CHEM 336: Introductory Organic Chemistry Laboratory

Fall Semester 2025

Section 001: Tuesday, 1:00 PM – 4:50 PM in SC 4323
Section 002: Wednesday, 1:00 PM – 4:50 PM in SC 4323

Instructor: Dr. Keith P. Reber
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Office: SC 4301J (office hours held in SC 4335)
Office Hours: Monday (1:00 – 2:00 PM); Tuesday (9:00 – 10:00 AM); Thursday (1:00 – 2:00 PM)
Course Website: https://blackboard.towson.edu

Course Catalog Description:

Structure, stereochemistry, reactions and their mechanisms, preparation and properties of alkanes, alkenes, alkynes, alkyl halides and alcohols. Laboratory techniques include purification, spectroscopic (IR, NMR) and chromatographic (GLPC) methods of identification, and synthesis. One hour of laboratory lecture and one three-hour lab. CHEM 334 and CHEM 337 comprise a traditional two-term organic chemistry lecture sequence with the CHEM 336 and CHEM 339 labs. Not open to students who have successfully completed CHEM 331. Prerequisite: CHEM 334. Lab/Class fee will be assessed.

Information about organic chemistry courses at TU:

Students are strongly encouraged to enroll in the organic chemistry course(s) that best align with their academic degree requirements and ultimate career goals. The only programs that require CHEM 336 are chemistry, forensic chemistry, and the molecular biology/biochemistry tracks within the MB3 major. The alternative is CHEM 333/333L, which is a one-semester (5 credit) combined organic chemistry lab/lecture course intended for biology majors. This course gives a broader overview of organic chemistry, focusing only on the most important concepts needed for biochemistry. **Note that CHEM 333/333L satisfies the graduation requirements for every track within the biology major, and this course also satisfies the prerequisite for taking biochemistry (CHEM 351).**

Required Course Materials:

- A bound **laboratory notebook** with sequentially numbered pages and carbon copies. This can be obtained from the Towson UStore or from the Student Affiliates of the American Chemical Society (SAACS) club. If you have a lab notebook from a previous chemistry course (e.g. CHEM 132L) with unused pages, then you can continue using it for this course.
- *Organic Chemistry Lab Techniques* by Lisa Nichols. This open-access lab manual is available as a PDF on Blackboard or can be accessed using the following link.
- A pair of **safety goggles**. Appropriate safety goggles can be obtained from the Towson Ustore or from the SAACS club. Note that you must wear goggles and not safety glasses.
- A blue or black **pen**. Using pencil and/or other pen colors is not considered acceptable for writing in a laboratory notebook.
- A **calculator**. A stand-alone model is required; calculators on mobile devices cannot be used.

Learning Outcomes:

By the end of CHEM 336, students will be able to:

1. Demonstrate proper use of basic glassware and other equipment.
2. Design, carry out, and analyze the results of organic reactions.
3. Perform basic purification techniques (recrystallization, chromatography, extraction, and distillation).
4. Work safely with hazardous organic compounds and properly dispose of chemical waste.
5. Report and analyze quantitative and qualitative experimental data / observations.
6. Interpret spectroscopic data (MS, IR, and ^{1}H NMR and ^{13}C NMR) for simple organic compounds.
7. Carry out calculations related to stoichiometry (i.e. percent yield, molar equivalents, etc.).
8. Keep a detailed and accurate laboratory notebook.

Course Overview:

CHEM 336 is the first half of a two-semester lab sequence designed to provide students with an introduction to experimental organic chemistry. Working in the laboratory will allow you to gain valuable hands-on experience conducting chemical reactions and collecting physical data, making the abstract concepts of organic chemistry more tangible. Ideally, your work in lab should complement and reinforce the concepts you have learned in lecture and place them in the proper chemical context.

Practicing organic chemists make use of a wide variety of experimental techniques, specialized equipment, and instrumentation. In this course, all of the techniques and equipment that you encounter will be used to address the following three fundamental concepts:

1) **Synthesis** – How do we carry out an organic chemical reaction?
2) **Purification** – How do we isolate the desired products(s) after the reaction is complete?
3) **Characterization** – How do we know what compound we made, and how do we assess its purity?

Course Information

A. Attendance:

Attendance in laboratory is mandatory. Failure to attend and attempt any lab period without a Towson University sanctioned excuse will result in a grade of ZERO for all work that should have been performed during that laboratory period, including completion of prior labs, running of current labs, or set-up of future labs. **Furthermore, late arrival to prelab/lab is not permitted.** Any student arriving late may be excluded, at the instructor's discretion.

Since CHEM 336 lab sections are typically filled to capacity, **no make-up labs will be offered**. However, students may be exempted from lab work if they have a Towson University sanctioned excuse and have made prior arrangements with the instructor. Please see http://catalog.towson.edu/undergraduate/academic-policies/class-attendance-absence-policy/ for the TU Policy regarding excused absences. Note that students are still responsible for any course material they may have missed due to an excused absence.

