AP Environmental Science Course Syllabus

COURSE GOALS

This course adheres to the objectives outlined in the *Course Description for AP Environmental Science* from the AP College Board, which states "the course is intended to be the equivalent of a one semester, introductory college course in environmental science." The aim of the AP Environmental Science course is "to provide students with the scientific principles, concepts and methodologies required to understand the inter-relationships 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 to resolving or preventing them."

This course is designed to acquaint students with the physical, ecological, social, and political principles of environmental science. The scientific method is used to analyze and understand the inter-relationships between humans and the natural environment. The course shows how ecological realities and the material desires of humans often clash, leading to environmental degradation and pollution.

Laboratory and field study are an essential component to this course. The labs and field investigations are designed to challenge the students' abilities to:

- critically observe environmental systems
- develop and conduct well-designed experiments
- utilize appropriate techniques and instrumentation
- analyze and interpret data, including appropriate statistical and graphical presentations
- think analytically and apply concepts to the solution of environmental problems
- make conclusions and evaluate their quality and validity
- propose further questions for study
- communicate accurately and meaningfully about observations and conclusions

The goal is for students to master the scientific techniques and methodologies that will enable them to become independent learners, capable of gathering and evaluating information and making rational and informed judgments that they will be able to communicate to others. This will enable them to function effectively as responsible citizens in a society that is increasingly shaped by science and technology.

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.

The following main topics are covered in the course: Introduction to Environmental Science; Earth's Systems and Resources; The Living World; Human Population Dynamics; Land and Water Use; Energy Resources and Consumption; Environmental Quality and Pollution; Global Changes; Urbanization; and Natural Disasters and Catastrophes.

EXPECTATIONS

As this is a college-level class, students are expected to participate fully in all aspects of the course. Through hands-on laboratory and field exercises, frequent class discussions of issues, and extensive readings, students take an active role in learning, appreciating, and understanding environmental issues, as well as developing their critical thinking and problem solving skills. Another important part of the course is data analysis, measurement, statistics, dimensional analysis, and other operations that require mathematical skills.

Independent work is an expectation of this course, and students will be required to master much content material on their own so that we have more time for laboratory and fieldwork. In addition, students will be required to do long-term observations outside of class time.

The course places considerable emphasis on laboratory and field work. A minimum of one to two class days per week are devoted to labs and field work. For many labs,

students are given a pre-lab description and questionnaire. On lab days, students are expected to have read the pre-lab, answered the questions posed, prepared any necessary data tables and charts, and be completely prepared to perform the lab or field work required. Some labs are more involved, and in these cases students are expected to take responsibility for performing background research, developing and setting up their own experiments, and monitoring their experiments as needed. Additionally, students are expected to share and collaborate with one another, including peer reviewing, on lab and field work.

Communicating ideas and concepts is another important component of this course. In addition to the group discussions and the collaboration over lab projects, students are expected to express their ideas by making periodic presentations for the class. These presentations range from reports on their more involved experiments to project assignments covering local environmental issues.

At the conclusion of each unit, a unit test is administered. Unit tests typically consist of short answer and essay questions focused on the chapters, labs and field activities covered in the unit. The intent of these tests is to evaluate depth and breadth of knowledge, and critical thinking skills.

The semester final exams are comprehensive and are similar in scope to the AP test, consisting of multiple choice, short answer and free-response sections. There is also a lab component to the exam, requiring the students to identify a problem, propose a hypothesis, use materials provided to develop an experiment, perform the experiment, evaluate their hypothesis and then interpret and present their information. Students are challenged to use the lab skills, methodologies, and mathematics they have been learning through the course, as well as their powers of observation and interpretation.

To facilitate time-management for the students, a weekly schedule for the course is handed out at the beginning of each semester listing the chapters to be covered in the class, the laboratory and field exercises to be conducted, the assigned readings, the weekly written assignments, and the dates of all major unit tests.

