

Chemistry 3650
Environmental Chemistry

Instructor: Stephen Bialkowski

Office: ML 359, Logan Campus

Phone: (435) 797-1907

Email: stephen.bialkowski@usu.edu

Text: James E. Girard *Principles of Environmental Chemistry*, 3rd Edition, Jones and Bartlett Publishers **2014** (required)

Prerequisites: "General knowledge" of chemical principles. This may include introductory general chemistry.

Course Content: This course is a survey of the chemistry of the environment and issues of a chemical nature involved in global change. Lectures, videos, and assignments are used to acquaint the student to the chemistry taking place in the natural environment and to 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 the different regions of the planet. This interdisciplinary study of environmental chemistry aims to prepare students to understand the fundamental principles governing natural environment, pollutant transport and ecotoxicity, and the chemical transformations taking place in all environmental settings. This is a Physical Sciences Depth course.

Course Objectives: 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 illustrate our 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.

Instruction: The course consists of online lecture, video presentations, text book reading, and online data "mining". Homework assignments are given to help students understand the core principles. The three examinations are 'take-home' and 'open book' in nature. Ample time is allowed to complete the exams.

The lectures build from basic elements of air, soil, water chemistry and energy to enhance understanding of problems associated with pollution from both natural and anthropogenic substances. Lectures 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 take-home examinations, each worth 75 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. Students will be expected to find, read, and interpret articles found in the popular and scientific literature. You will have one week to complete the examinations.

Homework: Reading exercises from the textbook and outside sources will be assigned. Homework will account for 75 points. 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 ($3 \times 75 = 225$ points) and assignments (75 points). Point scores will be added and a percent score calculated. The guaranteed grade cut-off of 90+% A, 80%-89% B, 70%-79% C, and 55%-69% D will be used. +/- Marks 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: The American Chemical Society has outlines core skills for students. From this list, the following core skills will be developed in this course:

- 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.
- 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. This means that students may be asked to fill out questionnaires or take ungraded quizzes used only to assess class knowledge.

Withdrawal Policy: This course will follow the University policy on withdrawals stated in the current catalog. Drop dates are listed in the schedule of classes.

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

Attendance Policy: Online participation 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.

Subject	Reading Assignment	Assignment
Concepts in Environmental Chemistry and Chemical Cycles		
Introduction to Environmental Science	Chapter 1 and supplemental reading	Statement of your interest in environmental chemistry
<i>Trade Secrets</i> Video		Worksheet for Trade Secrets
The Earth's Atmosphere	Chapter 2	Chapter 2 Problems
Atmospheric Chemistry		
Global Warming and Climate Change	Chapter 3	<i>Choose an article on atmospheric chemistry from the popular literature to critique</i>
Troposphere Chemistry	Chapter 4	Chapter 4 Problems
Stratosphere Chemistry	Chapter 5	Chapter 5 Problems
1st Examination		
Aquatic Chemistry		
Water Resources	Chapter 7	<i>Choose an aquatic environmental chemistry article to critique</i>
Environmental Biochemistry	Chapter 7 & readings	Chapter 7 Problems
Water Pollution and Waste Treatment	Chapter 8	Chapter 8 Problems
Toxicology	Chapter 16	Chapter 16 Problems
Inorganic Pollution	Chapter 13	Chapter 13 Problems
Organic Chemicals in the Environment	Chapter 14	Chapter 14 Problems
Pesticides in the Environment	Chapter 15	Chapter 15 Problems
2nd Examination		
Energy and Lithosphere Chemistry		
Soil and Agriculture Revisited?	Reading Supplement	<i>Choose a geochemistry or energy related article to critique</i>
Classification and Disposal of Hazardous Waste	Chapter 18	Chapter 18 Problems
Fossil Fuels: Our Major Energy Source	Chapter 10	Chapter 19 Problems
Nuclear Energy	Chapter 11	Chapter 11 Problems
Energy Sources for the Future	Chapter 12	Chapter 12 Problems
3rd Examination!!!		