AP Environmental Science

Course Description

AP Environmental Science is a full year high school course designed to be the equivalent of a college introductory Environmental Science course. A major goal of the course is to understand the interrelations of the natural world and the impact of humans on natural systems. The course has seven major themes including: *Energy Systems and Resources*, *The Living World*, *Populations*, *Land and Water Use*, *Energy Resources and Consumption*, *Pollution*, and *Global Change*.

The content, discussions, and laboratory investigations will focus on the roles humans play in changing the natural world. We will investigate how to identify and analyze environmental problems and also propose solutions to these problems based on scientific principles.

This class will prepare you for the AP exam. Class discussion, textbook readings, labs, activities and field studies will all be used to help you master the concepts and ideas of the course.

Class Schedule & Methods

The AP Environmental Science course uses a combination of lectures, discussions, in-class assignments, demonstrations, written assignments, research projects, and Lab work. One lab period per week is used for hands-on laboratory work or fieldwork. The Lab period is an 88-minute double period. Therefore, this course meets for 6 periods a week for a total of 256 minutes a week, of which at least 88 are devoted to lab work and field work. Lab activities are hands-on so that students can experience the process of science, not just the results. During lab activities, students will develop and test hypotheses, collect, analyze and present data and clearly present their results. Summaries of Lab results and fieldwork reports are collected no later than one week after the conclusion of each activity.

Textbook

Botkin, Daniel and Edward Keller. *Environmental Science: Earth as a Living Planet.* 8th Edition; *New York, NY: John Wiley and Sons.*

Grade Breakdown

Tests & Quizzes	60%	
Labs & Projects		30%
Classwork & Homework	10%	

Summer Homework

Students will choose and read a book from the list provided about the environment and write an essay response. Students will also watch a movie entitled “Home” and answer questions based on the movie. Lastly students will research and complete a chart with information about environmental laws & treaties.

Course Outline

(with partial list of activities – subject to change with current events)

Unit 1- Introduction to Earth Systems and Environmental Issues

Chapters 1, 2, 3, 6, 20 *Timeline: 17 days*

Topics:

- Key Themes in Environmental Science; general overview of the topics covered throughout the year
- Earth Science Concepts- Plate tectonics, the rock cycle, weathering and erosion, volcanoes and earthquakes, natural disasters, climate and weather
- Biogeochemical Cycles
- Science Systems, Matter, and Energy
- Science as a Way of Knowing: Critical Thinking about the Environment
- Global Water Resources and Use
- The Atmosphere- Composition, structure, weather and climate, atmospheric circulation and the Coriolis Effect, atmosphere-ocean interactions, ENSO

Labs/Activities:

- Eco Bottles
- Climate Change/ Atmospheric gases Lab
- Air Quality Monitoring- Analyze car tailpipe emissions

Readings and Homework:

- R: 1.1- 1.2; 1.3- 1.4; Provide an example of something you've seen that is "sustainable"; R: 1.4-1.5; Easter Island & CTQ 1-3; SQ 3; R 2.1-2.2; SQ 1,3,6,8; Ch3 Case Study, 3.1, Feedback loop examples- create 1 pos. & 1 neg. R: A Closer Look, 3.3-3.4; R 6.2-6.3; 6.5- create diagram/chart in your notebook; R 6.5; SQ 1-6; R 20.1-20.4; 20.7-20.8; CTQ 2, 4; SQ 1-5;

Unit 2- The Living World

Chapters 5, 8 & 13 *Timeline: 17 days*

Topics:

- Ecosystems; Energy Flow, Biological Diversity- Keystone species, biomes, ecological niches, generalists and specialists
- Ecosystem Energy Flow, Population dynamics, food chains and webs, and flow of energy, species interactions
- Ecosystem Diversity, Evolution, biodiversity, endangered plants and animals
- Biogeochemical Cycles-Water, carbon, nitrogen, phosphorus, sulfur
- Conservation of matter
- Ecological pyramids and productivity
- Wildlife, Fisheries, Aquaculture, Endangered Species

Labs/Activities:

- Tree ID- in groups (scavenger hunt) then in a line march together in good area with many trees. Biodiversity is calculated using the Shannon-Weiner Diversity Index.
- Water Quality (fall) Abiotic factors: dissolved oxygen, turbidity, pH, nitrates, phosphates, stream flow, physical observations of lake or stream
  Biotic factors: Macroinvertebrate testing, Leaf litter bag. Biodiversity is calculated using the Shannon-Weiner Diversity Index.
- Project- Endangered Species Report- Students choose an endangered species and they research their status (threatened, endangered) and when they became threatened, where they live, and what actions are being taken to help the species recover.
- Tri-color pasta Evolution lab

Readings and Homework:

- R 5.1-5.2; 5.6; SQ5; R 8.2-8.3, 8.7

Unit 3- Populations

Chapter 4 *Timeline: 17 days*

Topics:

- Population Biology Concepts; Human Population Growth, Trends, Expectations and Predictions, Demographic Transition
- Carrying capacity, conservation biology, biotic potential, environmental resistance, growth rates, exponential versus logistic growth rates
- Human Population: Growth, Demography, distribution, and impacts of population growth

Labs/Activities:

- Human Population Growth; Constructing Age Structure Diagrams
- Exponential Growth- A Toss of the Dice- Using random throws of dice, this activity simulates population growth of a species. Factors such as life span, birthrate, resource depletion, and population momentum are explored. Probability and statistics are introduced to the study of ecology.
- Field Trip to dump/ recycling center
- Video “Matters of Life and Death” A Science Odyssey

Readings and Homework:

- R 4.1-4.2; 4.7; SQ 2-5

Unit 4- Land and Water Use

Chapters 7, 11, 12, 18, 22 *Timeline: 17 days*

Topics:

- Economic Issues and resource use; Agriculture, Land Use; Wilderness, Parks, Forests, Water Supply, Use, and Management Urban Environments
- Agriculture; forestry; mining; global economics

- Soil; Structure of soil, erosion, desertification, and conservation
- Agriculture and Food Production
- Pesticides- History, problems, and alternatives
- Forestry- History, sustainable forestry, forest management, old growth forests, deforestation, forest fires
- Rangelands- Federal rangelands, desertification, deforestation, overgrazing
- Land Management- Conservation, wilderness, problems, national parks, wetlands, wildlife refuges, laws to manage public lands
- Urban land development; Sprawl
- Mining;
- Salt Water / Ocean resources- Ocean water pollution, global fisheries, aquaculture, overfishing, relevant laws and treaties
- Fresh Water- Properties of water, irrigation, flooding and floodplain management, water shortages, desalinization, irrigation, solution to overuse of water

Labs/Activities:

- Lab: Tragedy of the Commons
- Lab- Soil Diversity Lab
- Agriculture/Soil/Plant study (winter) Experimental design using grow lights during Jan-Feb. Students design own experiment to monitor every day
- Lab: Mining for Chocolate- CC Cookies
- Video- “A Hidden America: Children of the Mountains” Appalachia
- Video- “Alaska Gold” Frontline PBS
- Activity- Making Recycled Paper
- Field Trip- Water or Wastewater Treatment Facility

Readings and Homework:

- R 7.3-7.4-7.5; R11.1-11.2; Food Scavenger Hunt Projects; Soil collection; R 11.4-11.5; 11.6-11.7- 11.8; watch Food Inc.; SQ 1-5; 6-8; R 12.1; 12.2; 12.3; CTQ 1-3; R 18.1-18.3; CTI- What is your water footprint?- Water Use Home Calculation; R18.4; 18.6; 18.7- 18.8; SQ 1-10; R 22.3-22.4; 22.5-22.6; 22.7

Unit 5- Energy Resources and Consumption

Chapters 14, 15, 16 & 17 *Timeline: 17 days*

Topics:

- Energy; Fossil Fuels, Alternative Energy, Nuclear Energy; consumption and conservation
- Nonrenewable Energy- Fossil Fuels, coal and oil formation, natural gas, extraction and refinery processes, global demand, effects of the environment, nuclear energy, environmental advantages/disadvantages, safety issues, radioactive wastes
- History of Energy use and development, the Industrial Revolution, energy crisis, energy demands worldwide, present energy consumption rates and units

