

Chemistry 325 Syllabus Fall 2018

Instructor	Robin S. Tanke, Ph.D.
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Office:	CBB 447 (Lab CBB 436 East end)
Office Hours:	Tuesday and Thursday 11AM- noon, Friday 9-10AM or by appointment, drop in

Class Sessions:

Lecture:	T, R, F 10 AM	CBB 105
Lab 1	W 8 AM-11 AM	CBB 420
Lab 2	T 2 PM – 5 PM	CBB 420
Lab 3	R 2 PM – 5 PM	CBB 420

Exam Schedule:

- ☞ Exam 1: Friday, September 28, 2018
- ☞ Exam 2: Friday, October 19, 2018
- ☞ Exam 3: Friday, November 9, 2018
- ☞ Exam 4: Friday, December 7, 2018

Final Exam: Monday, December 17, 2018 8-10AM CBB 105

Learning Outcomes

By the end of this course, students will

- ☺ predict the physical properties and chemical reactivity of simple organic molecules
- ☺ propose products and reasonable mechanisms for chemical reactions based on a fundamental understanding of organic chemistry.
- ☺ propose efficient syntheses of simple organic molecules.
- ☺ use a variety of characterization data to identify organic compounds.
- ☺ safely prepare, purify and characterize organic compounds and appropriately document and present their laboratory work.

Prerequisite: Chem 117, Chem 106 or equivalent

Required Materials:

- The text, available at text rental, is Organic Chemistry, Fifth Edition by Janice Smith
- You will need a bound laboratory notebook. The pages will need to be numbered; you may buy one with numbered pages or number the pages yourself.
- You are required to obtain safety goggles (not glasses) to work in lab.

Recommended Materials:

- A laboratory text is available for purchase at the UWSP bookstore Making the Connections, A How-To Guide for Organic Chemistry Lab Techniques, Second Edition (STRONGLY RECOMMENDED) by Anne B. Padias. You may choose another text or websites to complete your prelab assignments.
- Molecular Models (STRONGLY RECOMMENDED) Model kits are available from Indigo (www.indigo.com) for about \$32.00. The bookstore also has model kits available for you to purchase.
- Study Guide and Solutions Manual for Organic Chemistry, Fifth Edition by Smith and Smith (RECOMMENDED) This manual gives answers to all the problems in your text. A few copies are on reserve at the library.

Grading: The tentative letter grades will be given as follows: 'A' – 705 pts; 'B' – 622 pts; 'C' – 540 pts, 'D' – 488 pts.

General Chemistry Review	30 pts
Homework Assignments (4@ 25 points each)	100 pts
4 Exams (70 points each)	280 pts
Laboratory Grade ¹	185 pts
Final Exam	155 pts

Notes

1. Details of the laboratory grade will be given the first day of lab.

LATE WORK POLICY: I expect work to be turned in at the designated time; however, if work must be late, you will receive a 10% grade reduction for material 1 day to 1 week late. Any work turned in more than 1 week late will not be accepted except under special circumstances.

Student Conduct:

Given the new state policies regarding attendance of students receiving financial aid, attendance will be taken at times through out the semester.

You are required to attend exams and labs at the assigned time. Unexcused absences during these times are unacceptable. Excused absences will be granted under certain conditions; contact me as soon as possible if you need to miss an exam or lab.

Please be respectful of your classmates!

Students are reminded that they are to conduct themselves in accordance with the rules for academic conduct. Academic misconduct is described in Chapter UWSP 14 and is to be followed by all students, staff, and faculty. This document that may be accessed via the University Web site at <http://www.uwsp.edu/dos/Documents/CommunityRights.pdf#page=11>. An excerpt from it follows:

UWSP 14.03 ACADEMIC MISCONDUCT SUBJECT TO DISCIPLINARY ACTION.

Academic misconduct is an act in which a student:

1. Seeks to claim credit for the work or efforts of another without authorization or citation;
2. Uses unauthorized materials or fabricated data in any academic exercise;
3. Forges or falsifies academic documents or records;
4. Intentionally impedes or damages the academic work of others;
5. Engages in conduct aimed at making false representation of a student's academic performance; or
6. Assists other students in any of these acts.

Disabilities: If you have disabilities and need any special accommodations, you should contact the office of Disability Services during the first two weeks of the semester.

Accommodations for Religious Beliefs: Religious beliefs will be accommodated according to UWS 22.03 provided I am notified during the first three weeks of classes.

