Grade 6: Earth Science
Unit 1: Earth History 2011

Students investigate rocks and fossils to discover clues the reveal Earth's history. They explore sedimentary rocks and fossils form the Grand Canyon, consider the processes that created them, and compare evidence discovered in the rocks to present-day geologic processes and contemporary life-forms. The students use these data to make inferences about past organisms, environments, and events that occurred on Earth over its history. Students engage in further exploration of the constructive and destructive processes that have shaped the New Jersey landscape.

Essential Questions:

How are earth processes similar to those that occurred in the past?
How do fossils provide evidence of past life and environmental conditions?
How is the earth composed?
How are earth materials cycled and what effect does this process have on the earth's surface?

Resources:

FOSS Earth History Module
FOSS Earth History Resources
FOSS Earth History Notebook
Prentice Hall Science Explorer Earth Science Textbook

NJ Cumulative Progress Indicator (NJCPI):

5.4.6.B.1 Interpret a representation of a rock layer sequence to establish oldest and youngest layers, geologic events, and changing life forms.

5.4.6.B.2 Examine Earth's surface features and identify those created on a scale of human life or on a geologic time scale.

5.4.6.B.3 Determine if landforms were created by processes of erosion (e.g., wind, water, and/or ice) based on evidence in pictures, video, and/or maps.

5.4.6.B.4 Describe methods people use to reduce soil erosion.

5.4.8.B.1 Correlate the evolution of organisms and the environmental conditions on Earth as they changed throughout geologic time.

5.4.8.B.2 Evaluate the appropriateness of increasing the human population in a region (e.g., barrier islands, Pacific Northwest, Midwest United States) based on the region's history of catastrophic events, such as volcanic eruptions, earthquakes, and floods.

5.4.6.C.2 Distinguish physical properties of sedimentary, igneous, or metamorphic rocks and explain how one kind of rock could eventually become a different kind of rock.

5.4.6.C.3 Deduce the story of the tectonic conditions and erosion forces that created sample rocks or rock formations.

5.4.6.D.1 Apply understanding of the motion of lithospheric plates to explain why the Pacific Rim is referred to as the Ring of Fire.

5.4.6.D.2 Locate areas that are being created (deposition) and destroyed (erosion) using maps and satellite images.

5.4.6.D.3 Apply knowledge of Earth's magnetic fields to successfully complete an orienteering challenge.

5.4.8.D.1 Model the interactions between the layers of Earth.

5.4.8.C.2 Explain how chemical and physical mechanisms (changes) are responsible for creating a variety of landforms.

5.4.8.D.2 Present evidence to support arguments for the theory of plate motion

Science Content (Declarative Conceptual Knowledge) **Students Will Know and Understand:**	**NJCCCS**
Earth processes that we see today are similar to those that occurred in the past.	**5.4.6.B.1** **5.4.8.B.1**
Fossils provide important evidence of how life and environmental conditions have changed.	**5.4.8.B.1**
Solid Earth is layered with a lithosphere, hot convecting mantle, and dense metallic core.	**5.4.8.D.1**
Landforms are the result of a combination of constructive forces (crustal deformation, volcanic eruption, and deposition of sediments) and destructive forces (weathering and erosion).	**5.4.6.B.2**
The rock cycle involves old rocks that break down to form the source of sediments that are buried, compacted, heated, and often crystallized into new rocks.	**5.4.6.C.2**
The rock cycle creates three types of rocks; igneous, sedimentary, and metamorphic.	**5.4.6.C.2**

