AP Environmental Science Curriculum
Summit High School
2021-2022
Written by:
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	**Unit 1: The Living World: Ecosystems**		
Grade and Subject	11th-12th Grade APES	**Unit Instructional Time**	~2.5 weeks
Unit Title (Topic)	The Living World: Ecosystems		

Big Ideas

Matter and Energy Transformations: Food is required for energy and building cellular materials. Organisms in an ecosystem have different ways of obtaining food, and some organisms obtain their food directly from other organisms.

Interdependence: All animals and most plants depend on both other organisms and their environment to meet their basic needs.

Evolution and Diversity: Sometimes, differences between organisms of the same kind provide advantages for surviving and reproducing in different environments. These selective differences may lead to dramatic changes in characteristics of organisms in a population over extremely long periods of time.

Standard 5.3 Life Sciences: All students will understand that life science principles are powerful conceptual tools for making sense of the complexity, diversity, and interconnectedness of life on Earth. Order in natural systems arises in accordance with rules that govern the physical world, and the order of natural systems can be modeled and predicted through the use of mathematics.

Identify Unit Topics and Learning Goals: List main unit concepts related to grade level PEs/standards that support student learning goals in figuring out the anchoring phenomenon; revise as needed.

ERT-1.A Explain how the availability of resources influences species interactions
ERT-1.B Describe the global distribution and principal environmental aspects of terrestrial biomes.
ERT-1.C Describe the global distribution and principal environmental aspects of aquatic biomes.
ERT-1.D Explain the steps and reservoir interactions in the carbon cycle.
ERT-1.E Explain the steps and reservoir interactions in the nitrogen cycle.
ERT-1.F Explain the steps and reservoir interactions in the phosphorus cycle.

ERT-1.G Explain the steps and reservoir interactions in the hydrologic cycle
ENG-1.A Explain how solar energy is acquired and transferred by living organisms.
ENG-1.B Explain how energy flows and matter cycles through trophic levels
ENG-1.C Determine how the energy decreases as it flows through ecosystems.
ENG-1.D Describe food chains and food webs, and their constituent members by trophic level.

Identify Enduring Understanding: What will students understand about the big ideas?

ERT-1 Ecosystems are the result of biotic and abiotic interactions.
ENG-1 Energy can be converted from one form to another.

Examples, Outcomes, and Assessments

Instructional Focus:

- Describing the differences between abiotic and biotic factors in an ecosystem.
- Describing the range of tolerance of certain species and what limiting factors determine this range.
- Explaining how biotic factors depend on abiotic factors for survival.
- Describing the levels of organization in an ecosystem from species to biosphere.
- Explaining the difference between a habitat and a niche.
- Discussing the role of natural selection in evolution.
- Understanding reproductive potential and its effects on the timing of evolution.
- Discussing how insects become resistant to pesticides and how bacteria become resistant to antibiotics through natural selection.
- Explaining the role of a keystone species in an environment and the effects of removing that keystone species due to human interference.
- Describing energy requirements of organisms
- Explaining the different trophic levels in an energy pyramid/food web.
- Explaining how energy not transferred is lost as heat
- Describing how the Earth is one interconnected system.
- Discussing the importance of the carbon cycle and how the burning of fossil fuels contributes to too much carbon dioxide within the atmosphere.
- Explaining how plants convert nitrogen into a more usable form.
- Explaining the different climates of the world's terrestrial biomes
- Discussing how plants and animals are adapted to survive in their biome
- Discussing how humans have altered our world's biomes
- Differentiating types of aquatic ecosystems
- Describing various freshwater life zones

Instructional Strategies:

Interdisciplinary Connections

- Connects to Biological Science
- Biodiversity loss throughout human history.
- Laws relating to environmental protection.

Technology Integration

- Natural Selection Simulation
- Biodiversity research project

Global Perspectives

- Global Biodiversity Loss.
- Global Conservation Practices

Sample Assessments

- Biogeochemical Webquest
- Biome speed dating game
- Symbiosis Station Activity
- World Biome Distribution Map
- Analyzing niche of warbler species to understand niche.
- Reproductive potential lab.
- Wolf Case Study - looking at keystone species
- Build a food web and energy pyramid to discuss energy transfer.
- Diagram the carbon cycle, nitrogen cycle, and phosphorus cycle and explain human interference/impact
- Observe ecological succession and read about The Pine Barrons, NJ, or other local case study (Great Swamp or NYC).
- Practice Free Response Questions - Cycles

Summative Assessment:

Unit 1 Test (30 MC & 1 FRQ)

Lessons

Lesson 1: Introduction to Environmental Science
Lesson 2: Organization of Life
Lesson 3: Biomes
Lesson 4: Biogeochemical Cycles
Lesson 5: Ecological Pyramids

