Organic Chemistry II Laboratory - Chem 2325 Syllabus – Fall 2019

INSTRUCTOR: Holly Sebahar, Ph.D. Room: 2416 TBBC Email: holly.sebahar@utah.edu
Office hour: Monday 11:45am-12:35 pm or by appointment

ADMINISTRATIVE ASSISTANT: Ms. Melanie Feeney, 3264 HEB; melanie.feeney@utah.edu

COURSE PHILOSOPHY:
It is important to me that every person feels welcome, every person is included, and every person feels valued. I view the diversity that students and teaching assistants bring to this class as a great strength. It is my intent to present materials and activities that are respectful of diversity: gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture. I may make mistakes. If there is anything that I can do to improve this class for you or other students please let me know either in person, by email, or anonymously.

COURSE DESCRIPTION:
The purpose of the laboratory is to give students hands on experience with the scientific method, teach critical thinking and writing and oral communication skills as well as important techniques to prepare students for advanced work in chemistry and related science and engineering fields, review concepts learned in lecture, and to introduce certain concepts that are well-suited to hands-on discovery.

EXPECTED LEARNING OUTCOMES:
Students that successfully complete this course should be able to:

- Calculate limiting reagent, theoretical yield, and percent yield.
- Engage in safe laboratory practices by handling laboratory glassware, equipment, and chemical reagents appropriately.
- Dispose of chemicals in a safe and responsible manner.
- Work effectively as a member of a team. Communicate productively with lab mates, teaching assistant and instructor.
- Maintain a detailed scientific notebook.
- Use the scientific method to create, test, and evaluate a hypothesis.
- Characterize products by physical and spectroscopic means including mp, IR, NMR, GC, and MS.
- Consult the scientific literature for physical data and experimental procedures.
- Perform common laboratory techniques including reflux, distillation, recrystallization, vacuum filtration, and thin-layer chromatography. Create and carry out work up and separation procedures.
- Critically evaluate data collected to determine the identity, purity, and percent yield of products and to summarize findings in writing in a clear and concise manner.
- Predict the outcome of several common organic reactions using a basic understanding of the general reactivity of functional groups and mechanism.

LECTURES:
Live lecture: Tuesdays from 10:45am-11:35 am in HEB 2008. Lectures will be recorded and posted on Canvas in the Media Gallery immediately after lecture. The recorded lecture from a previous semester will be posted by the Saturday prior to the experiment so students with a Tuesday afternoon lab have time to prepare. Please realize you are responsible for the material covered in the lectures. This information is fair game for the quizzes. The skeleton for the lecture notes will be posted on Canvas. It is recommended that you print these slides (4-slides per page) so that you can fill in only the most important details as you view the lecture.

CREDIT PRE, CO-REQUISITES:
2 credit hours. Chem 2315 must be taken before Chem 2325. Chem 2315 and 2325 may not be taken simultaneously. Chem 2325 may not be taken before Chem 2320.

REQUIRED TEXTS:
Customized Lab Record, or similar bound notebook with carbon copies
Published by Hayden-McNeil
You may use the end of your lab notebook from Chem 2315.

OPTIONAL TEXT:
The Organic Chem Lab Survival Manual (any edition)
Author: James W. Zubrick

COURSE WEBSITES:
CHEM 2325-002 – Organic Chemistry Lab II
Look here to find the lab syllabus and schedule, grades, announcements, spectra, lectures, and experiments. Your TA may choose to maintain a folder for your section. You may email your classmates, TA or the instructor using the Canvas email system. Important: I often send out updates and instructions via Canvas Announcements. You are responsible for this information. Please check the website regularly or change your settings within Canvas to have announcements forwarded to your email.

ASSISTANTS:
The teaching assistants have full responsibility and authority in the laboratory. Please respect their authority by being responsible individuals when a request is made. The TA’s mailboxes are located in HEB 1504. Be sure to put your TA’s name on anything you put in the mailbox because many TAs share mailboxes. Always keep an electronic copy...
of your write-ups. You can also e-mail your write-up to your TA, however please request a confirmation that they received it.

STOCKROOM ATTENDANTS: The stockroom personnel are an integral part of our laboratory team. Please respect their authority and treat them with kindness and respect when making a request.

CHECK-IN: Check-in will occur in the first laboratory period. You are required to bring a combination (not key) lock to share with your lab partner (one lock for 2 people), safety glasses, and a 100% cotton lab coat. Your lock combination number will be left with the attendant for emergencies.

