CHEM 417:
SPRING 2010
Environmental Chemistry

Environmental chemistry is an applied interdisciplinary course which draws upon the disciplines of biology, chemistry, toxicology, and geology to gain a better understanding of our chemical environment and to solve environmental problems.

Lecturer: Dr. Jeff Ashley, Assistant Professor
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Lecture Hours: M, W, F 9-9:50 am

Office Hours: Tuesdays from 1:00 to 2:00 pm
Thursdays from 10:00 to 11:00 am
Friday from noon to 1 pm

Textbook: NO REQUIRED TEXT

This course will rely upon selected readings from various sources. These materials will be distributed in class. Reading assignments will be posted on the course website (http://faculty.philau.edu/ashleyj)

Lab Hours: Monday from 3:30 pm to 6:15 pm (Hayward 201)

Lab Manual: There is no lab manual. Labs will be distributed in class or be available on the course website.

Objectives of Lecture:

- ***To gain an understanding of the chemistry of the hydrosphere, lithosphere and atmosphere.***
- ***To determine the chemical nature, sources, potential effects, and cycling of pollutants in each sphere.***
- ***To provide some potential solutions to environmental problems.***
- ***To gain an understanding of the close and dependent inter-relationships of organisms, humans and the different components of the environment.***
- ***To hone analytical, critical thinking, writing, communication, and problem solving skills.***

Grading: Three In-class Tests (non-cumulative; 15 points each)
Mini-Research Proposal and Oral Presentation (25 points)
Assignments and Class Preparation/Participation during Discussions (15 points)
Lab (15 points)

Your final letter grade will be based on the following percent distributions:

Letter Grade	*Corresponding % Range*	*Letter Grade*	*Corresponding % Range*
A	94-100%	C+	77-79%
A-	90-93%	C	74-76%
B+	87-89%	C-	70-73%
B	84-86%	D+	60-69%
B-	80-83%	D	50-59%
		F	<50%

Mini-Research Proposal: Whether you find a position in industry, government or academia, it is likely that a portion (or all) of your salary will be derived from a funded project. Prior to projects being funded, someone initially had to submit a proposal. As a research scientist, proposals are extremely important not only because they provide that person with a salary but they also allow the scientist to investigate research topics which they feel are important and interesting. However, the formulation of a successful proposal (one which eventually receives funding) is one of the most daunting tasks of a scientist.

To get you familiar with the process of formulating research proposals, you will be required to write a proposal detailing a research project which you feel needs to be accomplished to shed light on an important aspect of environmental chemistry. More information on what this entails will be given in class as well as plenty of examples from past years. **A 1 page outline of your research proposal will be due on February 26, 2010. A draft of your proposal is due on April 5, 2010. Your final proposal is due on April 19, 2010.** An example of a former students' proposal is posted on the website.

Presentation of Mini-Research Proposal: As a future scientist, one of your biggest challenges may well be presenting your research in an articulate and interesting manner. Developing these skills early in your career is highly desirable. To give you the opportunity to sharpen these oral and visual skills, a 15 minute Power Point presentation of your research proposal during the last full week of classes is required. There will be 3-5 minutes after each presentation allotted for questions and discussion. The presentation should clearly convey the background information needed for your audience to fully understand what you are proposing as a research project. A portion of your grade will be based on evaluations from your classmates. Presentations **will be held on April 26, 28 and 30. Check the website for your scheduled time.**

Lecture & Laboratory Schedule (Tentative):

January 13 and 15

Wk 1 **Environmental Chemistry and Chemical Cycles**
Defining the discipline of environmental chemistry
The history of environmental chemistry and its importance today

January 20 and 22

Wk 2 **Aquatic Chemistry**
The physical and chemical properties of water
Fundamentals of solution chemistry

January 25, 27, and 29

Wk 3 **Phase Interactions**
Chemical interactions involving solids, gases and water
The importance of sediments to an environmental chemist

LAB (January 25): Statistical Treatment of Raw Data and Properties of Natural Waters

February 1, 3, and 5

Wk 4 **Water Pollution**
Nutrients and Eutrophication

LAB (February 1) – FILM FOR DISCUSSION "Poisoned Waters"

February 8, 10 and 12

Wk 5 **Water Pollution**
Sources, transport and fate of pollutants in aquatic systems

LAB (February 8) – Determination of Chlorophyll a Concentration in Benthic Algae

February 15, 17 and 19

Wk 6 **Bioaccumulation and Biomagnification**
Food chain interactions
Why do substances bioaccumulate?