Robin Tanke Fall Semester 2018

	Monday	Tuesday	Wednesday	Thursday	Friday
08:00	Research & Outreach		325 Lab 01L1 420		
09:00			325 Lab 01L1 420		Office Hour
10:00		325 Lec 01 105	325 Lab 01L1 420	325 Lec 01 105	325 Lec 01 105
11:00		Office Hour	WCC	Office Hour	
12:00					
13:00					
14:00		325 Lab 01L2 420	105 Lab 01L4 230	325 Lab 01L3 420	Meeting or seminar
15:00		325 Lab 01L2 420	105 Lab 01L4 230	325 Lab 01L3 420	
16:00		325 Lab 01L2 420	105 Lab 01L4 230	325 Lab 01L3 420	
In class		Office Hours		Maybe Available	

Chemistry 325 Tentative Schedule Fall 2018

Week #	Topic	Assignment
1 (9/3)	Unit 1: Covalent Bonding and Organic Molecules	Review General Chemistry
2 (9/10)	Unit 2: Acids and Bases	Review Due 9/11
3 (9/17)	Unit 2 continued, Unit 3: Functional Groups	Homework 1 due 9/21
4 (9/24)	Unit 3: IR spectroscopy and Mass Spectrometry	Exam 1: Friday, 9/28
5 (10/1)	Unit 4: Alkanes and Conformational analysis	
6 (10/8)	Unit 5: Chirality	Homework 2 due 10/12
7 (10/15)	Unit 6: Reaction Mechanisms	Exam 2: Friday, 10/19
8 (10/22)	Unit 7: NMR Spectroscopy	
9 (10/29)	Unit 8: Substitution reactions	Homework 3 due 11/2
10 (11/6)	Unit 8 continued, Units 9: Elimination Reactions	Exam 3: Friday, 11/9
11 (11/12)	Unit 9 continued, Unit 10 Alcohols and Ethers	
12 (11/19)	Unit 10 and THANKSGIVING! (No labs this week)	
13 (11/26)	Unit 11: Alkenes Unit 11	Homework 4 due 11/30
14 (12/3)	Unit 12: Chemical Reactions involving Radicals	Exam 4: Friday, 12/7
15 (12/10)	Organic Syntheses and Review	
12/17	Final Exam Monday	8-10AM CBB 105

LABORATORY SYLLABUS Fall 2018

Instructor Robin S. Tanke, Ph.D.
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Office: CBB 447

Lab 1	W 8AM – 11 AM	CBB 420
Lab 2	T 2 PM – 5 PM	CBB 420
Lab 3	R 2 PM – 5 PM	CBB 420

Objectives To safely perform basic organic chemistry laboratory skills, to maintain a laboratory notebook that legally documents your work, to collect, analyze and interpret data and to write technical reports.

Recommended Text

The laboratory text is available for purchase at the UWSP bookstore is Making the Connections, Second edition by Padias.

Lab Activities These will be distributed in class or available on D2L.

Notebook You will need a bound laboratory notebook. The pages will need to be numbered; you may buy one with numbered pages or number the pages yourself. Your properly labeled spectral data should be permanently attached to your notebook or kept in a separate binder. Loose spectral or chromatographic data is not acceptable.

Goggles You will need to obtain safety goggles for lab activities.

Attendance **Attendance is Mandatory.** The laboratory schedule has been constructed so that you should comfortably finish all work during the scheduled time periods. On special occasions, you may use some equipment outside your scheduled period.

General Laboratory Procedures

Safety in the laboratory is very important. Organic chemicals are often flammable and hazardous. You are encouraged to work in the hoods as much as possible. Specific safety requirements include:

1. **Safety goggles must be worn over the eyes whenever anyone is handling chemicals in the lab.** This includes the seated area.
2. **Clothing that is worn should cover your entire torso and protect your feet.** Shorts, short sleeve shirts or blouses, sandals, etc. permit the possibility of chemicals coming into contact

with your bare skin. Either wear "covering" clothing or purchase a lab apron or lab coat. Use gloves when advised or whenever you feel you need them.

3. Perform chemical operations in the hood. See procedures for proper hood use below.
4. **Come to class prepared and ask questions.**
5. You may not work in the laboratory outside of the normal class without permission.
6. Keep your work area and common work areas clean.
7. Report all accidents and spills, however minor. All powders must be disposed in hazardous or non-hazardous waste containers; loose powder in the trash is unacceptable.
8. Neither food nor drink are allowed in the laboratory; this includes the seating area.
9. Headphones and cellphones are not to be used in the lab. If you must use your phone (texting included) secure the work area and move to the seated area or out of the lab.
10. Read the safety information (MSDS) of each substance that you use.
11. Any woman who is pregnant or thinking of becoming pregnant should consult with her doctor before participating in this class.

Using a Fume Hood

To minimize exposure to chemical vapors and maximize safety we will perform most chemical operations in side a fume hood. The hood only works if operated properly.

