2016 Middle School Earth Science Curriculum Map: Grade 6
Overview and Timeline

This document provides an overview of the academic year for the Grade 6 Science course. Sixth grade science focuses on space systems, history of Earth, Earth's systems, weather and climate and human impact. The topics were created and organized according to the Next Generation Earth Science Standards. The Next Generation Science Standards are identified in each separate unit map, along with disciplinary core ideas, science practices and performance expectations.

Unit	Suggested Timeline	Standards Addressed
Introduction to 6th Grade Science	2 weeks	
Astronomy	8 weeks	MS-ESS1-1, MS-ESS1-2, MS-ESS1-3, HS-ESS1-6
Earth Systems	12 weeks	MS-ESS1-4, MS-ESS2-1, MS-ESS2-2, MS-ESS2-3, MS-ESS3-1, MS-ESS3-2, **HS-ESS2-1**, **HS-ESS2-3**, **HS-ESS3-1**
Weather and Climate	10 weeks	MS-ESS2-4, MS-ESS2-5, MS-ESS3-2, **HS-ESS2-4**, **HS-ESS3-1**, **HS-ESS3-5**

Applicable **Next Generation Science Standards** are detailed within each unit, and can also be accessed at **www.nextgenscience.org**.

Earth and Space Science Evidence Statements:
http://www.nextgenscience.org/sites/default/files/evidence_statement/black_white/MS%20ESS%20Evidence%20Statements%20June%202015%20asterisks.pdf

ASTRONOMY Unit Overview

Content Area: Science

Target Course/Grade Level: Middle School Earth Science - Grade Six

Unit Title: Astronomy

Overview:

In this unit, students examine Earth's place in relation to the solar system, the Milky Way galaxy and the universe. There is a strong emphasis on 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 the 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.
(*adapted from NJ Model Curriculum, Grade Six Unit 6: Astronomy).*

Next Generation Science Standards Addressed: MS-ESS1-1, MS-ESS1-2, MS-ESS1-3, HS-ESS1-6

Standard Statements:

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

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

MS-ESS1-3: Analyze and interpret data to determine the 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.]*

HS-ESS1-6: Apply scientific reasoning and evidence from ancient Earth materials, meteorites, and other planetary surfaces to construct an account of Earth's formation and early history.

Primary interdisciplinary connections:

English Language Arts

Cite specific textual evidence to support analysis of science and technical texts. (MS-ESS1-3)

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-ESS1-3) RST.6-8.7

Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest. (MS-ESS1-1),(MS-ESS1-2) SL.8.5

Mathematics:

Reason abstractly and quantitatively. (MS-ESS1-3) MP.2

Model with mathematics. (MS-ESS1-1),(MS-ESS1-2) MP.4

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) 6.RP.A.1

Recognize and represent proportional relationships between quantities. (MS-ESS1-1),(MS-ESS1-2),(MS-ESS1-3) 7.RP.A.2

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) 6.EE.B.6

21st Century Skills/Themes:

Themes

Global Awareness

Skills

Creativity & Innovation, Media Literacy, Critical Thinking & Problem Solving, ICT Literacy, Communication & Collaboration, Life & Career Skills, Information Literacy

Career Ready Practices:

CRP2. Apply appropriate academic and technical skills.

CRP4. Communicate clearly and effectively and with reason.

CRP5. Consider the environmental, social and economic impacts of decisions.

CRP6. Demonstrate creativity and innovation.

CRP7. Employ valid and reliable research strategies.

CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.

CRP11. Use technology to enhance productivity.

CRP12. Work productively in teams while using cultural global competence.

Unit Essential Questions	Unit Enduring Understandings
● What pattern in Earth-sun-moon system can be used to explain the lunar phases, eclipses of the sun and moon, and seasons?	● 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 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 differential intensity of sunlight on different areas of the Earth across the year. ● 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.
● What is the role of gravity in the motions within galaxies and the solar system?	● Gravity plays a role in the motions within galaxies and the solar system. ● Gravity is the force that holds together the solar system and 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 the 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 system occur in consistent patterns that are understandable through measurement and observation.
● What are the scale properties of objects in the solar system?	● 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.

Unit Learning Targets

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 Practices

Developing and Using Models

• Develop and use a model to describe phenomena. (MS-ESS1-1),(MS-ESS1-2)

Analyzing and Interpreting Data

• Analyze and interpret data to determine similarities and differences in findings. (MS-ESS1-3)

Performance Expectations

- 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 Assessment – Benchmark (end of module)

Students will complete a final performance task assessment and/or complete a unit test.
The performance task will require students to synthesize the concepts they have learned in the unit. Each of the subunits will conclude with a project including, but not limited to: choice board, presentation, and/or interactive lab. The complete unit will be assessed with a Planetary Science Final Exam.

