Hillside Township School District

Science
Environmental Earth Science Curriculum

Grades 11-12

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Hillside Township School District

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District Mission Statement

The mission of the Hillside Public Schools is to ensure that all students at all grade levels achieve the New Jersey Core Curriculum Content Standards and make connections to real-world success. We are committed to strong parent-community school partnerships, providing a safe, engaging, and effective learning environment, and supporting a comprehensive system of academic and developmental support that meets the unique needs of each individual.

Academic Area Overview

The Hillside Township School District is committed to excellence. We believe that all children are entitled to an education that will equip them to become productive citizens of the twenty-first century. We believe that an education grounded in the fundamental principles of science will provide students with the skills and content necessary to become our future leaders.

A sound science education is grounded in the principles of inquiry and rigor. Children are actively engaged in learning as they model real-world scientific behaviors to construct knowledge. They have ample opportunities to manipulate materials in ways that are developmentally appropriate to their age. They work in an environment that encourages them to take risks, think critically, and make models, note patterns and anomalies in those patterns. Children are encouraged to ask questions, not just the "how" and the "what" of observed phenomena, but also the "why".

Our program provides teachers with cost-effective science materials that are aligned to state and national standards, incorporate instructional strategies that are research-based, and provides teachers with a deep understanding of science and the pedagogical underpinnings of science. Our teachers receive quality professional development through a district partnership with the Merck Institute for Science Education as well as the Martinson Foundation at Fairleigh Dickinson University. Our K-8 kit based program encourages "hands-on science" and is endorsed by the National Science Foundation.

Equality and Equity in Curriculum

The Hillside Township School District ensures that the district's curriculum and instruction are aligned to the State's Core Curriculum Content Standards and addresses the elimination of discrimination and the achievement gap, as identified by underperforming school-level AYP reports for State assessment, by providing equity in educational programs and by providing opportunities for students to interact positively with others regardless of race, creed, color, national origin, ancestry, age, marital status, affectional or sexual orientation, gender, religion, disability or socioeconomic status.

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N.J.A.C. 6A:7-1.7(b): Section 504, Rehabilitation Act of 1973; N.J.S.A. 10:5; Title IX, Education Amendments of 1972

Science Department Lesson Plan Template

Lesson Information

Lesson Name: _____
Unit: _____
Date: _____

Lesson Data

1.	Essential Question(s)	
2.	NGSS	
3.	Disciplinary Core Ideas	*Students will know ...*
4.	Science/Engineering Practices	*Students will be able to ...*
5.	Crosscutting Concepts	*Students will apply ...*
6.	Assessment	*Evidence of student learning*
7.	Lesson Agenda	*Include in Lesson Outline:* ● *Anticipated timing* ● *DO NOW* ● *Activities and Investigations* ● *Discussion prompts* ● *Journal writing prompts* ● *Student uses of technology* ● *Safety precautions* ● *Materials*

8.	Homework	

Related NGSS in Earth and Space Science, Life Science & Physical Science

HS-ESS1 Earth's Place in the Universe	HS-LS1 From Molecules to Organisms: Structures and Processes	HS-PS3 Energy
HS ESS2 - Earth's System	HS-LS2 Ecosystems: Interactions, Energy, and Dynamics	HS-ETS1-Engineering Design
HS-EES3-Earth and Human Activity	HS-LS4 Biological Evolution: Unity and Diversity	

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Environmental Earth Science: Unit 1 Earth's Spheres

ENDURING UNDERSTANDINGS	ESSENTIAL QUESTIONS
✓ The Earth can be separated into various spheres which interact dynamically. ✓ Today's decisions influence our future environment.	✓ How do Earth's systems work? ✓ How do we impact our environment? ✓ How does the environment impact us? ✓ What is the role of the government in protecting our environment from negative human impact?

NGSS Student Learning Objective	KNOWLEDGE Students will know:	Science & Engineering PRACTICES/SKILLS Students will be able to:	CROSSCUTTING CONCEPTS Students will apply:
SCI-HS-LS2-1 SCI-HS-LS2-2 SCI-HS-LS4-4 SCI-HS-LS2-6 SCI-HS-ESS2-7	**The Biosphere** ● All of Earth's spheres connect and interact. Soils are at the interface of the Earth systems, linking together the biosphere (biotic environmental factors), geosphere, atmosphere, and hydrosphere (abiotic environmental factors). ● The biosphere consists of all the planet's living or once-living things and the nonliving parts of the environment with which they interact. ● Ecological communities are made up of producers and consumers. The feeding relationships between these organisms can be illustrated in a food web. o A keystone species has a strong or wide-reaching impact on a	● Using Mathematical and Computational Thinking ● Engaging In Arugument from Evidence ● Constructing Explanations and Designing Solutions --- ● Differentiate between biotic and abiotic factors in an ecosystem ● Create a food web based on community relationships ● Analyze data and scenarios surrounding keystone species, invasive species, and biological magnification ● Identify and evaluate the human impact (positive and negative) on the biodiversity of an ecosystem	Cause and Effect Scale, Proportion, Quanity Stability and Change