1.d.1. Science and Engineering Practices (SEP) (skills)	1.d.2. Disciplinary Core Ideas (DCI) (content)	1.d.3. Crosscutting Concepts (CCC) (connections)

HS-ETS1-2. Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering. 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.	ETS1.A: Defining and Delimiting Engineering Problems ETS1.B: Developing Possible Solutions LS1.C: Organization for Matter and Energy Flow in Organisms	Systems and System Models Energy and Matter Influence of Science, Engineering and Technology on Society and the Natural World

Unit 2: The Living World: Biodiversity

Grade and Subject	11th-12th Grade APES	**Unit Instructional Time**	~2 weeks
Unit Title (Topic)	The Living World: Biodiversity		

Big Ideas

Matter and Energy Transformations: Food is required for energy and building cellular materials. Organisms in an ecosystem have different ways of obtaining food, and some organisms obtain their food directly from other organisms.

Interdependence: All animals and most plants depend on both other organisms and their environment to meet their basic needs.

Evolution and Diversity: Sometimes, differences between organisms of the same kind provide advantages for surviving and reproducing in different environments. These selective differences may lead to dramatic changes in characteristics of organisms in a population over extremely long periods of time.

Standard 5.3 All students will understand that life science principles are powerful conceptual tools for making sense of the complexity, diversity, and interconnectedness of life on Earth. Order in natural systems arises in accordance with rules that govern the physical world, and the order of natural systems can be modeled and predicted through the use of mathematics.

Identify Unit Topics and Learning Goals: List main unit concepts related to grade level PEs/standards that support student learning goals in figuring out the anchoring phenomenon; revise as needed.

ERT-2.A Explain levels of biodiversity and their importance to ecosystems.
ERT-2.B Describe ecosystem services.
ERT-2.C Describe the results of human disruptions to ecosystem services
ERT-2.D Describe island biogeography
ERT-2.E Describe the role of island biogeography in evolution
ERT-2.F Describe ecological tolerance

ERT-2.G Explain how natural disruptions, both short and long-term, impact an ecosystem.
ERT-2.H Describe how organisms adapt to their environment
ERT-2.I Describe ecological succession.
ERT-2.J Describe the effect of ecological succession on ecosystems.

Identify Enduring Understanding: What will students understand about the big ideas?

ERT-2 Ecosystems have structure and diversity that change over time.

Examples, Outcomes, and Assessments

Instructional Focus:

- Discuss the different levels of biodiversity
- Discussing how biodiversity can prevent the spread of disease
- Discuss the differences in monocultures vs. polycultures
- Discuss how biodiversity can impact an ecosystem's resilience
- Discussing the steps of primary and secondary ecological succession

Instructional Strategies:

Interdisciplinary Connections

- Connects to Biological Science

Technology Integration

- Ecosystem Services Worksheet
- Videos on Succession

Global Perspectives

- Studying succession and how the world's ecosystems are formed

Sample Assessments

- Ecosystem Services Worksheet
- Biodiversity Activity - showing disease in a monoculture vs. polyculture environment
- Succession Worksheet
- Free Response Questions about Succession
- Disaster Science

Summative Assessment:

Unit 2 Test (30 MC & 1 FRQ)

Lessons

Lesson 1: Biodiversity
Lesson 2: Ecosystem Services
Lesson 3: Disasters and Disaster Science/Ecosystem Resilience
Lesson 4: Succession

1.d.1. Science and Engineering Practices (SEP) (skills)	1.d.2. Disciplinary Core Ideas (DCI) (content)	1.d.3. Crosscutting Concepts (CCC) (connections)

HS-ETS1-2. Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering. 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.	ETS1.A: Defining and Delimiting Engineering Problems ETS1.B: Developing Possible Solutions LS1.C: Organization for Matter and Energy Flow in Organisms	Systems and System Models Energy and Matter Influence of Science, Engineering and Technology on Society and the Natural World

Unit 3: Populations

Grade and Subject	11th-12th Grade APES	**Unit Instructional Time**	~2 weeks
Unit Title (Topic)	Populations		

Big Ideas

Matter and Energy Transformations: Food is required for energy and building cellular materials. Organisms in an ecosystem have different ways of obtaining food, and some organisms obtain their food directly from other organisms.

Interdependence: All animals and most plants depend on both other organisms and their environment to meet their basic needs.

Evolution and Diversity: Sometimes, differences between organisms of the same kind provide advantages for surviving and reproducing in different environments. These selective differences may lead to dramatic changes in characteristics of organisms in a population over extremely long periods of time.

