

AP Environmental Science

Theme

The goal of the AP Environmental Science course is to provide students with the scientific principles, concepts, and methodologies required to understand the interrelationships of the natural world, to identify and analyze environmental problems both natural and human-made, to evaluate the relative risks associated with these problems, and to examine alternative solutions for resolving or preventing them.

Environmental science is interdisciplinary; it embraces a wide variety of topics from different areas of study. Yet there are several major unifying constructs, or themes, that cut across the many topics included in the study of environmental science. The following themes provide a foundation for the structure of the AP Environmental Science course.

1. Science is a process
 - Science is a method of learning more about the world.
 - Science constantly changes the way we understand the world.
2. 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.
3. The Earth itself is one interconnected system.
 - Natural systems change over time and space.
 - Biogeochemical systems vary in ability to recover from disturbances.
4. Humans alter natural systems.
 - Humans 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.
5. Environmental problems have a cultural and social context.
 - Understanding the role of cultural, social, and economic factors is vital to the development of solutions.
6. Human survival depends on developing practices that will achieve sustainable systems.
 - A suitable combination of conservation and development is required.
 - Management of common resources is essential.

Reading Standards

Key Ideas and Details:

1. Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.
2. Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.

Writing Standards

Text Types and Purposes:

1. Write arguments focused on discipline-specific content.
 - a. Introduce precise, knowledgeable claim(s), establish the significance of the claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that logically sequences the claim(s), counterclaims, reasons, and evidence.
 - b. Develop claim(s) and counterclaims fairly and thoroughly, supplying

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3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.

Craft and Structure:

4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11-12 texts and topics.
5. Analyze how the text structures information or ideas into categories or hierarchies, demonstrating understanding of the information or ideas.
6. Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, identifying important issues that remain unresolved.

Integration of Knowledge and Ideas:

7. Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.
8. Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.
9. Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.

Range of Reading and Level of Text Complexity:

10. By the end of grade 12, read and comprehend science/technical texts in the grades 11-CCR text complexity band independently and proficiently.

the most relevant data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in a discipline-appropriate form that anticipates the audience's knowledge level, concerns, values, and possible biases.

- c. Use words, phrases, and clauses as well as varied syntax to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.
 - d. Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing.
 - e. Provide a concluding statement or section that follows from or supports the argument presented.
2. Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.
 - a. Introduce a topic and organize complex ideas, concepts, and information so that each new element builds on that which precedes it to create a unified whole; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension.
 - b. Develop the topic thoroughly by selecting the most significant and relevant facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience's knowledge of the topic.
 - c. Use varied transitions and sentence structures to link the major sections of the text, create cohesion, and clarify the relationships among complex ideas and concepts.
 - d. Use precise language, domain-specific vocabulary, and techniques such as metaphor, simile, and analogy to manage the complexity of the topic; convey a knowledgeable stance in a style that responds to the discipline and context as well as to the expertise of likely readers.

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e. Provide a concluding statement or section that follows from and supports the information or explanation provided (e.g., articulating implications or the significance of the topic).

3. Students' narrative skills continue to grow in these grades. The Standards require that students be able to incorporate narrative elements effectively into arguments and informative/explanatory texts. In history/social studies, students must be able to incorporate narrative accounts into their analyses of individuals or events of historical import. In science and technical subjects, students must be able to write precise enough descriptions of the step-by-step procedures they use in their investigations or technical work that others can replicate them and (possibly) reach the same results.

Production and Distribution of Writing:

4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
5. Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.
6. Use technology, including the Internet, to produce, publish, and update individual or shared writing products in response to ongoing feedback, including new arguments or information.

Research to Build and Present Knowledge:

7. Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.
8. Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation.

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9. Draw evidence from informational texts to support analysis, reflection, and research.

Range of Writing:

10. Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.

