POMPTON LAKES SCHOOL DISTRICT

EARTH SCIENCE

GRADE 7
COURSE OF STUDY
June 2019

Dr. Paul Amoroso, Superintendent

Board Approval, June 11, 2019

Content Area:	Earth Science
Unit Title:	Space Systems
Target Course/Grade Level:	Middle School 7

Unit Summary

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. Students examine geosciences data in order to understand the processes and events in Earth's history. 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 understanding of the core ideas.

Primary interdisciplinary connections:

NJSLS ELA/Literacy

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)*
NJSLS Mathematics	
MP.2	Reason abstractly and quantitatively. (MS-ESS1-3)
MP.4	Model with mathematics. *(MS-ESS1-1),(MS-ESS1-2)*
6.RP.A.1	Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. *(MS-ESS1-1),(MS-ESS1-2),*(MS-ESS1-3)
7.RP.A.2	Recognize and represent proportional relationships between quantities. *(MS-ESS1-1),(MS-ESS1-2),*(MS-ESS1-3)
6.EE.B.6	Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set. *(MS-ESS1-2),(MS-ESS1-4)*
7.EE.B.6	Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities. *(MS-ESS1-2)*

Unit Rationale:

Students need to have a basic understanding that Earth's orbit and rotation and the orbit of the moon around Earth cause observable patterns.

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)

Science and Engineering Practice

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)

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)

Next Generation Science Standards

(ESS1.B) Generate and analyze evidence (through simulations or long term investigations) to explain why the Sun's apparent motion across the sky changes over the course of a year.

(MS-ESS1-1) Develop and use a model of the Earth-sun-moon system to describe the cyclic patterns of lunar phases, eclipses of the sun and moon, and seasons. *[Clarification Statement: Examples of models can be physical, graphical, or conceptual.]*

(ESS1.A; ESS1.B) Develop and use a model that shows how gravity causes smaller objects to orbit around larger objects at increasing scales, including the gravitational force of the sun causes the planets and other bodies to orbit around it holding together the solar system.

(MS-ESS1-3) Analyze and interpret data to determine scale properties of objects in the solar system. *[Clarification Statement: Emphasis is on the analysis of data from Earth-based instruments, space-based telescopes, and spacecraft to determine similarities and differences among solar system objects. Examples of scale properties include the sizes of an object's layers (such as crust and atmosphere), surface features (such*

as volcanoes), and orbital radius. Examples of data include statistical information, drawings and photographs, and models.] [Assessment Boundary: Assessment does not include recalling facts about properties of the planets and other solar system bodies.]

(MS-ESS1-2) Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system. *[Clarification Statement: Emphasis for the model is on gravity as the force that holds together the solar system and Milky Way galaxy and controls orbital motions within them. Examples of models can be physical (such as the analogy of distance along a football field or computer visualizations of elliptical orbits) or conceptual (such as mathematical proportions relative to the size of familiar objects such as students' school or state).] [Assessment Boundary: Assessment does not include Kepler's Laws of orbital motion or the apparent retrograde motion of the planets as viewed from Earth.]*

Essential Questions	**Unit Enduring Understanding**
• What pattern in the Earth–sun–moon system can be used to explain lunar phases, eclipses of the sun and moon, and seasons? • What is the role of gravity in the motions within galaxies and the solar system? What are the scale properties of objects in the solar system?	

Students Learning Targets

Students will…

- 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.

Evidence of Learning

Summative Assessments: 20 days
Equipment needed:
Teacher Resources: textbook

Formative Assessments: Tests, Quizzes, Labs

Lesson Plans

Lesson	Timeframe
Generate and analyze evidence (through simulations or long term investigations) to explain why the Sun's apparent motion across the sky changes over the course of a year. 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.	10
Develop and use a model that shows how gravity causes smaller objects to orbit around larger objects at increasing scales, including the gravitational force of the sun causes the planets and other bodies to orbit around it holding together the solar system.	10
Analyze and interpret data to determine scale properties of objects in the solar system.	10

Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system.	10
Teachers notes: none	
Curriculum Development Resources: NASA Solar System Exploration: This link will connect you to NASA's Solar system Exploration website. The website offers a wide variety of student activities. Seasons Interactive provides students with the opportunity to investigate how Earth's angle of inclination affects three factors: the angle of incoming sunlight, average daily temperatures and the Sun's ecliptic path. Three preset values for the angle of inclination are available (corresponding to the values of Earth, Venus and Uranus). In Eclipse Interactive, students investigate both lunar and solar eclipses by manipulating up to three independent variables: Moon's tilt from orbit, Earth-Moon distance and size of the Moon. By viewing the effects of changes to these variables, students will be able to construct explanations for solar and lunar eclipses. The Pull of the Planets is part of a thematic series of lessons highlighting the Juno mission to Jupiter. It is a traditional hands-on activity that models how gravitational forces can keep planets and asteroids in orbit within the Solar System. Using a stretchable fabric held in place with an embroidery hoop, students work with spheres of various materials to explore how mass and sizes affect the strength of gravitational forces. Background materials, including a materials sheet, aid teachers in organizing this activity.	

