Chemistry 332 Lab – Organic Chemistry II Lab

Spring 2015

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Office hours: MW 3:30-4:30, T 11:30-12:30 (or just stop by!)
CCC hours: R 11-12:30

I. Course Philosophy

Experimentation is at the heart of chemistry, and most new knowledge in chemistry comes from careful examination and interpretation of experimental results. To have confidence in your results, it is important that the experiments be executed carefully and properly. This laboratory is designed to teach lab skills, reinforce concepts from Ochem lecture, and reinforce how to think about scientific problem solving.

The experiments in any university course are very unrealistic. Most genuine experiments "fail," and it take hours and multiple trials to deduce the nature of the failure and alter the experiment to achieve the desired result. The experiments in this class, in contrast, have all been well–tested so they stand a high chance of working perfectly the first time through.

Poor you, dear student! You will be missing the thrill of discovery and the agony of mysterious outcomes! Attack science research sometime, and enjoy the experience of profound, productive confusion!

II. Materials/Equipment

Suggested Text: "Making the Connections," by Padias (1st or 2nd edition)

Laboratory Manual: The laboratory experiments for Chem 332, as well as other important lab information, are online at **www.chemlab.truman.edu** under the Organic Chemistry link.

Required Laboratory Notebook: A permanently bound laboratory notebook capable of creating duplicate pages is required. ***You must have this notebook at the first experiment.***

Required Laboratory Attire: Proper lab attire will be required at ALL times. **You must always attend lab wearing safety glasses, long pants, close-toed shoes, and a shirt that covers the upper body (at least equivalent to a t-shirt)**. Inappropriately attired people will not be allowed in lab and will be sent home to change clothes.

III. General Information

Attendance: You will not be allowed to submit work for a lab you did not attend. You will receive a zero for that lab regardless of what you turn in!

Safety: ***You*** are the person primarily responsible for your own safety in the lab. Take it seriously! You are also responsible for the safety of those around you. No horseplay! Expulsion from lab (and hence, a zero grade) at the instructor's judgment may be the result of unsafe lab practices.

Academic Integrity: Don't cheat. Use your original words and ideas for all of your lab reports or properly cite the words and ideas of others. Any intentional cheating (instructor's judgment) will result in a grade of zero for that lab!

IV. Lab Notebooks

Purpose: The guiding purpose of a lab notebook is that ***it should be complete enough to enable you or any other worker of the same level as you to understand your experiment and the results, and to duplicate your work without you present.*** While Chem 333 lab experiments are not conducted in a "research" environment, it is still a major goal to teach the habits and level of detail that are required of a scientist or any other (medical, legal, engineering) professional.

Rules for the Laboratory Notebook:

* **The notebook for an experiment or a series of experiments is due one week after the conclusion of the experiment or series of experiments.**
* You are required to maintain a permanently bound and numbered lab notebook, capable of making duplicate pages that will be handed in for grading.
* Always write in your notebook in PEN, not pencil! Mistakes in the lab notebook should be crossed out with a single line. Whiteout is not acceptable.
* Your notebook must have an up-to-date table of contents on the first page.
* All pages must include your name (printed), signature, and the date completed.
* The notebook should always be entirely written in third-person removed viewpoint. The tense of the writing shall vary depending on whether the thing being discussed is over (e.g. a procedural step that was executed during lab) or still exists (e.g. the results are currently still in existence even though the experiment is concluded).

Each complete notebook will have the following sections

1. Title and Date
2. Statement of Objective
3. Background
4. Procedure
5. Results and Calculations
6. Discussion and Conclusions

A typical notebook is composed in three distinct sessions (with thanks to Anne Moody):

Prelab:

- In your notebook, write the title of the experiment and the date that the work will be done. Include a short statement indicating the objective(s) of the experiment.
- If chemical reactions are involved, write overall reaction equations for them.
- Prepare a table of important physical properties and the hazardous properties of the ORGANIC materials (starting materials, solvents, and products) with which you will be working. Skim through the experimental section to be sure that your table includes all the organic chemicals that you will use. Always include the

name of the compound, its molecular structure, and molecular weight. Other properties that may be important are melting points, boiling points, density, optical rotation, etc. **You are responsible for knowing the hazards of the substances that you use and how to handle them properly.** This type of information is readily available online.

