

# Introduction to Environmental Science

## Course Text

Enger, Eldon D., and Bradley F. Smith. *Environmental Science: A Study of Interrelationships*. 16th ed., McGraw-Hill Education, 2022.

The text is provided digitally as part of the course enrollment. Students may find used, new, or rental print copies by searching for the ISBN.

## Course Description

This course provides students with a comprehensive overview of the basic principles and unifying concepts of environmental science. Various ecosystems are described, and conservation efforts are evaluated. Other topics include the importance of maintaining biodiversity, human population growth and demography, and the problems of urbanization in developed and developing countries. Techniques of sustainable agriculture are evaluated, as are techniques for water conservation. The impact of air pollution on the climate and on human beings is analyzed and the factors that determine energy consumption and the use of fossil fuels are assessed. Local, national, and international policies, laws, and programs that aim to protect the environment are also discussed.

## Course Objectives

After completing this course, students will be able to:

- Assess the various methods used to understand natural phenomena and the human impact on it, and analyze the steps taken to protect the environment.
- Explain chemical cycles with reference to exchange of energy in chemical reactions and natural selection and evolution, and assess the effect of changes in the cycles on organisms.
- Differentiate between various ecosystems, explain the interdependency of organisms within an ecosystem, and how changes in the environment can affect ecosystems.
- Evaluate the impact of civilization on forests and grasslands, and assess how conservation efforts are useful in preserving species and restoration of habitats.
- Analyze the use of and factors determining population characteristics of a species, explain the reasons for maintaining biodiversity, and evaluate the reasons for extinction of species.
- Analyze human population growth and demography, and assess its impact on the environment.

- Analyze the problems of urbanization in developed and developing countries, and evaluate its implication on the environment.
- Evaluate techniques of sustainable agriculture and the need for pest control, and explain how pesticides degrade the soil and therefore the environment.
- Describe the hydrologic cycle, classify sources of water pollution, and analyze techniques for water conservation and management.
- Analyze the impact of air pollution on the climate and on human beings, and evaluate measures to reduce pollution.
- Assess the factors that determine energy consumption and use of fossil fuels, and evaluate its effect on global warming.
- Explain various alternative sources of energy, compare them in terms of environmental issues, and appraise energy conservation methods.
- Explain the concept of waste management and evaluate programs and policies to reduce the harmful effects of waste.
- Analyze the various factors influencing the use of environmental resources, and evaluate important local, national, and international policies, laws, and programs that aim to protect the environment.

## Course Prerequisites

There are no prerequisites for this course.

## Important Terms

In this course, different terms are used to designate tasks:

- **Proctoring:** all final exams require proctoring which can be completed conveniently from your home. A webcam is required.
- **Tutoring:** memberships include online tutoring for students with access to any content/subject related questions in the place of faculty. If your tutor is not able to answer your questions, please contact a student advisor.
- **Practice Exercise:** A non-graded assignment to assist you in practicing the skills discussed in a topic.
- **Homework:** Non-graded practice quizzes which provide feedback to the student.
- **Exam:** A graded online test.

## Academic Integrity Statement

Academic integrity is the pursuit of scholarly activity in an honest, truthful and responsible manner. Violations of academic integrity include, but are not limited to, plagiarism, cheating, fabrication and academic misconduct. Failure to comply with the Academic Integrity Policy can result in a failure and/or zero on the attempted assignment/examination, a removal from the course, disqualification to enroll in future courses, and/or revocation of an academic transcript.

## Course Completion Policy

In order for a course to be considered complete, all required coursework must be attempted, submitted, and graded. Required coursework consists of graded assignments.

Any Academic Integrity Policy violations may prevent a course from being considered complete.

## Course Evaluation Criteria

Your score provides a percentage score and letter grade for each course. A passing percentage is **70%** or higher.

There are a total of 1000 points in the course:

Topic	Assessment	Points Available
3	Graded Exam #1	125
7	Graded Exam #2	125
7	Cumulative Graded Midterm Exam	200
10	Graded Exam #3	125
14	Graded Exam #4	125
15	Cumulative Graded Final Exam	300
Total		1000