Content Area:	Earth Science
Unit Title:	Earth Systems
Target Course/Grade Level:	Middle School 7

Unit Summary

Students examine geoscience data in order to understand processes and events in Earth's history. Important crosscutting concepts in this unit are *scale, proportion, and quantity*, *stability and change*, and *patterns* in relation to the different ways geologic processes operate over geologic time. An important aspect of the history of 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.

Primary interdisciplinary connections:

NJSLS ELA/Literacy

- Cite specific textual evidence to support analysis of science and technical texts. (MS-ESS1-4),(MS-ESS2-2) **RST.6-8.1**
- Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content. (MS-ESS1-4)**,**(MS-ESS2-2) **WHST.6-8.2**
- 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) **RST.6-8.7**
- 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) **RST.6-8.9**
- Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest. (MS-ESS2-1),(MS-ESS2-2) **SL.8.5**

NJSLS Mathematics

- 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) **7.EE.B.4**
- Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set. (MS-ESS1-4),(MS-ESS2-2),(MS-ESS2-3) **6.EE.B.6**
- Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities. (MS-ESS1-4) **7.EE.B.6**
- Reason abstractly and quantitatively. (MS-ESS2-2),(MS-ESS2-3) **MP.2**

Unit Rationale:

Students need to have a basic understanding that a variety of hazards result from natural processes (e.g., earthquakes, tsunamis, volcanic eruptions).

Disciplinary Core Ideas

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)

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)

Science and Engineering Processes

Developing and Using Models

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

Constructing Explanations and Designing Solutions

Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students' own experiments) and the assumption that theories and laws that describe nature operate today as they did in the past and will continue to do so in the future. (MS-ESS1-4),(MS-ESS2-2)

Analyzing and Interpreting Data

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

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)

Next Generation Science 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: Paleo magnetic anomalies in oceanic and continental crust are not assessed.*]*

Essential Questions	**Unit Enduring Understanding**
• How do we know that the Earth is approximately 4.6-billion-year-old history?	

• What drives the cycling of Earth's materials? • Do all of the changes to Earth systems occur in similar time scales? • How is it possible for the same kind of fossils to be found in New Jersey and in Africa?	

Students Learning Targets

Students will…

- Analyze and interpret data such as distributions of fossils and rocks, continental shapes, and sea floor 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.

Evidence of Learning

Summative Assessments: 30 days
Unit Test
Equipment needed:
Teacher Resources: textbook

Formative Assessments: Tests, Quizzes, Labs

Lesson Plans

Lesson	Timeframe
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.	10 days
Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process.	10
Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales.	10
Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions.	10

Teachers notes: none

Curriculum Development Resources:
Rock Cycle Journey: This is an activity out of one of the DLESE Teaching boxes. The Teaching Box is titled Mountain Building.
Interactives-Dynamic Earth: Dynamic Earth is an interactive website where students can learn about the structure of the Earth, the movements of its tectonic plates, as well as the forces that create mountains, valleys, volcanoes and earthquakes.

Content Area:	Earth Science
Unit Title:	History of Earth
Target Course/Grade Level:	Middle School 7

Unit Summary:
An important aspect of the history of 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. Earth's geosystems operate by modeling the flow of energy and cycling of matter within and among different systems.

