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STAGE 1 – DESIRED RESULTS

Unit Title: Earth's Place in the Universe

Grade Level: 6

Length/Timing of Unit:

Teacher(s)/Designer(s): Pascack Valley Regional Science Committee

Science State standards addressed (verbatim):

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 scale properties of objects in the solar system.** [Clarification Statement: Emphasis is on the analysis of data from Earth-based instruments, space-based telescopes, and spacecraft to determine similarities and differences among solar system objects. Examples of scale properties include the sizes of an object's layers (such as crust and atmosphere), surface features (such as volcanoes), and orbital radius. Examples of data include statistical information, drawings and photographs, and models.] [Assessment Boundary: Assessment does not include recalling facts about properties of the planets and other solar system bodies.]

MS-ESS1-4. **Construct a scientific explanation based on evidence from rock strata for how the geologic time scale is used to organize Earth's 4.6-billion-year-old history.** [Clarification Statement: Emphasis is on how analyses of rock formations and the fossils they contain are used to establish relative ages of major events in Earth's history. Examples of Earth's major events could range from being very recent (such as the last Ice Age or the earliest fossils of homo sapiens) to very old (such as the formation of Earth or the earliest evidence of life). Examples can include the formation of mountain chains and ocean basins, the evolution or extinction of particular living organisms, or significant volcanic eruptions.] [Assessment Boundary: Assessment does not include recalling the names of specific periods or epochs and events within them.]

Connections to Common Core Standards (verbatim)**:**

ELA/Literacy

RST.6-8.1 Cite specific textual evidence to support analysis of science and technical texts. (MS-ESS1-3),(MS-ESS1-4)

RST.6-8.7 Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table). (MS-ESS1-3)

WHST.6-8.2 Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant
content. (MS-ESS1-4)

SL.8.5 Include multimedia components and visual displays in presentations to clarify claims and findings and emphasize salient points. (MS-ESS1-1),(MS-ESS1-2)

Mathematics

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

MP.4 Model with mathematics. (MS-ESS1-1),(MS-ESS1-2)
6.RP.A.1 Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. (MS-ESS1-1),(MS-ESS1-2),(MS-ESS1-3)

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

6.EE.B.6 Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an
unknown number, or, depending on the purpose at hand, any number in a specified set. (MS-ESS1-2),(MS-ESS1-4)

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7.EE.B.4 Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning
about the quantities. (MS-ESS1-2),(MS-ESS1-4)

Essential Questions (3-4) in provocative, student-friendly language:

- EQ 1: How do forces affect objects in the universe?
- EQ 2: What can we learn from studying the solar system?
- EQ 3: What can rocks tell us about the age of Earth?

Big Ideas/ Enduring Understandings: ***Students will understand that…***

EQ 1:

- There are predictable patterns among objects in the universe (ESS1-1)
- Earth and the solar system are part of the Milky Way galaxy, which is one of many galaxies in the universe (ESS1-2)
- Forces in the universe affect the arrangement of objects in the solar system such as the sun, planets, moons, and asteroids (ESS1-3)
- The arrangement of objects in the solar system create observable patterns and events (ESS1-1)

EQ 2:

- The formation of solar systems occurs when a disk of dust and gas is drawn together by gravity (ESS1-2)
- The relative size of objects and their composition in the universe (ESS1-3)
- We study the solar system through Earth-based instruments, space-based telescopes, and manned spacecraft exploration (ESS1-3)

EQ 3:

- Interpretation of rock strata tells us about the relative age of Earth (ESS1-4)
- Analysis of rock sample chemistry can give absolute age (ESS1-4)

A list of factual knowledge to be taught – *Students will know…*

EQ 1 - EQ 3:

- Definitions: gravity, force, planet, moon, orbit, revolution, rotation, solar eclipse, lunar eclipse, seasons, phases, waxing, waning, crescent, gibbous, full moon, new moon, tilt, axis, geology, astronomy, strata, fossil, radiometric dating, neap tide, spring tide, galaxy, etc.
- Relative and Absolute age of rocks
- Lunar and Solar Eclipse
- Lunar phases
- Spring and neap tides
- Axial Tilt
- Gravity is a force that pulls object
- Tools for research - telescopes, probes, satellites, space shuttle
- Geocentric and Heliocentric models
- Lunar and Solar Calendars

A list of skills to be taught or reinforced (including habits of mind) – *Students will be able to…*

- 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.
- Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system.
- Analyze and interpret data to determine scale properties of objects in the solar system.
- 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.

