

## DREYFOUS & ASSOCIATES

Course Overview

# Environmental Science



## TABLE OF CONTENT

Unit 1. Environmental Interrelationships1
Unit 2. Environmental Ethics2
Unit 3. Environmental Risk: Economics, Assessment and Management4
Unit 4. Interrelated Scientific Principles: Matter, Energy and Environment
Unit 5. Interaction: Environments and Organisms8
Unit 6. Kinds of Ecosystems and Communities11
Unit 7. Populations: Characteristics and Issues13
Unit 8. Energy and Civilization: Patterns of Consumption16
Unit 9. Energy Sources17
Unit 10. Nuclear Energy19
Unit 11. Biodiversity Issues21
Unit 12. Land-Use Planning23
Unit 13. Soil and its Uses25
Unit 14. Agricultural Methods and Pest Management27
Unit 15. Water Management29
Unit 16. Air Quality Issues
Unit 17. Solid Waste Management and Disposal
Unit 18. Environmental Regulations: Hazardous Substances and Wastes
Unit 19. Environmental Policy and Decision Making



## **Unit 1. Environmental Interrelationships**

At the end of this unit, the student will:

- Understand why environmental problems are complex and interrelated.
- Realize that environmental problems involve social, ethical, political, and economic issues, not just scientific issues.
- Understand that acceptable solutions to environmental problems often are not easy to achieve.
- Understand that all organisms have an impact on their surroundings.
- Understand what is meant by an ecosystem approach to environmental problem solving.
- Recognize that different geographic regions have somewhat different environmental problems, but the process for resolving them is often the same and involves compromise.

#### Lesson 1. The Nature of Environmental Science

**Code:** C416G0SU01L01

#### Concepts

- ecosystem
- environment
- environmental science
- science

#### Lesson 2. Regional Environmental Concerns

**Code:** C416G0SU01L02

#### Concept

• wilderness

## Unit 2. Environmental Ethics

At the end of this lesson, the student will:

- Understand the role of ethics in society.
- Recognize the importance of a personal ethical commitment.
- List three conflicting attitudes toward nature.
- Explain the connection between material wealth and resource exploitation.
- Describe the factors associated with environmental justice.
- Explain how corporate behavior connects to the state of the environment.
- Describe how environmental leaders in industry are promoting more sustainable practices.
- Describe the influences that corporations wield because of their size.
- Explain the relationship among economic growth and environmental degradation.
- Explain some of the relationship between affluence, poverty, and environmental degradation.
- Explain the importance of individual ethical commitments toward environment.
- Explain why global action on the environment is necessary.

## Lesson 1. The Call for a New Ethic

**Code:** C416G0SU02L01

## Concepts

- animal rights / welfare
- anthropocentrism
- biocentrism
- cultural relativism
- deep ecology
- ecocentrism
- ecofeminism
- environmental aesthetics
- environmental pragmatism
- ethics
- laws
- social ecology

## Lesson 2. Environmental Attitudes / Environmental Justice

## **Code:** C416G0SU02L02

- conservation
- environmental justice
- preservation
- sustainable development

#### Lesson 3. Environmental Ethics: Social, Corporate, and Individual Code: C416G0SU02L03

#### Concepts

- corporations
- ecological economics (environmental ecologics)
- economic growth
- industrial ecology
- natural capitalism
- profitability
- resource exploitation

## Lesson 4. The Ethics of Consumption

**Code:** C416G0SU02L04

Concept

• energy

## Lesson 5. Personal Choices / Global Environmental Ethics

**Code:** C416G0SU02L05

## Concept

• ecological footprint

## Unit 3. Environmental Risk: Economics, Assessment and Management

At the end of this lesson, the student will:

- Describe why the analysis or risk has become an important tool in environmental decision making.
- Understand the difference between risk assessment and risk management.
- Describe the issues involved in risk management.
- Understand the difference between true and perceived risks.
- Define what an economic good or service is.
- Understand the relationship between the available supply of a commodity or service and its price.
- Understand how and why cost-benefit analysis is used.
- Understand the concept of sustainable development.
- Understand environmental external costs and the economics of pollution prevention.
- Understand market approaches to solving environmental problems.
- Describe RBCA and Eco-RBCA.
- Understand what is meant by risk tolerance.
- Understand the concept of perceived versus actual risk.

