

Course Description

The AP Environmental Science course is designed to be the equivalent of a one-semester, introductory college course in environmental science.

AP Environmental Science engages students with the scientific principles, concepts, and methodologies required to understand the interrelationships in the natural world. Students will explore how energy is transferred, interactions of the Earth's systems, interactions between species, interactions between species and their environment, the process and actions that affect species, populations, and biogeochemical cycle sustainability.

The course requires that students identify and analyze natural and human-made environmental problems, evaluate the relative risks associated with these problems, and examine alternative solutions for resolving or preventing them. Environmental science is interdisciplinary, embracing topics from geology, biology, environmental studies, environmental science, chemistry, and geography.

Course Objectives

Students will meet the following goals by taking this course:

- Explain the balance of all of Earth's systems that maintain life.
- Identify their ecological footprint by analyzing their interactions in the biosphere.
- Identify sustainable practices to protect the environment.

Prerequisites

Students should have completed two years of high school laboratory science—one year of life science and one year of physical science (e.g., a year of biology and a year of chemistry). Students should also have taken at least one year of algebra, given the quantitative analysis required in the course. Also desirable (but not necessary) is a course in earth science.

Lab Requirement

Although there are no specific AP Environmental Science labs or field investigations required for the course, it is required that students have the opportunity to spend a minimum of 25 percent of instructional time engaged in hands-on, inquiry-based laboratory and/or fieldwork investigations. In this course, students will complete laboratory experiences equivalent to 25 percent of the course material. Labs and their descriptions are listed in the activities section of each corresponding unit in this syllabus. **CR11**

Throughout the course, students are expected to maintain a lab/field notebook or portfolio that includes all lab and field reports. This can be kept in a digital or hard copy format. The reports from each lab experience should include: title, essential question and answer, hypothesis, lab procedure summary, data, analysis questions, findings, and conclusions. **CR12**

Big Ideas

This course introduces students to a broad set of big ideas, including:

BIG IDEA 1: ENERGY TRANSFER **ENG**

- Energy conversions underlie all ecological processes. Energy cannot be created; it must come from somewhere. As energy flows through systems, at each step, more of it becomes unusable.

BIG IDEA 2: INTERACTIONS BETWEEN EARTH SYSTEMS **ERT**

Course Overview and Syllabus (continued)

- Earth is one interconnected system. Natural systems change over time and space. Biogeochemical systems vary in their ability to recover from disturbances.

BIG IDEA 3: INTERACTIONS BETWEEN DIFFERENT SPECIES AND THE ENVIRONMENT **EIN**

- Humans alter natural systems and have had an impact on the environment for millions of years. Technology and population growth have enabled humans to increase both the rate and scale of their impact on the environment.

BIG IDEA 4: SUSTAINABILITY **STB**

- Human survival depends on developing practices that will achieve sustainable systems. A suitable combination of conservation and development is required. The management of resources is essential. Understanding the role of cultural, social, and economic factors is vital to the development of solutions.

In addition, this course emphasizes Science Practices:

- Science Practice 1: Concept Explanation **1**
- Science Practice 2: Visual Representation **2**
- Science Practice 3: Text Analysis **3**
- Science Practice 4: Scientific Experiments **4**
- Science Practice 5: Data Analysis **5**
- Science Practice 6: Mathematical Routines **6**
- Science Practice 7: Environmental Solutions **7**

On the AP Exam, students must be able to describe and explain concepts related to the tragedy of the commons, clearcutting, agricultural practices, and mining. To practice this, case studies that represent real-world examples of human activities can be helpful, focusing on understanding concepts in applied contexts. Case studies can also be used to help students practice proposing solutions to environmental problems and describing the benefits or disadvantages of those solutions.

The College Board has defined nine major topic areas for the students to focus on during this course. The following are the units that align with this course structure and their weight on the AP Environmental Science Exam.