STAGE 2 – SAMPLE ASSESSMENT

Goal: Students are presented with the problem of creating a drawing of rock layers in a cliff by interpreting the notes of a geologist. To solve this problem, students must apply the concepts they learned in the unit, including relative and absolute dating.

Role: Geologist

Audience: Panel of geologists

Situation: Last spring, a team of geologists made a study of the rock layers exposed on the side of a cliff. Here are the notes one of the geologists made. “On this cliff, we can see six layers of sedimentary rock. There is an extrusion between the third and fourth oldest layers. Through dating a sample of that rock, we determined the extrusion to be 250 million years old. An intrusion extends from the bottom layer into the fourth oldest layer. Through dating a sample of that rock, we determined the intrusion to be 100 million years old. We also looked for fossils. In the three oldest layers, we discovered fossil trilobites. In the second and third oldest layers, we found fossils of fishes. We found reptile fossils in the third oldest layer and the layer above it. In the younger layer that had a reptile fossil, we also discovered a dinosaur fossil. We found bird fossils in the second and third youngest layers. Most interesting was the fossil from a whale we found in the youngest layer.” This geologist needs a drawing for the final report that shows what the team found. How can you make a drawing from the geologist’s notes?

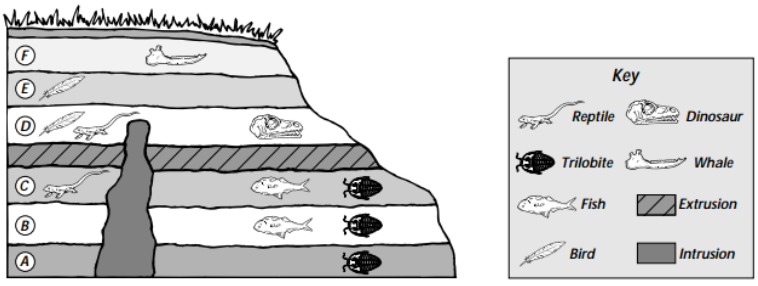
Product/Performance and Purpose:

1. Make a list of every feature the geologist found that could help you make a drawing of the site.
2. Make a drawing from your list. Label the sedimentary rock layers A–F, from oldest to youngest.
3. Create a key that tells what symbols you used on the drawing.

Analyze and Conclude
1. Which rock layer is the oldest? Explain how you know.
2. How did the geologists probably date the extrusion and intrusion? Explain.
3. Why didn’t the geologist include dates in the notes for the sedimentary rock layers?
4. What is the age of sedimentary rock layer D? Explain how you determined its age.
5. By inferring from the fossils in layer B, could this rock layer have been deposited in the Cambrian Period? Why or why not?
6. By inferring from the fossils in each layer, describe a major event in the history of life on Earth that occurred at about the time of the extrusion.
7. In which era was layer F deposited? How do you know?

Standards and Criteria: This activity assesses students’ knowledge of the law of superposition, extrusions, intrusions, index fossils, relative and absolute dating, the geologic time scale, and major events in Earth’s history.
Rubric and additional materials found at:
http://www.montgomery.k12.nc.us/cms/lib07/NC01000976/Centricity/Domain/634/Layers_of_Rock.pdf

Key (Based off of explanation): :



Fossil Game for Practice of skills: http://www.amnh.org/explore/ology/paleontology

STAGE 3 – LEARNING PLAN

Summary of Learning Activities (Lectures, mini-lessons, readalouds, independent reading, films, website exploration, discussions, dialogues, debates, partner or small-group work, student presentations, reports, journals, reflections, in-class assessments, written

reports, essays, research, and homework):

EQ1. How do forces affect objects in the universe?

