Unit 1: Introduction to Environmental Science

Content Area: **Science**
Course(s): **Environmental & Earth Science**
Time Period: **First Marking Period**
Length: **7 Weeks**
Status: **Published**

Unit Overview

April 22, 1970, marked the first nationwide celebration of Earth Day. During this event, more than 20 million people demonstrated their support for a new perspective of how our nation should address environmental issues. The legacy of Earth Day was clear and immediate. Environmental Science quickly found a home in both the public consciousness and the school science curriculum.
It is our responsibility, as science educators, to ensure that students gain the intellectual tools to engage fully in the current debates and decisions regarding local, national, and universal environmental issues.
The term “environment” is derived from the French word Environner, which means encircle or surrounding. Environmental science is the study of the interactions between the physical, chemical, and biological components of the environment, including their effects on all types of organisms but more often refers to human impact on the environment.

STAGE 1- DESIRED RESULTS

Standards- 2020 New Jersey Student Learning Standards- Science

SCI.9-12.HS-PS1-1	Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms.
SCI.9-12.HS-PS2-6	Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials.
SCI.9-12.HS-PS1-6	Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium.
SCI.9-12.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.
SCI.9-12.HS-ESS2-3	Develop a model based on evidence of Earth's interior to describe the cycling of matter by thermal convection.
SCI.9-12.HS-ESS2-7	Construct an argument based on evidence about the simultaneous coevolution of Earth's systems and life on Earth.
SCI.9-12.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.
SCI.9-12.HS-ESS3-2	Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.

SCI.9-12.HS-ESS3-4	Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.

Science and Engineering Practices

- Analyzing and Interpreting Data
- Asking Questions and Defining Problems
- Constructing Explanations and Designing Solutions
- Developing and Using Models
- Engaging in Argument from Evidence
- Obtaining, Evaluating, and Communicating Information
- Planning and Carrying Out Information
- Using Mathematics and Computational Thinking

Cross Cutting Concepts

- Cause and Effect
- Energy and Matter
- Influence of Engineering, Technology, and Science on Society and the Natural World
- Interdependence of Science, Engineering, and Technology
- Patterns
- Scale, Proportion, and Quantity
- Stability and Change
- Structure and Functions
- Systems and System Models

Disciplinary Core Ideas

Physical Sciences

- PS1A: Structure and Properties of Matter
- PS1B: Chemical Reactions
- PS1C: Nuclear Processes
- PS2A: Forces and Motion
- PS2B: Types of Interaction
- PS3A: Definitions of Energy
- PS3B: Conservation of Energy and Energy Transfer
- PS3C: Relationship Between Energy and Forces
- PS3D: Energy in Chemical Processes and Everyday Life
- PS4A: Wave Properties
- PS4B: Electromagnetic Radiation

- PS4C: Information Technologies and Instrumentation

Life Sciences

- LS1A: Structure and Functions
- LS1B: Growth and Development of Organisms
- LS1C: Organization for Matter and Energy Flow in Organisms
- LS1D: Information Processing
- LS2A: Interdependent Relationships in Ecosystems
- LS2B: Cycles of Matter and Energy Transfer in Ecosystems
- LS2C: Ecosystems Dynamics, Functioning, and Resilience
- LS2D: Social Interactions and Group Behavior
- LS3A: Inheritance of Traits
- LS3B: Variation of traits
- LS4A: Evidence of Common Ancestry and Diversity
- LS4B: Natural Selection
- LS4C: Adaptation
- LS4D: Biodiversity and Humans

Earth and Space Sciences

- ESS1A: The Universe and its Stars
- ESS1B: Earth and the Solar System
- ESS1C: The History of Planet Earth
- ESS2A: Earth Materials and Systems
- ESS2B: Plate Tectonics and Large-Scale Systems
- ESS2C: The Role of Water in Earth's Surface Processes
- ESS2D: Weather and Climate
- ESS2E: Biogeology
- ESS3A: Natural Resources
- ESS3B: Natural Hazards
- ESS3C: Human Impacts on Earth Systems
- ESS3D: Global Climate Change