	community. The removal of this species can disrupt the entire food web. o Invasive species (non-native organisms) entering an ecosystem can disturb the food web by eliminating native species through predation or competition. o Through biological magnification, pollutants become increasingly concentrated as you go further up the food web. ● Species diversity, genetic diversity, and ecosystem diversity are all parts of an area's overall biodiversity. o Biodiverse ecosystems provide economically valuable services and products to humans. o Biodiversity is threatened by extinctions due to habitat change and loss, pollution, overharvesting, and climate change. o The Endangered Species Act protects listed protected species from human activity. Key Terms: abiotic, atmosphere, biodiversity, biological magnification, biotic, consumer, Earth sphere, ecological community, Endangered Species Act, extinction, food web, geosphere,	● Apply the Endangered Species Act to appropriate situations ● Explain the unintended consequences of harvesting natural resources (such as trees and other organisms) from an ecosystem ● Apply understanding to case studies	

	hydrosphere, invasive species, keystone species, overharvesting, producer, soil		
SCI-HS-ESS2-6 SCI-HS-LS2-5	**The Atmosphere** ● The atmosphere consists of the layers of gases surrounding our planet. ● The chemical and physical properties of the layers of the atmosphere support life on Earth. o We live in the lowest level of the atmosphere, called the troposphere, in which most of Earth's weather occurs. o The next layer of the atmosphere is the stratosphere. This is where the ozone layer is found, which absorbs ultraviolet (UV) radiation. In the 1970's and 1980's, scientists predicted the depletion of the ozone layer and the probable cause as pollution by CFCs (chlorofluorocarbons). The US worked with other countries to develop the Clean Air Act to restrict the production of CFCs and evidence indicates that the ozone is beginning to recover. o Many organisms rely on oxygen from Earth's atmosphere to perform cellular respiration. The source of	● Developing and Using Models _ ● Identify and describe the troposphere and stratosphere ● Identify and evaluate the human impact (positive and negative) on the atmosphere ● Trace the evolution of our atmosphere and relate the changes in rock types and life forms to the evolving atmosphere ● Analyze the vertical structure of Earth's atmosphere, and account for the global, regional, and local variations of these characteristics and their impact on life ● Apply the Clean Air Act to appropriate situations ● Apply understanding to case studies	Energy and Matter System and System Models

	oxygen in the atmosphere is photosynthesis. Before the evolution of photosynthesis, there was no oxygen in the atmosphere. Key Terms: atmosphere, chlorofluorocarbons (CFCs), Clean Air Act, ozone, stratosphere, troposphere, ultraviolet radiation		
SCI-HS-ESS2-6 SCI-HS-LS2-5	**The Hydrosphere** ● The hydrosphere includes all of the water above and below Earth's surface and in the atmosphere. This water is in the form of liquid, ice, or vapor. o Water cycles through the environment through the processes of evaporation, transpiration, precipitation, and condensation. o Natural and human-made chemicals circulate with water in the hydrologic cycle. Government regulation and water treatment are two ways of decreasing the effects of water pollution. o Fresh water is both renewable and limited. Human usage of both surface and groundwater has caused a depletion of fresh water sources. o Earth's hydrologic cycle is complex and varies globally, regionally, and locally.	● Developing and Using Models _ ● Trace the path of a water molecule through the water cycle in multiple pathways ● Distinguish between natural and human-made chemicals that travel with water through the cycle ● Identify and evaluate the human impact (positive and negative) on the hydrosphere ● Analyze and explain the sources and impact of a specific industry on a large body of water ● Explain the unintended consequences of harvesting fresh water from an ecosystem ● Apply understanding to case studies	Energy and Matter System and System Models

	Key Terms: condensation, evaporation, hydrosphere, precipitation, transpiration, water cycle		
SCI-HS-ESS2-6 SCI-HS-LS2-5	**The Geosphere** ● ● The geosphere is made of all the rock at and below Earth's surface. ● Rocks are formed in various ways and can change forms in the rock cycle between sedimentary, igneous, and metamorphic. o Absolute dating, using radioactive isotopes in rocks, makes it possible to determine the age of a rock sample. o Relative dating uses index fossils and rock layers to determine the age of a rock sample. ● The surface of the Earth is made up of a series of tectonic plates. Convection currents in the upper mantle drive plate motion. Plates are pushed apart at spreading zones and pulled down into the crust at subduction zones. o Natural disasters such as Earthquakes and volcanoes occur because of the movement of these plates. ● Earth has magnetic field with a north pole and a south pole. Evidence from lava flows	● Developing and Using Models _ ● Use models to represent an Earth process at a classroom scale and develop explanations ● Trace the path of a rock through multiple pathways in the rock cycle ● Explain the unintended consequences of harvesting minerals from an ecosystem ● Distinguish between absolute and relative dating and choose appropriate situations for the use of each ● Correlate stratographic columns from various locations by using index fossils and other dating techniques ● Account for the evolution of species by citing specific absolute dating evidence of fossil samples ● Explain the mechanisms for plate motions using Earthquake data, mathematics, and conceptual models ● Identify and evaluate the impact on humans of catastrophic events caused by movement of tectonic plates ● Explain how we know that the Earth has a magnetic field using evidence	Energy and Matter System and System Models

	shows that Earth's magnetic field reverses (North-South) over geologic time. ● <u>Key Terms:</u> absolute dating, convection currents, geosphere, igneous, index fossil, magnetic field, mantle, metamorphic, radioactive isotope, relative dating, rock cycle, sedimentary, spreading zone, subduction zone, tectonic plates	● Calculate the average rate of seafloor spreading using archived geomagnetic-reversals data ● Apply understanding to case studies	

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Environmental Earth Science: Unit 2 Earth's Cycles

ENDURING UNDERSTANDINGS	ESSENTIAL QUESTIONS
✓ Important molecules circulate through Earth's spheres. ✓ Today's decisions influence our future environment.	✓ How do Earth's systems work? ✓ How do we impact our environment? ✓ How does the environment impact us? ✓ What is the role of the government in protecting our environment from negative human impact?

