Chemistry 3650
Environmental Chemistry

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Office Hours: M 1:30-2:20, T&Th 9:30-11:00, or by appointment. E-mail questions work well.

Text: Stanley E. Manahan *Environmental Chemistry* 8th Edition, Lewis Publishers **2005** (required)

Class web site: http://www.chem.usu.edu/~sbialkow/Classes/3650/index.html

Prerequisites: Any Physical Science breadth course and "General knowledge" of chemical principles. Because a lot of environmental chemistry involves organic substances, Chem 2300 or Chem 2310 is recommended. A short synopsis of organic chemistry is given in Chapters 25 and 26 for those students who have not taken organic chemistry (entering with Chem 1120 prerequisite).

Course Content: This course is a survey of the chemistry of the environment and issues of a chemical nature involved in global change. Lectures, demonstrations, and assignments are used to educate the student in current issues associated with environmental chemistry. A host of environmental problems are not confined to any one medium (air, soil, water) but are characterized by dynamic transfers among media. This interdisciplinary study of environmental chemistry aims to prepare students to understand the fundamental principles governing pollutant transport and transformation in all environmental settings.

Course Objectives: This is a Physical Sciences depth course. Chemistry is used to illustrate how we can understand environmental problems associated with modern society. Particular emphasis is placed on the chemical nature of the problem and how these problems may affect our environment and the quality of our lives. The theories, models, concepts, and data analysis, as they apply to environmental degradation, will be discussed. The focus on chemistry is intended to further our limited understanding of chemical principles that, together with physical and biological processes, determine the environmental conditions in which we must find a sustainable way to live.

Lectures: The lectures will build from basic elements of air, soil, and water chemistry to enhance our understanding of problems associated with pollution from both natural and anthropogenic substances. The lecture will emphasize chemical reactions, chemical equilibrium within natural settings, transport, chemical degradation, and toxicological effects. All phases will be considered; water pollution in the hydrosphere; stratospheric ozone depletion, urban smog in the atmosphere; and soil and subterranean pollution in the lithosphere. This class will apply the principles of analytical, inorganic, organic, and physical chemistry, to the complex milieus encountered outside the laboratory.

Examinations: There will be three examinations, each worth 100 points. They will be based on the environmental chemistry of the hydrosphere, lithosphere, and atmosphere, respectively. Examination questions will be drawn from homework (out-of-class exercises, reading, and problems from the book) and concepts addressed in the lectures. Examinations may be partially or totally "take-home" in nature.

Homework: Reading exercises from the textbook and outside sources will be assigned. Students will be expected to find, read, and interpret articles found in the popular and scientific literature. Students will also learn how to use the internet to research topics associated with environmental pollution.

Grading: Grades are based on your performance on examinations and assignments. Point scores will be added and a percent score calculated. The guaranteed grade cut-off of 90+% A, 80%-89% B, 70%-79% C, 55%-69% D will be used. +/- scores will be used as prescribed in the Catalog. The percentile scores may be adjusted, only upward, to curve the percent scores *if* the examinations appear to be too difficult and if the class, as a whole, did not perform well on specific questions.

Learning Objectives:

- Be able to relate the microscopic and macroscopic properties of matter to each other
- Comprehend the importance of stoichiometry, chemical equilibrium and kinetics in analysis.
- Demonstrate knowledge of sampling methods for all states of matter
- Discuss the basic chemical components of living systems, including proteins, nucleic acids, lipids, and carbohydrates
- Apply theory and operational principles of analytical instruments
- Distinguish between qualitative and quantitative measurements and compare and critically select methods for elemental and molecular analyses
- Professional ethics

Assessment: Gain score method will be used for course effectiveness assessment. This will be part of all three take-home examinations.

Withdrawal Policy: This course will follow the University policy on withdrawals stated in the current Undergraduate Catalog. Drop dates are listed in the Spring Schedule of Classes.

Missed Examination Policy: Students may be excused from an examination in cases of emergency. Documentation to support the emergency must be supplied to the instructor. In cases of excused absence, grades will be assigned based on % of adjusted total score. No repetition of examinations is permitted.

Attendance Policy: Attendance is required for satisfactory performance.

Student Disability Statement: Any student with a disability that requires accommodations must contact the Instructor. The disability must be documented by the Disability Resource Center. Course materials may be requested in alternative formats.

Approximate Dates	Subject	Reading Assignment	Homework Assignment
Concepts in Environmental Chemistry and Chemical Cycles			
January 7	Introduction - Video	Chapter 1	
January 12	Chemical Fate and Transport…	Chapter 1	Statement of your interest in environmental chemistry
January 19	No Class - Dr. Martin Luther King, Jr. Day	Chapter 2	
January 21	The Anthrosphere…	Chapter 2	Chapter 2 Problems
Aquatic Chemistry			
January 28	Fundamentals of Aquatic Chemistry	Chapter 3	Choose an article on aquatic environmental chemistry from the popular literature to critique
February 2	Oxidation-Reduction in the Environment	Chapter 4	Chapter 4 Problems
February 6	Phase Interactions	Chapter 5	Chapter 5 Problems
February 11	Aquatic Microbial Biochemistry	Chapter 6 Chapter 21	
February 13	Water Pollution	Chapter 7	Chapter 7 Problems
Atmospheric Chemistry			
February 16	President's Day; Class meets Tuesday February 17		Choose an article on atmospheric environmental chemistry from the popular literature to critique
February 18	The Atmosphere and Atmospheric Chemistry	Chapter 9	Chapter 9 Problems
February 23	Particles in the Atmosphere	Chapter 10	Chapter 10 Problems
February 27	Gaseous Inorganic Air Pollutants	Chapter 11	Chapter 11 Problems
March 6	Organic Air Pollution	Chapter 12	Chapter 12 Problems
March 9 - 13	Spring Break		
March 16	Photochemical Smog	Chapter 13	Chapter 13 Problems
March 20	The Endangered Global Atmosphere - Global Change	Chapter 14	Chapter 14 Problems
Chemistry of the Earth			
March 30	The Geosphere and Geochemistry	Chapter 15	Choose an article on soil or geochemistry from the popular literature to critique
April 6	Soil and Agricultural Environmental Chemistry	Chapter 16	Chapter 16 Problems
April 13	Hazardous Wastes	Chapter 19	Chapter 19 Problems
April 20	Additional Topics		
April 24	Last Day of Class		