CHEMISTRY 233 - ORGANIC CHEMISTRY LAB I

SPRING 2020

Professors	**Office**	**Office Hours**
Yutan Getzler	Tom 308*	T, 10-11 am; W, 10-noon; R, 10-11 am; F, 10-11 am (drop-in or appointment)
Mo Hunsen	Tom 310	T, 12-2 pm; R 12-2 pm, and F 2-3 pm (drop-in or appointment)

Prof. Getzler will teach all three sections through the end of the week of 3/23 (Green Oxidation). Prof. Hunsen will teach all three sections from that point forward.

**I share my office with a friendly dog. If this might be a problem for you, tell me and we will find a solution.*

Resources:

Textbooks**:** Zubrick "The Organic Chem Lab Survival Manual" (required, any edition)
chapter numbers are for the 9th edition; use this key for other editions
Mayo *et. al.* "Microscale Organic Laboratory (MOL)" (optional, any edition; select scans available on Moodle)

Webpage**:** Moodle, Kenyon's Google suite

Required Materials:

Laboratory notebook and goggles. You may continue to use a notebook from introductory chemistry until it is finished or request a new notebook from Carolyn Waggoner.

Point Distribution and Grading:

ChemDraw Activity	30
Notebook check (10 wks @ 2 pts)	20
Quizzes (7 @ 10 pts)	70
Data Sets (5 @ 30 pts)	150
Unknown Identification Oral Report	30
Safety, Technique, and Citizenship	50
Lab Report	50
Final Exam	50
Total	**450**

Instructors will assign fair grades at the end of the semester based on students' achievement of course learning goals (see below). Students can estimate their grade during the semester by calculating their average (total points earned/total points possible to date) and comparing their average to the following scale: 100% - 90% = A range, 90% - 80% = B range, 80% - 70% = C range, 70% - 60% = D range, lower than 60% = F.

Academic Accommodations:

Students who anticipate they may need accommodations in this course because of the impact of a learning, physical, or psychological disability are encouraged to meet with me privately early in the semester to discuss their concerns. In addition, students must contact Erin Salva, Director of Student Accessibility and Support Services (740-427-5453 or salvae@kenyon.edu), as soon as possible, to verify their eligibility for reasonable academic accommodations.

Non-Discrimination:
Kenyon College does not discriminate in its educational programs and activities on the basis of race, color, national origin, ancestry, sex, gender, gender identity, gender expression, sexual orientation, disability, age, religion, medical condition, veteran status, marital status, genetic information, or any other characteristic protected by institutional policy or state, local, or federal law. The requirement of non-discrimination in educational programs and activities extends to employment and admission. Information on Kenyon College's Office of Civil Rights, including policies for sexual misconduct and harassment (Title IX, VAWA, Title VII), discrimination, and ADA/Section 504, is available at: www.kenyon.edu/directories/offices-services/ocr/.

Academic Integrity:
"Kenyon College is, at the core, an intellectual community of scholars – students and faculty – engaged in the free and open exchange of ideas. Critical to this lively exchange and deep engagement with ideas is the academic integrity of our work, both inside and outside the classroom." In short, all materials submitted for credit must be your own work. We hold you responsible for ensuring each other's honesty; if you know of a violation, please relay your concerns to us, the Office of the Provost, or the Dean of Students. If you are uncertain about the expectations for this class, please ask for clarification.

Withdraw Late:
Co-requisite with this course is CHEM 231, but withdrawing late (WL) from the lab does not also withdraw you from the associated lecture course – they are separate courses with separate grades. This course assumes you are currently enrolled in CHEM 231, or have completed it and retained working knowledge of the material.

Learning Goals:
Chemistry 233 provides a technical foundation for first-hand experimental work in organic chemistry. The course emphasizes techniques and skills that will be used in other courses, especially Chemistry 234. The techniques and reactions used integrate and illustrate Chemistry 231 (the lecture course) material. A primary learning goal of the two-course organic laboratory sequence (233/234) is that students develop the skills necessary to enter a research setting that requires organic chemistry. Consistent with that aim, the courses progress from learning techniques to focused multi-week research projects over the two semesters. Specific learning goals for Chem 233 include:

1. Students will know the purpose of and be able to execute the basic organic chemistry laboratory techniques involved in the experiments this semester.
2. Students will be able to assess the safety of a given experimental procedure and make responsible decisions to assure its safe execution.
3. Students will be able to use the computer software (ChemDraw, Delta, online databases, etc.) utilized in this laboratory course.
4. Students will be able to acquire and interpret analytical data to identify organic compounds.