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Strand Connection: <i>Earth Systems and Resources</i>	
Topic A. Earth Science Concepts B. The Atmosphere C. Global Water Resources and Use D. Soil and Soil Dynamics	Pacing 15-20 Days
Learning Targets 1. Explain the relationships among plate tectonics, earthquakes, and volcanism. 2. Outline the rock cycle and its relationship to soil formation. 3. Discuss the state of the atmosphere in terms of weather, climate, air pollution, ozone, and greenhouse gases. 4. Analyze the environmental quality of air, soil, and water.	Content Elaborations <i>I. Earth Systems and Resources (10-15%)</i> A. Earth Science Concepts (Geologic time scale; plate tectonics, earthquakes, volcanism; seasons; solar intensity and latitude) B. The Atmosphere (Composition; structure; weather and climate; atmospheric circulation and the Coriolis Effect; atmosphere-ocean interactions; ENSO) C. Global Water Resources and Use (Freshwater/saltwater; ocean circulation; agricultural, industrial, and domestic use; surface and groundwater issues; global problems; conservation) D. Soil and Soil Dynamics (Rock cycle; formation; composition; physical and chemical properties; main soil types; erosion and other soil problems; soil conservation)
Content Vocabulary <ul style="list-style-type: none"> • geologic time scale • plate tectonics • earthquakes • volcanism • seasons • solar • intensity • latitude • weather • climate • freshwater/saltwater • ocean circulation • agricultural • industrial • domestic use • conservation • rock cycle • composition • physical and chemical properties • erosion 	Academic Vocabulary <ul style="list-style-type: none"> • derive • differentiation • extrapolate • assess • evaluate • impact • interpret • outcome • predict • qualitative • quantitative • unify • validate

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<ul style="list-style-type: none">• atmospheric circulation• Coriolis effect <ul style="list-style-type: none">• soil conservation	
Formative Assessments <ul style="list-style-type: none">• Will be created as course evolves	Summative Assessments <ul style="list-style-type: none">• Will be created as course evolves
Resources <ul style="list-style-type: none">• <i>Environment: The Science Behind the Stories</i>, by Jay Withgott	Enrichment Strategies
Integrations	Intervention Strategies

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Strand Connection: <i>The Living World</i>	
Topic A. Ecosystem Structure B. Energy Flow C. Ecosystem Diversity D. Natural Ecosystem Change E. Natural Biogeochemical Cycles	Pacing 15-20 Days
Learning Targets 1. Outline the flow of energy and the cycling of matter within the natural Earth's system. 2. Construct a food web showing interrelationships among organisms in an ecological community. 3. Explain how usable energy is generated from fossil fuels, nuclear fuels, and alternative sources and the tradeoffs associated with their use.	Content Elaborations <i>II. The Living World (10-15%)</i> A. Ecosystem Structure (Biological populations and communities; ecological niches; interactions among species; keystone species; species diversity and edge effects; major terrestrial and aquatic biomes) B. Energy Flow (Photosynthesis and cellular respiration; food webs and trophic levels; ecological pyramids) C. Ecosystem Diversity (Biodiversity; natural selection; evolution; ecosystem services) D. Natural Ecosystem Change (Climate shifts; species movement; ecological succession) E. Natural Biogeochemical Cycles (Carbon, nitrogen, phosphorus, sulfur, water, conservation of matter)
Content Vocabulary <ul style="list-style-type: none"> ● biological populations ● communities ● ecological niches ● symbiosis ● keystone species ● species diversity ● edge effects ● biomes ● photosynthesis ● ecological pyramids ● biodiversity ● natural selection ● evolution ● ecosystem services ● climate shifts ● species movement ● ecological succession ● carbon 	Academic Vocabulary <ul style="list-style-type: none"> ● derive ● differentiation ● extrapolate ● assess ● evaluate ● impact ● interpret ● outcome ● predict ● qualitative ● quantitative ● unify ● validate

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<ul style="list-style-type: none">• cellular respiration• food webs• trophic levels• nitrogen• phosphorus	
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Strand Connection: <i>Population</i>	
Topic A. Population Biology Concepts B. Human Population	Pacing 15-20 Days
Learning Targets 1. Describe and analyze population growth, including the dynamic of human populations. 2. Explain the factors that lead to the endangering of species and the loss of biodiversity.	Content Elaborations <i>III. Population (10-15%)</i> A. Population Biology Concepts (Population ecology; carrying capacity; reproductive strategies; survivorship) B. Human Population 1. Human population dynamics (Historical population sizes; distribution; fertility rates; growth rates and doubling times; demographic transition; age-structure diagrams) 2. Population size (Strategies for sustainability; case studies; national policies) 3. Impacts of population growth (Hunger; disease; economic effects; resource use; habitat destruction)
Content Vocabulary <ul style="list-style-type: none"> • population ecology • carrying capacity • reproductive strategies • survivorship • historical population sizes • distribution • fertility rates • growth rates • doubling times • demographic transition • age-structure diagrams • sustainability 	Academic Vocabulary <ul style="list-style-type: none"> • derive • differentiation • extrapolate • assess • evaluate • impact • interpret • outcome • predict • qualitative • quantitative • unify • validate
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Integrations