NGSS Student Learning Objective	KNOWLEDGE Students will know:	Science & Engineering PRACTICES/SKILLS Students will be able to:	CROSSCUTTING CONCEPTS Students will apply:
SCI-HS-LS2-5 SCI-HS-LS2-4 SCI-HS-LS1-5	**Biogeochemical Cycles** ● The Law of Conservation of Matter states that matter can be transformed from one type of another, changing its physical and chemical properties, but it cannot be created nor destroyed. ● Matter cycles through an ecosystem, while energy moves in one direction. Matter on Earth is considered a closed system in which no matter enters or leaves. Energy on Earth is considered an open system, because energy enters from the sun and leaves as heat. ● Nutrients and energy are stored chemically in various reservoirs within Earth's spheres.	● Developing and Using Models ● Using Mathematics and Computational Thinking _ ● Identify reservoirs for energy and nutrients in each of Earth's spheres ● Distinguish between the flow of matter and the flow of energy in an ecosystem ● Apply the laws of conservation of matter and conservation of energy to an ecosystem ● Model the interrelationships among the spheres in the Earth systems by creating a flow chart ● Apply understanding to case studies	Energy and Matter System and System Models

	● There are several nutrients that are cycled within an ecosystem. They include carbon, phosphorous and nitrogen. Key Terms: , biogeochemical cycle, carbon, closed system, energy, Law of Conservation of Matter, nitrogen, open system, phosphorous, reservoir		
SCI-HS-LS2-3 SCI-HS-LS2-4 SCI-HS-LS2-5 SCI-HS-PS3-1 SCI-HS-PS3-4	**The Carbon Cycle** ● The carbon cycle includes organisms such as producers, consumers, and decomposers. Each organism contributes or takes away carbon from the environment. ● Carbon is removed from the atmosphere by producers during photosynthesis who store it in organic compounds. It moves through the food web to consumers and decomposers. Producers, consumers, and decomposers put carbon back in the atmosphere during cellular respiration. ● Carbon collects in sedimentary rocks when organisms die and their remains compress. This is also how fossil fuels are made. Humans extract fossil fuels and burn them, releasing carbon into the atmosphere. ● Some carbon molecules are toxic to humans.	● Developing and Using Models ● Using Mathematical and Computational Thinking ● Constructing Explanations and Designinig Solutions ● Planning and Carrying out Investigations _ ● Trace the path of a carbon atom through multiple pathways in the carbon cycle ● Distinguish between natural and human-made carbon compounds that travel through the carbon cycle ● Identify and evaluate the human impact (positive and negative) on the environment as result of their participation in the carbon cycle ● Apply understanding to case studies	Energy and Matter System and System Models

	Key Terms: carbon, cellular respiration, consumer, decomposer, fossil fuel, photosynthesis, producer, sediment		
SCI-HS-LS2-4 SCI-HS-ESS3-6	**The Phosphorus Cycle** ● The phosphorous cycle involves mainly the geosphere and the hydrosphere. ● Plants take up phosphorus from the soils. It moves through the food web to consumers and decomposers. Decomposers return phosphorus to the soil. ● Humans mine phosphorus as a fertilizer and release it into the ecosystem in wastewater. The addition of phosphorus to a body of water can lead to an overgrowth of producers called eutrophication. Key Terms: consumer, decomposer, eutrophication, phosphorous, producer	● Developing Models ● Using Mathematical and Computational Thinking --- ● Trace the path of a phosphorus atom through multiple pathways in the phosphorus cycle ● Distinguish between natural and human-made phosphorus compounds that travel through the phosphorus cycle ● Identify and evaluate the human impact (positive and negative) on the environment as result of their participation in the phosphorus cycle ● Apply understanding to case studies	Energy and Matter Systems and System Models
SCI-HS-LS2-4 SCI-HS-ESS3-6	**The Nitrogen Cycle** ● Nitrogen is an essential ingredient in proteins, DNA and RNA. It is one of the most abundant elements in our environment. ● Nitrogen gas is “fixed” from the atmosphere by energy from lightning strikes or by nitrogen-fixing bacteria in the soil. ● Plants take up nitrogen from the soil. It moves through the food web to consumers	● Developing Models ● Using Mathematical and Computational Thinking --- _ ● Trace the path of a nitrogen atom through multiple pathways in the nitrogen cycle ● Distinguish between natural and human-made nitrogen compounds that travel through the phosphorus cycle	Energy and Matter Systems and System Models

