

### EARTH AND SPACE SCIENCE

The Earth and Space Science course content focuses on a comprehensive application of all disciplines of science, based on the biologically active nature of our ever-changing planet and the integration of systems that constantly evolve. In an effort to encourage students to pursue careers in the fields of science, technology, engineering, and mathematics (STEM), this course incorporates the scientific and engineering practices that reflect the scientific processes used by scientists. The scientific and engineering practices are implemented through a student-centered, laboratory-intensive, collaborative classroom environment.

The Earth and Space Science standards provide a depth of conceptual understanding to adequately prepare students for college, career, and citizenship with an appropriate level of scientific literacy. Resources specific to the local area as well as external resources, including evidence-based literature found within scientific journals, should be used to extend and increase the complexity of the core ideas.

The foundation of the course is taken from two disciplinary core ideas in the Earth and Space Science domain. The first core idea, Earth's Place in the Universe, addresses the concepts of the universe and its stars, Earth and the solar system, and the history of planet Earth. The second core idea, Earth's Systems, examines Earth's materials and systems, plate tectonics and large-scale system interactions, the roles of water in Earth's surface processes, weather and climate, and biogeology. Integrated within the disciplinary core ideas of Earth and Space Science are the Engineering, Technology, and Applications of Science (ETS) core ideas, which are denoted with an asterisk (\*). The ETS core ideas require students to use tools and materials to solve simple problems and to use representations to convey design solutions to a problem and determine which is most appropriate.

## Space Systems

### (Earth's Place in the Universe)

Students will:

AL.ESS.1 - Develop and use models to illustrate the lifespan of the sun, including energy released during nuclear fusion that eventually reaches Earth through radiation.

AL.ESS.2 - Engage in argument from evidence to compare various theories for the formation and changing nature of the universe and our solar system (e.g., Big Bang Theory, Hubble's law, steady state theory, light spectra, motion of distant galaxies, composition of matter in the universe).

AL.ESS.3 - Evaluate and communicate scientific information (e.g., Hertzsprung-Russell diagram) in reference to the life cycle of stars using data of both atomic emission and absorption spectra of stars to make inferences about the presence of certain elements.

AL.ESS.4 - Apply mathematics and computational thinking in reference to Kepler's laws, Newton's laws of motion, and Newton's gravitational laws to predict the orbital motion of natural and man-made objects in the solar system.

AL.ESS.5 - Use mathematics to explain the relationship of the seasons to the tilt of Earth's axis (e.g., zenith angle, solar angle, surface area) and its revolution about the sun, addressing intensity and distribution of sunlight on Earth's surface.

## Space Systems

### (Earth's Place in the Universe)

Students who demonstrate understanding can:

- HS-ESS1-1**    **Develop a model based on evidence to illustrate the life span of the sun and the role of nuclear fusion in the sun's core to release energy that eventually reaches Earth in the form of radiation.** [Clarification Statement: Emphasis is on the energy transfer mechanisms that allow energy from nuclear fusion in the sun's core to reach Earth. Examples of evidence for the model include observations of the masses and lifetimes of other stars, as well as the ways that the sun's radiation varies due to sudden solar flares ("space weather"), the 11-year sunspot cycle, and non-cyclic variations over centuries.] [Assessment Boundary: Assessment does not include details of the atomic and sub-atomic processes involved with the sun's nuclear fusion.]
- HS-ESS1-2**    **Construct an explanation of the Big Bang theory based on astronomical evidence of light spectra, motion of distant galaxies, and composition of matter in the universe.** [Clarification Statement: Emphasis is on the astronomical evidence of the red shift of light from galaxies as an indication that the universe is currently expanding, the cosmic microwave background as the remnant radiation from the Big Bang, and the observed composition of ordinary matter of the universe, primarily found in stars and interstellar gases (from the spectra of electromagnetic radiation from stars), which matches that predicted by the Big Bang theory (3/4 hydrogen and 1/4 helium).]
- HS-ESS1-3**    **Communicate scientific ideas about the way stars, over their life cycle, produce elements.** [Clarification Statement: Emphasis is on the way nucleosynthesis, and therefore the different elements created, varies as a function of the mass of a star and the stage of its lifetime.] [Assessment Boundary: Details of the many different nucleosynthesis pathways for stars of differing masses are not assessed.]
- HS-ESS1-4**    **Use mathematical or computational representations to predict the motion of orbiting objects in the solar system.** [Clarification Statement: Emphasis is on Newtonian gravitational laws governing orbital motions, which apply to human-made satellites as well as planets and moons.] [Assessment Boundary: Mathematical representations for the gravitational attraction of bodies and Kepler's Laws of orbital motions should not deal with more than two bodies, nor involve calculus.]

