

# **CHEMISTRY 233 - ORGANIC CHEMISTRY LAB I**

**SPRING 2019**

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Office Hours:	M: 2:00-5:00PM by appointment	M & W: 2:00-4:00PM, F: 2:00-3:00PM
		Schedule an appointment at: <a href="https://tinyurl.com/y8ahxy9k">https://tinyurl.com/y8ahxy9k</a>

## **Texts:**

Mayo, Dana W.; Pike, Ronald M. and Trumper, Peter K. "Microscale Organic Laboratory: With Multistep and Multiscale Syntheses," 5th edition

Zubrick, James W. "The Organic Chemistry Lab Survival Manual," 8th edition

## **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
Lab Report	50
Prelab Assignments (5 @ 30 pts)	150
Data Sets (4 @ 30 pts)	120
Unknown Identification Oral Report	30
Safety, Technique, and Citizenship	50
Final Exam	100
<b>Total:</b>	<b>530</b>

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.

## 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 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 Hall 207 for a pre-lab discussion during the first week of a particular experiment. This meeting should last between 20-40 minutes. Prior to each session of the lab, you will prepare a preliminary write-up in your notebook (see Prelab). It is vital that these notes be clearly separate from what you write during lab. Planning your lab work ahead of time will increase your efficiency in lab. During the second and subsequent weeks of a multi-week experiment, you can begin working promptly at 1:10 pm in Tomsich Hall 209. You must confine your lab work to the scheduled hours for your section.

### Late Work:

Late work will not be accepted.

### Safety:

The safety rules for the course are stated in Mayo, Chapter 2 and 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.

### Prelab:

Students will write a prelab at the beginning of each experiment. Carbon copies of the prelab will be submitted upon arrival to class on the first week of a given experiment. Prelabs will contain the following labeled sections:

1. **Name** – Your name.
2. **Title** – This should be the title given to the experiment in the text or handout.
3. **Date** – The date the pre-lab is completed
4. **Purpose** – A brief statement that of the purpose or objective of the experiment to be completed.
5. **References** – Cite all references that you consulted to prepare to carry out the experiment using format found in ACS journals (a link to the *Journal of Organic Chemistry* can be found on the Moodle page and the reference format used therein can be used as a model).
6. **Prelab Questions** - Answers to pre-lab questions for the experiment (see the schedule for the questions). You may collaborate with peers and consult with experts to respond to these questions but each individual is responsible for understanding the response to all questions.
7. **Prelab Information** – this lab has any notes or calculations that you do prior to entering the laboratory. The contents of this section are up to you but could include a summary of the procedure you plan to employ, responses to conceptual questions, a mechanism for a reaction that you will perform, calculations needed to start the lab, and relevant physical or chemical properties of the materials to be used. This section should be labeled “Pre-Lab Information for *Experiment Name*”

Following the Pre-lab Information section, you will prepare your laboratory notebook for the experimental work to be completed during the session on a new page (Items 1-6 in the Laboratory

Notebook section below). Carbon copies of your prelab work will be collected upon arrival to class and your instructor or TA will glance at your notebook before you begin your experimental work.

### Laboratory Notebooks:

You will maintain a laboratory notebook. Learning to keep an accurate, up-to-date and detailed lab notebook is critical -- as it is your only source of information to help you remember what you actually did in lab when writing a lab report or data sets in the days ahead. The notebook for this course contains white pages and carbon copies of the white pages. After you have finished for the day, you must complete your account of your laboratory work and then have your notebook signed and dated by the instructor or the laboratory teaching assistant prior to leaving the lab. The relevant pages will be submitted with the Hard Copy Data set or report for the lab (see below).

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. **Experiment Title** – This should appear on the top of blank page
2. **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.
3. **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).
4. **References** – All references consulted to plan the laboratory work should be cited.
5. **Chemical Data 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 1-5 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.
6. **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 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.
7. **Wrap-up** – A reader of the notebook should be able to quickly learn the outcome of the experiment and the plans for next steps by reading the wrap-up. This should include information about if the experiment worked, how well it worked, possible sources of errors, if the procedure should be modified prior to trying it again, what one can understand from the results of the experiment. This section will necessarily discuss the data collected and what it means.

## 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 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 and will be submitted on TurnItIn (via Moodle). A Word template file for the EDS is 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 and will be due at 11:59 pm the day before your lab section meets one week after completion of the lab. 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 (KAM-01-005, initials – notebook number - page), and method of sample preparation (i.e. KBr pellet, thin film,  $\text{CDCl}_3$ , 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 on the day the lab is due.

## 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 Acc. Chem. Res. style with full article titles.<sup>1</sup> You may find Table 14-2 particularly useful.

### **Final Exam:**

There will be an exam, covering all the experiments we have performed, during final exam week (see the schedule exams to find your exam time and day). The full report for your project (final version) is due prior the exam time for your section of the course.

### **Statement of Academic Integrity:**

At Kenyon we expect all students, at all times, to submit work that represents the highest standards of academic integrity. It is the responsibility of each student to learn and practice the proper ways of documenting and acknowledging those whose ideas and words they have drawn upon (see Academic Honesty and Questions of Plagiarism in the Course Catalog). Ignorance and carelessness are not excuses for academic dishonesty. If you are uncertain about the expectations for this class, please ask for clarification.

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<sup>1</sup> 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).

**Statement on Disability 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](tel:740-427-5453) or [salvae@kenyon.edu](mailto:salvae@kenyon.edu)), as soon as possible, to verify their eligibility for reasonable academic accommodations.*

**Title IX Responsibilities:**

Kenyon faculty are committed to supporting our students and upholding gender equity laws as outlined by Title IX. Therefore, if a student chooses to confide in a member of Kenyon's faculty regarding an issue of sexual misconduct, that faculty member is obligated to tell Kenyon's Title IX Coordinator. The Title IX coordinator will assist the student in connecting with all possible resources both on and off campus. For more information about your options at Kenyon, please go to: <http://www.kenyon.edu/directories/offices-services/office-of-equal-opportunity/sexual-assault-and-harassment/>

**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 syllabus is subject to change. The instructors will notify you of any changes in class or by e-mail.*