LAB ATTIRE: IMPORTANT!! For your own safety, the following are required AT ALL TIMES in lab: Safety glasses, 100% cotton lab coat, shoes that cover the entire foot, short- or long-sleeved shirt, and pants/shorts/skirt that extend to your ankle. Please tie back long hair. This means NO sandals, shorts or short skirts. If you come to lab wearing inappropriate clothing you will be sent home. You should change clothes and return as quickly as possible. If a large amount of the lab is missed you will be required to come back at a different time to make it up. *We recommend that you keep extra shoes and long pants in a locker. Please ask the TA for an empty drawer if you are interested in this.*

GROUP WORK: In lab and in life group work will be required. Learning to work efficiently and amicably is extremely important. In this course you will work closely with a lab partner. It is imperative that you treat your lab partner with respect and common courtesy at all times. Personality and scheduling conflicts may arise. However, it is your responsibility to maintain open communication with your lab partner so that you can work through potential problems. If your efforts to resolve the issues on your own are unsuccessful, please notify your TA or the lab instructor asap so that we may help. It is recommended you switch lab partners frequently.

POINT BREAKDOWN: 1) Pre-lab/Observations 7 x 5 35 2) Post lab 9 x 40 360 3) Quizzes 8 x 15 120 TOTAL POINTS POSSIBLE 515

GRADING: Your TA should return assignments and enter grades into Canvas approximately one week after an assignment has been turned in. If work has not been returned within two weeks please notify the instructor immediately. Please check your grades early and often to ensure that everything has been entered accurately. Grades will not be changed after the semester has ended. IMPORTANT: Please inform the instructor of concerns regarding the grading of lab assignments early in the semester so that the problem can be addressed. Grades will be normalized at the end of the term to account for slight differences in TA grading. Grades on Canvas do not reflect the normalization. Grades of approximately ≥93% - some form of A; 92-85% - some form of B; 84-76% - some form of C; 75-68% - D. These cutoffs are approximate and I reserve the right to change slightly the cutoffs. You must complete 8 of the 9 experiments to pass the course. If you have experience extraordinary life circumstances please contact Prof. Sebahar to discuss your options.

QUIZZES: Quizzes will be given at the beginning of every experiment. The ONE lowest quiz score will be dropped. The quizzes will cover techniques, chemical concepts, mechanisms, safety, common calculations like percent and theoretical yield, and your ability to draw conclusions from data from the previous experiment. Approximately one third to one half of the quiz will cover the pre and your ability to draw conclusions from data from the previous experiment. Approximately one third to one half of the quiz will cover techniques, chemical concepts, mechanisms, safety, common calculations like percent and theoretical yield, and your ability to draw conclusions from data from the previous experiment. Approximately one third to one half of the quiz will cover the pre and your ability to draw conclusions from data from the previous experiment.

MAKE-UP LABS: Lab make up is only allowed if you miss your regular laboratory section because you are ill, traveling to a conference or other legitimate reason. You may not make up a lab because you skipped your regularly scheduled lab to study for a test, etc. In this case, you will earn a 0 for the lab. A **maximum of two lab make-ups are permitted per semester unless you experience serious life circumstances.** Inform your TA if you know you will be missing a lab. *Please make every effort to make up the lab the same week the lab is scheduled or at the very latest the following week.* To make up the lab follow these steps:

1) First, choose a day and time that you are able to make up the lab. See the class schedule for available times.

2) Download the “Lab Make-up Form” from the Canvas website and fill it out. Please ask the stockroom attendant to sign the form upon arrival to lab. They will keep a record of students making up labs during the semester.

3) Report to the lab room at the beginning of lab. Introduce yourself to the TA and join a lab group. **The TA should grade your pre-lab and quiz and sign your notebook pages and the make-up form before you leave the lab.**

4) No later than one week after making up the experiment staple your quiz, lab notebook pages, the conclusion, and the make-up form together and turn the packet into your TA. You may give your assignment to the TA directly or drop it off in their mailbox (HEB 1504). Notify your TA if you have left an assignment in their mailbox. If the assignment is turned in late, penalties will apply.
CHECKOUT: Checkout will occur at the end of the last lab. You are required to clean all your glassware and review the glassware with your TA. The section will also be responsible for cleaning the common areas of the lab. Failure to check out will result in your grade being lowered one level (e.g., an A- to a B+).