Thinking Processes (Procedural Knowledge) **Students Will Be Able To:**	**NJCCCS**
Make observations and generate evidence to support an idea.	**5.1.8.B.3**
Share study results with others for critical review.	**5.1.8.B.3**
Make inferences based on evidence.	**5.1.8.B.3**
Observe, describe, and compare rocks using appropriate tools.	**5.4.6.C.2**
Use scientific methods to identify and name types of rocks.	**5.4.6.C.2**
Correlate rock samples from two different locations.	**5.4.6.C.2**
Investigate how sand can be made from larger rocks.	**5.4.6.C.2**
Model the formation of layers of sandstone and shale in an ancient environment.	**5.4.6.C.2**
Relate the process of weathering, erosion, and deposition, to the formation of sedimentary rock.	**5.4.8.B.2** **5.4.6.C.2**
Create a timeline of geologic events and prehistoric life.	**5.4.6.B.2** **5.4.6.B.1**
Determine the relative age of rocks.	**5.4.6.B.1**
Use index fossils to correlate rock layers in three locations.	**5.4.6.B.1**
Compare various events and fossils to derive a faunal succession over geologic time.	**5.4.6.B.1**
Make inferences from fossil evidence that contribute to an understanding of fossil succession.	**5.4.8.B.1** **5.4.6.B.1**
Observe and compare the properties of igneous, sedimentary, and metamorphic rock.	**5.4.6.C.2**
Relate the formation processes of the three types of rocks to develop the rock cycle.	**5.4.6.C.2**
Relate the size of crystals in igneous rocks to environmental variables.	**5.4.8.C.2**

Unit 2: Weather and Water

Students investigate the properties of Earth's atmosphere and the processes that produce weather, including energy transfer, atmospheric pressure, and water cycle. They study principles that govern temperature, wind, humidity, precipitation, and severe weather. Students collect and analyze local and global weather data using instruments and reports from various media. They investigate fresh water as a vital resource.

Essential Questions:

How is the atmosphere composed?
How do global patterns of atmospheric movement affect weather and climate?
How can technology be used to help interpret and predict weather patterns?
How does water circulate through the Earth's crust, oceans, and atmosphere?

Resources: FOSS Weather and Water Module
FOSS Weather and Water Resources
FOSS Weather and Water Notebook
Prentice Hall Science Explorer Earth Science Textbook

NJCPI:

5.2.6.A.1 Determine the volume of common objects using water displacement methods.

5.2.6.A.2 Calculate the density of objects or substances after determining volume and mass.

5.2.6.C.1 Predict the path of reflected or refracted light using reflecting and refracting telescopes as examples.

5.2.6.C.2 Describe how to prisms can be used to demonstrate that visible light from the Sun is made up of different colors.

5.2.6.C.3 Relate the transfer of heat from oceans and land masses to the evolution of a hurricane.

5.2.8.C.1 Structure evidence to explain the relatively high frequency of tornadoes in "Tornado Alley."

5.2.8.C.2 Model and explain current technologies used to capture solar energy for the purposes of converting it to electrical energy.

5.2.6.E.1 Model and explain how the description of an object's motion from one observer's view may be different from a different observer's view.

5.2.6.E.2 Describe the force between two magnets as the distance between them is changed.

5.2.6.E.4 Predict if an object will sink or float using evidence and reasoning.

5.4.6.A.1 Generate and analyze evidence (through simulations) that the Sun's apparent motion across the sky changes over the course of a year.

5.4.6.A.2 Construct and evaluate models demonstrating the rotation of Earth on its axis and the orbit of Earth around the Sun.

5.4.8.A.2 Use evidence of global variations in day length, temperature, and the amount of solar radiation striking Earth's surface to create models that explain these phenomena and seasons.

5.4.8.C.3 Model the vertical structure of the atmosphere using information from active and passive remote-sensing tools (e.g., satellites, balloons, and/or ground-based sensors) in the analysis.

5.4.6.E.1 Generate a conclusion about energy transfer and circulation by observing a model of convection currents.

5.4.8.E.1 Explain how energy from the Sun is transformed or transferred in global wind circulation, ocean circulation, and the water cycle.

5.4.6.F.1 Explain the interrelationships between daily temperature, air pressure, and relative humidity data.

5.4.6.F.2 Create climatographs for various locations around Earth and categorize the climate based on the yearly patterns of temperature and precipitation.