## Space Systems (Earth's Place in the Universe)

The performance expectations were developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
<p><b><u>Developing and Using Models</u></b> Modeling in 9–12 builds on K–8 experiences and progresses to using, synthesizing, and developing models to predict and show relationships among variables between systems and their components in the natural and designed world(s).</p> <ul style="list-style-type: none"> <li>Develop a model based on evidence to illustrate the relationships between systems or between components of a system. (HS-ESS1-1)</li> </ul> <p><b><u>Using Mathematical and Computational Thinking</u></b> Mathematical and computational thinking in 9–12 builds on K–8 experiences and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions including trigonometric functions, exponentials and logarithms, and computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical models of basic assumptions.</p> <ul style="list-style-type: none"> <li>Use mathematical or computational representations of phenomena to describe explanations. (HS-ESS1-4)</li> </ul> <p><b><u>Constructing Explanations and Designing Solutions</u></b> Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories.</p> <ul style="list-style-type: none"> <li>Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, theories, simulations, peer review) 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. (HS-ESS1-2)</li> </ul> <p><b><u>Obtaining, Evaluating, and Communicating Information</u></b> Obtaining, evaluating, and communicating information in 9–12 builds on K–8 experiences and progresses to evaluating the validity and reliability of the claims, methods, and designs.</p> <ul style="list-style-type: none"> <li>Communicate scientific ideas (e.g. about phenomena and/or the process of development and the design and performance of a proposed process or system) in multiple formats (including orally, graphically, textually, and mathematically). (HS-ESS1-3)</li> </ul>	<p><b><u>ESS1.A: The Universe and Its Stars</u></b></p> <ul style="list-style-type: none"> <li>The star called the sun is changing and will burn out over a lifespan of approximately 10 billion years. (HS-ESS1-1)</li> <li>The study of stars' light spectra and brightness is used to identify compositional elements of stars, their movements, and their distances from Earth. (HS-ESS1-2), (HS-ESS1-3)</li> <li>The Big Bang theory is supported by observations of distant galaxies receding from our own, of the measured composition of stars and non-stellar gases, and of the maps of spectra of the primordial radiation (cosmic microwave background) that still fills the universe. (HS-ESS1-2)</li> <li>Other than the hydrogen and helium formed at the time of the Big Bang, nuclear fusion within stars produces all atomic nuclei lighter than and including iron, and the process releases electromagnetic energy. Heavier elements are produced when certain massive stars achieve a supernova stage and explode. (HS-ESS1-2), (HS-ESS1-3)</li> </ul> <p><b><u>ESS1.B: Earth and the Solar System</u></b></p> <ul style="list-style-type: none"> <li>Kepler's laws describe common features of the motions of orbiting objects, including their elliptical paths around the sun. Orbits may change due to the gravitational effects from, or collisions with, other objects in the solar system. (HS-ESS1-4)</li> </ul> <p><b><u>PS3.D: Energy in Chemical Processes and Everyday Life</u></b></p> <ul style="list-style-type: none"> <li>Nuclear Fusion processes in the center of the sun release the energy that ultimately reaches Earth as radiation. (secondary to HS-ESS1-1)</li> </ul> <p><b><u>PS4.B: Electromagnetic Radiation</u></b></p> <ul style="list-style-type: none"> <li>Atoms of each element emit and absorb characteristic frequencies of light. These characteristics allow identification of the presence of an element, even in microscopic quantities. (secondary to HS-ESS1-2)</li> </ul>	<p><b><u>Scale, Proportion, and Quantity</u></b></p> <ul style="list-style-type: none"> <li>The significance of a phenomenon is dependent on the scale, proportion, and quantity at which it occurs. (HS-ESS1-1)</li> <li>Algebraic thinking is used to examine scientific data and predict the effect of a change in one variable on another (e.g., linear growth vs. exponential growth). (HS-ESS1-4)</li> </ul> <p><b><u>Energy and Matter</u></b></p> <ul style="list-style-type: none"> <li>Energy cannot be created or destroyed—only moved between one place and another place, between objects and/or fields, or between systems. (HS-ESS1-2)</li> <li>In nuclear processes, atoms are not conserved, but the total number of protons plus neutrons is conserved. (HS-ESS1-3)</li> </ul> <p style="text-align: center;">-----</p> <p style="text-align: center;"><i>Connections to Engineering, Technology, and Applications of Science</i></p> <p style="text-align: center;">-----</p> <p><b><u>Interdependence of Science, Engineering, and Technology</u></b></p> <ul style="list-style-type: none"> <li>Science and engineering complement each other in the cycle known as research and development (R&amp;D). Many R&amp;D projects may involve scientists, engineers, and others with wide ranges of expertise. (HS-ESS1-2), (HS-ESS1-4)</li> </ul> <p style="text-align: center;">-----</p> <p style="text-align: center;"><i>Connections to Nature of Science</i></p> <p style="text-align: center;">-----</p> <p><b><u>Scientific Knowledge Assumes an Order and Consistency in Natural Systems</u></b></p> <ul style="list-style-type: none"> <li>Scientific knowledge is based on the assumption that natural laws operate today as they did in the past and they will continue to do so in the future. (HS-ESS1-2)</li> <li>Science assumes the universe is a vast single system in which basic laws are consistent. (HS-ESS1-2)</li> </ul>

# EARTH AND SPACE SCIENCE

<p style="text-align: center;"><i>Connections to Nature of Science</i></p> <p><b>Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena</b></p> <ul style="list-style-type: none"> <li>A scientific theory is a substantiated explanation of some aspect of the natural world, based on a body of facts that have been repeatedly confirmed through observation and experiment and the science community validates each theory before it is accepted. If new evidence is discovered that the theory does not accommodate, the theory is generally modified in light of this new evidence. (HS-ESS1-2)</li> </ul>		
<p><i>Connections to other DCIs in this grade-band:</i>  <b>HS.PS1.A</b> (HS-ESS1-2),(HS-ESS1-3); <b>HS.PS1.C</b> (HS-ESS1-1),(HS-ESS1-2),(HS-ESS1-3); <b>HS.PS2.B</b> (HS-ESS1-4); <b>HS.PS3.A</b> (HS-ESS1-1),(HS-ESS1-2); <b>HS.PS3.B</b> (HS-ESS1-2); <b>HS.PS4.A</b> (HS-ESS1-2)</p>		
<p><i>Articulation of DCIs across grade-bands:</i>  <b>MS.PS1.A</b> (HS-ESS1-1),(HS-ESS1-2),(HS-ESS1-3); <b>MS.PS2.A</b> (HS-ESS1-4); <b>MS.PS2.B</b> (HS-ESS1-4); <b>MS.PS4.B</b> (HS-ESS1-1),(HS-ESS1-2); <b>MS.ESS1.A</b> (HS-ESS1-1),(HS-ESS1-2),(HS-ESS1-3),(HS-ESS1-4); <b>MS.ESS1.B</b> (HS-ESS1-4); <b>MS.ESS2.A</b> (HS-ESS1-1); <b>MS.ESS2.D</b> (HS-ESS1-1)</p>		
<p><i>Common Core State Standards Connections:</i></p> <p><i>ELA/Literacy -</i></p> <p><b>RST.11-12.1</b> Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. (HS-ESS1-1),(HS-ESS1-2)</p> <p><b>WHST.9-12.2</b> Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. (HS-ESS1-2),(HS-ESS1-3)</p> <p><b>SL.11-12.4</b> Present claims and findings, emphasizing salient points in a focused, coherent manner with relevant evidence, sound valid reasoning, and well-chosen details; use appropriate eye contact, adequate volume, and clear pronunciation. (HS-ESS1-3)</p> <p><i>Mathematics -</i></p> <p><b>MP.2</b> Reason abstractly and quantitatively. (HS-ESS1-1),(HS-ESS1-2),(HS-ESS1-3),(HS-ESS1-4)</p> <p><b>MP.4</b> Model with mathematics. (HS-ESS1-1),(HS-ESS1-4)</p> <p><b>HSN-Q.A.1</b> Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. (HS-ESS1-1),(HS-ESS1-2),(HS-ESS1-4)</p> <p><b>HSN-Q.A.2</b> Define appropriate quantities for the purpose of descriptive modeling. (HS-ESS1-1),(HS-ESS1-2),(HS-ESS1-4)</p> <p><b>HSN-Q.A.3</b> Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (HS-ESS1-1),(HS-ESS1-2),(HS-ESS1-4)</p> <p><b>HSA-SSE.A.1</b> Interpret expressions that represent a quantity in terms of its context. (HS-ESS1-1),(HS-ESS1-2),(HS-ESS1-4)</p> <p><b>HSA-CED.A.2</b> Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. (HS-ESS1-1),(HS-ESS1-2),(HS-ESS1-4)</p> <p><b>HSA-CED.A.4</b> Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. (HS-ESS1-1),(HS-ESS1-2),(HS-ESS1-4)</p>		

