SCIENCE DEPARTMENT **ENVIRONMENTAL SCIENCE (H/AP): COURSE #459**

The Department's Educational Philosophy

We believe that students should be exposed to the process of scientific inquiry so they can acquire and interpret scientific knowledge, and begin to realize the wider applicability of scientific problem-solving methods. By making the laboratory the focal point of learning, we seek to foster students' appreciation for the experience of doing science.

Guiding Principles

- Students must be able to collect and analyze data and formulate hypotheses.
- Inductive and deductive problem-solving skills are central to science education.
- An effective program in science addresses the limitations of data and conclusions.
- Students should be able to use or design a strategy for testing scientific concepts.
- A comprehensive science program will emphasize the delicate checks and balances in man's abiotic and biotic environments and the stresses upon these ecosystems, which could affect the destiny of the world.
- Science is integrally related to mathematics.
- An effective science program builds students' ability to communicate accurately and precisely.
- An effective science program stresses both cooperative and independent learning.

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Course Frequency: Full-year course, five times per week
Credits Offered: Five
Prerequisites: Biology and Honors Chemistry or by the Recommendation of the Department

Background to the Curriculum

The AP Environmental Science course is designed to be the equivalent of a one-semester introductory college course in environmental science. It is a rigorous science course that stresses scientific principles and analysis and includes a laboratory component. The course will provide students with the principles, concepts, and methodologies needed to understand the interrelationships of the natural world and to identify and analyze environmental problems, with the goal of examining alternative solutions for resolving and preventing such problems. Areas of study include ecology, earth science, population, energy, pollution, land use, waste management, and global climate change. Students completing this course take the Advanced Placement Exam in environmental science with the possibility of eliminating the first level college environmental science course.

Core Topics/Question/Concepts/Skills

Core Topics	Concepts
I. Interdependence of Earth's Systems: Fundamental Principles and Concepts	**A.** The Flow of Energy 1. forms and quality of energy 2. energy units and measurement 3. sources and sinks, conversions **B.** The Cycling of Matter 1. water 2. carbon 3. major nutrients a. nitrogen b. phosphorous 4. differences between cycling of major and trace elements **C.** The Solid Earth 1. Earth history and the geologic time scale 2. Earth dynamics: plate tectonics, volcanism, the rock cycle, soil formation

I. Interdependence of Earth's Systems (continued)	**D.** The Atmosphere 1. atmospheric history: origin, evolution, composition, and structure 2. atmospheric dynamics: weather, climate **E.** The Biosphere 1. organisms: adaptations to their environments 2. populations and communities: exponential growth, carrying capacity 3. ecosystems and change: biomass, energy transfer, succession 4. evolution of life: natural selection, extinction
II. Human Population Dynamics	**A]** History and Global Distribution 1. numbers 2. demographics, such as birth and death rates 3. patterns of resource utilization **B]** Carrying Capacity – Local, Regional, Global **C]** Cultural and Economic Influences
III. Renewable and Nonrenewable Resources: Distribution, Ownership, Use, Degradation	**A.** Water 1. fresh: agricultural, industrial, domestic 2. oceans: fisheries, industrial **B.** Minerals **C.** Soils 1. soil types 2. erosion and conservation **D.** Biological 1. natural areas 2. genetic diversity 3. food and other agricultural products

III. Renewable and Nonrenewable Resources: Distribution, Ownership, Use, Degradation (continued)	**E.** Energy 1. conventional sources 2. alternative sources **F.** Land 1. residential and commercial 2. agricultural and forestry 3. recreational and forestry
IV. Environmental Quality	**A.** Air/Water/Soil 1. major pollutants a. types, such as SO_2, NO_x, and pesticides b. thermal pollution c. measurement and units of measure, such as ppm, pH, μg/L d. point and nonpoint sources (domestic, industrial, agricultural) 2. effects of pollutants on: a. aquatic systems b. vegetation c. natural features, buildings and structures d. wildlife 3. pollution reduction, remediation, and control **B.** Solid Waste 1. types, sources, and amounts 2. current disposal methods and their limitations 3. alternative practices in solid waste management **C.** Impact on Human Health 1. agents: chemical and biological 2. effects: acute and chronic, dose-response relationships 3. relative risks: evaluation and response

V. Global Changes and Their Consequences	**A.** First-order Effects 1. atmosphere: CO2, CH4, stratospheric O3 2. oceans: surface temperatures, currents 3. relative risks: evaluation and response **B.** Higher-order Interactions (consequences) 1. atmosphere: global warming, increasing ultraviolet radiation 2. oceans: increasing sea level, long-term climate change, impact on El Niño 3. biota: loss of biodiversity
VI. Environment and Society: Trade-Offs and Decision-Making	**A.** Economic Forces 1. cost-benefit analysis 2. marginal costs 3. ownership and externalized costs **B.** Cultural and Aesthetic Considerations **C.** Environmental Ethics **D.** Environmental Laws and Regulations (International, National, and Regional) **E.** Issues and options (conservation, preservation, restoration, remediation, sustainability, mitigation)

Course-End Learning Objectives

Interdependence of Earth's Systems: Fundamental Principles and Concepts

1] Student-designed experiments on competition

Human Population Dynamics

Renewable and Nonrenewable Resources: Distribution, Ownership, Use, Degradation

1] Student-designed experiments on the effects of acid deposition
2] Student-designed experiments on the effects of radiation on the germination of growth of radish seeds
3] PowerPoint presentations on alternative energy options
4] Home energy audits

Environmental Quality

1] Student-designed experiments on toxicity testing

Global Changes and Their Consequences

Environment and Society: Trade-Offs and Decision-Making

Assessment

- Tests: written in AP exam format (multiple choice and open response)
- Quizzes: multiple choice, based on assigned reading in the textbook
- Labs: formal reports based on experiments designed and conducted by students, involve the generation of spreadsheets and graphs and the statistical analysis of data
- Activities: informal, may involve worksheets with questions based on the activity
- Projects: often in cooperative groups, presented to the class
- Homework: assigned readings, worksheets based on activities, vocabulary or other topics of interest

Materials and Resources

- Student text: Raven, Peter H. and Linda R. Berg, Environment, Harcourt College Publishers (2001)
- Numerous audio-visual tools, websites, and lab materials to supplement the material taught in this course