

AP Environmental Science Syllabus

Course Description:

Advanced Placement Environmental Science is a college-level environmental science course. It is broken down into two semester long courses, semester A is 18 weeks long and semester B is 15 weeks long. This course is taught virtually and covers a wide variety of topics from many different areas of study. The big ideas provide the foundation for the structure of the course and include: energy transfer, interactions between earth's systems, interactions between different species and the environment, and sustainability. Students will participate in labs, field investigations, engineering projects, and analyze data. Students will have an opportunity to develop seven important science practice skills including: concept application, visual representations, text analysis, scientific experiments, data analysis, mathematical routines, and environmental solutions. The course is organized into 12 units of study that cover the nine major topics indicated by the College Board as the units of study. The corresponding units can be seen in the table below: **[CR3]**

Units in the Course	College Board Units
Unit 1: Introduction to Environmental Science	
Unit 2: Science, Matter and Energy	Unit 6: Energy Resources and Consumption
Unit 3: Population Dynamics	Unit 3: Populations
Unit 4: Ecosystems and Biodiversity	Unit 1: The Living World Ecosystems
Unit 5: Terrestrial Biodiversity	Unit 2: The Living World Biodiversity
Unit 6: Aquatic Biodiversity	Unit 2: The Living World Biodiversity
Unit 7: Food, Soil, and Pests	Unit 5: Land and Water Use
Unit 8: Earth Systems and Resources	Unit 4: Earth Systems and Resources Unit 6: Energy Resources and Consumption
Unit 9: Water and Pollution	Unit 5: Land and Water Use Unit 8: Aquatic and Terrestrial Pollution

Unit 10: Air and Pollution	Unit 5: Land and Water Use Unit 7 Atmospheric Pollution
Unit 11: Environmental Hazards and Waste Management	Unit 8: Aquatic and Terrestrial Pollution
Unit 12: Sustainability, Economics, and Politics	Unit 9: Global Change

Objectives:

- Understand the interrelationships of the natural world
- Identify and analyze environmental problems both natural and human-made
- Evaluate the relative risks associated with environmental problems
- Examine alternative solutions for resolving or preventing environmental problems

Textbook:[CR1]

Required

***Living in the Environment, 19th Edition by G. Tyler Miller, JR. and Scott E. Spoolman. 2018.
Hardcover ISBN: 978-1-337-09415-3 eText: ISBN: 978-0-357-69324-7.***

Recommended

Fast Track To A 5: Preparing for the AP Environmental Science Examination, by David Hong and Karen Lionberger, ISBN 978-0-538-49382-6

Other Reading Materials: Listed throughout course outline per unit. Various scholarly articles.

[CR2]

Legislation and Policies included in course:	Where in the Course the Policy can be found
Clean Air Act	Lesson 10.3 - Link to Article https://www.learner.org/series/the-habitable-planet-a-systems-approach-to-environmental-science/atmospheric-pollution/online-textbook/
Clean Water Act	Lesson 9.5 (in reading)
Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES);	Lesson 4.8 (in reading)
Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA);	Lesson 11.4 (in reading)
Resource Conservation and Recovery Act (RCRA);	Lesson 11.4 (in reading)
Montreal Protocol	Lesson 10.3 - Link to Article https://www.learner.org/series/the-habitable-planet-a-systems-approach-to-environmental-science/atmospheric-pollution/online-textbook/
Kyoto Protocol;	Lesson 10.5 - Link to article (https://www.learner.org/series/the-habitable-planet-a-systems-approach-to-environmental-science/earth-changing-climate/online-textbook/)
Endangered Species Act;	Lesson 4.8 (in reading)
Safe Drinking Water Act (SDWA)	Lesson 9.5 - Link to article To learn more about the Safe Drinking water act take a close look at section 10: Major Laws and Treaties: https://www.learner.org/series/the-habitable-planet-a-systems-approach-to-environmental-science/water-resources/online-textbook/
Delany Clause	Lesson 7.5 - Link to article https://www.ncbi.nlm.nih.gov/books/NBK216642/#:~:text=The%20regulation%20of%20carcinogens%20has.cancer%20in%20animals%20or%20human%20s.

Laboratory Work: [CR11]

All of the laboratory experiments in this course are hands-on. Students will collect, process, manipulate, and graph data from both qualitative and quantitative observations. Inquiry is emphasized in many of the experiments that students complete. The laboratory work requires students to design, carry out, and analyze data using guided inquiry principles. Students are engaged in hands-on laboratory work, integrated throughout the course, which accounts for approximately 25% of the course.