\* The performance expectations marked with an asterisk integrate traditional science content with engineering through a Practice or Disciplinary Core Idea.

The section entitled "Disciplinary Core Ideas" is reproduced from *A Framework for K-12 Science Education: Practices, Cross-Cutting Concepts, and Core Ideas*. Integrated and reprinted with permission from the National Academy of Sciences.

## History of Earth (Earth's Systems)

Students will:

AL.ESS.6 - Obtain and evaluate information about Copernicus, Galileo, Kepler, Newton, and Einstein to communicate how their findings challenged conventional thinking and allowed for academic advancements and space exploration.

AL.ESS.7 - Analyze and interpret evidence regarding the theory of plate tectonics, including geologic activity along plate boundaries and magnetic patterns in undersea rocks, to explain the ages and movements of continental and oceanic crusts.

AL.ESS.8 - Develop a time scale model of Earth's biological and geological history to establish relative and absolute age of major events in Earth's history (e.g., radiometric dating, models of geologic cross sections, sedimentary layering, fossilization, early life forms, folding, faulting, igneous intrusions).

Students who demonstrate understanding can:

- HS-ESS1-5** Evaluate evidence of the past and current movements of continental and oceanic crust and the theory of plate tectonics to explain the ages of crustal rocks. [Clarification Statement: Emphasis is on the ability of plate tectonics to explain the ages of crustal rocks. Examples include evidence of the ages of oceanic crust increasing with distance from mid-ocean ridges (a result of plate spreading) and the ages of North American continental crust increasing with distance away from a central ancient core (a result of past plate interactions).]
- HS-ESS1-6** Apply scientific reasoning and evidence from ancient Earth materials, meteorites, and other planetary surfaces to construct an account of Earth's formation and early history. [Clarification Statement: Emphasis is on using available evidence within the solar system to reconstruct the early history of Earth, which formed along with the rest of the solar system 4.6 billion years ago. Examples of evidence include the absolute ages of ancient materials (obtained by radiometric dating of meteorites, moon rocks, and Earth's oldest minerals), the sizes and compositions of solar system objects, and the impact cratering record of planetary surfaces.]
- HS-ESS2-1** Develop a model to illustrate how Earth's internal and surface processes operate at different spatial and temporal scales to form continental and ocean-floor features. [Clarification Statement: Emphasis is on how the appearance of land features (such as mountains, valleys, and plateaus) and sea-floor features (such as trenches, ridges, and seamounts) are a result of both constructive forces (such as volcanism, tectonic uplift, and orogeny) and destructive mechanisms (such as weathering, mass wasting, and coastal erosion).] [Assessment Boundary: Assessment does not include memorization of the details of the formation of specific geographic features of Earth's surface.]

