

AP Environmental Science Course Description

The class size of each section of AP Environmental Science averages 30 students. The class meets three times a week. The week consists of one single period of 45 minutes and two block periods lasting 95-105 minutes. Total class time is approximately 245 minutes per week. The course is a combination of lectures, discussions, labs and analysis assignments. Labs are conducted with each unit and average approximately one block day (100 minutes) per week. The labs include hands-on activities, field work at a local lake or lab activities conducted on-line. The course is divided into 8 units. Throughout each unit, two major themes of the class are the human population and sustainable use of resources.

C11-Evidence of Curricular Requirement: The course includes a laboratory and/or field investigation component. A minimum of one class period or its equivalent per week is spent engaged in laboratory
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Grades are determined by the performance on labs, quizzes, exams, a quarterly project, and a community service requirement. Weekly quizzes are given on 1-2 chapters and unit exams will cover 3-5 chapters. The unit exams are modeled after the AP test, using released multiple choice questions and essay questions. Each exam has 60 multiple choice questions (60%) and 2-3 essays (40%). The students are required to complete four hours of environmentally based community service. Examples include stream restoration, stream monitoring, tree plantings, organized removal of invasive plants and community clean ups.

Course Prerequisites

The course is open to all students who have successfully passed Biology and Chemistry.

Textbook

Miller, G. Tyler. *Living in the Environment, 14th Edition*. Brooks/Cole, 2005.

Course Planner

Unit 1-Introduction and Population Issues (Weeks 1-5)

- Chapter 1-Environmental Problems, Their Causes and Sustainability
 - Topics covered include introduction to sustainability, population growth, resource use, and pollution
 - Lab-Tragedy of the Commons-Students illustrate the concept of Tragedy of the Commons using a resource that all students have equal access to.
 - Movie-The Lorax-used as an introduction to the class to discuss the problems associated with rapid population growth, sustainable use of resources, and pollution.
- Chapter 2-Environmental History Learning from the Past
 - Environmental history of the United States
- Chapter 3-Science, Systems, Matter and Energy
 - Basic concepts include the nature of science, models, matter and energy
 - Lab-Journaling in Nature-Field trip to local lake where students make observations and identification of plants, animals, abiotic factors and interactions between organisms. Journal includes reflections, observations and sketches.
- Chapter 9-Population Ecology
 - Topics include carrying capacity, reproductive patterns, genetic variations and human impacts on natural systems

C1-Evidence of Curricular Requirement: Earth Systems

C8-Evidence of Curricular Requirement: The course provides students with the scientific principles, concepts and methodologies required to understand the interrelationships of the natural world. The curriculum draws upon

C3-Evidence of Curricular Requirement: Population

- Lab-Survivorship Curves-students analyze current and historical obituaries to compare the average lifespan in each period for both sexes. They create survivorship curves and compare them to typical Type I and Type III curves
- Exponential growth lab-Using random throws of coins, this activity simulates population growth of a species.

C9-Evidence of Curricular Requirement: The course includes methods for analyzing and interpreting information and experimental data, including mathematical

● Chapter 10-Applying Population Ecology to the Human Population

- Topics include developed/developing nations, age structure diagrams, problems associated with population growth, trends and solutions.
- Lab/Research project-Population pyramid-students create an age structure diagram for an assigned country. They analyze the graph and write a research paper on how their country is affected by the growth pattern (resource use, pollution, economy, education).

C10-Evidence of Curricular Requirement: The course teaches students how to identify and analyze environmental problems, to evaluate the ecological and human health risks associated with these problems and to critically examine various solutions for resolving or

Exam 1-chapters 1,2,3,9 and 10

Unit 2-Water (Weeks 6-11)

- Chapter 15-Water Resources
 - Topics include-properties of water, use of water resources, dams, groundwater and floods.
- Chapter 22-Water Pollution and Treatment
 - Topics include-sources of water pollution, effects of pollution on streams, lakes, oceans and groundwater, preventing pollution, wastewater treatment and drinking water quality
 - Field Study/Lab-Students perform a variety of water quality tests at local lake. Tests include Nitrates, Phosphates, pH, temperature, turbidity, fecal coliform, Dissolved Oxygen, Biological Oxygen Demand. We may also test for macroinvertebrates, depending on testing site. Students will analyze data to determine quality of water,