LAB (February 15) **TEST 1**

February 22, 24, and 26

Wk 7 **Bioaccumulation and Biomagnification *(Con't)***
Factors controlling bioaccumulation and biomagnification
The Grasshopper Effect

LAB (Feb 22): Determination of the Octanol/Water Partition Coefficients for Organic Pollutants of Varying Hydrophobic/Hydrophic Character

March 1, 3, and 5

Wk 8 **Acid Mine Drainage**

The chemistry and environmental problems of coal mining
Remediation methods

LAB (March 1): Determining the Solubility Product of $Fe(OH)_3$:
An Equilibrium Study with Environmental Significance

March 8, 10 and 12

Wk 9 **Water Treatment**

Municipal and industrial methods of treatment of water
The chlorine debate

LAB (March 8): Removal of Chromium (IV) from Wastewater

March 22, 24, and 26

Wk 10 **Environmental Geochemistry**

Introduction to geochemical processes
Contaminant movement through groundwater
November 3, Draft of Proposal Due

LAB (March 22) – FILM FOR DISCUSSION – "Civil Action"

March 29, 31 and April 2

Wk 11 **Atmospheric Chemistry**

Introduction to meteorology
The "Dirty Dozen"
Acid Deposition

LAB (March 29) – **TEST 2**

April 5, 7 and 9

Wk 12 **Atmospheric Chemistry**

Global warming: Hype or threat?

LAB (April 5) – FILM FOR DISCUSSION – "The Great Warming"

Arpil 12, 14, and 16

Wk 13 **Atmospheric Chemistry**

Ozone and its depletion

LAB (April 12) – Measurement of Carbon Dioxide Levels in the Atmosphere

April 19, 21, and 23

Wk 14 **Environmental Toxicology and Risk Assessment**

LAB (April 21) – Attending an Environmental Chemistry and Toxicology Conference (NO LAB ON APRIL 19)

April 26, 28 and 30
Wk 15 **Presentation of Research Proposals**
A 17 minute slot per student will be allotted for presentations

NO LAB

May 3
Wk 16 LAB (May 3) – **TEST 3**

Course Policies:

If you miss a test or quiz due to an excused absence, your remaining grades will be averaged for your final grade (**NO MAKE-UP TESTS ARE GIVEN**). If your absence is not excused, you will receive a grade of zero for that test or quiz.

Student Code of Conduct:

Please familiarize yourself with the **Student Code of Conduct** as it appears in the **Student Handbook for Philadelphia University**.

Gutman Library (www.philau.edu/library)

The home page of the Gutman Library provides students with a variety of information resources, including databases and research guides. Librarians are available online and in person at the information desk to help students with research.

The Learning and Advising Center (www.philau.edu/learning)

The Learning and Advising Center provides one-on-one tutoring assistance for writing, study strategies, and test taking. To make a tutoring appointment, students should stop by the Learning and Advising Center in Haggar Hall or call (215) 951-2799. Academic resources, including information on citation and documentation, note taking, and study strategies are available on the Center's website.

Technology assistance (http://www.philau.edu/OIT/)

For assistance with technology issues, students should contact the Technology Help Desk at (215) 951-4648 or send an email to helpdesk@philau.edu. General purpose computing facilities are available in Search Hall and Gutman Library.

Guidelines For Preparing A Formal Lab Report
(revised from ACS Guidelines)

Laboratory or research experience is as close to a professional problem-solving activity as anything in your undergraduate curriculum. It provides exposure to laboratory and research methodologies and provides an opportunity for you to work with classmates and a faculty member.

Research is genuine exploration of the unknown that leads to new knowledge which often warrants publication. But whether or not the results of a research project are publishable, the project should be communicated in the form of a report written by the student. It is important to realize that science depends on precise transmission of facts and ideas. Preparation of a comprehensive written report is an essential part of a valid research experience, and the student should be aware of this requirement at the outset of the project or lab session. Interim reports may also be required, usually at the termination of the quarter or semester.

Guidelines on how to prepare a professional-style laboratory or research report are not routinely available. For this reason, the following information on report writing and format is provided to be helpful to undergraduate researchers and to faculty advisors.