- Models of rotation and revolution using objects or online simulations: http://www.fossweb.com/delegate/ssi-foss-ucm/Contribution%20Folders/FOSS/multimedia/Planetary_Science/binders/earth/earth_motions/seasons_simulation_1.html
- Brainpop - Seasons, Eclipses, moon phases
- Phases of the Moon Webquest - http://mrscienceut.net/phasesofthemoonwebquest.html
- Reasons for Seasons worksheet

EQ2. What can we learn from studying the solar system?

- **Brainpop -** Gravity & The Solar System
- CK-12 Videos
    - Gravity in the solar system and planet orbits in the solar system
    - https://www.ck12.org/ngss/middle-school-earth-and-space-sciences/earth's-place-in-the-universe
- Newton's Law of Gravitation Simulation - https://phet.colorado.edu/en/simulation/gravity-force-lab
- Scale Model of the solar system activity
- Planet distance activity using receipt tape

EQ3. What can rocks tell us about the age of Earth?

- Graphic of Geologic Time Scale - 9e8a9f421799c81b5748b16c21a7e21b.jpg
- Activity involving the formation of the geologic time scale and relative vs absolute time: https://www.utexas.edu/tmm/education/resources/pdf/geologic-time.pdf
- Activity - Arranging rock layers according to the fossils contained within the layers: http://www.amnh.org/explore/curriculum-collections/dinosaurs-ancient-fossils-new-discoveries/solve-a-sedimentary-layers-puzzle

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STAGE 1 – DESIRED RESULTS

Unit Title: Earth's Systems

Grade Level: 6

Length/Timing of Unit:

Teacher(s)/Designer(s): Pascack Valley Regional Science Committee

Science State standards addressed (verbatim):

MS-ESS2-1. **Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process.** [Clarification Statement: Emphasis is on the processes of melting, crystallization, weathering, deformation, and sedimentation, which act together to form minerals and rocks through the cycling of Earth's materials.] *[Assessment Boundary: Assessment does not include the identification and naming of minerals.]*

MS-ESS2-2. **Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales.** [Clarification Statement: Emphasis is on how processes change Earth's surface at time and spatial scales that can be large (such as slow plate motions or the uplift of large mountain ranges) or small (such as rapid landslides or microscopic geochemical reactions), and how many geoscience processes (such as earthquakes, volcanoes, and meteor impacts) usually behave gradually but are punctuated by catastrophic events. Examples of geoscience processes include surface weathering and deposition by the movements of water, ice, and wind. Emphasis is on geoscience processes that shape local geographic features, where appropriate.]

MS-ESS2-3. **Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions.** [Clarification Statement: Examples of data include similarities of rock and fossil types on different continents, the shapes of the continents (including continental shelves), and the locations of ocean structures (such as ridges, fracture zones, and trenches).] *[Assessment Boundary: Paleomagnetic anomalies in oceanic and continental crust are not assessed.]*

MS-ESS2-4. **Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity.** [Clarification Statement: Emphasis is on the ways water changes its state as it moves through the multiple pathways of the hydrologic cycle. Examples of models can be conceptual or physical.] *[Assessment Boundary: A quantitative understanding of the latent heats of vaporization and fusion is not assessed.]*

MS-ESS2-5. Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions.

[Clarification Statement: Emphasis is on how air masses flow from regions of high pressure to low pressure, causing weather (defined by temperature, pressure, humidity, precipitation, and wind) at a fixed location to change over time, and how sudden changes in weather can result when different air masses collide. Emphasis is on how weather can be predicted within probabilistic ranges. Examples of data can be provided to students (such as weather maps, diagrams, and visualizations) or obtained through laboratory experiments (such as with condensation).] *[Assessment Boundary: Assessment does not include recalling the names of cloud types or weather symbols used on weather maps or the reported diagrams from weather stations.]*

MS-ESS2-6. Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates.

