow the use of Google Translate where appropriate.
- Utilize bilingual reading texts provided by the STC program.

G/T

Utilize differentiation in the areas of acceleration, enrichment, and grouping. Examples include, but are not limited to:

- interdisciplinary and problem-based assignments with planned scope and sequence
- advance, accelerated, or compacted content
- abstract and advanced higher-level thinking
- allowance for individual student interests
- assignments geared to development in areas of affect, creativity, cognition, and research skills
- complex, in-depth assignments
- diverse enrichment that broadens learning
- variety in types of resources
- internships, mentorships and independent study where applicable

504/IEP

Modifications and accommodations must be aligned to the stated plan and uphold expectations of the plan lawfully. Every student requires a different set of accommodations based upon need. Examples specific to science practice include, but are not limited to:

- Note taker or lab assistant
- Group lab assignments
- Use of scribe
- Adjustable tables and lab equipment within reach

- Classrooms, labs and field trips in accessible locations
- Additional time and separate room for test taking
- Additional time for in-class assignments
- Additional time in lab
- Visual and tactile instructional demonstrations
- Computer with voice output, spelling and grammar checker
- Seating in the front of the class
- Tactile drawings and graphs, and three-dimensional models
- Assignments in electronic format
- Large-print handouts, lab signs and equipment labels
- TV monitor connected to microscope to enlarge images
- Computer equipped to enlarge screen characters and images
- Auditory lab warning signals
- Adaptive lab equipment (talking calculators, talking thermometers, light probes, tactile timers)
- Staples on sticks to indicate units of measurement
- Visual warning system for lab emergencies

Career Readiness, Life Literacies, and Key Skills NJSLs

Please select all standards that apply to this unit of study:

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

Suggestions on integrating these standards can be found at:
<https://www.nj.gov/education/standards/clicks/>

LINKS TO CAREERS:

Cartographer or Photogrammetrist
Civil Engineering Technician
Civil Engineers
Climate Change Analyst
Environmental Engineer
Environmental Engineering Technician
Geographer

Geographic Information Systems Technician
Geoscientists
Petroleum Engineer
Soil Scientist
Surveyor

UNIT 3: Astronomy

Timeframe (approximate)	Key Concepts To Cover
Universe & Stars 4 weeks	- Analyze scale models to compare distances between stars and galaxies, recognizing that even the closest stars are many light-years away. - Interpret star brightness data to explain why some stars appear brighter due to distance while others are intrinsically more luminous. - Examine images of nebulae to identify evidence of star formation in gas and dust clouds. - Construct a sequence model showing how stars change over time from birth in a nebula to their final stages. - Use patterns in star color to infer temperature differences among stars. - Argue from evidence that gravity is the force that organizes stars into galaxies and keeps them in motion.
Earth & the Solar System 4 weeks	- Develop a physical model of the solar system to compare the relative sizes and spacing of planets. - Analyze seasonal sunlight data to explain how Earth's tilt and revolution create seasonal temperature patterns. - Use observations of shadows to infer Earth's rotation and the daily motion of the Sun across the sky. - Model Moon-Earth-Sun positions to predict moon phases and explain why they follow a repeating pattern. - Interpret orbital period graphs to show that planets farther from the Sun take longer to orbit. - Use evidence from meteorites to describe how the solar system formed from ancient dust and rock.
History of Planet Earth 2 weeks	- Analyze rock layer diagrams to determine the relative ages of events in Earth's history. - Examine fossil evidence to infer how environments and life forms have changed over millions of years. - Model plate movement to explain how shifting plates create mountains, earthquakes, and volcanoes. - Track patterns of earthquakes to identify plate boundaries and support the theory of plate tectonics. - Construct explanations for how Earth's surface changes through weathering, erosion, and deposition. - Interpret geologic time charts to place major events — such as mass extinctions — in Earth's 4.6-billion-year timeline.

Unit 3	
Astronomy	
Summary and Rationale	
This unit is broken down into three sub-ideas: the universe and its stars, Earth and the solar system, and the history of planet Earth. Students examine the Earth's place in relation to the solar system, the Milky Way galaxy, and the universe. There is a strong emphasis on a systems approach and using models of the solar system to explain the cyclical patterns of eclipses, tides, and seasons. There is also a strong connection to engineering through the instruments and technologies that have allowed us to explore the objects in our solar system and obtain the data that support the theories explaining the formation and evolution of the universe. The crosscutting concepts of patterns, scale, proportion, and quantity and systems and systems models provide a framework for understanding the disciplinary core ideas. Students are expected to demonstrate proficiency in developing and using models and analyzing and interpreting data. Students are also expected to use these practices to demonstrate an understanding of the core ideas.	
Recommended Pacing	
10 weeks	
Standards	
MS-ESS1-1	Develop and use a model of the Earth-sun-moon system to describe the cyclic patterns of lunar phases, eclipses of the sun and moon, and seasons.
MS-ESS1-1	Explain eclipses of the sun and moon and that the Earth's spin axis is fixed in direction over the short term but tilted relative to its orbit around the sun. Explain that the seasons are a result of that tilt and are caused by the differential intensity of sunlight on different areas of Earth across the year.
MS-ESS1-2	Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system.
MS-ESS1-3	Analyze and interpret data to determine scale properties of objects in the solar system.

