

CHEM 302: ORGANIC CHEMISTRY II SYLLABUS SPRING 2018

Instructor: Professor Lauren L. Rossi
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Class Location and Meeting Times:

Section 1: Monday, Wednesday, Friday: 9:00-9:50 AM, FCAS 121.

Section 2: Monday, Wednesday, Friday: 10:00-10:50 AM, FCAS 121.

Poor attendance= poor performance. Regular attendance in all classes is expected of all students. Attendance sheets are not used in this course but I do keep track of student class absences. Any student who fails to attend a course by the end of the add/drop period may be administratively withdrawn from the course. A 'W' grade is assigned in such instances and the Registrar notifies the student. Withdrawal from classes may impact financial aid.

Weekly Office Hours:

Monday 1-2PM, Thursday 9-10 AM, and Friday, 11AM-12 PM in MNS 200A. If you can't make these office hours, we can arrange a different appointment time as needed. I can also be reached by email.

Brief Course Description:

In this course, we will continue our examination of organic compounds and chemical reactions from CHEM 301. Organic chemistry builds upon itself. As this is the second semester of organic chemistry, the topics covered and the skills developed from CHEM 301 (identifying functional groups, naming of organic compounds, representing the three dimensional structure of organic compounds, and investigating the properties and reactions of alkanes, alkenes, alkynes, and alcohols) will be assumed. Topics in this four credit lecture and lab course include: spectroscopic structural determination, alcohols, aromatics, acids, and their derivatives; aldehydes and ketones; amines; and bio-organic compounds. Laboratory is project-oriented and emphasizes synthesis and instrumental techniques.

Prerequisite: Successful completion of CHEM 301.

Course Website:

The Bridges website will contain the lecture schedule, suggested end-of-chapter problems, and other course related information.

Course Goals & Learning Outcomes:

Many students approach organic chemistry as a memorization feat, however this route for most will not be successful. One needs to be able to identify and apply the principles of this course to novel situations, something that memorization does not provide. It may be useful for you to approach learning organic chemistry as you would a foreign language, continuous practice and application allows one to write and speak fluently. The goal of this course will be for you to think about and ultimately gain an understanding and appreciation for organic chemistry and its relevance to the world around you. Particular emphasis will be placed on reaction mechanisms, how organic molecules react under specified conditions, and the development of analytical skills to solve organic chemistry problems. Select topics and concepts from lecture will be applied in the laboratory portion of the course.

The analytical skills to solve organic chemistry problems will be developed by examining functional groups, reactivity trends, and reaction mechanisms. The biologically relevant functional groups studied in CHEM 302 will include: alcohols, amines, ethers, aldehydes, ketones, carboxylic acids and carboxylic acid derivatives.

You will be able to: critically examine molecules, identify functional groups within a complex organic molecule, identify reactive centers, predict nucleophile/ electrophile reactivity patterns, and propose possible reaction outcomes under specified conditions. Your development and progress will be evaluated through applications in problem sets, examinations, and laboratory exercises throughout the semester.

Upon successful completion of this course, you should be able to demonstrate: an understanding of how molecules interact and react with each other through mechanistic drawings, a working knowledge of spectroscopic techniques commonly employed to identify and characterize organic molecules (nuclear magnetic spectroscopy, ultraviolet spectroscopy, mass spectrometry, and infrared spectroscopy), and dissect a target molecule into proposed reactant molecules (retrosynthesis). The information covered within this course and the developed skills will be useful not only if one continues studying chemistry, but also other scientific fields including textiles, pharmacy, nutrition, medicine, forensics, molecular biology, etc.

Lecture Textbook and Other Course Material:

- (1) Organic Chemistry 9th Edition by L.G. Wade, (Pearson), *required*. ISBN: 978-0-321-97137-1.
- (2) Solutions Manual 9th Edition by L.G. Wade and J. Simek, *recommended*. ISBN: 978-0-134-16037-5.
- (3) Molecular models are **recommended** (available in the bookstore, online, etc.)
- (4) Laboratory items (including **required** RWU manual, goggles, and bound notebook).

Please note that course materials distributed by an instructor are the intellectual property of the instructor and may not be shared or distributed without written expressed permission.

Overall Grade Breakdown:

Your course performance will be evaluated in four categories. The final grades will be based on a straight curve from the total points (75% for lecture, 25% for lab). Examinations and problem sets are not scaled. The overall course mean will typically be around the C dividing mark (approximately 75).

<u>Examinations:</u>	45% (15% each)
<u>Final Examination:</u>	15%
<u>Problem Sets:</u>	15%
<u>Laboratory:</u>	25%
<u>Total:</u>	100%

Examinations:

There will be three (3) 'in-class' examinations during the semester and a final examination. Each examination is worth 100 pts. *You must take the exam with your registered section.* As organic chemistry builds upon itself, the final examination will be cumulative (as is life!). These exams are meant to assess the application and your working knowledge of the covered material.

The final examination will be given on a date and time determined by the Registrar. *There will be no makeup final examination.* If you miss the final with a valid reason *and* a note (provided within three days of examination), you will receive an incomplete (I) in the course. If you miss the final *and do not* have a valid reason or no note, you will receive a zero (0) on the final examination.

