

## SCIENCE DEPARTMENT

## SCIENCE AND THE ENVIRONMENT(SP): COURSE #461

(Alternate Year Offering; See the Program of Studies)

### 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:** Semester course, 5 times per week; 6 times in a 6-day cycle

**Credits Offered:** 2.5 credits

**Prerequisites:** By Recommendation of the Department

### Background to the Curriculum

Science and the Environment (SP) is a new course that was developed for the 2001-2002 school year in accordance with the recommendations of the NEASC. It was felt that there were not enough science electives for juniors and seniors who do not take advanced placement courses, or chemistry and physics. This semester course is supported by a special educator and is designed to be accessible to special education students with minimal or no curriculum modifications. This course is designed to reinforce scientific inquiry, problem solving, and application of terms and concepts. It was designed to target issues with human activity and the environment through a series of topics that relate to the students' everyday life.

### Core Topics/Questions/Concepts/Skills

Core Topics	Questions	Concepts	Skills
Water Quality	What is water quality? Where does drinking water come from? What is ground water and what are potential problems with it? How is wastewater dealt with? What contaminates drinking water? What role does human activity play in maintaining quality drinking water?	<ul style="list-style-type: none"><li>• Finding a safe water supply</li><li>• Problems with groundwater</li><li>• Types of wells</li><li>• Septic systems and waste treatment facilities</li><li>• Human activity and water pollution</li></ul>	<ul style="list-style-type: none"><li>• Data analysis from data sets</li><li>• Design experiments; follow experimental design and laboratory set-ups.</li><li>• Construct topographic profile</li><li>• Use of vocabulary in presentations and projects.</li><li>• Write a persuasive essay</li><li>• Work in cooperative groups</li></ul>

Air Quality	<p>What is air quality? What is pH, and how is it related to acid precipitation? How does acid precipitation form, and what are its environmental impacts? What pollutants affect air quality? What role does human activity play in air quality?</p>	<ul style="list-style-type: none"> <li>• pH scale</li> <li>• Acid precipitation</li> <li>• Environmental impact from acid precipitation and pollution.</li> <li>• Solutions to acid precipitation and pollution</li> <li>• Human activity and acid precipitation and air pollution</li> </ul>	<ul style="list-style-type: none"> <li>• Use pH scale</li> <li>• pH testing using test strips</li> <li>• Set up experimental design to solve a problem</li> <li>• Germinate seeds in acidic, basic and control situations</li> <li>• Write position paper</li> <li>• Work in cooperative groups</li> <li>• Use of vocabulary in projects and presentations</li> <li>• In class presentation</li> </ul>
Waste Management	<p>What is waste management? What is considered solid waste? Why is solid waste a global problem? Why is recycling important? What are landfills and incinerators? What role does human activity play in solid waste production?</p>	<ul style="list-style-type: none"> <li>• Solid waste production</li> <li>• Landfills and incinerators</li> <li>• Eco-friendly cleaners and other chemicals</li> <li>• Sanitary landfills vs. garbage dumps</li> <li>• Human activity and solid waste</li> </ul>	<ul style="list-style-type: none"> <li>• Make eco-friendly cleansers from common organic products.</li> <li>• Lab experimental design on toxicity testing</li> <li>• Data collection over a period of weeks</li> <li>• Use vocabulary and concepts in poster presentation</li> <li>• Work in cooperative groups</li> </ul>
Climate Change	<p>What is climate change? What is global warming and what causes it? What is the greenhouse effect? What is ozone depletion and what causes it? What are the environmental impacts of global warming and ozone depletion? What role does human activity play in global warming and ozone depletion?</p>	<ul style="list-style-type: none"> <li>• Climate change</li> <li>• Greenhouse effect and global warming</li> <li>• Deforestation</li> <li>• UV radiation</li> <li>• Human activity and global warming.</li> <li>• Human activity and ozone depletion.</li> </ul>	<ul style="list-style-type: none"> <li>• Experimental set up to mimic the greenhouse effect</li> <li>• Test the effectiveness of sunscreen on UV radiation protection</li> <li>• Use of vocabulary in ozone and global warming “talk show”</li> </ul>