## Lesson 1. Characterizing Risk / Risk and Economics

**Code:** C416G0SU03L01

## Concepts

- negligible risk
- probability
- risk
- risk assessment
- risk management

## Lesson 2. Environmental Economics

## **Code:** C416G0SU03L02

- biodegradable
- cost-benefit analysis
- deferred costs
- demand
- economics
- environmental costs
- external costs
- natural resources
- nonrenewable resources
- pollution

- pollution costs
- pollution prevention costs
- price
- renewable resources
- resources
- supply
- supply/demand curve

## Lesson 3. Using Economic Tools to Address Environmental Issues Code: C416G0SU03L03

## Concepts

- brownfields
- extended product responsibility
- life cycle analysis
- subsidy

## Lesson 4. Economics and Sustainable Development

**Code:** C416G0SU03L04

- debt-for-nature exchanges
- developing nations
- economics
- environment
- sustainable development

## Unit 4. Interrelated Scientific Principles: Matter, Energy and Environment

At the end of this lesson, the student will:

- Understand that science is usually reliable because information is gathered in a manner that requires impartial evaluation and continuous revision.
- Understand that matter is made up of atoms that have specific subatomic structure of protons, neutrons and electrons.
- Recognize that each element is made of atoms that have a specific number of protons and electrons and that isotopes of the same element may differ in the number of neutrons present.
- Recognize that atoms may be combined and held together by chemical bonds to produce molecules.
- Understand that rearranging chemical bonds results in chemical reactions and that these reactions are associated with energy changes.
- Recognize that matter may be solid, liquid or gas, depending on the amount of kinetic energy contained by the molecules.
- Realize that energy can be neither created nor destroyed, but when energy is converted from one form to another, some energy is converted into a less useful form.
- Understand that energy can be of different qualities.

#### Lesson 1. The Nature of Science / Limitations and Pseudoscience

**Code:** C416G0SU04L01

#### Concepts

- cause-and-effect relationships
- controlled experiment
- experiment
- hypothesis
- Kinetic molecular theory
- law of Conservation of Mass
- observation
- pseudoscience
- reproducibility
- science
- scientific law
- scientific method
- theory
- variables

Lesson 2. The Structure of Matter Code: C416G0SU04L02 Concepts

- acid
- activation energy
- atoms
- base
- catalyst
- chemical bonds
- compound
- electrons
- element
- endothermic reactions
- enzymes
- exothermic reactions
- hydroxide ions
- ions
- matter
- mixtures
- molecules
- neutrons
- nucleus
- pH
- photosynthesis
- protons
- respiration

#### Lesson 3. Energy Principles

**Code:** C416G0SU04L03

#### Concepts

- energy
- entropy
- first law of thermodynamics
- kinetic energy
- latent heat
- potential energy
- second law of thermodynamics
- sensible heat

#### Lesson 4. Environmental Implications of Energy Flow

**Code:** C416G0SU04L04

- combustion
- entropy
- pollution
- thermodynamics

#### Unit 5. Interaction: Environments and Organisms

At the end of this lesson, the student will:

- Identify and list abiotic and biotic factors in an ecosystem.
- Define niche.
- Describe the process of natural selection as it operates to refine the fit among organism, habitat and niche.
- Describe predator-prey, parasite-host, competitive, mutualism, and commensalistic relationships.
- Differentiate between a community and an ecosystem.
- Define the roles of producer, herbivore, carnivore, omnivore, scavenger, parasite, and decomposer.
- Describe energy flow through an ecosystem.
- Relate the concepts of food webs and food chains to trophic levels.
- Explain the cycling of nutrients such as nitrogen, carbon, and phosphorus through an ecosystem.