5.4.8.F.1 Determine the origin of local weather by exploring national and international weather maps.

5.4.8.F.2 Explain the mechanisms that cause varying daily temperature ranges in a coastal community and in a community located in the interior of the country.

5.4.8.F.3 Create a model of the hydrologic cycle that focuses on the transfer of water in and out of the atmosphere. Apply the model to different climates around the world.

Science Content (Declarative Conceptual Knowledge) **Students Will Know and Understand:**	**NJCCCS**
Heat energy is transferred in many ways; radiation, conduction, and convection.	**5.2.6.C.3**
Heat moves in predictable ways, flowing from warmer objects to cooler ones, until both reach the same temperature.	**5.4.8.F.2** **5.2.6.C.3**
The Sun is a major source of energy for changes on Earth's surface.	**5.4.6.A.4**
Seasonal temperature changes are due to the position of the Earth in relation to the Sun and the angle at which the Sun's rays reach the Earth.	**5.4.8.A.1**
The atmosphere is a mixture of nitrogen, oxygen, and trace gases including carbon dioxide and water vapor. The atmosphere has different properties at different locations.	**5.4.8.C.3**
Clouds, formed by the condensation of water vapor, affect weather and climate.	**5.4.8.F.3**
Global patterns of atmospheric movement include local weather. Oceans have a have a major effect on climate because water in the oceans holds a large amount of heat.	**5.4.8.F.1**
Water circulates through Earth's crust, oceans, and atmosphere in the water cycle.	**5.4.8.F.3**

Thinking Processes (Procedural Knowledge) **Students Will Be Able To:**	**NJCCCS**
Describe weather instruments and the weather factors that they measure.	**5.1.8.D.3**
Use weather instruments to measure temperature, atmospheric pressure, humidity, wind direction, and wind speed.	**5.1.8.D.3**
Conduct experiments to determine that air has mass.	**5.2.6.A.2**
Explain how experimental results provide evidence that air has mass.	**5.2.6.A.2**
Use a Sun-Earth model to identify relationships involving the tilt of Earth's axis, Earth's rotation, and Earth's revolution around the sun.	**5.4.8.A.1** **5.4.8.A.2**
Collect and analyze temperature data measuring the heating and cooling of different earth materials.	**5.1.8.D.3**
Describe heat transfer in terms of molecular activity.	**5.2.6.C.3** **5.2.8.C.2**
Describe how the atmosphere is heated.	**5.2.6.C.3**
Describe how materials of different densities interact.	**5.2.8.C.2**
Observe how heating and cooling of fluids moves air in a system.	**5.2.8.C.2**
Explain how energy transfer drives the process of convection.	**5.2.6.C.3** **5.2.8.C.2**
Engage in simulations to follow the movement of a molecule of water through the water cycle.	**5.4.8.F.3**
Explain with words and drawings how evaporation, condensation, precipitation and other processes produce many variations of the water cycle.	**5.4.8.F.3**
Apply pressure to a system and observe the compression of gas.	**5.4.6.F.1**

Build an anemometer and use it to gather data.	**5.4.6.F.1**
Interpret a pressure map.	**5.4.6.F.1**
Describe the relationship between changing air pressure and wind.	**5.4.6.F.1**
Explain how differential heating of Earth by the Sun creates local winds.	**5.4.6.F.1**
Model and explain what happens when two air masses of different densities meet.	**5.4.6.F.1**
Explain how a global temperature increase could affect the water cycle and Earth's climate.	**5.4.8.F.1**

Unit 3: Planetary Science

Throughout time, humans have been fascinated by the vastness that is beyond the Earth and have felt compelled to make sense of our place in the universe. Students will examine the history and technology of planetary science that has created our current understanding of the solar system and beyond. They will investigate Sun, Earth, and Moon relationships to explain such phenomena as the day, the year, seasons, moon phases, eclipses and tides. A further exploration of objects in the solar system helps students compare characteristics of stars, planets, and lesser bodies to those of Earth.

