

Prepared by the Department of Natural Sciences & Life Fitness

Date of Departmental Approval: 2/5/07

Date approved by Curriculum and Programs: October 3, 2007

Effective: Fall 2007

1. Course Number: ENV115

Course Title: Environmental Chemistry

2. Description: Discussion and study of the relationship between Chemistry and contemporary environmental topics, including energy and the environment, air, soil, oil, solid and water pollution, agricultural chemistry.

3. Student Learning Outcomes: (instructional objectives, intellectual skills):

Upon successful completion of this course, students are able to:

- Describe air in terms of its major components, relative amounts of components and the local regional variations in the composition of air.
- List major air pollutants and describe the effects of each on humans.
- Evaluate conditions significant in risk-benefit analysis.
- Interpret air quality data in terms of concentration units and pollution levels.
- Explain the different pollutants produced by burning coal and gasoline.
- Describe how ozone forms, including how sunlight, NO, NO₂, and Volatile Organic Compounds (VOCs) are involved.
- Describe the chemical nature of ozone, location of the ozone layer and factors affecting its existence.
- Describe the electromagnetic spectrum in terms of frequency, wavelength and energy.
- Express how the ozone layer protects against harmful radiation and differentiate the energies and biological effects of UV-A, UV-B and UV-C radiation.
- Explain the Capman cycle and the role of nature in stratospheric ozone depletion.
- Summarize the political and scientific dimensions of the Montreal Protocol and its amendments.
- Discuss the factors that distribute to the recovery of the ozone layer.
- Differentiate between Earth's natural greenhouse effect and the enhanced greenhouse effect.
- Assess the sources, relative emission quantities and effectiveness of greenhouse gases other than CO₂.
- Explain world and U.S. policy concerning the Kyoto Protocol.
- Explain how potential energy stored in a chemical compound and describe how combustion reactions release energy.
- Calculate the heat of combustion for a reaction using bond energies.
- Describe the factors related to the U.S.'s dependence on fossil fuels for energy.
- Discuss the physical and chemical principles associated with petroleum refining and describe octane rating and how refining, leaded gasoline, ethanol and MTBE relate to it.
- Differentiate among pure water, drinking water and water unfit for human consumption.
- Discuss the ways in which water is "cleaned".
- Explain and summarize water's physical and chemical properties.
- Explain the role of sulfur oxides and nitrogen oxides in causing acid rain.
- List the different sources of NO_x and SO_x and explain the variations in the levels of these pollutants over the past 30 years.
- List different ways to control acid rain and appraise the cost-benefit considerations involved.
- Demonstrate an understanding of three additional topics that the students select for the course.

4. Credits: 3 credits

5. Satisfies General Education Requirement: No

6. Prerequisite: CHM106 Survey of Chemistry

7. Semester(s) Offered: Fall

8. Suggested General Guidelines for Evaluation: Exams; Homework; Final Exam and Papers

9. General Topical Outline (Optional):

Course Outline for ENV115 Environmental Chemistry

- I. The Air We Breath
- II. Protecting the Ozone Layer
- III. The Chemistry of Global Warming
- IV. Energy, Chemistry and Society
- V. The Water We Drink
- VI. Neutralizing the Threat of Acid Rain

And three of the following topics:

- The Fires of Nuclear Fission
- Energy from Electron Transfer
- The World of Plastics and Polymers
- Manipulating Molecules and Designing Drugs
- Nutrition: Food for Thought
- Genetic Engineering and the Chemistry of Heredity