Piedmont Project 2009

Susanna Widicus Weaver
Department of Chemistry, Emory University
Chemistry 375L

Chemistry 375L is an upper level lab design course that is being developed in the Chemistry Department, but is not currently offered. This course draws from the concepts taught in existing upper-level chemistry courses including Chem 260 (analytical chemistry), Chem 360 (instrumental chemistry), and Chem 331/332 (physical chemistry). The concept is to have the students design their own experiments, incorporating the techniques learned in these other courses.

Chemical research has a huge and direct impact on our environment, and issues pertaining to sustainability are becoming increasingly relevant to the design of chemical experiments. It is imperative that the next generation of chemistry students be made aware of these issues and be trained to consider such issues in their experimental design. My Piedmont Project proposal was to place a requirement in this new course that each of the students' proposed experiments directly address sustainability issues. Specifically, in this design project lab, the students' experimental designs are required to include mechanisms for water conservation, reduction of power usage, and/or the use of so-called green chemistry practices (reduction or elimination of the use of hazardous substances), or other more creative applications to sustainability concerns. The students will be expected to include a section in their written proposal outlining the sustainability efforts being pursued, and will measure and report (quantitatively) the overall reduction in environmental impact based on this implementation.

Syllabus for Chemistry 375L:
Experimental Methods and Design in Chemistry**

Instructor: Dr. Susanna Widicus Weaver
Office: 425 Atwood
Phone Number: 404-727-4049
e-mail: susanna.widicus.weaver@emory.edu

Office Hours: M, W 2:00-3:00 PM and by individual appointment.
Also, please stop by at any time if my door is open.

Class Times: T, Th 2:00 – 6:00

Room: Atwood 313

Required Course Materials: Safety glasses, hard-bound laboratory notebook

Course Description:

This is a design project laboratory course for upper-level chemistry majors that encourages development of the skills required to conduct independent research. This course also strives to increase awareness of sustainability issues with respect to laboratory research. Groups of 2-3 students (assigned at the beginning of the semester) will write two original research project proposals that will be reviewed by the instructor. Once approved, students will then conduct these experiments using available department facilities. Each project must incorporate chemical synthesis of one compound and a minimum of four analytical tests to verify the structure and physical properties of this compound (at least two of these must be instrument-based tests). The results will be reported in standard ACS journal style. The first project report will be peer-reviewed by another group in the class. Each project report must include a comprehensive evaluation of the experimental practices with respect to the issue of sustainability, and suggest changes that would allow implementation of more sustainable practices in the laboratory. In addition, at least one of these sustainability adaptations must be implemented during the experiment. Students are expected to quantitatively measure the overall reduction in environmental impact based on this implementation and report their findings along with the experimental report.

Important Dates and Assignments:

Assignment	Date	% of Grade
Introductory Meeting	August 31, 2010	
Proposal 1	September 7, 2010	15%
Proposal 2	October 5, 2010	15%
Report 1	October 28, 2010	20%
Peer Review 1	November 4, 2010	10%
Report 1 Revision	November 11, 2010	10%
Report 2	December 7, 2010	30%

***This course is partially based on the Chem 380 course offered by Illinois Wesleyan University.*

Grades:

Grades will be given for each class assignment. Your overall class grade will be determined by a fixed scale referenced to the class average. This is not the same as a curve, where there are just as many A's as F's. If everyone performs at an exceptionally high level, it is possible for everyone in this class to get an A. The fixed scale is listed to the right.

Score	Grade
93.1 – 100	A
90.0 – 93.0	A-
87.0 – 89.9	B+
83.1 – 86.9	B
80.0 – 83.0	B-
77.0 – 79.9	C+
73.1 – 76.9	C
70.0 – 73.0	C-
67.0 – 69.9	D+
63.1 – 66.9	D
60.0 – 63.0	D-
0 – 59.9	F

Project Selection and Proposals:

Each proposed project should be based on an original research idea and cannot come from any text or journal article. The project proposals should be submitted to the instructor for approval by the dates listed above. Lead-times for acquisition of equipment and supplies should be kept in mind while planning each project. Each proposal should do the following:

- outline the background and motivation for the project
- summarize the key steps in conducting the experiment
- list the equipment needed to conduct the experiment (include catalog name, number, page, and price if it is something Emory does not own)
- detail the chemicals required (including catalog name, number, page, amount, price, and CAS number)
- describe any hazards that might be encountered during the experiment
- summarize chemical disposal methods for each chemical used in the project
- overview the analytical techniques to be used and the information to be gained from this analysis
- discuss the sustainability issues presented by the experimental design and a plan for appropriate experimental adaptation
- include a timeline for each aspect of the experiment

This course is designed to give students exposure to analytical and instrumental techniques commonly used in chemistry. Therefore, the analytical tests included in each experiment should encompass a broad range of techniques. To this end, each experiment should include at least two analytical tests that are significantly different than those used in the other experiment, and one of these must be an instrumentation technique.

