TRUMBULL PUBLIC SCHOOLS

Trumbull, Connecticut

GRADE 6 INTEGRATED EARTH SCIENCES

Draft for Pilot 2017-18
(Last Revision Date: 2008)

Draft for Pilot 2017-18
This document, presented to the Board of Education Curriculum Committee on Aug. 17, 2017, will be developed further during 2017-18, the first year of implementation. A full curriculum guide will be returned to the Curriculum Committee to be formally recommended for adoption by the full Board prior to the 2018-19 school year.

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Grade 6 Integrated Earth Sciences
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The Trumbull Board of Education will continue to take Affirmative Action to ensure that no persons are discriminated against in its employment.

CORE VALUES AND BELIEFS

The Trumbull School Community engages in an environment conducive to learning which believes that all students will **read** and **write effectively**, therefore communicating in an articulate and coherent manner. All students will participate in activities **that present problem-solving through critical thinking**. Students will use technology as a tool applying it to decision making. We believe that by fostering self-confidence, self-directed and student-centered activities, we will promote **independent thinkers and learners**. We believe **ethical conduct** to be paramount in sustaining the welcoming school climate that we presently enjoy.

Approved 8/26/2011

INTRODUCTION & PHILOSOPHY

The Connecticut State Board of Education, based on its 2008 Position Statement on Science Education, has supported "a systematic approach to ensuring that every student in Connecticut receives a rich and coordinated PK-12 education in science. Science learning should focus simultaneously on developing an understanding of core concepts, as well as knowing how scientists work collaboratively to test ideas, analyze evidence, and solve problems. The realization of this vision is critical for our students' futures, as well as for Connecticut's place in the globally competitive economy."

In 2015, the Connecticut State Board of Education adopted the Next-Generation Science Standards (NGSS), which embody the National Research Council's *Framework for K-12 Education* (2011). The Grade 6 Integrated Earth Sciences curriculum integrates the NGSS as listed for each unit of study. The NGSS architecture uses Science and Engineering Practices along with various components of Disciplinary Core Ideas and Crosscutting Concepts to comprise the performance expectations for students. Based on the NRC *Framework,* a core idea for science education should meet at least two of the following four criteria:

- "Have broad importance across multiple sciences or engineering disciplines or be a key organizing principle of a single discipline."
- "Provide a key tool for understanding or investigating more complex ideas and solving problems."
- "Relate to the interests and life experiences of students or be connected to societal or personal concerns that require scientific or technological knowledge."
- "Be teachable and learnable over multiple grades at increasing levels of depth and sophistication."

The Grade 6 Integrated Earth Sciences curriculum also follows the TPS guidelines for student safety in the classroom as represented in the National Science Education Standards, the Next-Generation Science Standards, the National Science Teachers Association, and OSHA. The curriculum encourages and fosters a hands-on, process and inquiry-based approach to science education, with student safety first and foremost. Lab safety guidelines are implemented through the district.

COURSE GOALS

The course goals derive from the 2013 Next-Generation Science Standards and the 2010 Connecticut Core Standards. Goals are listed specific to each unit in this curriculum guide, and developed through unit lessons using the 5-E learning model (engage, explore, explain, elaborate, evaluate) in order to encourage student engagement and foster metacognitive learning strategies through a reflective process. An important role of science education is not to teach "all the facts," but rather to prepare students with sufficient core knowledge so that they can later acquire additional information on their own.

COURSE ENDURING UNDERSTANDINGS

Students will understand that . . .

- The planet Earth is a tiny part of a vast universe that has developed over a huge expanse of time. The history of the universe, and of the structures and objects within it, can be deciphered using observations of their present condition together with knowledge of physics and chemistry. Similarly, the patterns of motion of the objects in the solar system can be described and predicted on the basis of observations and an understanding of gravity.
- 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 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. Water, weather and climate are influenced by interactions involving sunlight, the ocean, the atmosphere, ice, landforms, and living things.

