CHE 246: Environmental Chemistry

M, W, Th, F 10:30-11:20 in Nobel 121
Course Syllabus, Spring 2009

Dr. Geoffrey Bowers
Nobel 206 C, Office Phone: 933-6235
gbowers@guastuvs.edu
Office Hours: M, W 3:30 - 5:30 pm

Required Text and Materials

- *Environmental Chemistry*, 4th Edition by Baird and Cann
- Scientific Calculator: Required for everyone, need not be expensive - must be able to do logarithms and exponentials. Cell phone calculators are not allowed.

Online Resources

Course website: http://moodle.gac.edu - Announcements, handouts, supplementary materials, practice materials, links to other cool websites.

Course Description

The industrial revolution dramatically changed the way in which human beings interact with their environment. Since the mid-twentieth century, we have become increasingly aware of how our actions impact the natural world. The current culture in the United States is increasingly interested in doing something to minimize, stop, or reverse the damage. However, the global system is extremely complicated and not very well understood. Much debate still rages regarding what role our actions have played, if any, and whether or not there is anything we can do about it. In order for all of us to be informed citizens that can actively participate in the environmental political, social, or scientific dialogue, or to take action, we must have a fundamental understanding of chemistry in the environment. This course attempts to break the global system down into smaller, more readily understandable parts and provides an introduction to the field of environmental chemistry. Topics we can/will explore include the chemistry of global warming, stratospheric ozone depletion, smog formation, chemical reactions in natural waters, soil chemistry, and pollutant fate and transport. In addition, the course will examine current energy sources, alternative energy, and related environmental impacts.

Budding Professionals

Each of you attends Gustavus Adolphus to prepare for a professional career in some discipline. In every job, problem solving and communication skills are essential, as is professionalism. We will develop all three of these attributes in this course as much as possible. I expect all of you to act like young professionals. Some aspects of professional conduct include (i) abiding by the academic honesty guidelines set forth by Gustavus Adolphus and (ii) respecting your colleagues, which include yourself, your classmates, and your instructor(s) at all times. Part of respecting your colleagues includes ***turning off your cell phones before class begins***, just as you would at an important meeting. Also, neatness and spelling will count on written assignments because they are ***required*** to be successful in the academic and business worlds.

My Teaching Philosophy

So that you understand what motivates the course content and style, I have included a brief summary of my teaching philosophy below. If you are interested in learning more about teaching and learning styles, I will be happy to recommend and/or provide some appropriate literature.

I believe the chemistry educator should (i) provide future consumers of chemistry the tools they need to form educated opinions on current and future chemically-oriented issues, (ii) inspire young people to follow a career path in chemistry, (iii) involve themselves in the study of chemistry pedagogy and integrate promising new techniques in the classroom, and (iv) provide young chemists with the tools to succeed in an interdisciplinary community. The most important of these tools for the aspiring young professional (chemists and all other vocations) are problem solving skills and an ability to communicate effectively with professional and lay audiences. One way problem-solving skills are instilled in students is by answering student questions with questions. In my experience, students have always proven capable of answering their own questions when the instructor provides appropriate scaffolding for the student's individual needs and level of understanding, a technique that is well established in the education community. This approach facilitates effective learning because the student is making connections and conclusions rather than the instructor dictating methods or answers. I believe in teaching students a problem-solving strategy from their earliest exposure to chemistry and providing the opportunity to practice the strategy by incorporating at least one challenging, loosely-framed conceptual question on all homework assignments and each examination. Because all students at the collegiate level are expected to read their texts, I believe it is the job of a lecturer to supplement and augment the text as well as emphasize and clarify complicated text material rather than recounting or summarizing the entire textbook in lecture form. These approaches have proven effective for developing problem solving skills and teaching concepts in my educational background and represent the foundation of my teaching style.