Each week has 3.75 hours of instruction (45 min/day, 5 days/week). There are 18 weeks in the first semester for 67.5 hours and 15 weeks in the second semester (56.25 hours) for a total instructional time of 123.75 hours. Each lab takes approximately 1.5 hours of time to complete. There are 22 labs for a total lab time of 33 hours. This accounts for 26.7% of instructional time.

Laboratory Notebook: [CR12]

A laboratory notebook is required for the course. Students must write a lab report for each lab that includes a **lab title, abstract, hypothesis, procedure, data, analysis and conclusions** section. A lab template is provided to students for writing these lab reports.

Students must submit a digital copy of each lab. Students are also instructed to further keep a digital portfolio/notebook of all lab work housed within Google Drive.

Tests:

A unit test is assigned for each unit. A comprehensive, standardized exam is administered at the end of the year.

AP Exam Review:

The final 7 full class days before the AP Environmental Science Exam are used for exam review and practice tests using released AP Environmental Science exam materials. Several practice AP Exams are administered as part of the review prior to the AP Environmental Science Exam.

Unit 1: Introduction to Environmental Science

Big Idea 4 (STB)

Reading	Chapter 1.1-1.4; Core case studies from textbook; “From Carrying Capacity to Footprint, and Back Again” essay by Michael Cain; Essay on Natural Capital by Paul Hawken “Environmental Justice for All” by Robert Bullard; ELC scientific study report on diversity and stability
Lab	Tragedy of the Commons

	Students will use a simulation to explore how resources are used and exploited when they are available to multiple parties. Students will record and analyze data from the simulation and draw conclusions as to how the understanding gained from the simulation should be used in managing environmental resources and possible future implications it could have. Science Practice 7: Environmental Solutions. Propose and justify solutions to environmental problems. [CR10]
Lab	I=PAT equation This activity enables exploration of a resource, breaking it down into raw materials, processing, manufacturing, disposal, and other aspects of consumption, and then applying this information to the I=PAT equation to determine impact. Science Practice 6: Apply quantitative methods to address environmental concepts. [CR9]
Quizzes	
Activity	The Green President In this activity you will take on the role of a senator, making recommendations on a series of environmental bills. You will need to research each of the bills and consider both the impact to the environment as well as the impact to your constituents. Science Practice 7: Propose and justify solutions to environmental problems. [CR10]
Lab	Forecasting Earth's Future In this activity, you will be asked to research current environmental trends and resources that environmental scientists use to predict what the Earth will be like in 5,000,000 years. Using a PowerPoint, Prezi, or Google Slides and your voice, share your prediction based on the research you will have completed in the Student Handout. Science Practice 2: Analyze visual

	representations of environmental concepts and processes. [CR5]
Discussion	Sustainability
Practice quizzes	Ungraded
Test	Unit Test

Unit 2: Science, Matter and Energy

Big Idea 1: Energy Transfer (ENG)

AP Unit 6 [CR3]

Read	Chapter 2; “Weather, Climate, and Atmospheric Warming” article Energy Primer article from AP Central Article from Environmental Literacy Council on Energy and Humans “Ecosystems and Energy Flow” by Carol Widegren
Lab	Lab Seed Germination Gizmo & Introduction to Experimentation Using the Lab Seed Germination Gizmo, students must design an experiment using different environmental variables such a light, temperature, and water to determine the effect of each on growing plants. A formal lab report is generated by students that includes graphical data. Science Practice 4:Scientific Experiments. Analyze research studies that test environmental principles. [CR7]
Lab	Phase Diagrams Phase diagrams represent the pressure-temperature relationships for a substance in each state of matter. In this lab, students will learn how to interpret and create phase diagrams using collected data via websites. Science Practice 5: Data Analysis. Analyze and interpret quantitative data represented in tables, charts and graphs. [CR8]

Quizzes	2
Practice quizzes	ungraded
Test	Unit test

Unit 3 Population Dynamics

Big Idea 2 (ERT); Big Idea 3 (EIN)

AP Unit 3 [CR3]