- 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 geological processes. Renewable energy resources, and the technologies to exploit them, are being rapidly developed.

- The geological time scale interpreted from rock strata provides relative dates as a way to organize Earth's history. Major historical events include the formation of mountain chains and ocean basins, the evolution and extinction of particular living organisms, volcanic eruptions, periods of massive glaciation, and development of watersheds and rivers through glaciation and water erosion.

- 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 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.

- Some natural hazards, such as volcanic eruptions and severe weather, are preceded by phenomena that allow for reliable predictions. Others, such as earthquakes, occur suddenly and with no notice, and thus they are not yet predictable. However, mapping the

history of natural hazards in a region, combined with an understanding of related geological forces, can help forecast the locations and likelihoods of future events.

- Humans have significantly altered the biosphere, sometimes damaging or destroying natural habitats and causing the extinction of many other species. But 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.

- Patterns of the apparent motion of the sun, the moon, and stars in the sky can be observed, described, predicted, and explained with models. Earth and its solar system are part of the Milky Way galaxy, which is one of many galaxies in the universe.

- The solar system consists of the sun and a collection of objects, including planets, their moons, and asteroids that are held in orbit around the sun by its gravitational pull on them. This model of the solar system can explain tides, eclipses of the sun and the moon, and the motion of the planets in the sky relative to the stars. Long-range gravitational interactions govern the evolution and maintenance of large-scale systems in space, such as galaxies or the solar system, and determine the patterns of motion within those structures.

COURSE ESSENTIAL QUESTIONS

- How do Earth's systems interact?
- How do the properties and movements of water shape Earth's surface and affect its systems?
- What regulates weather and climate?
- How does the unequal heating of the Earth affect local and global weather?
- How do people model and predict the effects of human activities on Earth's climate?
- How do the motions and complex interactions of air masses result in changes in weather conditions?
- How do humans depend on Earth's resources?
- How do natural hazards affect individuals and societies?
- How do living organisms alter Earth's processes and structures?
- How and why is Earth constantly changing?
- How do continents move, and what causes earthquakes and volcanoes?
- How do people reconstruct and date events in Earth's planetary history?
- What is the universe, and what is Earth's place in it?
- What are the predictable patterns caused by Earth's movement in the solar system?
- What goes on in stars?

COURSE KNOWLEDGE & SKILLS

Students will understand . . .

- Patterns. Observed patterns of forms and events guide organization and classification, and they prompt questions about relationships and the factors that influence them.
- Cause and effect: Mechanism and explanation. Events have causes, sometimes simple, sometimes multifaceted. A major activity of science is investigating and explaining causal relationships and the mechanisms by which they are mediated. Such mechanisms can then be tested across given contexts and used to predict and explain events in new contexts.
- Scale, proportion, and quantity. In considering phenomena, it is critical to recognize what is relevant at different measures of size, time, and energy and to recognize how changes in scale, proportion, or quantity affect a system's structure or performance.
- Systems and system models. Defining the system under study – specifying its boundaries and making explicit a model of that system – provides tools for understanding and testing ideas that are applicable throughout science and engineering.
- Energy and matter: Flows, cycles, and conservation. Tracking fluxes of energy and matter into, out of, and within systems helps one understand the systems' possibilities and limitations.
- Structure and function. The way in which an object or living thing is shaped and its substructure determine many of its properties and functions.
- Stability and change. For natural and built systems alike, conditions of stability and determinants of rates of change or evolution of a system are critical elements of study.

Students will be able to . . .

- ask questions (for science) and define problems (for engineering).
- develop and use models.
- plan and carry out investigations.
- analyze and interpret data.
- use mathematics and computational thinking.
- construct explanations (for science) and design solutions (for engineering).
- engage in arguments from evidence.
- obtain, evaluate, and communicate information.