## History of Earth (Earth's Systems)

The performance expectations were developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
<p><b><u>Developing and Using Models</u></b></p> <p><u>Modeling in 9–12 builds on K–8 experiences and progresses to using, synthesizing, and developing models to predict and show relationships among variables between systems and their components in the natural and designed world(s).</u></p> <ul style="list-style-type: none"> <li>Develop a model based on evidence to illustrate the relationships between systems or between components of a system. (HS-ESS2-1)</li> </ul> <p><b><u>Constructing Explanations and Designing Solutions</u></b></p> <p><u>Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories.</u></p> <ul style="list-style-type: none"> <li>Apply scientific reasoning to link evidence to the claims to assess the extent to which the reasoning and data support the explanation or conclusion. (HS-ESS1-6)</li> </ul> <p><b><u>Engaging in Argument from Evidence</u></b></p> <p><u>Engaging in argument from evidence in 9–12 builds on K–8 experiences and progresses to using appropriate and sufficient evidence and scientific reasoning to defend and critique claims and explanations about the natural and designed world(s). Arguments may also come from current scientific or historical episodes in science.</u></p> <ul style="list-style-type: none"> <li>Evaluate evidence behind currently accepted explanations or solutions to determine the merits of arguments. (HS-ESS1-5)</li> </ul> <p>-----</p> <p style="text-align: center;"><i>Connections to Nature of Science</i></p> <p><b><u>Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena</u></b></p> <ul style="list-style-type: none"> <li>A scientific theory is a substantiated explanation of some aspect of the natural world, based on a body of facts that have been repeatedly confirmed through observation and experiment and the science community validates each theory before it is accepted. If new evidence is discovered that the theory does not accommodate, the theory is generally modified in light of this new evidence. (HS-ESS1-6)</li> <li>Models, mechanisms, and explanations collectively serve as tools in the development of a scientific theory. (HS-ESS1-6)</li> </ul>	<p><b><u>ESS1.C: The History of Planet Earth</u></b></p> <ul style="list-style-type: none"> <li>Continental rocks, which can be older than 4 billion years, are generally much older than the rocks of the ocean floor, which are less than 200 million years old. (HS-ESS1-5)</li> <li>Although active geologic processes, such as plate tectonics and erosion, have destroyed or altered most of the very early rock record on Earth, other objects in the solar system, such as lunar rocks, asteroids, and meteorites, have changed little over billions of years. Studying these objects can provide information about Earth's formation and early history. (HS-ESS1-6)</li> </ul> <p><b><u>ESS2.A: Earth Materials and Systems</u></b></p> <ul style="list-style-type: none"> <li>Earth's systems, being dynamic and interacting, cause feedback effects that can increase or decrease the original changes. (HS-ESS2-1), (Note: This Disciplinary Core Idea is also addressed by HS-ESS2-2.)</li> </ul> <p><b><u>ESS2.B: Plate Tectonics and Large-Scale System Interactions</u></b></p> <ul style="list-style-type: none"> <li>Plate tectonics is the unifying theory that explains the past and current movements of the rocks at Earth's surface and provides a framework for understanding its geologic history. (ESS2.B Grade 8 GBE) (secondary to HS-ESS1-5), (HS-ESS2-1)</li> <li>Plate movements are responsible for most continental and ocean-floor features and for the distribution of most rocks and minerals within Earth's crust. (ESS2.B Grade 8 GBE) (HS-ESS2-1)</li> </ul> <p><b><u>PS1.C: Nuclear Processes</u></b></p> <ul style="list-style-type: none"> <li>Spontaneous radioactive decays follow a characteristic exponential decay law. Nuclear lifetimes allow radiometric dating to be used to determine the ages of rocks and other materials. (secondary to HS-ESS1-5), (secondary to HS-ESS1-6)</li> </ul>	<p><b><u>Patterns</u></b></p> <ul style="list-style-type: none"> <li>Empirical evidence is needed to identify patterns. (HS-ESS1-5)</li> </ul> <p><b><u>Stability and Change</u></b></p> <ul style="list-style-type: none"> <li>Much of science deals with constructing explanations of how things change and how they remain stable. (HS-ESS1-6)</li> <li>Change and rates of change can be quantified and modeled over very short or very long periods of time. Some system changes are irreversible. (HS-ESS2-1)</li> </ul>

## History of Earth (Earth's Systems)

<i>Connections to other DCIs in this grade-band:</i>	
<b>HS.PS2.A</b> (HS-ESS1-6); <b>HS.PS2.B</b> (HS-ESS1-6),(HS-ESS2-1); <b>HS.PS3.B</b> (HS-ESS1-5); <b>HS.ESS2.A</b> (HS-ESS1-5)	
<i>Articulation of DCIs across grade-bands:</i>	
<b>MS.PS2.B</b> (HS-ESS1-6),(HS-ESS2-1); <b>MS.LS2.B</b> (HS-ESS2-1); <b>MS.ESS1.B</b> (HS-ESS1-6); <b>MS.ESS1.C</b> (HS-ESS1-5),(HS-ESS1-6),(HS-ESS2-1); <b>MS.ESS2.A</b> (HS-ESS1-5),(HS-ESS1-6),(HS-ESS2-1); <b>MS.ESS2.B</b> (HS-ESS1-5),(HS-ESS1-6),(HS-ESS2-1); <b>MS.ESS2.C</b> (HS-ESS2-1); <b>MS.ESS2.D</b> (HS-ESS1-1)	
<i>Common Core State Standards Connections:</i>	
<i>ELA/Literacy -</i>	
<b>RST.11-12.1</b>	Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. (HS-ESS1-5),(HS-ESS1-6)
<b>RST.11-12.8</b>	Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. (HS-ESS1-5),(HS-ESS1-6)
<b>WHST.9-12.1</b>	Write arguments focused on discipline-specific content. (HS-ESS1-6)
<b>WHST.9-12.2</b>	Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. (HS-ESS1-2),(HS-ESS1-5)
<b>SL.11-12.5</b>	Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest. (HS-ESS2-1)
<i>Mathematics -</i>	
<b>MP.2</b>	Reason abstractly and quantitatively. (HS-ESS1-5),(HS-ESS1-6),(HS-ESS2-1)
<b>MP.4</b>	Model with mathematics. (HS-ESS2-1)
<b>HSN-Q.A.1</b>	Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. (HS-ESS1-5),(HS-ESS1-6),(HS-ESS2-1)
<b>HSN-Q.A.2</b>	Define appropriate quantities for the purpose of descriptive modeling. (HS-ESS1-5),(HS-ESS1-6),(HS-ESS2-1)
<b>HSN-Q.A.3</b>	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (HS-ESS1-5),(HS-ESS1-6),(HS-ESS2-1)
<b>HSF-IF.B.5</b>	Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. (HS-ESS1-6)
<b>HSS-ID.B.6</b>	Represent data on two quantitative variables on a scatter plot, and describe how those variables are related. (HS-ESS1-6)

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## Earth's Systems

### (Earth's Systems)

Students will:

AL.ESS.9 - Obtain, evaluate, and communicate information to explain how constructive and destructive processes (e.g., weathering, erosion, volcanism, orogeny, plate tectonics, tectonic uplift) shape Earth's land features (e.g., mountains, valleys, plateaus) and sea features (e.g., trenches, ridges, seamounts).

AL.ESS.10 - Construct an explanation from evidence for the processes that generate the transformation of rocks in Earth's crust, including chemical composition of minerals and characteristics of sedimentary, igneous, and metamorphic rocks.

AL.ESS.11 - Obtain and communicate information about significant geologic characteristics (e.g., types of rocks and geologic ages, earthquake zones, sinkholes, caves, abundant fossil fauna, mineral and energy resources) that impact life in Alabama and the southeastern United States.