## Lesson 1. Ecological Concepts

Code: C416G0SU05L01

#### Concepts

- abiotic factors
- biotic factors
- ecology
- environment
- habitat
- limiting factor
- niche
- range of tolerance

#### Lesson 2. The Role of Natural Selection and Evolution

#### **Code:** C416G0SU05L02

#### Concepts

- coevolution
- evolution
- extinction
- genes
- natural selection
- polyploidy
- population
- speciation
- species

#### Lesson 3. Kinds of Organism Interactions

#### **Code:** C416G0SU05L03

#### Concepts

- commensalism
- competition
- competitive exclusion principle
- ectoparasites
- endoparasites
- host
- interspecific competition
- intraspecific competition
- mutualism
- mycorrhizae
- parasite
- parasitism
- predation
- predator
- prey
- symbiosis
- vectors

#### Lesson 4. Community and Ecosystem Interactions

**Code:** C416G0SU05L04

- community
- ecosystem
- producers
- consumers
- primary consumers
- herbivores
- secondary consumers
- carnivores
- omnivores
- decomposers
- keystone species
- trophic level
- food chain
- biomass
- detritus
- food web
- biogeochemical cycles
- carbon cycle
- nitrogen cycle
- nitrifying bacteria

• denitrifying bacteria

#### Unit 6. Kinds of Ecosystems and Communities

At the end of this lesson, the student will:

- Recognize the difference between primary and secondary succession.
- Describe the process of succession from pioneer to climax community in both terrestrial and aquatic situations.
- Associate typical plants and animals with the various terrestrial biomes.
- Recognize the physical environmental factors that determine the kind of climax community the will develop.
- Differentiate the forest biomes that develop based on temperature and rainfall.
- Describe the various kinds of aquatic ecosystems and the factors that determine their characteristics.

## Lesson 1. Succession

Code: C416G0SU06L01

## Concepts

- climax community
- pioneer community
- primary succession
- secondary succession
- sere
- succession
- successional stage (seral stage)

## Lesson 2. Biomes are Determined by Climate

**Code:** C416G0SU06L02

#### Concept

• biomes

#### Lesson 3. Major Biomes of the World (I)

**Code:** C416G0SU06L03

#### Concepts

- deserts
- temperate grasslands (prairies or steppes)
- savannas
- mediterranean shrublands
- tropical dry forest

#### Lesson 4. Major Biomes of the World (II)

**Code:** C416G0SU06L04

#### Concepts

• alpine tundra

- permafrost
- taiga (northern coniferous forest or boreal forest)
- temperate deciduous forests
- temperate rainforests
- tropical rainforests
- tundra

#### Lesson 5. Major Aquatic Ecosystems

## **Code:** C416G0SU06L05

- abyssal ecosystem
- benthic ecosystem
- benthic organisms
- biochemical oxygen demand (BOD)
- coral reef ecosystem
- emergent plant
- estuary
- euphotic zone
- eutrophic lakes
- freshwater ecosystem
- littoral zone
- mangrove swamp ecosystem
- marine ecosystem
- marine ecosystem
- oligotrophic lakes
- pelagic ecosystem
- pelagic organisms
- periphyton
- phytoplankton
- plankton
- submergent plant
- zooplankton

## Unit 7. Populations: Characteristics and Issues

At the end of this lesson, the student will:

- Understand that birthrate and death rate are both important in determining the population growth rate.
- Define the following characteristics of a population: natality, mortality, sex ratio, age distribution, biotic potential, and spatial distribution.
- Explain the significance of biotic potential to the rate of population growth.
- Describe the lag, exponential growth, deceleration, and stable equilibrium phases of a population growth curve. Explain why each of these stages occurs.
- Describe how limiting factors determine the carrying capacity for a population.
- List of the four categories of limiting factors.
- Recognize that humans are subject to the same forces of environmental resistance as are other organisms.
- Understand the implications of over reproduction.
- Explain how human population growth is influenced by social, theological, philosophical, and political thinking.
- Explain why the age distribution and the status and role of women affect population growth projections.
- Recognize that countries in the more-develop world are experiencing an increase in the average age of their populations.
- Recognize that most countries of the world have a rapidly growing population.
- Describe the implications of the demographic transition concept.
- Recognize that rapid population growth and poverty are linked.

