

SENIOR THESIS 2024-2025***A message from Prof. Liu,***

Welcome to Senior Thesis! It is important to me that our classroom be a place to learn and explore chemistry research in a welcoming, inclusive, and equitable environment. I want every student to feel like they belong in the class and that their voice and experience is valid and valued, regardless of their race, gender, religious beliefs, and other intersectional identities that enrich their lives. I am aware that we all have implicit biases, and I will try to continually examine my judgments, words, and actions to keep my biases in check and treat everyone fairly. I hope that you will do the same and that you will let me know if there is anything I can do to make sure everyone is encouraged to succeed in this class. If there are any aspects of the instruction or design of the course that result in barriers to your learning, please let me know as soon as possible. I hope that you will feel comfortable contacting me directly, but if you do not, you can also reach out by contacting your thesis advisor or the Chemistry Department Liaisons.

The Senior Thesis Exercise

The senior capstone exercise for all chemistry majors is the Senior Thesis. In this Speaking Intensive course, students will conduct literature research on a field of chemistry and will either propose experiments to be performed in this field (CHEM 191 PO) or report on the unpublished results of experiments that have been performed (CHEM 194 PO). Students will present the results of their work in the form of an oral presentation and a written thesis document.

Materials Required for the Course

- Computer with internet access
- Access to the course Canvas site

Meeting Times:

Fall: Tuesdays, 11:00 am-12:15 pm PT (Location varies)
Thursdays, 11:00 am-12:15 pm PT, Seaver Commons 103
Spring: See calendar

Coordinating Instructor:

Prof. Jane Liu
jane.liu@pomona.edu

Credit (1 credit total):

0.5 per semester, 2 semesters required
Letter grade given at end of second semester

Course Goals

Throughout your studies of chemistry, you have been developing not only your content knowledge, but also skills relevant to professional chemists. The Senior Thesis experience focuses primarily on further developing these skills by asking you to undertake a yearlong project in the field of chemistry. The **overarching learning goals** of the Senior Thesis fall under four broad categories:

1. Be able to interact with data and scientific literature and use critical analysis of this information to guide your own research, including:
 - a. Find and use primary literature relevant to your project
 - b. Thoroughly and properly analyze scientific data
 - c. Relate your own work to previous work in the field
2. Be able to effectively communicate with a broader community of chemists, including:
 - a. Write with a level of sophistication, using accurate terminology, appropriate for a sub-field of chemistry
 - b. Present, orally, your project to effectively engage both a non-expert and an expert audience
3. Be able to take ownership of a research project, including:
 - a. Manage a long-term research project, including the use of scientific reasoning to realistically plan out next steps in the research process
 - b. Achieve independence and direct your own research agenda
 - c. Conduct research in an organized, safe, ethical, and productive manner
4. Be able to be an engaged member of a community of learners, including:
 - a. Contribute constructively to community conversations and in giving feedback to peers
5. Be able to conduct yourself in a professional manner and actively engage with other scientists in the field, including
 - a. Attending research seminars
 - b. Behaving professionally during these seminars
 - c. Asking seminar speakers questions about their research

SUMMARY OF REQUIREMENTS:

First Semester	Second Semester
- Time devoted to research and engagement in the thesis exercise - Contribution to class discussion and group activities - Annotated bibliography I - Annotated bibliography II - Outline of the Thesis Introduction / Literature Review - Intro Presentation - Intro / Lit Review Draft for Peer review - Peer review of a classmate's Intro / Lit Review - Intro / Lit Review - Next steps planning document - Seminar Attendance / Journal	- Time devoted to research and engagement in the thesis exercise - Contribution to class discussion and group activities - Peer review of presentations - Symposium abstract - Presentation / participation at departmental symposium - First submission of full thesis to readers - Final submission of thesis to department - Electronic deposit of thesis to Scholarship@Claremont and to thesis coordinator - Seminar Attendance / Journal