UNIT 1
Earth's Systems

Unit Goals

At the completion of this unit, students will:

NGSS.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.
NGSS.MS.ESS2-5	Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions.
NGSS.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.
NGSS.MS.ESS3-5	Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century.
NGSS.MS.PS1-4	Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed.
NGSS.MS.PS3-4	Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample.
NGSS.MS.LS1-4	Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed.
NGSS.MS.LS1-6	Construct a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms.
NGSS.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.
NGSS.MS.ETS1-2	Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
NGSS.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 anew solution to better meet the criteria for success.
NGSS.MS.ETS1-4	Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.
CCS.ELA-Literacy.RI.6.1	Use textual evidence to support analysis of texts.
CCS.ELA-Literacy.RI.6.7	Analyze different media to compare and contrast ideas presented in texts (e.g., in a flowchart, diagram, model, graph, or table).
CCS.ELA-Literacy.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.
CCS.ELA-Literacy.W.6.2	Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content.
CCS.ELA-Literacy.W.6.8	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.
CCS.ELA-Literacy.SL.6.5	Include multimedia components (e.g., graphics, images, music, and sound) and visual displays in presentations to clarify information.
CCS.MP.2	Reason abstractly and quantitatively.

CCS.6.RP.A.1	Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities.
CCS.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.

Science & Engineering Practices	**Disciplinary Core Ideas**	**Crosscutting Concepts**
Developing and Using Models: • Describe and use a model to describe phenomena. (NGSS.MS-ESS2-1, NGSS.MS-ESS2-6) • Develop a model to describe unobservable mechanisms. (NGSS.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. (NGSS.MS-ESS2-5) Analyzing and Interpreting Data: • Analyze and interpret data to provide evidence for phenomena. (NGSS.MS-ESS2-3) Constructing Explanations and Designing Solutions: • Construct a scientific explanation based on valid and reliable evidence obtained from sources	ESS2.C: The Role 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. (NGSS.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. (NGSS.MS-ESS2-5) • Global movements of water and its changes in form are propelled by sunlight and gravity. (NGSS.MS-ESS2-4) • Variations in density due to variations in temperature and salinity drive a global pattern of interconnected ocean currents. (NGSS.MS-ESS2-6) ESS2.D: Weather and	Cause and Effect: • Cause and effect relationships may be used to predict phenomena in natural or designed systems. (NGSS.MS-ESS2-5, NGSS.MS.PS1-4) Systems and System Models: • Models can be used to represent systems and their interactions – such as inputs, processes, and outputs – and energy, matter, and information flows within systems. (NGSS.MS-ESS2-6) Energy and Matter: • Within a natural or designed system, the transfer of energy drives the motion and/or cycling of matter. (NGSS.MS-ESS2-4, NGSS.MS.LS1-6) Stability and Change: • Stability might be disturbed either by sudden events or gradual changes that accumulate over time. (NGSS.MS-ESS3-5)

(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. (NGSS.MS-ESS2-2)	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. (NGSS.MS-ESS2-6) • Because these patterns are so complex, weather can only be predicted probabilistically. (NGSS.MS.ESS2-5) 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. (NGSS.MS-ESS3-5) LS1.C: Organization for Matter and Energy Flow in	Connections to Nature of Science: Science Addresses Questions about the Natural and Material World: • Scientific knowledge can describe the consequences of actions but does not necessarily prescribe the decisions that society takes. (NGSS.MS-ESS3-4)

	Organisms: • Plants, algae (including phytoplankton), and many microorganisms use the energy from light to make sugars (food) from carbon dioxide from the atmosphere and water through the process of photosynthesis, which also releases oxygen. These sugars can be used immediately or stored for growth or later use. (NGSS.MS-LS1-6) PS3.A: Definitions of Energy: • The term "heat" as used in everyday language refers both to thermal energy (the motion of atoms or molecules within a substance) and the transfer of that thermal energy from one object to another. In science, heat is used only for this second meaning; it refers to the energy transferred due to the temperature difference between two objects. (secondary to NGSS.MS-PS1-4)	

UNIT 1, Part 1
Earth's Systems: The Water Cycle, Weather, & Climate

Unit Essential Questions

- How do Earth's systems interact?
- How do the properties and movements of water shape Earth's surface and affect its systems?
- What regulates weather and climate?
- How does the unequal heating of the Earth affect local and global weather?
- How do people model and predict the effects of human activities on Earth's climate?
- How do the motions and complex interactions of air masses result in changes in weather conditions?

