CHE 112: Chemistry of the Manhattan Project

M-F 10:30-12:20 in Vickner 202
Lab W 12:30 to 3:30 in Nobel 306
Course Syllabus, January 2008

Dr. Geoffrey Bowers
Nobel 206 C, Office Phone: 933-6235
gbowers@guastuvs.edu
Office Hours: Tu, Th 1:00 - 2:30 pm

Required Text and Materials

- No text is required; reading materials for class and lab will be provided
- Composition book to use as a course journal and lab notebook
- Safety Glasses/Goggles: Available from the Bookmark
- Close-toed shoes are required for lab!!
- 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, blogs, practice materials, links to other cool websites.

Course Description

This course explores the chemistry behind the Manhattan project, the legacy chemical issues faced today, and the close interplay of society, politics, and science from project inception to modern times. You will learn about nuclear chemistry, chemical separations, environmental transport, waste treatment, Manhattan scientists, and the social-political-science relationship through class discussion, reflections, laboratory experiments, guest speakers, videos, and oral presentations. Course work will include class participation, journaling, short papers, laboratory reports, reading, and two oral presentations. Internet videoconferences/live guest presentations by experts around the country and instructional DVDs will provide alternate perspectives on the topics discussed. Lab meets once weekly.

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. This is particularly true as we discuss a variety of viewpoints on issues that tend to evoke emotional responses during this course. 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

Journal Reflections	25 %	A	>94%
Opening and Closing Papers	10 %	A-	90-93
Laboratory	20 %	B+	87-90
Oral Presentations (2)	20%	B	83-87
Presentation Evaluations	5%	B-	80-83
Class Participation	20%	C+	77-80
		C	73-77
		C-	70-73
		D	60-69
		F	<60

The laboratory portion of the course will involve four experiments, with the lab reports and participation (preparation, follow safety and conduct rules, time management) counting for 5% of the final grade each week. The 20% class participation includes attendance at the lecture sections and contributing significantly toward course discussion at least twice a week. Everyone must ask at least one question of each guest speaker during the semester.

I reserve the right to also conduct unannounced quizzes if it becomes apparent that the reading assignments are not being completed by class members.

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 a B+ if you average 87% in the course).

The Laboratory

The laboratory exercises will be handed out in the "lecture" component of the course. The lab objective and procedure should be written in your lab notebook before you arrive at lab, as detailed in the write-up for Experiment 1. If they are not completed, you will be required to do this before beginning the experiments. Be sure to dress appropriately (no open-toed footwear, exposed midriffs) and bring your lab handout, a composition lab notebook, and safety eyewear to each laboratory session. ***Laboratory attendance is mandatory and only family emergency or severe illness are excuses for missing a lab***. If one of these applies to you this J-term, you must contact Dr. Bowers by email or phone ***BEFORE*** the lab period begins. We will commonly have a short break between lecture and lab to allow everyone to each some lunch.

Homework Assignments

Journal reflections about the days reading and discussion make up a significant component of the grade, are required, and must be completed DAILY. Proper format includes writing a summary of the discussion and reading in a bound composition book (separate paragraphs), followed by an insightful commentary on the day's events or how your perspective on nuclear issues has changed. It is fine to include sketches, pictures, etc. as well and creativity will be worth points. These journals should come to each class period in case they are inspected and class notes should not be taken in your journal. Journals will be collected each Friday and returned each Monday at the beginning of class. You can see Dr. Bowers during the spring semester to pick up your journal if you would like it back after its final grading. Spelling and neatness will count.

A handout describing what to include in the opening and closing papers will be provided during the semester. Essentially, you will write a 1-2 page typed paper describing your knowledge and opinion of nuclear energy and nuclear issues at the beginning of the semester and will write a similar paper noting what you learned and if your attitudes/opinions changed during the course. You will not be graded on your opinion, but on evidence of introspection and growth as well as format/style/spelling. Paper format should follow the guidelines on the handouts.

You will prepare and present two oral presentations to the class. Presentation guidelines will also be provided as handouts. The first presentation topic will be a biographical presentation regarding an important figure or scientist in the Manhattan project. A list of potential choices will be provided. The second presentation will involve a short summary and critique of a scientific paper involving modern-day chemistry issues associated with the Manhattan project. This can be about waste and waste treatment, monitoring, transport, current research at the national labs, etc. Again, a handout with additional details will be provided later in the J-term.

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. Lab reports and presentations are exempt from the academic honesty policy in this course and you are encouraged to discuss topic with one another.

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.

Tentative Course Topics

JANUARY				
Monday	Tuesday	Wednesday	Thursday	Friday
			1	2
5 Hanford DVD Course Overview Current Conceptions	6 Manhattan Project History - HCRP 1.x	7 Radiochemistry - Gen Chem Review **Lab**: **Lit searches and Lab notebooks**	8 Radiochemistry and Current Societal Perspectives - Chang Chp 21 and BBC article on Moodle	9 Fuel Manufacturing - HCRP 2.2 Reactor Operations - HCRP 2.3
12 **Presentations: Biographies**	13 Chemical Separations - HCRP 2.4	14 Waste Management - HCRP 2.6 **Lab: Metal Recovery**	15 Waste Management - HCRP 2.6 **Guest - Roy Gephardt, PNNL**	16 Uranium and Oak Ridge Operations - PDF on Moodle
19 Trinity, Los Alamos, Nuclear Weapons **Guest - Ray Smith, ORNL**	20 Modern Missions Soil Chemistry	21 Ion transport **Lab: Cation Mobility**	22 Modern Missions Waste Cleanup - Gephart Chp. 8	23 **Presentations: Current Issues**
26 Safety at Hanford and Oak Ridge - HCRP 2.10	27 Society and Manhattan Legacy - Gephart Chp. 2, 6, 7.3	28 Society, Politics, and Manhattan Legacy **Guest - Aaron Crowell** **Lab: Radioactive Banana**	29 Modern Reactors and Issues for your generation - MIT Report	30 Closing Discussion - Gephart Chp. 11, 12