

**CHEM 108M – Organic Chemistry II Lab****Instructor:** Dr. Caitlin Binder**Email:** cambinde@ucsc.edu**Office Location:** Thimann Labs 313**Office hours:** W 3-4pm

Th 9:15-9:50am (Baskin 152)

**Teaching Assistants & Office Hours** – all students welcome in any TA's office hours

Gabriella Amberchan (gamberch@ucsc.edu), Mondays 9 – 10 am, PSB 341

Miguel Pinto (mnpinto@ucsc.edu), Wednesdays 4 – 5 pm, PSB 341

Ana Kareh (akareh@ucsc.edu), Mondays 12:15 – 1:15 pm, PSB 253

Ian Colinas (icolinas@ucsc.edu), Mondays 4 – 5 pm, PSB 253

**Course Prerequisites:** CHEM 108L and previous or concurrent enrollment in 108B.**Course Fees:** \$55 materials fee

**Course Description:** CHEM 108M (2 units) builds on the isolation and purification techniques learned in the 108L, including liquid-liquid extraction, chromatography, and distillation. Synthetic organic chemistry is a broad and exciting field that requires careful analysis of compounds, many of which are clear liquids and white solids (maybe not so exciting color-wise!). Students will become proficient in compound characterization *via* gas chromatography (GC), thin-layer chromatography (TLC), infrared (IR) spectroscopy, and nuclear magnetic resonance (NMR) spectroscopy. Technical scientific writing skills are emphasized.

**Required Materials**

- Access to the **course website** (<https://acrochem.sites.ucsc.edu/chem-108m/>)
- Mohrig, JR; Hammond, CN; Schatz, PF "Techniques in Organic Chemistry, 4<sup>th</sup> Edition" Freeman, 2010 (previous or newer editions are okay too, but pay attention to titles as section numbers may be different)
- Lab Notebook and approved safety goggles (shared goggles & lab coat)
- *Optional:* You may purchase your own lab coat and safety goggles.

**Enrollment and Make-up Policies** – see also page 5 for more details

- Enrolled students must be present and prepared at the first lab meeting. If you are more than **15 minutes** late for the first lab, **you will be dropped from the course.**
- Starting the second meeting of lab, you cannot be more than **two minutes late** for lab.
- There will be **no section switching.**
- There will be **no lab make-ups in summer session.**
- If you miss or come to lab late, unprepared, or are asked to leave the lab for violating safety rules, you are **not eligible for a make-up and will take a zero for the results portion of the lab,** at minimum. You may still receive credit for pre-lab questions and notebook pages if you make arrangements before the end of the lab period. You are also responsible for turning in the lab report due that day, if applicable.
- Consult the schedule for experiment due dates. Assume **no late lab reports** will be accepted unless **prior permission** is given by your TA in writing/e-mail before the due date. *Missing one full report means you drop one letter grade (ex. A to B).*
- *If you do not turn in two reports or if you miss two labs, you cannot pass the course.*

**Disability Accommodation**

If you qualify for classroom accommodations because of a disability, please submit your Accommodation Authorization Letter from the Disability Resource Center (DRC) to me as soon as possible, *preferably during the first week of summer session II.* Contact DRC by phone at 831-459-2089 or by email at drc@ucsc.edu for more information.

**Academic Integrity** - [https://www.ue.ucsc.edu/academic\\_integrity](https://www.ue.ucsc.edu/academic_integrity)

Students work in pairs on several labs and are encouraged to discuss experiments with each other, but *each student turns in an individual lab report*. The work you turn in should be your own. Avoid copy/pasting from someone else's work. Instead, you may talk about thoughtful responses and put it in your own words. Your TA will on the look out for blatant copying – it is pretty obvious! *Zero points will be assigned to duplicate lab reports, or sections of lab reports that are obviously copied, at the TA's discretion*. The following are a few clarifications to avoid issues.

- Both students in a lab pair must perform roughly the same amount of hands-on lab work. If a TA finds only one student is performing the lab out of a pair, a warning will be issued. A second offense will result in dismissal from the lab and possibly from the course.
- Each student records his/her own raw data, not to be copied from a lab partner unless specifically instructed to do so.
- All calculations and analyses must be performed individually before comparing answers with another student.
- The technical writing assignments (abstracts & experimental methods) are to be completed individually using the provided guidelines. Lab partners are encouraged to proofread each other's work only after a draft has been completed. Consult the TA for help as well.