C4-Evidence of Curricular Requirement: Land and Water

C9-Evidence of Curricular Requirement: The course includes methods for analyzing and interpreting information and experimental data, including mathematical

C6-Evidence of Curricular Requirement: Pollution

- Sewer Science Program-Students model the wastewater treatment process, including primary, secondary and tertiary treatment. Guest lectures on wastewater treatment, biological treatment and storm water management are included.
- Field trip to Wastewater treatment plant-students visit and tour a wastewater treatment plant to observe the process.
- Chapter 7-Aquatic Biodiversity
 - Topics include-aquatic habitats (streams, oceans and lakes), diversity of organisms found in the oceans
 - Optional field trip to Key Largo in the spring to observe and study coral reef ecology.
- Chapter 13-Sustaining Aquatic Biodiversity
 - Topics include human effects on aquatic biodiversity, managing fisheries, wetlands, protecting and restoring aquatic habitats

C10, C11

C2-Evidence of Curricular Requirement: The Living World

Exam 2-Chapters 15, 22, 7 and 13

Unit 3-Forests, Soils and Agriculture (Weeks 11-15)

C1, C2, C3, C4, C5, C8, C10, C11

- Chapter 4, section 6-Soil formation
- Chapter 14-Food and soil resources
 - Topics include-agricultural techniques, green revolution, soil erosion, soil conservation, increasing crop production and sustainable agriculture techniques
 - Lab-Physical and Chemical Characteristics of Soil-students will use control samples of sand and clay as well as local soil samples to determine a variety of physical and chemical properties and relate the characteristics to topics such as agriculture, erosion and landfills
 - Mining lab-students will model the process of mining and the decisions that need to be made when mining in a natural habitat using a “habitat” in a box. The habitat consists of sand substrate within which are buried minerals. The students decide

how to mine the site and how to manage the local plants and animals.

- Chapter 11-Terrestrial Biodiversity
 - Topics include-human impacts on terrestrial ecosystems, public lands and parks, managing forest resources, deforestation, ecological restoration
- Chapter 16-Geologic Processes
 - Topics include-earthquakes, plate tectonics, volcanism, minerals, mining, effects of mining, rock cycle, and sustainable use of minerals
 - Geology Project-students will create a children's book describing the rock cycle and create a time line of geologic history and illustrate the characteristic plants and animals of each era

Exam 3-chapters 4,6, 11, 14 and 16

C1, C3, C4, C5, C6, C9, C10, C11

Unit 4-Energy (Weeks 15-18)

- Chapter 3.4-3.8-Energy Basics
 - Topics include-laws of thermodynamics, energy efficiency, and nuclear energy
- Chapter 17-Nonrenewable Energy Sources
 - Topics include-sources of energy (oil, coal, natural gas and nuclear energy), energy demands of increasing population, effects of use of fossil fuels
 - Lab-Home Energy Audit-students will record energy use over a period of 5 days and compare their usage to their electric bill. They will analyze their usage patterns to see where energy can be conserved
- Chapter 18-Renewable Energy Sources
 - Topics include sources of energy (solar, wind, hydroelectric, tidal, geothermal, hydrogen), effects of these sources of energy, and sustainable use of resources
 - Lab-Design Environmental Dream House-the students create a 3-D model of a house utilizing green architecture techniques. They can include architectural changes, methods to make the house

C5-Evidence of Curricular Requirement: Energy Resources

more energy efficient or any additional modifications to conserve resources

Exam 4-Chapters 3.4-3.8, 17 and 18

Unit 5-Climate and Air (weeks 19-23)