Scope and Sequence

- Phenomena: Dino Water
  - Where does Earth's water come from?
  - Where did the dinosaur's drinking water come from?
  - In what forms does water exist on Earth?
  - How does water move through the atmosphere?
  - What are clouds?
  - How do clouds form?
  - What is the role of clouds in the water cycle?
  - What happens when precipitation comes back to the Earth?
  - How does material/shape of the land affect water flow?
  - Who, or what, else needs Dino Water?
  - If everyone uses water, how and why is water still present on Earth?

Assured Assessments
Student performance on the following assessments will be included in the trimester report card.

Formative Assessments:
1. Dino Diagram

2. Cloud in a Jar investigation

Summative Assessments:
1. Dr. Gregory investigation

2. Water Cycle Model: Students will construct an evidence-based explanation using the model to describe the cycling of water throughout Earth's systems.

Resources

Core

- Padilla, Michael J., Ioannis Miaoulis, and Martha Cyr. *Science Explorer: Weather and Climate*. Upper Saddle River, NJ: Prentice Hall, 2008. Print.

Supplemental

- online resources developed collaboratively

Time Allotment

- Approximately six weeks

UNIT 1, Part 2
Earth's Systems: Weather & Environmental Impact

Unit Essential Questions

- How do humans depend on Earth's resources?
- How do natural hazards affect individuals and societies?
- How do living organisms alter Earth's processes and structures?

Scope and Sequence

- Phenomena: Connecticut's Climate
  - What are the characteristics of Connecticut's climate today?
  - What causes bad weather?
  - What are the properties of an air mass?
  - Are all air masses alike, or are there different types?
  - What happens when two masses meet?

Assured Assessments
Student performance on the following assessments will be included in the trimester report card.

Formative Assessments:
1. Investigation: Air Masses

Summative Assessments:
1. Air and Mass Fronts investigation

Resources
Core

- Padilla, Michael J., Ioannis Miaoulis, and Martha Cyr. *Science Explorer: Weather and Climate*. Upper Saddle River, NJ: Prentice Hall, 2008. Print.

Supplemental

- online resources developed collaboratively

Time Allotment

- Approximately three weeks

UNIT 1, Part 3
Earth's Systems: Natural Resources & Human Impact

Unit Essential Questions

- How do humans depend on Earth's resources?
- How do natural hazards affect individuals and societies?
- How do living organisms alter Earth's processes and structures?

Scope and Sequence

- Phenomena: Model of Connecticut's weather
  - Why are there different temperatures in Connecticut's forecast?
  - What are the advantages and disadvantages to living by the coast or inland, to living at a high elevation or a low elevation?
  - What global influences affect Connecticut's weather?
  - How do landforms affect local weather?
  - What are the differences between weather and climate?
  - How have humans been impacted by climate changes, temperature in particular?

Assured Assessments
Student performance on the following assessments will be included in the trimester report card.

Formative Assessments:
1. Distinguishing between land and sea breezes

2. Investigation: Coriolis Effect

3. Comparison: Connecticut and World Models

Summative Assessments:
1. Unequal heating of the Earth's surface and heat transfer investigation

2. Investigation: Wind: high and low pressures; local and global winds

3. Culminating Performance Assessment: "You are a meteorologist advising some adventurers on a trip they plan to take. Why are different places on Earth so hot, cold, dry, windy, wet, and sunny?"

Resources
Core
- Prentice Hall CFP-4032 Global Winds/Exploration activity
- Padilla, Michael J., Ioannis Miaoulis, and Martha Cyr. *Science Explorer: Weather and Climate*. Upper Saddle River, NJ: Prentice Hall, 2008. Print.