	and decomposers. Decomposers return nitrogen to the soil. ● Humans can artificially fix nitrogen from the atmosphere and increase its flow through the ecosystem. Humans also return nitrogen to the atmosphere by burning forests and fields and fossil fuels. Key Terms: consumer, decomposer, nitrogen, nitrogen fixation, producer	● Identify and evaluate the human impact (positive and negative) on the environment as result of their participation in the nitrogen cycle ● Apply understanding to case studies	
SCI-HS-ESS3-6 SCI-HS-ESS3-3 SCI-HS-ESS3-4	**Environmental Impact of Waste Disposal** ● Human activities and processes produce wastes, which are any unwanted material or substances. ● Conventional waste disposal methods include sanitary landfills in which waste is buried underground or piled in large engineered mounds, and incineration in which waste is burned. Both disposal methods have benefits and drawbacks. ● The best way to reduce waste is to not make it in the first place. ● Waste recovery reduces waste by composting and recycling. ● Waste that is ignitable, corrosive, chemically reactive, or toxic is considered hazardous waste. This is produced by industry and the private sector. ● Humans should develop responsible and safe methods for disposing hazardous waste and	● Using Mathematical and Computational Thinking ● Constructing Explanations and Designing Solutions _ ● Evaluate the pros and cons of conventional waste disposal methods ● Identify wastes from a households that are candidates for waste reduction by composting or recycling ● Identify household wastes that would be considered hazardous and explain proper disposal methods ● Use data to defend recycling efforts in the community ● Apply understanding to case studies	Stability and Change Systems and System Models

	should follow strict regulations for its disposal. ● Scientific, economic, and other data can assist in assessing environmental risks and benefits associated with societal activity. <u>Key Terms:</u> biodegradable, industrial waste, hazardous waste, leachate, municipal solid waste, radioactive waste, source reduction, waste		

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Environmental Earth Science: Unit 3 Energy and Climate Change

ENDURING UNDERSTANDINGS	ESSENTIAL QUESTIONS
✓ The sun is the ultimate energy source for all of Earth's processes. ✓ Climate is a long-term pattern of temperature and moisture conditions. ✓ Climate is determined by the Earth's rotation and revolution as well as processes on the Earth. ✓ Today's decisions influence our future environment.	✓ Where does energy go? ✓ How are climate and the environment related? ✓ How can we use Earth's resources sustainably?

NGSS Student Learning Objective	KNOWLEDGE Students will know:	Science & Engineering PRACTICES/SKILLS Students will be able to:	CROSSCUTTING CONCEPTS Students will apply:
SCI-HS-ESS1-1 SCI-HS-ESS1-2 SCI-HS-ESS1-3	**The Sun** ● The Big Bang theory places the origin of the universe at approximately 13.7 billion years ago. Shortly after the big bang, matter (primarily hydrogen and helium) began to group to form galaxies and stars. ● According to the Big Bang theory, the universe has been expanding since its beginning, explaining the apparent movement of galaxies away from one another. ● The Sun is one of an estimated two hundred billion stars in our Milky Way galaxy, which together with over one hundred billion other galaxies, make up the universe. ● Stars experience significant changes during their life cycles, which can be illustrated with an Hertzsprung-Russell (H-R) Diagram that	● Developing and Using Models ● Constructing Explanations and Designing Solutions ● Obtaining, Evaluating, and Communicating Information _ ● Use models to represent an Earth process at a classroom scale and develop explanations ● Explain the Big Bang theory in their own words and critique evidence for the theory that the universe evolved as it expanded from a single point 13.7 billion years ago and that it is still expanding ● Collect, analyze, and critique evidence that supports the theory that the Earth	Scale, Proportion and Quantity Energy and Matter

	incorporates data on the star's luminosity and temperature. o Forces of gravity and gas pressure act on a star during its life cycle. Stars begin as nebular clouds of dust, and collapse under gravitational forces to form main sequence stars. Stars then expand during their lives, with the outer layer cooling and becoming less bright. Eventually they will collapse and explode to form a black hole. o Our sun is currently a main sequence star, formed at the same time as our Earth about 4.6 billion years ago. Scientists support this claim with evidence from the current properties of the sun and Earth as well as radioactive dating of meteorites and lunar samples. ● Prior to the work of 17th-century astronomers, scientists believed the Earth was the center of universe (geocentric model). Current evidence supports the idea that the Earth revolves around the sun (heliocentric model). <u>Key Terms:</u> Big Bang theory, black hole, geocentric model, heliocentric model, force, gravity, gas pressure, Hertzprung-Russel diagram, luminosity, lunar sample, main sequence star, matter, Milky Way galaxy, meteorite, nebular, radioactive dating, revolve, universe	and the rest of the Solar System formed from a nebular cloud of dust and gas 4.6 billion years ago ● Identify the sun as a star in our galaxy and analyze simulated and/or real data to estimate the number of stars in our galaxy and the number of galaxies in our universe ● Interpret a H-R diagram to determine the luminosity and temperature of a star and explain the life cycle of stars of different masses using simple stellar models ● Model and explain the Earth's revolution around the sun ● Explain how new evidence obtained using telescopes allowed 17th century astronomers to displace the geocentric model of the universe ● Apply understanding to case studies	