Intervention Strategies

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Strand Connection: <i>Land and Water Use</i>	
Topic A. Agriculture B. Forestry C. Rangelands D. Other Land Use E. Mining F. Fishing G. Global Economies	Pacing 15-20 Days
Learning Targets 1. Describe the problems associated with agriculture and food production in today's world. 2. Identify renewable and nonrenewable resources, including distribution, ownership, use, and degradation. 3. Explain environmental problems in relationship to scientific, social, legal, cultural, and economic factors.	Content Elaborations IV. Land and Water Use (10-15%) A. Agriculture 1. Feeding a growing population (Human nutritional requirements; types of agriculture; Green Revolution; genetic engineering and crop production; deforestation; irrigation; sustainable agriculture) 2. Controlling pests (Types of pesticides; costs and benefits of pesticide use; integrated pest management; relevant laws) B. Forestry (Tree plantations; old growth forests; forest fires; forest management; national forests) C. Rangelands (Overgrazing; deforestation; desertification; rangeland management; federal rangelands) D. Other Land Use 1. Urban land development (Planned development; suburban sprawl; urbanization) 2. Transportation infrastructure (Federal highway system; canals and channels; roadless areas; ecosystem impacts) 3. Public and federal lands (Management; wilderness areas; national parks; wildlife refuges;

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	<p>forests; wetlands)</p> <p>4. Land conservation options (Preservation; remediation; mitigation; restoration)</p> <p>5. Sustainable land-use strategies</p> <p>E. Mining (Mineral formation; extraction; global reserves; relevant laws and treaties)</p> <p>F. Fishing (Fishing techniques; overfishing; aquaculture; relevant laws and treaties)</p> <p>G. Global Economics (Globalization; World Bank; Tragedy of the Commons; relevant laws and treaties)</p>
<p>Content Vocabulary</p> <ul style="list-style-type: none"> • human nutritional requirements • types of agriculture • Green Revolution • genetic engineering • crop production • deforestation • irrigation • sustainable agriculture • integrated pest management • overgrazing 	<p>Academic Vocabulary</p> <ul style="list-style-type: none"> • derive • differentiation • extrapolate • assess • evaluate • impact • interpret • outcome • predict • qualitative • quantitative • unify • validate
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Strand Connection: <i>Energy Resources and Consumption</i>	
Topic A. Energy Concepts B. Energy Consumption C. Fossil Fuel Resources and Use D. Nuclear Energy E. Hydroelectric Power F. Energy Conservation G. Renewable Energy	Pacing 15-20 Days
Learning Targets 1. Identify renewable and nonrenewable resources, including distribution, ownership, use, and degradation. 2. Explain how usable energy is generated from fossil fuels, nuclear fuels, and alternative sources and the tradeoffs associated with their use.	Content Elaborations V. Energy Resources and Consumption (10-15%) A. Energy Concepts (Energy forms; power; units; conversions; Laws of Thermodynamics) B. Energy Consumption 1. History (Industrial Revolution; exponential growth; energy crisis) 2. Present global energy use 3. Future energy needs C. Fossil Fuel Resources and Use (Formation of coal, oil, and natural gas; extraction/purification methods; world reserves and global demand; synfuels; environmental advantages/disadvantages of sources) D. Nuclear Energy (Nuclear fission process; nuclear fuel; electricity production; nuclear reactor types; environmental advantages/disadvantages; safety issues; radiation and human health; radioactive wastes; nuclear fusion) E. Hydroelectric Power (Dams; flood control; salmon; silting; other impacts) F. Energy Conservation (Energy efficiency; CAFE standards; hybrid electric vehicles; mass transit) G. Renewable Energy (Solar energy; solar electricity; hydrogen fuel cells; biomass; wind energy;