Supplemental

- online resources developed collaboratively

Time Allotment

- Approximately four weeks

UNIT 2
History of Earth: Geology, Tectonics, and Land Formation

Unit Goals

At the completion of this unit, students will:

NGSS.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.
NGSS.MS.ESS2-1	Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process.
NGSS.MS.ESS2-2	Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales.
NGSS.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.
NGSS.MS.LS4-1	Analyze and interpret data for patterns in the fossil record that document the existence, diversity, extinction, and change of life forms throughout the history of life on Earth under the assumption that natural laws operate today as in the past.
NGSS.MS.PS1-2	Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.
NGSS.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.
NGSS.MS.ETS1-2	Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
NGSS.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 anew solution to better meet the criteria for success.
NGSS.MS.ETS1-4	Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.

Science & Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Developing and Using Models: • Describe and use a model to describe phenomena. (NGSS.MS-ESS2-1, NGSS.MS-ESS2-6) • Develop a model to describe unobservable mechanisms. (NGSS.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. (NGSS.MS-ESS2-5) Analyzing and Interpreting Data: • Analyze and interpret data to provide evidence for phenomena. (NGSS.MS-ESS2-3) 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	ESS1.C: The History of Planet Earth: • Tectonic processes continually generate new ocean sea floor at ridges and destroy old sea floor at trenches. (secondary to NGSS.MS-ESS2-3) ESS2.A: Earth's Materials and Systems: • All Earth processes are the result of energy flowing and matter cycling within and among the planet's systems. This energy is derived from the sun and Earth's hot interior. The energy that flows and matter that cycles produce chemical and physical changes in Earth's materials and living organisms. (NGSS.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. (NGSS.MS.ESS2-2) ESS2.B: Plate Tectonics and	Patterns: • Patterns in rates of changes and other numerical relationships can provide information about natural systems. (NGSS.MS-ESS2-3) Cause and Effect: • Cause and effect relationships may be used to predict phenomena in natural or designed systems. (NGSS.MS-ESS2-5) Scale, Proportion, and Quantity: • Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small. (NGSS.MS-ESS2-2) Systems and System Models: • Models can be used to represent systems and their interactions – such as inputs, processes, and outputs – and energy, matter, and information flows within systems. (NGSS.MS-ESS2-6) Energy and Matter:

and laws that describe nature operate today as they did in the past and will continue to do so in the future. (NGSS.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. (NGSS.MS-ESS2-3)	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. (NGSS.MS-ESS2-3) ESS2.C: The Roles of Water in Earth's Surface Processes: • Water continually cycles among land, ocean, and atmosphere via transpiration, evaporation, condensation and crystallization, and precipitation, as well as downhill flows on land. (NGSS.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. (NGSS.MS-ESS2-5) • Global movements of water and its changes in form are propelled by sunlight and gravity. (NGSS.MS-ESS2-4) • Variations in density due to variations in temperature and salinity drive a global pattern of interconnected ocean currents. (NGSS.MS-ESS2-6) • Water's movements – both on the land and underground – cause	• Within a natural or designed system, the transfer of energy drives the motion and/or cycling of matter. (NGSS.MS-ESS2-4) Stability and Change: • Explanations of stability and change in natural or designed systems can be constructed by examining the changes over time and processes at different scales, including the atomic scale. (NGSS.MS-ESS2-1)

	weathering and erosion, which change the land's surface features and create underground formations. (NGSS.MS-ESS2-2) ESS2.D: Weather and Climate: • Weather and climate are influenced by interactions involving sunlight, the ocean, the atmosphere, ice, landforms, and living things. These interactions vary with latitude, altitude, and local and regional geography, all of which can affect oceanic and atmospheric flow patterns. (NGSS.MS-ESS2-6) • Because these patterns are so complex, weather can only be predicted probabilistically. (NGSS.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. (NGSS.MS-ESS2-6)	

Unit Essential Questions

- How and why is Earth constantly changing?
- How do continents move, and what causes earthquakes and volcanoes?
- How do people reconstruct and date events in Earth's planetary history?