SCI-HS-ESS3-6	**Seasons and Climates** ● The Sun is the major external source of energy for Earth's global energy budget. Earth's radiation budget varies globally, but is balanced. Climate is the conditions of weather and moisture determined by energy transfer from the Sun at and near Earth's surface. The weather we experience is the result of day to day atmospheric changes within our climates. ● Global climate differences result from the uneven heating of Earth's surface by the Sun. Seasonal climate variations are due to the tilt of Earth's axis with respect to the plane of Earth's nearly circular orbit around the Sun. ● Climate is influenced by dynamic processes, such as cloud cover and Earth's rotation, as well as static condition, such as proximity to mountain ranges and the ocean. o The Gulf Stream in the Atlantic Ocean is caused by cooler saltier water sinking at the poles and warmer, less salty water rising at the equator. This current brings warm water up the east coast of North America. o The prevailing winds from West to East in our hemisphere are caused by the rotation of the Earth and the movement of air masses. Air is heated at the equator and rises, moving towards the poles, where it cools.	● Using Mathematical and Computational Thinking _ ● Use models to represent an Earth process at a classroom scale and develop explanations ● Distinguish between weather and climate ● Explain that it is warmer in summer and colder in winter for people in New Jersey because the intensity of sunlight is greater and the days are longer in summer than in winter. Connect these seasonal changes in sunlight to the tilt of Earth's axis with respect to the plane of its orbit around the Sun ● Identify and prioritize what processes impact climate in a given region and how ● Model and explain the physical science principles that account for the global energy budget ● Apply understanding to case studies	Systems and System Models

	○ El Nino and La Nina are interactions between ocean and atmosphere in which changes in the wind patterns cause changes in water temperatures and disrupt weather. ○ The topography or surface characteristics of an area influence climate because as winds pass over mountains, the rising air cools and clouds form, leading to precipitation. Air loses much of its moisture as it passes a mountain range. Key Terms: axis, climate, cloud cover, direct sun rays, dynamic, El Nino, energy, energy budget, Gulf Stream, indirect sun rays, La Nina, plane, prevailing winds, tilt, radiation, rain-shadow effect, revolution, rotation, seasons, static, topography, weather		
SCI-HS-ESS2-4 SCI-HS-ESS3-5 SCI-HS-ESS3-6	**Climate Change** • The greenhouse effect is a major cause of global climate change. ○ Greenhouse gasses, such as carbon dioxide, accumulate in the atmosphere due to burning fossil fuels and deforestation. • Scientists study climate change by directly measuring present conditions and indirectly measuring past conditions. ○ Evidence that shows global climate change includes rising temperature, melting glaciers, rising sea levels and changes in precipitation.	• Analyzing and Intrepreting Data • Using Mathematical and Computational Thinking • Developing and Using Models _ • Use models to represent an Earth process at a classroom scale and develop explanations • Explain the greenhouse effect in their own words • Articulate how and why scientists study climate change	Systems and System Models Stability and Change Cause and Effect

	○ Indirect evidence of climate change includes data from ice samples, sedimentary rocks, and tree rings. ○ Scientists create models to predict future climate changes. • Climate change could shift locations of organism habitats, change migration times of organisms, and disrupts ocean ecosystems. • Climate change could affect humans in terms of changing crop growing seasons, producing heat waves that affect human health, supporting wider range of diseases, and possibly decreasing the fresh water supply. • Individuals and organizations monitor their carbon footprints, which is the amount of carbon dioxide for which an individual or group is responsible. • Necessary strategies in response to climate change could include conserving electricity to reduce greenhouse gasses, using alternative sources of energy instead of fossil fuel, more efficient modes of transportation and replacing lost trees to help take carbon out of the atmosphere. • Scientific, economic, and other data can assist in assessing environmental risks and benefits associated with societal activity. Key Terms: carbon footprint, climate, convection, deforestation, fossil fuel, greenhouse effect, greenhouse gasses, global climate change, migration , topography	• Identify and evaluate the human impact (positive and negative) on the climate as a result of participation in environmental processes • Assess the carbon footprint that an individual or group is responsible for • Suggest appropriate strategies in response to climate change in a variety of situations • Use data to assess risks and evaluate environmental policies • Predict the impact on biogeochemical systems would be if there was an increase or decrease in internal and external energy • Apply understanding to case studies	
SCI-HS-ESS3-3 SCI-HS-ESS3-4	**Alternative Energy Sources**	• Using Mathematical and Computational Thinking	Cause and Effect

SCI-HS-ESS 3-2 SCI-HS-ESS3-1 SCI-HS:ETS1	• Scientists are currently developing renewable alternatives to fossil fuels, which will not last forever. Additionally, alternative energy sources may reduce the environmental impact of current energy sources such as fossil fuels and nuclear power. • Biofuels are one form of alternative energy. Biodiesel and ethanol are currently used to run gasoline and diesel engines. • Earth systems have internal and external sources of energy, both of which create heat. Geothermal energy can be harnessed to run a power plant or directly for heating homes and offices. • Hydropower can be used to generate electricity. While this is a renewable resource, the use of dams and reservoirs interrupts the natural flow of water through the ecosystem. • Solar energy can be used to generate electricity. The manufacturing of solar-energy devices creates some pollution and is very expensive. Additionally, some regions are not sunny enough to provide much solar power. • Wind turbines convert wind's kinetic energy into electric energy. • Hydrogen fuel can be produced from the breakdown of water or other hydrogen-containing compounds. Hydrogen gas can be used to produce electricity within a fuel cell. Key Terms: alternative, biodiesel, biofuel, ethanol, fossil fuel, fuel cell, geothermal energy, hydrogen fuel,	• Constructing Explanations and Designing Solutions • Engaging in Arugument from Evidence. _____ _ • Define which energy sources are considered "alternative" • Distinguish between renewable and non-renewable resources • Defend the need for alternative energy sources • Explain how alternative energy sources generate electricity or fuel • Evaluate the benefits and risks associated with alternative sources of energy • Assess (using scientific, economic, and other data) the potential environmental impact of large-scale adoption of emerging technologies • Apply understanding to case studies	Stability and Change

	hydropower, non-renewable, nuclear power, renewable, solar energy, wind turbine		

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Environmental Earth Science Course Pacing Chart