Equipment/Materials needed:

Student access to computers/ipads for research and recording
Digital projector for presentations

Formative Assessments

- Choice Boards
- Quizzes/Tests
- Formal labs (craters)
- Notebook entries and checks

Modifications (ELLs, Special Education, Gifted and Talented)

- Teacher tutoring
- Peer tutoring
- Cooperative learning groups
- Modified assignments
- Differentiated instruction
- Native language texts and native language to English dictionary
- Response to Intervention (RTI) www.help4teachers.com.
- Follow all IEP modifications/504 plan

Suggested Lesson Pacing

Essential Question	Timeframe	Resources
What pattern in the Earth-Sun-Moon system can be used to explain the lunar phases, eclipses of the sun and moon and seasons?	4 weeks	Prentice Hall Astronomy Ch.1: Earth, Moon and Sun FOSS Planetary Science investigations • Moon log • Rotation and Revolution Models • Seasons simulations • Seasons Interactive • Eclipse Interactive • Solar and Lunar Eclipse Models • Tide Models • Moon-Phase Models • Moon-Phase Simulations • Crater Lab

What is the role of gravity in motions within galaxies and the solar system?	2 weeks	Prentice Hall Astronomy Ch.2: The Solar System FOSS Planetary Science investigations ● Weight and jumping length activity ● Gravity models and simulations ● Pull of the Planets activity ● Gravity and falling objects
What are the scale properties of objects in the solar system?	4 weeks	Prentice Hall Astronomy Ch. 3: Stars, Galaxies and the Universe FOSS Planetary Science investigations ● Solar System in the Hallway model ● Scale drawings ● Register tape models ● Scaling with Google Earth ● Search for life on other planets
Teacher Notes:		
Curriculum Development Resources Click the links below to access additional resources used to design this unit: Fossweb.com: Planetary Science module NASA Solar System Exploration Seasons Interactive Eclipse Interactive Pull of the Planets Gravity and Falling Objects		

EARTH SYSTEMS Unit Overview
Content Area: Science
Target Course/Grade Level: Middle School Earth Science - Grade Six
Unit Title: Earth Systems **Overview:** In this unit, students examine geoscience data in order to understand processes and events in Earth's history. 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. (*adapted from NJ Model Curriculum Unit: Earth Systems).*
Next Generation Science Standards Addressed: MS-ESS1-4, MS-ESS2-1, MS-ESS2-2, MS-ESS2-3, MS-ESS3-1, MS-ESS3-2, HS-ESS2-3, HS-ESS2-1
Standard Statements: **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 on how analyses of rock formations and the fossils they contain are used to establish relative aged 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 of 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.] **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 process of melting, crystallization, weathering, deformation, and sedimentation, which act together to form minerals and rocks through the cycling of Earth's materials.] **HS-ESS2-3** Develop a model based on evidence of Earth's interior to describe the cycling of matter by thermal convection. **MS-ESS2-2** Construct an explanation based on evidence of 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 (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 as 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.] **HS-ESS2-1** Develop a model to illustrate how Earth's internal and surface processes operate at different spatial and temporal scales to form continental and ocean-floor features. **MS-ESS2-3** Analyze and interpret data in 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 zone, and trenches).]

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 non-renewable, 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 organize 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).]

Primary interdisciplinary connections:

English Language Arts

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

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

21st Century Skills/Themes:

Themes

Global Awareness, Financial, Economic, Business, and Entrepreneurial Literacy, Civic Literacy, and Health Literacy

Skills

Creativity & Innovation, Media Literacy, Critical Thinking & Problem Solving, ICT Literacy, Communication & Collaboration, Life & Career Skills, Information Literacy

Career Ready Practices:

CRP1. Act as a responsible and contributing citizen and employee.
CRP2. Apply appropriate academic and technical skills.
CRP3. Attend to personal health and financial well-being.
CRP4. Communicate clearly and effectively and with reason.
CRP5. Consider the environmental, social and economic impacts of decisions.
CRP6. Demonstrate creativity and innovation.
CRP7. Employ valid and reliable research strategies.
CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.
CRP9. Model integrity, ethical leadership and effective management.
CRP10. Plan education and career paths aligned to personal goals.
CRP11. Use technology to enhance productivity.
CRP12. Work productively in teams while using cultural global competence.