Engineering. Technology. and Applications of Science

- ETS1A: Defining and Delimiting an Engineering Problem
- ETS1B: Developing Possible Solutioins
- ETS1C: Optimizing the Design Solution

Enduring Understanding

- Science is an organized way of studying the natural world and the knowledge gained from such studies.
- In order to have any impact, scientists must share their work at conferences and in journals.
- We can use science to study and understand the complex interactions between humans and their environment.
- Like all species on Earth, humans rely on a healthy, functioning planet for air, water, food, and shelter.
- The Earth operates as a set of complex, dynamic and interconnected systems, and is part of the all-encompassing system of the universe.
- Internal and external sources of energy drive Earth systems.
- Human population size can have adverse environmental effects along with increased resource consumption rates.
- In order to sustain our large human population, improvements in agriculture, public health, resource recovery and waste disposal are needed.

Standards	Students will know	Students will do	Suggested Activities/ Strategies
HS-ESS2-7	• Environmental scientists study how the natural world works, and how humans and the environment affect each other.	• Explain the focus of environmental science.	• Define and describe the field of environmental science.
HS-ESS2-7	• In the last several hundred years, both human population and resource consumption have increased dramatically.	• Describe the recent trends in human population and resource consumption.	• Analyze a current human population growth graph, and extrapolate the growth rate by the year 2050, *(Pearson Environmental Science: Your World, Your Turn,* 2011, p.8*).* • Figure 7: Relative Footprints, *(Pearson Environmental Science: Your World, Your Turn,* 2011, p.10*).* • Case Study*:* Easter Island*, (Pearson Environmental Science: Your World, Your Turn,* 2011, p.28*).*
HS-ESS2-7	• Science is both an organized and methodical way of studying the natural world and the knowledge gained from such studies.	• Explain what science is.	• Open discussion about the role of science in a society. • Activity: The Nature of Science. The purpose of this activity is to get the students to think about the nature of science, and also, to show the importance of being an active participant in the learning process.
HS-ESS2-7	• The process of science involves making observations, asking questions, developing hypotheses, making and testing predictions, and analyzing and	• Describe the process of science.	• Apply the scientific method to different types of problems and inquiries. • Activity: The FDA's Drug Review Process.

	interpreting results.		• Case Study: The Ozone Depletion.
HS-ESS2-7	• The scientific community, through peer review and replication, helps to verify the accuracy of results and contributes to the establishment of scientific theories.	• Describe the major role of the scientific community.	• Explore renowned scientific journals and magazines. • Explore major scientific projects managed by a scientific organization such as NASA. • Students to classify various scientific statements as, laws, theories, hypothesis, or observations.
HS-ESS2-7	• Environmental ethics explores how environmental science interacts with and is guided by, a society's morals and principles.	• Explain the study of environmental ethics.	• Open discussion about ethics of the following environmental issues: - Climate Change - Global Warming - Fossil fuel - Local and National Laws - International Treaties and Accords • Use the format: claims, evidence, reasoning, and rebuttal to investigate ethical issues.
HS-ESS3-2	• Supply and demand and cost-benefit analysis are two economic concepts that greatly contribute to decision-making.	• Describe two basic concepts of economics.	• Students to explore the five top career opportunities in environmental economics - Environmental consulting - Project Management - Resources Policy Advocacy - Agricultural Economics - Resources Management
HS-ESS3-3	• All economies depend on	• Explain the	• Lab: Cost-Benefit Analysis,

	the environment for resources and for the management of wastes, but these connections are often overlooked.	relationship between economics and the environment.	*(Pearson Environmental Science: Your World, Your Turn,* 2011, p.37*).* • Analyze related charts and graphs. • Apply related mathematical principles.
HS-ESS3-2	• A new trend in economics is the recognition that suppliers of goods and services need to consider how to conserve resources and reduce harm to the environment.	• Describe ways that economies are working toward sustainability.	• Compare and contrast market value and non-market value. • Lab: Ecolabels
HS-ESS3-4	• Environmental policy makes use of science, ethics, economics, and the political process to solve environmental problems.	• Explain the purpose of the environmental policy.	• Group discussion about current ethical issues in environmental science.
HS-ESS3-4	• Throughout its history, the United States government has reinvented its approach to the relationship between the nation's goals and the environment.	• Describe the history of U.S. environmental policy.	• Search U.S. environmental laws and regulations. • A brief history of U.S. policies regarding environmental protestation, *(Pearson Environmental Science: Your World, Your Turn,* 2011, p.44*).*
HS-ESS3-4	• Modern U.S. environmental policy	• Describe the direction of current	• Search current data regarding global warming and climate