GENERAL INFORMATION

Engagement and Time Devoted to Research

All thesis authors need to spend sufficient time engaged in thesis activities during each semester. This means that the thesis author is spending time each week on the thesis exercise, including conducting literature research, writing, preparing presentations, attending the class sessions, and participating in group activities. Note: for the 191/194 course, “research” is defined as engaging with the literature and synthesizing ideas for experimental research to be performed. If a thesis author will be writing about data that they will be generating themselves experimentally, that work will be conducted separately from the CHEM 194 course. These authors should enroll in CHEM 199 (Independent Research) with a faculty researcher. (Usually 0.5 credit for 1 afternoon/week, 1 credit for two afternoons/week)

Grading for Senior Thesis

Your course grade will be based on your final thesis document, your final thesis presentation, and your participation and engagement in the thesis exercise throughout both semesters, including meeting the deadlines indicated. Specific rubrics for your written document and oral presentation will be provided.

Distinction in the senior exercise. The department, in consultation with the first and second readers, occasionally awards distinction in the senior exercise to recognize particularly exceptional thesis work that has been recognized with an A letter grade. Distinction can be awarded for several different reasons, including exceptional commitment, creativity, or independence in executing undergraduate research and/or the thesis process, or writing a thesis comprised of text which has served or will serve as the starting point for a peer-reviewed journal article. The lack of sufficient product(s) to evaluate or unethical behavior (e.g., plagiarism) while conducting the senior exercise may result in a failing grade (F).

Academic Accommodations

Your experience in this class is important to me and the entire Chemistry Department. Pomona College is committed to making all courses accessible for everyone and Prof. Liu is committed to making this course accessible to you. I encourage you to meet with me early in the semester to discuss your Accessibility Resources and Services (ARS) authorized accommodation needs for this course.

If you need academic accommodations or have any questions about the accommodations procedure, please contact ARS in the Dean of Students office at disability@pomona.edu or 909-621-8017.

The Center for Speaking, Writing, and the Image

The **Center for Speaking, Writing, and the Image** (formerly The Writing Center) opens at **full capacity after the second week of the semester**, but and will be holding **limited appointments and drop-in hours as soon as classes begin**. Writing and Speaking Partners meet one-on-one with students to talk about their work and provide feedback at any stage of their preparation process. Trained to think deeply about written, oral, and visual rhetoric and communication, these student peers facilitate conversations about everything from ID1 papers to senior theses, lab reports to creative writing, giving presentations to developing strategies for reading and engaging more deeply and confidently in class discussion. Jenny Thomas, Asst. Director of College Writing and Language Diversity, offers specialized writing and speaking support for multilingual students navigating English as an additional language. To make an appointment with a Writing or Speaking Partner, please log onto the Portal and go to Academics > Writing Center or contact us at writing.center@pomona.edu. They offer both in-person and virtual appointments, and they have regular drop-in hours in SCC 148.

Mental Health

It is common that college students experience a great deal of stress. In a class of this size, there will likely be a number of individuals who are going through hard times and who are experiencing psychological difficulties. You are not alone, there are many people who care about you and are here for you. If you are feeling miserable, or you think you are experiencing psychological problems, please do seek help! If you think you may benefit from psychological help, please make an appointment to see someone at Monsour Counseling and Psychological Services (MCAPS), 909-621-8202.

Special circumstances:

If there are any special circumstances which should be taken into account with regard to any of the stated class policies, please reach out to me and we will work together to make alternative arrangements.

TIMELINE AND GUIDELINES (subject to change; also see attached calendars; all times are PT)

Seminar attendance and participation

The 5Cs chemistry seminar series is a great way to learn about research that is in progress in a variety of areas of chemistry. Attending the seminars will help you develop your abilities to engage chemistry at a professional level. Students are required to participate in the 5C's Chemistry seminar series. Participation constitutes attendance, a seminar speaker background presentation, and keeping a seminar journal:

Attendance: Students are required to attend at least 5 chemistry seminars in the fall semester. In the spring semester, students are required to attend 8 seminars and ALL of the Robbins lectures. The purpose of this requirement is to develop your abilities to engage chemistry at a professional level. *Dates:* Seminars take place on most Tuesdays from 11:00-12:15. The Robbins Lecture series will take place the week of February 24, 2025.

Specific dates and details: <https://www.pomona.edu/academics/departments/chemistry/seminars>.