The hood should be closed unless you are performing operations in the hood. (Figure 1). The hood is equipped with an air flow monitor (Figure 2). Should the alarm sound, make certain the hood is placed in the closed position. If the alarm continues, contact your instructor.



Figure 1

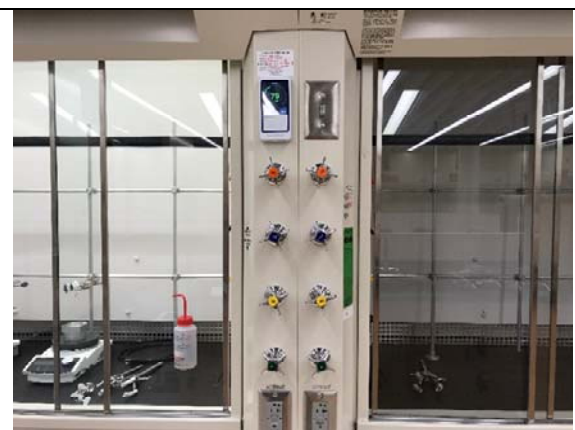


Figure 2

Opening the hood There are two ways to open the hood.

- 1) Raising the sash (Figure 3). This can be used when setting up an experiment but will rarely be used when performing chemical operations. If you raise the sash too far, the hood will alarm, and additional fans will be engaged for several minutes. Also, do not raise the hood unless the side sash openings are closed.

- 2) Opening the sash side to side (Figure 4). This will be the most common way to work in the hood.



Hood Maintenance

At the end of the lab period, please put away any common equipment, clean the hood, and remove any paper towels, Kleenex and chem wipes from the hood.

Laboratory Experiments All experiments will be graded on the six criteria below. The points for each criterion, which vary with each experiment, will be delineated throughout the semester.

- ☺ **Pre-lab** - The pre-lab questions will be graded. **They are due at the beginning of the period that you begin the experiment.** Please note that for most labs you will also need to come to lab with some preliminary data in your lab notebook.
- ☺ **Notebook** - A complete notebook is an essential component of any work done in an organic laboratory. See supplemental material on keeping a laboratory notebook. Your laboratory notebook and spectral data will be handed in with most postlab assignments.
- ☺ **Characterization** - Data and its proper collection, documentation and interpretation will be required for all labs.
- ☺ **Percent Yield** - Product yields will be considered in some cases and you may be required to turn in your product.
- ☺ **Purity** - Product purity will be considered in some cases.
- ☺ **Postlab** - This will vary with each experiment.

References

You will cite literature or reference boiling points, melting points, and/ or spectra in your lab notebooks and assignments. Several sources available to you. The following may be useful:

- You may find safety information by search "Compound name" MSDS or SDS.
- You may also find some spectral data on the Integrated Spectral Data Base System for Organic Compounds: <http://www.aist.go.jp/RIODB/SDBS/menu-e.html>

Academic Misconduct - I expect you to do your own work. I will enforce University policy if violations such as the following occur.

1. claiming work of others to be your own
2. falsifying laboratory data
3. knowingly assisting others in any of the above

Grade

Your lab grade will be based upon the total points you earn throughout the semester. There are 185 points possible, which are apportioned as described in the lab schedule. Anyone not following safety and housekeeping procedures may have points deducted from their lab grade and may be requested to leave the laboratory at any time.

POLICY ON LATE WORK I hope that you will avoid turning in an assignment late. If you must turn in work late, it will be accepted up to one week late with a 10% grade point penalty. Work handed in more than one week late will generally not be accepted.

Supplemental information: Laboratory Notebook^{1,2,3}

The pedagogical goals for requiring a laboratory notebook are:

1. Preserve the experimental data and observations you generate in the lab.
2. Develop your laboratory note keeping skills.
3. Develop your observational laboratory skills.

The objective of laboratory experimentation is to collect data from which new insight and theoretical understanding can be developed. Very little new insight can be gleaned from mulling over recollections of laboratory data. Most theoretical developments come from studying and analyzing laboratory results. This type of analysis is impossible if you have not accurately recorded your observations in a permanent and accessible fashion. Memory is not sufficient. You must record your results as they are obtained in your notebook.

"The guiding principle for notekeeping is to write with enough detail and clarity that another scientist could pick up the notebook some time in the future, repeat the work based on the written descriptions, and make the same observations that were originally recorded. If this guideline is followed, even the original author will be able to understand the notes when looking back on them after considerable time has passed."⁴

¹ Kanare, H. M. *Writing the Laboratory Notebook*; American Chemical Society: 1985. This is an excellent text that examines all facets of laboratory notetaking and is the basis for much of this handout.

² Keese, R.; Müller, R. K.; Toube, T. P. *Fundamentals of Preparative Organic Chemistry*; Horwood: 1982, pp 81-86. This short chapter provides additional basis for this handout.