#### Lesson 1. Population Characteristics

**Code:** C416G0SU07L01

#### Concepts

- age distribution
- birthrate
- death rate
- dispersal
- emigration
- immigration
- mortality
- natality
- population
- population density
- population growth rate
- survivorship curve

Lesson 2. A Population Growth Curve / Factors that Limit Population Size Code: C416G0SU07L02

#### Concepts

- biotic potential
- deceleration phase
- density-independent limiting factors
- environmental resistance
- exponential growth phase (log phase)
- extrinsic limiting factors
- intrinsic limiting factors
- lag phase
- limiting factors
- stable equilibrium phase

## Lesson 3. Categories of Limiting Factors / Carrying Capactity

**Code:** C416G0SU07L03

#### Concepts

- carrying capacity
- death phase

## Lesson 4. Reproductive Strategies and Population Fluctuations

#### **Code:** C416G0SU07L04

## Concepts

- K-strategists
- r-strategists

## Lesson 5. Human Population Growth / Characteristics and Implications

## Code: C416G0SU07L05

#### Concepts

- ecological footprint
- less-develop countries
- more-develop countries
- population density

#### Lesson 6. Factors that Influence Human Population Growth

**Code:** C416G0SU07L06

#### Concepts

- age distribution
- demography
- replacement fertility
- total fertility rate
- zero population growth

## Lesson 7. Population Growth Rates and Standard of Living Code: C416G0SU07L07

## Concepts

- gross national income (GNI)
- standard of living

## Lesson 8. The Demographic Transition Concept

**Code:** C416G0SU07L08

- demographic transition
- postwar baby boom

#### Unit 8. Energy and Civilization: Patterns of Consumption

At the end of this lesson, the student will:

- Explain why all organisms require a constant input of energy.
- Describe how per capita energy consumption increased as civilization advanced cultures.
- Describe hoy advanced modern civilizations developed as new fuels were used to run machines.
- Correlate the Industrial Revolution with social and economic changes.
- Explain how cheap oil and natural gas led to a consumption-oriented society.
- Explain how the automobile changed people's lifestyles.
- Explain why energy consumption is growing more rapidly in developing countries than in the industrialized world.
- Describe the role of OPEC in determining oil prices.

## Lesson 1. History of Energy Consumption

**Code:** C416G0SU08L01

## Concepts

- fossil fuels
- industrial Revolution

#### Lesson 2. How Energy is Used / Electrical Energy

Code: C416G0SU08L02

#### Concepts

- electrical energy
- energy

## Lesson 3. The Economics and Politics of Energy Use

**Code:** C416G0SU08L03

#### Lesson 4. Energy Consumption Trends

**Code:** C416G0SU08L04

## Unit 9. Energy Sources

At the end of this lesson, the student will:

- Differentiate between resources and reserves.
- Identify peat, lignite, bituminous coal, and anthracite coal as steps in the process of coal formation.
- Recognize that natural gas and oil are formed from ancient marine deposits.
- Explain how various methods of coal mining can have negative environmental impacts.
- Explain why surface mining of coal is used in some areas and underground mining in other areas.
- Explain why it is more expensive to find and produce oil today than it was in the past.
- Recognize that secondary recovery methods have been developed to increase the proportion of oil and natural gas is still a problem in some areas of the world.
- Explain why the amount of energy supplied by hydroelectric power is limited.
- Describe how wind, geothermal, and tidal energy are used to produce electricity.
- Recognize that wind, geothermal, and tidal energy can be developed only in areas with the proper geologic or geographical features.
- Describe how the use of solar energy in passive heating systems, active heating systems, and the generation of electricity.
- Recognize that fuel wood is a major source of energy in many parts of the lessdeveloped world and that fuel wood shortages are common.
- Describe the potential and limitations of biomass conversion and waste incineration as sources of energy.
- Recognize that energy conservation can significantly reduce our need for additional energy sources.