REQUIREMENTS

Core requirements:

- To demonstrate engagement in class lectures, discussions, internet activities, videos and other in-class activities, students are required to actively maintain a **comprehensive notebook** (bound or loose-leaf). The notebook will be collected and checked on a periodic basis.

- The course outline is divided into ten units, and each unit includes various chapters from the textbook. At the conclusion of each chapter, there is a list of key terms, a group of study questions, and a “Critical Thinking Issue” that

includes a reading and questions. To demonstrate an understanding of required readings and lectures, the students are to:

- Maintain a notebook of all vocabulary terms, including definitions of the terms in the students' own words, and an example sentence from a source other than the textbook that puts the term in context. This notebook will be collected and checked at the conclusion of each unit.
- Answer the assigned study questions at the end of each chapter and submit them for grading. Some of the questions require short answers, and others require more critical thinking and analysis. All of the questions require the students to pull together, and make sense of, a variety of topics from inside and outside the scope of the unit. As we will cover approximately one chapter per week, these assignments will be due by the end of the week (refer to weekly schedule).
- Read the Critical Thinking Issue and answer the questions that pertain to the reading, considering as many facets of the issue as possible by drawing on knowledge from readings, lectures, videos, lab activities, etc. These assignments will be due by the end of the week (refer to weekly schedule).

- Lab work is required as a component of every unit. Most lab activities are conducted in groups of two, though some labs are individual and others involve larger groups, To demonstrate an understanding of the scientific method, observational skills, data recording, and analytical skills, the students are to:
  - Maintain a **bound** notebook of all laboratory work (***Note: Before awarding credit for APES, some colleges request to see these lab notes***.) Most labs include a series of analysis questions to complete, and students are also expected to write a condensed report including a conclusion and error analysis. This notebook is collected and checked on a periodic basis. There are some labs that require more work, as next noted.
  - Complete and submit formal lab reports, including background research, for the following labs:
    - Fertilizers and plants – design your own lab (Unit 1)
    - Ecocolumn lab (Unit 3)
    - Salinization lab (Unit 5)
    - Toxicity lab (Unit 7)

    *These lab reports are subjected to a peer review process from fellow classmates prior to submittal. Peer reviewers are graded for the quality and thoroughness of their reviews, and this grade is incorporated into the lab report grade of each student.

General Requirements:

- The following assignments are required of each student throughout the course:

- Maintain a bound or loose-leaf journal of environmental science related news stories from multiple sources (newspapers, magazines, on-line services, etc.). A minimum of one article per week is required throughout the year. The assignment for *each* article includes the writing of a brief summary and background of the topic, the connection of the topic to class material, and an analysis of the science versus the opinion in the article. The journal will be collected and checked monthly.
- From an extensive reading list, choose one book each semester to read and write a book report on. The book report must include a thorough analysis of the main themes in the book, as well as the connection to material covered in the course. In addition to the written report, a presentation to the class is required.
- Once per semester participate in an environmental-based event (subject to instructor approval) outside of the regular school day. Documentation of participation must be provided, as well as an essay discussing the connection of the activity to the subject matter of the course. An oral presentation to the class is also required and will be graded. A partial list of acceptable events includes
  - Creek/stream clean-up
  - Wetland clean-up/restoration
  - Water/energy conservation classes
  - Composting/gardening with native plants classes
  - Wildlife rescue
  - Green building or green garden tours
  - Green building construction courses
  - Trail restoration

- Periodically, the class will participate in field trips. For each field trip, the students are to:
  - Be active participants by making observations, asking critical questions, and sharing information and insights with fellow classmates.
  - Complete a short essay describing the connection of the trip to material covered in the course, including observations, insights and interpretations. This essay is to be submitted for grading within one week of the fieldtrip.

- The following is assigned to students on a rotating basis through the year:
  - Year-long climate record activity
    - Students will maintain a daily record of quantitative and qualitative meteorological data, including temperature, humidity, cloud cover and types, etc.