NOTEBOOK: Accurate record keeping is essential to many fields including chemistry. Doctors are required to take accurate, meticulous notes when speaking with patients to guarantee proper medical care; an accountant must keep a carefully detailed record of each transaction to avoid hassle with the IRS; a lawyer’s notes must be thorough and complete to avoid misinformation being presented at a trial. Likewise, the lab notebook is a permanent record of a chemist’s laboratory activities. Chemists often refer to their notebooks when applying for patents and writing scientific papers, and when formulating conclusions before moving forward with a research project. Additionally, the lab notebook is used as evidence when a company is taken to court. Because of these significant implications it is important to learn data collection techniques that prepare you for your future, regardless of your specific field of study. In chemistry 2325 careful record-keeping will be encouraged and enforced.

The goal when writing in your laboratory notebook should be to write clear enough and with sufficient organization and detail such that someone unfamiliar with the subject would be able to repeat your experiment exactly and obtain the same results using only your notebook. The following general guidelines should be followed:

**You are required to purchase the “Customized Lab Record” from the bookstore. This is a carbonless duplicate set laboratory notebook that will allow you to give one copy of your notebook entry to the teaching assistant. **Leave the first two pages of your notebook blank and make a table of contents. **Items A – E constitute the prelab. The pre-lab must be done before you come to the lab and will be graded by the T.A. Item F is to be done during the lab and G is to be done at home following the lab. **Your TA will initial your pre-lab at the beginning of lab to indicate that it was complete. **Write directly into your notebook – NOT on a separate sheet of paper. Inevitably, the paper will be lost or misplaced. To encourage formation of good habits your TA will sign your notebook pages before you leave lab each day. All procedural information and observations must be recorded at this time. **Write in pen only, NOT pencil. Do not erase or use whiteout. Make corrections by drawing a single line through the mistake. **Write neatly and leave a lot white space! If someone is to repeat your work they have to be able to read it and follow your organization. **We will not be using the yellow copy, so only the white copy must be legible. The use of tables is highly recommended. **Permanently attach any graphs/spectra that are generated to the notebook with staples or tape.

You must follow the format presented below for your notebook entry. It is recommended, but not required, that you use the left side of the page for outlining procedures and the right side for observations. An example of a completed notebook entry has been posted on Canvas.

A. Title
B. Reaction (draw out structures).
C. Mechanism. Include the mechanism for each reaction, unless otherwise instructed. Your effort, not accuracy, will be considered as part of the pre-lab points.
D. Physical data for all reactants used and products produced and solvents (with literature reference cited) with appropriate precautions (when using dangerous chemicals such as sulfuric acid). Do NOT fill in the amounts used. These should be the actual amounts measured out in lab.
E. Brief outline of the procedure. The procedure is usually given in detail in the lab manual. Therefore, the procedural details can be referenced. **You should still include a brief outline of the important main points of the procedure in your notebook and be sure to note any changes to the procedure written in the manual. Rewriting the main steps of the procedure will help you to more fully understand the experiment and what is expected of you. Avoid copying the text of the manual word for word. Write this outline on the left side of your notebook page.
F. Actual procedure and observations. Include comments about what occurs during the experiment, like color changes, gas evolution, precipitates, etc. Make sure to write in such a manner that a person attempting to reproduce your experiment can do so without getting verbal instructions from you and can then get identical results to yours. Be sure to write during the lab as you perform the experiment. Also include things that occurred that were not planned and which may or may not influence your results. Note that authentic description of the actual procedure sometimes demands recording the time. Write these observations on the right side of your notebook page.
G. Calculations- include important calculations (percent yield, etc).

PRE-LAB: It is important that you have read the laboratory experiment in advance. It is your responsibility to read the experimental procedure and background information thoroughly so that you understand the details of the experiment. You must complete sections A-E of the notebook (see above) before arriving to lab. You may start work only after your TA has signed the pre-lab. **No work is permitted without a completed pre-lab.

PHYSICAL CONSTANTS: Physical constants can be found online at chemfinder.com and in hard copies of the Merck Index and the Chemical Rubber Company Handbook of Chemistry and Physics in the Science Reserve desk on the fourth floor of the Marriott Library. To find the electronic edition of the CRC go to http://www.lib.utah.edu → research tools → article databases → C (or same route for the electronic edition of the Merck).
CONCLUSIONS:

Your conclusions will be collected at the beginning of the next scheduled lab period. Conclusions 1 - 7 days overdue will be assessed a 3-point penalty for each business day they are late. Conclusions more than 7 business days overdue will not be accepted. Conclusions for the make-up lab will be due in your TA’s mailbox (HEB 1504) one week after you complete the make-up lab.