Primary interdisciplinary connections:

NJSLS ELA/Literacy	
RST.6-8.1	Cite specific textual evidence to support analysis of science and technical texts. (MS-ESS1-4),(MS-ESS2-2),*(MS-ESS2-3)*
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-ESS2-3)
RST.6-8.9	Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic. (MS-ESS2-3)
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-ESS1-4),(MS-ESS2-2)
WHST.6-8.8	Gather relevant information from multiple print and digital sources; assess the credibility of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and providing basic bibliographic information for sources. *(MS-ESS2-5)*
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)*
NJSLS Mathematics	
MP.2	Reason abstractly and quantitatively. (MS-ESS2-2),(MS-ESS2-3),(MS-ESS2-5)
6.EE.B.6	Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set. *(MS-ESS1-4),(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-ESS1-4),(MS-ESS2-2),(MS-ESS2-3)*

Unit Rational:
Students need to have a basic understanding of water, ice, wind, living organisms, and gravity break rocks, soils, and sediments into smaller particles and move them around. The locations of mountain ranges, deep ocean trenches, ocean floor structures, earthquakes, and volcanoes occur in patterns. Most earthquakes and volcanoes occur in bands that are often along the boundaries between continents and oceans. Major mountain chains form inside continents or near their edges. Maps can help locate the different land and water features of Earth. A variety of hazards result from natural processes (e.g., earthquakes, tsunamis, volcanic eruptions). Humans cannot eliminate the hazards but can take steps to reduce their impacts.

Learning Targets

Disciplinary Core Ideas:

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)

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)

ESS3.C: Human Impacts on Earth Systems

Typically as human populations and per-capita consumption of natural resources increase, so do the negative impacts on Earth unless the activities and technologies involved are engineered otherwise. (MS-ESS3-4)

ESS3.D: Global Climate Change

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

Science and Engineering Practices:

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-ESS1-4),(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)

Next Generation Science Standard:

(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: Paleo magnetic anomalies in oceanic and continental crust are not assessed.*]*

Essential Questions	**Unit Enduring Understanding**
• Why aren't minerals and groundwater distributed evenly across the world? • How can we predict and prepare for natural disasters? • How might we treat resources if we thought about the Earth as a spaceship on an extended survey of the solar system? (How would astronauts manage their resources?) • How can basic chemistry be used to explain the mechanisms that control the global temperature the atmosphere?	

Students Learning Targets

Students will…

- Ask questions to identify and clarify a variety of evidence for an argument about the factors that have caused the rise in global temperatures over the past century.
- Ask questions to clarify human activities and natural processes that are major factors in the current rise in Earth's mean surface temperature.

Evidence of Learning

Summative Assessments: 30 Days (Unit Test)
Equipment needed:
Teacher Resources: textbook

Formative Assessments: Tests, Quizzes, Labs

Lesson Plans

Lesson	Timeframe
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.	10 days
Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process.	10 days

Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales.	10 days
Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions.	10 days
Teachers notes: none	
Curriculum Development Resources: USGS Educational Resources for Secondary Grades (7–12): This web site contains selected USGS educational resources that may be useful to educators in secondary school grades. Many of these resources can be used directly in the classroom or will be useful in classroom lessons or demonstration activities preparation, or as resources for teacher education and curriculum development. NOAA Education Resources: This website contains access to curriculum resources, professional development opportunities, student opportunities, and outreach events.	

Content Area:	Earth Science
Unit Title:	Human Impact on Earth & Water
Target Course/Grade Level:	Middle School 7

Unit Summary:
In this unit of study, students analyze and interpret data and design solutions to build on their understanding of the ways that human activities affect Earth's systems. The emphasis of this unit is the significant and complex issues surrounding human uses of land, energy, mineral, and water resources and the resulting impacts of these uses. The crosscutting concepts of *cause and effect* and *the influence of science, engineering, and technology on society and the natural world* are called out as organizing concepts for these disciplinary core ideas.

Primary interdisciplinary connections:

NJSLS ELA/Literacy

Cite specific textual evidence to support analysis of science and technical texts. (MS-ETS1-1), (MS-ETS1-2), (MS-ETS1-3) **RST.6-8.1**

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-ESS3-3)**,** (MS-ETS1-3) **RST.6-8.7**

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-ETS1-2), (MS-ETS1-3) **RST.6-8.9**

Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration. (MS-ETS1-2) **WHST.6-8.7**

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-ESS3-3), (MS-ETS1-1) **WHST.6-8.8**

Draw evidence from informational texts to support analysis, reflection, and research. (MS-ETS1-2) **WHST.6-8.9**

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

Mathematics

Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set. (MS-ESS3-3) **6.EE.B.6**

Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities. (MS-ESS3-3) **7.EE.B.4**

Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. (MS-ESS3-3) **6.RP.A.1**

Recognize and represent proportional relationships between quantities. (MS-ESS3-3) **7.RP.A.2**

Reason abstractly and quantitatively. (MS-ETS1-1), (MS-ETS1-2), (MS-ETS1-3) **MP.2**

Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies. (MS-ETS1-1), (MS-ETS1-2), (MS-ETS1-3) **7.EE.3**

Unit Rational:
Students need to have a basic understanding that human activities in agriculture, industry, and everyday life have major effects on land, vegetation, streams, oceans, air, and even outer space. But individuals and communities are doing things to help protect Earth's resources and environments.