Grading

Homework	10 %	A	>94%
Open-book Exams (3)	45 %	A-	90-93
Methods Summaries (3)	15 %	B+	87-90
Student-lead Fridays (1)	5%	B	83-87
Final Project	20%	B-	80-83
Participation	5%	C+	77-80
		C	73-77
		C-	70-73
		D	60-69
		F	<60

The percentiles required to achieve a certain grade in this course are not fixed; the scale provided above is for general information purposes and tells you that you need at least a 94% to guarantee an A. I reserve the right to adjust the percent required for each grade ***DOWN***, but will not adjust these ranges up (e.g. for the final grade, you may only need 85% for a B+ and are guaranteed at least a B+ if you average 87% in the course).

Most of the grading categories will be discussed in greater detail below. The participation points are present to encourage you to speak up in class…I like to dialogue with students and this is a free 5% of your final grade if you are willing to talk!

I reserve the right to conduct unannounced quizzes if attendance slips or if it becomes apparent that the reading assignments are not being completed on time. These will be incorporated into the participation grade.

Homework Assignments

We will have five homework assignments distributed throughout the semester. Homework will be announced in class and posted to the Moodle site. You will typically have two weeks to complete the assignments on a separate sheet of notebook paper. You are encouraged to form study groups and work together, however, remember that *you* will be responsible for *knowing* homework material for the exams. Please list the people you worked with below your own name on homework assignments as "Partners". **Late homework will not be accepted.**

Exams

We will have three open book exams during the first 2/3 of the semester. Feel free to use post-it organizational tabs to help you navigate your text during the tests. Tentative exam topics and dates are listed below. Specific exam topics and dates will be announced in class no later than one week prior to the exam date. Exams will be held during the class period and you will have 50 minutes to complete each test.

Exam 1 - Atmospheric Chemistry	Wednesday, March 4th
Exam 2 - Water and Soil Chemistry	Thursday, March 19th
Exam 3 - Pollutants and Remediation	Friday, April 24th

If you must miss an exam for an academically justifiable reason or severe illness, you should notify Dr. Bowers as soon as possible and ***prior*** to the exam date. If you miss an exam for an illness, you will be required to produce a signed doctor's note and you are still responsible for notifying Dr. Bowers prior to the start of class on exam day.

Method Summaries

Our textbook contains a series of short write-ups on different analytical methods and an example of their applications in environmental chemistry. Because it is very important to understand the analytical tools available to you and when they can help you solve a problem, you will be required to choose three of these sections over the course of the semester and write "method summaries". The method summary should include one paragraph describing the analytical method that includes the fundamental chemistry behind its operation, how a sample is analyzed (for example, how is a sample loaded onto a GC column? How does it get from source to detector? How is it detected?), and what kind of information the technique can provide. You must also find an article published in *Environmental Science and Technology*, an ACS journal, that uses the technique in a different environmentally relevant application. Summarize this article in the second paragraph, including the motivation for the study, research methods, and key conclusions. Definitely highlight the method you are summarizing and the role it played in the author's experiments. Be sure to indicate the article name, authors, and volume/page/date information somewhere in this second paragraph and to attach a copy of your article to the method summary. Grading criteria and additional details will be made available on a separate handout later in the semester. Method summaries will be due by 5 pm via email to Dr. Bowers on the following dates.

Summary 1 - March 13

Summary 2 - April 17

Summary 3 - May 8

Student-Lead Fridays

Presentation skills are critically important for young professionals, and one type of presentation is called a "chalk talk", or a semi-formal presentation of some topic to a small group of people with a lecture-like feel. To enhance your life-learning in this course, everyone will be required to lead the class in one such 30 minute discussion of a current hot topic in environmental chemistry in-class on Fridays. To prepare for your mini-lecture, you should find a news article related to the environment in *Environmental Science and Technology*, *Science*, *Nature,* or *Chemical and Engineering News* that really interests you and email a pdf copy to Dr. Bowers by the start of lecture on Wednesday morning the week you are scheduled to present. The connection to an environmental issue(s) must be readily apparent (see Dr. Bowers if you aren't sure about the appropriateness of an article). If you find an interesting article from another source that you really want to present, please check with Dr. Bowers before Wednesday to receive approval for your information source. The news article for the week will be posted to the Moodle site on Wednesday so that the rest of the class can read the article by Friday's lecture period. What you choose to do with your 30 minutes is up to you (as long as it is safe!), but you must tell the class why you are interested in the particular topic, you must have some two-way dialogue with the class, and you are not allowed to dismiss class early. A sign-up sheet will be available at the beginning of class tomorrow for all of you to select one of the available Fridays. Be creative and have fun with this assignment, but remember that **you must lead a Friday mini-lecture to receive a passing grade in the course.**