	reveals lessons learned from past misuses of resources and strives for a sustainable future.	U.S. environmental policy.	change. • Open discussion about current debate addressing environmental protection laws and regulations.
HS-ESS3-4	• International organizations, laws, and treaties help governments of the world come to an agreement on environmental issues.	• Identify major international institutions involved in environmental policy.	• Compare and contrast national and international laws regarding environmental issues. • Figure 10: Treaties, *(Pearson Environmental Science: Your World, Your Turn,* 2011, p.49*).*
HS-ESS3-4	• Approaches to the environmental policy may include direct laws from a government body or policies with economic incentives.	• Discuss different approaches to environmental policy.	• Search local environmental laws and regulations. • Real Data: Analyzing Plans, *(Pearson Environmental Science: Your World, Your Turn,* 2011, p.51*).*
HS-ESS3-4	• Steps of the environmental policy process include identifying a problem, finding the cause, proposing solutions, getting organized, gaining access to policymakers, and guiding the solution to law.	• List the steps involved in the environmental policy process.	• Apply the steps of issuing a new environmental law or policy to a current local or national problem.
HS-PS1-1	• Atoms and elements are the building blocks of chemistry.	• Differentiate among an atom, an element, a	• Activity: Atomic Structure. • Compare and contrast different

		molecule, and a compound.	models of the atom.
HS-LS1-6	• Proteins, nucleic acids, carbohydrates, and lipids are the building blocks of life.	• Discuss how various macromolecules are essential to life.	• Analyze the atomic structures of different types of macromolecules.
HS-ESS2-5	• Water is a unique compound with several unusual properties that make it essential to life.	• Identify some unusual properties of water.	• Lab: Properties of Water. • Lab: pH Scale.
HS-ESS2-2	• An output of one of Earth's systems is often also an input to that or another system.	• Describe two major ways that Earth's systems interact.	• Compare and contrast negative and positive feedback loops. • Figure 12: Negative Feedback Loop, *(Pearson Environmental Science: Your World, Your Turn,* 2011, p.73*).*
HS-ESS2-2	• Earth's geosphere, biosphere, atmosphere, and hydrosphere are defined according to their functions in Earth's systems.	• Define Earth's geosphere, lithosphere, biosphere, atmosphere, and hydrosphere.	• Activity: Earth Structure Model.
HS-ESS2-3	• Earth's geosphere consists of the crust, the mantle, and the core.	• Describe the parts of Earth's geosphere.	• Pangaea Model: Make a table that lists the modern continents and describes the animal fossils that are found on each, according to the provided maps and graphs. • Figure 15: Plate Tectonic Map, *(Pearson Environmental Science: Your World, Your Turn,* 2011, p.77*).*

HS-ESS2-7	• Earth's biosphere and atmosphere are the living Earth and the ocean of gasses that supports and protects it.	• Describe Earth's biosphere and atmosphere.	• Atmospheric Zones Model.
HS-ESS2-5	• Water cycles through the lithosphere, biosphere, and atmosphere endlessly.	• Discuss the water cycle.	• Lab: Distribution of Earth's Water, *(Pearson Environmental Science: Your World, Your Turn,* 2011, p.80*).* • Figure 19: The Water Cycle, *(Pearson Environmental Science: Your World, Your Turn,* 2011, p.81*).*
HS-LS2-4	• Nutrients cycle through the environment endlessly.	• Explain how the law of Conservation of Matter applies to the behavior of nutrients in the environment.	• Lab: Conservation of Matter.
HS-LS2-4	• Producers play vital roles in the cycling of carbon through the environment.	• Describe the carbon cycle.	• Analyze the interrelationships and interdependencies among different organism; explain how these relationships contribute to the stability of the ecosystem. • Figure 21: Carbon Cycle, *(Pearson Environmental Science: Your World, Your Turn,* 2011, p.84*).*
HS-LS2-4	• The phosphorus cycle keeps phosphorus availability naturally low.	• Describe the events of the phosphorus cycle.	• Figure 23: Phosphorus Cycle, *(Pearson Environmental Science: Your World, Your Turn,* 2011, p.86*).*