## Course Topics and Objectives

Topic	Title	Subtopics	Objectives
1	Introduction to Environmental Science	<ul style="list-style-type: none"> <li>• Scope of the Subject</li> <li>• Natural Sciences</li> <li>• Social Sciences Ethics</li> </ul>	<ul style="list-style-type: none"> <li>• Define environmental science as a subject that draws on learnings from natural and social sciences to investigate human impact on the natural environment.</li> <li>• Explain how the scientific method is used to investigate natural phenomena, particularly the interrelationships between organisms and between organisms and their environments.</li> <li>• Give examples of how a study of social, cultural, and economic issues relates to understanding human impact on the natural environment.</li> <li>• Demonstrate how principles of ethics and justice can be applied by individuals, corporations, and societies to decisions related to protecting the environment.</li> </ul>
2	Matter, Energy, and Life	<ul style="list-style-type: none"> <li>• Matter</li> <li>• Energy</li> <li>• Life Forms and Evolution</li> </ul>	<ul style="list-style-type: none"> <li>• Describe the characteristics of elements of matter and chemical actions and reactions, and illustrate the principle of conservation of matter.</li> </ul>

Topic	Title	Subtopics	Objectives
			<ul style="list-style-type: none"> <li>• Describe energy as a force, the forms of energy, and explain the laws of thermodynamics.</li> <li>• Illustrate the characteristics of broad categories of life forms, the food chain, and life processes.</li> <li>• Illustrate how life forms interact with other life forms and their environment, and the process of natural selection and evolution.</li> </ul>
3	Ecosystems	<ul style="list-style-type: none"> <li>• Biological Communities</li> <li>• Biological Communities on Land</li> <li>• Biological Communities in Water</li> </ul>	<ul style="list-style-type: none"> <li>• Define a biological community as a group of species that interact with one another, and give examples of such interactions and of the roles of individual species in the ecosystem.</li> <li>• Describe terrestrial biomes in terms of climate, life forms, their interactions, food chains, and process of change.</li> <li>• Illustrate characteristics of biological communities such as structure, diversity of life forms, complexity and connectedness, resilience, and stability.</li> <li>• Describe aquatic biomes in terms of climate, type of water body, life forms, their interactions, food chains, and process of change.</li> </ul>
4	Species Populations and Biodiversity	<ul style="list-style-type: none"> <li>• Population Measures and Characteristics</li> <li>• Population Growth Determinants</li> <li>• Benefits of Biodiversity</li> <li>• Threats to Biodiversity</li> <li>• Preserving Biodiversity</li> </ul>	<ul style="list-style-type: none"> <li>• Demonstrate the use of population characteristics such as natality and mortality, sex ratio and age distribution, density and spatial distribution.</li> <li>• Analyze the factors that determine the population of a species, such as the rate and strategy of reproduction and carrying capacity of the environment.</li> <li>• Illustrate the concept and types of biodiversity, and explain its benefits to humans.</li> <li>• Examine human impact on the process of extinction of species and on biodiversity.</li> <li>• Analyze the rationale and effectiveness of various interventions to preserve biodiversity.</li> </ul>
5	Human Population	<ul style="list-style-type: none"> <li>• Population Measures and</li> </ul>	<ul style="list-style-type: none"> <li>• Summarize the data on human population characteristics such as birth</li> </ul>

Topic	Title	Subtopics	Objectives
		Characteristics <ul style="list-style-type: none"> <li>• Population Growth</li> <li>• Population, Quality of Life, and Environment</li> </ul>	and fertility rates, mortality rates, life expectancy, sex ratio and age distribution, and density. <ul style="list-style-type: none"> <li>• Illustrate the effect of economic, social, and cultural factors on population growth.</li> <li>• Evaluate effectiveness of attempts to bring down fertility rates and population growth rates.</li> <li>• Analyze the impact of population growth on quality of life and the natural environment.</li> </ul>
6	Energy Consumption and Conventional Sources	<ul style="list-style-type: none"> <li>• Energy Consumption</li> <li>• Fossil Fuels</li> </ul>	<ul style="list-style-type: none"> <li>• Summarize data on uses, consumption, and reserves of energy.</li> <li>• Classify types of fossil fuels, explain their properties and availability, and discuss their use.</li> <li>• Analyze economic, social, and political factors that determine the use of energy.</li> <li>• Analyze the environmental effects of the use of fossil fuels for energy.</li> </ul>
7	Alternative Sources and Energy Management	<ul style="list-style-type: none"> <li>• Renewable Sources</li> <li>• Nuclear Energy</li> <li>• Conservation</li> </ul>	<ul style="list-style-type: none"> <li>• Classify the renewable sources of energy and explain their physical properties.</li> <li>• Analyze the process of energy creation for renewable sources and the effect on the natural environment.</li> <li>• Explain the process of generating nuclear energy.</li> <li>• Analyze the environmental effects of generation and use of nuclear power and radioactive waste.</li> <li>• Evaluate energy conservation methods and estimate energy use in the future based on assumptions.</li> </ul>
8	Forests and Conservation	<ul style="list-style-type: none"> <li>• Forests and Grasslands</li> <li>• Conservation Efforts: Parks and Refuges</li> <li>• Conservation Efforts: Ecosystems</li> </ul>	<ul style="list-style-type: none"> <li>• Summarize data on forests and grasslands, and their characteristics in terms of life forms, process of change, and impact on the environment.</li> <li>• Explain human impact on forests and grasslands, including the role of land ownership, and examine U.S. forest management.</li> </ul>