[Clarification Statement: Emphasis is on how patterns vary by latitude, altitude, and geographic land distribution. Emphasis of atmospheric circulation is on the sunlight-driven latitudinal banding, the Coriolis effect, and resulting prevailing winds; emphasis of ocean circulation is on the transfer of heat by the global ocean convection cycle, which is constrained by the Coriolis effect and the outlines of continents. Examples of models can be diagrams, maps and globes, or digital representations.] *[Assessment Boundary: Assessment does not include the dynamics of the Coriolis effect.]*

Connections to Common Core Standards (verbatim)**:**

ELA/Literacy

RST.6-8.1 Cite specific textual evidence to support analysis of science and technical texts. (MS-ESS3-1),(MS-ESS3-2),(MS-ESS3-4),(MS-ESS3-5)

RST.6-8.7 Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table). (MS-ESS3-2)

WHST.6-8.1 Write arguments focused on discipline content. (MS-ESS3-4)

WHST.6-8.2 Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content. (MS-ESS3-1)

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. (MS-ESS3-3)

WHST.6-8.8 Gather relevant information from multiple print and digital sources; assess the credibility of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and providing basic bibliographic information for sources. (MS-ESS3-3)

WHST.6-8.9 Draw evidence from informational texts to support analysis, reflection, and research. (MS-ESS3-1),(MS-ESS3-4)

Mathematics

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

6.RP.A.1 Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. (MS-ESS3-3),(MS-ESS3-4)

7.RP.A.2 Recognize and represent proportional relationships between quantities. (MS-ESS3-3),(MS-ESS3-4)

6.EE.B.6 Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set. (MS-ESS3-1),(MS-ESS3-2),(MS-ESS3-3),(MS-ESS3-4),(MS-ESS3-5)

7.EE.B.4 Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about
the quantities. (MS-ESS3-1),(MS-ESS3-2),(MS-ESS3-3),(MS-ESS3-4),(MS-ESS3-5)

Essential Questions (3-4) in provocative, student-friendly language:

- EQ 1: How does the flow of energy affect Earth's processes?
- EQ 2: How have geologic processes changed Earth's surface?
- EQ 3: How do we know tectonic plates move?
- EQ 4: How does water move?
- EQ 5: How do air masses influence weather?
- EQ 6: How does heat affect the atmosphere and oceans?

Big Ideas/ Enduring Understandings: ***Students will understand that…***

<u>EQ 1:</u>

- Energy from the sun is the driving force of the water cycle (ESS2-1)
- Energy from Earth's interior drives plate motion (ESS2-1)
- Energy influences rocks changing from one form to another (ESS2-1)

<u>EQ 2:</u>

- Tectonic processes continually change oceanic and continental crust. (ESS2-3)
- Different Earth processes that range in size and time scale have shaped Earth both past and present (ESS2-2)
- Water's movements—both on the land and underground—cause weathering and erosion, which change the land's surface features and create underground formations (ESS2-2)

<u>EQ 3:</u>

- The distribution of fossils and rocks, continental shapes, and seafloor structures provide evidence of past plate motions (ESS2-3).

<u>EQ 4:</u>

- Water circulates through land, ocean, and atmosphere through a change of state and movement influenced by gravity and sunlight. (ESS2-4)

<u>EQ 5:</u>

- Weather is influenced by patterns and changes in the movement of water in the atmosphere that are caused by by winds, landforms, and ocean temperatures and currents (ESS2-5)
- Because these patterns are so complex, weather can only be predicted probabilistically. (ESS2-5)

<u>EQ 6:</u>

- Weather and climate are influenced by interactions involving sunlight, the ocean, the atmosphere, ice, landforms, and living things geography, all of which can affect oceanic and atmospheric flow patterns (ESS2-6)
- 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.
- Variations in density due to variations in temperature and salinity drive a global pattern of interconnected ocean currents. (ESS2-6)

A list of factual knowledge to be taught – *Students will know…*

EQ 1:

- Definitions: energy, convection, conduction, radiation, density, melting, crystallization, weathering, erosion, deformation, sedimentation, sedimentary, metamorphic, igneous, pressure, heat, etc.
- Rock Cycle
- Relationship between heat and pressure
- Weathering and erosion
- Types of heat transfer (convection, conduction, and radiation)

EQ 2:

- Definitions: weathering and erosion, oceanic and continental crust, etc.
- Continental Drift → Seafloor Spreading → The Theory of Plate Tectonics