Unit 2: The Living World: Ecosystems	6–8%
Unit 3: The Living World: Biodiversity	6–8%
Unit 4: Populations	10–15%
Unit 5: Earth Systems and Resources	10–15%
Unit 7: Land and Water Use	10–15%
Unit 8: Energy Resources and Consumption	10–15%
Unit 9: Atmospheric Pollution	7–10%
Unit 10: Aquatic and Terrestrial Pollution	7–10%
Unit 11: Global Change	15–20%

Resources **CR1**

- Botkin, Daniel. *Environmental Science: Earth as a Living Planet* (10th edition), Atlas Elite Publishing Partners, 2020. <https://botkinlc.com>

Course Overview and Syllabus (continued)

- Resource manuals for laboratory investigations
- Other resource publications
- Magazines
- Newspapers
- Television and radio
- Videos
- Interactive software
- Websites
- Equipment suppliers

Required Environmental Policies and Legislation **CR2**

Understanding the following environmental policies and legislation are required for the course as they relate to solutions to environmental problems. Teachers are encouraged to incorporate an understanding of legislation and policies and how they impact the environment. You can find the policies and legislation within the lessons marked in parenthesis after the name.

- Clean Air Act
- Clean Water Act
- Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)
- Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)
- Montreal Protocol
- Kyoto Protocol
- Endangered Species Act
- Safe Drinking Water Act (SDWA)
- Delaney Clause of Food, Drug, and Cosmetic Act
- Resource Conservation and Recovery Act (RCRA)

Student Expectations

This course requires the same level of commitment from the student as a traditional classroom course. Students are expected to spend approximately five to seven hours per week online on:

- interactive lessons that include a mixture of instructional videos and tasks.
- assignments in which students apply and extend learning in each lesson.
- assessments, including quizzes, tests, and cumulative exams.

Communication

Teachers will communicate with students regularly through discussions, emails, chats, and system announcements. Students will also communicate with classmates, either using online tools or face-to-face conversations, to collaborate on projects, ask and answer questions in peer groups, and develop speaking and listening skills.

Course Overview and Syllabus (continued)

Grading Policy

Students will be graded on the work completed online and the work submitted electronically to the teacher. Each category of graded activity is weighted as follows:

Grading Category	Weight
Assignments	10%
Projects	20%
Lesson quizzes	20%
Unit tests	30%
Cumulative exams	20%

Scope and Sequence CR3

When students log on to Edgenuity, they can view the entire course map—an interactive scope and sequence of all topics under study. The units of study are listed below:

Semester A	Semester B
<ul style="list-style-type: none"> • Introduction <i>Students are introduced to the Big Ideas of the course, as well as scientific methods.</i> 	<ul style="list-style-type: none"> • Land and Water Use <i>In this unit, students examine how humans use and consume natural resources and how we disrupt ecosystems, both positively and negatively.</i>
<ul style="list-style-type: none"> • The Living World: Ecosystems <i>Students explore a view of planet Earth as one system made up of regional ecosystems composed of interdependent environmental features, processes, and relationships between species.</i> 	<ul style="list-style-type: none"> • Energy Resources and Consumption <i>In this unit, students learn about renewable and nonrenewable sources of energy, where they're used, and their impact on the environment.</i>
<ul style="list-style-type: none"> • The Living World: Biodiversity <i>In this unit, students learn about the importance of biodiversity in an ecosystem and the impact of outside factors on the evolution of organisms.</i> 	<ul style="list-style-type: none"> • Atmospheric Pollution <i>In this unit, students learn more about air pollution, including how human actions can cause it, and they analyze legislation intended to regulate emissions and improve air quality.</i>
<ul style="list-style-type: none"> • Populations <i>In this unit, students examine how populations in ecosystems change over time and the factors that affect population growth.</i> 	<ul style="list-style-type: none"> • Aquatic and Terrestrial Pollution <i>In this unit, students examine the impact of pollution on ecosystems and learn how to determine its source.</i>
<ul style="list-style-type: none"> • Earth Systems and Resources <i>In this unit, students study the natural components that make up the environment, from geologic features to the atmosphere and climate.</i> 	<ul style="list-style-type: none"> • Global Change <i>In this unit, students come to understand the global impact of local and regional human activities and evaluate and propose solutions.</i>
<ul style="list-style-type: none"> • Semester Review and Practice Exam 	<ul style="list-style-type: none"> • Exam Review and Practice Exam

Course Overview and Syllabus (continued)

<i>In this unit, students will review the previous five units and take at least one APES practice exam.</i>	<i>In this unit, students will review for and complete an AP Environmental Science Exam. Post AP Exam, students will complete a culminating project.</i>
• APES Practice Exam and Alternate APES Practice Exam	

See the full course outline below.

