

Department of Chemistry and Geoscience

CHEM 253 Introduction to Environmental Chemistry

Course Outline - Winter 2004

A. General Information

Instructor: Neil Meanwell

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Office Hours: Monday, 1.30 pm to 2.30 pm; Tuesday, 11.30 am to 12.30 pm and 1.30 pm to 2.30 pm; Wednesday, 12.30 pm to 1.20 pm; Thursday, 1.30 pm to 2.30 pm; Friday, 10.30 am to 11.30 am.

Scheduled Lectures: Monday, 12.30 pm to 1.20 pm (F 360); Wednesday, 8.30 am to 9.20 am (F 360); Friday, 12.30 pm to 1.20 pm (F 360).

Scheduled Labs: Wednesday, 2.30 to 5.20 pm (F 356)

B. Course Textbook: *Environmental Chemistry, 2nd Edition, (Freeman), Colin Baird*. This text is available from the Camosun bookstore.

C. Intended Learning Outcomes

At the end of the course the student will be able to:

1. Describe the natural physical and chemical processes that occur in the environment, especially those pertaining to the atmosphere and the hydrosphere.
1. Use the specialized language and terminology of environmental chemistry.
2. Describe the effects of human activity upon the environment and comment on the properties of specific organic and inorganic pollutants.
3. Utilise the knowledge of the chemical and physical properties of substances to determine how various pollutants exert their effects on the environment both qualitatively and quantitatively.
5. Classify hazardous substances according to their properties and describe the approaches to their safe disposal.
6. Classify toxic substances according to type and use the terminology associated with chemical toxicology.
7. Perform numerous laboratory procedures involving the monitoring of various pollutants in the environment.

D. Lecture Material (with Chapter References)

1. General Introduction (supplemented with handouts) 2 lectures

Environmental science, biosphere, hydrosphere, geosphere, lithosphere, atmosphere, energy and energy cycles, matter and matter cycles, humans and pollution, anthrosphere, technology and the anthrosphere, effects of the anthrosphere on Earth.

2. Energy Use and Environmental Consequences (Parts of Chapter 5) 3 lectures

Survey of current sources of energy, limitations of energy conversions (second law of thermodynamics), alternative sources of energy and alternative fuels.

3. The Chemistry of Natural Waters (Chapters 8) 6 lectures

Properties of water, hydrologic cycle, oxidation-reduction chemistry in natural waters, solubility of oxygen in water, Henry's law, oxygen demand, chemical and biochemical oxygen demand, anaerobic decomposition of organic matter, aerobic and anaerobic conditions, pE scale, sulphur and nitrogen compounds in water, acid mine drainage.

Acid-base chemistry in natural waters - the carbonate system, water in equilibrium with calcium carbonate, water in equilibrium with carbon dioxide, water in equilibrium with calcium carbonate and carbon dioxide, measured ion concentrations in natural waters and drinking water, alkalinity and acidity, hardness index for natural waters, aluminum, metal complexation, other chemical species in water.

4. Toxic Organic Chemicals (Chapter 6) 4 lectures

Pesticides including herbicides and insecticides, organochlorine compounds, principles of toxicology, dose-response relationships, other types of modern insecticides, herbicides. Other notable organic pollutants including dioxins, PCBs, and polynuclear aromatic hydrocarbons (PAHs). Long range transport of atmospheric pollutants.

5. Toxic Heavy Metals (Chapter 7) 3 lectures

General features of heavy metals and their toxicity, bioaccumulation of heavy metals. Mercury, lead, cadmium, and arsenic.

6. The Purification of Polluted Water (Chapter 9) 3 lectures

Contamination of groundwater, purification of drinking water, methods of disinfection. Treatment of wastewater and sewage. Modern wastewater and air purification techniques.

7. Stratospheric Chemistry (Chapter 1) 5 lectures

Description and importance of the atmosphere including regions and their physical characteristics, environmental concentration units, fundamentals of atmospheric chemistry. The chemistry of the ozone layer, ozone depletion and the Antarctic ozone hole, chemicals that cause ozone destruction.

8. Ground Level Air Chemistry and Air Pollution (Chapter 3) 6 lectures

The chemistry of photochemical smog and measures to control it. Acid rain and the sources and abatement of sulphur dioxide pollution, environmental impact of acid rain and photochemical smog. Particulates in air pollution, sources of atmospheric particulates, air quality indices, health effects of particulates. Detailed chemistry of the troposphere including the oxidation of hydrocarbons and the fate of free radicals. Indoor air pollution including tobacco smoke, asbestos, and radon gas.

9. The Greenhouse Effect and Global Warming (Chapter 4) 3 lectures

Mechanism of the greenhouse effect, Earth's energy balance, method of infrared absorption by greenhouse gases, major greenhouse gases, other substances that affect global warming.

10. Hazardous Waste (Chapter 10) 3 lectures

The nature of hazardous wastes, ignitable wastes, reactive substances, corrosive substances, toxic and radioactive substances.

E. Assignments

Assignment questions will be distributed periodically to keep pace with the course material. The questions will be chosen from the questions given at the end of each chapter of the textbook. Some additional questions will also be given. The assignments will not be taken in for marking. Solutions will be posted periodically outside my office.

F. Exams

You will be required to take the following exams:

Review Exam Week 5 - 120 minutes duration. Written exam which covers topics in Chem 120 and Chem 121 which are essential for Chem 253. Scheduled for the lab period of Week 5.

Midterm Exam #1 Week 8 - 120 minutes duration. Written exam on the lecture material presented from Week 1 to Week 7 of the course. Scheduled for the lab period of Week 8.

Midterm Exam #2 Week 13 - 120 minutes duration. Written exam on the lecture material presented from Week 8 to Week 12 of the course. Scheduled for the lab period of Week 13.

Final Exam 180 minutes duration. Written exam on **all** the lecture material presented in the course. Scheduled for the week immediately following the end of the semester.

Note: If you have to miss an exam through illness you must inform me as soon as possible to allow me to make alternative arrangements.

G. Laboratory Work

You will be required to perform a laboratory experiment each week of the semester except the first and last weeks and the weeks when exams are scheduled.

H. Course Mark

Review test	10%
Midterm exams (@ 15%)	30%
Final exam	30%
Laboratory work	30%

The Letter Grade

The following scale is used:

>95 A+	80-84 B+	65-69 C+	50-59 D	0-49 F
90-94 A	75-79 B	60-64 C		
85-89 A-	70-74 B-			

I. LEARNING SUPPORT AND SERVICES FOR STUDENTS

There are a variety of services available for students to assist them throughout their learning. This information is available in the College Calendar, Registrar's Office or the College web site at <http://www.camosun.bc.ca>

ACADEMIC CONDUCT POLICY

There is an Academic Conduct Policy. It is the student's responsibility to become familiar with the content of this policy. The policy is available in each School Administration Office, Registration, and on the College web site in the Policy Section.

www.camosun.bc.ca/divisions/pres/policy/2-education/2-8