

CHEM 1600/2600: SYNTHESIS AND CHARACTERIZATION OF POLYMERS

SPRING 2019

AT A GLANCE

- Lectures** MW 3-4:15pm in Eberly 228
- Office Hours** F 9:30-10:30am in Chevron G12A
- Professor** Jennifer Laaser
Chevron G12A
j.laaser@pitt.edu
- Prerequisites** The prerequisites for this course are:
- Two semesters of organic chemistry (CHEM 310/320 or 730/740 or equivalent)
 - A course in physical chemistry covering thermodynamics and introductory statistical mechanics (CHEM 1420, 1480, 1302, 1342, or equivalent)

If you are uncertain about whether your preparation is sufficient for this course, please don't hesitate to ask.

Required Materials The required textbook for this course is:

Polymer Chemistry
P. C. Hiemenz & T. P. Lodge
2nd edition (2007)
ISBN 978-1574447798

This book is available at the University Store (approx. \$125 new/\$94 used) and on Amazon (approx. \$70). A copy is also available on reserve in the chemistry library (Chevron 130).

Each student will also need a scientific or graphing calculator for use on in-class activities and exams.

COURSE GOALS

- Overview** Chem 1600/2600 is an introductory course in the synthesis and characterization of polymers. My goal in this course is to help students develop a firm grounding in modern methods in polymer synthesis and characterization, with the intent that students will leave the course well-prepared to work or conduct research in polymer science.
- Key Concepts** By the end of the course, students will be able to:
- Describe the chemistry and architecture of polymer chains
 - Describe and analyze the molecular weight distribution of a polymer sample
 - Plan syntheses of target polymer architectures using methods including condensation, radical, ionic, and ring-opening polymerizations, with appropriate control of polymer composition and molecular weight
 - Characterize the thermal and mechanical properties of polymers, and understand their physical origins
 - Read and understand current literature in polymer science

Detailed lists of learning objectives will be posted on CourseWeb for each major unit of the course.

Grading Students registered for the undergraduate course number (CHEM 1600) will be graded on the following items:

Item	Points Possible
Problem Sets (10 points each)	100 points
Midterms (100 points each)	200 points
Final Presentation	50 points
Final Exam	150 points
Total	500 points

Final grades will be determined using the percent of total points earned.

Students registered for the graduate course number (CHEM 2600) will be graded according to slightly different requirements; see the CHEM 2600 syllabus supplement for details.

Homework Problem sets will be assigned approximately once a week, and will be due by the start of class one week after they are assigned. There will be 10 problem sets over the course of the semester, each worth 10 points. Students registered for the graduate course number (CHEM 2600) will also be required to submit solutions an extended challenge problem along with each problem set; see the CHEM 2600 syllabus supplement for more information on this requirement.

To facilitate efficient marking and return of submitted work, we will use Gradescope for submission of problem sets and professional problems. If you are officially registered for this class, you should receive an invitation to Gradescope within the next 24 hours; if you are auditing and are not officially registered, please contact the instructor for access. If you are unable to submit your work online due to technical problems, you should email a copy of your completed work to the instructor before the start of class, or, if absolutely necessary, may bring a hard copy to turn in in class. Solutions will be posted online shortly after the due date, and as such, no credit will be given for problem sets turned in after the class in which they are due.

Exams Exams will be based on the material from the lectures and the problem sets. Midterms will be given during the normal class meeting times (see schedule, below), and the final exam will be given on the date listed on Pitt's official final exam schedule. More details on exam format and expectations will be provided as the exam dates approach.

Scores for midterms missed due to excused absences will be replaced by the student's score on the final exam; otherwise, missed midterm exams will be given a zero.

Presentation Students registered for CHEM 1600 will, working in groups of three or four, prepare and present a presentation on a paper from the current polymers literature during the last two weeks of class. A detailed list of requirements, group assignments, and a list of suggested papers will be posted after the first midterm; groups will be required to clear their final choice of paper with the instructor before beginning work on their presentation.

A Note About Lectures Course meetings will consist of lectures interspersed with in-class activities, including both short problems for practice and discussion, and more extended guided problem solving and exploratory activities. Many of these exercises will be conducted in small groups, which will be assigned by the instructor at the start of each unit.

While class participation will not be factored directly into your final grade, you should plan to attend class consistently and participate fully in these in-class activities, as they will both provide key opportunities for you to develop your own understanding of the material, and will be used as jumping-off points for exercises on the homework problems and exams.

