Unit 1: Birth of the Earth				
How do scientists use evidence to construct an account of the formation of the universe, solar system, and Earth?				
Sub Unit	Essential Question	Science Concepts	Performance Expectations	Science Practices & CC
The Sun	How are stars like the sun the key to understanding matter in our universe?	ESS1.A The Universe and Its Stars The star called the sun is changing and will burn out over a lifespan of approximately 10 billion years. PS3.D Energy in Chemical Processes and Everyday Life Nuclear Fusion processes in the center of the sun release the energy that ultimately reaches Earth as radiation. ESS1.A The Universe and Its Stars The study of stars' light spectra and brightness is used to identify compositional elements of stars, their movements, and their distances from Earth. 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-ESS1-1. 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. HS-ESS1-3. Communicate scientific ideas about the way stars, over their life cycle, produce elements.	Developing and Using Models: Develop and use a model based on evidence to illustrate the relationships between systems or between components of system. Obtaining, Evaluating, and Communicating Information Communicate scientific ideas in multiple formats (including orally, graphically, textually, and mathematically). *Scale, Proportion, and Quantity: The significance of a phenomenon is dependent on the scale, proportion, and quantity at which it occurs. *Energy and Matter In nuclear processes, atoms are not conserved, but the total number of protons plus neutrons is conserved.
	Notes: Nuclear fusion in stars creates elements and releases energy. A star's initial mass influences the elements created and the energy released over its lifetime. The elements produced by stars make up all matter in the universe. The energy released by stars (specifically the sun) reaches Earth through radiation. This energy is the key to life on Earth. By studying stars like the sun, scientists can understand our planet and universe better - and potentially even find another habitable planet.			

Sub Unit	Essential Question	Science Concepts	Performance Expectations	Science Practices & CC
Big Bang Theory	How did the universe form? How can scientists use observations made today to understand what has occured in the past?	ESS1.A The Universe and Its Stars The study of stars' light spectra and brightness is used to identify compositional elements of stars, their movements, and their distances from Earth. 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. 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. PS4.B Electromagnetic Radiation 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.	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.	Constructing Explanations and Designing Solutions: 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. Energy and Matter Energy cannot be created or destroyed--only moved between one place and another place, between objects and/or fields, or between systems.
	Notes: Evidence from stars and interstellar gases provide us an understanding of the history of the universe. Light spectra released by stars, the motion of distant galaxies, and an examination of the composition of the universe all support the big bang theory as the leading explanation of how our universe formed.			

Sub Unit	Essential Question	Science Concepts	Performance Expectations	Science Practices & CC
Birth of the Earth	How did the Earth form? How does studying other planetary bodies help us understand our own planet?	ESS1.C The History of Planet Earth Although active geologic processes, such as plate tectonics and erosion, have destroyed or altered most of the 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. PS1.C Nuclear Processes 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.	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.	Constructing Explanations and Designing Solutions Apply scientific reasoning to link evidence to the claims to assess the extent to which the reasoning and data support the explanation or conclusion. *Stability and Change Much of science deals with constructing explanations of how things change and how they remain stable.
	Notes: Evidence from ancient Earth materials and other solar system objects can reveal the early history of Earth. Scientists are able to construct a timeline of the formation of the solar system and our planet by examining rocks and meteorites on Earth, observing the surfaces of other planetary bodies, and gathering magnetic evidence from the ocean floor.			

Unit 2: Earth's Early Geology				
How and why is Earth constantly changing?				
Sub Unit	Essential Question	Science Concepts	Performance Expectations	Science Practices & CC
Earth's Structure	How does matter cycle through Earth's interior to the surface? How do scientists know what is inside the Earth?	ESS2.A Earth Materials and Systems 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. ESS2.B Plate Tectonics and Large-Scale System Interactions 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. Develop a model based on evidence of Earth's interior to describe the cycling of matter by thermal convection.	Developing and Using Models: Develop and use a model based on evidence to illustrate the relationships between systems or between components of system. *Energy and Matter Energy drives the cycling of matter within and between systems. Interdependence of Science, Engineering, and Technology Science and engineering complement each other in the cycle known as research and development. Many R&D projects may involve scientists, engineers, and others with wide ranges of expertise.
	Notes: The Earth is composed of a liquid inner and solid outer core, and a solid mantle and crust. Matter moves within the mantle through thermal convection, which then causes the movement of Earth's crust. Scientists have developed an understanding of Earth's interior by studying seismic waves, magnetic evidence from the ocean floor, and meteorites.			