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-ESS1-1),(MS-ESS1-2) Analyzing and Interpreting Data Analyzing data in 6–8 builds on K–5 experiences and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis. - Analyze and interpret data to determine similarities and differences in findings. (MS-ESS1-3) Constructing Explanations and Designing Solutions Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories. - Construct 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-ESS1-4)	
Disciplinary Core Ideas	
ESS1.A: The Universe and Its Stars - Patterns of the apparent motion of the sun, the moon, and stars in the sky can be observed, described, predicted, and explained with models. (MS-ESS1-1) - Earth and its solar system are part of the Milky Way galaxy, which is one of many galaxies in the universe. (MS-ESS1-2) ESS1.B: Earth and the Solar System - The solar system consists of the sun and a collection of objects, including planets, their moons, and asteroids that are held in orbit around the sun by its gravitational pull on them. (MS-ESS1-2),(MS-ESS1-3) - This model of the solar system can explain eclipses of the sun and the moon. Earth's spin axis is fixed in direction over the short-term but tilted relative to its orbit around the sun. The seasons are a result of that tilt and are caused by the differential intensity of sunlight on different areas of Earth across the year. (MS-ESS1-1) - The solar system appears to have formed from a disk of dust and gas, drawn together by gravity. (MS-ESS1-2) ESS1.C: The History of Planet Earth - The geologic time scale interpreted from rock strata provides a way to organize Earth's history. Analyses of rock strata and the fossil record provide only relative dates, not an absolute scale. (MS-ESS1-4)	
Crosscutting Concepts	
Patterns - Patterns can be used to identify cause-and-effect relationships. (MS-ESS1-1) 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-ESS1-3),(MS-ESS1-4) Systems and System Models - Models can be used to represent systems and their interactions. (MS-ESS1-2) ----- Connections to Engineering, Technology, and Applications of Science Interdependence of Science, Engineering, and Technology - Engineering advances have led to important discoveries in virtually every field of science and scientific discoveries have led to the development of entire industries and engineered systems. (MS-ESS1-3) ----- Connections to Nature of Science Scientific Knowledge Assumes an Order and Consistency in Natural Systems - Science assumes that objects and events in natural systems occur in consistent patterns that are understandable through measurement and observation. (MS-ESS1-1),(MS-ESS1-2)	
Interdisciplinary Connections	
RST.6-8.1	Cite specific textual evidence to support analysis of science and technical texts. (MS-ESS1-3)
RST.6-8.7	Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table). (MS-ESS1-3)
SL.8.5	Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest. (MS-ESS1-1),(MS-ESS1-2)
MP.2	Reason abstractly and quantitatively. (MS-ESS1-3)
Integration of Technology	
8.1	All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and create and communicate knowledge.
8.2	All students will develop an understanding of the nature and impact of technology, engineering, technological design, computational thinking and the designed world as they relate to the individual, global society, and the environment.

Career Readiness, Life Literacies and Key Skills	
9.4.8.CI.1	Assess data gathered on varying perspectives on causes of climate change (e.g., cross-cultural, 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.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).
Enduring Understandings:	Essential Questions
Universe & Stars: Patterns of the apparent motion of the sun, the moon, and stars in the sky can be observed, described, predicted, and explained with models. Earth & The Solar System: Earth and its solar system are part of the Milky Way galaxy, which is one of many galaxies in the universe. The solar system consists of the sun and a collection of objects, including planets, their moons, and asteroids that are held in orbit around the sun by its gravitational pull on them. History of Planet Earth: This model of the solar system can explain eclipses of the sun and moon. Earth's spin axis is fixed in direction over the short-term but tilted relative to its orbit around the sun. The seasons are a result of that tilt and are caused by the differential intensity of sunlight on different areas of Earth across the year. The solar system appears to have formed from a disk of dust and gas, drawn together by gravity.	Universe & Stars 1. Why do objects in space appear to move? 2. What is Earth's place in the universe? 3. How do we observe and record information about the universe? Earth & The Solar System 1. What is the cause of seasons? 2. What is the cause of lunar phases? 3. What causes solar and lunar eclipses? 4. How did our solar system form? 5. How does the size of Earth compare to other objects in our solar system? History of Planet Earth: 1. What role does gravity play in our solar system? 2. What causes tides? 3. What evidence can we identify to support the history of changes in the Earth? 4. What changes in Earth can we see daily?