³ *ACS Style Guide*, 2nd ed.; American Chemical Society: 1997. The basic document and reference formats used in this handout are based upon this guide and the article format used in the *Journal of Organic Chemistry*.

⁴ Kanare, H. M. *Writing the Laboratory Notebook*; American Chemical Society: 1985, p. 1.

Physical Requirements:

The laboratory notebook must be permanently bound and pages numbered consecutively. All entries must be in **permanent, non-bleeding ink** (an ordinary black ballpoint pen is sufficient) on one side of each page.

Notebook Organization:


1. The first page or two of the notebook must be reserved for an index (Table of Contents) that will include the page number(s), descriptive title, and date for each project.
2. Your experiment should begin with a title and presentation of the chemical reaction or technique being investigated.
3. You should include the chemical properties (molecular weight, melting point, boiling point, density, or concentration) of all chemicals you are using. You should include safety and hazard information for chemicals you are using. If special PPE is required that should be included as well. A proper reference should be included for all physical data and experimental details. Reference format includes author, publication, edition, publisher, city, year, page number, as possible or the WEB link. (The WEB link will often be cited for MSDS.)
4. Each page must be signed and dated (Friday, January 12, 2010) by you the day the procedure is performed. **The instructor must initial the last entry you make at the end of laboratory. (Do not leave lab before showing me your notebook.)**
5. You must record what you have done as you perform the experiment. A chronological outline of experimental procedure may be prepared before lab is permitted, but this is **not** to be used as your record of the experiment. If you do insert such an outline, it should be dated and signed also.
6. It is critical that you record temperatures, reaction times, masses, volumes, color changes, gas evolution, etc. as you observe them in your laboratory notebook. You should also make a sketch of relevant apparatus and any special preparation of starting materials.
7. Record calculations that you perform indicating notebook page numbers where original data is located. If you perform a number of similar calculations on a number of similar samples, you need include only one sample calculation and may tabulate the rest of the results.
8. All spectra (infrared (IR), nuclear magnetic resonance (NMR), mass spectra (MS), gas chromatograms (GC), etc. should be given an identifying number/code which should be recorded in the lab notebook. The make and model of the instrument used, instrumental conditions, solvent used should be recorded, as appropriate, in the lab notebook. The

spectra should be labeled with identifying number and date and may be taped into your notebook. For example, one compound isolated by Robin S. Tanke described on page 23 of her first notebook (1) might be indicated as 1-RST-23A. A second compound isolated on that same page might be described as 1-RST-23B.

9. Include product yields and properly labeled characterization data. This means your spectra must include the sample number described in Note 8. Your characterization data may be kept in a separate binder or taped into your notebook. Loose spectra or GC data is not acceptable.
10. Good penmanship and clearly written prose are important but not more important than recording data while you are in the lab.

Lab notebook Grading Key:

- I. The table of contents is missing or incomplete.
- II. Presentation of the chemical reaction or technique being investigated not included or incomplete.
- III. Chemical properties (molecular weight, melting point, boiling point, density, or concentration) and safety information are not listed or not cited.
- IV. Pages are not signed and dated (Friday, January 12, 2010) and initialed properly.
- V. The description of your procedure is incomplete. (It is critical that you record temperatures, reaction times, masses, volumes, color changes, gas evolution, etc. as you observe them in your laboratory notebook.
- VI. Calculations are unclear or incorrectly carried out.
- VII. Data and sample labeling is missing or done incorrectly.
- VIII. Product yields and characterization data are missing.
- IX. Prose is poorly written or illegible.

Lab Dates	Title	Points
9/4, 9/5, & 9/6	Check-in and Safety Quiz	5
9/11, 9/12, & 9/13	Distillation	25
9/18, 9/19, & 9/20	Distillation, continued, Melting Point of Extraction Mixture	
9/25, 9/26, & 9/27	Organic Structures, Functional groups, IR and MS introduction	20
10/2, 10/3, & 10/4	Extraction and Crystallization	30
10/9, 10/11 & 10/12	Extraction, continued	
10/16, 10/17 & 10/18	Isolation of Essential Oils from Spices	35
10/23, 10/24, & 10/25	Isolation, continued	
10/30, 10/31, & 11/1	Lab Practical Planning and NMR introduction	5
11/6, 11/7 & 11/8	Lab Practical	35
11/13, 11/14, & 11/15	Lab Practical , continued	
	No Labs – 11/20, 11/21 or on Thanksgiving	
11/27, 11/28, & 11/29	Lab Practical, continued	
12/4, 12/5, & 12/6	Substitution reaction	30
12/11, 12/12, 12/13	Substitution and Check-out	