Sub Unit	Essential Question	Science Concepts	Performance Expectations	Science Practices & CC
Plate Tectonics	How do Earth's internal processes affect its surface? How does plate tectonics explain the ages of Earth's rocks and its surface features?	ESS1.C The History of Planet Earth 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. ESS2.A Earth Materials and Systems Earth's systems, being dynamic and interacting, cause feedback effects that can increase or decrease the original changes. ESS2.B Plate Tectonics and Large-Scale System Interactions 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 geologic history. Plate movements are responsible for most continental and ocean-floor features and for the distribution of most rocks and minerals within Earth's crust.	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. 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.	Engaging in Argument from Evidence: Evaluate evidence behind currently accepted explanations or solutions to determine the merits of arguments. Developing and Using Models: Develop and use a model based on evidence to illustrate the relationships between systems or between components of system. *Patterns: Empirical evidence is needed to identify patterns. *Stability and Change: Change and rates of change can be quantified and modeled over very short or very long periods of time. Some system changes are irreversible.
	Notes: Mantle convection results in plate tectonics, which explains the different ages of Earth's crustal rocks. Mantle convection is responsible for the constructive forces (volcanism, tectonic uplift, and orogeny) that result in land and sea-floor features (mountains, valleys, trenches, ridges, seamounts).			

Sub Unit	Essential Question	Science Concepts	Performance Expectations	Science Practices & CC
Project Based Learning	What are the strengths and weaknesses of _____?	ETS1.B Developing Possible Solutions: When evaluating solutions, it is important to take into account a range of constraints, including cost, safety, reliability, and aesthetics, and to consider social, cultural, and environmental impacts.	HS-ETS1-3. Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.	Constructing Explanations and Designing Solutions: Evaluate a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. *Influence of Science, Engineering, and Technology on Society and the Natural World 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.
	Notes: Science, technology, and engineering is used to solve real-world problems and improve the lives of individuals, Students will investigate a real-world problem, identify existing solutions, evaluate them in light of criteria and constraints, and propose an idea of their own. Possible problems to investigate: earthquakes; fracking; volcanic eruptions; searching for habitable planets; exploring Mars; etc.			

Unit 3: Earth's Atmosphere and Climate (Then and Now)				
How does Earth's atmosphere interact with and support life?				
Sub Unit	Essential Question	Science Concepts	Performance Expectations	Science Practices & CC
The Evolution of Earth's Atmosphere	What is the relationship between Earth's atmosphere and the development of life?	ESS2.D Weather and Climate Gradual atmospheric changes were due to plant and other organisms that captured carbon dioxide and released oxygen. ESS2.E: Biogeography 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. LS1.C: Organization for Matter and Energy Flow in Organisms The process of photosynthesis converts light energy to stored chemical energy by converting carbon dioxide plus water into sugars plus released oxygen. LS2.B: Cycles of Matter and Energy Transfer in Ecosystems Photosynthesis and carbon respiration are important components of the carbon cycle, in which carbon is exchanged among the biosphere, atmosphere, oceans, and geosphere through chemical, physical, geological, and biological processes.	HS-ESS2-7. Construct an argument based on evidence about the simultaneous coevolution of Earth's systems and life on Earth. HS-LS2-5. Develop a model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere. HS-LS1-5. Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy.	Developing and Using Models: Develop a model based on evidence to illustrate the relationships between systems or between components of a system. Engaging in Argument from Evidence: Construct an oral or written argument or counter-arguments based on data and evidence. Stability and Change Much of science deals with construction explanations for how things change and how they remain stable. Systems and System Models Models can be used to simulate systems and interactions - including energy, matter, and information flows - within and between systems at different scales.
	Notes: The evolution of photosynthetic life on Earth increased atmospheric oxygen and allowed for the evolution of animal life. This animal life takes in the oxygen in the atmosphere and releases carbon dioxide through respiration. Our atmosphere is the result of millions of years of simultaneous coevolution of Earth's climate system and plant and animal life.			

Sub Unit	Essential Question	Science Concepts	Performance Expectations	Science Practices & CC
The Carbon Cycle	How does carbon move through Earth's system? How do living organisms affect the cycling of carbon through Earth's system?	ESS2.D: Weather and Climate Gradual atmospheric changes were due to plant and other organisms that captured carbon dioxide and released oxygen. Changes in atmosphere due to human activity have increased carbon dioxide concentrations and thus affect climate. ESS2.E: Biogeography 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-ESS2-6. Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere. HS-ESS3-6. Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity.*	Using Mathematics and Computational Thinking: Use a computational representation of phenomena or design solutions to describe and/or support claims and/or explanations. *Energy and Matter: The total amount of energy and matter in closed systems is conserved. Changes of energy and matter in a system can be described in terms of energy and matter flows into, out of, and within that system. *Systems and System Models: When investigating or describing a system, the boundaries and initial conditions of the system need to be defined and their inputs and outputs analyzed and described using models.
	Notes: Earth's carbon cycle is a primary determinant of Earth's climate and its ability to support life. The biosphere has a vital role in the cycling of carbon through Earth's atmosphere, hydrosphere, and lithosphere through the processes of respiration and photosynthesis. Human activities like combustion have increased carbon dioxide concentrations in the atmosphere [and affected the climate. This has resulted in changes to Earth's ecosystems.]			