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	small-scale hydroelectric; ocean waves and tidal energy; geothermal; environmental advantages/disadvantages)
<p>Content Vocabulary</p> <ul style="list-style-type: none"> • laws of thermodynamics • exponential growth • extraction • purification • nuclear fission • nuclear fusion • radioactive waste • silting • energy efficiency • solar energy • hydrogen fuel cells • biomass • hydroelectric • geothermal 	<p>Academic Vocabulary</p> <ul style="list-style-type: none"> • derive • differentiation • extrapolate • assess • evaluate • impact • interpret • outcome • predict • qualitative • quantitative • unify • validate
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Strand Connection: <i>Pollution</i>	
Topic A. Pollution Types B. Impacts on the Environment and Human Health C. Economic Impacts	Pacing 30-40 Days
Learning Targets <ol style="list-style-type: none"> 1. Analyze the environmental quality of air, soil, and water. 2. Outline the processes involved in water and sewage treatment. 3. Identify the problems associated with the disposal of solid and toxic wastes. 4. Identify global changes and their consequences. 	Content Elaborations VI. Pollution (25-30%) A. Pollution Types <ol style="list-style-type: none"> 1. Air pollution (Sources – primary and secondary; major air pollutants; measurement units; smog; acid deposition – causes and effects; heat islands and temperature inversions; indoor air pollution; remediation and reduction strategies; Clean Air Act and other relevant laws) 2. Noise pollution (Sources; effects; control measures) 3. Water pollution (Types; sources, causes, and effects; cultural eutrophication; groundwater pollution; maintaining water quality; water purification; sewage treatment/septic systems; Clean Water Act and other relevant laws) 4. Solid waste (Types; disposal; reduction) B. Impacts on the Environment and Human Health <ol style="list-style-type: none"> 1. Hazards to human health (Environmental risk analysis; acute and chronic effects; dose-response relationships; air pollutants; smoking and other risks) 2. Hazardous chemicals in the environment (Types of hazardous waste; treatment/disposal of hazardous waste; cleanup of contaminated sites; biomagnification; relevant laws) C. Economic Impacts (Cost-benefit analysis; externalities; marginal costs; sustainability)

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<p>Content Vocabulary</p> <ul style="list-style-type: none"> • smog • acid deposition • temperature inversion • Clean Air Act • cultural eutrophication • groundwater pollution • Clean Water Act • biomagnification 	<p>Academic Vocabulary</p> <ul style="list-style-type: none"> • derive • differentiation • extrapolate • assess • evaluate • impact • interpret • outcome • predict • qualitative • quantitative • unify • validate
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<p>Resources</p> <ul style="list-style-type: none"> • <i>Environment: The Science Behind the Stories</i>, by Jay Withgott 	<p>Enrichment Strategies</p>
<p>Integrations</p>	<p>Intervention Strategies</p>

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Strand Connection: <i>Global Change</i>	
Topic A. Ozone B. Global Warming C. Loss of Biodiversity	Pacing 15-20 Days
Learning Targets 1. Explain the factors that lead to the endangering of species and the loss of biodiversity. 2. Discuss the state of the atmosphere in terms of weather, climate, air pollution, ozone, and greenhouse gases. 3. Discuss the effects of environmental quality on human health.	Content Elaborations VII. Global Change (10-15%) A. Stratospheric Ozone (Formation of stratospheric ozone; ultraviolet radiation; causes of ozone depletion; effects of ozone depletion; strategies for reducing ozone depletion; relevant laws and treaties) B. Global Warming (Greenhouse gases and the greenhouse effect; impacts and consequences of global warming; reducing climate change; relevant laws and treaties) C. Loss of Biodiversity 1. Habitat loss; overuse; pollution; introduced species; endangered and extinct species 2. Maintenance through conservation 3. Relevant laws and treaties
Content Vocabulary <ul style="list-style-type: none"> • stratospheric ozone • ultraviolet radiation • ozone depletion • greenhouse gases • greenhouse effect • global warming • climate change • invasive species • conservation 	Academic Vocabulary <ul style="list-style-type: none"> • derive • differentiation • extrapolate • assess • evaluate • impact • interpret • outcome • predict • qualitative • quantitative • unify • validate

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