EQ 3:

- Definitions: tectonic plate, lithosphere, asthenosphere, subduction, divergent, convergent, transform, continental drift, seafloor spreading, plate tectonics, trenches, ridges, fault, etc.
- Pangaea
- Fossil types/fossilization
- Rock layers (strata)
- Landforms

EQ 4:

- Definitions: evaporation, transpiration, condensation, precipitation, run-off, percolation, etc.
- Water Cycle
- Phase Changes: solid, liquid, gas

EQ 5:

- Definitions:, jet stream, troposphere, stratosphere, mesosphere, ionosphere, exosphere, thermosphere, air pressure, cloud varieties, etc.
- Layers of the Atmosphere
- Pressure systems and affect on weather (fronts)
- Weather maps and symbols

EQ 6:

- Definitions: salinity, latitude, longitude, topography, Coriolis Effect, global wind types, temperature, current, etc.
- Relationship between temperature and pressure
- Effect of wind and water currents on global heat transfer

A list of skills to be taught or reinforced (including habits of mind) – *Students will be able to…*

- Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process.
- Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales.
- Analyze and interpret data on the distribution of fossils and rocks, continental shapes and landforms, and seafloor structures to provide evidence of the past plate motions.
- Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity.
- Collect data to provide evidence for how the motions and complex interactions of air masses results 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.

STAGE 2 – SAMPLE ASSESSMENT

Goal: Analyze the scientific theory of plate tectonics and identify related major processes and features as a result of moving plates.

Role: You are a college student at Princeton University, in 1966, under the tutelage of Harry Hess in the geology department.

Audience: Your family back at home.

Situation: You are telling your family about the newly formed plate tectonic theory.

Product/Performance and Purpose: Letter

Standards and Criteria:
In your letter you will describe:
-The formation of the plate tectonic theory including history, and types of evidence that support the theory (remember GPS is not available yet)
- Explain the process of plate movement including divergent plate boundaries and subduction at convergent plate boundaries, and sliding past at transform boundaries.
-Explain the land features associated with each plate boundary.
-Explain volcanism and earthquakes at plate boundaries and how plate movement is associated with both.

STAGE 3 – LEARNING PLAN

Summary of Learning Activities (Lectures, mini-lessons, readalouds, independent reading, films, website exploration, discussions, dialogues, debates, partner or small-group work, student presentations, reports, journals, reflections, in-class assessments, written reports, essays, research, and homework):

EQ 1: How does the flow of energy affect Earth's processes?

- Read and watch videos from CK-12 on rock cycle, earthquakes, volcanoes, tsnamis, water cycle, carbon cycle, nitrogen cycle - https://www.ck12.org/ngss/middle-school-earth-and-space-sciences/earth's-systems
- Virtual Earthquake Online - http://www.sciencecourseware.com/virtualearthquake/vquakeexecute.html

EQ 2: How have geologic processes change Earth's surface?

- Plate Tectonic Activity: http://www.pbs.org/wgbh/aso/tryit/tectonics/ and
- Brainpop: Erosion

EQ 3: How do we know tectonic plates move?

- http://www.pbslearningmedia.org/resource/ess05.sci.ess.earthsys.lp_platetectonics/plate-tectonics/

EQ 4: How does water move?

- Water Cycle Card Activity
- Water Cycle Graphic watercyclesummary.jpg

EQ 5: How do air masses influence weather?

- Air masses scaffolding activity http://sciencenetlinks.com/lessons/air-masses/
- Weather Tank Lab - https://us.vwr.com/store/catalog/product.jsp?product_id=10548736

EQ 6: How does heat affect the atmosphere and oceans?

- Heat and the atmosphere activity: http://www.ucar.edu/learn/1_3_2_13t.htm
- The effect of heat on oceans lab: https://www.ucar.edu/learn/1_1_2_7t.htm

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STAGE 1 – DESIRED RESULTS

Unit Title: Earth and Human Activity

Grade Level: 6

Length/Timing of Unit:

Teacher(s)/Designer(s): Pascack Valley Regional Science Committee

Science State standards addressed (verbatim):

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 organic marine sediments and subsequent geologic traps), metal ores (locations of past volcanic and hydrothermal activity associated with subduction zones), and soil (locations of active weathering and/or deposition of rock).]