Technology Requirements

Students are expected to have a basic understanding of how to access the internet and use a keyboard and mouse; no additional prerequisite technology skills are required.

All course materials are provided through the student portal. You will become familiar with them through an orientation video and the student handbook. These resources are available in the Student Help Center, where you can also check the status of your operating system, processor speed, plug-ins, and connection speed.

The course is designed for accessibility to all students. The system provides features and accommodations to meet the needs of ELL and students with Individualized Learning Plans (IEPs), 504 Plans, and Section 508. These accommodations include addressing multiple learning styles, accommodations for assessments, video caption/transcripts, read-aloud and translation tools, and many other features/accommodations.

Course Outline

Semester A

Unit 1: Introduction to Environmental Science

Students are introduced to the Big Ideas of the course as well as scientific methods.

Big Ideas: **ENG EIN STB**

Topics:

- Energy Transfer
- Interactions Among Living Things, Land, Water, and Air
- Resource Availability, Human Consumption, and Population Growth: Impacts on Sustainability
- Human Resource Use and Sustainability
- Methods of Science
- Accuracy, Precision, and Uncertainty
- Data Analysis

Skill Pairing

1.A
1.A
1.A
1.A
6.A
6.B 6.C
5.E

Course Overview and Syllabus (continued)

Unit 2: The Living World: Ecosystems

Students explore a view of planet Earth as one system made up of regional ecosystems that are themselves composed of interdependent environmental features, processes, and relationships among species.

Big Ideas: **ERT** **ENG**

Topics:

Skill Pairing

- Predation 1.A
- Symbiosis, Mutualism, Commensalism, and Parasitism 1.A
- Interspecific and Intraspecific Competition 1.A
- Niches and Competitive Exclusion 1.A
- Trophic Levels 1.B
- Energy Flow in a Food Web 6.C
- Species Loss and Gain and Effect on Food Webs 2.A
- Introduction to Ecosystems 1.A
- Inputs, Outputs, and Cycling of Materials in Ecosystems 1.B
- Carbon Sources and Sinks 2.B
- Carbon Reservoirs and Holding Time 2.B
- Carbon Cycling in Producers, Consumers, and Decomposers 2.B
- Use of Fossil Fuels and the Carbon Cycle 2.B
- Nitrogen Sources and Sinks 2.B
- Nitrogen Reservoirs and Holding Times 2.B
- Nitrogen Fixation 2.B
- Phosphorus Sources and Sinks 2.B
- Phosphorus as a Limiting Factor in Aquatic and Terrestrial Ecosystems 2.B
- The Water Cycle 2.B
- Movement Between Sources and Sinks in the Water Cycle 2.B
- Climate Influence on Biome Distribution 1.B
- Characteristics of Terrestrial Biomes 1.B
- Characteristics of Aquatic Biomes 1.B
- Freshwater Biomes 1.B
- Saltwater Biomes 1.B
- Productivity and Change in Biomes 1.A
- Productivity in Aquatic and Terrestrial Biomes 1.A
- Climate Changes and Effects on Biome Distribution 1.A

Unit 3: The Living World: Biodiversity

In this unit, students learn about the importance of biodiversity in an ecosystem and the impact of outside factors on the evolution of organisms.

Big Ideas: **ERT**

Topics:

Skill Pairing

- Genetic Diversity, Habitat Diversity, and Species Diversity 1.A
- Introduction to Biodiversity 1.A
- Population Bottlenecks and Genetic Diversity 1.A

Course Overview and Syllabus (continued)

- Disturbances and Ecosystems 1.A
- Introduction to Biodiversity: Part 2 1.A
- Ecosystem Services 1.B
- Human Activity and Disruptions on Ecosystem Services 1.B
- Island Biogeography 1.A
- Effects of Invasive Species on Island Ecosystems 1.A
- Disturbances in Ecosystems 5.A
- Specialist Versus Generalist Species 5.A
- Organisms and Adaptation to Their Environment 5.A
- Natural Disruptions and Their Impacts on Ecosystems 5.A
- Environmental Change and Natural Selection 5.A
- Ecological Succession 5.C
- Keystone Species 5.C
- Indicator Species and Ecosystem Health 5.C
- Pioneer Species and Ecological Succession 5.C
- Disturbances in Ecosystems: Part 2 5.C

Unit 4: Populations

In this unit, students examine how populations in ecosystems change over time and the factors that affect population growth.