AL.ESS.12 - Develop a model of Earth's layers using available evidence to explain the role of thermal convection in the movement of Earth's materials (e.g., seismic waves, movement of tectonic plates).

AL.ESS.13 - Analyze and interpret data of interactions between the hydrologic and rock cycles to explain the mechanical impacts (e.g., stream transportation and deposition, erosion, frost-wedging) and chemical impacts (e.g., oxidation, hydrolysis, carbonation) of Earth materials by water's properties.

AL.ESS.14 - Construct explanations from evidence to describe how changes in the flow of energy through Earth's systems (e.g., volcanic eruptions, solar output, ocean circulation, surface temperatures, precipitation patterns, glacial ice volumes, sea levels, Coriolis effect) impact the climate.

## Earth's Systems

### (Earth's Systems)

Students who demonstrate understanding can:

- HS-ESS2-2** Analyze geoscience data to make the claim that one change to Earth's surface can create feedbacks that cause changes to other Earth systems. [Clarification Statement: Examples should include climate feedbacks, such as how an increase in greenhouse gases causes a rise in global temperatures that melts glacial ice, which reduces the amount of sunlight reflected from Earth's surface, increasing surface temperatures and further reducing the amount of ice. Examples could also be taken from other system interactions, such as how the loss of ground vegetation causes an increase in water runoff and soil erosion; how dammed rivers increase groundwater recharge, decrease sediment transport, and increase coastal erosion; or how the loss of wetlands causes a decrease in local humidity that further reduces the wetland extent.]
- HS-ESS2-3** Develop a model based on evidence of Earth's interior to describe the cycling of matter by thermal convection.[Clarification Statement: Emphasis is on both a one-dimensional model of Earth, with radial layers determined by density, and a three-dimensional model, which is controlled by mantle convection and the resulting plate tectonics. Examples of evidence include maps of Earth's three-dimensional structure obtained from seismic waves, records of the rate of change of Earth's magnetic field (as constraints on convection in the outer core), and identification of the composition of Earth's layers from high-pressure laboratory experiments.]
- HS-ESS2-5** Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.[Clarification Statement: Emphasis is on mechanical and chemical investigations with water and a variety of solid materials to provide the evidence for connections between the hydrologic cycle and system interactions commonly known as the rock cycle. Examples of mechanical investigations include stream transportation and deposition using a stream table, erosion using variations in soil moisture content, or frost wedging by the expansion of water as it freezes. Examples of chemical investigations include chemical weathering and recrystallization (by testing the solubility of different materials) or melt generation (by examining how water lowers the melting temperature of most solids).]
- HS-ESS2-6** Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere. [Clarification Statement: Emphasis is on modeling biogeochemical cycles that include the cycling of carbon through the ocean, atmosphere, soil, and biosphere (including humans), providing the foundation for living organisms.]
- HS-ESS2-7** Construct an argument based on evidence about the simultaneous coevolution of Earth's systems and life on Earth.[Clarification Statement: Emphasis is on the dynamic causes, effects, and feedbacks between the biosphere and Earth's other systems, whereby geoscience factors control the evolution of life, which in turn continuously alters Earth's surface. Examples of include how photosynthetic life altered the atmosphere through the production of oxygen, which in turn increased weathering rates and allowed for the evolution of animal life; how microbial life on land increased the formation of soil, which in turn allowed for the evolution of land plants; or how the evolution of corals created reefs that altered patterns of erosion and deposition along coastlines and provided habitats for the evolution of new life forms.] [Assessment Boundary: Assessment does not include a comprehensive understanding of the mechanisms of how the biosphere interacts with all of Earth's other systems.]