Evidence of Learning (Assessments)

Upon completion of the unit, students will be able to engage in assessment tasks to show their ability to:

- Identify patterns of the apparent motion of the sun, the moon, and stars in the sky can be observed, described, predicted, and explained with models.
- Recognize that Earth and its solar system are part of the Milky Way galaxy, which is one of many galaxies in the universe. The solar system consists of the sun and a collection of objects, including planets, their moons, and asteroids that are held in orbit around the sun by its gravitational pull on them.
- Use a model of the solar system can explain eclipses of the sun and moon.

Students will utilize the following assessments and activities to demonstrate learning:

- Pre-Assessment
- Do Now/Exit Tickets
- Formal quiz/test assessments
- Inquiries/Labs
- Waygrounds Assessments
- Benchmark tests
- Projects
- Astronomy Unit Assessment

Objectives (SLO)

Students will know:

- Patterns in the apparent motion of the sun, moon, and stars in the sky can be observed, described, predicted, and explained with models.
- The Earth and solar system model of the solar system can explain eclipses of the sun and the moon.
- Earth's spin axis is fixed in direction over the short term but tilted relative to its orbit around the sun.
- The seasons are a result of that tilt and are caused by the differential intensity of sunlight on different areas of Earth across the year.

Students will be able to:

- Develop and use a physical, graphical, or conceptual model to describe patterns in the apparent motion of the sun, moon, and stars in the sky.
- Develop and use models to explain the relationship between the tilt of Earth's axis and seasons.
- Analyze and interpret data to determine similarities and differences among objects in the solar system.

- Patterns can be used to identify cause-and-effect relationships that exist in the apparent motion of the sun, moon, and stars in the sky.
- Science assumes that objects and events in the solar system systems occur in consistent patterns that are understandable through measurement and observation.
- Gravity plays a role in the motions within galaxies and the solar system.
- Gravity is the force that holds together the solar system and the Milky Way galaxy and controls orbital motions within them.
- Earth and its solar system are part of the Milky Way galaxy, which is one of many galaxies in the universe.
- The solar system consists of the sun and a collection of objects, including planets, their moons, and asteroids, that are held in orbit around the sun by its gravitational pull on them.
- The solar system appears to have formed from a disk of dust and gas, drawn together by gravity.
- Models can be used to represent the role of gravity in the motions and interactions within galaxies and the solar system.
- Science assumes that objects and events in the solar systems occur in consistent patterns that are understandable through measurement and observation.
- Objects in the solar system have scale properties.
- Data from Earth-based instruments, space-based telescopes, and spacecraft can be used to determine similarities and differences among solar system objects.

• The solar system consists of the sun and a collection of objects, including planets, their moons, and asteroids that are held in orbit around the sun by its gravitational pull on them. • Time, space, and energy phenomena in the solar system can be observed at various scales, using models to study systems that are too large. • Engineering advances have led to important discoveries in space science, and scientific discoveries have led to the development of entire industries and engineered systems.	
Suggested Resources/Technology Tools	
Carolina Science STC “Researching the Sun-Earth-Moon System” Crash Course Kids Videos: Space Science Playlist Solar System WebQuest https://docs.google.com/document/d/1rn1cR-mFOdAG4dnjDAkEwWTcOU27ECqfG-xaMwkXdqw/edit?usp=sharing Student Notebook: Earth, Sun, and Moon https://docs.google.com/presentation/d/17j9MgTy5JssARTchGUTmOI9CQm2Q7iR92XLDQkFdtYw/edit?usp=sharing Sun and Other Stars Reading https://drive.google.com/file/d/1-yMdtpkERTjyxBlYjX4kzj-41kSeRTYH/view?usp=sharing Solar System Digital Notebook https://docs.google.com/presentation/d/15E9pWpXtanK0_Hh5CqVL77a-C00KveCsJeM3Y6dQLC8/edit?usp=sharing Solar System Scavenger Hunt https://drive.google.com/file/d/17spmft-GcAUBubHexQ414RhIPUA_k5iE/view?usp=sharing Answer Key Solar System Digital Notebook https://docs.google.com/presentation/d/1Neyu6cnS_Ya4OTLUIQCEDLs8e3fXzbJmHgANs_bSj-A/edit?usp=sharing Moon and Tide Slides https://docs.google.com/presentation/d/1eqnCU16aR0zmsgzr9hvvYlqNCETaLZXw3hO9Q_RvEn0/edit?usp=sharing Answer Key Moon and Tide Slides https://docs.google.com/presentation/d/1X3BBhXf5LU7r8k_yGViqieVjgXizrlm8wFUSPHm8Ty8/edit?usp=sharing Moon Phases Scavenger Hunt	