			• Analyze the interrelationships and interdependencies among different organism, and explain how these relationships contribute to the stability of the ecosystem.
HS-LS2-4	• The nitrogen cycle relies on bacteria that make nitrogen useful to organisms and bacteria that can return it to the atmosphere.	• Explain the importance of bacteria to the nitrogen cycle.	• Figure 24: Nitrogen Cycle, *(Pearson Environmental Science: Your World, Your Turn,* 2011, p.87*).* • Analyze the interrelationships and interdependencies among different organism, and explain how these relationships contribute to the stability of the ecosystem.

Predictable Misconceptions

- Predator and prey populations are similar in size.
- The relative sizes of predator and prey populations have no bearing on the size of the other.
- Varying the population size of a species may not affect an ecosystem because some organisms are not important.
- Ecosystems are not a functioning whole, but simply a collection of organisms.
- Species coexist in ecosystems because of their compatible needs and behaviors; they need to get along.
- Losing a species does not affect humans.
- All species have been discovered.
- Individuals develop traits in response to the needs of other individuals.
- Species have always gone extinct so we do not need to worry about a few animals or plants disappearing.

Modifications
• IEP guideline and modification for classified students. • Extended time for struggling students. • When available, assignments are to be sent electronically to online accounts and MacBook Air. • Special accommodations for students with physical or visual impairments. • Differentiated instruction.
Suggested Case Studies
• A Watery Balancing Act, *(Pearson Environmental Science: Your World, Your Turn,* 2011, p. xxii*).* • Fixing a Hole in the Sky, *(Pearson Environmental Science: Your World, Your Turn,* 2011, p.3*).* • Cleaning the Tides of San Diego and Tijuana, *(Pearson Environmental Science: Your World, Your Turn,* 2011, p.33*).* • The Gulf of Mexico Dead Zone, *(Pearson Environmental Science: Your World, Your Turn,* 2011, p.63*).*

Essential Questions

- How am I connected to the Earth and other living organisms?
- How can we best balance our own interest and needs with the health of the environment?
- How do scientists uncover and solve environmental problems?
- How does environmental science help us understand the natural world?
- What does it mean to "do science"?
- What happens to a scientific study after data has been gathered and the results are analyzed?
- How is sustainability affected by economics?
- How do environmental policies protect the environment?
- How can governments work with one another and citizens to form sound environmental policy?

- How do the nonliving parts of Earth's systems provide the basic materials to support life?
- What properties of matter are most important to environmental systems?
- What types of systems play roles in environmental science?
- What are the characteristics of Earth's major spheres?
- How do nutrients cycle through the environment?

STAGE 2- EVIDENCE OF LEARNING

Formative Assessment

- 3- Minute Pause
- Exit Card / Ticket
- Index Card Summaries
- Journal Entry
- Misconception Check
- Observation
- One Minute Essay
- Portfolio Check
- Questions & Answers
- Quiz
- Self-Assessment
- Think-Pair-Share
- Web or Concept Map

Authentic Assessments

- Chapter 1 Assessment, *(Pearson Environmental Science: Your World, Your Turn,* 2011, p.31-32).
- Chapter 2 Assessment, *(Pearson Environmental Science: Your World, Your Turn,* 2011, p.60-61).
- Chapter 3 Assessment, *(Pearson Environmental Science: Your World, Your Turn,* 2011, p.93-94).
- E-text: Chapter 1,2,3, Test A, B.
- Unit 1: E-Text, Self-test Assessment, *(Pearson Environmental Science: Your World, Your Turn,*

2011).

- Teacher–prepared Case Study Assessment.
- Student Workbook: Pearson: Chapter 1, 2, 3, *(Pearson Environmental Science: Your World, Your Turn,* 2011, p. 1: 55).
- Related Labs and Activities.