Learning Targets

Disciplinary Core Ideas:

ESS3.C: Human Impacts on Earth Systems

- Human activities have significantly altered the biosphere, sometimes damaging or destroying natural habitats and causing the extinction of other species. But changes to Earth's environments can have different impacts (negative and positive) for different living things. (MS-ESS3-3)
- Typically as human populations and per-capita consumption of natural resources increase, so do the negative impacts on Earth unless the activities and technologies involved are engineered otherwise. (MS-ESS3-3),(MS-ESS3-4)

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. (MS-ETS1-2), (MS-ETS1-3)
- Sometimes parts of different solutions can be combined to create a solution that is better than any of its predecessors. (MS-ETS1-3)
- Models of all kinds are important for testing solutions. (MS-ETS1-4)

Science and Engineering Practices:

Constructing Explanations and Designing Solutions

- Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students' own experiments) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (MS-ESS3-1)
- Apply scientific principles to design an object, tool, process or system. (MS-ESS3-3)

Asking Questions and Defining Problems

- 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)

Engaging in Argument from Evidence

- Evaluate competing design solutions based on jointly developed and agreed-upon design criteria. (MS-ETS1-2)

Analyzing and Interpreting Data

- Analyze and interpret data to determine similarities and differences in findings. (MS-ETS1-3)

Connections to Nature of Science

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

- 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-ESS3-3)

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)

Next Generation Science Standard:

(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, and pollution (such as of the air, water, or land).]*

(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.

Essential Questions	**Unit Enduring Understanding**
• How do we monitor the health of the environment (our life support system)? • Is it possible to predict and protect ourselves from natural hazards?	

Students Learning Targets

Students will…

- Human activities have significantly altered the biosphere, sometimes damaging or destroying natural habitats and causing the extinction of other species.
- Changes to Earth's environments can have different impacts (negative and positive) for different living things.
- Typically as human populations and per capita consumption of natural resources increase, so do the negative impacts on Earth, unless the activities and technologies involved are engineered otherwise.
- Relationships can be classified as causal or correlational, and correlation does not necessarily imply causation.

- 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.

Evidence of Learning

Summative Assessments: (25 days)
Equipment needed:
Teacher Resources: textbook

Formative Assessments: Tests, Quizzes, Labs

Lesson Plans

Lesson	Timeframe
Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.	10 days
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.	10 days
Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.	10 days
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.	10 days

Teachers notes: none

Curriculum Development Resources:

USGS Educational Resources for Secondary Grades (7–12): This web site contains selected USGS educational resources that may be useful to educators in secondary school grades. Many of these resources can be used directly in the classroom or will be useful in classroom lessons or demonstration activities preparation, or as resources for teacher education and curriculum development.

NOAA Education Resources: This website contains access to curriculum resources, professional development opportunities, student opportunities, and outreach events.

Content Area:	Earth Science
Unit Title:	Weather and Climate
Target Course/Grade Level:	Middle School 7

Unit Summary:
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.

Primary interdisciplinary connections:

NJSLS ELA/Literacy	
RST.6-8.1	Cite specific textual evidence to support analysis of science and technical texts. (MS-ESS2-5), (MS-ESS3-5)
RST.6-8.9	Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic. (MS-ESS2-5)
WHST.6-8.8	Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation. (MS-ESS2-5)
SL.8.5	Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest. (MS-ESS2-6)
NJSLS Mathematics	
MP.2	Reason abstractly and quantitatively. (MS-ESS2-5), (MS-ESS3-5)
6.NS.C.5	Understand that positive and negative numbers are used together to describe quantities having opposite directions or values (e.g., temperature above/below zero, elevation above/below sea level, credits/debits, positive/negative electric charge); use positive and negative numbers to represent quantities in real-world contexts, explaining the meaning of 0 in each situation. (MS-ESS2-5)
6.EE.B.6	Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set. (MS-ESS3-5)
7.EE.B.4	Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities. (MS-ESS3-5)

Unit Rational:
Students need to have a basic understanding that most of the Earth's water is in the ocean, and much of the Earth's fresh water is in glaciers or underground. Climate describes patterns of typical weather conditions over different scales and variations. Historical weather patterns can be analyzed.