Final Projects

In place of a final exam, you will make a formal presentation of an original research project related to environmental chemistry during the last week of the semester. Implicit in this statement is that you will design a project, collect data, analyze your results, and draw conclusions over the next 14 weeks. While this may seem daunting, it has been a standard feature of this course for the past few years and all of you are capable of doing it! To make the workload manageable, we will:

- Have no exams or homework assignments due during the last three-and-a-half weeks of class, save one of your method summary assignments, so that you can focus on your project over the final stretch.
- Work in pairs to help divide up the work.
- Have deadlines and meetings with Dr. Bowers throughout the semester to keep you on track.

Projects you are currently engaged in for independent research or other courses can be used for the final project in this class provided you prepare a good proposal that is approved by Dr. Bowers. Additional details will be forthcoming on a separate handout in the next few weeks. **Please form your teams by Friday, February 13th.** If we have an odd number of students in the class, it will be necessary to have one team of three, which you should consider if you have a somewhat ambitious idea. Dr. Bowers will record team members at the beginning of class on Feb 13.

Academic Honesty

Every student is required to abide by the honor code. Gustavus Adolphus College is proud to operate under an honor system. The faculty and students have jointly created an Honor Board to enforce this policy. Please see the academic catalog for full details of the academic honesty policy. Depending on the severity of the violation, in this class you will generally receive a zero for the first academic honesty violation and fail the course for a second violation. It is Gustavus Adolphus policy that academic honesty violations are reported to the Dean's office. Homework and your formal team presentations are exempt from the academic honesty policy in this course and you are encouraged to work together on these assignments.

Disability Services

Section 504 of the Rehabilitation Act of 1973 and the Americans with Disabilities Act (1990) work together to ensure 'reasonable accommodation' and non-discrimination for students with disabilities in higher education. A student who has a physical, psychiatric/emotional, medical, learning, or attentional disability that may have an effect on the student's ability to complete assigned course work should contact the Disability Services Coordinator in the Advising Center, who will review the concerns and decide with the student what accommodations are necessary. To provide any such services, I must hear formally from Disability Services.

Tentative Course Topics

	DATES	TOPICS	READINGS
WEEK 1	**FEBRUARY 9-13**	**ATMOSPHERIC CHEMISTRY**	**CHP 1**
WEEK 2	**FEBRUARY 16-20**	**ATMOSPHERIC CHEMISTRY**	**CHP 3** **CHP 4**
WEEK 3	**FEBRUARY 23-27**	**ATMOSPHERIC CHEMISTRY**	**CHP 5**
WEEK 4	**MARCH 2-6**	**WATER CHEMISTRY**	**CHP 13**
WEEK 5	**MARCH 9-13**	**WATER/SOIL CHEMISTRY**	**CHP 16** **SUPPLEMENTS**
WEEK 6	**MARCH 16-20**	**SOIL CHEMISTRY**	**SUPPLEMENTS**
WEEK 7	**MARCH 23-27**	***SPRING BREAK - NO CLASS***	
WEEK 8	**MARCH 30-APRIL 3**	**ORGANIC POLLUTANTS**	**AP1, CHP 10**
WEEK 9	**APRIL 6-9**	**ORGANIC POLLUTANTS**	**CHP 11, CHP 12**
WEEK 10	**APRIL 14-17**	**HEAVY METAL POLLUTANTS**	**CHP 15**
WEEK 11	**APRIL 20-24**	**WATER/SOIL REMEDIATION**	**CHP 14, CHP 16**
WEEK 12	**APRIL 27-MAY 1**	**ENERGY**	**CHP 7**
WEEK 13	**MAY 4-8**	**ENERGY**	**CHP 9**
WEEK 14	**MAY 11-15**	**ENERGY**	**CHP 8**
WEEK 15	**MAY 18-20**	**PRESENTATIONS**	