Benchmark Assessments

- Unit One: Final Test
- Unit One: Project Assessment
- Final Exam

STAGE 3- LEARNING PLAN

Instructional Map

Unit	Time Frame	Date	Marking Period
1	7 Weeks: • 5 Weeks of Instruction. • 2 Weeks of Formative and Summative Assessment.	September and October	1st

- Assess students' prior knowledge of the related topics in the unit (Pre-Assessment).
- Unit Case Study:

- Preview the case study.

- Read the case study.

- Assimilate the facts.

- Gather additional information.

- Map the contents.

- Make local connection.

- Create a project.

- Teacher to use formative assessment and feedback to improve students' learning.
- Students to use the textbook, or E-text, for reading and definitions.
- Teacher to use PowerPoint and multi-sensory media to introduce concepts and main points.
- Teacher to use the suggested activities, in the table above, for teaching each concept in the unit.
- Students to connect and relate unit topics to their local communities and environment, when possible.
- Students to use study guides, homework, and students' workbook for reference and feedback.
- Apply labs and outside activities as indicated in the table above.
- Teacher to guide students through authentic resources during their conduction of research and inquiries.
- Students to use graphs, charts, data table, and maps throughout the unit as indicated in the table above.
- At the end of the unit, students should present scientifically sound projects supported by evidence, data, charts, and maps.
- Unit summative assessment.

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Modification/Differentiation of Instruction

Differentiation Strategies for Special Education Students

- Remove unnecessary material, words, etc., that can distract from the content
- Use of off-grade level materials
- Provide appropriate scaffolding
- Limit the number of steps required for completion
- Time allowed
- Level of independence required
- Tiered centers, assignments, lessons, or products
- Provide appropriate leveled reading materials
- Deliver the content in "chunks"
- Varied texts and supplementary materials
- Use technology, if available and appropriate
- Varied homework and products
- Varied questioning strategies
- Provide background knowledge
- Define key vocabulary, multiple-meaning words, and figurative language.
- Use audio and visual supports, if available and appropriate
- Provide multiple learning opportunities to reinforce key concepts and vocabulary
- Meet with small groups to reteach idea/skill

- Provide cross-content application of concepts
- Ability to work at their own pace
- Present ideas using auditory, visual, kinesthetic, & tactile means
- Provide graphic organizers and/or highlighted materials
- Strategy and flexible groups based on formative assessment
- Differentiated checklists and rubrics, if available and appropriate

Differentiation Strategies for Gifted and Talented Students

- Increase the level of complexity
- Decrease scaffolding
- Variety of finished products
- Allow for greater independence
- Learning stations, interest groups
- Varied texts and supplementary materials
- Use of technology
- Flexibility in assignments
- Varied questioning strategies
- Encourage research
- Strategy and flexible groups based on formative assessment or student choice
- Acceleration within a unit of study
- Exposure to more advanced or complex concepts, abstractions, and materials
- Encourage students to move through content areas at their own pace
- After mastery of a unit, provide students with more advanced learning activities, not more of the same activity
- Present information using a thematic, broad-based, and integrative content, rather than just single-subject areas

Differentiated Strategies for ELL Students

- Remove unnecessary materials, words, etc., that can distract from the content
- Provide appropriate scaffolding
- Limit the number of steps required for completion
- Gradually increase the level of independence required
- Tiered centers, assignments, lessons, or products
- Provide appropriate leveled reading materials
- Deliver the content in “chunks”
- Varied texts and supplementary materials, including visuals
- Use technology, if available and appropriate
- Differentiate homework and products
- Varied questioning strategies

- Provide background knowledge
- Define key vocabulary, multiple-meaning words, and figurative language.
- Use audio and visual supports, if available and appropriate
- Provide multiple learning opportunities to reinforce key concepts and vocabulary
- Meet with small groups to reteach idea/skill
- Provide cross-content application of concepts
- Allow students to work at their own pace
- Presenting ideas through auditory, visual, kinesthetic, & tactile means
- Role play
- Provide graphic organizers, highlighted materials
- Strategy and flexible groups based on formative assessment