B. Preparing for Lab:

Success in the organic chemistry laboratory requires a great deal of preparation outside of class. Before you come to lab, it is critical that you have: (1) read and understood all aspects of the specific experiment you will be conducting that day, (2) read the relevant chapters in *Organic Chemistry Laboratory Techniques* and/or the textbook, and any other specific materials posted for the experiment, (3) submitted the pre-lab quiz, and (4) prepared your notebook in the manner described later in the syllabus. **Students who have not adequately prepared for lab will be asked to leave (without the opportunity for a make-up lab) and will receive a grade of zero for all work related to that particular experiment.**

C. Pre-lab Quizzes:

Each experiment will have an associated pre-lab quiz that must be submitted through Blackboard. This quiz will test your understanding of the experiment along with any relevant techniques and calculations. Before completing the quiz, you will need to read the posted lab handout, watch any associated videos, and read any relevant chapters in *Organic Chemistry Lab Techniques*. All pre-lab quizzes must be submitted by **12:00 PM (noon) on Tuesday** during the week indicated on the lab schedule. Late submissions will not be accepted for credit.

D. Post-Lab Assignments and Notebook Pages:

Each experiment will have a post-lab assignment (submitted through Blackboard) in which you will report / analyze your data, perform calculations, and answer post-lab questions. You will also need to submit signed carbon copies of your notebook pages and upload PDF or image files of the original notebook pages on Blackboard. All post-lab assignments must be submitted by **6:00 PM on the day your lab section meets** during the weeks indicated on the lab schedule.

E. Final Exam:

There will be one lab exam testing your understanding of lab techniques / calculations and your knowledge of organic spectroscopy. You will be allowed to use a calculator during this exam and will be provided with any necessary spectroscopic data tables. **This exam will be administered during the final exam period on Tuesday, December 9 (Section 001) / Wednesday, December 10 (Section 002) from 3:00 PM – 5:00 PM in SC 4323.**

F. Grading:

Your final grade in this course will be determined based on your total score out of a possible 1000 points:

- Pre-lab quizzes: **10 x 5 points = 50 points**
- Lab notebook pages: **10 x 25 points = 250 points**
- Post-lab assignments: **10 x 60 points = 600 points**
- Final Exam: **100 points**

Late submissions for post-lab assignments or uploading copies of notebook pages on Blackboard will receive a **20% penalty** for each day past the due date (including weekends). At the end of each lab period, students must clean their lab bench, dispose of all chemicals in the proper waste container, and return supplies to the common area. Failure to do so will result in a **20% penalty** on the post-lab assignment for that particular experiment.

The correlation between point totals and final letter grades is given in the following table; note that (+)/(–) grade cutoffs will only be determined at the end of the semester after examining the overall grade distribution.

Total Points	Letter Grade
900 – 1000	A
	A-
800 – 899	B+
	B
	B-
700 – 799	C+
	C
600 – 699	D+
	D
0 – 599	F

Scores on individual assignments will not be adjusted; however, if the overall class average is too low at the end of the semester, a fixed number of points will be added to everyone's score to shift the average to a more appropriate level. Note that this can only improve your score, and you will never receive a lower grade than that which you would have received based on earned points alone.

Additional Information

A. Safety:

Safety should be everyone's first priority whenever they set foot in a chemical laboratory. For this reason, **you must wear eye protection at all times when you are in the laboratory**. Note that goggles must be worn instead of safety glasses, which do not provide adequate splash protection, even if they claim to have "side shields." Proper attire is also required -- you must wear close-toed shoes (e.g. no sandals or Crocs), and your legs and ankles must be completely covered to protect from spills. Any accidents, even if they seem minor, must be reported to me immediately. No food or drink of any kind is permitted in the laboratory. Students are required to read the organic lab safety agreement posted on Blackboard and submit the lab safety quiz before they are allowed to perform any experimental work. **Students who do not wear appropriate attire for lab (including eye protection and closed-toed shoes) or who present a safety hazard will be asked to leave and will receive a zero on the post-lab assignment for that particular experiment.**

B. The Laboratory Notebook:

Maintaining a proper laboratory notebook is one of the most important skills for any scientist. If an experiment is not well-documented and reproducible, then it is, for all practical purposes, useless! The key feature of a well-maintained laboratory notebook is that another person could easily follow and understand exactly what you have done or observed and could, if necessary, repeat your experimental procedure. For this reason, it is important that you learn good laboratory notebook practices now, as these skills will then carry over into subsequent laboratory courses and will hopefully be applicable in your future career. It should be stated that fabrication of data violates all principles of scientific ethics and will not be tolerated in this course.