Conclusions must be written individually, even if the experiment is done with a lab partner.

The conclusion should be sufficiently concise so as to not exceed two pages of text (reactions, mechanisms and tables are not included in this limit), but it is doubtful you can do an adequate job in much less than two pages. Conclusions should be written on a computer, double-spaced.

In Chem 2325 you will be conducting chemical reactions. It is important that your conclusions not include procedural details. The conclusion should concentrate on “why” and not “what”, should be scientific and objective, and should not include any personal pronouns (I, we). You should begin the write-up by stating the chemical reaction and its mechanism. You may draw these by hand or use the wonderful chemical drawing software, ChemDraw, available to you in HEB 2030. You will be graded on the accuracy and completeness of your mechanism in the final write-up therefore it is important to ask questions during lab if necessary. Explain why you did certain important things in the reaction procedure (why was a catalyst or a reflux necessary, why was it necessary to have anhydrous conditions, why was an extraction or recrystallization or cooling necessary, etc.). What did some of your observations indicate about the reactions that were occurring? How were impurities, by-products, and unreacted starting materials removed during the work-up?

Use your results as evidence to tell a story that culminates in your major conclusions. Be sure to evaluate your confidence in the results. Important note here: any organic chemist can tell you that following a written, published procedure is no guarantee that you will actually get the product you set out to make. Therefore, treat all products isolated or synthesized as unknowns. Prove to your TA the true identity of the product(s). Give your percent yield and show how you did your calculation (indicating limiting reagent). Does your data (mp, optical activity, IR, NMR) agree with the accepted (literature) values? Always be sure to include the literature value and reference the source. Discuss the quantity and purity of your product, and do an error analysis on your results if you had problems. Explain the possible sources of a low yield or impurities and what you would do differently if you were to repeat the experiment. You should emphasize concepts in your write-up that were emphasized in the lab lecture. The lab handouts will also provide additional important concepts that you should include in your write-up.

If you use a reference for your conclusion, be sure to indicate it. Plagiarism in the conclusion is unethical and will result in a failure on the entire write-up.

Writing a thoughtful conclusion will help you to prepare for the quiz the following week.

If you have difficulty writing coherent conclusions, ask your TA, the instructor or the University Writing Center for help. The Writing Center is located on the third floor of the Marriott Library. Their phone number is 587-9122 and their website is www.writingcenter.utah.edu.

ACADEMIC HONESTY:

All students are expected to act honestly in the course. By submitting an assignment, you are representing that it is your own work and that you have followed the rules associated with the assignment. Any and all cases of suspected academic dishonesty such as cheating, plagiarizing, or misrepresenting one’s work will be dealt with severely, in accordance with the Student Code: http://regulations.utah.edu/academics/6-400.php. A few specific guidelines are given below. If you have questions about what is acceptable please ask!

⇒ All work in the lab notebook must belong to the student alone. It should be completed by the individual and everything should be in the student’s own words. Each student should record his/her own data as the experiment progresses and must complete any analysis individually.

⇒ Students are encouraged to discuss results and conclusions to more fully understand the experiment, however all written work (recording of data, observations, etc. in the lab notebook, and all work on reports, etc.) should be done individually, even when working in groups. This means that reports may contain similar ideas, but everything should be presented in your own words and formatting.

WASH HANDS:

All students are REQUIRED to wash their hands as a safety precaution before leaving the laboratory in case they have accidentally encountered any chemicals.

PREGNANCY:

A student who is pregnant is encouraged to consult her physician about the safety of taking a laboratory class that requires the routine handling of organic compounds and organic solvents. A student who is pregnant may wish to delay taking organic laboratory courses until the pregnancy is completed. If you choose to continue in the lab be sure to let the instructor know asap.
WITHDRAWAL INSTRUCTIONS: The last day to drop a class without tuition penalties is Friday, August 30. It is possible to withdraw from the course up to Friday, October 18, but you will still have to pay tuition for the course and a “W” will appear on your transcript. You do NOT need the instructor’s signature to withdraw. After October 18 a student must petition for withdrawal to the Dean's office of their academic college. University policy states that withdrawals after this date should only be granted for "non-academic reasons beyond the student's control.” "I want to avoid a bad grade" or similar does not qualify.