SCHEDULE

Important Dates Class will meet regularly on Mondays and Wednesdays at 3:00pm, with the following exceptions:

January 7	First day of class
January 21	No class - Martin Luther King Day
February 13	Midterm 1 (<i>tentative</i>)
March 11 & 13	No class - spring break
March 27	Midterm 2 (<i>tentative</i>)
April 17	Last day of class
April 24	Final exam (2pm-3:50am, location TBD)

Please note that exam dates are *tentative* and are subject to change; finalized exam dates will be announced as soon as they are scheduled, and in all cases no later than one week before the exam.

Scheduled Topics The first half of this course will focus on polymer synthesis, while the second half will focus on the physical properties of the resulting materials and important characterization methods.

The following is a *tentative* schedule of the topics that we will cover this semester:

Jan. 7-14	Introduction to Polymers	Chapter 1
Jan. 16-28	Step-Growth Polymerizations	Chapter 2
Jan. 30 - Feb. 4	Free-Radical Polymerization	Chapter 3
Feb. 6	Controlled Radical Polymerization	Chapter 4
Feb. 11-18	Other Controlled Polymerizations	Chapters 4 & 5
Feb. 20	Copolymers	Chapter 5
Feb. 25-27	Conformations of Polymers	Chapter 6
Mar. 4-6	Elasticity & Mechanical Properties	Chapters 10 & 11
Mar. 18-20	Thermodynamics of Polymer Solutions	Chapter 7
Mar. 25 - Apr. 1	Thermal Properties of Polymers	Chapters 12 & 13
Apr. 3-8	Special Topics	TBD
Apr. 10-17	Student Presentations	

Changes to this schedule will be announced on CourseWeb and in class as they occur.

RESEARCH SURVEY

Students in this course will be given the opportunity to participate in a research study on the use of guided inquiry learning in upper-level chemistry courses. For this study, we will be surveying students in CHEM 1600/2600 at the University of Pittsburgh by asking them to complete a short (approximately 10 minute) survey twice during

the semester. We will also be analyzing students' midterm and final exam grades. All participants must be 18 years of age or older. If you are willing to participate, our questionnaires will ask about your experiences in and opinions about both CHEM 1600/2600 and your prior chemistry classes.

There are no foreseeable risks associated with this project, nor are there any direct benefits to you.

Each participant will receive 5 points of extra credit for each survey completed, for a total of 10 extra credit points (equivalent to one homework assignment). Students who choose not to participate in this research study will be offered alternate extra credit assignments worth the same number of points. Surveys will be conducted anonymously, and so your responses will not be identifiable in any way. Grades will be de-identified (have your names removed) before analysis. All responses and grade data are confidential, and results will be kept under lock and key or in password-protected files. Your research data may be shared with investigators conducting other research; however, this information will be shared in a de-identified manner (without identifiers).

Your participation is voluntary, and you may notify the instructor that you wish to withdraw at any time. Your decision about research participation will not negatively affect your relationship with the teacher-investigator or faculty in general. Your decision about research participation will not affect (favorably or unfavorably) grades, potential letters of recommendation, or other opportunities or decisions made by teacher-investigators.

This study is being conducted by Jennifer Laaser, who can be reached at 412-383-0125 or j.laaser@pitt.edu, if you have any questions.

OTHER POLICIES

- Office Hours** If you are unable to attend regularly scheduled office hours, please send me an email to set up an individual meeting. Please note that these meetings are *by appointment only*, and must be scheduled at least 24 hours in advance.
- Email** I will make an effort to respond to all course-related emails within 24 hours on weekdays and 48 hours on weekends.
- If you have a more immediate question, especially about the practice problems, you are encouraged to discuss it with your fellow students, either in person or via the course discussion forums on CourseWeb/Blackboard.
- Classroom Environment** I strongly believe in the importance of the diversity of views, experiences, and identities of those in our scientific community. It is my goal that students from all backgrounds and perspectives be welcomed and well-served by this course. If there are aspects of the design, instruction, and/or your experiences within this course that you feel are acting as barriers to your full participation or achievement, please let me know as soon as possible so that we may take steps to address them.
- Classroom Recording** To ensure the free and open discussion of ideas, students may not record classroom lectures, discussion and/or activities without the advance written permission of the instructor, and any such recording properly approved in advance can be used solely for the student's own private use. If you have (or think you may have) a disability such that you need to record or tape classroom activities, you should contact your instructor and the Office of Disability Resources and Services (see below) to request an appropriate accommodation.
- Academic Integrity** Students in this course will be expected to comply with the University of Pittsburgh's Policy on Academic Integrity (<http://www.cfo.pitt.edu/policies/policy/02/02->