- Renewable Energy and Conservation Efforts- Solar, wind, water, geothermal, biomass, ocean waves and tidal energy, hydrogen fuel cells, advantages and disadvantages of each types, energy efficiency, CAFÉ standards, hybrid electric vehicles, mass transit, local food production and consumption

Labs/Activities:

- Project: Building a Model Solar House
- Activity: Personal Home Energy Audit

Readings and Homework:

- R 14.1-14.3; 14.4-14.5; 14.6SQ 1-8; 15.1-15.2; 15.3; 15.4; CTI 1-5; CTQ 1-7; SQ 1-10; 16.1-16.3; 16.4-16.6; 16.7-16.8; SQ 1-6; R17.1-17.2; 17.3-17.4; 17.5-17.7

Unit 6- Pollution and other Environmental Hazards

Chapters 10, 19, 21 & 23 *Timeline: 38 days*

Topics:

- Types of pollution and its impact; waste disposal; Environmental Health, Pollution, and Toxicology, Water Pollution and Treatment, Air Pollution,
- Water Pollution-Water sources and types of pollution, point and nonpoint sources of pollution, groundwater pollution, Clean Water Act, water purification, sewage treatment systems, eutrophication
- Air pollution-Major air pollutants, Clean Air Act and timeline of legislation, acid deposition, smog, heat islands, temperature inversions, indoor air pollution, primary and secondary sources of air pollution, remediation efforts
- Noise pollution- Sources, effects, control measures
- Pesticides-Types of pesticides, history of use, problems associated with pesticide use, alternatives, integrated pest management, pesticide regulation in the US
- Thermal pollution
- Urbanization and Environmental hazards
- Disposing of hazardous wastes safely and fairly, Environmental Justice, NIMBY
- Hazards to human health- Environmental risk analysis, acute and chronic effects, dose-response relationships, air pollutants, smoking and other risks, waste management, cleanup of contaminated sites, biomagnifications, cancer clusters
- Hazardous waste legislation (Resource Conservation and Recovery Act, Comprehensive Environmental Response, Compensation, and Liability Act etc.)
- Municipal Solid Waste (MSW) Recycling and reducing wastes

Labs/Activities:

- Lab: LD50- Effects of salt on plant growth
- Project: 20th Century Environmental disasters
- Field trip- Landfill or Recycling station
- Lab: Air Particulates- Car Exhaust particulate matter collection with white socks

Readings and Homework:

- R 10.1; 10.2; 10.3-10.4; CTI/CTQ 1-3; SQ 1-4; R 19.1-19.3; 19.4-19.9; 19.10-19.13; CTI/CTQ 1-4; SQ 1-11; R 21.1; 21.2; 21.3; 21.4-21.5; R 23.1-23.4; 23.5-23.6; 23.7-23.8; 23.9-23.10; 23.11-23.13; 23.14-23.15

Unit 7- Global Change and The Future of Sustainability

Chapters 9, 20 & 24 *Timeline: 17 days*

Topics:

- Ozone- Locations in the stratosphere versus troposphere, causes and chemical reactions, ultra violet radiation, effects on human health, strategies for reducing ozone depletion, relevant laws and treaties
- Global Warming/Global Climate Change- Global warming, greenhouse gases and the greenhouse effect, reducing climate change, relevant laws and treaties
- Loss of biodiversity- Habitat loss; pollution; overuse; introduced species; endangered and extinct species
- Future energy needs
- Ecological restoration
- Sustainability in the future
- Economic Impacts of Environmental Changes- Cost-benefit analysis, externalities, marginal costs, job creation, sustainability, quality of life

Labs/Activities:

- Project: Ecological Restoration- hiking trail maintenance with local group of the Sierra Club or Environmental Commission
- Research Project and Presentation- How to help threatened and endangered species
- Mock IPCC Convention Assignment- Student will have to assume the various roles of the stakeholders that would attend the IPCC or UN Climate Change Convention.