5.3 Life Science: All students will understand that life science principles are powerful conceptual tools for making sense of the complexity, diversity, and interconnectedness of life on Earth. Order in natural systems arises in accordance with rules that govern the physical world, and the order of natural systems can be modeled and predicted through the use of mathematics.

Identify Unit Topics and Learning Goals: List main unit concepts related to grade level PEs/standards that support student learning goals in figuring out the anchoring phenomenon; revise as needed.

ERT-3.A Identify differences between generalist and specialist species
ERT-3.B Identify differences between K- and r-selected species.
ERT-3.B Identify differences between K- and r- selected species.

ERT-3.C Explain survivorship curves
ERT-3.D Describe carrying capacity.
ERT-3.E Describe the impact of carrying capacity on ecosystems.
ERT-3.F Explain how resource availability affects population growth.
EIN-1.A Explain age structure diagrams.
EIN-1.B Explain factors that affect total fertility rate in human populations.
EIN-1.C.1 Explain how human populations experience growth and decline.
EIN-1.D Define the demographic transition.

Identify Enduring Understanding: What will students understand about the big ideas?

RT-3 Populations change over time in reaction to a variety of factors
EIN-1 Human populations change in reaction to a variety of factors, including social and cultural factors.
Students will understand that…
• Various reproductive patterns exist that are important for that particular organisms survival.
• Predation, mutualism, commensalism, parasitism, are all interactions that help control populations.
• Limiting factors determine not only what types of organisms can live in a given location, but also the number of organisms that can be supported (K).
• Three survivorship curves exist, late loss, constant loss, and early loss.
• R-selective species are able to adapt quickly, are small, reproduce early in life, frequently with large litters and have a short lifespan.
• K-selective species reproduce later in life with longer gestational periods, fewer offspring, care for young and live longer

Examples, Outcomes, and Assessments

Instructional Focus:
• Identifying reproductive patterns.
• Assessing resources to determine carrying capacity.
Instructional Strategies:
Interdisciplinary Connections
• Sociology and societal norms of family and family planning.
• History and population changes. Technology Integration
• Use of computer software to predict growth rate, and carrying capacity
due to limiting factors.

Sample Assessments

• Population Graphing Activity
• Human Population Worksheet
• Material World Activity
• Age Structure Diagram Worksheet
• Demographic Transition Worksheet
• Don’t Panic Video Worksheet
Summative Assessment:
Unit 3 Test (30 MC & 1 FRQ)

Lessons

Lesson 1: Population Dynamics in Ecosystems
Lesson 2: Human Population Dynamics
Lesson 3: Material World- Looking at consumption across different developing and developed countries
Lesson 4: Age Structure Diagrams
Lesson 5: Demographic Transition

1.d.1. Science and Engineering Practices (SEP) (skills)	1.d.2. Disciplinary Core Ideas (DCI) (content)	1.d.3. Crosscutting Concepts (CCC) (connections)
HS-ETS1-2. Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering. 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.	ETS1.A: Defining and Delimiting Engineering Problems ETS1.B: Developing Possible Solutions LS1.C: Organization for Matter and Energy Flow in Organisms	Systems and System Models Energy and Matter Influence of Science, Engineering and Technology on Society and the Natural World

Unit 4: Earth Systems and Resources

Grade and Subject	11th-12th Grade APES	**Unit Instructional Time**	~2 weeks
Unit Title (Topic)	Earth Systems and Resources		

Big Ideas
History of Earth: From the time that Earth formed from a nebula 4.6 billion years ago, it has been evolving as a result of geologic, biological, physical, and chemical processes.
Properties of Earth Materials: Earth's composition is unique, is related to the origin of our solar system, and provides us with the raw resources needed to sustain life.
Tectonics: The theory of plate tectonics provides a framework for understanding the dynamic processes within and on Earth.
Biogeochemical Cycles: The biogeochemical cycles in the Earth systems include the flow of microscopic and macroscopic resources from one reservoir in the hydrosphere, geosphere, atmosphere, or biosphere to another, are driven by Earth's internal and external sources of energy, and are impacted by human activity.

5.4 Earth Systems Science: All students will understand that Earth operates as a set of complex, dynamic, and interconnected systems, and is a part of the all-encompassing system of the universe.

Identify Unit Topics and Learning Goals: List main unit concepts related to grade level PEs/standards that support student learning goals in figuring out the anchoring phenomenon; revise as needed.