MS-ESS3-2. **Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.** [Clarification Statement: Emphasis is on how some natural hazards, such as volcanic eruptions and severe weather, are preceded by phenomena that allow for reliable predictions, but others, such as earthquakes, occur suddenly and with no notice, and thus are not yet predictable. Examples of natural hazards can be taken from interior processes (such as earthquakes and volcanic eruptions), surface processes (such as mass wasting and tsunamis), or severe weather events (such as hurricanes, tornadoes, and floods). Examples of data can include the locations, magnitudes, and frequencies of the natural hazards. Examples of technologies can be global (such as satellite systems to monitor hurricanes or forest fires) or local (such as building basements in tornado prone regions or reservoirs to mitigate droughts).]

MS-ESS3-3. **Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.*** [Clarification Statement: Examples of the design process include examining human environmental impacts, assessing the kinds of solutions that are feasible, and designing and evaluating solutions that could reduce that impact. Examples of human impacts can include water usage (such as the withdrawal of water from streams and aquifers or the construction of dams and levees), land usage (such as urban development, agriculture, or the removal of wetlands), and pollution (such as of the air, water, or land).]

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

MS-ESS3-5. **Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century.** [Clarification Statement: Examples of factors include human activities (such as fossil fuel combustion, cement production, and agricultural activity) and natural processes (such as changes in incoming solar radiation or volcanic activity). Examples of evidence can include tables, graphs, and maps of global and regional temperatures, atmospheric levels of gases such as carbon dioxide and methane, and the rates of human activities. Emphasis is on the major role that human activities play in causing the rise in global temperatures.]

Connections to Common Core Standards (verbatim)**:**

ELA/Literacy

RST.6-8.1 Cite specific textual evidence to support analysis of science and technical texts.
(MS-ESS3-1),(MS-ESS3-2),(MS-ESS3-4),(MS-ESS3-5)

RST.6-8.7 Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram,
model, graph, or table). (MS-ESS3-2)

WHST.6-8.1 Write arguments focused on discipline content. (MS-ESS3-4)

WHST.6-8.2 Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant
content. (MS-ESS3-1)

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. (MS-ESS3-3)

WHST.6-8.8 Gather relevant information from multiple print and digital sources; assess the credibility of each source; and quote or paraphrase the data and conclusions of others
while avoiding plagiarism and providing basic bibliographic information for sources. (MS-ESS3-3)

WHST.6-8.9 Draw evidence from informational texts to support analysis, reflection, and research. (MS-ESS3-1),(MS-ESS3-4)

Mathematics

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

6.RP.A.1 Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities.
(MS-ESS3-3),(MS-ESS3-4)

7.RP.A.2 Recognize and represent proportional relationships between quantities. (MS-ESS3-3),(MS-ESS3-4)

6.EE.B.6 Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown
number, or, depending on the purpose at hand, any number in a specified set.
(MS-ESS3-1),(MS-ESS3-2),(MS-ESS3-3),(MS-ESS3-4),(MS-ESS3-5)

7.EE.B.4 Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about
the quantities. (MS-ESS3-1),(MS-ESS3-2),(MS-ESS3-3),(MS-ESS3-4),(MS-ESS3-5)

Essential Questions (3-4) in provocative, student-friendly language:

- EQ 1: What are resources?
- EQ 2: Why do natural disasters occur?
- EQ 3: How do humans impact the environment?
- EQ 4: What affects climate change?