Unit Essential Questions	Unit Enduring Understandings
● How do we know that the Earth has an approximately 4.6-billion-year-old history?	● The geologic time scale is used to organize Earth’s 4.6-billion-year-old history. ● Rock formations and the fossils they contain are used to establish relative ages of major events in Earth’s history. ● The geologic time scale interpreted from rock strata provides a way to organize

● 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?	Earth's history. ● Analyses of rock strata and the fossil record provide only relative dates, not an absolute scale. ● Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small. ● Energy drives the process that results in the cycling of Earth's materials. ● The processes of melting, crystallization, weathering, deformation, and sedimentation act together to form minerals and rocks through the cycling of Earth's materials. ● All Earth processes are the result of energy flowing and matter cycling within and among the planet's systems. ● Energy flowing and matter cycling within and among the planet's systems derive from the sun and Earth's hot interior. ● Energy that flows and matter that cycles produce chemical and physical changes in Earth's materials and living organisms. ● Explanations of stability and change in Earth's natural systems can be constructed by examining the changes over time and processes at different scales, including the atomic scale. ● 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. ● Water's movements—both on the land and underground—cause weathering and erosion, which change the land's surface features and create underground formations. ● 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 new sea floor 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.

Unit Learning Targets
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 Practices

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)

Performance Expectations

- Construct a scientific explanation based on valid and reliable evidence from rock strata obtained from sources (including the students’ own experiments).
- Construct a scientific explanation based on rock strata and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.
- Develop a model to describe the cycling of Earth’s materials and the flow of energy that drives this process.
- Construct a scientific explanation for how geoscience processes have changed Earth’s surface at varying time and spatial scales based on valid and reliable evidence obtained from sources (including the students’ own experiments).
- Construct a scientific explanation for how geoscience processes have changed Earth’s surface at varying time and spatial scales based on the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.
- Collect evidence about processes that change Earth’s surface 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 distributions of fossils and rocks, continental shapes, and seafloor structures to provide evidence of past plate motions.
- Analyze how science findings have been revised and/or reinterpreted based on new evidence about past plate motions.

Evidence of Learning

Summative Assessment – Benchmark (end of module)

Students will complete a final performance task assessment and/or complete a unit test. The performance task will require students to pull together all of the concepts they have learned in the unit to explain Earth's systems. They will construct a visual representation that answers the question of: "What is the story of Earth?"

Equipment/Materials needed:

Student access to computers/ipads for research and recording
Digital projector for presentations

Formative Assessments

- Interactive Notes
- Quick Writes & Checks for Understanding
- Claim, Evidence, Reasoning (CER)
- Lab Investigations
- Benchmark Quizzes
- Plate Boundary Presentations

Modifications (ELLs, Special Education, Gifted and Talented)

- Teacher tutoring
- Peer tutoring
- Cooperative learning groups
- Modified assignments
- Differentiated instruction
- Native language texts and native language to English dictionary
- Response to Intervention (RTI) www.help4teachers.com.
- Follow all IEP modifications/504 plan

Suggested Lesson Pacing

Essential Question	Timeframe	Resources
How do we know that the Earth has an approximately 4.6-billion-year-old history?	3 weeks	Prentice Hall: Inside Earth FOSS Earth History investigations Geologic Time Scales and models Student Timelines Fossil timelines Index Fossils Fossil dating investigation
What drives the cycling of Earth's materials?	5 weeks	Prentice Hall: Inside Earth FOSS Earth History investigations

		Rock Cycle investigations (weathering, erosion, deposition)
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?	4 weeks	Prentice Hall: Inside Earth FOSS Earth History investigations Wegener's Hypothesis Pangea Puzzle Mapping Earthquakes and Volcanoes Investigating Plate Boundaries (Rice University)
Teacher Notes:		
Curriculum Development Resources: www.fossweb.com (Earth History Module, Middle School) http://plateboundary.rice.edu *Additional development resources will be added as this unit is finalized.*		

Unit Overview
Content Area: Science
Target Course/Grade Level: Middle School Earth Science - Grade 6
Unit Title: Weather and Climate **Overview:** In this unit, students investigate Earth's large-scale systems interactions, the roles of water in Earth's surface processes, and weather and climate. Students make sense of how Earth's geosystems operate by modeling the flow of energy and cycling of matter within and among different systems. Students examine the feedback between systems as energy from the Sun is transferred between systems and circulates through the ocean and atmosphere. *(adapted from NJ Model Curriculum - Weather and Climate)*
Next Generation Science Standards Addressed: MS-ESS2-4, MS-ESS2-5, MS-ESS2-6, HS-ESS2-4, HS-ESS3-1, HS-ESS3-5.
Standard Statements: **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). **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.] **HS-ESS2-4** Use a model to describe how variations in the flow of energy into and out of Earth's systems result in changes in climate. **HS-ESS3-1** Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity. **HS-ESS3-5** Analyze geoscience data and the results from global climate models to make an evidence-based forecast of the current rate of global or regional climate change and associated

future impacts to Earth systems.