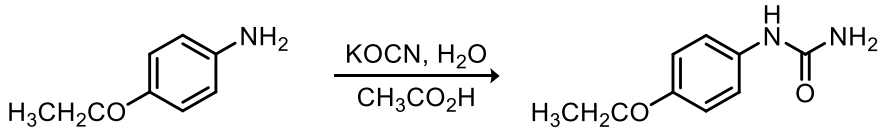
For this course, you will need a bound laboratory notebook with sequentially numbered pages and carbon copies; appropriate notebooks can be obtained at the university bookstore or through the Student Affiliates of the American Chemical Society (SAACS) club. If you have a partially filled laboratory notebook from a previous course (e.g. CHEM 132L), then you may continue to use that notebook for this course.

All entries in your notebook must be fully legible and written in either blue or black ink. If you make a mistake, cross it out with a single neat line and initial the entry nearby to acknowledge the error. Each page in your notebook is accompanied by a carbon copy; make sure to insert the back cover of your notebook after the carbon copy before you begin writing so that you do not make stray marks on subsequent sheets. You will also find a table of contents at the beginning of your notebook, and it is highly recommended that you keep it up to date so that you can easily find relevant information when you are writing lab reports.

Preparing your notebook for lab:

It is important that you use your laboratory notebook to record all of the information required for you to complete each day's experiment **before coming to lab**. I will come around to check your pre-lab assignment at the beginning of each lab; this will serve as your "ticket" into lab each day and will be evaluated as part of your notebook grade. The sections that must be included in your notebook before coming to lab are:

- **Your name and the title of the experiment to be performed.**
- **Chemical structures and reaction equations.** For a synthetic experiment, you must draw the reaction equation, including all reactant(s), reagents, solvents, and product(s). An example is shown below:



phenetidine **Dulcin**

- **A brief summary of the experiment.** In 1-2 sentences, summarize the experiment that will be performed. Be sure to mention any relevant techniques (e.g. purification methods) and how the product(s) will be analyzed. For example: "In this experiment, a mixture of unknown compounds will be separated using the technique of liquid/liquid extraction. Each component will be purified by recrystallization and analyzed based on its melting point and IR spectrum."
- **Data table for all reactants, reagents, and products.** A table containing physical data (molecular weight, melting point, density, etc.) for all relevant compounds is included with each lab handout. You must copy this table into your notebook and fill in any blanks by performing the necessary calculations (e.g. determining reactant masses, volumes, mmols, and molar equivalents) before coming to lab. You will also need to calculate the theoretical yield (both in mmol and mg) for the product.
- **Experimental procedure**. For this section, you must divide the notebook page in half: the left-hand side of the page will be used for recording the procedure; the right-hand side of the page will be used for recording data and observations during the experiment. Students must write out the full experimental procedure before coming to lab. Your instructor will briefly check your notebook at the beginning of the

lab period, and students who have not recorded the procedure will not be permitted to perform the experiment. Note that you should not copy the procedure word-for-word from the experimental handout, and you do not need to write in complete sentences. Instead, it is recommended that you use a numbered or bulleted list for each procedural step. It is recommended that students bring a printout of the experimental handout along with them to lab for reference. **Accessing the handout on an electronic device (e.g. a phone, laptop, or tablet) during lab is not permitted.**

Using your notebook in lab:

During lab, you will use your notebook to record all of the data you collect over the course of the experiment along with your observations. At the end of each lab period, your instructor will briefly inspect your notebook and initial the appropriate pages. This provides an official record of your work and ensures that no data can be added to the notebook at a later time. Information that must be recorded in your notebook during lab includes:

- **The date the experiment is being performed.** If you are working with a partner for a particular lab, their name should also be recorded.
- **Experimental data**. All information collected during lab will be recorded on the blank right-hand side of the notebook page directly across from the relevant part of the procedure. **All numerical data must be recorded in your notebook along with appropriate units and significant figures *as the data is collected*.** Examples of numerical data include masses, volumes, melting point ranges, etc.

  Always keep in mind that you must record the values you actually used; if your written procedure said "add 2.000 grams of compound X to a round bottom flask" and you measured out 2.050 g, then you must record the mass as 2.050 g on the right-hand side of the page. Note that these actual amounts of reagents must also be used when calculating theoretical and overall percent yields in the post-lab assignments. In the example given above, it is also important to record the mass as 2.050 g instead of 2.05 g in order to maintain the correct number of significant figures. For numerical values less than 1, a leading zero must be included, i.e. 0.789 g instead of .789 g; alternatively, this data could be written as 789 mg.
- **Experimental observations**. Your observations are important pieces of information, so do not be afraid to record them! Examples include color changes, gas evolution, changes in temperature, formation of a precipitate, explosions, etc.