**Lab Conduct**

**Safety first!** Not safety "top ten." With more advanced labs, comes the responsibility of more potentially dangerous chemicals and procedures. Students are expected to act responsibly in lab. A comprehensive list of safety rules can be found later in this syllabus. An abbreviated version is below:

- No food or drink in the lab
- Wear proper attire and arrive to lab on time.
- No running, or otherwise 'horsing around' during lab; keep belongings out of the way
- Take care of chemical spills immediately; consult the instructor
- Keep your work station clean and follow instructions on washing glassware
- Be sure you understand the full procedure before beginning an experiment.
- Pay attention to waste procedures and chemical hazards
- Label all glassware at every stage of an experiment
- Help your lab-mates clean up if you are done early
- **ABSOLUTELY NO GLASS IN THE TRASHCANS, INCLUDING PIPETS**

**Classroom Conduct**

*Students are expected to treat their instructor and fellow students respectfully!*

Attendance to every lecture is mandatory and necessary for successful completion of this course. An introductory lecture will be given on each experiment to aid in your preparation, as well as tutorials on scientific writing. Quizzes will be given in lecture periodically.

\* You are welcome to ask questions in lecture. It's more fun that way!

\* Come to class on-time, stay for the duration, and stay in your seat.

\* Please do not talk while the instructor is talking.

\* **CELL PHONES OFF AND AWAY!**

\* Do not take pictures in class. Write notes by hand.

\* **Electronic devices are not permitted in the classroom** unless *prior permission* is obtained from the instructor and/or special accommodations are needed.

**Description of Assignments:**

Experiments and certain reading assignments are online. Additional reading assignments are from Mohrig, *et. al.* "Techniques in Organic Chemistry, 4<sup>th</sup> Edition." The schedule of reading assignments is on the last page of the syllabus. Read each section thoroughly before lecture and lab. Arrive to lab on time with a prepared lab notebook per the guidelines below. You cannot bring/use the text or handouts in lab unless otherwise instructed.

**Notebook preparation:** Your TA will check your lab notebook before you begin the lab. If your notebook is not properly prepared, you will be asked to leave, you will receive zero points for the results sections of the lab, including abstract and experimental methods, and you will not be eligible for a make-up. See *sample notebook page provided online and read specific instructions in lab handouts*. Write in pen (no pencil). If you make a mistake, use a single-line strike-through (no scribbles), NO WHITE-OUT!

- Experiment Number, Title, Your Name, Lab Partner Name, Date, Section Day/Time
- Purpose (as a reaction scheme with structures, see specific notes in each lab handout)
- Reagent Table
  - For each chemical used, make a table with its chemical name, molecular mass, moles used (mmol), mass or volume used (mg or mL), molar equivalents (for reactions only) bp/mp, density, and relevant hazards (flammable, corrosive, lachrymator, pyrophoric, hygroscopic, etc.)
- **Full hand-written, step-by-step procedure with pictures.** DO NOT copy directly from the handouts. This should be in your own words. You can number your procedure, use bullet points, or any other format that will be useful to you or a lab mate in easily following your own instructions in the lab. The included pictures should be of glassware, especially if it's new to you, and/or some type of flow chart that complements your written procedure. This is not a substitute for the hand-written procedure.
- **Waste and Clean-up Notes.** Pay attention to notes in the handout and announcements in lecture/lab.

**Introduction (Pre-Lab Questions)**

- **Responses to pre-lab questions** are to be written in complete sentences, neatly *typed*, printed, and handed in to your TA at the very beginning of the lab period (as you walk in the door).
- DO NOT re-type the question.
- You may leave space to hand-write structures, mechanisms, calculations, etc. in PEN. Responses in pencil will not be graded.
- *This is your only opportunity to get credit for the pre-lab questions, no exceptions.* Pick up the initialed pre-lab questions before leaving lab and include them in the lab report in the order stated in the grading rubric.
- The pre-lab questions will not be graded if the TA's initials are not present. Altering pre-lab questions after turning them in would qualify as academic dishonesty and you will receive zero points for that section of the lab report. A second infraction will not be tolerated (see section on Academic Integrity above).
- **Get help with your introduction before it is due!**

In-lab Quizzes – There will be a short quiz at the beginning of lab to assess your preparation. If you read the lab handout and put thought into the pre-lab questions, this should be easy! If you are late to lab, you cannot take the quiz.