<https://drive.google.com/file/d/1y9-0BXX25qYGONvLiVPF1wTdZPT84lOb/view?usp=sharing>

Moon Phases Journal

<https://docs.google.com/document/d/1HayQ2RsBDWGAqNOjteSfjT9FAxJKC7u2Fe8pc2xi2K0/edit?usp=sharing>

Eclipses Notes Slides

<https://docs.google.com/presentation/d/1MtPByyV6g5n3c-ckThV67TuknePcsNKHgZ03lHhEfnQ/edit?usp=sharing>

Seasons Guided Reading and Comprehension Questions Slides

https://docs.google.com/presentation/d/16deKmLFQSiaJxp5KZK5cnddxkoua4ESFgl0aEm_mEZo/edit?usp=sharing

Why Does the Moon Change? Video and Questions

<https://docs.google.com/document/d/1qF0mKd5gOFIVItcYKK2V65j83YvUOSuXaxwsMNILaZw/edit?usp=sharing>

Gizmos Labs: Solar System, Seasons: Earth, Moon, and Sun, Seasons 3D, Seasons Around the World, Summer and Winter, Phases of the moon, Eclipses, Tides

Tier 1 Modifications and Accommodations

Including special education students, Multilingual Language Learners (MLLs), students at risk of school failure, gifted and talented students, and students with 504 plans;

Teachers can choose from any of the suggested modifications that follow based upon teaching style, instructional method and needs of individual students.

General Modifications for students struggling to learn:

- Focus on building relationships in the classroom.
- Control the stressors for the student and manage alternate pathways for completion of assignments.
- Provide feedback utilizing a growth mindset and praise what is done correctly based upon effort, attitude and strategy.
- Boost engagement with material by providing opportunities of differentiation, group work and alternative assignments/assessments where appropriate.

MLL

- Provide additional wait time for student responses to questions to allow students the ability to undergo the process of translation between languages, composition of response and attempted response.
- Simplification of sentence structure and repetition of questions/sentences exactly as stated before trying to rephrase to allow MLL students to hear the sentence and try to comprehend it.
- Rephrase idioms and teach their meanings as when learning a new language, translations are often very literal. IE "Take a stab at it." Ensure students understand what is meant.
- Use directed reading activities. Ensure preview of text before assigned/read, provide pre-reading questions about the main idea and offer help utilizing key words.
- Allow the use of Google Translate where appropriate.
- Utilize bilingual reading texts provided by the STC program.

G/T

Utilize differentiation in the areas of acceleration, enrichment, and grouping. Examples include, but are not limited to:

- interdisciplinary and problem-based assignments with planned scope and sequence
- advance, accelerated, or compacted content
- abstract and advanced higher-level thinking
- allowance for individual student interests
- assignments geared to development in areas of affect, creativity, cognition, and research skills
- complex, in-depth assignments
- diverse enrichment that broadens learning
- variety in types of resources
- internships, mentorships and independent study where applicable

504/IEP

Modifications and accommodations must be aligned to stated plan and uphold expectations of the plan lawfully. Every student requires a different set of accommodations based upon need. Examples specific to science practice include, but are not limited to:

- Note taker or lab assistant
- Group lab assignments
- Use of scribe
- Adjustable tables and lab equipment within reach
- Classrooms, labs and field trips in accessible locations
- Additional time and separate room for test taking
- Additional time for in-class assignments
- Additional time in lab
- Visual and tactile instructional demonstrations
- Computer with voice output, spelling and grammar checker
- Seating in the front of the class
- Tactile drawings and graphs, and three-dimensional models
- Assignments in electronic format
- Large-print handouts, lab signs and equipment labels
- TV monitor connected to microscope to enlarge images
- Computer equipped to enlarge screen characters and images
- Auditory lab warning signals
- Adaptive lab equipment (talking calculators, talking thermometers, light probes, tactile timers)
- Staples on sticks to indicate units of measurement
- Visual warning system for lab emergencies

Career Readiness, Life Literacies, and Key Skills NJSLs

Please select all standards that apply to this unit of study:

- ☐ Act as a responsible and contributing citizen and employee.
- ☐ Apply appropriate academic and technical skills.
- ☐ Attend to personal health and financial well being.
- ☐ Communicate clearly and effectively and with reason.
- ☐ Consider the environmental, social and economic impacts of decisions.
- ☐ Demonstrate creativity and innovation.
- ☐ Employ valid and reliable research strategies.
- ☐ 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.

- ❑ Work productively in teams while using cultural global competence.

Suggestions on integrating these standards can be found at:
<https://www.nj.gov/education/standards/clicks/>

LINKS TO CAREERS:

Science Buddies: Careers
Astronomer
Meteorologist
Aerospace Engineers
Mechanical Engineers
NASA jobs

Optional Extensions:

NASA Solar System Exploration
Pull of the Planets
Sunbeams and Sundials