CHM 515: Green Chemistry Laboratory
Course Syllabus Spring 2014

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Office hours: M 1:30-2:30 pm; T 9:30-10:30 am; W 10:00 – 11:00 am; by appointment
Course website: BlueLine2
Research guide: http://ralresearch.creighton.edu/CHM515

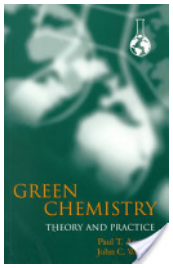
Course Description. Chemistry has had many positive impacts on society, such as the development of medicines and many of the materials we take for granted, such as plastics, cosmetics, paints and coatings. Many of the items we depend on have come at a cost to the environment. Green chemistry considers human beings, our surroundings, and the environment when designing a chemical reaction, experiment, or process. The ultimate goal of green chemistry is pollution prevention. In this laboratory-based course, you will learn how to implement the principles of green chemistry throughout the field of chemistry. You will learn the 12 principles of green chemistry and use them in laboratory experiments that focus on pollution prevention, energy minimization, and safety.

Course Objectives. Students will

- Understand that green chemistry is not a chemistry sub-discipline, but a set of ideals to be applied throughout chemistry.
- Learn how to apply the twelve principles of green chemistry to laboratory experiments.
- Identify the principles of green chemistry in a chemical process or procedure.
- Appreciate how science, especially chemistry, is linked to the fate of the earth.
- Communicate, orally and in writing, scientific principles, data and proposed ideas to a general and scientific audience.
- Become proficient at reading, interpreting and making critical judgments about topics in the scientific literature.
- Appreciate how their actions or inactions affect the earth and its inhabitants.

Course Materials.

- Text (optional): Paul T. Anastas and John C. Warner, *Green Chemistry: Theory and Practice*, Oxford University Press (2000)
- Scientific calculator
- Safety Glasses
- Laboratory Notebook (research-style is fine)



Course Requirements. This two credit-hour course consists of a 3-hour laboratory period and a 1-hour recitation time. Students will receive hands-on experience in the laboratory. The recitation will be used for discussion and lectures over the theories corresponding to the lab work. A course calendar with descriptions of the topics and corresponding dates is at the end of this document.

Laboratory. The laboratory time will be used for inquiry-based experiments along with green-chemistry related field trips. Students will keep a laboratory notebook for each experiment and will submit a summary for each of the four laboratory experiments. You will receive a handout with laboratory experiment descriptions and notebook and summary instructions.

Recitation. During the recitation, we will discuss theories and literature topics related to green chemistry and the laboratory experiments. It is expected that reading assignments will be read before class time and that every member of the class will participate in discussions over the reading material. If I sense that you are not staying caught up with the material, I will have to institute quizzes. We will also have some homework assignments and in-class activities.

Literature review. There will be a number of student lead literature reviews in the syllabus. These will be on a topic related to a Presidential Green Chemistry Challenge Award. On the date of the review, the student is responsible for leading the discussion about the chosen topic. This can be done in any number of ways including leading a discussion at the chalkboard or a PowerPoint presentation. You should have your topic approved by me no later than one week before your presentation. The other students will also fill out a critique form (rubric) for each presentation.

Green Chemistry Newspaper Article. It is important that scientists effectively communicate with each other. It is also important that scientists clearly communicate to non-scientists. Your final paper will be written in a newspaper style format, with the target audience a non-scientist layperson. You will be given a handout at a later date with a guide/grading rubric for this assignment. Guidelines can be found at the Reuter's website.
http://handbook.reuters.com/index.php?title=Reporting_and_Writing_Basics

Assignments / in-class activities	20%
Laboratory Experiments (notebooks 20%, summaries 80%)	50%
Literature Review	15%
Final Article	15%

Your grade can be determined with the following chart. Note: These are the absolute cut-offs; there is no "rounding"; 89.9 is a "B+".

Letter Grade	Percentage
A	92.0 - 100%
B+	88.0 - 91.9%
B	81.0 - 87.9%
C+	77.0 - 80.9%
C	70.0 - 76.9%
D	60.0 - 69.9%
F	<60%

- If you wish to have an assignment or paper re-graded, you have one week for a re-grade request. You must attach a clearly written explanation of why you are requesting a re-grade. The entire paper will be re-graded and this new grade will replace the old grade.
- Late work is generally not accepted, but in the rare case that it is, a 10% deduction will be applied for each day that the work is late.

Attendance. Laboratory work is difficult to make-up and attendance to all laboratory meetings and recitations is mandatory. You must obtain approval prior to a scheduled recitation or laboratory if you must be absent. In the event of an excused absence, make-up work may be scheduled at the discretion of the instructor. In the event of a class cancellation, I will notify you by email at your @creighton.edu

account. In the event of inclement weather, call the university weather hotline at 280-5800 for the status of university closings.