Read	Chapter 3 Case Studies from textbook “Living in an Exponential Age” case study “Projecting Future Population Change” article “Family Planning in Iran” article
Lab	3.1. Prairie Ecosystems In this activity students observe the populations of grass, prairie dogs, ferrets and foxes in a prairie ecosystem. They Investigate feeding relationships and determine the food chain. Bar graphs and line graphs show changes in populations over time. Science Practice 1: Concept Explanation. Explain environmental concepts, processes, and models presented in written format. [CR4] Science Practice 3: Text Analysis. Analyze sources of information about environmental issues. [CR6]
Lab	3.3 Rabbit Population by Season Virtual Lab In this activity students will observe the population of rabbits in an environment over many years. The land available to the rabbits and weather conditions can be adjusted to investigate the effects of urban sprawl and unusual weather on wildlife populations. Science Practice 5: Data Analysis. Analyze and interpret quantitative data represented in tables, charts and graphs. [CR8]
Lab	3.6 Reintroducing the Lynx

	Students examine forest health and tree age distribution to determine where suitable lynx habitat exists. Utilizing large data quantities and creating different mathematical models, including graphs, students will recommend the most suitable habitat for the lynx. Science Practice 5: Data Analysis. Analyze and interpret quantitative data represented in tables, charts and graphs. [CR8] Science Practice 6: Mathematical Routines. Apply quantitative methods to address environmental concepts. [CR9]
Discussion	Population Regulation
Quizzes	2
Practice Quizzes	Ungraded
Test	Unit test

Unit 4 Ecosystems and Biodiversity
Big Idea 1 (ENG); Big Idea 2 (ERT)
AP Unit 1 [CR3]

Read	Chapters 3, 4, and 9 from textbook Core case studies from textbook “The Diversity-Stability Debate” article “Ecosystems” from the Environmental Literacy Council “Cascading Through the Environment” United Nations Environment Programme 2003 Yearbook “The California Natural Diversity Database; A Spatial Model for Cataloging Biodiversity” from ESRI Article on Evolution from AP Central by Mark Ewoldsen “Species Extinction Rate Speeding Up” by Dan Olson “Return of the American Bison” article
Activity	Dissolved Oxygen and Aquatic Primary Productivity virtual lab bench Students measure the amount of dissolved oxygen in water samples at different

	temperatures and analyze the effect of varying amounts of light on primary productivity. Students vary the conditions to determine the effects of temperature and light as well as create graphs to support conclusions. Science Practice 4: Scientific Experiments. Analyze research studies that test environmental principles. [CR7] Science Practice 5: Data Analysis. Analyze and interpret quantitative data represented in tables, charts and graphs. [CR8]
Lab	4.5 Evolution and Biodiversity Virtual Lab Students run a simulation examining the evolution and natural selection of the peppered moth and its relation to the industrial revolution. Students collect data and then draw conclusions from the collected data trends and graphs they create. Science Practice 1: Concept Explanation. Explain environmental concepts, processes, and models presented in written format. [CR4] Science Practice 4: Scientific Experiments. Analyze research studies that test environmental principles. [CR7] Science Practice 5: Data Analysis. Analyze and interpret quantitative data represented in tables, charts and graphs. [CR8]
Lab	4.6 Model Ecosystem Virtual Lab Students examine the populations of various producers and consumers in an ecosystem. Students predict how changing the population will change the ecosystem and then test their hypotheses. Students that collect data and draw conclusions on how varying populations affect ecosystems. Science Practice 4: Scientific Experiments. Analyze research studies that test environmental principles. [CR7]
Discussion	Vehicle Regulation
Quizzes	3
Practice quizzes	ungraded

Test	Unit test
------	-----------

Unit 5 Terrestrial Biodiversity

Big Idea 2 (ERT)

AP Unit 2 [CR3]

Read	Chapters 7 and 10 from textbook Core case studies from textbook “Forests” article from the World Resources Institute “Ecosystems Services Fact Sheet” by Ecological Society of America “Tropical Deforestation and Global Warming: Smithsonian Scientists Challenges Results of Recent Study” “Biodiversity Hotspots” from The Habitable Planet Series “Ecologist Urges Sharing Land with Other Species to Foster Biodiversity” from Johns Hopkins University “Biodiversity Hotspot in East Africa” article
Lab	5.1 Ocean Currents and Weather Gizmo Students explore the relationship between land and water temperature as well as air temperature over time and determine how it affects the weather. Science Practice 1: Concept Explanation. Explain environmental concepts, processes, and models presented in written format. [CR4]
Lab	5.3 Butcher of the Biomes Students must create a fictitious island complete with a topographical map and determine the climate for the biome based on its location and relation to different bodies of water. Students then compare their predictions with places in the world that are in a similar location to their fictitious biome to see how accurate they were. Science Practice 1: Concept Explanation. Explain environmental concepts, processes, and models presented in written format. [CR4] Science Practice 2: Visual