Disciplinary Core Ideas:

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

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

ESS2.D: Weather and Climate

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

ESS3.D: Global Climate Change

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

Science and Engineering Practices:

Developing and Using Models

- Develop and use a model to describe phenomena. (MS-ESS2-6)
- Develop a model to describe unobservable mechanisms. (MS-ESS2-4)

Planning and Carrying Out Investigations

- 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)

Connections to Nature of Science

Scientific Knowledge is Open to Revision in Light of New Evidence

- NA

Next Generation Science Standard:

(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 results 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.]*

Explain how variations in density result from variations in temperature and salinity drive a global pattern of interconnected ocean currents. *[Note: This SLO is based on a disciplinary core idea found in the Framework. It is included as a scaffold to the following SLO.]* (ESS2.C)	
Use a model to explain the mechanisms that cause varying daily temperature ranges in a coastal community and in a community located in the interior of the country. *[Note: This SLO is based disciplinary core ideas found in the Framework. It is included as a scaffold to the following SLO.]* (ESS2.C; ESS2.D)	
(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.]*	
Essential Questions What factors interact and influence weather and climate?	**Unit Enduring Understanding**
Learning Targets *Students will . . .*	
Evidence of Learning	
Summative Assessments: **Equipment needed:** **Teacher Resources:**	
Formative Assessments: Tests, Quizzes, Labs	
Lesson Plans	
Lesson	**Timeframe**
Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity.	10 days
Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions.	10 days
Use a model to explain the mechanisms that cause varying daily temperature ranges in a coastal community and in a community located in the interior of the country.	10 days
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	10 days
Teachers notes: none	
Curriculum Development Resources:	

Content Area Unit Name	Science
Interdisciplinary Connections	Mathematics, Technology, and English Arts, Science
Core Instructional Materials **including digital tools**	Textbooks, Classroom Resources, Digital Tools
21st Century Themes and Skills	For information related to the 12 Career Ready Practices follow the links below: http://www.state.nj.us/education/cccs/2014/career/CareerReadyPractices.pdf Personal Financial Literacy 9.1 http://www.state.nj.us/education/cccs/2014/career/91.pdf Career Awareness, Exploration, and Preparation 9.2 http://www.state.nj.us/education/cccs/2014/career/92.pdf Career and Technical Education 9.3 http://www.state.nj.us/education/cccs/2014/career/93.pdf
8.1 Educational Technology **8.2 Technology Education, Engineering, Design, and Computational**	K-2: Navigate provided URL'S, Use basic word processing to create and illustrate a simple story, Work collaboratively with peers on project, Use digital tools to explore an issue and design solution for a problem, Identify how technology improves life, Use digital tools to design an approach to solving problems. 3-5: Peers collaborate to produce text about current events; Understand the consequences for inappropriate use of technology and social media, Apply engineering designs to data collection and solutions, Understand how technology evolves based on need and cultural influences.

Thinking - Programming	6-8: Select appropriate technology and applications to create publication on global topic, Use technology and social media responsibly, Employ a wide range of digital resources to collect data and form solutions, Identify the forces that come into play for further development of technology; apply engineering design process to real world problems. 9-12: Create and edit multi-page document for public presentation.

Considerations for classified students:

Classroom Instruction:

- All instruction for classified students will be guided by the students' Individualized Education Plan (IEP).
- Regular education teachers will be responsible for differentiating instruction for classified students based on the instructional modifications listed in the IEP.
- In the case of General Education - Supported Instruction (GE-SI) Classes, the special education teacher will be responsible for support in modifying the curriculum for the students, informing the class room teacher of the modifications, and directing instructional aide(s) to provide support accordingly.
- Grading will be done collaboratively by the regular and special education teachers.

Modifications:

- Modifications include but are not limited to:
  Extra time for assignments, modified classwork/homework assignments based on disability, preferential seating, study guides, copies of class notes, assistive technology and rewording/repeating or clarifying directions.

In-class Assessments:

- All assessments are to be in line with students' IEPs. In-class support teachers should modify tests for classified students. Tests may be given in the regular education classroom or completed with the inclusion teacher in another location with additional time. Students may be tested separately according to the IEP.
- Assessment grades may be modified based on a student's disability and in accordance with their IEP.