Big Ideas: EIN ERT

Topics:

- Life History Strategies 1.B
- Generalist and Specialist Species 1.B
- r and K-selected Species 1.B
- Life History Strategies 1.B
- Survivorship Curves 5.C
- Survivorship in r-selected and K-selected Species 5.C
- Population Abundance, Density, and Distribution 5.B
- Carrying Capacity 5.B
- Population Growth Rates and Carrying Capacity 5.B
- Human Population Growth 5.B
- Limiting Factors and Effects on Population Growth 7.A
- Doubling Time of a Human Population 7.A
- Population Growth Rates 1.C
- Demographic Transition 1.C
- Stages of Demographic Transition 1.C

Skill Pairing

Unit 5: Earth Systems and Resources

In this unit, students study the natural components that make up the environment, from geologic features to the atmosphere and climate.

Big Ideas: ERT ENG

Topics:

- The Lithosphere 2.C
- Convection and Plate Tectonics 2.C

Skill Pairing

Course Overview and Syllabus (continued)

- Convergent and Divergent Boundaries 2.C
- Transform Boundaries 2.C
- Soil Formation 2.C
- Soil Horizons 4.C
- Soil Erosion 2.C
- Soils and Water Quality 2.C
- Effects on Soil Properties: Particle Size and Composition 4.C
- Testing Methods for Soil Properties 4.C
- Using a Soil Texture Triangle 2.B
- Major Gases of Earth's Atmosphere 2.A
- Layers of the Atmosphere 2.B
- Global Wind Patterns 2.A
- Coriolis Effect 2.A
- Weather, Climate, and Geography 2.B
- Rain Shadow and Effect on Local Climate 2.B
- El Niño and La Niña 2.B
- Seasons, Latitude, and Solar Radiation 2.B
- Latitude and the Seasons 2.B
- Seasons: Longest Summer and Shortest Winter Days 2.B
- The Hydrosphere: Freshwater 7.C

Unit 6: Semester Review and Practice Exam

In this unit, students will review the previous five units.

Activities:

- Semester 1 Review
- Complete Unit 6 Exam

Semester B

Unit 1: Land and Water Use

In this unit, students examine how humans use and consume natural resources and how we disrupt ecosystems, both positively and negatively.

Big Ideas: EIN STB

Topics:

- The Tragedy of the Commons (CERCLA)
- Clearcutting and the Environment
- The Green Revolution and Global Agricultural Production
- Impacts of Agricultural Practices
- Irrigation Methods
- Pest Control Methods
- Meat Production Methods
- Impacts of Overfishing
- Impacts of Mining
- Impacts of Urbanization
- Ecological Footprints
- Introduction to Sustainability
- Methods to Reduce Urban Runoff

Skill Pairing

- 1.B
- 1.A
- 3.A 3.B 3.C 3.D 3.E
- 1.A
- 7.C
- 7.E
- 5.E
- 7.B
- 7.B
- 7.E
- 5.E
- 5.E
- 4.B

Course Overview and Syllabus (continued)

- Integrated Pest Management
- Sustainable Agriculture
- Aquaculture
- Sustainable Forestry

7.D
7.E
7.C
7.F

Unit 2: Energy Resources and Consumption

In this unit, students learn about renewable and nonrenewable sources of energy, where they're used, and their impact on the environment.

Big Ideas: ENG

Topics:

- Renewable and Nonrenewable Resources
- Global Energy Consumption
- Fuel Types and Uses
- Distribution of Natural Energy Resources
- Fossil Fuels
- Nuclear Power
- Energy from Biomass
- Solar Energy
- Hydroelectric Power
- Geothermal Energy
- Hydrogen Fuel Cell
- Wind Energy
- Energy Conservation

Skill Pairing

1.C
6.C
1.A
2.B
7.A
2.B
7.B
5.C
7.F
1.B
1.C
7.B
7.C

Unit 3: Energy Resources

In this unit, students learn more about air pollution, including how human actions can cause it. Students also analyze legislation intended to regulate emissions and improve air quality.