**Lab Reports**

Reports are due in the beginning of lab on the due date (see schedule) and are to be **typed** (with the exception of notebook pages, figures, structures, and calculations) in the format outlined below and according to technical writing guidelines provided on the first day of lab and posted online.

The components are as follows. *No single lab report will contain all of these components.* Consult the specific grading rubric found at the end of each lab handout. The lab report must be in the order indicated in the grading rubric. Your TA may have specific instructions or expectations. Please pay attention to in-class announcements and **get help with your pre-lab questions and reports before they are due!**

- **Abstract** – refer to *Technical Writing Guidelines*
  - Contains purpose, procedure overview, main result(s), and conclusions.
- **Introduction** - original pre-lab responses with TA initials, see description on previous page
  - Enumerate the questions and separate each question into its own paragraph.
  - Reword the question into your answer. Do not re-write the question itself.
- **Results** – Typed responses to in-lab questions in complete sentences
  - You may hand-write calculations, structures, and mechanisms.
  - Reports due at the end of lab – results section hand-written in the lab notebook
  - Relevant tables should be given clear labels (**Table 1**, etc.) and a descriptive title.
- **Experimental Details and Characterization** – refer to *Technical Writing Guidelines*
  - One **General Methods** paragraph
  - One additional paragraph for each reaction performed
- **Lab Notebook Pages** – the only hand-written component
  - Tear out the carbon-copy pages from your notebook for that lab and attach to the lab report. DO NOT re-write or alter your experimental notebook pages once the lab is completed, except to complete calculations or analysis.
  - TA initials for leaving lab with all the proper data and analysis.
- **Pre-Lab Quiz, Neatness & Organization**, 10-15% of each report.
  - Refer to report guidelines in the syllabus, experiment handout, and technical writing guidelines when putting together every report.
  - Student workspace and locker will be checked for cleanliness at each lab.
- **Lab Technique**, 5-10% of each report
  - Students will be assessed on their ability to safely carry out experiments using proper techniques as described in the safety rules (p. 5-6), experiments posted online, and any other demonstrations or instructions given by TAs in lab.

**Lab Practical Exam (25%)**

- Each student will perform this experiment individually using the provided procedure (no notebook) in 1 hr, 45 min without help from classmates or the TA (no talking).
- Your lab practical time will be assigned as either the *first or second half of your regular 4-hour lab time*. *If you come at the wrong time, you will get a zero for the exam.*

**Tentative Grade Distribution** – any changes made will be to your benefit.

A+ 98 – 100%	A 93 - 97	A- 90 - 92
B+ 88 - 89%	B 83 - 87	B- 80 - 82
C+ 78 – 79%		C 70 - 76
D 55 - 69		F < 55

**COURSE ASSESSMENT**

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**Assignments Overview**

- \* Read **lab handouts and text assignments** before lecture and to prepare for lab.
  - \* Prepare your **lab notebook** and **pre-lab questions** before each lab (see guidelines).
  - \* Be prepared for a short **pre-lab quiz** at the beginning of every lab.
  - \* Six individual **lab reports** (see due dates on schedule).
  - \* **Final Lab Practical Exam** assessing student's ability to complete an experiment & analysis.
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**Grade Breakdown****1000 Point Scale:**

(10 points, 1%) **Clean-up Day (Thursday August 27<sup>th</sup>)**

(40 points, 4%) **Orientation Activities (Safety, Writing, & Error)**

(700 points, 70%) **Lab Reports**

(250 points, 25%) **Final Lab Practical Exam – Tuesday August 25<sup>th</sup> in lab**

\* **During 1<sup>st</sup> or 2<sup>nd</sup> half of regularly scheduled lab – pay attention to your assignment!**

\* **Students must get a minimum of 60% on the final lab practical exam to pass the course, even if lab report grades are in the passing range.**

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**Grading Policies**

\* **Students are to keep a record of their own graded assignments.**

\* Grading rubrics indicate total possible point values for each lab report.

\* **Students must perform all labs and turn in all lab reports.**

\* Missing one full lab report will drop one letter grade.