Considerations for English Language Learners (ELLs):

Classroom Instruction:

- Instruction for ESL students will be guided by their WIDA English Language Proficiency level. Teachers should receive this level from the ESL teacher assigned to the building.
- General education teachers will be responsible for differentiating instruction for ELLs with the assistance of the ESL teacher that promotes language, literacy and content learning.
- Sheltered Instruction Observation Protocol (SIOP)
  http://siop.pearson.com/about-siop/
  The following 8 components provide all teachers with lesson planning and instructional strategies that support language and learning goals for all students. This approach to teaching aligns with preparing students with college and career ready skills.

  The SIOP Model components:

  1. Lesson Preparation
  2. Building Background
  3. Comprehensible Input
  4. Strategies
  5. Interaction
  6. Practice and Application
  7. Lesson Delivery
  8. Review and Assessment
- In the case of Content-Based ESL (CBE), the ESL teacher and the general education teacher will be responsible for identifying language objectives and additional instructional strategies that improve proficiency in English and academic success of ELLs. Instructional strategies and the necessary scaffolds to promote student learning will be shared with the general education teacher for daily lessons that are aligned to District Curricula, CCSS, and WIDA Standards. The general Education teacher and ESL teacher will be co-teachers for a pre-determined amount of classroom instruction.
- Grading will be done collaboratively by the regular and ESL teachers.

Modifications: The following are possible modifications but are not limited to this list –

- Direct instruction, small group or pullout, about the contrasting letter sound correspondences, syllabication patterns and morphology in English supported with connections to their native language, native language text and/or resources, graphic organizers, visuals, sentence starters/ sentence frames, cloze activities, modeling, working with a partner, timeline and phrase wall and adapted text (in English) or specific sections of the original text, highlighted/bold-faced words within text.
- Draw pictures instead of writing/speaking.
- Match drawings with new vocabulary that might correspond.
- Work in small group or pairs with their English Only (EOs) peers for authentic content language talk and grade level modeling.
- Write simple sentences instead of complex sentences that demonstrates an understanding of academic language particular to specific content.
- Match simple sentences with new vocabulary that might apply to edit sentences.
- Have students provide examples/explanations of main idea in simple sentences. Revisions show an attempt to improve Language Control by embedding academic content vocabulary and Linguistic Complexity by expanding and varying sentence structures and using correct punctuation.
- Draw pictures instead of writing/speaking about seasonal changes. Match drawings with new vocabulary (adjective word wall, content word walls) that might correspond.

- Provide multiple opportunities for authentic speech acts to practice language skills and develop English fluency.
- Total Physical Response (TPR) to model critical thinking skills like analyze and synthesize.
- Study Guides

In Class Assessments:

- All formative and summative assessments will include modifications that support student's English Proficiency level. ESL teachers will collaborate with regular education teachers to provide appropriate differentiation for assessing ELLs.

Considerations for At Risk Students:

- At Risk students are identified by the I&RS committee in each school. The committee works to understand the reasons behind the student's low performance level in school and to create and implement a plan that is carried out by a variety of staff members in the building.
- Teachers with At Risk students are notified by the I&RS committee and provided with a copy of the plan and a timeframe for assessing the growth of the student. There are academic as well as behavioral goals that are listed for the students with recommended strategies unique to each individual.
- Classroom teachers are to follow the plan using instructional strategies that will help the student improve his/her performance while applying appropriate behavioral strategies consistent with the needs of the student.
- Teachers will report student progress to the I&RS committee within the specified timeframe for the plan.

Classroom instruction:

- Teachers will use differentiated instruction for At Risk students as they do for all students in their class. The strategies would be guided by the I&RS plan and be consistent with the student's ability and learning modality.

Modifications:

- Clarify all assignments and place specific timeframes for completion. Provide student with opportunity for one on one time for clarification.
- Set clear expectations for all assignments, in and outside of class. Keep expectations within the framework of the I&RS plan.
- Use positive reinforcement for all successes. Hold student to defined consequences for not completing work.
- Provide time outside the normal class time for completion of work. Not completing assignments is unacceptable, all assignments will be completed.

In Class Assessments:

- At Risk students should receive any modifications listed in their I&RS plan.

- If necessary, students should be provided with extended time to complete assessments.

Considerations for Gifted Students:

- Teachers will use differentiated instruction for Gifted Students as they do for all students in their class.
- Assignments and assessments can be planned and implemented with input from the student.
- Gifted students will be provided with the opportunity to demonstrate their knowledge through a variety of platforms.
- Teachers will have the latitude to provide assignments with the individual student's ability in mind.