Big Ideas: STB

Topics:

- Introduction: Air Pollution Sources and Effects (Clean Air Act)
- Photochemical Smog
- Thermal Inversion and Pollution
- Atmospheric CO₂ and Particulates
- Indoor Air Pollution
- Acid Rain: Causes and Effects
- Noise Pollution

Skill Pairing

7.A
5.B
2.C
1.A
5.C
1.A
3.A 3.C 3.D 3.E

Unit 4: Aquatic and Terrestrial Pollution

In this unit, students examine the impact of pollution on ecosystems and learn how to determine its source.

Big Ideas: STB EIN

Topics:

- Sources of Pollution

Skill Pairing

1.A

Course Overview and Syllabus (continued)

- Human Impacts on Ecosystems (Clean Water Act, SDWA) 6.B
- Endocrine Disruptors 1.A
- Human Impacts on Wetlands and Mangroves 7.B
- Eutrophication 2.C
- Thermal Pollution 1.C
- Persistent Organic Pollutants (POPs) 1.B
- Impacts of Solid Waste Disposal in Aquatic Environments 7.D
 - Bioaccumulation and Biomagnification (RCRA)
- Waste Reduction Methods 6.B
- Sewage Treatment 2.A
- Lethal Dose 50 (LD₅₀) 6.A
- Dose Response Curve 5.E
- Pollution and Human Health 4.C
 - (Delaney Clause of Food, Drug, and Cosmetic Act)
- Pathogens and Infectious Disease 2.B

Unit 5: Global Change

In this unit, students come to understand the global impact of local and regional human activities and evaluate and propose solutions.

Big Ideas: **STB** **EN**

Topics:

- Stratospheric Ozone Depletion
- Reducing Ozone Depletion (Montreal Protocol)
- The Greenhouse Effect
- Increases in Greenhouse Gases (Kyoto Protocol)
- Global Climate Change
- Ocean Warming
- Ocean Acidification
- Invasive Species
- Endangered Species (CITES, Endangered Species Act)
- Human Impacts on Biodiversity

Skill Pairing

- 1.A
- 7.B
- 1.B
- 2.C
- 5.D
- 7.A
- 1.C
- 7.E
- 7.D
- 7.C

Unit 6: Exam Review and Practice Exam

In this unit, students review for and complete an AP Environmental Science Exam.

Labs and Activities

Lab Portfolio: students are required to keep a lab portfolio that includes all lab reports completed throughout the course.

Lab Report Components:

- Title
- Essential Question with Answer
- Hypothesis

Course Overview and Syllabus (continued)

- Lab Procedure Summary
- Data
- Analysis Questions
- Application and Reflection Questions

Unit 1

Wet Lab: The Scientific Method **4.D**

In this lab, students will review and begin applying the scientific method to inquiry-based labs. Students will use the scientific method to design their own experiments. They will develop an experiment consisting of two mini-experiments to: 1) determine how temperature affects the rate of dissolving an antacid tablet and 2) determine how changing the surface area affects the rate of dissolving an antacid tablet. *Science Practice 1: Concept Explanation* **CR4**

Unit 2

Wet Lab: Chemical Weathering: Carbonation vs. Hydrolysis **4.D**

In this lab, students compare weak acids and water in the process of chemical weathering of rocks. Students will design an experiment to compare the effects of carbonation and hydrolysis on rocks. They will determine which type of weathering, carbonation (addition of acid) or hydrolysis (addition of water), breaks down chalk more rapidly. *Practice 4: Scientific Experiments* **CR7**

Wet Lab: Study Your Biome **4.D**

In this lab, students will determine the biome that they live in by exploring the abiotic and biotic factors of their local environment.

Wet Lab: Primary Productivity of Grass **4.D**

In this lab, students will discover primary productivity and how sunlight influences net productivity in an ecosystem.

Unit 3

Wet Lab: Modeling Species Abundance and Diversity of Pollinators **4.D**

In this lab, students will model the diversity of pollinators and calculate the diversity index of two different sample groups.

Wet Lab: Island Biogeography **4.D**

In this lab, students will observe the migration of species to islands from the mainland and model how this affects the islands' biogeography.

Interactive Simulation: Natural Selection **4.D**

In this interactive simulation, students will experience natural selection by observing organisms and their adaptation to the environment through imagery and visual manipulation.