## Earth's Systems (Earth's Systems)

The performance expectations were developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
<p><b><u>Developing and Using Models</u></b> Modeling in 9–12 builds on K–8 experiences and progresses to using, synthesizing, and developing models to predict and show relationships among variables between systems and their components in the natural and designed world(s).</p> <ul style="list-style-type: none"> <li>Develop a model based on evidence to illustrate the relationships between systems or between components of a system. (HS-ESS2-3), (HS-ESS2-6)</li> </ul> <p><b><u>Planning and Carrying Out Investigations</u></b> Planning and carrying out investigations in 9–12 builds on K–8 experiences and progresses to include investigations that provide evidence for and test conceptual, mathematical, physical, and empirical models.</p> <ul style="list-style-type: none"> <li>Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly. (HS-ESS2-5)</li> </ul> <p><b><u>Analyzing and Interpreting Data</u></b> Analyzing data in 9–12 builds on K–8 experiences and progresses to introducing more detailed statistical analysis, the comparison of data sets for consistency, and the use of models to generate and analyze data.</p> <ul style="list-style-type: none"> <li>Analyze data using tools, technologies, and/or models (e.g., computational, mathematical) in order to make valid and reliable scientific claims or determine an optimal design solution. (HS-ESS2-2)</li> </ul> <p><b><u>Engaging in Argument from Evidence</u></b> Engaging in argument from evidence in 9–12 builds on K–8 experiences and progresses to using appropriate and sufficient evidence and scientific reasoning to defend and critique claims and explanations about the natural and designed world(s). Arguments may also come from current scientific or historical episodes in science.</p> <ul style="list-style-type: none"> <li>Construct an oral and written argument or counter-arguments based on data and evidence. (HS-ESS2-7)</li> </ul> <hr/> <p style="text-align: center;"><i>Connections to Nature of Science</i></p> <p><b><u>Scientific Knowledge is Based on Empirical Evidence</u></b></p> <ul style="list-style-type: none"> <li>Science knowledge is based on empirical evidence. (HS-ESS2-3)</li> </ul>	<p><b><u>ESS2.A: Earth Materials and Systems</u></b></p> <ul style="list-style-type: none"> <li>Earth's systems, being dynamic and interacting, cause feedback effects that can increase or decrease the original changes. (HS-ESS2-2)</li> <li>Evidence from deep probes and seismic waves, reconstructions of historical changes in Earth's surface and its magnetic field, and an understanding of physical and chemical processes lead to a model of Earth with a hot but solid inner core, a liquid outer core, a solid mantle and crust. Motions of the mantle and its plates occur primarily through thermal convection, which involves the cycling of matter due to the outward flow of energy from Earth's interior and gravitational movement of denser materials toward the interior. (HS-ESS2-3)</li> </ul> <p><b><u>ESS2.B: Plate Tectonics and Large-Scale System Interactions</u></b></p> <ul style="list-style-type: none"> <li>The radioactive decay of unstable isotopes continually generates new energy within Earth's crust and mantle, providing the primary source of the heat that drives mantle convection. Plate tectonics can be viewed as the surface expression of mantle convection. (HS-ESS2-3)</li> </ul> <p><b><u>ESS2.C: The Roles of Water in Earth's Surface Processes</u></b></p> <ul style="list-style-type: none"> <li>The abundance of liquid water on Earth's surface and its unique combination of physical and chemical properties are central to the planet's dynamics. These properties include water's exceptional capacity to absorb, store, and release large amounts of energy, transmit sunlight, expand upon freezing, dissolve and transport materials, and lower the viscosities and melting points of rocks. (HS-ESS2-5)</li> </ul> <p><b><u>ESS2.D: Weather and Climate</u></b></p> <ul style="list-style-type: none"> <li>The foundation for Earth's global climate systems is the electromagnetic radiation from the sun, as well as its reflection, absorption, storage, and redistribution among the atmosphere, ocean, and land systems, and this energy's re-radiation into space. (HS-ESS2-2)</li> <li>Gradual atmospheric changes were due to plants and other organisms that captured carbon dioxide and released oxygen. (HS-ESS2-6), (HS-ESS2-7)</li> </ul> <p><b><u>ESS2.E Biogeology</u></b></p> <ul style="list-style-type: none"> <li>The many dynamic and delicate feedbacks between the biosphere and other Earth systems cause a continual co-evolution of Earth's surface and the life that exists on it. (HS-ESS2-7)</li> </ul>	<p><b><u>Energy and Matter</u></b></p> <ul style="list-style-type: none"> <li>The total amount of energy and matter in closed systems is conserved. (HS-ESS2-6)</li> <li>Energy drives the cycling of matter within and between systems. (HS-ESS2-3)</li> </ul> <p><b><u>Structure and Function</u></b></p> <ul style="list-style-type: none"> <li>The functions and properties of natural and designed objects and systems can be inferred from their overall structure, the way their components are shaped and used, and the molecular substructures of its various materials. (HS-ESS2-5)</li> </ul> <p><b><u>Stability and Change</u></b></p> <ul style="list-style-type: none"> <li>Much of science deals with constructing explanations of how things change and how they remain stable. (HS-ESS2-7)</li> <li>Feedback (negative or positive) can stabilize or destabilize a system. (HS-ESS2-2)</li> </ul> <hr/> <p style="text-align: center;"><i>Connections to Engineering, Technology, and Applications of Science</i></p> <p><b><u>Interdependence of Science, Engineering, and Technology</u></b></p> <ul style="list-style-type: none"> <li>Science and engineering complement each other in the cycle known as research and development (R&amp;D). Many R&amp;D projects may involve scientists, engineers, and others with wide ranges of expertise. (HS-ESS2-3)</li> </ul> <p><b><u>Influence of Engineering, Technology, and Science on Society and the Natural World</u></b></p> <ul style="list-style-type: none"> <li>New technologies can have deep impacts on society and the environment, including some that were not anticipated. Analysis of costs and benefits is a critical aspect of decisions about technology. (HS-ESS2-2)</li> </ul>