Academic Integrity. The University has an established policy on academic dishonesty. The University defines the term to include "representing the work of others to be one's own (cheating on an exam), tampering with the experiments of others, defacing or tampering with library or student materials or facilitating dishonesty on an exam." The latter point is understood to include situations where you notice cheating occurring but do not report it immediately. In a course such as this one, the most blatant forms of academic dishonesty include: (a) plagiarizing or incomplete referencing in your presentation or paper (b) fabricating data for an experiment (c) recording primary data in places other than a laboratory notebook (d) copying the work of others on quizzes or assignments, (e) sharing information with others about quizzes (both during the quiz or between class periods), (f) using notes when notes are not allowed (in calculator slip covers, palms of hands, baseball caps, slips of paper tucked away, and so on), (g) making changes on graded materials that have been returned to you.

In the event that you are accused of engaging in academic dishonesty, at a minimum you will receive a zero for the assignment or quiz score. The incident will be reported in writing in accordance with the protocol set forth by the College of Arts and Sciences. (For details, see the website http://www.creighton.edu/fileadmin/user/CCAS/docs/2010_Site/Academic_Honesty_Policy_Revision_January_2012.pdf). Students accused of academic dishonesty have the right to an appeal.

Course Calendar

Below is a tentative schedule for the course. Due to the nature of the problem-based experiments, some may take longer than others and the schedule may be adjusted.

Week / Unit	Tuesday / Lab Experiment	Thursday / Lecture: Green Chemistry Principle
1		**Jan 16** Introduction to Green Chemistry 12 Principles of Green Chemistry Green Chemistry Resources
2 **Unit 1: Pollution and Food Safety**	**Jan 21** Experiment 1: Analysis of Pesticides on fruit Food Safety Introduction Literature review on sample preparation, pesticides and testing *Textbook Reading: Chapters 5-6; section 9.5.3*	**Jan 23** By this date, have a concrete plan for Sample preparation, pesticides and testing; review plan during lecture Lecture: Introduction to the presidential Green Chemistry Challenge award
3	**Jan 28** Experiment 1: Analysis of Pesticides on fruit: Sample preparation and beginning of analysis	**Jan 30** Analysis of data / determine if need for experimental modification.
4	**Feb 4** Experiment 1: Analysis of Pesticides on fruit: Sample and data analysis	**Feb 6** Presentation of results / future suggestions Green Chemistry / Science in the news – where to read about it.
5 **Unit 2: Greener Processes /Syntheses**	**Feb 11** Experiment 2: Biodegradation and Composting Dirt: The Movie screening	**Feb 13** Lecture: Recycling and Biodegradation
6	**Feb 18** Experiment 2: Biodegradation and Composting	**Feb 20** Catalysis: *TAML Oxidant Activators: General Activation of Hydrogen Peroxide for Green Oxidation Processes*
7	**Feb 25** Experiment 2: Biodegradation and Composting	**Feb 27** *Presidential Green Chemistry Award Midterm Presentations*
8 (Midterm Week)	**Mar 4** **No lab (conference)**	**Mar 6** *Presidential Green Chemistry Award Midterm Presentations*

Spring Break – no lecture or lab		
9 Unit 3: Alternative Energy	**Mar 18** Experiment 2: wrap up / prepare for biofuel experiment	**Mar 20** Introduction to Alternative Energy and Biofuels; make experimental plan
10	**Mar 25** Experiment 3: Synthesis and characterization of biodiesel from waste vegetable oil: synthesis from neat oil	**Mar 27** Scientific Writing for lay audiences Prof. Carol Zuegner, Creighton University Dept. of Journalism, Media and Computing
11	**Apr 1** Experiment 3: Synthesis and characterization of biodiesel from waste vegetable oil: synthesis from waste oil	**Apr 3** Lecture: Alternative Energy types Assignment due: article critiques
12	**Apr 8** Experiment 3: Synthesis and characterization of biodiesel from waste vegetable oil: characterization	**Apr 10** Lecture: Alternative Energy types Assignment due: writing leads
13	**Apr 15** Experiment 3: Synthesis and characterization of biodiesel from waste vegetable oil: characterization	**Apr 17** *Atom Economy Activity* *Textbook Reading: Chapter 7; section 9.2* Assignment due: choose topic for final article
14 Unit 4: Waste Prevention	**Apr 22** **Experiment 4:** Biodegradation and Compost: testing of our compost EARTH DAY!	**Apr 24** Lecture: Recycling and Biodegradation
15	Apr 29 **Experiment 4:** Biodegradation and Compost: testing of our compost	**May 1** Assignment due: rough draft of final article Wrap up / Concluding remarks / *Textbook Reading: Chapter 10*
16	***Final Newspaper-Style Articles Due by Thursday May 8 at noon***	