## Lesson 1. Energy Sources / Resources and Reserves

**Code:** C416G0SU09L01

#### Concepts

- renewable energy sources
- nonrenewable energy sources
- resource
- reserves

#### Lesson 2. Issues Related to the Use of Fossil Fuels

**Code:** C416G0SU09L02

- black lung disease
- liquefied natural gas

- natural gas
- oil
- overburden
- surface mining
- underground mining

## Lesson 3. Renewable Sources of Energy

## **Code:** C416G0SU09L03

## Concepts

- active solar system
- anaerobic digestion
- animal wastes
- biofuels production
- biomass
- crop residues
- direct combustion
- energy plantations
- fuelwood
- geothermal energy
- hydropower
- passive solar system
- pyrolysis
- solar energy
- solar furnace
- solid waste
- tidal power
- wind energy

## Lesson 4. Energy Conservation

**Code:** C416G0SU09L04

- energy conservation
- fuel cells

#### Unit 10. Nuclear Energy

At the end of this lesson, the student will:

- Explain how nuclear fission has the potential to provide large amounts of energy.
- Describe how the nuclear reactor produces electricity.
- Describe the basic types of nuclear reactors.
- Explain the steps involved in the nuclear fuel cycle.
- List the concerns about the use of nuclear power.
- Explain the problem of decommissioning a nuclear plant.
- Describe how high-level radiation waste is stored.
- Describe the accident at Chernobyl.
- Explain how a breeder reactor differs from other nuclear reactors.

#### Lesson 1. The Nature of Nuclear Energy / History

**Code:** C416G0SU10L01

#### Concepts

- absorbed dose
- alpha radiation
- beta radiation
- dose equivalent
- gamma radiation
- ionizing radiation
- nuclear chain reaction
- nuclear fission
- radiation
- radioactive
- radioactive half-life

#### Lesson 2. Nuclear Fission Reactors

**Code:** C416G0SU10L02

#### Concepts

- boiling-water reactor
- fissionable
- gas-cooled reactor
- heavy-water reactor
- moderators
- nuclear reactor
- pressurized-water reactor
- Uranium 235 (U-235)

## Lesson 3. Investigating Nuclear Alternatives Code: C416G0SU10L03

#### Concepts

- nuclear breeder reactor
- nuclear fusion
- plutonium 239 (Pu 239)

#### Lesson 4. The Nuclear Fuel Cycle

**Code:** C416G0SU10L04

#### Concepts

- fuel fabrication
- nuclear cycle
- reactor
- underground mining

#### Lesson 5. Nuclear Concerns

**Code: C**416G0SU10L05

#### Concepts

- nuclear power
- nuclear weapons
- transuranic nuclear waste
- thermal pollution
- decommissioning

## Lesson 6. The Future of Nuclear Power

**Code:** C416G0SU10L06

#### Unit 11. Biodiversity Issues

At the end of this lesson, the student will:

- Recognize that humans significantly modify natural ecosystems.
- State the major causes of biodiversity loss.
- Give examples of genetic diversity, species diversity, and ecosystem diversity.
- Describe the values of biodiversity.
- Appreciate the ways of humans modify forests.
- Identify causes of desertification.
- Describe the role of endangered species legislation and the biodiversity treaty.
- Describe the techniques that foster the sustainable use of wildlife and fisheries resources.

#### Lesson 1. Biodiversity Loss and Extinction

**Code:** C416G0SU11L01

#### Concepts

- biodiversity
- extinction

#### Lesson 2. Describing Biodiversity

**Code:** C416G0SU11L02

#### Concepts

- biodiversity
- ecosystem diversity
- genetic diversity
- species diversity

#### Lesson 3. The Value of Biodiversity

**Code:** C416G0SU11L03

#### Lesson 4. Threats of Biodiversity

**Code:** C416G0SU11L04

- bush meat
- clear-cutting
- deforestation
- desertification
- habitat loss
- overexploitation
- patchwork clear-cutting
- reforestation
- selective harvesting

## Lesson 5. What is Being done to Preserve Biodiversity?

**Code:** C416G0SU11L05

- endangered species
- habitat management
- migratory birds
- threatened species

## Unit 12. Land-Use Planning

At the end of this lesson, the student will:

- Explain why the most major cities are located on rivers, lakes, or the ocean.
- Describe the forces that result in farmland adjacent to cities being converted to urban uses.
- Explain why floodplains and wetlands are often mismanaged.
- Describe the economic and social values involved in planning for outdoor recreation opportunities.
- Explain why some land must be designated for particular recreational uses, such as wilderness areas, and why that decision sometimes invites disagreement from those who do not wish to use the land in the designated way.
- List the steps in the development and implementation of a land-use plan.
- Describe the methods of enforcing compliance with land-use plans.
- Describe the advantages and disadvantages of both local and regional land-use planning.
- Describe the concept of smart growth.