Seminar Journal: Students will chronicle their seminar attendance by answering a few brief questions about each presentation attended – there are questions to be completed BEFORE and AFTER the seminar. More details about this assignment, including a template for the seminar journal entries, can be found on the course Canvas site. This document will be used as part of your final evaluation.

Fall Seminar Journal Due Date: Tuesday December 3, 2024, 11:59 pm

Spring Seminar Journal Due Date: Tuesday, April 29, 2025, 11:59 pm

First Semester, Fall 2024

Week 1: Orientation

Date: 11:00 a.m., Thursday, August 29

Outline of course, goals for the exercise, thesis requirements, and deadlines are discussed.

Week 2: What is A Literature Review?

Date: 11:00 a.m., Thursday, September 5

Week 3: Research Notetaking Strategies

Date: 11:00 a.m., Thursday, September 12

Submit Annotated Bibliography I

Due Date: 11:59 pm, Thursday, September 12 (electronic copy)

Present 5 annotated references (primary or secondary scientific papers) that provide background on the overall topic that you are tackling. Remember – this is a chemistry thesis project, so your overall project must involve some sort of molecular interaction and/or address some fundamental issue of chemistry. While some of your references may provide more general background information, at least 1-2 should make it *clear that chemistry is relevant to your project*. The department uses this document to provide students with feedback regarding their thesis topic/scope, and to assign faculty as readers.

Week 4: What's the Plan?

Date: 11:00 a.m., Thursday, September 19

Week 5: Career Exploration

Date: 11:00 a.m., Thursday, September 26

Week 6: Work session w/ STEM Librarian

Date: 11:00 a.m., Thursday, October 3

Submit Annotated Bibliography II

Due Date: 11:59 pm, Thursday, October 3 (electronic copy)

Present 10 more annotated references (primary or secondary scientific papers) that are relevant to your literature review. You will need references that:

- Provide context for your question and your proposed experiments.
- Provide support for any claims you plan to make
- Provide support that the question you are asking is an important and unanswered one
- Help you develop your experimental approach (perhaps a similar study was done?)

Week 7: Outlines

Date: 11:00 a.m., Thursday, October 10

Submit an Outline for your Introduction / Literature Review

Due Date: 11:59 pm, Thursday, October 10 (electronic copy)

Week 8: Prepare for Introductory Presentations

Date: 11:00 a.m., Thursday, October 17

Week 9 + 10: Introductory Presentations

Dates: 11:00 a.m.-1 p.m., Thursdays October 24 & 31, Seaver North Auditorium (Extended Session)

The purpose of this exercise is to provide you an early opportunity to communicate orally an overview of your thesis project: What is the major question being asked and how will the question be addressed. The target audience for this presentation is any faculty member in the Chemistry Department – so someone who has a degree in chemistry, but is not necessarily an expert in your particular field.

You will give a brief (~6-8 minutes, suggested no more than 6 PowerPoint slides) introduction to your project. This is an opportunity to share with the chemistry faculty and your peers the project that you are undertaking for the year. This presentation should focus on your literature review and background research, rather than on experimental work that has been done or is planned. The goal is to present the context for the experiments that will be proposed or reported on in the final presentation in the Spring Semester.

All students are expected to attend the presentations and provide anonymous feedback to the speaker via a survey that will be administered after each presentation.

Week 11: The Introduction / Lit Review of your Thesis

Date: 11:00 a.m., Thursday, November 7

Submit a Draft of your Literature Review for Peer Review

Due Date: 11:59 pm, Thursday, November 14 (electronic copy)

Thesis authors submit a complete draft of their Introduction / Literature Review, which will then be read by at least one peer, who will provide feedback. This process is meant to give feedback such that a thesis author can review and make edits to their Introductions / Literature Review before submitting it to their thesis readers for formal evaluation. While this draft will not be formally assessed, it is respectful and appropriate to submit a draft of your Introduction / Literature Review that is in a complete state—that is, it is worth your classmate's time and energy to read it and give you feedback.