Big Ideas/ Enduring Understandings: *Students will understand that…*

EQ 1:
- Some resources are renewable while others are nonrenewable (MS-ESS3-1)
- Human impact on resources (MS-ESS3-1)
- Geologic processes affect the distribution of resources (MS-ESS3-1)

EQ 2:
- Some natural disasters are predictable while others are not (MS-ESS3-2)
- Natural disasters are driven by interior processes, surface processes, and/or severe weather events (MS-ESS3-2)

EQ 3:
- Human activity impacts ecosystems (MS-ESS3-3) (MS-ESS3-4)
- The relationship between human population and the impact on natural resources (MS-ESS3-3) (MS-ESS3-4)

EQ 4:
- Human activities and natural processes affect climate (MS-ESS3-5)

A list of factual knowledge to be taught – *Students will know…*

EQ 1:
- Key terms: renewable, non-renewable, resources, etc.
- Geoscience processes: volcanic eruptions, hydrothermal activity, weathering, erosion, deposition, subduction, etc.
- Examples of resources: coal, oil, natural gas, water, electrical energy (wind, water, solar), mineral resources (gold, lithium, etc)

EQ 2:
- Types of natural disasters: interior processes(volcanoes, earthquakes), surface processes(mass wasting, tsunamis), or severe weather events(hurricanes, tornadoes, floods)
- Measuring/Monitoring Devices: Seismometer, GPS, Laser ranging devices, creep meter, etc.

EQ 3:
- Key terms: population density, extinction, limiting factors, pollution, per capita
- Positive and negative impacts on the natural environment: destruction of habitat, extinction or endangerment of species, etc.

EQ 4:
- Natural processes:
    - Plate tectonic processes - positions of continents, sizes of oceans and the amount of volcanic activity that takes place
    - The Sun due to the shape of the planet's orbit, its axial tilt, and its wobble.
    - Atmospheric greenhouse gas levels correlate with average global temperatures.
- Human activities:
    - Carbon footprints, artificial carbon sources, greenhouse effect, pollution, human waste disposal, etc.

A list of skills to be taught or reinforced (including habits of mind) – *Students will be able to…*
- Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes.
- Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development.
- Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.
- Construct an argument supported by evidence for how increases in human population and per-capita consumption.
- Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past.

STAGE 2 – SAMPLE ASSESSMENT

Goal : Find the best settlement site for your new settler

Role : You are yourself, playing a video game

Audience: Others playing the game

Situation: You are playing the video game similar to Civilization V. You are a new settler, and need to determine where to start a new settlement. Your world is full of volcanoes – based on real volcanoes that are on Earth. Ultimately, your settlement will be situated near an actual volcano. Determine which of the possible settlement sites will be the best place to settle. To make your decision, consider:

- Location on the map
- Landform features around the volcano
- Magnitude and Frequency of eruption
- Deaths
- Financial Data

Product:

1. You will create a presentation for the class
2. You will utilize “Google Earth” to take us on a tour of the location you have chosen for your settlement.
3. Explain the site you chose, and why it will be the best site for a new settlement.
4. You will include a description/model of at least 3 innovative safety features the settlers will have to develop to keep future citizens safe.

Standards and Criteria:

- Include real data from the NOAA site about the volcano closest to your settlement
- Utilize specific vocabulary
- Identify the term hydrothermal activity and indicate devices that your town will use to monitor possible eruptions
- Based on previous data, suggest a possible new warning system to either calculate volcanic activity or predict level of destruction
- Establish a plan of action to follow in the event of an eruption

STAGE 3 – LEARNING PLAN

Summary of Learning Activities (Lectures, mini-lessons, readalouds, independent reading, films, website exploration, discussions, dialogues, debates, partner or small-group work, student presentations, reports, journals, reflections, in-class assessments, written reports, essays, research, and homework):

EQ 1: What are resources?

- Brainpop - Natural Resources
- Read Intro to Resources: https://www.ck12.org/ngss/middle-school-earth-and-space-sciences/earth-and-human-activity

EQ 2: Why do natural disasters occur?

- Brainpop - Natural Disasters, Hurricanes, earthquakes
- Natural disaster research project: http://www.kenton.k12.ny.us/Page/8677

EQ 3: How do humans impact the environment?

- Human Impact - Webquest - http://www.nationalgeographic.com/eye/impact.html
- Brainpop - Humans and the Environment
- Calculate your ecological footprint - http://footprintnetwork.org/en/index.php/GFN/page/calculators/

EQ 4: What effects climate change?

- Video - An Inconvenient Truth
- Debate - Global Warming
- Online resource for climate change (reading and video) - http://www.epa.gov/climatechange/science/causes.html