University of Michigan
Chemistry 216H — Winter Term, 2008

Class Meetings

Section	*Day*	*Time*	*Room*	*GSI*
220	Tu	8:10 - 12 noon	2411	Cheryl Moy
230	Tu	1:10 - 5 PM	2411	Annie Hong
231	Tu	1:10 - 5 PM	2500	Andrew Lewandoski
250	W	1:10 - 5 PM	2411	Cheryl Moy
251	W	1:10 - 5 PM	2500	Crystal Young
270	Th	1:10 - 5 PM	2411	Annie Hong
271	Th	1:10 - 5 PM	2500	Justin Lomont

Please note that we consider Chem 215H/216H to be rather seamless melding of 4 lecture periods (M/W/Th/F), a laboratory period, and your SSG meeting. Subject matter will flow rather freely from one of these time periods to the others.

Instructors

Professor Masato Koreeda (koreeda@umich.edu)
Annie Hong (jannieh@umich.edu)
Justin Lomont (jplomont@umich.edu)
Crystal Young (youngcly@umich.edu)
Zachary Buchan (zbuchan@umich.edu)
Andrew Lewandoski (dowski@umich.edu)
Cheryl Moy (moyc@umich.edu)

Textbooks: • Harwood, L. M.; Claridge, T. D. W. "Introduction to Organic Spectroscopy" Oxford University Press: Oxford, UK; 1997 (ISBN# 0 19 855755 8)
• Zubrick, J. W. "The Organic Chem Lab Survival Manual" John Wiley & Sons, Inc.; 2008; 7th Edition (ISBN#978 0 470 12932 6)

Introduction

The purpose of this course is to allow you to develop some of the fundamental skills used by chemists who prepare (*synthesize and purify*) and identify (*characterize*) organic substances. These skills range from the practical aspects of laboratory work, such as the proper selection and use of equipment, to the more philosophical aspects of scientific practice, such as how experiments are designed, evaluated and reported.

Perhaps the most overlooked aspect of scientific practice is that the conscious participation of the experimentalist in every role of performing an experiment is most like the role of a writer in creating a composition. Just because you are writing sentences where the nouns and verbs occur in the correct order doesn't make you a good writer; in the same way, just because you are following directions and mixing substances together doesn't make you a good experimentalist. Good experimentalists think about the whole experiment, why it is being done, what the possible outcomes are, what the steps are and why they are taken in that order, and, significantly, how to evaluate progress during the course of an experiment. It is on this point that most inexperienced experimentalists make their errors: they behave like disengaged technicians who are simply watching predestined results unfold. The fact is that it does not matter how many times a procedure is performed, and even how many times you have performed it, every chemical experiment is a brand-new event where even a small, unanticipated or unknown variable can cause a wildly different outcome.

The upshot of the last paragraph is that the most important lesson you can walk away from this course with is: just because you might be using a written procedure on the same substances that someone else has reported, never assume anything about the progress and outcome of the reaction. Signs of poor experimental behavior include the following statements, which are altogether too commonly heard from young scientists:

- *"I knew the reaction was done because the procedure said to let is stir for 30 minutes."*
- *"The reaction was done, and I just let it sit in solution over the weekend."*

In both cases, the problem should seem clear to you: chemical substances do not obey your thoughts; they cannot read procedures; they do not know what they are "supposed" to do because you learned it that way in class; and they do not stop reacting just because you want them to stop. Another benefit of developing the habits of a good experimentalist is that you will tend to carry these critical behaviors into other parts of your intellectual life. Many times, the ability to question, analyze and evaluate assumptions is required. Indeed, one of the goals of your formal education is to give you the chance to develop these skills in a relatively "safe" environment, and with plenty of repetition, so that when you need these skills in a higher risk situation, as in a critical situation you encounter in your professional career, that you are not facing these sorts of decisions for the first time! Your education is intended to provide you with experiences from which you can construct analogies when you come face-to-face with more monumental situations. No one course, and certainly not Chemistry 216H, is going to fulfill this entire role, but the chance for you to take advantage of the learning experience will always be there. Can we ever "force" you to take advantage of the opportunity? No. Can we ensure you will "get a poor grade" if you do not do things the way we would prefer? Unfortunately, no. But we can remind you about these things, because, like it or not, they are always operating behind the scenes, even when the students and the instructors ignore or are unaware of them!

In a nutshell, the kinds of experiences that you will encounter in Chemistry 216H are:

(1) Designing experiments, by
- using a reported procedure on reported compounds,
- using a reported procedure on analogous compounds,
- using parts of a reported procedure to invent a new procedure, and
- constructing a new design based on experience and predictions.

(2) Monitoring and evaluating of experimental results, by
- changes in observable physical properties,
- thin layer chromatography, and
- spectroscopic methods.

(3) Separating and purifying reaction products, by
- chromatography,
- extraction,
- crystallization, and
- possibly distillation.

(4) Identifying reaction products, by
- reported or anticipated spectroscopic characteristics, and
- comparison with reported or anticipated physical and chemical characteristics.

The formal course content for Chemistry 216H will appear in many places. The lecture, laboratory, and SSGs are separate threads woven into the same cloth.

For example, your Structured Study Groups will carry the biggest responsibility for spectroscopy instruction. Although spectroscopic determination of structure is an extremely significant topic, we have found that it is best handled by long-term self-instruction, and that this has given the most successful results. Spectroscopic information will appear on every exam this term, and on a number of the quizzes.

Laboratory issues will be raised as needed during one of the regular class periods (usually Fridays) and in lab. Many of the things you seem to be learning "for class" will also help you out in your laboratory tasks, and *vice versa*. Again, the intent of the course is to create a fairly seamless chemistry experience through your formal (lecture, lab, SSG) and informal coursework.

Required Supplies & Behaviors

You will need a laboratory notebook. You may continue to use your notebook from 211.

All other text based materials will come in the form of handouts or be found on the course website: http://www.umich.edu/~chemh215/

Arrive at lab on time and prepared to work. When you arrive, you will be asked to fill out a weekly reflection sheet. This is your incentive to think about how things went the previous week in lab as well as your preparation for the current lab time.

Use your time wisely. Lab runs from 1:10-5:00 PM or 8:10am-12:00 noon. Start cleaning up before it is time to leave. Do not plan on staying late.

Dress safely for lab (long pants, wear goggles at all times; no contacts; closed-toed shoes). This is easy when it is 10° and snowing. Once the first signs of spring appear, you must continue to dress safely for lab or you will be sent home to change into more appropriate clothing.

Work safely in lab. Use the hoods. Don't leave gloves lying around or wear them outside of lab. Dispose of waste and clean up spills properly. If you are unsure, ask!