ERT-4.A Describe the geological changes and events that occur at convergent, divergent, and transform plate boundaries.
ERT-4.B Describe the characteristics and formation of soil.
ERT-4.C Describe similarities and differences between properties of different soil types
ERT-4.D Describe the structure and composition of the Earth's atmosphere.
ERT-4.E Explain how environmental factors can result in atmospheric circulation.
ERT-4.F Describe the characteristics of a watershed.
ENG-2.A Explain how the sun's energy affects the Earth's surface
ENG-2.B Describe how the Earth's geography affects weather and climate.
ENG-2.C Describe the environmental changes and effects that result from El Niño or La Niña events (El Niño–Southern Oscillation).

Identify Enduring Understanding: What will students understand about the big ideas?

ERT-4 Earth's systems interact, resulting in a state of balance over time.
ENG-2 Most of the Earth's atmospheric processes are driven by input of energy from the sun.
Students will…
• 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.
• Soils are at the interface of the Earth systems, linking together the biosphere, geosphere, atmosphere, and hydrosphere.
• Soils form through primary succession and soil formation is a very time consuming process.
• Fertile soil takes 100s of years to form but can depleted quickly due to erosion, overgrazing, deforestation, unsound farming practices, and urbanization.
• Geologic processes are a naturally occurring process. Humans are impacted due to building in unsound locations.
• Soils can be characterized based on composition and soil horizons.
• Soil structure can be used to help classify/ characterize biomes and ecosystems.

Examples, Outcomes, and Assessments

Instructional Focus:
• Identifying the various geologic processes that have shaped today's Earth.
• Explaining humans impact on geologic formations, and the implications they may have on humans.
• Discussing the severe implications of soil erosions on many aspects of life.
Instructional Strategies:
Interdisciplinary Connections
• Foods
• Chemistry
• International affairs
Technology Integration

• Use of various probes to assess soil chemistry.

Global Perspectives

• Soil composition is different in every part of the world. With analysis of current soil composition we can globally determine the best locations for food production.

Sample Assessments

• Porosity Lab/Gizmo
• Rock Cycle Station Activity
• Soil Webquest
• Soil Lab
• Atmosphere Diagram
• Seasons Gizmo
• Wind Webquest
• El Nino/La Nina Webquest

Summative Assessment:
Unit 4 Test (30-35 MC & 1 FRQ)

Lessons

Lesson 1: Layers of the Atmosphere
Lesson 2: Soil- Porosity vs. Permeability
Lesson 3: Rock Cycle
Lesson 4: Wind Patterns and Seasons
Lesson 5: El Nino & La Nina

1.d.1. Science and Engineering Practices (SEP) (skills)	**1.d.2. Disciplinary Core Ideas (DCI) (content)**	**1.d.3. Crosscutting Concepts (CCC) (connections)**
HS-ETS1-2. Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering. 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.	ETS1.A: Defining and Delimiting Engineering Problems ETS1.B: Developing Possible Solutions LS1.C: Organization for Matter and Energy Flow in Organisms	Systems and System Models Energy and Matter Influence of Science, Engineering and Technology on Society and the Natural World

Unit 5: Land and Water Use

Grade and Subject	11th-12th Grade APES	**Unit Instructional Time**	~3 weeks
Unit Title (Topic)	Land and Water Use		

Big Ideas

Matter and Energy Transformations: Food is required for energy and building cellular materials. Organisms in an ecosystem have different ways of obtaining food, and some organisms obtain their food directly from other organisms.

Standard 5.3 All students will understand that life science principles are powerful conceptual tools for making sense of the complexity, diversity, and interconnectedness of life on Earth. Order in natural systems arises in accordance with rules that govern the physical world, and the order of natural systems can be modeled and predicted through the use of mathematics.

Identify Unit Topics and Learning Goals: List main unit concepts related to grade level PEs/standards that support student learning goals in figuring out the anchoring phenomenon; revise as needed.

EIN-2.A Explain the concept of the tragedy of the commons.
EIN-2.B Describe the effect of clearcutting on forests.
EIN-2.C Describe changes in agricultural practices.
EIN-2.D Describe agricultural practices that cause environmental damage.
EIN-2.E Describe different methods of irrigation.
EIN-2.F Describe the benefits and drawbacks of different methods of irrigation.
EIN-2.G Describe the benefits and drawbacks of different methods of pest control
EIN-2.H Identify different methods of meat production.
EIN-2.I Describe the benefits and drawbacks of different methods of meat production.
EIN-2.J Describe causes of and problems related to overfishing
EIN-2.K Describe natural resource extraction through mining
EIN-2.L Describe ecological and economic impacts of natural resource extraction through mining.
EIN-2.M Describe the effects of urbanization on the environment.
EIN-2.N Explain the variables measured in an ecological footprint.
STB-1.A Explain the concept of sustainability
STB-1.B Describe methods for mitigating problems related to urban runoff.
STB-1.C Describe integrated pest management.
STB-1.D Describe the benefits and drawbacks of integrated pest management (IPM).
STB-1.E Describe sustainable agricultural and food production practices.
STB-1.F Describe the benefits and drawbacks of aquaculture.
STB-1.G Describe methods for mitigating human impact on forests.