	Representations. Analyze visual representations of environmental concepts and processes. [CR5]
Discussion	Old Growth Forests
Quizzes	3
Practice quizzes	Ungraded
Test	Unit Test

Unit 6 Aquatic Biodiversity

Big Idea 2 (ERT); Big Idea 4 (STB)

AP Unit 2 [CR3]

Read	Chapter 8 and 11 from textbook Core case studies from textbook “A Global Map of Human Impacts to Marine Ecosystems” from NCEAS Saving Mangroves article from Cengage Learning Jellyfish article from Cengage Learning “Fully Protected Marine Reserves” from IW Learn “Impaired Waters and Total Maximum Daily Loads” from EPA “Oceans ‘13: The Post-Election Future of Ocean Policy” from National Geographic “A River in New Zealand Gets a Legal Voice” article
Lab	6.1 Pond Ecosystem Virtual Lab Students predict and examine how abiotic and biotic factors such as algae growth and temperature affect the ecosystem of a pond. Science Practice 4: Scientific Experiments. Analyze research studies that test environmental principles. [CR7]
Ungraded Practice	Released AP Free-response question
Lab	6.4 Coral Reefs Abiotic Factors Virtual Lab <i>In this activity students will explore the abiotic factors that affect Caribbean coral reefs.</i>

	Many factors can be manipulated in this simplified reef model, including ocean temperature and pH, storm severity, and input of excess sediments and nutrients from logging, sewage, and agriculture. Students can click "Advance year" to see how the reef responds to these changes. Science Practice 4: Scientific Experiments. Analyze research studies that test environmental principles. [CR7]
Lab	6.5 Coral Reefs Biotic Factors Virtual Lab In this follow up to the Coral Reefs Abiotic Factors activity, students investigate the impacts of fishing, disease, and invasive species on a model Caribbean coral reef. Many variables can be manipulated, including intensity of fishing, presence of black band and white band disease, and the presence of actual and potential invasive species. Students can click "Advance year" to see the impacts of these biotic changes. Science Practice 3: Text Analysis. Analyze sources of information about environmental issues. [CR6] Science Practice 7: Environmental Solutions. Propose and justify solutions to environmental problems. [CR10]
Lab	6.7 How Is My Waterway Virtual Lab Students will take a look at their local waterways to determine what pollutants exist and how they got there using the EPA database. Ultimately, students will develop a plan outlining what techniques should be implemented to restore the aquatic ecosystem. Science Practice 5: Data Analysis. Analyze and interpret quantitative data represented in tables, charts and graphs. [CR8] Science Practice 7: Environmental Solutions. Propose and justify solutions to environmental problems. [CR10]
Discussion	Commercial Whaling

Quizzes	2
Practice quizzes	Ungraded
Test	Unit test

Unit 7 Introduction to Food, Soil, and Pests

Big Idea 3 (EIN); Big Idea 4 (STB)

AP Unit 5 [CR3]

Read	Chapter 12 textbook Core case studies from textbook “Genetic Engineering Issues” from Explore More
Activity	7.1 Food Security Infomercial Students will be asked to create an audio infomercial in which they highlight some of the major issues surrounding world food security. Science Practice 7: Environmental Solutions. Propose and justify solutions to environmental problems. [CR10]
Ungraded Practice	Released AP Free-Response question
Discussion	Commercial Meat Production
Quizzes	2
Practice Quizzes	Ungraded
Test	Unit test

Unit 8 Introduction: Earth Systems and Resources

Big Idea 1 (ENG); Big Idea 2 (ERT)

AP Units 4, 6

Read	Chapters 14, 15, and 16 textbook Core case studies from textbook “Coal”, “Oil and Gas” and “Fossil Fuel Technology” articles from learner.org “Unconventional Fossil Fuels and
------	---

	Technologies” from learner.org
Lab	8.3 Home Energy Audit Lab Students examine the energy rating versus true energy use of appliances within their homes in order to gain understanding of how electricity is used through calculations. Students also propose how to reduce electrical energy use and potentially replace the appliance with a sustainable resource. Science Practice 6: Mathematical Routines. Apply quantitative methods to address environmental concepts. [CR9]
Discussion	Nuclear Power
Lab	Solar House Lab Students will build a scale model of a house using passive solar techniques to heat and cool the house. Students must take exterior design, orientation, building materials, temperature regulation, and lighting when building and presenting their solutions to demonstrate an understanding of energy conservation design within construction. Science Practice 7: Environmental Solutions. Propose and justify solutions to environmental problems. [CR10]
Quizzes	3
Practice quizzes	Ungraded
Test	Unit test