Primary interdisciplinary connections:

English Language Arts:

Cite specific textual evidence to support analysis of science and technical texts (MS-ESS2-5), (MS-ESS3-5) RST.6-8.1

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) RST.6-8.9

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) WHST.6-8.8

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

Mathematics:

Reason abstractly and quantitatively. (MS-ESS2-5),(MS-ESS3-5) MP.2

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.NS.C.5

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) 6.EE.B.6

21st Century Skills/Themes:

Themes

Global Awareness, Financial, Economic, Business, and Entrepreneurial Literacy, Civic Literacy,

Skills

Creativity & Innovation, Media Literacy, Critical Thinking & Problem Solving, ICT Literacy, Communication & Collaboration, Life & Career Skills, Information Literacy

Career Ready Practices:

CRP1. Act as a responsible and contributing citizen and employee.

CRP2. Apply appropriate academic and technical skills.

CRP4. Communicate clearly and effectively and with reason.

CRP5. Consider the environmental, social and economic impacts of decisions.

CRP6. Demonstrate creativity and innovation.

CRP7. Employ valid and reliable research strategies.

CRP8. Utilize critical thinking to make sense of problems and persevere in solving them. **CRP11.** Use technology to enhance productivity. **CRP12.** Work productively in teams while using cultural global competence.	
Unit Essential Questions	**Unit Enduring Understandings**
● What are the processes involved in the cycling of water through Earth's systems? ● What is the relationship between the complex interactions of air masses and changes in weather conditions?	● 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 change 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. ● The motion 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 atmosphere, determined by wind, 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, diagram and visualizations; other examples can be obtained through 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

● What are the major factors that determine regional climates?	when different air masses collide. ● Weather can be predicted within probabilistic ranges. ● 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 at atmospheric and oceanic circulation that determine regional climates can be diagrams, maps and globes or digital representations.

Unit Learning Targets

Disciplinary Core Ideas:

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)

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)

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)

Performance Expectations:
- 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.
- 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.

Evidence of Learning		
Summative Assessment – Benchmark (end of module) Students will complete a final performance task assessment and/or complete a unit test. The performance task will require students to pull together all of the concepts they have learned in the unit to explain weather. They will interpret radiosonde data from weather balloons and use a weather map to write and deliver a TV-style weather report. As an alternative, students may complete an end-of-unit formal assessment. **Equipment/Materials needed:** Student access to computers/ipads for research and recording Digital projector for presentations		
Formative Assessments ● Notebook quick writes and checks ● Section quizzes and/or investigation checks ● Formal Labs ● Choice Boards		● Final assessment
Modifications (ELLs, Special Education, Gifted and Talented) ● Teacher tutoring ● Peer tutoring ● Cooperative learning groups ● Modified assignments ● Differentiated instruction ● Native language texts and native language to English dictionary ● Response to Intervention (RTI) www.help4teachers.com. ● Follow all IEP modifications/504 plan		
Suggested Lesson Pacing:		
Essential Questions	**Timeframe**	**Resources**
What are the processes involved in the cycling of water through Earth's systems?	2 weeks	Prentice Hall Earth's Waters: Chapter 1 and 3 FOSS Weather and Water investigations Water-Cycle Simulation Ocean Currents investigation Ocean Climate investigation
What is the relationship between the complex interactions of air masses	4 weeks	Prentice Hall: Weather and Climate FOSS Weather and Water

and changes in weather conditions?		investigations Weather observations chart Weather balloons Weather maps Air pressure and wind: Air Pressure inquiry Pressure in a jar Surface Air-pressure map Density: liquid layers Convection chamber
What are the major factors that determine regional climates?	4 weeks	Prentice Hall: Weather and Climate FOSS Weather and Water investigations Heat Transfer: Latitude, Solar Angle, Heating Earth Air Flow: Conduction, Local Winds, Global Winds Climate Change The Role of Carbon Dioxide
Teacher Notes:		
Curriculum Development Resources Click the links below to access additional resources used to design this unit: http://www.nextgenscience.org/sites/default/files/MS-ESS_Watershed_Study_version2.pdf (Sample Task/Performance Assessment) www.fossweb.com (Weather and Water module, Middle School) Prentice Hall Earth's Waters: Section 3, Chapter 1 Prentice Hall Weather and Climate		