TIME FRAME	UNIT	PERFORMANCE TASKS ACTIVITIES/PROJECTS ASSESSMENTS	RESOURCES/INTERDISCIPLINARY CONNECTIONS
September *16 days*	The Biosphere	Central Case: Finding Gold in a Costa Rica Rain Forest p99 Central Case: Black and White and Spread All Over p125 Central Case: Too much of a good thing? P163 Central Case: Saving the Siberian Tiger p199 Central Case: The Rise and Fall and Rise of DDT p255 Central Case: Oil or Wilderness on Alaska's North Slope p515 Chapter 3, Lesson 2: Systems in Environmental Science Chapter 3, Lesson 3 Earth's Spheres Chapter 5, Lesson 3 Ecological Communities Chapter 5, Lesson 4 Community Stability Chapter 7, Lesson 1 Our Planet of Life Chapter 7, Lesson 2 Extinction and Biodiversity Loss Chapter 7, Lesson 3 Protecting Biodiversity Chapter 9, Lesson 3 Toxic Substances in the Environment Go Outside: Abiotic and Biotic Factors p102 Real Data: Turkey Vultures p112 Map It: Invading Mussels p210 Success Stories: A Couple of Birds Make Big Comebacks, p218-219 Ecological Footprints: Invasive Species p161 Ecological Footprints: Commercial Fishing p197	My Environmental Science BrainPOP: Ecosystems BrainPOP: Extinction SMART Notebook Lesson: Biomagnification in Food Chains

		Ecological Footprints: Habitat Loss p223 Online: MyEnvironmentalScience.com ● Video: Fish Farms of the Future ● Video: Belize's Safe Haven for Animals ● Video: Angeles Ashes: Wildfire Contained ● Video: Weekend Window to Katmai National Park ● Video: Invisible Cloak of the Cuttlefish ● 3-D Geo-Tour: Invasion of the Zebra Mussels ● Environmental Action Projects: Biodiversity Study ● Inquiry Lab: Exploring Plant Diversity ● Inquiry Lab: Modeling Overharvesting ● Inquiry Lab: Endangered Species ● Inquiry Lab: Invasive Organisms Near You Assessments (teacher generated; included but not limited to) ● DO NOW's ● Exit Slips ● Quizzes (constructed response) ● Tests (multiple choice; constructed response)	
October *10 days*	The Atmosphere	Central Case: Fixing a Holes in the Sky p3 Central Case: Charging Toward Cleaner Air in London p451 Chapter 3, Lesson 3 Earth's Spheres Chapter 15, Lesson 1: Earth's Atmosphere Chapter 15, Lesson 2: Pollution of the Atmosphere Chapter 15, Lesson 3: Controlling Air Pollution Real Data: Effects of the Clean Air Act p471 Ecological Footprints: Vehicle Emissions p479	My Environmental Science Air Pollution Game: Lung Attack! BrainPOP: Air Pollution BrainPOP: Earth's Atmosphere BrainPOP: The Ozone Layer Making Ozone interactive SMART Notebook Lesson: Earth's Atmosphere SMART Notebook Lesson: Origin of Earth's Atmosphere

		Online: MyEnvironmentalScience.com ● Video: Ozone Layer Under Repair ● 3-D Geo Tour – Discovery of the Ozone Hole ● 3-D Geo Tour – London's Charging Zones ● Inquiry Lab: What's in the Air? ● Inquiry Lab: Local UV Index Worksheet provided in "Shared File" covers following articles ● EPA: Common Air Pollutants ● EPA: Clean Air Act ● Air Now Assessments (teacher generated; included but not limited to) ● DO NOW's ● Exit Slips ● Quizzes (constructed response) ● Tests (multiple choice; constructed response)	
October *10 days*	The Hydrosphere	Central Case: Cleaning the Tides of San Diego and Tijuana p35 Central Case: Looking for Water in the Desert p419 Chapter 3, Lesson 3 Earth's Spheres Chapter 12, Lesson 2: Soil Degradation and Conservation Chapter 14, Lesson 1: Earth: The Water Planet Chapter 14, Lesson 2: Uses of Fresh Water Chapter 14, Lesson 3: Water Pollution Go Outside: Is the Rainwater acidic? P467 Quick Lab: Distribution of Earth's water p80 Ecological Footprints: Water use in showers p449 Online: MyEnvironmentalScience.com ● Video: Great Wall or Great Disaster?	My Environmental Science BrainPOP: The Water Cycle BrainPOP: Water Pollution EHP: Paving paradise article and lesson EHP: Streamside solutions article and lesson EPA: Local drinking water information NAS: Safe Drinking Water Water Cycle Animation