# EARTH AND SPACE SCIENCE

<ul style="list-style-type: none"> <li>• <u>Science disciplines share common rules of evidence used to evaluate explanations about natural systems.</u> (HS-ESS2-3)</li> <li>• <u>Science includes the process of coordinating patterns of evidence with current theory.</u> (HS-ESS2-3)</li> </ul>		
<p><i>Connections to other DCIs in this grade-band:</i>  <b><u>HS.PS1.A</u></b> (HS-ESS2-5),(HS-ESS2-6); <b><u>HS.PS1.B</u></b> (HS-ESS2-5),(HS-ESS2-6); <b><u>HS.PS2.B</u></b> (HS-ESS2-3); <b><u>HS.PS3.B</u></b> (HS-ESS2-2),(HS-ESS2-3),(HS-ESS2-5); <b><u>HS.PS3.D</u></b> (HS-ESS2-3),(HS-ESS2-6); <b><u>HS.PS4.B</u></b> (HS-ESS2-2); <b><u>HS.LS1.C</u></b> (HS-ESS2-6); <b><u>HS.LS2.A</u></b> (HS-ESS2-7); <b><u>HS.LS2.B</u></b> (HS-ESS2-2),(HS-ESS2-6); <b><u>HS.LS2.C</u></b> (HS-ESS2-2),(HS-ESS2-7); <b><u>HS.LS4.A</u></b> (HS-ESS2-7); <b><u>HS.LS4.B</u></b> (HS-ESS2-7); (HS-ESS2-7); <b><u>HS.LS4.C</u></b> (HS-ESS2-7); <b><u>HS.LS4.D</u></b> (HS-ESS2-2),(HS-ESS2-7); <b><u>HS.ESS3.C</u></b> (HS-ESS2-2),(HS-ESS2-5),(HS-ESS2-6); <b><u>HS.ESS3.D</u></b> (HS-ESS2-2),(HS-ESS2-6)</p>		
<p><i>Articulation of DCIs across grade-bands:</i>  <b><u>MS.PS1.A</u></b> (HS-ESS2-3),(HS-ESS2-5),(HS-ESS2-6); <b><u>MS.PS1.B</u></b> (HS-ESS2-3); <b><u>MS.PS2.B</u></b> (HS-ESS2-3); <b><u>MS.PS3.A</u></b> (HS-ESS2-3); <b><u>MS.PS3.B</u></b> (HS-ESS2-3); <b><u>MS.PS3.D</u></b> (HS-ESS2-2),(HS-ESS2-6); <b><u>MS.PS4.B</u></b> (HS-ESS2-2),(HS-ESS2-5),(HS-ESS2-6); <b><u>MS.LS2.A</u></b> (HS-ESS2-7); <b><u>MS.LS2.B</u></b> (HS-ESS2-2),(HS-ESS2-6); <b><u>MS.LS2.C</u></b> (HS-ESS2-2),(HS-ESS2-7); <b><u>MS.LS4.A</u></b> (HS-ESS2-7); <b><u>MS.LS4.B</u></b> (HS-ESS2-7); <b><u>MS.LS4.C</u></b> (HS-ESS2-2),(HS-ESS2-7); <b><u>MS.ESS1.C</u></b> (HS-ESS2-7); <b><u>MS.ESS2.A</u></b> (HS-ESS2-2),(HS-ESS2-3),(HS-ESS2-5),(HS-ESS2-6),(HS-ESS2-7); <b><u>MS.ESS2.B</u></b> (HS-ESS2-2),(HS-ESS2-3),(HS-ESS2-6); <b><u>MS.ESS2.C</u></b> (HS-ESS2-2),(HS-ESS2-5),(HS-ESS2-6),(HS-ESS2-7); <b><u>MS.ESS2.D</u></b> (HS-ESS2-2),(HS-ESS2-5); <b><u>MS.ESS3.C</u></b> (HS-ESS2-2),(HS-ESS2-6),(HS-ESS2-7); <b><u>MS.ESS3.D</u></b> (HS-ESS2-2),(HS-ESS2-6)</p>		
<p><i>Common Core State Standards Connections:</i>  <i>ELA/Literacy -</i>  <b><u>RST.11-12.1</u></b> <u>Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.</u> (HS-ESS2-2),(HS-ESS2-3)  <b><u>RST.11-12.2</u></b> <u>Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.</u> (HS-ESS2-2)  <b><u>WHST.9-12.1</u></b> <u>Write arguments focused on discipline-specific content.</u> (HS-ESS2-7)  <b><u>WHST.9-12.7</u></b> <u>Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.</u> (HS-ESS2-5)  <b><u>SL.11-12.5</u></b> <u>Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest.</u> (HS-ESS2-3)  <i>Mathematics -</i>  <b><u>MP.2</u></b> <u>Reason abstractly and quantitatively.</u> (HS-ESS2-2),(HS-ESS2-3),(HS-ESS2-6)  <b><u>MP.4</u></b> <u>Model with mathematics.</u> (HS-ESS2-3),(HS-ESS2-6)  <b><u>HSN.Q.A.1</u></b> <u>Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.</u> (HS-ESS2-2),(HS-ESS2-3),(HS-ESS2-6)  <b><u>HSN.Q.A.2</u></b> <u>Define appropriate quantities for the purpose of descriptive modeling.</u> (HS-ESS2-3),(HS-ESS2-6)  <b><u>HSN.Q.A.3</u></b> <u>Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.</u> (HS-ESS2-2),(HS-ESS2-3),(HS-ESS2-5),(HS-ESS2-6)</p>		

\* The performance expectations marked with an asterisk integrate traditional science content with engineering through a Practice or Disciplinary Core Idea.

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## Weather and Climate (Earth's Systems)

Students will:

AL.ESS.15 - Obtain, evaluate, and communicate information to verify that weather (e.g., temperature, relative humidity, air pressure, dew point, adiabatic cooling, condensation, precipitation, winds, ocean currents, barometric pressure, wind velocity) is influenced by energy transfer within and among the atmosphere, lithosphere, biosphere, and hydrosphere.

- a. Analyze patterns in weather data to predict various systems, including fronts and severe storms.
- b. Use maps and other visualizations to analyze large data sets that illustrate the frequency, magnitude, and resulting damage from severe weather events in order to predict the likelihood and severity of future events.

Students who demonstrate understanding can:

**HS-ESS2-4** Use a model to describe how variations in the flow of energy into and out of Earth's systems result in changes in climate. *[Clarification Statement: Examples of the causes of climate change differ by timescale, over 1-10 years: large volcanic eruption, ocean circulation; 10-100s of years: changes in human activity, ocean circulation, solar output; 10-100s of thousands of years: changes to Earth's orbit and the orientation of its axis; and 10-100s of millions of years: long-term changes in atmospheric composition.] [Assessment Boundary: Assessment of the results of changes in climate is limited to changes in surface temperatures, precipitation patterns, glacial ice volumes, sea levels, and biosphere distribution.]*

**HS-ESS3-5** Analyze geoscience data and the results from global climate models to make an evidence-based forecast of the current rate of global or regional climate change and associated future impacts to Earth systems. *[Clarification Statement: Examples of evidence, for both data and climate model outputs, are for climate changes (such as precipitation and temperature) and their associated impacts (such as on sea level, glacial ice volumes, or atmosphere and ocean composition).] [Assessment Boundary: Assessment is limited to one example of a climate change and its associated impacts.]*