Identify Enduring Understanding: What will students understand about the big ideas?

EIN-2 When humans use natural resources, they alter natural systems
STB-1 Humans can mitigate their impact on land and water resources through sustainable use.
Students will understand that…
▪ Agriculture has changed throughout time
▪ The Green Revolution increased crop productivity
▪ There is enough food to feed everyone in the world, but it is not distributed properly.
▪ Genetic Engineering what is it and how has it altered crop production
▪ Pesticides can increase short term production, but can be hazardous to the environment and human health
▪ Land can be used in a variety of ways. How it is used should be determined by the natural resources not by political considerations.
▪ With a growing human population, the amount of agriculturally available land has decreased.

Examples, Outcomes, and Assessments

Instructional Focus:
▪ Discussing how agriculture has changed throughout time
▪ Explaining the pros and cons of the Green Revolution
▪ Discussing the different ways in which land is used
▪ Discussing sustainable agriculture
▪ Explaining the pros and cons of pesticide use

Interdisciplinary Connections
▪ Connects to Health Class- nutritional requirements
▪ History of Food and agriculture

Technology Integration
▪ Land Use Plans online
▪ Research of Federal Lands

Global Perspectives
▪ How land is used worldwide, compare and contrast
▪ Global food distribution

Sample Assessments

▪ Tragedy of the Commons Lab
• Interactive Farming Game
• Pesticide Case Study
• Forest Management Case Study
• GMO worksheet
• Fishing Techniques Works=heet
• Ecological Footprint

Summative Assessment
Unit 5 Test (35 MC & 1-2 FRQ)

Lessons

Lesson 1: Tragedy of the commons

Lesson 2: Farming Practices (including sustainable farming)
Lesson 3: Pesticides Pros & Cons
Lesson 4: Forest Management (including sustainable management)
Lesson 5: GMOs
Lesson 6: Fishing Techniques (including sustainable techniques)
Lesson 7: Ecological & Carbon Footprints

1.d.1. Science and Engineering Practices (SEP) (skills)	**1.d.2. Disciplinary Core Ideas (DCI) (content)**	**1.d.3. Crosscutting Concepts (CCC) (connections)**
HS-ETS1-2. Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering. 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.	ETS1.A: Defining and Delimiting Engineering Problems ETS1.B: Developing Possible Solutions LS1.C: Organization for Matter and Energy Flow in Organisms	Systems and System Models Energy and Matter Influence of Science, Engineering and Technology on Society and the Natural World

Unit 6: Energy Resources and Consumption

Grade and Subject	11th-12th Grade APES	**Unit Instructional Time**	~3 weeks
Unit Title (Topic)	Land and Water Use		

Big Ideas
Matter and Energy Transformations: Food is required for energy and building cellular materials. Organisms in an ecosystem have different ways of obtaining food, and some organisms obtain their food directly from other organisms.

Standard 5.3 All students will understand that life science principles are powerful conceptual tools for making sense of the complexity, diversity, and interconnectedness of life on Earth. Order in natural systems arises in accordance with rules that govern the physical world, and the order of natural systems can be modeled and predicted through the use of mathematics.

Identify Unit Topics and Learning Goals: List main unit concepts related to grade level PEs/standards that support student learning goals in figuring out the anchoring phenomenon; revise as needed.

ENG-3.A Identify differences between nonrenewable and renewable energy sources.
ENG-3.B Describe trends in energy consumption.
ENG-3.C Identify types of fuels and their uses.
ENG-3.D Identify where natural energy resources occur.
ENG-3.E Describe the use and methods of fossil fuels in power generation.
ENG-3.G Describe the use of nuclear energy in power generation
ENG-3.H Describe the effects of the use of nuclear energy on the environment.
ENG-3.I Describe the effects of the use of biomass in power generation on the environment.
ENG-3.J Describe the use of solar energy in power generation.
ENG-3.K Describe the effects of the use of solar energy in power generation on the environment
ENG-3.L Describe the use of hydroelectricity in power generation.
ENG-3.M Describe the effects of the use of hydroelectricity in power generation on the environment.
ENG-3.N Describe the use of geothermal energy in power generation.
ENG-3.O Describe the effects of the use of geothermal energy in power generation on the environment.
ENG-3.P Describe the use of hydrogen fuel cells in power generation.
ENG-3.Q Describe the effects of the use of hydrogen fuel cells in power generation on the environment.
ENG-3.R Describe the use of wind energy in power generation
ENG-3.S Describe the effects of the use of wind energy in power generation on the environment.
ENG-3.T Describe methods for conserving energy

Identify Enduring Understanding: What will students understand about the big ideas?