RESOURCES: I hope that you feel comfortable coming to me with questions any time. It is never too late to ask a question. Additionally, there are other resources available depending on your exact needs:

- **Organic Chemistry Study Center.** Teaching and learning assistants for all organic courses hold office hours in TBBC 2619. Beginning the second week of class a list of available tutors/times will be found at: http://www.chem.utah.edu/undergraduate/resources/ochem-study.php

- **The Tutoring Center** offers one-on-one or group tutoring sessions. More information at www.sa.utah.edu/tutoring or 581-5153.

- **Private tutoring:** a list of graduate student tutors is available in the Department of Chemistry Main Office (HEB 2020) and is posted online at: http://www.chem.utah.edu/undergraduate/resources/grad-tutors.php

- **The Learning Enhancement Center** offers a variety of workshops covering topics such as Time Management and Test Taking Skills. They also offer a course for students called Educational Psychology 2600: Strategies for College Success. It is a 3-credit hour class that helps students with study skills, research skills, testing taking skills, etc. Find out more at https://learningcenter.utah.edu/ or 581-8746

- **The University Counseling Center** meets with students on a variety personal and academic issues and is low cost for students. https://counselingcenter.utah.edu/; 801-581-6862; 24/7 Crisis line: 801-587-3000

- **The Dean of Students Office** is an excellent resource for students that are experiencing significant life challenges that are creating barriers to success. Please contact the office if you are experiencing significant hardship and would like to know your options. https://Registrar.utah.edu/handbook/college-dean-contact.php

- **The Americans with Disabilities Act.** The University of Utah seeks to provide equal access to its programs, services, and activities for people with disabilities. If you will need accommodations in this class, reasonable prior notice needs to be given to the Center for Disability Services, 162 Olpin Union Building, (801) 581-5020. CDS will work with you and the instructor to make arrangements for accommodations. All written information in this course can be made available in an alternative format with prior notification to the Center for Disability Services.

- **Addressing Sexual Misconduct.** Title IX makes it clear that violence and harassment based on sex and gender (which Includes sexual orientation and gender identity/expression) is a civil rights offense subject to the same kinds of accountability and the same kinds of support applied to offenses against other protected categories such as race, national origin, color, religion, age, status as a person with a disability, veteran’s status or genetic information. If you or someone you know has been harassed or assaulted, you are encouraged to report it to the Title IX Coordinator in the Office of Equal Opportunity and Affirmative Action, 135 Park Building, 801-581-8365, or the Office of the Dean of Students, 270 Union Building, 801-581-7066. For support and confidential consultation, contact the Center for Student Wellness, 426 SSB, 801-581-7776. To report to the police, contact the Department of Public Safety, 801-585-2677(COPS).

- **University Safety Statement.** The University of Utah values the safety of all campus community members. To report suspicious activity or to request a courtesy escort, call campus police at 801-585-COPS (801-585-2677). You will receive important emergency alerts and safety messages regarding campus safety via text message. Lauren’s Promise – I will listen and believe you if you are being threatened. If you are in immediate danger call 911. Utah Domestic Violence Coalition is another good resource 800-897-5465. For more information regarding safety and to view available training resources, including helpful videos, visit safeu.utah.edu.

- **Undocumented Student Support.** Immigration is a complex phenomenon with broad impact—those who are directly affected by it, as well as those who are indirectly affected by their relationships with family members, friends, and loved ones. If your immigration status presents obstacles to engaging in specific activities or fulfilling specific course criteria, confidential arrangements may be requested from the Dream Center. **Arrangements with the Dream Center will not jeopardize your student status, your financial aid, or any other part of your residence.** The Dream Center offers a wide range of resources to support undocumented students (with and without DACA) as well as students from mixed-status families. **To learn more, please contact the Dream Center at 801.213.3697 or visit dream.utah.edu.**

- **Wellness Statement.** Personal concerns such as stress, anxiety, relationship difficulties, depression, cross-cultural differences, etc., can interfere with a student’s ability to succeed and thrive at the University of Utah. For helpful resources contact the Center for Student Wellness at www.wellness.utah.edu or 801-581-7776.

- **Veterans Center.** If you are a student veteran, the U of Utah has a Veterans Support Center located in Room 161 in the Olpin Union Building. Hours: M-F 8-5pm. Please visit their website for more information about what support they offer, a list of ongoing events and links to outside resources: http://veteranscenter.utah.edu/. Please also let me know if you need any additional support in this class for any reason.

- **English Language Learners.** If you are an English language learner, please be aware of several resources on campus that will support you with your language and writing development. These resources include: the Writing Center (http://writingcenter.utah.edu/); the Writing Program (http://writingprogram.utah.edu/); the English Language Institute (http://continue.utah.edu/eli/).