- Carefully read the experimental section. Write out the step-by-step procedure in your notebook (using a lab textbook to clarify the online lab procedure if needed). You should make one column for the instructions about 2/3 of the width of the page, and leave the other third page to record alterations that you make to the procedure during lab, and in-lab observations.
- If you are to record data in a table during the lab, prepare the table for data ahead of time so as to save lab time.
- **You may NOT use your textbook or the handouts from the web site in lab**, so all directions for the work that you do must be in your notebook.

While you are in the laboratory:

- Clarify and annotate the procedure that you follow, record the data you collect, and record observations. **Write all data and observations directly in the notebook, not on other paper.** If you write something incorrectly, put a single line through the error, initial and date the line, then enter the correction. Do not obliterate any entry.
- **It is a serious error to turn in at the end of the semester a notebook that has been rewritten or "copied over" outside of lab.** Plan your work well so that all information is entered into the notebook properly while you are in the laboratory, not at some later time.

After you finish the experiment:

- Carefully draw the detailed mechanism of any chemical reactions that you performed (if one was performed).
- If the experiment involved a chemical reaction, calculate the theoretical and percent yields. Sometimes, you will simply get back the same substance that you started with, so in that case you will compute percent recovery. SHOW YOUR WORK and units on these calculations to receive full credit!
- Make graphs, calculate values, analyze spectra for important information, etc., as required to obtain a result from the experiment. You will need two copies of each printed item: one for the notebook and one for the carbon-copy sheet. Note that all graphs or other loose items to be included in the notebook should be taped or glued onto the pages of your notebook, and their meaning should be described in words in the notebook. When you must fold an added item, fold it only once. Do not leave items hanging out of the notebook.
- Write a brief discussion/conclusion. Briefly state the experimental results, what they mean in regards to the objective (was it achieved or not?), and explain what could be done differently to improve the results.

The discussion and conclusions section should stand on its own, revealing the results and their meaning without needing the results or objective sections to be read.

- Refer to chemlab.truman.edu for specific information and formatting requirements, especially "The Laboratory Notebook, Before Laboratory, and Laboratory Safety". There is a sample Ochem lab notebook in there!

V. Presentations

Length

Presentations should be about ten to fifteen minutes long. If given in groups, all group members must take part in the presentation. A too-short presentation cannot get full credit.

Format

The exact organization and format of the presentation is up to the presenter, but it must involve at least some graphics shown on the screen, such as scanned NMR spectra or IR spectrum or mechanism, structure, etc. Prezi or powerpoint is fine, but the room has whiteboards too.
The presentation should more or less follow the format of a lab notebook discussion nd conclusion section, i.e. it should be obvious what the objective of the experiment was, and whether the objective was met. To back up that answer, evidence must be presented. The procedure for synthesis of a molecule, or the procedure for identifying a molecule, should be presented, because Spectra can be used to indicate the successful synthesis of a desired product as well as a level of purity, or to indicate the failure or partial success of a synthesis. Melting point can also give clear, vaulable information. Sometimes, data from an experiment will disagree with one another. If that happens, it should be noticed and explained. It is kind of cool when data disagree, because then it must be decided which data point to trust more than the other. That is an interesting process!

Grading

Assessment will be given by students and the professor, based on the evaluation sheet shown here. Overall scores will be assigned by the professor after taking student feedback into account.
Since this is a science class, the science in your discussion is paramount! Your spectra and interpretation must be featured and correct and any other facts or any procedural notes must also be correct in order to attain a high score, even if the presentation looks really snazzy.
THE AUDIENCE will get one grade. There will be three points per presentation for questions and comments from the peanut gallery. Two or more questions/comments gets full credit for the audience!