Submit your feedback on the Introductions / Literature Reviews written your Peers

Due Date: 10:59 am, Thursday, Nov 21 (electronic copy)

Submit your Introduction / Literature Review

Due Date: 11:59 pm, Thursday, November 26 (electronic copy)

The purpose of this Introduction / Literature Review is to provide context for any analysis or proposal you present later in your thesis. That is, the document provides the necessary background to understand your own work. The document also reveals what open questions remain. By providing background, you will make clear what work still needs to be done and, thus, highlight the relevance of your own contributions to the field. At the end of your document, both you and your reader should know the question(s) you want to address in the remainder of your thesis.

Logistically, by writing this section first, the process of reading and writing will also help you identify gaps in knowledge. If the aim of your thesis is to ultimately propose a research plan for experiments to be done, then this process is critical to help you know what questions you should be asking and what the best experiments would be to address those questions. If the aim of your thesis is to report on unpublished experiments that were actually done (by you or someone else), then this process is critical to help you explain why those experiments were done in the first place.

The target audience for this section is someone with a foundation in chemistry -- not necessarily an expert in the field. Students should refer to the Architecture of an Excellent Chemistry Senior Thesis rubric for more details on what should be included in the Introduction / Literature Review.

The purpose of this draft is to provide a checkpoint for both the student and the thesis advisor(s) regarding the progress of the student in developing an understanding of their thesis project

Submit a Next Steps Planning Document

Due Date: 11:59 pm, Wednesday, December 4 (electronic copy)

After you've written your literature review, use what you've learned during that process to propose an experimental plan that you will write about in the rest of your thesis document. This might be an experimental plan for experiments you are proposing to do, or it might be an experimental plan for experiments that you are actually going to do (or are in the process of doing). Provide a statement of the objective of your experimental plan (what question you are hoping to address). Try to be very specific here – your question or objective should be addressed/testable with 1-2 well-designed experiments. Try to be explicit too about how your experimental plan involves chemistry.

Mid-year evaluation

TBA with advisor. Communication method to be arranged with advisor.

Students are expected to contact their thesis advisor and arrange for a meeting to occur no later than Friday, December 13 to discuss their progress in their project and next steps. The purpose of this meeting is

to discuss the student's mid-year evaluation (a blank example is included at the end of this syllabus) and make preliminary plans for a successful completion of the thesis in the second semester.

Second Semester, Spring 2025

Orientation Meeting

Date: 11:00 a.m., Thursday, Jan 23

We will go over the format for the spring semester. The spring semester of the thesis course is far less structured than the fall semester.

Thesis symposium presentation abstract and discussant assignment

Due Date: 11:59 pm, Friday, February 21, 2025 (submit via Canvas).

Students are expected to submit an electronic copy of the abstract of their oral presentation in advance of the symposium. The document must be a single page in length and include 2-3 key references and may contain a representative figure (optional but strongly suggested). You must use the template provided on Canvas for the abstract, whose format includes Times New Roman, 12-point font, single-spaced, 1-inch margins. The abstract will be published in the Chemistry Senior Thesis Symposium proceedings. With their abstract submission, students should also indicate (via email to Prof. Liu) who will serve as the discussant for their talk.

Participation in the chemistry thesis symposium

The Thesis Symposium is scheduled for **Thursday, March 6 and Friday March 7, 2025. (Specific times will be arranged and communicated by the Instructor)**. Students are required to fully participate in the Chemistry Senior Thesis Symposium. Full participation includes preparing for the symposium by giving a peer-reviewed practice talk, presenting at the symposium, and attending the symposium.

Students are expected to give a 25-minute presentation. An additional five minutes will be allocated for questions and discussion. Students must submit a copy of their PowerPoint presentation to Canvas by 8 am of the day of their presentation so that all presentation files will be readily accessible throughout the symposium. The purpose of this presentation is to showcase your senior thesis project – the question(s) you asked, the significance of the project, what you did to address the question and potential future directions. Your presentation needs to satisfy both a broad audience (your peers and the chemistry faculty), but also needs to appeal to your primary and secondary readers (experts in the field). Students should refer to Presentation Assignment and the Presentation Rubric on Canvas for more details on what should be included in the presentation.

Peer review/practice: Students are expected to present at least one formal practice talk to an audience made up of your peer reviewer partner in advance of the Senior Thesis Symposium. It is also recommended that you give a practice presentation to your research advisor, if they are willing and available, so that you can benefit from their advice before giving the final presentation. Guidance for giving feedback to your peers can be found on Canvas.