Second semester project:

- The following is a second semester project required of each student, working independently on their own project, but each participating in a peer review process of one another's work:
    - This project is designed to further develop skills in research, experiment design, field work, lab work and report writing. As a group, the class decides on a major theme for the project (such as "wetlands," or "alternative energy"). Once the theme is chosen, each student identifies a topic within the theme that they would like to pursue. They then research the topic using a variety of sources, looking for problems from which they can develop a testable hypothesis. Each student next designs a controlled experiment to test their hypothesis. Upon approval by the instructor, the students run their experiments, collecting data in an organized form. Acceptable experiments shall involve extensive field and/or lab work, and shall be challenging in nature. At regular intervals through the semester, drafts of work are peer reviewed, evaluated and discussed by the class. A comprehensive, "journal-ready" lab report is due by end of the semester.

Grading

Class Participation

Active participation in class discussions, lab and field work, group activities, and field trips is essential. This includes working in a cooperative manner in groups, taking responsibility for tasks, demonstrating intellectual curiosity, respecting the views and opinions of others, asking questions and making comments that indicate careful preparation for class and insight into the material, and behaving in a manner that promotes learning for all in the class. Additionally, *students are expected to help one another in a supportive manner* to learn and understand the course material and lab activities.

Class participation accounts for 15% of overall grade.

Homework

The majority of homework for the course consists of the study questions and "critical thinking issues" assignment at the end of each chapter in the textbook. These assignments are due weekly and are graded for thoroughness, a clear understanding and application of the material, incorporation of relevant knowledge beyond that presented in the chapter,

and clarity of thought. Timeliness in the submitting of assignments will also be considered.

Homework assignments account for 10% of overall grade.

Laboratory and Field Work

A significant portion of class time is spent on laboratory and field work. Some labs require students to work independently, but for most labs and field work students are expected to work cooperatively with others, promoting learning for each member of the group.

On both independent and group work, students are expected to become familiar with the scientific method, to show intellectual curiosity, to demonstrate analytical and creative thinking, to exhibit logical reasoning based on available evidence, to effectively communicate their ideas, and to develop their report writing and presentation skills.

Students are evaluated on these factors through their participation, collaboration, design and conducting of experiments, interpretation of data and observations, mathematical analyses, presentation of findings, and report writing.

Laboratory and field work accounts for 30% of overall grade.

*Note: The second semester lab project will account for two-thirds of the overall semester lab grade.

Special Projects

Special projects include all other activities beyond homework assignments, laboratories, and field work. These projects typically require independent or small group work outside of class, including the production of a written report or a class presentation.

Special projects account for 5% of overall grade.

Quizzes and Tests

Quizzes are administered at least once for each unit. The quizzes typically consist of multiple choice and short answer questions pertaining to the current class material or recent videos. The intent of the quizzes is to evaluate the students for comprehension of the material, and to show if the students are keeping current with and critically analyzing the course material.

At the conclusion of each unit, a unit test is administered. Unit tests typically consist of short answer and essay questions focused on the chapters, labs and field activities covered in the unit. The intent of these tests is to evaluate depth and breadth of knowledge, and critical thinking skills.

The semester final exams are comprehensive and are similar in scope to the AP test, consisting of multiple choice, short answer and free-response sections. There is also a lab component to the exam, requiring the students to identify a problem, propose a hypothesis, use materials provided to develop an experiment, perform the experiment, evaluate their hypothesis and then interpret and present their information. Students are challenged to use the lab skills and methodologies they have been learning through the course, as well as their powers of observation and interpretation.

Quizzes account for 5% of overall grade.

Unit tests account for 10% of overall grade.

The semester final exam accounts for 25% of overall grade.

Textbook

Primary text for course: *Environmental Science: Earth as a Living Planet,* 7th Ed., by Daniel B. Botkin and Edward A. Keller, 2009 (John Wiley & Sons, Inc.)