Analytical instruments available include (but are not limited to):

Mass spectrometer
X-ray crystallography center
AAS
UV-VIS
FTIR
Fluorimeter
NMR
GC
HPLC
Polarimeter
Cyclic voltammeter
Scanning electron microscope

Reports:

Each report should be written in standard ACS style. Be sure to include appropriate references and follow the ACS guidelines for these references. Inclusion of figures and equations is encouraged, and these should be embedded in the text. Reports should include an introduction to the project, relevant background information, experimental details, results, and discussion. The sustainability discussion (see below) should be included as an appendix to the paper.

Sustainability:

Chemical research has a huge and direct impact on our environment, and issues pertaining to sustainability are becoming increasingly relevant to the design of chemical experiments. It is imperative that the next generation of chemistry students be made aware of these issues and be trained to consider such issues in their experimental design. Therefore, in addition to the standard sections included in a journal article, reports must also include a comprehensive evaluation of the experimental practices with respect to the issue of sustainability. Some topics that might be relevant here are chemical storage and waste disposal, electricity consumption, and water consumption. This list is not comprehensive, and creative suggestions are encouraged. The report should suggest changes that would allow implementation of more sustainable practices in the laboratory. In addition, at least one of these adaptations must be implemented in the experiment, and the impact of this change should be discussed in the report. You are expected to quantitatively measure the overall reduction in environmental impact based on this implementation and report your findings in your writeup.

Peer Reviews and Report Revisions:

Report 1 will be peer reviewed by another group in the class. This review process will be similar to that used by journals to evaluate submitted manuscripts. You will be provided with the evaluation forms used by ACS journals. Upon receipt of the peer review for your report, you are expected to respond to the reviewers' comments and submit a revised report accordingly.

Regrading requests:

It is your responsibility to save all graded materials for this class. As per University policies, all grade disputes must be settled by the midpoint of the next non-summer semester which immediately follows this course.

All graded course materials will be photocopied before they are returned to you, and the photocopies will be kept for comparison in the case of a regrade request. All materials should be reviewed immediately upon return for grading errors. If there appears to be an error, submit your request for a regrade **in writing** no later than one week after the assignment was returned to you.

Honor Code:

As is stated in the Emory College of Arts and Sciences Honor Code:

Academic misconduct is an offense generally defined as any action or inaction which is offensive to the integrity and honesty of the members of the academic community. This offense includes, but is not limited to, the following:

(a) Seeking, acquiring, receiving, or giving information about the conduct of an examination, knowing that the release of such information has not been authorized:
(b) Plagiarizing;
(c) Seeking, using, giving, or obtaining unauthorized assistance or information in any academic assignment or examination;
(d) Intentionally giving false information to professors or instructors for the purpose of gaining academic advantage;
(e) Breach of any duties prescribed by this Code;
(f) Intentionally giving false evidence in any Honor Council hearing or refusing to give evidence when requested by the Honor Council.

All suspicions of academic misconduct should be reported to the instructor immediately. The instructor will then report the case to the Honor Council per Emory College guidelines.

Attendance, Excused Absences:

You are required to attend all laboratory sessions until both of your research projects are completed. Your final grade will be reduced by 10 percentage points for each laboratory session that you do not attend.

In the event of a missed laboratory session, this time may be made up at a later time outside of the regularly-scheduled class time ONLY WHEN proper documentation is provided for an accepted excuse. Your final grade will be reduced by 10 percentage points if the absence is not excused.

The following excuses are the only accepted excuses for missing an exam or laboratory exercise:

- A serious illness requiring medical attention. A note from the emergency room, your doctor, the Graduate Dean's office, or the Chemistry Department's Director of Graduate Studies will be required.
- A family emergency. A note from the Graduate Dean's office or the Chemistry Department's Director of Graduate Studies will be required.
- Travel as part of a recognized University organization. Arrangements to work in the lab at another time must be made at least one week PRIOR to the time of travel.