Attendance: With the exception of academic conflicts, all senior and junior chemistry majors are expected to attend all of the talks. Seniors who elect to attend only a portion of the symposium will not meet this particular thesis requirement, regardless of the quality of their own presentation.

Peer review of thesis

Due date: 11:59 pm, Thursday, March 27, 2025

Thesis authors submit a complete draft of their thesis, which will then be read by at least one peer, who will provide feedback. This process is meant to give feedback such that a thesis author can review and make edits to their thesis before submitting it to their thesis readers for evaluation. While this draft will not be formally assessed, it is respectful and appropriate to submit a draft of thesis that is in a complete state—that is, it is worth your classmate's time and energy to read it and give you feedback.

Submission of full thesis manuscript

Due Date: 11:59 pm, Monday, April 7, 2025 (electronic copy)

Faculty readers will meet with their students and relay individual comments/suggestions to them no later than Monday, April 14, 2025

This is not a rough draft; it should be your final draft representing your best effort. Your readers will read it and make final corrections/suggestions and return it to you within a week so that you can make any edits needed to produce your final manuscript. Students should refer to the Thesis Rubrics for more details on what should be included in the final manuscript.

Submission of final thesis manuscript

Due Date: 11:59 pm, Friday, April 18, 2025

Use the input of your first and second readers to revise your thesis and submit a final copy via Canvas. Your manuscript should be in PDF format, with the following title: LASTNAME_finalthesis.PDF. This is the version that will be discussed to assign final Senior Thesis grades.

Binding and publishing your thesis

Due Date: 5 pm, Friday, April 25, 2025

For Bound copies of your thesis, **e-mail** duplication services at Duplicating@pomona.edu. Ask for **three bound copies**. Lauri has sent your names to them, so they are expecting them. They should charge the Chemistry department. You will receive instructions on how to submit things. **Please cc' Prof. Liu when you submit this copy**. One copy will go to the department. One copy will go to your primary thesis reader. One copy will go to you.

Submit an electronic copy of your thesis to scholarship@claremont. Instructions are at the link below. This requires a bit of time, so give yourself ~30 min (including registration). **Please e-mail your primary reader and Prof. Liu when you have confirmation that it has been submitted.**

For a thesis where experiments were conducted:

If you are doing an experimental thesis, you must add your research advisor as an author. They will ultimately decide to access the document (second link explains it all).

For a thesis where experiments were proposed:

Otherwise known as a literature thesis, you do not need to list anyone other than yourself as an author. If you are not sure, please contact your primary advisor.

How to submit (click link below): <https://library.claremont.edu/wp-content/uploads/2022/04/2022-S@C-General-Upload-Instructions.pdf>

How does scholarship@claremont.edu

work? https://docs.google.com/document/d/14LGKC7vDQUVB1z7qEL1QML7hDgVJ4-Z3E_SvD_nhwm8/edit?usp=sharing

MID-YEAR EVALUATION OF CHEMISTRY SENIOR THESIS PARTICIPANT

December 2024

Student Name:

First Reader:

Second Reader:

The feedback listed below is intended to assess whether you are making significant progress towards your senior thesis. If areas for improvement are identified, you have time until the end of the second semester to improve. The assessment provided below should be taken as an indicator of areas where the expectations of the chemistry senior thesis are being met, as well as areas where the work to date only partially meets or does not currently meet expectations.

Area	Does Not Meet	Partially Meets	Meets
The student has devoted sufficient time and effort on the project			
The student understands the goals, details, and concepts/theories relevant to the project			
The student demonstrates engagement and the ability to work independently			
The student has attended class sessions and engaged in group discussions and peer evaluation exercises.			
The student has attended the minimum number of 5C chemistry seminars and has completed a seminar journal			
The student has presented an Introduction / Literature Review (both written and oral)			
The student has submitted a Next Steps document that outlines the planned work they will engage in next semester			
The student has written their Introduction / Literature Review. Any additional materials required by advisor have been included.	Letter grade:		

Specific comments from readers/department:

Interpreting your feedback:

Meets or Partially Meets will be the most common assessments of your thesis work. An assessment of Partially Meets indicates that there are aspects of your work that require additional attention, time, and work to understand concepts or independent thought. An assessment of Does Not Meet signals significant problems with your work. An assessment of Does Not Meet in more than one area provides the basis for the department to assign a year-end course grade that is significantly below the norm.