## Weather and Climate (Earth's Systems)

The performance expectations were developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
<p><b><u>Developing and Using Models</u></b></p> <p>Modeling in 9–12 builds on K–8 experiences and progresses to using, synthesizing, and developing models to predict and show relationships among variables between systems and their components in the natural and designed world(s).</p> <ul style="list-style-type: none"> <li>Use a model to provide mechanistic accounts of phenomena. (HS-ESS2-4)</li> </ul> <p><b><u>Analyzing and Interpreting Data</u></b></p> <p>Analyzing data in 9–12 builds on K–8 experiences and progresses to introducing more detailed statistical analysis, the comparison of data sets for consistency, and the use of models to generate and analyze data.</p> <ul style="list-style-type: none"> <li>Analyze data using computational models in order to make valid and reliable scientific claims. (HS-ESS3-5)</li> </ul> <p>-----</p> <p style="text-align: center;"><i>Connections to Nature of Science</i></p> <p><b><u>Scientific Investigations Use a Variety of Methods</u></b></p> <ul style="list-style-type: none"> <li>Science investigations use diverse methods and do not always use the same set of procedures to obtain data. (HS-ESS3-5)</li> <li>New technologies advance scientific knowledge. (HS-ESS3-5)</li> </ul> <p><b><u>Scientific Knowledge is Based on Empirical Evidence</u></b></p> <ul style="list-style-type: none"> <li>Science knowledge is based on empirical evidence. (HS-ESS3-5)</li> <li>Science arguments are strengthened by multiple lines of evidence supporting a single explanation. (HS-ESS2-4),(HS-ESS3-5)</li> </ul>	<p><b><u>ESS1.B: Earth and the Solar System</u></b></p> <ul style="list-style-type: none"> <li>Cyclical changes in the shape of Earth's orbit around the sun, together with changes in the tilt of the planet's axis of rotation, both occurring over hundreds of thousands of years, have altered the intensity and distribution of sunlight falling on the earth. These phenomena cause a cycle of ice ages and other gradual climate changes. (secondary to HS-ESS2-4)</li> </ul> <p><b><u>ESS2.A: Earth Materials and Systems</u></b></p> <ul style="list-style-type: none"> <li>The geological record shows that changes to global and regional climate can be caused by interactions among changes in the sun's energy output or Earth's orbit, tectonic events, ocean circulation, volcanic activity, glaciers, vegetation, and human activities. These changes can occur on a variety of time scales from sudden (e.g., volcanic ash clouds) to intermediate (ice ages) to very long-term tectonic cycles. (HS-ESS2-4)</li> </ul> <p><b><u>ESS2.D: Weather and Climate</u></b></p> <ul style="list-style-type: none"> <li>The foundation for Earth's global climate systems is the electromagnetic radiation from the sun, as well as its reflection, absorption, storage, and redistribution among the atmosphere, ocean, and land systems, and this energy's re-radiation into space. (HS-ESS2-4)</li> <li>Changes in the atmosphere due to human activity have increased carbon dioxide concentrations and thus affect climate. (HS-ESS2-6),(HS-ESS2-4)</li> </ul> <p><b><u>ESS3.D: Global Climate</u></b></p> <ul style="list-style-type: none"> <li>Though the magnitudes of human impacts are greater than they have ever been, so too are human abilities to model, predict, and manage current and future impacts. (HS-ESS3-5)</li> </ul>	<p><b><u>Cause and Effect</u></b></p> <ul style="list-style-type: none"> <li>Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. (HS-ESS2-4)</li> </ul> <p><b><u>Stability and Change</u></b></p> <ul style="list-style-type: none"> <li>Change and rates of change can be quantified and modeled over very short or very long periods of time. Some system changes are irreversible. (HS-ESS3-5)</li> </ul>

## Weather and Climate

### (Earth's Systems)

<i>Connections to other DCIs in this grade-band:</i>	
<b><u>HS.PS3.A</u></b> (HS-ESS2-4); <b><u>HS.PS3.B</u></b> (HS-ESS2-4),(HS-ESS3-5); <b><u>HS.PS3.D</u></b> (HS-ESS3-5); <b><u>HS.LS1.C</u></b> (HS-ESS3-5); <b><u>HS.LS2.C</u></b> (HS-ESS2-4); <b><u>HS.ESS1.C</u></b> (HS-ESS2-4); <b><u>HS.ESS2.D</u></b> (HS-ESS3-5); <b><u>HS.ESS3.C</u></b> (HS-ESS2-4); <b><u>HS.ESS3.D</u></b> (HS-ESS2-4)	
<i>Articulation of DCIs across grade-bands:</i>	
<b><u>MS.PS3.A</u></b> (HS-ESS2-4); <b><u>MS.PS3.B</u></b> (HS-ESS2-4),(HS-ESS3-5); <b><u>MS.PS3.D</u></b> (HS-ESS2-4),(HS-ESS3-5); <b><u>MS.PS4.B</u></b> (HS-ESS2-4); <b><u>MS.LS1.C</u></b> (HS-ESS2-4); <b><u>MS.LS2.B</u></b> (HS-ESS2-4); <b><u>MS.LS2.C</u></b> (HS-ESS2-4); <b><u>MS.ESS2.A</u></b> (HS-ESS2-4),(MS-ESS3-5); <b><u>MS.ESS2.B</u></b> (HS-ESS2-4); <b><u>MS.ESS2.C</u></b> (HS-ESS2-4); <b><u>MS.ESS2.D</u></b> (HS-ESS2-4),(HS-ESS3-5); <b><u>MS.ESS3.B</u></b> (HS-ESS3-5); <b><u>MS.ESS3.C</u></b> (HS-ESS2-4),(HS-ESS3-5); <b><u>MS.ESS3.D</u></b> (HS-ESS2-4),(HS-ESS3-5)	
<i>Common Core State Standards Connections:</i>	
<i>ELA/Literacy -</i>	
<b><u>RST.11-12.1</u></b>	Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. (HS-ESS3-5)
<b><u>RST.11-12.2</u></b>	Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms. (HS-ESS3-5)
<b><u>RST.11-12.7</u></b>	Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem. (HS-ESS3-5)
<b><u>SL.11-12.5</u></b>	Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest. (HS-ESS2-4)
<i>Mathematics -</i>	
<b><u>MP.2</u></b>	Reason abstractly and quantitatively. (HS-ESS2-4),(HS-ESS3-5)
<b><u>MP.4</u></b>	Model with mathematics. (HS-ESS2-4)
<b><u>HSN.O.A.1</u></b>	Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. (HS-ESS2-4),(HS-ESS3-5)
<b><u>HSN.O.A.2</u></b>	Define appropriate quantities for the purpose of descriptive modeling. (HS-ESS2-4),(HS-ESS3-5)
<b><u>HSN.O.A.3</u></b>	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (HS-ESS2-4),(HS-ESS3-5)

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