Virtual Lab: Evidence of Succession **4.D**

In this virtual lab, students will examine ecological succession and its role in forming a climax community. Students will design a climax community by introducing plants and animals to an ecosystem in a specific order.

Unit 4

Course Overview and Syllabus (continued)

Virtual Lab: Effects of Limiting Factors on Population Growth **4.D**

In this virtual lab, students analyze factors that limit population growth through land and resource allocation.

Activity: Can We Feed The Growing Population

In this activity, students will be challenged in a variety of ways to discover how humans have changed Earth. This data-driven activity will allow students to critically consider the uses and changes of land around the world and how population, climate, and resources play a role in those changes. *Science Practice 5: Data Analysis* **CR8**

Unit 5

Wet Lab: Climate Change and Cities Engineering Design **4.D**

In this lab, students develop an engineering design solution using temperature data that they have collected to determine materials and landscaping that will help lower temperatures in their school building or home.

Unit 6

Semester 1 Review

Semester 1 Exam

Unit 7

Wet Lab: The Tragedy of the Commons **4.D**

In this lab, students will analyze the tragedy of the commons and why it is important to manage shared resources sustainably. Students will simulate fishing over four fishing seasons while making sure that enough fish are remaining at the end of each season to replenish the fish caught. Each season, they will calculate the amount of money they earned through fishing. *Science Practice 7: Environmental Solutions* **CR10**

Virtual Lab: Genetically Modified Corn **4.D**

In this virtual lab, students discover how genetically modified (GM) corn is created and how it compares to natural/organic corn.

Unit 8

Activity: A Tale of Two Watersheds

In this activity, students will explore and compare two unique watersheds. As they analyze the differences, they will predict how these watersheds would be different given different circumstances and decide what preventive measures could be taken to protect them. *Science Practice 2: Visual Representations* **CR5**

Unit 9

Interactive Simulation: Determining Sources of Air Pollution in an Industrialized Area **4.D 4.E**

In this interactive simulation, students analyze and identify sources of air pollution and pollutant reduction in the vicinity of an industrialized city.

Wet Lab: Airborne Particulates **4.C 4.D**

In this lab, students decipher how atmospheric particulates can affect our health and impact air quality.

Virtual Lab: Acid Rain and the Water Cycle **4.B 4.D**

In this virtual lab, students determine the impact of acid rain on water pH levels and the effects on the environment. They also examine ways to prevent acid rain.

Noise Pollution Activity

Course Overview and Syllabus (continued)

In this activity, students will immerse themselves in the legislation known as the Clean Air Act Title IV—Noise Pollution. As they uncover the elements that make up this act, they are led to investigate its intentions, bias, accuracy, and credibility. Ultimately, students are tasked with expanding on the role of the EPA in its efforts to ensure the people are protected from violators and the impact that noise pollution has on the health and well-being of American citizens. *Science Practice 3: Text Analysis* **CR6**

Unit 10

Interactive Simulation: Nonpoint and Point Source Pollution Investigation **4.D 7.A**

In this interactive simulation, students engage in a scenario focused on pollution to better understand where pollution originates.

Wet Lab: Bioaccumulation and Biomagnification **4.A 4.D**

In this lab, students learn about how plastics in the ocean combine with persistent organic pollutants (POPs) and how they are passed up through a food web.

Activity: Lethal Dose 50 (LD₅₀) **4.E**

In this activity, students will analyze a data set and work to discover how to assist Farmer Frank in the task of dosing his farm animals with medication they need to stay healthy. It is the student's job to ensure Farmer Frank takes the right approach while ensuring the animals' safety. *Science Practice 9: Mathematical Routines* **CR9**

Unit 11

Interactive Simulation: Ozone Depleting Chemicals **4.D 7.B**

In this interactive simulation, students will recognize the ozone cycle and how ozone-depleting chemicals interfere with this process. Students will then model how CFCs interfere with the natural cycle of ozone reactions in the atmosphere.

Wet Lab: Climate Change Inquiry **4.D**

In this lab, students learn about climate change by performing three experiments that investigate indicators of climate change, including melting ice and sea-level rise, CO₂ and impacts on air temperature, and sea ice and its effect on water temperature.

Unit 12

Semester 2 Review

Semester 2 Exam

Two Practice Exams