YEAR-END EVALUATION OF CHEMISTRY SENIOR THESIS PARTICIPANT

May 2025

Student Name:

First Reader:

Second Reader:

The feedback listed below is intended to provide you with feedback on the second semester of Senior Thesis and to provide you with a rationale for your course grade.

Area	Does Not Meet	Partially Meets	Meets
Engagement of Thesis Project, Seminars and Workshops (10%)			
The student has devoted sufficient time and effort on the project			
The student understands the goals, details and concepts/theories relevant to the project			
The student demonstrates engagement and the ability to work independently			
The student has attended class sessions and engaged in group discussions and peer evaluation exercises.			
The student has attended the minimum number of 5C chemistry seminars and has completed a seminar journal			
The student has met and adhered to all deadlines set by thesis advisors			
Departmental Thesis Symposium (30%)			
The student has written a clear presentation abstract			
The student has presented their thesis work at the departmental symposium	Letter grade:		
The student participated fully in the departmental thesis symposium			
Thesis Manuscript (60%)			
The student has met the requirements for submitting a graded thesis manuscript (on time), has responded collegially to the comments and suggestions by both readers, and has filed a bound thesis manuscript with both readers and the department	Letter grade:		
At the end of the second semester, students are awarded a letter grade for Senior Thesis. Your grade is indicated at right.			

Fall 2024

SUNDAY	MONDAY	TUESDAY	WEDNES.	THURS.	FRIDAY	SAT.
AUG 25	26 CLASSES START	27	28	29 ORIENTATION	30	31
SEPT 1	2 NO CLASSES	3	4	5 LIT REVIEWS	6	7
8	9	10	11	12 NOTES AB I DUE	13	14
15	16	17	18	19 RES PLAN	20	21
22	23	24	25	26 CAREER	27	28
29	30	OCT 1	2	3 RESEARCH AB II DUE	4	5
6	7	8	9	10 OUTLINES OUTLINE DUE	11	12
13	14 FALL RECESS	15 FALL RECESS	16	17 PRESENTATION PREP	18	19
20	21	22	23	24 INTRO TALKS	25	26
27	28	29	30	31 INTRO TALKS	Nov 1	2
3	4	5	6	7 WRITING PREP	8	9
10	11	12	13	14 DRAFT DUE	15	16
17	18	19	20	21 PEER REVIEW DUE	22	23
24	25	26 INTRODUCTION DUE	27	28 THANKSGIVING	29	30
DEC 1	2	3 SEMINAR JOURNALS DUE	4 NEXT STEPS DUE	5 READING DAY	6 READING DAY	7
8	9 FINALS	10 FINALS	11 FINALS	12 FINALS	13 FINALS	14

Spring 2025

SUNDAY	MONDAY	TUESDAY	WEDNES.	THURS.	FRIDAY	SAT.
19	20	21 CLASSES START	22	23 ORIENTATION	24	25
26	27	28	29	30	31	FEB 1
2	3	4	5	6	7	8
9	10	11	12	13 PRESENTATION PREP	14	15
16	17	18	19	20	21 ABSTRACT DUE	22
23	24 ROBBINS	25 ROBBINS	26 ROBBINS	27 ROBBINS	28	MAR 1
2	3	4	5	6 THESIS SYMPOSIUM	7 THESIS SYMPOSIUM	8
9	10	11	12	13	14	15
16	17 SPRING BREAK	18 SPRING BREAK	19 SPRING BREAK	20 SPRING BREAK	21 SPRING BREAK	22
23	24	25	26	27 PEER DRAFT DUE	28 NO CLASSES	29
30	31	APR 1	2	3	4	5
6	7 THESIS DUE	8	9	10	11	12
13	14	15	16	17	18 FINAL THESIS DUE	19
20	21	22	23	24	25	26
27	28	29 SEMINAR JOURNAL DUE	30	MAY 1	2	3
4	5	6	7 LAST DAY	8 READING	9 READING	10