## Lesson 1. The Need for Planning

Code: C416G0SU12L01

#### Concepts

- megalopolis
- ribbon sprawl
- tract development

#### Lesson 2. Factors that Contribute to Sprawl

**Code:** C416G0SU12L02

#### Concepts

- economic factors
- policy factors

## Lesson 3. Problems Associated with Unplanned Urban Growth (I)

#### **Code:** C416G0SU12L03

## Concept

• infrastructure

#### Lesson 4. Problems Associated with Unplanned Urban Growth (II)

**Code:** C416G0SU12L04

- floodplain zoning ordinances
- floodplains
- land-use planning

- urban growth limit
- wetlands

Lesson 5. Mechanism for Implementing Land-Use Plans Zoning Code: C416G0SU12L05

## Lesson 6. Special Urban Planning Issues

**Code:** C416G0SU12L06

- brownfields
- brownfields development

#### Unit 13. Soil and its Uses

At the end of this lesson, the student will:

- Describe the geological process that build and erode the Earth's surface.
- List the physical, chemical, and biological factors involved in soil formation.
- Explain the importance of hummus to soil fertility.
- Differentiate between soil texture and soil structure.
- Explain how texture and structure influence soil atmosphere and soil water.
- Explain the role of living organisms in soil formation and fertility.
- Describe the various layers in a soil profile.
- Describe the process of soil erosion by water and wind.
- Explain how contour farming, strip farming, terracing, waterways, windbreaks, and conservation tillage reduce soil erosion.
- Understand that the misuse of soil reduces soil fertility, pollutes streams, and requires expensive remedial measures.
- Explain how land not suited for cultivation may still be productively used for other purposes.

## Lesson 1. Geological Process / Soil (Land and Formation)

Code: C416G0SU13L01

#### Concepts

- asthenosphere
- chemical weathering
- crust
- humus
- land
- lithosphere
- mantle
- mechanical weathering
- parent material
- plate tectonics
- soil
- weathering

#### Lesson 2. Soil: Properties, Profile and Erosion

**Code:** C416G0SU13L02

- erosion
- friable
- horizon
- leaching

- litter
- loam
- soil profile
- soil structure
- soil texture

## Lesson 3. Soil Conservation Practices

## **Code:** C416G0SU13L03

## Concepts

- contour farming
- strip farming
- terraces
- waterways
- windbreaks

## Lesson 4. Conventional versus Conservation Tillage

**Code:** C416G0SU13L04

- conservation tillage
- reduce tillage

#### Unit 14. Agricultural Methods and Pest Management

At the end of this lesson, the student will:

- Explain how mechanization encouraged monoculture farming.
- List the advantages and disadvantages of monoculture farming.
- Explain why chemical fertilizers are used.
- Understand how fertilizers alter soil characteristics.
- Explain why modern agriculture makes extensive use of pesticides.
- Differentiate between persistent pesticides and nonpersistent pesticides.
- List four problems associated with pesticide use.
- Define biomagnification.
- Define organic farming.
- Explain why integrated pest management depends on a complete knowledge of the pest's life history.
- Recognize that genetically modified crops are created by using biotechnological techniques to insert genes from one species into another.

## Lesson 1. The Development of Agriculture

**Code:** C416G0SU14L01

#### Concepts

- green Revolution
- monoculture

#### Lesson 2. The Impact of Fertilizer

**Code:** C416G0SU14L02

- auxins
- biocides
- carbamates
- chlorinated hydrocarbons
- fungicides
- herbicides
- insecticides
- macronutrients
- micronutrients
- nonpersistent pesticide
- nontarget organism
- organophosphates
- persistent pesticides
- pesticide
- pests
- rodenticides

- target organism
- weeds

#### Lesson 3. Problems with Pesticide Use

**Code:** C416G0SU14L03

#### Concepts

- bioaccumulation
- biomagnification

## Lesson 4. Alternatives to Conventional Agriculture

## **Code:** C416G0SU14L04

- alternative agriculture
- genetic engineering (biotechnology)
- genetically modified organism
- integrated pest management
- organically grown
- pheromone
- precision agriculture
- sustainable agriculture