ENG-3 Humans use energy from a variety of sources, resulting in positive and negative consequences.
Students will understand that…
• Fuels are used to generate electricity in an electric power plant.
• Patterns of energy consumption and production in the world and in the United States.
• The process in which fossil fuels are formed, extracted and used.
• The advantages and disadvantages of nuclear energy.
• The six forms of renewable energy and compare their advantages and disadvantages and technological challenges.
• The difference between technological and political challenges to the energy crises.
• The difference between biodegradable and nonbiodegradable waste.

Examples, Outcomes, and Assessments

Instructional Focus:
• Describing oil extraction, refining, and use
• Describing natural gas, refining, and use
• Explaining old sources of energy
• Describing modern form of energy

Interdisciplinary Connections
• History of energy consumption
• Global energy use
• Future energy needs

Technology Integration

• Using energy simulations

Global Perspectives

• Global energy production and consumption

• United States reliance on foreign resources to support economy

Sample Assessments

• Intro to Energy Worksheet

• How Fossil Fuels are Formed Book Activity

• Oil Spill Interactive

• Nonrenewable Energy Worksheet (pros & cons)

• Renewable Energy Worksheet (pros & cons)

• Dam Case Study

• Renewable Energy Video Project

Summative Assessment

Unit 6 Test (35 MC, 1-2 FRQ)

Lessons

Lesson 1: Energy

Lesson 2: What is a Fossil Fuel- pros and cons of fossil fuels

Lesson 3: Nuclear Energy

Lesson 4: Renewable Energy - pros and cons of each type

1.d.1. Science and Engineering Practices (SEP) (skills)	1.d.2. Disciplinary Core Ideas (DCI) (content)	1.d.3. Crosscutting Concepts (CCC) (connections)
HS-ETS1-2. Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering. 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.	ETS1.A: Defining and Delimiting Engineering Problems ETS1.B: Developing Possible Solutions LS1.C: Organization for Matter and Energy Flow in Organisms	Systems and System Models Energy and Matter Influence of Science, Engineering and Technology on Society and the Natural World

Unit 7: Atmospheric Pollution

Grade and Subject	11th-12th Grade APES	**Unit Instructional Time**	~2 weeks
Unit Title (Topic)	Atmospheric Pollution		

Big Ideas

Biogeochemical Cycles: The biogeochemical cycles in the Earth systems include the flow of microscopic and macroscopic resources from one reservoir in the hydrosphere, geosphere, atmosphere, or biosphere to another, are driven by Earth's internal and external sources of energy, and are impacted by human activity.

Climate and Weather: Earth's weather and climate systems are the result of complex interactions between land, ocean, ice, and atmosphere.

Standard 5.4 All students will understand that Earth operates as a set of complex, dynamic, and interconnected systems, and is a part of the all-encompassing system of the universe.

Identify Unit Topics and Learning Goals: List main unit concepts related to grade level PEs/standards that support student learning goals in figuring out the anchoring phenomenon; revise as needed.

STB-2.A Identify the sources and effects of air pollutants.
STB-2.B Explain the causes and effects of photochemical smog and methods to reduce it.
STB-2.C Describe thermal inversion and its relationship with pollution.
STB-2.D Describe natural sources of CO2 and particulates.
STB-2.E Identify indoor air pollutants
STB-2.F Describe the effects of indoor air pollutants
STB-2.G Explain how air pollutants can be reduced at the source.
STB-2.H Describe acid deposition.
STB-2.I Describe the effects of acid deposition on the environment.
STB-2.J Describe human activities that result in noise pollution and its effects.

Identify Enduring Understanding: What will students understand about the big ideas?

STB-2 Human activities have physical, chemical, and biological consequences for the atmosphere.
Students will understand that…

- Pollution occurs in air, land, and water
- Pollution can have detrimental effects on ecosystems and living organisms
- The causes and effects of acid deposition.
- Laws like the Clean Air Act and Clean Water Act were created in response to extreme pollution cases.
- The best solution to hazardous waste is to not create it but once created it must be treated and disposed of properly.
- The Earth's Ozone protects living organisms from UV radiation

• Greenhouse gases are natural gases which keep Earth habitable
• Human activity has increased the amount of Greenhouse gases.
• A warming climate will have profound environmental, economic and political ramifications.