5. Students will be able to document their experimental work in a laboratory notebook using the conventions described in this syllabus.
6. Students will be able to connect the conceptual information learned in the organic lecture or during this course to what occurs in the laboratory
7. Students will be able to convey their understanding of the outcome of their laboratory work in the form of a written laboratory report (as described herein).
8. Students will be able to write experimental procedures using the conventions of *The Journal of Organic Chemistry*.

Attendance:
Organic chemistry is a science that continually builds upon itself, and it is quite easy to get behind if you miss a particular lab period. Therefore, attendance to your assigned laboratory section is mandatory. There will be no makeup labs. If you must miss your assigned lab period due to illness or a College sanctioned event then you may attend another section of the lab during that week only with permission of the instructors involved. In cases of prolonged illness, students will notify the instructor and the Dean of Academic Advising to make an appropriate plan.

Course Meeting Time:
We will meet in Tomsich 207 at 1:10 pm for a 20 – 30 minute pre-lab lecture during the first week of an experiment. Planning your lab work ahead of time will increase your efficiency in lab. Following recitation, laboratory work will commence in Tomsich 209. If we are in the second week of an experiment, you may begin lab work promptly at 1:10 pm. You will confine your lab work to the scheduled hours.

Late Work:
Late electronic submissions will lose points as follows: 0.1%/min (1-10 min late), 1%/min (11-20 min late), 5%/min (21-30 min late), 10%/min (31-40 min late). Because the the three sections function through a combined Moodle page, do not rely on TurnItIn to alert you to whether or not your submission is late. Unless otherwise stated, all assignments are due at 11:59 pm, the day before your section meets.

Safety:
The safety rules for the course are stated in Zubrick, Chapter 1. In the laboratory, the most important rules are: 1. Wear safety **goggles at all times**; 2) Long pants and shoes that cover the entire foot must be worn at all times; 3) No eating or drinking; 4) Be alert to hazards and prepared for emergencies. If you are uncertain whether something is safe, consult with the instructor.

Reading:
The location of an experiment and relevant supporting information in your laboratory texts is listed in the schedule. Some labs are described in handouts linked to the course Moodle page. It is essential that you read **and review** this information and other relevant information referenced therein prior to beginning and experiment and throughout each experiment. **It is your responsibility to have read and understood this material. If you have questions about what you read seek help immediately.**

Quizzes:

A five-minute quiz will be given at the beginning of each experiment (on the first week of two-week experiments). The quiz ends at 1:15 pm sharp; if you are not present for the quiz, you will receive no credit. The content of the quiz will be germane to the experiment at hand and may include questions about technique as discussed in Zubrick, suggested questions, spectral interpretation, or questions about material you should know in preparation for the experiment. You may use your laboratory notebook during the quiz, so you should make relevant notes therein. It is vital that these notes be clearly separate from what you write *during* lab.

Laboratory Notebooks:
You will purchase and maintain a laboratory notebook; if you have one from a previous semester with many unused pages, you may use it. Learning to keep an accurate and detailed lab notebook is critical as it is often your only source of information to help you remember what you actually did in lab when writing a lab report, interpreting spectra, testifying in court, etc. Although there is no single correct way to keep a notebook, *for this course you must precisely follow the format of the example on the Moodle page and detailed below*. I will check your notebooks at the end of each lab (✓-, ✓, ✓+) and they will be graded in more detail when handed in. The most important rules are: 1) Your lab notebook is your scratch paper – observations, data and calculations should be recorded directly into your notebook at the time the observations or measurements are made; 2) You must write with indelible ink; 3) After you are finished with your experiment, your lab notebook should contain sufficient information for another investigator, familiar with the field, to be able to reproduce your work, using only your notebook as a guide. Other useful references can be found *MOL*, pp. 40-44 or in Zubrick, Chapter 2.

Laboratory notebooks for this class will conform to the format indicated below. An example of this format is provided on Moodle. The following organization is required for every experiment and it is most helpful if the sections are labeled for clarity:

1. **Date** – This should be the date you begin the experiment. Dates should be added in the margin when you pick-up experimental work in multi-week labs.
2. **Experimental Graphic** – The exact nature of this graphic will vary but must include chemical structures. Someone viewing the graphics should be able to quickly discern the reaction or process to be undertaken in the laboratory. In the case of synthesis labs, a specific format is required (see the example on Moodle).
3. **References** – All references consulted to plan the laboratory work should be cited.
4. **Stoichiometry Table** – This table will contain the relevant information for all chemicals to be employed in the laboratory. There is a specific format for this table for synthesis work (see the example on Moodle). **Students will have completed 1-3 (and parts of 4) of their notebook prior to entering the laboratory at the beginning of an experiment. This should be done before the class session to give you the most time for working in lab.** The instructor or TA will briefly check notebooks when it is time to enter the laboratory.
5. **Procedure** – This section will contain a living description of what was actually done in the laboratory. It should not be (cannot be) written in advance of the laboratory session. The preferred format for this section is a list (numbered or bulleted) of operations carried out in the laboratory. This section should include data or a description/interpretation of data collected

during the course of an experiment. It may also include relevant calculations. If the experiment has multiple parts, sections may be titled for clarity.