#### Unit 15. Water Management

At the end of this lesson, the student will:

- Explain how water is cycled through the hydrologic cycle.
- Explain the significance of groundwater, aquifers, and runoff.
- Explain how land use affects infiltration and surface runoff.
- List the various kinds of water use and the problems associated with each.
- List the problems associated with water impoundment.
- List the major sources of water pollution.
- Define biochemical oxygen demand (BOD).
- Differentiate between point and nonpoint sources of pollution.
- Explain how heat can be a form of pollution.
- Differentiate among primary, secondary, and tertiary sewage treatments.
- Describe some of the problems associated with stormwater runoff.
- List sources of groundwater pollution.
- Explain how various federal laws control water use and prevent misuse.
- List the problems associated with water-use planning.
- Explain the rationale behind the federal laws that attempt to preserve certain water areas and habitats.
- List the problems associated with groundwater mining.
- Explain the problem of salinization associated with large-scale irrigation in arid areas.
- List the water-related services provided by local goverments.

#### Lesson 1. Hydrologic Cycle

**Code:** C416G0SU15L01

- Potable water
- Hydrologic cycle
- Evapotranspiration
- Runoff
- Groundwater
- Aquifer
- Unconfined aquifer
- Water table
- Vadose zone
- Confined aquifer
- Aquiclude
- Aquitard
- Artesian wells
- Porosity

#### Lesson 2. Kinds of Water Use

#### **Code:** C416G0SU15L02

#### Concepts

- domestic water
- industrial water use
- in-stream water use
- irrigation

#### Lesson 3. Kinds and Sources of Water Pollution

#### **Code:** C416G0SU15L03

#### Concepts

- biochemical oxygen demand (BOD)
- eutrophication
- fecal coliform bacteria
- limiting factor
- thermal pollution

#### Lesson 4. Water-Use Planning Issues

**Code:** C416G0SU15L04

- activated-sludge sewage treatment
- groundwater mining
- primary sewage treatment
- salinization
- saltwater intrusion
- secondary sewage treatment
- sewage sludge
- stormwater runoff
- tertiary sewage treatment
- trickling filter system
- water diversion

#### Unit 16. Air Quality Issues

At the end of this lesson, the student will:

- Recognize that air can accept and disperse significant amounts of pollutants.
- List the major sources and effects of the six criteria air pollutants.
- Describe how photochemical smog is formed and how it affects humans.
- Explain how acid rain is formed.
- Understand that human activities can alter the atmosphere in such a way that they can change climate.
- Describe the kinds of changes that could occur as a result of global warming.
- Describe the links between chlorofluorocarbon use and ozone depletion.
- Recognize that there are many positive actions that have improved air quality.
- Recognize that enclosed areas can trap air pollutants that are normally diluted in the atmosphere.

#### Lesson 1. The Atmosphere

**Code:** C416G0SU16L01

#### Concepts

- atmosphere
- carcinogenic
- criteria air pollutants
- hazardous air pollutants (air toxics)
- hydrocarbons
- nitrogen dioxide
- nitrogen monoxide
- nitrogen oxides
- ozone
- particulate matter
- photochemical smog
- primary air pollutants
- secondary air pollutants
- sulfur dioxide
- thermal inversion
- volatile organic compounds

#### Lesson 2. Control of Air Pollution / Acid Deposition

**Code:** C416G0SU16L02

Concept

acid deposition

#### Lesson 3. Ozone Depletion / Global Warming

**Code:** C416G0SU16L03

## Concepts

- carbon dioxide
- chlorofluorocarbons (CFC)
- climate change
- global warming
- greenhouse effect
- greenhouse gases
- methane
- nitrous oxide

## Lesson 4. Addressing Climate Change

**Code:** C416G0SU16L04

#### Concepts

- biomass
- energy efficiency

## Lesson 5. Indoor Air Pollution / Noise Pollution

**Code:** C416G0SU16L05

- air pollution
- decibels
- noise pollution
- radon

## Unit 17. Solid Waste Management and Disposal

At the end of this lesson, the student will:

- Explain why solid waste is a problem throughout the world.
- Understand that the management of municipal solid waste is directly affected by economics, changes in technology, and citizen awareness and involvement.
- Describe the various methods of waste disposal and the problems associated with each method.
- Understand the difficulties in developing new municipal landfills.
- Define the problems associated with incineration as a method of waste disposal.
- Describe some methods of source reduction.
- Describe composting and how it fits into solid waste disposal.
- List some benefits and drawbacks of recycling.