Sub Unit	Essential Question	Science Concepts	Performance Expectations	Science Practices & CC
Climate Change	How has Earth's climate changed throughout time?	ESS2.A: Earth Materials and Systems The geologic 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 (ex/ volcanic ash clouds) to intermediate (ice ages) to very long-term tectonic cycles.	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.	Developing and Using Models: Use a model to provide mechanistic accounts of phenomena. *Cause and Effect: Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects.
	Notes: Earth's climate can change as the result of natural factors or human activities that affect the flow of energy in and out of Earth's systems. These changes can occur rapidly or over millions of years.			

Sub Unit	Essential Question	Science Concepts	Performance Expectations	Science Practices & CC
Anthropogenic Climate Change	What is the role of humans in Earth's changing climate?	ETS1.A: Defining and Delimiting Engineering Problems Criteria and constraints also include satisfying any requirements set by society, such as taking issues of risk mitigation into account, and they should be quantified to the extent possible and stated in such a way that one can tell if a given design meets them. Humanity faces major global challenges today, such as the need for supplies of clean water and food or for energy sources that minimize pollution, which can be addressed through engineering. These global challenge also may have manifestation in local communities. ESS3.D: Global Climate Change Though the magnitudes of human impacts are greater than they have ever been, so too are human ability to model, predict, and manage current and future impacts. Through computer simulations and other studies, important discoveries are still being made about how the ocean, the atmosphere, and the biosphere interact and are modified in response to human activities. ESS2.D: Weather and Climate Current models predict that, although future regional climate changes will be complex and varied, average global temperatures will continue to rise. The outcomes predicted by global climate models strongly depend on the amounts of human-generated greenhouse gases added to the atmosphere each year and by the ways in which these gases are absorbed by the ocean and biosphere.	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. HS-ETS1-1. Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.	Analysing and Interpreting Data: Analyze data using computational models in order to make valid and reliable scientific claims. Scientific Investigations Use A Variety of Methods: Science investigations use diverse methods and do not always use the same set of procedures to obtain data. New technologies advance scientific knowledge. Asking Questions and Defining Problems: Analyze complex real-world problems by specifying criteria and constraints for successful solutions. *Stability and Change Change and rates of change can be quantified and modeled over very short or very long periods of time. Some system changes are irreversible. *Influence of Science, Engineering, and Technology on Society and the Natural World 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.
	Notes: The Earth's climate is changing as a result of human activities, and the impacts of these changes will affect Earth's ecosystems and human society. There are still a number of possible solutions to mitigate some of the effects of global warming and climate change, although there are pros and cons to all options.			

Unit 4: Water Resources				
How does human activity impact water resources?				
Sub Unit	Essential Question	Science Concepts	Performance Expectations	Science Practices & CC
Water and Earth's Surface Processes	How does the hydrologic cycle affect Earth's surface? How does water affect Earth's energy balance?	ESS2.C The Roles of Water in Earth's Surface Processes 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. Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.	Planning and Carrying Out Investigations: Plan and conduct an investigation individually or 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 (number of trials, cost, risk, time), and refine the design accordingly. *Structure and Function: 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.
	Notes: The hydrologic cycle is a primary force in Earth's surface processes and the formation of surface features like lakes and rivers.			

Sub Unit	Essential Question	Science Concepts	Performance Expectations	Science Practices & CC
Human Impacts on Water Resources	How do human activities impact water resources? How can technology help humans reduce their impact on water resources?	ESS2.A Earth's Materials and Systems Earth's systems, being dynamic and interacting, cause feedback effects that can increase or decrease the original changes. ESS3.C Human Impacts on Earth Systems Scientists and engineers can make major contributions by developing technologies that produce less pollution and waste and that preclude ecosystem degradation. ETS1.A: Defining and Delimiting Engineering Problems Criteria and constraints also include satisfying any requirements set by society, such as taking issues of risk mitigation into account, and they should be quantified to the extent possible and stated in such a way that one can tell if a given design meets them. Humanity faces major global challenges today, such as the need for supplies of clean water and food or for energy sources that minimize pollution, which can be addressed through engineering. These global challenge also may have manifestation in local communities.	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. HS-ESS3-4. Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.*	Analysing and Interpreting Data Analyze data using tools, technologies, and/or models in order to make valid and reliable scientific claims or determine an optimal design solution. Constructing Explanations and Designing Solutions: Design or refine a solution to a complex real-world problem, based on scientific knowledge, student generated sources of evidence, prioritized criteria, and trade-off considerations. *Stability and Change: Feedback (negative or positive) can stabilize or destabilize a system.
	Notes: Human activities can change the landscape and result in the degradation of water resources, such as through increased erosion due to the loss of vegetation, eutrophication due to agricultural fertilization, and reduced water quality due to the expansion of impervious surfaces and urban runoff. Technology can reduce the impact of our activities on these systems.			