Differentiation Strategies for At Risk Students

- Remove unnecessary materials, words, etc., that can distract from the content
- Provide appropriate scaffolding
- Limit the number of steps required for completion
- Gradually increase the level of independence required
- Tiered centers, assignments, lessons, or products
- Provide appropriate leveled reading materials
- Deliver the content in “chunks”
- Varied texts and supplementary materials
- Use technology, if available and appropriate
- Differentiate homework and products
- Varied questioning strategies
- Provide background knowledge
- Define key vocabulary, multiple-meaning words, and figurative language
- Use audio and visual supports, if available and appropriate
- Provide multiple learning opportunities to reinforce key concepts and vocabulary
- Meet with small groups to reteach idea/skill
- Provide cross-content application of concepts
- Presenting ideas through auditory, visual, kinesthetic, & tactile means
- Provide graphic organizers and/or highlighted materials
- Strategy and flexible groups based on formative assessment

504 Plans

Students can qualify for 504 plans if they have physical or mental impairments that affect or limit any of their abilities to:

- walk, breathe, eat, or sleep

- communicate, see, hear, or speak
- read, concentrate, think, or learn
- stand, bend, lift, or work

Examples of accommodations in 504 plans include:

- preferential seating
- extended time on tests and assignments
- reduced homework or classwork
- verbal, visual, or technology aids
- modified textbooks or audio-video materials
- behavior management support
- adjusted class schedules or grading
- verbal testing
- excused lateness, absence, or missed classwork
- pre-approved nurse's office visits and accompaniment to visits
- occupational or physical therapy

Modification Strategies

- Cooperative Grouping
- Extended Time
- Highlighted Text
- Interactive Notebook
- Modified Test
- Oral Directions
- Preferential Seating
- Re-direct
- Repeated Drill and Practice
- Shortened Assisgnment
- Teacher Notes
- Use of Additional Reference Materials

Horizontal Intergration- Interdisciplinary Connections

See Appendix

Vertical Integration- Discipline Mapping

- **Middle School**

- 6th Grade: Weather and Water

- 7th Grade: Populations and Ecosystems, Planetary Science

- 8th Grade: Earth History

- **High School**

- Biology

- Anatomy and Physiology

- Chemistry

- Physics

- Forensic Science

- Zoology

- Human Impact on the Environment

Additional Materials

- ***Lab Manual and Equipment***
- ***Safety Rules and Equipment***
- ***Pearson: Environmental Science, Your World, Your Turn, 2011***
- ***Textbook, Students' Workbook, and Lab Manual***
- ***E-texts, Teacher Resources, and Students Resources***
- ***Environmental Protection Agency http://www.epa.gov***
- ***Food and Drug Administration, http://www.fda.gov***
- ***National Oceanographic and Atmospheric Administration (NOAA)***
- ***National Oceanographic and Atmospheric Administration (NOAA)***
- ***National Environmental Satellite, Data and Information Service (NESDIS)***
- ***National Marine Fisheries Service (NMFS)***
- ***National Ocean Service (NOS)***
- ***National Weather Service (NWS)***
- ***Office of Oceanic and Atmospheric Research (OAR)***
- ***Department of Health and Human Services (HHS)***

- ***Agency for Toxic Substances and Disease Registry (ATSDR)***
- ***Centers for Disease Control and Prevention (CDCP)***
- ***National Institutes of Health (NIH)***
- ***New Jersey Department of Environmental Protection***
- ***New Jersey Division of Fish, Game and Wildlife***
- ***US Fish and Wildlife Service Offices in New Jersey***
- ***Nature, http://www.nature.com/nature/index.html***
- ***Conservation Fund, http://www.conservationfund.org***
- ***Conservation International, http://www.conservation.org***
- ***Earth Justice, http://earthjustice.org***
- ***Environmental Defense Fund, https://www.edf.org***
- ***Natural Resources Defense Council, http://www.nrdc.org***
- ***Oceana, http://oceana.org***
- ***Rainforest Alliance, http://www.rainforest-alliance.org***
- ***Sierra Club Foundation, http://www.sierraclubfoundation.org***
- ***Union of Concerned Scientists, http://www.ucsusa.org***
- ***World Resources Institute, http://www.wri.org***
- ***Discovery: http://www.discovery.com***