Organization of the "Formal Laboratory Report"

Most scientific research reports, irrespective of the field, parallel the method of scientific reasoning. That is: the problem is defined, a hypothesis is created, experiments are devised to test the hypothesis, experiments are conducted, and conclusions are drawn. This framework is consistent with the following organization of a research report:

Title
Abstract
Introduction
Methods and Materials
Results
Discussion
Conclusions and Summary
References

Title and Title Page

The title should reflect the content and emphasis of the project described in the report. It should be as short as possible and include essential key words.

The author's name (e.g., Mary B. Chung) should follow the title on a separate line, followed by the author's affiliation (e.g., Department of chemistry, Central State college, Arkansas, 67123). Also include the name of your laboratory partner. All of the above could appear on a single cover page.

Abstract

The abstract should, in the briefest terms possible, describe the topic, the scope, the principle findings, and the conclusions. It should be written last to reflect accurately the content of the report. The lengths of abstracts vary but seldom exceed 200 words.

A primary objective of an abstract is to communicate to the reader the essence of the paper or the laboratory experiment you performed. The reader will then be the judge of whether to read the

full report of not. Were the report to appear in the primary literature, the abstract would serve as a key source of indexing terms and key words to be used in information retrieval. Author abstracts are often published verbatim in *Chemical Abstracts.*

Introduction

"A good introduction is a clear statement of the problem or project and why you are studying it." (**The ACS Style Guide**. American Chemical Society, Washington, DC, 1986)

The nature of a problem and why it is of interest should be conveyed in the opening paragraphs. This section should describe clearly but briefly the background information on the problem or the subject at hand and the objectives of the current project.

In a real-life research paper (as opposed to a formal lab write-up), a clear relationship between the current project and the scope and limitations of earlier work should be made so that the reasons for the project and the approach used will be understood.

Methods and Materials

Do not simple reference the lab manual. This section should describe what was actually done, all written in the past tense. It is a succinct exposition of the laboratory notebook, describing procedures, techniques, instrumentation, special precautions, and so on. It should be sufficiently detailed that other experienced researchers would be able to repeat the work and obtain comparable results.

In theoretical reports, this section would include sufficient theoretical or mathematical analysis to enable derivations and numerical results to be checked. Computer programs from the public domain should be cited. New computer programs should be described in outline form.

Results

In this section, relevant data, observations, and findings are summarized. Tabulation of data, equations, charts, and figures can be used effectively to present results clearly and concisely. Schemes to show reaction sequences may be used here or elsewhere in the report. Tables and figures must be numbered and captioned. Figure captions are to be placed under the figure while Table captions are to be placed above the table.

Discussion

The crux of the report is the analysis and interpretation of the results. What do the results mean? How do they relate to the objectives of the project? To what extent have they resolved the problem? Because the "Results" and "Discussion" sections are interrelated, they can often be combined as one section but we will attempt to keep them separate entities throughout this course. If you lab manual has any questions, answer these as part of the discussion section.

Conclusions

A separate section outlining the main conclusions of the project is appropriate if conclusions have not already been stated in the "Discussion" section. *Directions for future work are also suitably expressed here.*

A lengthy report, or one in which the findings are complex, usually benefits from a paragraph summarizing the main features of the report: the objectives, the findings, and the conclusions.

NOTE: The last paragraph of text in manuscripts prepared for publication is customarily dedicated to acknowledgements. However, there is no rule about this, and research reports or senior theses frequently place acknowledgements following the title page.

References

Literature references should be collated at the end of the report and cited in one of the formats described in **The ACS Style Guide** or standard journals. Do not mix formats. All references should be checked against the original literature. **IN THIS COURSE, we will follow the style of articles published in the ACS journal *Environmental Science and Technology*.**

Helpful Reference:

The ACS Style Guide, Dodd, J.S., Ed; *American Chemical Society*, Washington, DC, 1997.

This volume is an invaluable writer's handbook in the field of chemistry. It contains a wealth of data on preparing any type of scientific report and is useful for both students and professional chemists. Every research laboratory should have a copy, and it should be as accessible as the **Handbook of Chemistry and Physics**. It gives pointers on the organization of a scientific paper, correct grammar and style, and accepted formats in citing chemical names, chemical symbols, units, and references. There are useful suggestions on constructing tables, preparing illustrations, using different type faces and type sizes, and giving oral presentations. In addition, there is a brief overview of the chemical literature, the way in which it is organized and how information is disseminated and retrieved. A list of other excellent guides to technical writing is also provided.