Examples, Outcomes, and Assessments

Instructional Focus:
• Identifying outdoor air pollution
• Describing how photochemical and industrial smog are generated
• Relating pollution to the chemical cycles.
• Explaining the significance of thermal inversions
• Exploring the consequences of acid precipitation
• Describing indoor air pollution, providing examples and effects on human health
• Describing solutions and legislation for air pollution
• Describing the natural greenhouse effect
• Identifying examples of global climate change
• Describing the importance of the ozone layer and implications of its depletion.

Interdisciplinary Connections
• Chemistry
• Health
• History of Clean Air and Water Act

Technology Integration
• Using probes to determine pollutant levels in water, air, and soil
• Discovering ozone change

Global Perspectives
• Comparing pollution levels globally • Ozone change
• Global Climate change

Sample Assessments

• World AQI activity
• Smog and Acid Rain Webquest and Labs
• Ozone Depletion Webquest
• Bear Pond Case Study
• Sick Building Syndrome Activity

Summative Assessment
Unit 7 Test 40 MC and 2 FRQ

Lessons

Lesson 1: What is Air Pollution - AQI
Lesson 2: Primary vs. Secondary Air Pollutants
Lesson 3: Different types of outdoor air pollutants and their effects

Lesson 4: Different types of indoor air pollutants and their effects		
1.d.1. Science and Engineering Practices (SEP) (skills)	**1.d.2. Disciplinary Core Ideas (DCI) (content)**	**1.d.3. Crosscutting Concepts (CCC) (connections)**
HS-ETS1-2. Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering. 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.	ETS1.A: Defining and Delimiting Engineering Problems ETS1.B: Developing Possible Solutions LS1.C: Organization for Matter and Energy Flow in Organisms	Systems and System Models Energy and Matter Influence of Science, Engineering and Technology on Society and the Natural World

	**Unit 8: Aquatic and Terrestrial Pollution**		
Grade and Subject	11th-12th Grade APES	**Unit Instructional Time**	~3.5 weeks
Unit Title (Topic)	Aquatic and Terrestrial Pollution		
Big Ideas Biogeochemical Cycles: The biogeochemical cycles in the Earth systems include the flow of microscopic and macroscopic resources from one reservoir in the hydrosphere, geosphere, atmosphere, or biosphere to another, are driven by Earth's internal and external sources of energy, and are impacted by human activity.			
Standard 5.4 All students will understand that Earth operates as a set of complex, dynamic, and interconnected systems, and is a part of the all-encompassing system of the universe.			
Identify Unit Topics and Learning Goals: List main unit concepts related to grade level PEs/standards that support student learning goals in figuring out the anchoring phenomenon; revise as needed.			

STB-3.A Identify differences between point and nonpoint sources of pollution.
STB-3.B Describe the impacts of human activities on aquatic ecosystems.
STB-3.C Describe endocrine disruptors.
STB-3.D Describe the effects of endocrine disruptors on ecosystems.
STB-3.E Describe the impacts of human activity on wetlands and mangroves
STB-3.F Explain the environmental effects of excessive use of fertilizers and detergents on aquatic ecosystems.
STB-3.G Describe the effects of thermal pollution on aquatic ecosystems.
STB-3.H Describe the effect of persistent organic pollutants (POPs) on ecosystems.
STB-3.I Describe bioaccumulation and biomagnification
STB-3.J Describe the effects of bioaccumulation and biomagnification.
STB-3.K Describe solid waste disposal methods.
STB-3.L Describe the effects of solid waste disposal methods.
STB-3.M Describe changes to current practices that could reduce the amount of generated waste and their associated benefits and drawbacks.
STB-3.N Describe best practices in sewage treatment.
EIN-3.A Define lethal dose 50% (LD50)
EIN-3.B Evaluate dose response curves.
EIN-3.C Identify sources of human health issues that are linked to pollution.
EIN-3.D Explain human pathogens and their cycling through the environment

Identify Enduring Understanding: What will students understand about the big ideas?

STB-3 Human activities, including the use of resources, have physical, chemical, and biological consequences for ecosystems.
Students will understand that…
• Most water pollution is due to nonpoint source pollution and may be hard to trace back.
• Cultural eutrophication is a result of the overuse of fertilizers, which gets into ponds and lakes through runoff.
• Infrastructure changes have created non-permeable surfaces, which have increased the amount of surface runoff.
• Groundwater is extremely difficult to clean because it is hard to get access to.
• Organic waste can impact the temperature, D.O. levels, alter life forms and create dead zones in water supplies.

Examples, Outcomes, and Assessments

Instructional Focus:
• Identifying the various types of water pollution.
• Explaining the impact of altered D.O levels on aquatic systems.
• Discussing ways to limit surface runoff.