Essential Questions: How does gravity govern the movement of objects in the solar system?
How do these movements explain such phenomena as the day, the year, seasons, moon phases, eclipses, and tides?
What are the physical characteristics of the planets and other objects in the solar system?
How can planetary science be studied?

Resources:
FOSS Planetary Science Module
FOSS Planetary Resources
FOSS Planetary Notebook
Prentice Hall Science Explorer Earth Science Textbook

NJCPI:

5.4.6.A.2 Construct and evaluate models demonstrating the rotation of Earth on its axis and the orbit of Earth around the Sun.

5.2.6.E.1 Model and explain how the description of an object's motion from one observer's view may be different from a different observer's view.

5.4.6.A.3 Predict what would happen to an orbiting object if gravity were increased, decreased, or taken away.

5.4.6.A.4 Compare and contrast the major physical characteristics (including size and scale) of solar system objects using evidence in the form of data tables and photographs.

5.4.8.A.1 Analyze moon-phase, eclipse, and tidal data to construct models that explain how the relative positions and motions of the Sun, Earth, and Moon cause these three phenomena

Science Content (Declarative Conceptual Knowledge) **Students Will Know and Understand:**	**NJCCCS**
Frame of reference is important in describing locations on Earth.	**5.2.6.E.1**
Curved surfaces create horizons, which interrupt the line of sight.	**5.2.6.E.1**
The lengths of shadows cast by identical objects vary from place to place on Earth.	**5.2.6.E.1**
The Sun, a star, is the light source in our system.	**5.2.6.C.2**
Changes in the Earth's position relative to the sun produces differing amounts of daylight seasonally.	**5.4.6.A.2**
Earth rotates counterclockwise about every 24 hours, causing day and night.	**5.4.6.A.2**
The Moon's appearance changes predictably over the course of a 28-day period.	**5.4.8.A.1**
The Moon can be observed during different times of the day and night.	**5.4.8.A.1**
Regular and predictable motions of the Earth and moon produce tides.	**5.4.8.A.1**
The Moon has characteristics different from that of the Earth.	**5.4.8.A.1**
The Moon revolves around Earth and rotates on its axis; half of the Moon is lit by the Sun at all times.	**5.4.8.A.1**
Motions of the Sun, Earth and Moon explain the day, year, seasons, eclipses, and Moon phases.	**5.4.8.A.1**
Stars maintain their relationships to one another; planets, comets, and asteroids move with respect to the stars.	**5.4.6.A.4**
From the Earth, the positions of the constellations appear to change in the night sky.	**5.4.6.A.4**
The Sun's gravitational pull holds the planets in their orbits and the planets' gravitational pull holds their moons in their orbits.	**5.4.6.A.4**
The universe consists of many billions of galaxies, each including billions of stars.	**5.4.6.A.4**
Technology and space exploration has enhanced our understanding of space.	**5.1.8.D.3**

Thinking Processes (Procedural Knowledge) **Students Will Be Able To:**	**NJCCCS**
Relate information from different frames of reference.	**5.2.8.E.1**
Use models and simulations to make observations, gather evidence, and draw conclusions about the shape of Earth.	**5.1.8.B.1**
Make shadow observations, collect and organize information, graph shadow data, and describe and explain the resulting relationship.	**5.1.D.8.3**
Use models to relate Earth's motions to the Sun.	**5.1.8.B.1**
Communicate how to determine the directions of Earth's rotation.	**5.4.6.A.2**
Investigate the convention of time zones with maps and globes.	**5.1.8.B.1**
Observe and record the Moon's appearance for a month.	**5.4.8.A.1**
Observe photos of the Moon, describe major surface features, and communicate a list of questions.	**5.4.8.A.1**
Design and conduct experiments to relate impact variables to resulting landforms.	**5.1.8.B.2**
Relate evidence and understanding of processes to construct explanations about the lunar surface.	**5.4.8.A.1**