\* Missing two labs - grade is dropped to a D and student will have to re-take the course.

\* No make-up labs are provided in summer session.

\* **Email your TA (cc Dr. B) as soon as possible** if you will miss lab or if you will be more than 2 minutes late to lab. We will consider partial credit on a case-by-case basis **as long as students communicate with us before the lab is over. Don't forget to turn in the lab report if there's one due!**

\* The following conditions will keep students from performing the lab...

\* Arriving to lab unprepared, including missing notebook components and improper attire.

\* Arriving to lab late (more than 2 minutes).

\* Not abiding by safety rules, procedures, or TA instructions.

**For example, if you are late, if you will miss lab, or are not prepared...**

...you should still go to your section as soon as possible to have your TA check your prepared materials and to turn in your lab report, if applicable. You will not be able to make up the lab, but will at least get credit for your preparation (introduction and notebook pages). You will still turn in a lab report the following week and at minimum get credit for the intro and notebook pages (roughly 50% of the report is better than 0%!). You are welcome to complete other parts of the report for feedback, considering how this material will be covered on the final. *This offer expires when your lab is over! If you can't physically get to lab, you must email your TA before lab is over to make arrangements to turn in any reports and get your preparation checked off ASAP.*

\* Assume **no late lab reports** are accepted without prior permission from the TA (before the due date). This is handled on a case-by-case basis. Communicate with your TA.

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**LABORATORY SAFETY RULES AND AGREEMENT**

*"Safety First! Not safety top ten, not safety third."*

Violation of any of the rules below may result in you being removed from the lab and you will receive ZERO POINTS for that lab. A second violation will result in you being dropped from the course. *No make-up labs for students who violate these rules.*

1. **Safety goggles must be worn** at all times when anyone in the room is working with chemicals, especially yourself!
2. **NO food, drinks, or gum** are allowed anywhere in the labs or in your mouth while you're in the labs.
3. **Appropriate lab attire** must be worn at every lab or you will take a ZERO for that lab. No make-up labs will be offered to students who are not properly dressed.
  - **OK LAB ATTIRE:** Pants or long skirt, short or long-sleeve shirt, closed-toe shoes that cover the entire top of the foot. Long hair and loose clothing are confined or tied back.
  - **NOT OK:** Most summer attire is not appropriate for lab...Shorts or short skirts (no exposed ankles), leggings/tights, tank tops, sandals, ballet flats, or any other shoes that expose the tops of the feet (Crocs and Tom's are NOT OK!). High heels, baggy clothing, and dangling jewelry are strongly discouraged.
4. Lab aprons or coats are recommended (not required) but must be worn over appropriate lab attire (see above).
5. **NO running, fighting, or other acts of mischief.**
6. NO visitors, including pets and side-kicks.
7. Know the locations of fire alarms, fire extinguishers, chemical fume hoods, safety showers, and emergency eye washes.
8. Notify your instructor immediately of any injury, spill, fire, or explosion. You may clean up small spills (less than a few milliliters) yourself, but let the TA know. You're not in trouble unless you do it on purpose!
9. Keep your lab space clean and organized. Backpacks, purses, jackets, phones, etc. are not allowed where chemicals are being used.
10. Never leave an ongoing experiment unattended. If you need to leave the room, be sure a neighbor is watching your experiment.
11. Unless otherwise specified, dispose of broken glassware in broken glassware boxes only, including ceramics and disposable glass pipets. NO paper or other items in the broken glass boxes. **NO PIPETS OR OTHER GLASSWARE IN THE TRASH!** Not cool and you'll lose points.
12. DO NOT TASTE ANYTHING IN THE LAB. EVER.
13. Never remove chemicals or equipment from the labs or stockroom without proper authorization.
14. NO unauthorized experiments. Stick to the given procedure.
15. Follow appropriate procedures for inserting glass into a stopper and/or have the stockroom or your TA assist you. Seriously, students stab themselves when they're not paying attention.
16. Wash your hands and arms with soap and water before you leave the lab, even if you've been wearing gloves.