		• 3-D Geo Tour – The Colorado River Watershed • Inquiry Lab: Acid Rain and Seeds • Inquiry Lab: Watershed Boundaries • Inquiry Lab: The Water You Drink • Inquiry Lab: Testing Water Quality Assessments (teacher generated; included but not limited to) • DO NOW's • Exit Slips • Quizzes (constructed response) • Tests (multiple choice; constructed response)	
October November *10 days*	The Geosphere	Central Case: Mining for Cell Phones? P391 Chapter 3, Lesson 3 Earth's Spheres Chapter 9, Lesson 4: Natural Disasters Chapter 13, Lesson 1: Minerals and Rocks Go Outside: Classifying Rocks p396 Map It: Pangaea p77 Map It: Predicting Earthquakes p278 Ecological Footprints: Metal supplies p417 Online: MyEnvironmentalScience.com • Video: Volcano to Earthquake • 3-D Geo Tour – Dead Zones • Inquiry Lab: Age the Island • Inquiry Lab: Local Geology • Inquiry Lab: Mineral Identification • Inquiry Lab: Combating Erosion Assessments (teacher generated; included but not limited to) • DO NOW's • Exit Slips • Quizzes (constructed response)	My Environmental Science BrainPOP: Earthquakes BrainPOP: Plate Tectonics BrainPOP: The Rock Cycle BrainPOP: Volcanoes Interactive Timeline SMART Notebook Lesson: Earth's Surface SMART Notebook Lesson: Earth's Formation and History SMART Notebook Lesson: Layers of the Earth SMART Notebook Lesson: Plate Tectonics SMART Notebook Lesson: The Rock Cycle

		• Tests (multiple choice; constructed response)	
November *4 days*	Biogeochemical Cycles	Chapter 3, Lesson 1: Matter and the Environment Chapter 3, Lesson 2: Systems in Environmental Science Chapter 3, Lesson 4: Biogeochemical Cycles Online: MyEnvironmentalScience.com • Video: Wal-Mart's Green Revolution Assessments (teacher generated; included but not limited to) • DO NOW's • Exit Slips • Quizzes (constructed response) • Tests (multiple choice; constructed response)	My Environmental Science
December *4 days*	The Carbon Cycle	Chapter 3, Lesson 4: Biogeochemical Cycles Assessments (teacher generated; included but not limited to) • DO NOW's • Exit Slips • Quizzes (constructed response) • Tests (multiple choice; constructed response)	My Environmental Science BrainPOP: The Carbon Cycle Carbon Cycle Animation *Uncovering Student Ideas in Science (USIS)* Vol.3 – Rotting Apple, p.139.
December *4 days*	The Phosphorus Cycle	Central Case: The Gulf of Mexico's Dead Zone p63 Chapter 3, Lesson 4: Biogeochemical Cycles QuickLab: Cultural Eutrophication p437 Make A Difference: Phosphates in household p86 Assessments (teacher generated; included but not limited to) • DO NOW's • Exit Slips • Quizzes (constructed response) • Tests (multiple choice; constructed response)	My Environmental Science Discovery Education: Hypoxia: The O2 Blues

December *4 days*	The Nitrogen Cycle	Chapter 3, Lesson 4: Biogeochemical Cycles Ecological Footprints: Lawn Fertilizer p95 Online: MyEnvironmentalScience.com ● Inquiry Lab: Green vs. Conventional Cleaners Assessments (teacher generated; included but not limited to) ● DO NOW's ● Exit Slips ● Quizzes (constructed response) ● Tests (multiple choice; constructed response)	My Environmental Science BrainPOP: The Nitrogen Cycle Nitrogen Cycle Animation
December January *16 days*	Waste Management	Central Case: Transforming NY's Fresh Kills Landfill Chapter 19, Lesson 1: Municipal and Industrial Waste Chapter 19, Lesson 2: Minimizing Solid Waste Chapter 19, Lesson 3: Hazardous Waste Real Data: Radiation and Human Health p601 Quick Lab: Cost-benefit analysis p37 Quick Lab: Reduce, Re-use, Recycle p591 Ecological Footprints: State of Garbage in America p609 Unit 5 Project: Energy Audit, p610 Online: MyEnvironmentalScience.com ● Video: Bottled-Water Backlash ● 3- D Geotour of Fresh Kills Park with Google Earth ● Inquiry Lab: Where Waste Goes ● Inquiry Lab: Overpackaging ● Inquiry Lab: Observing a Compost ● Inquiry Lab: Making Recycled Paper Mock Trial Project Assessments (teacher generated; included but not limited to)	My Environmental Science BrainPOP: Recycling BrainPOP: Waste Management SMART Notebook Lesson: Human Impact on the Environment Film: *A Civil Action* (1998, rated PG-13)