Topic	Title	Subtopics	Objectives
			<ul style="list-style-type: none"> <li>Examine the reasons for creating parks and wildlife refuges, their success in preserving life forms and ecosystems, and the problems they face.</li> <li>Illustrate the principles underlying preservation and restoration of ecosystems.</li> </ul>
9	Urbanization	<ul style="list-style-type: none"> <li>Urbanization</li> <li>Problems of Urbanization</li> <li>Urban Planning</li> </ul>	<ul style="list-style-type: none"> <li>Analyze the push and pull factors of migration to urban areas and urban sprawl.</li> <li>Analyze the problems of urbanization in developed and developing countries, and evaluate solutions.</li> <li>Evaluate the principles and effectiveness of urban planning and other ways to reduce the problems of urbanization.</li> </ul>
10	Food, Agriculture, and Pest Control	<ul style="list-style-type: none"> <li>Soil Formation, Use, and Degradation</li> <li>Food and Agriculture</li> <li>Pesticides</li> <li>Sustainable Agriculture</li> </ul>	<ul style="list-style-type: none"> <li>Explain the process of soil formation, use, and erosion, and correlate soil properties to life forms and agriculture.</li> <li>Correlate human nutritional needs to sources of food, and explain the historical development of agriculture.</li> <li>Analyze the need for pesticides and herbicides for agriculture and their harmful effects.</li> <li>Evaluate techniques of sustainable agriculture that aim to maintain yield while minimizing damage to the natural environment.</li> </ul>
11	Water: Availability and Pollution	<ul style="list-style-type: none"> <li>Hydrologic Cycle and Water Bodies</li> <li>Water Availability and Use</li> <li>Water Pollution</li> <li>Water Management</li> </ul>	<ul style="list-style-type: none"> <li>Sequence the steps of the hydrologic cycle, and summarize data about water bodies.</li> <li>Correlate the uses of water to the availability of water.</li> <li>Classify sources of water pollution, and analyze the harm they cause.</li> <li>Evaluate the rationale and effectiveness of strategies to increase the availability of water, conserve water, and purification of water.</li> </ul>
12	Climate, Weather, and Air Pollution	<ul style="list-style-type: none"> <li>Atmosphere</li> <li>Climate</li> <li>Air Pollution</li> </ul>	<ul style="list-style-type: none"> <li>Explain the components of the atmosphere and the processes that form climate and climate change.</li> </ul>

Topic	Title	Subtopics	Objectives
		<ul style="list-style-type: none"> <li>• Pollution Control</li> </ul>	<ul style="list-style-type: none"> <li>• Classify sources and types of air pollution.</li> <li>• Analyze the impact of air pollution on the climate and on human beings.</li> <li>• Evaluate the measures to reduce air pollution and slow down global warming.</li> </ul>
13	Waste Management (Health)	<ul style="list-style-type: none"> <li>• Solid Waste</li> <li>• Hazardous Materials</li> <li>• Health Effects</li> <li>• Waste Management</li> </ul>	<ul style="list-style-type: none"> <li>• Classify types of solid waste and disposal methods, and explain the associated environmental effects.</li> <li>• Classify hazardous materials by sources and effects on the environment.</li> <li>• Analyze the effect of waste and hazardous waste on human health.</li> <li>• Evaluate strategies, programs, and policies to reduce the amount of waste and to reduce the harmful effects of waste.</li> </ul>
14	Economics, Environment, and Policy	<ul style="list-style-type: none"> <li>• Economic Concepts</li> <li>• Economics for Environmental Protection</li> <li>• Policy and Law</li> <li>• Environmental Action</li> </ul>	<ul style="list-style-type: none"> <li>• Correlate economic goals of demand, supply, development, cost-benefit, and so on to human use of natural resources.</li> <li>• Illustrate the use of economic concepts to protect the environment.</li> <li>• Survey important national and international policies, laws, and programs that aim to protect the environment.</li> <li>• Evaluate and propose actions by individuals, organizations, and communities to protect the environment.</li> </ul>
15	Review	<ul style="list-style-type: none"> <li>• Review</li> </ul>	<ul style="list-style-type: none"> <li>• Complete a review of key content covered in this course.</li> </ul>

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