	Score	Comments
Does the presentation make the experiment interesting to the audience?	1 2 3 4 5	
Are the methods explained or just mentioned?	1 2 3 4 5	
Is the level of confidence in the results mentioned and made relevant?	1 2 3 4 5	
Is the result (ID and yield, e.g.) featured and compared to the "expected" level?	1 2 3 4 5	
Did the group give a meaningful conclusion? (Do the data support the conclusion?)	1 2 3 4 5	
Were the powerpoint slides not boring to look at? (pictures!)	1 2 3 4 5	
Was the story of the presentation easy to follow? (good organization?)	1 2 3 4 5	
Was the presentation given in a confident, friendly manner?	1 2 3 4 5	

VI. Tentative Schedule and Tentative Grade Scale

January

3	12-Jan *Ch 14*	13-Jan *Ch 14*	14-Jan *Ch 14*	15-Jan	16-Jan *Ch 14*
4	19-Jan **MLK day**	20-Jan **Check-in**	21-Jan *Ch 14*	22-Jan	23-Jan *Ch 14*
5	26-Jan *Ch 15*	27-Jan **Multi-Step I (oxidation)**	28-Jan *Ch 15*	29-Jan	30-Jan *Ch 15*

February

3	2-Feb *Ch 16*	3-Feb **Qualitative Analysis**	4-Feb *Ch 16*	5-Feb **rec: meet to draw groups**	6-Feb *Ch 16*
4	9-Feb *Ch 16*	10-Feb **Qualitative Analysis**	11-Feb *Ch 17*	12-Feb **rec: 2 presentations on multistep (I)**	13-Feb
5	16-Feb *Ch 17*	17-Feb **(no lab)**	18-Feb *Ch 17*	19-Feb **University Conference**	20-Feb *Ch 17*
6	23-Feb *Ch 18*	24-Feb **Multi-Step II (nitration)**	25-Feb *Ch 18*	26-Feb **rec: 4 presentations on qual. analysis**	27-Feb *Ch 18*

March

	2-Mar *Ch 19*	3-Mar **Grignard I**	4-Mar *Ch 19*	5-Mar **rec: 4 presentations on qual. Analysis**	6-Mar *Ch 19*
8	9-Mar **Midterm Break**	10-Mar **Midterm Break**	11-Mar **Midterm Break**	12-Mar **Midterm Break**	13-Mar **Midterm Break**
9	16-Mar *Ch 20*	17-Mar **Grignard II**	18-Mar *Ch 20*	19-Mar	20-Mar
10	23-Mar *Ch 20*	24-Mar **Multistep III (oxidation)**	25-Mar *Ch 21*	26-Mar **rec: 2 presentation on Grignard**	28-Mar *Ch 9*
11	30-Mar *Ch 21*	31-Mar **Synthesis of Dilatin**			

April

			1-Apr *Ch 21*	2-Apr **rec: 2 presenations on multistep II/III**	3-Apr *Ch 22*
12	6-Apr **Spring Break**	7-Apr **Luminol**	8-Apr *Ch 22*	9-Apr	10-Apr *Ch 23*
13	13-Apr *Ch 23*	14-Apr **Student Research Conference**	15-Apr *Ch 23*	16-Apr **rec: 2 presentations on Dilatin**	17-Apr *Ch 23*
14	20-Apr *Ch 24*	21-Apr **Chemiluminescence, check-out**	22-Apr *Ch 24*	23-Apr	24-Apr
15	27-Apr *Ch 24*	28-Apr **Final Exam**	29-Apr *Ch 25*	30-Apr	

May

					1-May
16	4-May	5-May	6-May **Reading Day**	7-May	8-May

Title	#	pts per	total
Full lab notebooks	7	25	175
Presentations	2	40	80
Final Exam	1	50	50
Notebook prelab	~8	5	40
Safety Worksheet	1	10	10
Participation in rec.	8	3	24
Total Points			**355**

Course Grade Scale	
87.0-100%	A
75.0-86.9%	B
65.0-74.9%	C
55.0-64.9%	D
< 54.9%	F

Some Grading Policies

- Late work will be penalized at 20% per day
- Missed exams must be arranged in person ***before*** the exam day
- Rounding of course grades will be to the nearest 0.1%. For example, 64.69% rounds to 64.7%, not to 65.0%