Interdisciplinary Connections
• Various legislature exists such as the Safe Drinking Water Act and Clean Water Act that connect this issue to the Law class.
• Using probes to determine pollutant levels in water

Technology Integration
• Planet in Peril video documentaries on various water pollution due to mining, hazardous waste, etc.

Media Literacy Integration
• Reading through both scientific literature on water pollution case studies as well as popular media sources (Gulf of Mexico, Japan, etc).

Global Perspectives

• Oceans are continuously circulating water throughout the world. Pollution in one location can have a huge impact in another.

Sample Assessments

• Bottled Water Case Study
• Surface Water Worksheet
• Flint, MI Case Study
• Watch and assess Erin Brockovich

Summative Assessment

Unit 8 Test (35 MC & 2 FRQ)

Lessons

Lesson 1: What is water pollution?
Lesson 2: Primary vs. Secondary water pollution
Lesson 3: Freshwater vs. marine pollution
Lesson 4: Plastic Pollution (ocean)

1.d.1. Science and Engineering Practices (SEP) (skills)	1.d.2. Disciplinary Core Ideas (DCI) (content)	1.d.3. Crosscutting Concepts (CCC) (connections)
HS-ETS1-2. Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering. 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.	ETS1.A: Defining and Delimiting Engineering Problems ETS1.B: Developing Possible Solutions LS1.C: Organization for Matter and Energy Flow in Organisms	Systems and System Models Energy and Matter Influence of Science, Engineering and Technology on Society and the Natural World

Unit 9: Global Change

Grade and Subject	11th-12th Grade APES	Unit Instructional Time	~4 weeks

Unit Title (Topic)	Aquatic and Terrestrial Pollution

Big Ideas

Biogeochemical Cycles: The biogeochemical cycles in the Earth systems include the flow of microscopic and macroscopic resources from one reservoir in the hydrosphere, geosphere, atmosphere, or biosphere to another, are driven by Earth's internal and external sources of energy, and are impacted by human activity.

Climate and Weather: Earth's weather and climate systems are the result of complex interactions between land, ocean, ice, and atmosphere.

Matter and Energy Transformations: Food is required for energy and building cellular materials. Organisms in an ecosystem have different ways of obtaining food, and some organisms obtain their food directly from other organisms.

Standard 5.4 All students will understand that Earth operates as a set of complex, dynamic, and interconnected systems, and is a part of the all-encompassing system of the universe.

Identify Unit Topics and Learning Goals: List main unit concepts related to grade level PEs/standards that support student learning goals in figuring out the anchoring phenomenon; revise as needed.

STB-4.A Explain the importance of stratospheric ozone to life on Earth
STB-4.B Describe chemicals used to substitute for chlorofluorocarbons (CFCs).
STB-4.C Identify the greenhouse gases.
STB-4.D Identify the sources and potency of the greenhouse gases.
STB-4.E Identify the threats to human health and the environment posed by an increase in greenhouse gases
STB-4.F Explain how changes in climate, both short- and longterm, impact ecosystems.
STB-4.G Explain the causes and effects of ocean warming
STB-4.H Explain the causes and effects of ocean acidification.
EIN-4.A Explain the environmental problems associated with invasive species and strategies to control them.
EIN-4.B Explain how species become endangered and strategies to combat the problem.
EIN-4.C Explain how human activities affect biodiversity and strategies to combat the problem

Identify Enduring Understanding: What will students understand about the big ideas?

STB-4 Local and regional human activities can have impacts at the global level
EIN-4 The health of a species is closely t

Examples, Outcomes, and Assessments

Instructional Focus:

- Discuss sources of Greenhouse Gases
- Debate whether or not we should be in the Paris Climate Agreement

Interdisciplinary Connections

- Various legislature exists Paris Climate Agreement

Technology Integration

- Before the Flood Documentary

Media Literacy Integration

• Reading through both scientific literature on climate change case studies as well as popular media sources and doing blog posts and discussions

Global Perspectives

• Global Climate Change is impacting communities around the world

Sample Assessments

• Greenhouse Effect Webquest
• Evidence for Climate Change Worksheet
• Climate Change Lab
• Before the Flood Worksheet

Summative

Unit 9 Test (35 MC & 2 FRQ)
Trial AP Exam

Lessons

Lesson 1: The Greenhouse Effect
Lesson 2: Increases in Greenhouse Gases
Lesson 3: Global Climate Change
Lesson 4: Ocean Warming & Ocean Acidification
Lesson 5: Endangered Species
Lesson 6: Human Impacts on Biodiversity

1.d.1. Science and Engineering Practices (SEP) (skills)	1.d.2. Disciplinary Core Ideas (DCI) (content)	1.d.3. Crosscutting Concepts (CCC) (connections)
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