Sub Unit	Essential Question	Science Concepts	Performance Expectations	Science Practices & CC
Water Resources and Human Activity	How does access to potable water resources impact human societies, economies, and political systems?	ESS3.A Natural Resources Resource availability has guided the development of human society. ESS3.B Natural Hazards Natural hazards and other geologic events have shaped the course of human history; they have significantly altered the sizes of human population and have driven human migrations. ETS1.A: Defining and Delimiting Engineering Problems Humanity faces major global challenges today, such as the need for supplies of clean water and food or for energy sources that minimize pollution, which can be addressed through engineering. These global challenge also may have manifestation in local communities.	HS-ESS3-1. Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.	Constructing Explanations and Designing Solutions Construct and explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, 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. *Cause and Effect Empirical evidence is required to differentiate between causes and correlation and makes claims about specific causes and effects.
	Notes: The availability of water of clean, fresh water impacts human society, including local and global economies and political systems.			

Unit 5: The Anthropocene				
How have humans impacted Earth's geology and ecosystems?				
Sub Unit	Essential Question	Science Concepts	Performance Expectations	Science Practices & CC
Human Impacts	Does the human "footprint" warrant the recognition of a new geologic epoch?	ESS3.C: Human Impacts on Earth Systems The sustainability of human societies and the biodiversity that supports them requires responsible management of natural resources. ESS3.D: Global Climate Change Through computer simulations and other studies, important discoveries are still being made about how the ocean, the atmosphere, and the biosphere interact and are modified in response to human activities. ESS2.D: Weather and Climate Current models predict that, although future regional climate changes will be complex and varied, average global temperatures will continue to rise. The outcomes predicted by global climate models strongly depend on the amounts of human-generated greenhouse gases added to the atmosphere each year and by the ways in which these gases are absorbed by the ocean and biosphere.	HS-ESS3-3. Create a computational simulation to illustrate the relationships among the management of natural resources, the sustainability of human populations, and biodiversity. HS-ESS3-6. Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity.	Using Mathematics and Computational Thinking: Create a computational model or simulation of a phenomenon, designed device, process, or system. Use a computational representation of phenomena or design solutions to describe and/or support claims and/or explanations. *Systems and System Models When investigating or describing a system, the boundaries and initial conditions of the system need to be defined and their inputs and outputs analyzed and described using models.
	Notes: Humans actions have impacted Earth's geology and ecosystems. Impacts include the contamination of water and land resources, habitat destruction, extraction of natural resources, depletion of living resources (fishing, hunting, etc.), changes in land use (for urban development, agriculture, resource extraction, etc.), energy issues, waste management, climate change, and so on. There are a number of issues that classes can focus on in this unit.			

Sub Unit	Essential Question	Science Concepts	Performance Expectations	Science Practices & CC
Designing Solutions to Environmental Problems	How can science and technology address environmental problems?	ESS3.A: Natural Resources All forms of energy production and other resource extraction have associated economic, social, environmental, and geopolitical costs and risks as well as benefits. New technologies and social regulations can change the balance of these factors. ESS3.C: Human Impacts on Earth Systems Scientists and engineers can make major contributions by developing technologies that produce less pollution and waste and that preclude ecosystem degradation. ETS1.B: Developing Possible Solutions When evaluating solutions, it is important to take into account a range of constraints, including cost, safety, reliability, and aesthetics, and to consider social, cultural, and environmental impacts.	HS-ESS3-2. Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.* HS-ESS3-4. Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.*	Constructing Explanations and Designing Solutions: Design or refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and trade off considerations. Engaging in Argument from Evidence: Evaluate competing design solutions to a real-world problem based on scientific ideas and principles, empirical evidence, and logical arguments regarding relevant factors (e.g. economic, societal, environmental, ethical considerations) *Stability and Change: Feedback (negative or positive) can stabilize or destabilize a system. (HS-ESS3-4)
	Notes: Science and engineering can hold the key to developing solutions for our most pressing environmental issues.			