#### Lesson 1. Solid Waste

Code: C416G0SU17L01

#### Concepts

- agricultural waste
- industrial solid waste
- mining waste
- municipal solid waste (MSW)
- solid waste

#### Lesson 2. Methods of Waste Disposal

**Code:** C416G0SU17L02

- composting
- incineration
- landfill
- leachate
- mass burn
- mulch
- municipal solid waste landfill
- recycling
- source reduction

Unit 18. Environmental Regulations: Hazardous Substances and Wastes

At the end of this lesson, the student will:

- Distinguish between hazardous substances and hazardous wastes.
- Distinguish between hazardous and toxic substances.
- Describe the four characteristics used to identify hazardous substances.
- Describe the kinds of environmental problems caused by hazardous and toxic substances.
- Understand the difference between persistent and nonpersistent pollutants.
- Describe the difference between chronic and acute exposures to hazardous wastes.
- Describe why hazardous-waste dump sites developed.
- Describe how hazardous waste are managed, and list five technologies used in their disposal.
- Describe the importance of source reduction with regard to hazardous wastes.
- Describe when and why an Environmental Site Assessment would be conducted.
- Describe the benefits from enacting the ISO 14000 Environmental Management System.
- Understand the difficulties associated with determining cleanup criteria for hazardous substances/wastes,

## Lesson 1. Hazardous and Toxic Substances

Code: C416G0SU18L01

## Concepts

- corrosiveness
- hazardous
- hazardous substances (hazardous materials)
- hazardous waste
- ignitability
- reactivity
- resource Conservation and Recovery Act
- toxic
- toxicity

## Lesson 2. Determining Regulations

**Code:** C416G0SU18L02

- acute toxicity
- chronic toxicity
- nonpersisten pollutants
- persistent pollutants
- synergism

• threshold level

#### Lesson 3. Hazardous Wastes

**Code:** C416G0SU18L03

#### Concepts

- comprehensive Environmental Response
- compensation and Liability Act
- National Priorities List

## Lesson 4. Hazardous-Waste Management Choices

**Code:** C416G0SU18L04

#### Concepts

- incineration
- land disposal
- pollution prevention
- pollution-prevention hierarchy
- waste minimization

#### Lesson 5. Hazardous-Waste Management

**Code:** C416G0SU18L05

## Unit 19. Environmental Policy and Decision Making

At the end of this lesson, the student will:

- Explain how the executive, judicial and legislative branches of the U.S. government interact in forming policy.
- Understand how environmental laws are enforced in the United States.
- Describe the forces that led to changes in environmental policy in the United States during the past three decades.
- Understand the history of the major U.S. environmental legislation.
- Understand why some individuals in the United States are concerned about environmental regulations.
- Understand what is meant by "green" politics.
- Describe the reasons environmentalism is a growing factor in international relations.
- Understand the factors that could result in "ecoconflicts".
- Understand why it is not possible to separate politics and the environment.
- Explain how citizen pressure can influence governmental environmental policies.

#### Lesson 1. New Challenges for a New Century

Code: C416G0SU19L01

#### Concept

• governance

#### Lesson 2. Development of Environmental Policy in the United States

**Code:** C416G0SU19L02

#### Concepts

- executive branch
- government branches
- judicial branch
- legislative branch
- policy

#### Lesson 3. Environmental Policy and Regulation

**Code:** C416G0SU19L03

- ambiguous role for science
- complexity
- delayed consequences
- national vs regional conflict
- polarization
- winners and losers

## Lesson 4. The Greening of Geopolitics / Terrorism

**Code:** C416G0SU19L04

Concept

- environmental terrorism
- Lesson 5. International Environmental Policy

**Code:** C416G0SU19L05