Scope and Sequence

- Phenomena: Cycling of Earth's Materials
  - What drives the cycling of Earth's materials?
  - How do different natural phenomena change the surface of the Earth over different scales?

- How is it possible for the same kind of fossils to be found in both New Jersey and Africa?

Assured Assessments
Student performance on the following assessments will be included in the trimester report card.

Formative Assessments:
- TBD 2017-18

Summative Assessments:
- TBD 2017-18

Resources
Core
- Padilla, Michael J., Ioannis Miaoulis, and Martha Cyr. *Science Explorer: Earth's Changing Surface*. Upper Saddle River, NJ: Prentice Hall, 2005. Print.
- Padilla, Michael J., Ioannis Miaoulis, and Martha Cyr. *Science Explorer: Inside Earth*. Upper Saddle River, NJ: Prentice Hall, 2007. Print.

Supplemental
- online resources developed collaboratively

Time Allotment
- Approximately eight weeks

UNIT 3
Natural Resources and Human Impact

Unit Goals

At the completion of this unit, students will:

NGSS.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.
NGSS.MS.ESS3-3	Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.
NGSS.MS.ESS3-4	Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems.
NGSS.MS.LS2-5	Evaluate competing design solutions for maintaining biodiversity and ecosystem services.
NGSS.MS.PS1-3	Gather and make sense of information to describe that synthetic materials come from natural resources and impact society.
NGSS.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.
NGSS.MS.ETS1-2	Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
NGSS.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 anew solution to better meet the criteria for success.

NGSS.MS.ETS1-4 Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.

Science & Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Asking Questions and Defining Problems: • Ask questions to identify and clarify evidence of an argument. (NGSS.MS-ESS3-5) Analyzing and Interpreting Data: • Analyze and interpret data to determine similarities and differences in findings. (NGSS.MS-ESS3-2) 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. (NGSS.MS-ESS3-1) • Apply scientific principles to design an object, tool, process, or system. (NGSS.MS-ESS3-3) Engaging in Argument from Evidence: • Construct an oral and written argument supported by empirical evidence and scientific reasoning to support or refute an	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. (NGSS.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. (NGSS.MS-ESS3-2) 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	Patterns: • Graphs, charts, and images can be used to identify patterns in data. (NGSS.MS-ESS3-2) Cause and Effect: • Relationships can be classified as causal or correlational, and correlation does not necessarily imply causation. (NGSS.MS-ESS3-3) • Cause and effect relationships may be used to predict phenomena in natural or designed systems. (NGSS.MS.ESS3-4) Structure and Function: • Structures can be designed to serve particular functions by taking into account properties of different materials, and how materials can be shaped and used. (NGSS.MS-PS1-3) Connections to Engineering, Technology, and Applications of Science: Influence of Science, Engineering, and Technology on Society and the Natural World: • All human activity draws on natural resources and

explanation or a model for a phenomenon or a solution to a problem. (NGSS.MS-ESS3-4)	different living things. (NGSS.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. (NGSS.MS-ESS3-4) LS2.C: Ecosystem Dynamics, Functioning and Resilience: • Biodiversity describes the variety of species found in Earth's terrestrial and oceanic ecosystems. The completeness or integrity of an ecosystem's biodiversity is often used as a measure of its health. (NGSS.MS-LS2-5) PS1.B: Chemical Reactions: • Substances react chemically in characteristic ways. In a chemical process, the atoms that make up the original substances are regrouped into different molecules, and these new substances have different properties from those of the reactants. (NGSS.MS-PS1-2, NGSS.MS-PS1-3, NGSS.MS-PS1-5)	has both short- and long-term consequences, positive as well as negative, for the health of people and the natural environment. (NGSS.MS-ESS3-1, NGSS.MS-ESS3-4) • 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. (NGSS.MS-ESS3-2, NGSS.MS-ESS3-3) Connections to Nature of Science: Science Addresses Questions about the Natural and Material World: • Scientific knowledge can describe the consequences of actions but does not necessarily prescribe the decisions that society takes. (NGSS.MS-ESS3-4)

Unit Essential Questions

- How do humans depend on Earth's resources?
- How do natural hazards affect individuals and societies?
- How do living organisms alter Earth's processes and structures?