03-02.html). Any student suspected of violating this obligation for any reason during the semester will be required to participate in the procedural process, initiated at the instructor level, as outlined in the University Guidelines on Academic Integrity. This may include, but is not limited to, the confiscation of the examination of any individual suspected of violating University Policy. Furthermore, no student may bring any unauthorized materials to an exam, including dictionaries and programmable calculators.

Disabilities If you have a disability for which you are or may be requesting an accommodation, you are encouraged to contact both your instructor and the Office of Disability Resources and Services (<http://www.drs.pitt.edu/>), 140 William Pitt Union, (412) 648-7890, drsrecep@pitt.edu, (412) 228-5347 for P3 ASL users, as early as possible in the term. DRS will verify your disability and determine reasonable accommodations for this course.

Absences & Make-Up Policy If you must miss a required class activity or exam for any reason, please contact me as soon as possible so that we can make alternate arrangements.

While some exceptions may apply, make-up work will generally only be offered in the case of conflicts with religious observances, documented illnesses, and personal or family emergencies.

CHEM 2600: SYLLABUS SUPPLEMENT

SPRING 2019

WHY A SYLLABUS SUPPLEMENT?

Rationale As you may know, CHEM 1600/2600 is a combined course allowing enrollment by both undergraduate and graduate students. To ensure that grades earned by students enrolled in the graduate course number (CHEM 2600) are truly reflective of graduate-level achievement, graduate students will be required to complete several additional assignments, as described in this supplement to the CHEM 1600 syllabus.

If you have any questions about these requirements, or about how your final grade will be determined, please don't hesitate to ask.

ADDITIONAL COURSE REQUIREMENTS

Overview Students registered for the graduate course number (CHEM 2600) will, in addition to the requirements for CHEM 1600, also be required to complete the following:

- 10 weekly challenge problems;
- A final presentation proposing a brief research project in polymer science, in lieu of the literature review required of students registered for CHEM 1600; and
- A short paper on the topic of their final presentation

Each of these requirements is described in more detail, below.

Challenge Problems Along with each weekly problem set, students registered for the graduate course number will be required to submit a solution to one additional challenge problem. Solving these challenge problems will typically require detailed reading of the textbook, reading papers from the research literature, occasional consultation of other outside sources, and/or mathematical rigor beyond that required for work at the level of CHEM 1600.

Each challenge problem will be worth five points, for a total of 50 points over the course of the semester. You must earn at least 30 points on challenge problems to earn a B in CHEM 2600.

Final Presentation & Paper Instead of the group literature presentation required of students enrolled in CHEM 1600, students enrolled in CHEM 2600 will complete an *individual* project in which they will propose a solution to a current research problem in polymer science. A list of potential topics and topic guidelines will be posted to CourseWeb by the middle of January; students will discuss their choice of topic with the instructor and finalize their choice by the beginning of March.

Students will then complete a short (6-8 page) paper describing their chosen problem and proposing a polymer system and characterization methods suitable for addressing the chosen problem. They will also present their proposal to the class during the presentation week at the end of the semester. These proposals will be graded using the National Science Foundation's proposal scoring rubric: E (Excellent), VG (Very Good), G (Good), F (Fair), and P (poor). Detailed rubrics and expectations will be posted to CourseWeb when the list of topics is sent out.

For planning purposes, students should expect that this project will require significant out-of-class reading and research in the current polymers literature.

GRADE DETERMINATION

Grading Students registered for CHEM 2600 will receive the highest grade for which they meet all of the requirements listed in the following table:

Final Grade	CHEM 1600 Grade (Quizzes & Home- work)	Challenge Problems	Final Paper
A	A	At least 45 points	E
A-	A-	At least 40 points	VG or better
B+	B+	At least 35 points	VG or better
B	B	At least 30 points	G or better
B-	B-	At least 25 points	G or better
C	C	At least 15 points	F or better
F	F	Fewer than 15 points	P or better