Readings and Homework:

- R 9.1-9.3; 9.4-9.5; R 20.1-20.3; 20.4-20.5; 20.6-20.9; 20.10-20.14; CTI/CTQ 1-4; SQ 1-7; 24 Case Study; 24.1-24.5; 24.6-24.9

AP TEST Review

At this point you have done a multitude of activities, practice tests and essays to get you prepared for the rigorous AP Exam. You have been working hard all year, so I would not recommend re-

reading the book! (Maybe re-read only Chapter 1) We will continue to practice multiple choice questions and FRQs as the date of the exam gets closer. This is the breakdown for the AP test:

AP Test **May 7th, 2013**

100 Multiple Choice (90 minutes)
4 comprehensive essays (90 minutes)

After the AP Test you will be beginning your Final Project…TBD

Course Proficiencies
2012-2013

1. (5.1.12.A.2) Develop and use mathematical, physical, and computational tools to build evidence-based models and to pose theories.

2. (5.1.12.A.3) Use scientific principles and theories to build refine standards for data collection, posing controls, and presenting evidence.

3. (5.1.12.B.1) Design investigations, collect evidence, analyze data, and evaluate evidence to determine measures of central tendencies, causal/correlational relationships, and anomalous data.

4. (5.1.12.B.2) Build, refine, and represent evidence based models using mathematical, physical, and computational tools.

5. (5.1.12.B.3) Revise predictions and explanations using evidence, and connect explanations/arguments to established scientific knowledge, models, and theories.

6. (5.1.12.B.4) Develop quality controls to examine data sets and to examine evidence as a means of generating and reviewing explanations.

7. (5.1.12.C.1) Reflect on and revise understandings as new evidence emerges.

8. (5.1.12.C.3) Consider alternative theories to interpret and evaluate evidence-based arguments.

9. (5.1.12.D.1) Engage in multiple forms of discussion in order to process, make sense of, and learn from others' ideas, observations, and experiences.

10. (5.1.12.D.2) Represent ideas using literal representations, such as graphs, tables, journals, concept maps, and diagrams.

11. (5.1.12.D.3) Demonstrate how to use scientific tools and instruments and knowledge of how to handle animals with respect for their safety and welfare.

12. (5.3.12.B.3) Predict what would happen to an ecosystem if an energy source was removed.

13. (5.3.12.C.1) Analyze the interrelationships and interdependencies among different organisms, and explain how these relationships contribute to the stability of the ecosystem.

14. (5.3.12.C.2) Model how natural and human-made changes in the environment will affect individual organisms and the dynamics of populations.

15. (5.4.12.C.1) Model the interrelationships among the spheres in the Earth systems by creating a flow chart.

16. (5.4.12.E.1) Model and explain the physical science principles that account for the global energy budget.

17. (5.4.12.E.2) Predict what the impact on biogeochemical systems would be if there were an increase or decrease in internal and external energy.

18. (5.4.12.F.1) Explain that it is warmer in summer and colder in winter for people in New Jersey because the intensity of sunlight is greater and the days are longer in summer than in winter. Connect these seasonal changes in sunlight to the tilt of Earth's axis with respect to the plane of its orbit around the Sun.

19. (5.4.12.F.3) Explain variations in the global energy budget and hydrologic cycle at the local, regional, and global scales.

20. (5.4.12.G.1) Analyze and explain the sources and impact of a specific industry on a large body of water (e.g., Delaware or Chesapeake Bay).

21. (5.4.12.G.2) Explain the unintended consequences of harvesting natural resources from an ecosystem.

22. (5.4.12.G.3) Demonstrate, using models, how internal and external sources of energy drive the hydrologic, carbon, nitrogen, phosphorus, sulfur, and oxygen cycles.

23. (5.4.12.G.4) Compare over time the impact of human activity on the cycling of matter and energy through ecosystems.

24. (5.4.12.G.5) Assess (using maps, local planning documents, and historical records) how the natural environment has changed since humans have in habited the region.

25. (5.4.12.G.6) Assess (using scientific, economic, and other data) the potential environmental impact of large-scale adoption of emerging technologies (e.g., wind farming, harnessing geothermal energy).

26. (5.4.12.G.7) Relate information to detailed models of the hydrologic, carbon, nitrogen, phosphorus, sulfur, and oxygen cycles, identifying major sources, sinks, fluxes, and residence times.