Scope and Sequence

- TBD 2017-18

Assured Assessments
Student performance on the following assessments will be included in the trimester report card.

Formative Assessments:

- TBD 2017-18

Summative Assessments:

- TBD 2017-18

Resources
Core

- TBD

Supplemental

- online resources developed collaboratively

Time Allotment

- Approximately five weeks

UNIT 4
Earth's Place in the Universe: Astronomy

Unit Goals

At the completion of this unit, students will:

NGSS.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.
NGSS.MS.ESS1-2	Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system.
NGSS.MS.ESS1-3	Analyze and interpret data to determine scale properties of objects in the solar system.
NGSS.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.
NGSS.MS.PS2-1	Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects.
NGSS.MS.PS2-4	Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on masses of interacting objects.
NGSS.MS.LS2-1	Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.
NGSS.MS.LS2-2	Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.
NGSS.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.
NGSS.MS.ETS1-2	Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.

NGSS.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 anew solution to better meet the criteria for success.
NGSS.MS.ETS1-4	Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.

Science & Engineering Practices	**Disciplinary Core Ideas**	**Crosscutting Concepts**
Developing and Using Models: • Describe and use a model to describe phenomena. (NGSS.MS-ESS1-1, NGSS.MS-ESS1-2) Analyzing and Interpreting Data: • Analyze and interpret data to determine similarities and differences in findings. (NGSS.MS-ESS1-3) 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. (NGSS.MS-ESS1-4)	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. (NGSS.MS-ESS1-1) • Earth and its solar system are part of the Milky Way galaxy, which is one of many galaxies in the universe. (NGSS.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. (NGSS.MS-ESS1-2, NGSS.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 titled relative to its orbit around the sun.	Patterns: • Patterns can be used to identify cause-and-effect relationships. (NGSS.MS-ESS1-1) Scale, Proportion, and Quantity: • Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small. (NGSS.MS-ESS1-3, NGSS.MS-ESS1-4) Systems and System Models: • Models can be used to represent systems and their interactions. (NGSS.MS-ESS1-2) Connections to Engineering, Technology, and Applications of Science: Interdependence of Science, Engineering, and Technology: • Engineering advances have led to important discoveries in virtually every field of science, and scientific discoveries have led to the

	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. (NGSS.MS-ESS1-1) • The solar system appears to have formed from a disk of dust and gas, drawn together by gravity. (NGSS.MS-ESS1-2) ESS1.C: The History of Planet Earth • The geologic time scale interpreted from rock strata provides a way to organize Earth's history. Analyses of rock strata and the fossil record provide only relative dates, not an absolute scale. (NGSS.MS-ESS1-4)	development of entire industries and engineered systems. (NGSS.MS-ESS1-3) Connections to Nature of Science: Scientific Knowledge Assumes an Order and Consistency in Natural Systems: • Science assumes that objects and events in natural systems occur in consistent patterns that are understandable through measurement and observation. (NGSS.MS-ESS1-1, NGSS.MS-ESS1-2)

Unit Essential Questions

- What is the universe, and what is Earth's place in it?
- What are the predictable patterns caused by Earth's movement in the solar system?
- What goes on in stars?

Scope and Sequence

- TBD 2017-18

Assured Assessments
Student performance on the following assessments will be included in the trimester report card.

Formative Assessments:

- TBD 2017-18

Summative Assessments:

- Performance Assessment Project: Culminating EARTH Sciences Environmental Implications

Resources

Core

- Padilla, Michael J., Ioannis Miaoulis, and Martha Cyr. *Science Explorer: Astronomy*. Upper Saddle River, NJ: Prentice Hall, 2005. Print.

Supplemental

- online resources developed collaboratively

Time Allotment

- Approximately thirteen weeks