		• DO NOW's • Exit Slips • Quizzes (constructed response) • Tests (multiple choice; constructed response)	
February *12 days*	The Sun	STAR-LAB Lessons (If available) Supplemental Investigations Assessments (teacher generated; included but not limited to) • DO NOW's • Exit Slips • Quizzes (constructed response) • Tests (multiple choice; constructed response)	My Environmental Science BrainPOP: Life Cycle of Stars BrainPOP: The Big Bang BrainPOP: The Sun Life cycle of a star Simple HR diagram
February March *16 days*	Seasons and Climate	Chapter 16, Lesson 1: Our Dynamic Climate Go Outside: Does the Temperature Change? P564 Quick Lab: How does the hot water move p459 Quick Lab: Does Latitude Affect the sun's rays? P486 Online: MyEnvironmentalScience.com • Video: Climate Change in our Backyards • Inquiry Lab: Collecting Climate Data Assessments (teacher generated; included but not limited to) • DO NOW's • Exit Slips • Quizzes (constructed response) • Tests (multiple choice; constructed response)	My Environmental Science BrainPOP: Climate Types BrainPOP: Seasons SMART Notebook Lesson: Weather and Climate *Uncovering Student Ideas in Science (USIS)* Vol.3 – Summer Talk, p177.
April May *16 days*	Climate Change	Central Case: Rising Seas May Flood the Maldive Islands Chapter 16, Lesson 2: Climate Change Chapter 16, Lesson 3: Effects of Climate Change Chapter 16, Lesson 4: Responding to Climate Change	My Environmental Science BrainPOP: Greenhouse effect EHP: Global warming and coral reefs article and lesson EHP: Kyoto Protocol article and lesson Global Warming – The Signs and the Science

		Real Data: Changing Temperature of the Atmosphere p493 Real Data: Carbon Dioxide from Fossil Fuels p530 Map It: Comparing Ecological Footprints p10 Ecological Footprints: comparing national footprints p33 Ecological Footprints: modes of transportation p319 Ecological Footprints: Annual carbon footprint p513 Online: MyEnvironmentalScience.com ● Video: Climate Change in our Backyards ● Inquiry Lab: Fossil Fuel Use ● Inquiry Lab: Modeling Greenhouse Gasses ● Inquiry Lab: Measuring the Effects of CO_2 Assessments (teacher generated; included but not limited to) ● DO NOW's ● Exit Slips ● Quizzes (constructed response) ● Tests (multiple choice; constructed response)	Greenhouse effect animation Keystone Curriculum Lesson: Climate Change Debate Keystone Curriculum Lesson: Personal Emissions Calculator SMART Notebook Lesson: Carbon Footprint
May June *16 days*	Alternative Energy	Central Case: Germany's Big Bet on Renewable Energy p549 Chapter 18, Lesson 1: Biomass and Geothermal Energy Chapter 18, Lesson 2: Hydropower and Ocean Energy Chapter 18, Lesson 3: Solar and Wind Energy Chapter 18, Lesson 4: Energy from Hydrogen Real Data: Biodiesel p552 Map It: Wind Patterns p568 Ecological Footprints: Oil consumption p547 Ecological Footprints: PV Cell cost p579 Online: MyEnvironmentalScience.com ● Video: Autos – The Nation that runs on Ethanol	My Environmental Science BrainPOP: Biofuels BrainPOP: Dams BrainPOP: Fuel Cells BrainPOP: Solar Energy BrainPOP: Wind Energy Fuel Cell Career and Education Center Keystone Curriculum Lesson: Biodiesel Fuel Keystone Curriculum Lesson: Defining Sustainability SMART Notebook Lesson: Human Impact on the Environment SMART Notebook Lesson: Renewable Energy

		• Video: Coalmines – Integral to the Economy • 3- D Geotour: Alaska's North Slope Controversy • 3-D Geotour: Embracing Solar and Wind Power • Inquiry Lab: Modeling Energy from Wind • Inquiry Lab: Comparing Biofuels • Inquiry Lab: Regional Renewable Energy • Inquiry Lab: Home Energy Use Assessments (teacher generated; included but not limited to) • DO NOW's • Exit Slips • Quizzes (constructed response) • Tests (multiple choice; constructed response)	SMART Notebook Lesson: Wind Energy

Modifications

Teacher Note: Teachers identify the modifications that they will use in the unit.

- Teachers will incorporate the appropriate modifications based on student individualized education plan, IEP, and/or 504 accomodations included but not solely limited to this modification and accomodation list.
- Restructure lesson using UDL principals (http://www.cast.org/our-work/about-udl.html#.VXmoXcfD_UA)
- Structure lessons around questions that are authentic, relate to students' interests, social/family background and knowledge of their community.
- Provide students with multiple choices for how they can represent their understandings (e.g. multisensory techniques-auditory/visual aids; pictures, illustrations, graphs, charts, data tables, multimedia, modeling).
- Provide opportunities for students to connect with people of similar backgrounds (e.g. conversations via digital tool such as SKYPE, experts from the community helping with a project, journal articles, and biographies).
- Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures (e.g. multiple representation and multimodal experiences).
- Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understandings.
- Use project-based science learning to connect science with observable phenomena.
- Structure the learning around explaining or solving a social or community-based issue.
- Provide ELL students with multiple literacy strategies.
- Collaborate with after-school programs or clubs to extend learning opportunities.

NGSS Resources

Hillside Township School District

(Click on the following to access the following resources.)

High School Earth and Space Sciences

Capstone Science Model Units

Appendix F Science & Engineering Practices

Appendix G Crosscutting Concepts

Appendix I Engineering Design in NGSS

Appendix L Connections to CCCS - Mathematics

Appendix M Connections to CCCS - Literacy in Science and Technical Subjects.