Human Population Growth	<p>What is causing population growth? What is the rate of human population growth? Why do different countries have different ideas about reproduction and limits on population growth? What is the Earth's carrying capacity for humans? What role does human activity play in the rate of human population growth?</p>	<ul style="list-style-type: none"> <li>• Population growth</li> <li>• Factors affecting growth and limits on growth</li> <li>• Religion and culture on population growth</li> <li>• Carrying capacity for humans on Earth</li> <li>• Human activity on population growth and limits to population growth</li> </ul>	<ul style="list-style-type: none"> <li>• Data collection, analysis, and graphing</li> <li>• Calculation of population growth rates</li> <li>• Exponential vs. logistic growth curves</li> <li>• Use of vocabulary in projects and presentations</li> <li>• Work in cooperative groups</li> </ul>
Land and Food	<p>What is the green revolution? What are erosion, desertification, and salinization, and how are they caused? What is fertile soil? What are the different ways that humans use land? What are different ways that humans obtain food? What role does human activity play in the use of land and food?</p>	<ul style="list-style-type: none"> <li>• The green revolution</li> <li>• Land use</li> <li>• Selective cutting</li> <li>• Urbanization and suburban sprawl</li> <li>• Erosion, desertification, and salinization</li> <li>• Mining and the environment</li> <li>• Irrigation</li> <li>• Feeding the world</li> </ul>	<ul style="list-style-type: none"> <li>• Experimental set-up for modeling mining strategies</li> <li>• Data collection and analysis</li> <li>• Use of vocabulary in projects and papers.</li> <li>• Work in cooperative groups</li> </ul>

**Course-End Learning Objectives:**

*Students will:*

**Water Quality**

- 1] Describe where drinking water comes from, and the current ways that it is being contaminated.
- 2] Differentiate between septic systems and water treatment facilities.
- 3] Describe how wastewater is treated at water treatment facilities.
- 4] Identify the roles that humans play in contamination of drinking water.
- 5] Identify potential solutions to the environmental problems associated with water quality.

### **Air Quality**

- 1] Describe pH and identify pH values of different solutions by using pH test strips.
- 2] Describe how acid precipitation forms.
- 3] Identify environmental impacts of acid precipitation.
- 4] Identify pollutants that affect air quality.
- 5] Identify the roles that humans play in the deterioration of air quality.
- 6] Identify potential solutions to the environmental problems associated with air quality.

### **Waste Management**

- 1] Identify the components of solid waste in developed and under-developed countries.
- 2] Describe why solid waste is a global problem.
- 3] Describe the process of recycling, and list the major materials that can be easily recycled.
- 4] Differentiate between garbage dumps and sanitary landfills.
- 5] Identify the roles that humans play in the environmental problems with waste management.
- 6] Identify potential solutions to the environmental problems associated with waste management.

### **Climate Change**

- 1] Describe global warming, and identify its causes.
- 2] Describe the greenhouse effect; compare and contrast a greenhouse to the atmosphere.
- 3] Describe ozone depletion and identify its causes.
- 4] Identify the roles that humans play in the problems associated with climate change.
- 5] Identify the major ecological and environmental impacts of global warming and ozone depletion.
- 6] Identify the potential solutions to the environmental problems associated with climate change.

### **Human Population Growth**

- 1] Calculate the rate of human population growth from a data set.
- 2] Identify the causes for the overall increase in human population; identify the causes for the overall decrease in the rate of growth.
- 3] Describe the carrying capacity of the Earth, and why scientists are debating it.
- 4] Identify the major environmental impacts of continued human population growth.
- 5] Identify the roles that different countries play in the problems associated with population growth.
- 6] Identify potential solutions to the environmental problems associated with human population growth.

## **Land and Food**

- 1] Describe erosion, desertification, and salinization.
- 2] Describe the Green Revolution, and how it has impacted both how humans use land, and how humans get food.
- 3] Describe the different ways that humans use and abuse land through agriculture, urbanization, suburban sprawl, and mining.
- 4] Identify the major environmental impacts of the ways that humans use and abuse land.
- 5] Identify potential solutions to the environmental problems associated with land and food.

## **Assessment**

- Tests: written based on curriculum covered; focus on terms and concepts and application of these.
- Quizzes: vocabulary in matching or definition format.
- Laboratory activities and reports: some formal typed with hypotheses, procedure, materials, data, discussion and conclusion; some informal with questions.
- Projects: often in cooperative groups; presented to the class
- Homework: questions from the chapter review, reading assignments, and papers.

## **Materials and Resources**

- Student text: Arms, Karen. Environmental Science. Holt, Rinehart and Winston, 2000.
- Numerous audio-visual, websites, and lab materials to supplement the material are taught in this course.