17. Always know the hazards as well as the physical and chemical properties of the materials used. Your lab notebook should include a brief note on the safety hazards for each chemical being used based on Material Safety Data Sheets (MSDS) available online.
18. Read labels carefully. Read labels twice. Know what you're working with!
19. Label all containers with chemical/mixture names, your name, and the date **before** anything goes into that container.
20. Use plungers and pipet bulbs with glass pipets. NEVER pipet by mouth. It's gross.
21. Check all glassware for cracks and cleanliness before using...or you'll be sorry later that you didn't.
22. Avoid contamination. Take only what you need from reagent bottles and NEVER return unused chemicals to the original bottle that other students are sharing.
23. Add acid to water when making solutions.
24. Wash all glassware before leaving lab for the day.
25. **Dispose of all waste as instructed in the lab handout or by the TA.** Read waste container labels carefully to be sure it's going to the right place. Waste containers are typically in the fume hoods. Let your TA know if a waste container is full. **DO NOT LET THE WASTE CONTAINERS OVERFLOW!** Seriously, who does that?
26. NO use of flame in the lab. Nearly everything in the ochem labs are flammable.
27. **Wear gloves** when appropriate in the lab and **change your gloves** if you get chemicals on them. They're cheap! Gloves are only a first line of protection. They do not make you invincible! Take off gloves before you leave the room. **DO NOT touch door handles or your face with gloved hands.**
28. **Minimize chemical exposure** and treat every chemical as if it were hazardous.
29. No cell phones or electronic devices are allowed in the labs. If you'd like to take a picture or video of your experiment, ask your TA for permission, but take your gloves off first.
30. Abide by any additional rules announced by your TA.

**Violation of any of the rules above may result in you being removed from the lab and you will receive ZERO POINTS for that lab. A second violation will result in you being dropped from the course. No make-up labs for students who violate these rules.**

**You will sign a contract on the first day of lab, stating that you agree to abide by these rules.**

## LAB AND LECTURE SCHEDULE

<b>Week</b>	<b>Lecture Topic</b> <i>Reading Assignment</i> <i>"Sections" in Mohrig 4</i>	<b>Labs</b> <b>(Tu/Th)</b> <i>Experiments online</i>
1	<b>7/25</b> Column Chromatography <i>Exp 1; Section 18</i>	7/26 Check-in & Safety <b>Safety, Writing, and Error Analysis</b>
	<b>7/27</b> Acid-Base Extractions <i>Exp 2; Section 11</i>	7/28 - pairs <b>Exp 1</b> Separation of Limonene & Carvone <i>Due 8/2</i>
2	<b>8/1</b> TLC, <sup>1</sup> H NMR Introduction <i>Exp 2; Sections 17, 21 (through 21.7)</i>	8/2 - pairs <b>Exp 2</b> Acid-Base Extraction (Excedrin) <i>Due 8/4 at the end of lab</i>
	<b>8/3</b> Oxidation Rxns; <sup>1</sup> H NMR Chemical Shifts <i>Exp 3; Section 21.7-8</i>	8/4 - pairs <b>Exp 2</b> - Excedrin Analysis <i>Due at the end of lab</i>
3	<b>8/8</b> Esters; <sup>1</sup> H NMR Splitting <i>Exp 5</i>	8/9 - solo <b>Exp 3</b> Oxidation of Benzylol <i>Due 8/11</i>
	<b>8/10</b> <sup>1</sup> H NMR Splitting; Dyes <i>Exp 6; Section 21.9, 21.11</i>	8/11 – solo <b>Exp 5</b> Fruity Fragrances <i>Due 8/16</i>
4	<b>8/15</b> Dyes <i>Exp 6; Sections 4-5</i>	8/16 - pairs <b>Exp 6</b> Synthesis and Application of Organic Dyes <i>Due 8/23</i>
	<b>8/17</b> Aromatic <sup>1</sup> H NMR Splitting <i>Exp 7</i>	8/18 - pairs <b>Exp 6</b> Synthesis and Application of Organic Dyes <i>Due 8/23</i>
5	<b>8/22</b> Esters; <sup>13</sup> C NMR <i>Exp 7</i>	8/23 Writing Workshop and Clean-up <i>*Bring double-spaced draft of experimental methods section for Exp 6, turn in revised full report by 4pm</i>
	<b>8/24</b> <sup>13</sup> C NMR <i>Section 22</i>	8/25 <b>PRACTICAL EXAM</b> <b>Exp 7</b> Synthesis of Aspirin <i>Due at the end of lab</i>