Data Sets:
After finishing certain experiments (see schedule of experiments) a data set will be prepared. Data sets are your proof that you have completed the experiment and will be the primary basis of your grade for those labs that require them. Data sets have 2 parts and will be due as described below. Each data set will include the following items:

1. **Electronic Data Set (EDS):** The EDS will have two sections, using the Word template file available on Moodle. The first section will include **essential summary information**, e.g. product description, yield, % yield, and a list of analytical data and notebook pages to be separately submitted in hardcopy form (see below). The second section of the EDS will be an **experimental procedure**. For each experiment, you will write an experimental section in prose suitable for publication in an ACS journal. General guidelines for scientific writing should be followed. Each EDS will be submitted through TurnItIn (via Moodle) and will be due at **11:59 pm the day before your lab section meets** one week after completion of the experiment. Due dates are indicated on the schedule.

2. **Hardcopy Data Set (HDS)**: The HDS will have two components. The first will be all instrumental data collected for the experiment. The data should be **interpreted and clearly annotated**. Annotation includes carefully drawing the structure of the compound under analysis and clearly correlating spectral signals to that structure. Links to sample annotated spectra are on Moodle. All spectra should include the following: compound structure, compound name, compound ID number (SMD-07-013, initials – notebook number - page), and method of sample preparation (i.e. KBr pellet, thin film, $CDCl_3$, etc). For IR, only major features are labeled. For NMR, every peak must be labeled. The second section of the HDS is your lab notebook carbons. The HDS will be due at the beginning of lab one week after completion of the experiment.

Laboratory Report:
One laboratory report (approximately 4-6 typewritten pages, excluding attached data sets) will be written by each student this semester. The report is to be typewritten and should include the following sections: Abstract, Introduction, Results and Discussion, Experimental, and References. All structures must be drawn using ChemDraw. Chemical structures which are scanned, hand-drawn, copied from the web, etc. are not acceptable.

Please refer to "*A Brief Guide to Writing in Chemistry*" for guidance in writing your report. Brief descriptions of expectations for each section are included below:

Abstract: This is a summary of your results and the methods used to obtain them. It varies from 1-5 sentences, but never exceeds 110 words (approximately 8 lines). Abstracts must include a graphical summary no larger than 3.25" by 1.75".

Introduction: This is a statement describing the theoretical background, purpose and goals of your work. Give the reader a reason to care. You should describe (in words, pictures, balanced chemical equations, etc.) the method(s) and/or chemical reaction(s) that you have investigated for this report.

Results and Discussion: This includes your data (results) and the interpretation/explanation of your data (discussion). Your data are most effectively presented using tables, graphs, lists, etc. Spectra and other graphical data are included as appendices that are referenced in the text. You should interpret and discuss your data in terms of what you learned from them, and how the data reinforce or contradict the principles taught in this and other courses. Typically, this is the main body of text in your report.

Experimental: This is a description of what you actually did in the laboratory according to your notebook and not necessarily what is described in the protocol. The experimental is written in the third person, the past tense, and in the passive voice.

References: These are the sources of information that were used in the report (MOL, Zubrick, CRC Handbook of Chemistry and Physics, Science, Journal of Organic Chemistry, etc.). This is a critical and oft overlooked section of a lab report. On what are you basing your statements? A book, a journal article, a website (be careful!), your own imagination? All references should be according to the ACS Style Guide, using the *Accounts of Chemical Research* style with full article titles.[1] You may find Table 14-2 particularly useful.

Final Exam:
There will be a 50 minute written exam, covering all the experiments we have performed, during the time assigned to your section (see below). The full report for your project (final version) is due on the same date and will be submitted prior to the exam.

233.01 (Tuesday): Friday, May 8, 1:30 pm.
233.02 (Wednesday): Friday, May 8, 8:30 am.
233.03 (Thursday): Monday, May 4, 6:30 pm.

– This syllabus is subject to change. The instructors will notify you of any changes in class or by email. –

[1] Dodd, J. S.; Solla, L.; Bérard, P. M. References. In *The ACS Style Guide: Effective Communication of Scientific Information* [Online]; Coghill, A. M.; Garson, L. R., Eds.; Oxford University Press: 1996; Chapter 14, pp. 287-341. http://pubs.acs.org/doi/abs/10.1021/bk-2006-STYG.ch014 (accessed April 9, 2013).