C. Evaluation of Products:

Before the instructor signs your notebook pages, you must show them the vial containing your purified product from each experiment. Although we are not concerned with overall yield, inspecting this material provides evidence that you successfully completed the experiment. Spot checks may be performed on suspicious samples to ensure that mass and analytical data have been reported accurately. Sample vials must be labeled with the following information:

- **Your name and lab section**
- **Identity of the compound**
- **Mass of material**

General Policies

A. Academic integrity:

"The acquisition, sharing, communication, and evaluation of knowledge is at the core of a university's mission. To realize this part of its mission, a university must be a community of trust. Because integrity is essential to the purpose of an academic community, the responsibility for maintaining standards of integrity is shared by all members of that academic community."

https://www.towson.edu/about/administration/policies/03-01-00-student-academic-integrity-policy.html

I expect that all students taking this course will uphold the university's principles concerning academic integrity. Potential violations include, but are not limited to: (1) plagiarizing from written or online sources, (2) directly copying answers to pre-lab quizzes or post-lab assignments from other students, (3) posting or soliciting answers to quizzes or assignments on website such as Chegg or Course Hero, (4) posting or soliciting answers to quizzes or assignments on a group chat, (5) submitting answers from generative AI programs such as ChatGPT, (6) cheating on the final exam, either by (a) looking at another student's paper, or (b) using any unauthorized written or electronic resources, (7) altering graded assignments, and (8) fabricating experimental data. Should any of these infractions occur over the course of the semester, a grade of zero will be given to all persons involved, and an academic integrity violation will be submitted to the Office of Student Accountability and Restorative Practices.

B. Chemistry Department Statement on Classroom Diversity:

The students, faculty, and staff at Towson University represent a diverse and vibrant community of learners and scholars. As a community, we value the unique contributions of each individual and promote active participation in all aspects of the learning process by each community member. Your instructor supports Towson University's goal of fostering a diverse and inclusive educational setting. Your instructor strives to create a classroom environment built upon the principles of mutual respect and support. Toward this end, all members participating in this course are expected to demonstrate respect for all other members of the class. If you feel these expectations have not been met, please speak with your instructor or the chemistry department's designated diversity liaison, Dr. Cindy Zeller (czeller@towson.edu).

For further information regarding the diversity and inclusion policies of Towson University, please see Towson University's Diversity Strategic Plan, the Fisher College of Science and Mathematics Diversity Action Plan, and the Chemistry Department's Diversity Action Plan.

C. Students with Disabilities

Students with any sort of disability who may need special consideration should see *the instructor during the first week of class* with appropriate paperwork. This course is in compliance with Towson University policies for students with disabilities. Students with disabilities are encouraged to register with Accessibility & Disability Services (ADS), University Union, Suite 146, 410-704-2638 (Voice) or 410-704-4423 (TDD). Students who suspect that they have a disability but do not have documentation are encouraged to contact ADS for advice on how to obtain appropriate evaluation. A memo from ADS authorizing your accommodation is needed before any accommodation can be made.

D. Notice To Students Who Are Pregnant:

Pregnant students should consult their physicians for advice on whether or not to perform experiments in the laboratory. Students are encouraged to provide their physician with a list of the chemicals that they might be exposed to while in lab. They should also check the MSDS sheets (available in the Department) to be aware of the hazards of the chemicals. If a student is advised against performing laboratory work, then faculty will make appropriate accommodations for the student. Any accommodations should comprise a workload that is approximately equivalent to the regularly scheduled laboratory work. These accommodations may include:

- Performing "dry" experiments only, in a place free from exposure to ongoing experiments
- Performing the wet chemistry at a later date
- Receiving an incomplete grade in the course pending completion of experimental work

D. Auditing the course:

No audits will be granted for this course. After the end of the add/drop period, students must either remain in the course to receive a final grade or choose to withdraw before the university deadline (Monday, November 3, 2025).

E. Technology Support:

Pre-lab quizzes and post-lab assignments will be administered online via Blackboard. Therefore, a computer with stable internet access is required for this course. Should you encounter any issues related to technology, Towson University may be able to help. Please visit the Office of Technology Services website for more information (https://www.towson.edu/technology).

E. Lab Fees:

A lab fee of $100 is charged for this course. This fee pays for top loading balances, melting point capillaries, replacement of broken glassware and chemicals, melting point apparatus, stirring hotplates, instrumentation, instrument repair/maintenance, instrument supplies, lab consumables, safety equipment and miscellaneous laboratory equipment.

H. Copyright Notice:

Your instructor retains the copyright to all original materials distributed in this course (including, but not limited to, hard copies or electronic copies of lecture notes, problem sets, handouts, assignments, exams, answer keys, and lab materials). Reposting or otherwise distributing these materials without the advance written consent of your instructor is prohibited.

I. Syllabus Subject to Change:

All information, schedules, dates, and policies outlined in this syllabus are subject to change. Any changes will be announced in writing via email, and a revised version of the syllabus will be posted on Blackboard.