- **Names/Pronouns.** Class rosters are provided to the instructor with the student’s legal name as well as “Preferred first name” (if previously entered by you in the Student Profile section of your CIS account, which managed can be managed at any time). While CIS refers to this as
merely a preference, I will honor you by referring to you with the name and pronoun that feels best for you in class or on assignments. Please advise me of any name or pronoun changes so I can help create a learning environment in which you, your name, and your pronoun are respected. If you need any assistance or support, please reach out to the LGBT Resource Center https://lgbt.utah.edu/campus/faculty_resources.php

Please let me know if there is any additional support you would like to discuss for this class.

Note: This syllabus is meant to serve as an outline and guide for our course. Please note that I may modify it with reasonable notice to you. I may also modify the Course Schedule to accommodate the needs of our class. Any changes will be announced in class and posted on Canvas under Announcements.
<table>
<thead>
<tr>
<th>Week beginning:</th>
<th>Lecture Topics</th>
<th>Laboratory Topics</th>
<th>Quiz</th>
<th>Assignment</th>
<th>Analysis</th>
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</thead>
<tbody>
<tr>
<td>Aug 19</td>
<td>Safety, general policies and waste management.</td>
<td>No lab</td>
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<tr>
<td>Aug 26</td>
<td>NMR and IR for Analysis of Organic Products</td>
<td>Lab #1 - Check in and Spectroscopy Workshop</td>
<td>Quiz 1: Safety, waste disposal and spectroscopy</td>
<td>Worksheet</td>
<td>NMR (provide d) and IR</td>
</tr>
<tr>
<td>Sept 2</td>
<td>Diels Alder, critical analysis of resources</td>
<td>Lab #2 – Diels Alder</td>
<td>Quiz 2: Spectroscopy/ Diels Alder</td>
<td>Worksheet</td>
<td>IR, NMR</td>
</tr>
<tr>
<td>Sept 9</td>
<td>SciFinder Scholar, Chem Draw, Computational Chemistry</td>
<td>Lab #3 – Chemistry resources</td>
<td>Quiz 3: DA/Resources</td>
<td>*no pre-lab or observations Short Conclusion (Canvas upload)</td>
<td>NA</td>
</tr>
<tr>
<td>Sept 16</td>
<td>EAS, energy diagrams, explosives!</td>
<td>Lab #4 – EAS: Nitration of Toluene</td>
<td>Quiz 4: Resources/EAS</td>
<td>Oral Discussion</td>
<td>GC</td>
</tr>
<tr>
<td>Sept 23</td>
<td>GC Data Analysis</td>
<td>Lab #5 – EAS Discussion</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
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<td>Sept 30</td>
<td>Organometallic Cross Coupling</td>
<td>Lab #6 – Coupling</td>
<td>Quiz 5: EAS/Coupling</td>
<td>Worksheet</td>
<td>IR, NMR</td>
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<tr>
<td>Oct 7</td>
<td>No Lab – Happy Fall Break!</td>
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<tr>
<td>Oct 14</td>
<td>Grignard reaction, air sensitive technique</td>
<td>Lab #7 – Grignard Reaction</td>
<td>Quiz 6: Coupling/ Grignard</td>
<td>Oral Presentation</td>
<td>MP, IR NMR</td>
</tr>
<tr>
<td>Oct 21</td>
<td>Oral presentations and data analysis</td>
<td>Lab #8 – Oral Presentations</td>
<td>Embedded into Presentation</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Oct 28</td>
<td>Imine formation, drug discovery process</td>
<td>Lab #9 – Drug Discovery</td>
<td>Quiz 7: Drug discovery</td>
<td>Poster</td>
<td>NMR</td>
</tr>
<tr>
<td>Nov 4</td>
<td>Fisher esterification, Le Chatlier’s Principle, chemistry of smell</td>
<td>Lab #10 – Essence of Esterification</td>
<td>Quiz 8: Drug Discovery/ Esterification</td>
<td>Worksheet</td>
<td>IR, NMR</td>
</tr>
<tr>
<td>Nov 11</td>
<td>Unknown Analysis</td>
<td>Lab #11 – Unknown Analysis and Check-out</td>
<td>Quiz 9: Esterification/ Unknowns</td>
<td>Worksheet</td>
<td>NA</td>
</tr>
<tr>
<td>Nov 18</td>
<td>No lab or lecture</td>
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