C1, C3, C6, C7, C8, C9, C10, C11

- Chapter 6-Climate and Terrestrial Biodiversity
 - Topics include-weather systems, climate and biomes, and El Nino
- Chapter 20-Air Pollution
 - Topics include-structure of the atmosphere, outdoor air pollution, acid rain, indoor air pollution and pollution prevention
 - Lab-Air Particulates-students will hypothesize whether there is greater air pollution outdoors or indoors. They create slides with petroleum jelly to capture particulate matter and analyze the slides using microscopes
 - Lab-Acid Rain-students will observe the effects of acid rain on natural and man made objects. They will analyze where the primary pollutants are released and how wind pattern affect the distribution and concentration of acid rain.
- Chapter 21-Climate Change and Ozone Loss
 - Topics include-historic climate change, greenhouse effect, human effects on climate change, effects of global warming, ways to reduce emissions, causes of ozone depletion, and effects of ozone depletion
 - Lab-Global warming-students will measure the effect that CO₂ has on temperature increase and relate that to the increase in atmospheric CO₂ and global warming

C7-Evidence of Curricular Requirement: Global Change

Exam 5-Chapters 6, 20 and 21

Unit 6-Toxicology and Waste Management (weeks 23-26)

C3, C6, C9, C10, C11

- Chapter 19-Risk, Toxicology and Human Health
 - Topics include-risk, toxicology, chemical hazards, disease and risk analysis

- Lab-LC-50-students will decide on a specific toxin and create a series of dilutions to see the effect on the germination of lettuce seeds. They will use this data to determine the LC-50 of their particular toxin
- Virtual lab-students review experiment and data collected of toxicology experiment on exposure to tobacco smoke (from www.biology.arizona.edu)
- Chapter 23-Pest Management
 - Topics include-Types and uses of pesticides, benefits and dangers of pesticides, and alternatives to pesticide use
 - Lab-Pesticides-students will use positive and negative controls for the pesticide atrazine to determine if the pesticide is present in local water bodies.
- Chapter 24-Soild and Hazardous Waste
 - Topics include-waste production, recycling, landfills, alternative solutions to waste, hazardous waste, and Love Canal.

Exam 6-Chapters 19, 23, 24

Additional project-Current events-Students collect articles over the span of 2 months dealing with topics that we have covered in class. They summarize each article and write a short paper with a response for 3 selected articles.

Unit 7-Ecology (weeks 27-31)

C1, C2, C8, C9, C11

- Chapter 4-Ecosystems and nutrient cycles
 - Topics include-basics of ecology, energy flow, primary productivity, ecosystem components and the flow of energy and nutrients through the ecosystems
 - Lab-Predator/Prey-students will simulate and analyze the periodic changes in population associated with a predator prey relationship
- Chapter 5-Evolution and Biodiversity
 - Topics include-origins of life, evolution and adaptations, ecological niches and endangered species

- Lab-Natural Selection-Students will observe the process of natural selection using different colors of beans in a variety of habitats to observe the changes in relative frequencies of each “phenotype” over time. They will complete a chi square analysis using the data they collected.
- Chapter 8-Community Ecology
 - Topics include-community structure, species interactions and succession
 - Lab-Mark and Recapture-Students will simulate the process of estimating a population size using the mark and recapture method
- Chapter 12-Sustaining Biodiversity
 - Topics include-extinction, importance of biodiversity, human effects on habitats and protection of biodiversity
 - Project-Students will research and prepare a report on an 2 endangered species of their choice-one local and one other of their choice.

Exam 7-Chapter 4, 5, 8 and 12

C1, C3, C4, C5, C6, C8, C10, C11

Unit 8-Sustainable Development (weeks 31-33)

- Chapter 25-Sustainable Cities
 - Topics include-urbanization, transportation and land use
 - Lab-Students will create a plan for a “Sustainable City” using concepts covered throughout the year including land use, energy sources, zoning, air and water pollution control and habitat preservation.
- Chapter 26-Environmental Economics
 - Topics include-Cost Benefit analysis, sustainability and resource management
- Chapter 27-Politics and the Environment
 - Topics include-environmental legislation and environmental policy
 - Activity-students will be assigned a topic to research and prepare for a debate to their assigned topics

All students enrolled in the course are required to take the AP exam in May.

Environmental Education Project-After the AP test, the students complete a final project. They choose any topic that we covered in class and create an activity to teach that concept. We pair up with a local elementary school to conduct these activities.