Interpret lunar features from photographs and determine size relationships using mathematics.	**5.1.8.B.2**
Construct a scale model of the Earth/Moon system.	**5.4.6.A.4**
Compare and describe day and night on Earth and the Moon.	**5.4.6.A.4**
Make inferences about the origins of the Moon by comparing different theories	**5.1.8.A.3**
Use models and simulations to explain Moon phases and eclipses.	**5.4.6.A.4**
Predict the positions and motions of the dynamic Sun/Earth/Moon system that account for the day, year, seasons, and phases of the moon.	**5.4.6.A.4**
Communicate how the Moon influences tides on Earth.	**5.4.8.A.1**
Using tide and moon charts, predict when neap and spring tides will occur.	**5.4.8.A.1**
Observe and record the position of stars and constellations in the night sky.	**5.4.6.A.4**
Use a star chart to locate and identify constellations.	**5.4.6.A.4**
Review the current knowledge about the planets and propose a planetary tour to apply the knowledge.	**5.4.6.A.4**
Communicate understanding of the solar system.	**5.4.6.A.4**

Connections to "Common Core" Reading and Writing:

Reading:

Key Ideas and Details

- RST.6-8.1. Cite specific textual evidence to support analysis of science and technical texts.
- RST.6-8.2. Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions.
- RST.6-8.3. Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.

Craft and Structure

- RST.6-8.4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 6–8 texts and topics*.
- RST.6-8.5. Analyze the structure an author uses to organize a text, including how the major sections contribute to the whole and to an understanding of the topic.
- RST.6-8.6. Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text.

Integration of Knowledge and Ideas

- 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).
- RST.6-8.8. Distinguish among facts, reasoned judgment based on research findings, and speculation in a text.

- 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.

Range of Reading and Level of Text Complexity

- RST.6-8.10. By the end of grade 8, read and comprehend science/technical texts in the grades 6–8 text complexity band independently and proficiently.

Writing:

Text Types and Purposes

- WHST.6-8.1. Write arguments focused on *discipline-specific content*.
    - Introduce claim(s) about a topic or issue, acknowledge and distinguish the claim(s) from alternate or opposing claims, and organize the reasons and evidence logically.
    - Support claim(s) with logical reasoning and relevant, accurate data and evidence that demonstrate an understanding of the topic or text, using credible sources.
    - Use words, phrases, and clauses to create cohesion and clarify the relationships among claim(s), counterclaims, reasons, and evidence.
    - Establish and maintain a formal style.
    - Provide a concluding statement or section that follows from and supports the argument presented.
- WHST.6-8.2. Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.
    - Introduce a topic clearly, previewing what is to follow; organize ideas, concepts, and information into broader categories as appropriate to achieving purpose; include formatting (e.g., headings), graphics (e.g., charts, tables), and multimedia when useful to aiding comprehension.
    - Develop the topic with relevant, well-chosen facts, definitions, concrete details, quotations, or other information and examples.
    - Use appropriate and varied transitions to create cohesion and clarify the relationships among ideas and concepts.
    - Use precise language and domain-specific vocabulary to inform about or explain the topic.
    - Establish and maintain a formal style and objective tone.
    - Provide a concluding statement or section that follows from and supports the information or explanation presented.
- WHST.6-8.3. (See note; not applicable as a separate requirement)

Production and Distribution of Writing

- WHST.6-8.4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
- WHST.6-8.5. With some guidance and support from peers and adults, develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on how well purpose and audience have been addressed.

- WHST.6-8.6. Use technology, including the Internet, to produce and publish writing and present the relationships between information and ideas clearly and efficiently.

Research to Build and Present Knowledge

- WHST.6-8.7. Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration.
- 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.
- WHST.6-8.9. Draw evidence from informational texts to support analysis reflection, and research.

Range of Writing

- WHST.6-8.10. Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.