Unit 9 Water and Pollution
Big Idea 3 (EIN); Big Idea 4 (STB)
AP Units 5, 8

Read	Chapters 13 and 20 in textbook Core case studies in textbook “Distribution of Freshwater Resources” from learner.org “Depletion of Freshwater Resources” article
------	--

	“Groundwater” from the Groundwater Association “Water Pollution” from learner.org
Lab	9.1 Pond Ecosystem Field Experience Lab Students will identify a pond and record data on appearance, biological characteristics, and chemical characteristics of the pond in order to assess the overall health of the pond. This includes performing at least three different water quality tests that could include coliform bacteria, dissolved oxygen, nitrate, pH, phosphate, or turbidity. Between the tests and other surrounding observations, students will draw conclusions about the health of the pond. Science Practice 1: Concept Explanation. Explain environmental concepts, processes, and models presented in written format. [CR4] Science Practice 4: Scientific Experiments. Analyze research studies that test environmental principles. [CR7]
Discussion	Dams
Lab	9.4 Water Pollution Gizmo Lab Students explore the different types of pollution: toxic, sediment, nutrient, and bacterial. Students identify different types of pollution present in different situations and identify sources of the pollution in order to understand the repercussions of different environmental actions. Science Practice 1: Concept Explanation. Explain environmental concepts, processes, and models presented in written format. [CR4]
Quizzes	2
Practice quizzes	Ungraded
Test	Unit test

Big Idea 3 (EIN); Big Idea 4 (STB)
AP Units 5, 7

Read	Chapters 18 and 19 in textbook Core case studies in textbook EPA article on indoor air quality “Controlling Air Pollution” from learner.org “Atmospheric Pollution: Major Laws and Treaties” from learner.org “Earth’s Changing Climate: Major Laws and Treaties” from learner.org “Stratospheric Ozone” from learner.org
Lab	10.1 Earth’s Atmosphere Virtual Lab Students explore the various characteristics of the layers of the atmosphere then produce graphs to help determine the relationships between the various characteristics such as density and altitude. Science Practice 1: Concept Explanation. Explain environmental concepts, processes, and models presented in written format. [CR4] Science Practice 5: Data Analysis. Analyze and interpret quantitative data represented in tables, charts, and graphs. [CR8]
Discussion	Coal Power
Lab	10.4 Greenhouse Effect Gizmo Lab Students explore the mechanism of the Greenhouse Effect and how different conditions such as additional carbon dioxide change the severity of the effect. Science Practice 1: Concept Explanation. Explain environmental concepts, processes, and models presented in written format. [CR4]
Quizzes	2
Practice quizzes	Ungraded
Test	Unit test

Unit 11 Environmental Hazards and Waste Management

Big Idea 3 (EIN); Big Idea 4 (STB)

AP Unit 8

Read	Chapters 17 and 21 in textbook “PCBs in the Great Lakes” article from Scientific American
Discussion	HIV and AIDS
Ungraded Practice	Released AP Free-response question
Lab	11.4 Waste Management Field Experience Students will trace the path that both solid and liquid waste takes once leaving their homes or school. Students will also visit a waste disposal facility. Students will gain an understanding of how waste is handled and the challenges and practices that occur with it. Science Practice 1: Concept Explanation. Explain environmental concepts, processes, and models presented in written format. [CR4]
Quizzes	2
Practice quizzes	Ungraded
Test	Unit test

Unit 12 Sustainability: Economics and Policies

Big Idea 3 (EIN); Big Idea 4 (STB)

AP Unit 9

Read	Chapter 22, 23, and 24 in textbook “Noise Pollution and the Environment” from The Australian Academy of Science “Benefit-Cost Analysis and Risk Tradeoffs” from learner.org “Detroit Sustainability Action Agenda Summary” from detroitmi.gov
Activity	12.3 Tips For Taking the AP Exam Students will explore some resources from

	the college board pertaining to the AP Environmental Science exam and prepare a set of test-taking tips.
Discussion	Full Cost Pricing
Activity	12.6 Green President Project Students will take on the role of a Senator serving on a subcommittee in which they will endorse or oppose bills that have been proposed by the president. Their job is to play the role of a senator serving on a senate committee to review and make recommendations regarding the legislation she will be introducing. They must look at the needs of their constituents and ensure that they are being represented properly. Science Practice 7: Environmental Solutions. Propose and justify solutions to environmental problems. [CR10]
Quizzes	3
Practice Quizzes	Ungraded
Test	Unit Test