*If, for whatever reason including illness, you do not show for an exam you will receive an automatic zero (0). An excused absence from an exam will allow the missed exam grade to be replaced by the average score of your remaining three exams. You must provide proof to me of a very serious emergency in the case of a missed examination within three weekdays of the missed examination. This proof of serious emergency includes a written/ printed summons or doctor's note that states you are/were not able to attend class/ work on that examination date. *Student health services do not provide written excuses! Exams/ papers/ projects in other classes or a faulty alarm clock/ wake-up are not valid reasons for not showing to an examination!* An unexcused absence from an examination will earn you a zero (0), which cannot be replaced!*

BE ADVISED: You have up to one week after the graded in-class exams are available to submit your exam for a regrade if you believe there was an error in the grading of your exam. Also exams (or portions of) *written in pencil are not* eligible for a regrade. Approximately 10- 20% completed exams, chosen at random, are photocopied to guard against answers being changed for regrading. To submit an exam for a regrade, you must accompany the exam with a note indicating the problem you want to be reviewed. CAUTION: When you hand in an exam to be regarded, the entire exam and partial credit will be regraded not just the problem you have asked to be reviewed, so your score could actually decrease! Therefore, check the answer key posted on the course website before submitting a regrade.

Dates of Examinations: **February 21 (Wed.), April 4 (Wed.), and May 2 (Wed.)**
Final Exam: May TBA, 2018. Time and Location TBA

Problem Sets:

There will be problem sets assigned throughout the semester. These are meant for you to practice and develop problem solving skills and a working knowledge of the course topics/ concepts. The current plan is to have about six sets. **Late problem sets (not handed in during class) will be worth ½ points and will not be accepted after the key is posted.** There are no makeup problem sets. If you unable to attend class on its due date, please submit file through Bridges Assignment page. It is still due at the same time as class and the window to submit your completed problem set on Bridges closes at the same time the class ends.

Laboratory:

The RWU laboratory manual and a bound (not spiral) composition notebook are required (available at the bookstore). The lab exercises are designed to give you “hands on” experience with chemistry. They are an integral part of your learning process and they represent a significant portion (25%) of your course grade. You must come to the lab **prepared** before carrying out the experiment. Lab attendance is MANDATORY. Students **must** complete all the laboratory experiments to pass the laboratory portion of the course. If you cannot make your assigned lab section due to an extraordinary circumstance you must notify the lab instructor *in advance* to arrange to make up the lab. An exam in this or another class is **not** an extraordinary circumstance.

Important Reminders:

February 21- last day to withdraw from class, *without* a ‘W’ on transcript.

March 23- last day to withdraw from class, *with* a ‘W’ on transcript.

SAS Students:

Students with disabilities who wish to receive academic accommodations must register with the **Student Accessibility Services (SAS)** in order to begin the accommodation process. The SAS office will provide registered students with the specific information they need to share with each instructor. The SAS accommodation can only be provided after receipt of the SAS forms from you (not honored if forms provided in less than 24 hours before exam/quiz). SAS is located on the first floor of the Main University Library within the Center for Academic Development and is open from 8:00AM to 5:00PM, Monday through Friday. SAS students will take the examination on the same day as others and should begin the exam at the same start time (or earlier) as their respective section.

Tutorial Support Services (TSS):

Located on the second floor of the University Library within the Center for Academic Development, provides tutoring at no charge for all RWU students. The Math, Writing, Science, and Foreign Language Centers offer assistance Monday- Thursday 9AM- 8PM; Friday 9AM- 3PM; Sunday 2 PM- 8 PM. For additional information about the Center, including tutor schedules, visit <http://rwu.edu/go/tss>.

Academic Integrity:

During all exams, all cell phones, notes, study sheets, flashcards, coats, etc. will be placed in the front of the room prior to the start of the session. If any cell phone or paper is found in your vicinity, *it will be assumed you are cheating.*

All students at Roger Williams University are expected to maintain high standards of academic honesty and integrity. It is the responsibility of every student to be aware of the University's policy and to abide by its provisions. Academic misconduct is conduct by which a student misrepresents his or her academic accomplishments through cheating, fabrication, plagiarism, fraud, and/ or willful damage. Knowingly allowing others to represent your work as their own is as serious an offense as submitting another's work as your own. **All** violations of the Academic Honor Code will be forwarded in writing to both the Dean of the College of Arts and Sciences and in the most egregious cases, to the Vice President for Academic Affairs. Violations of the Academic Honor Code may result in dismissal from the university along with appropriate documentation being placed on your permanent transcript.

As there are multiple sections of this course, **DO NOT** discuss the contents of the examination with other students until all have taken the exam. Sharing of examination content before another has taken the exam provides an unfair advantage to some and therefore constitutes cheating. The examination topics are provided in a review sheet before each exam and each section exam will have different questions to minimize and dissuade cheating.

Title IX at RWU:

Roger Williams University fosters a campus free of power-based personal violence including sexual harassment, domestic violence, relationship violence, stalking, and/or any form of sex or gender-based discrimination. If you disclose a personal experience as described above, either verbally or in writing, the course instructor is required to notify the Title IX Coordinator. To disclose any such violence confidentially, contact one of the three resources listed below:

- The RWU Counseling Center – 401-254-3124
- Health Services – 401-254-3156
- University Chaplain, Rev. Nancy Soukup – 401-254-3433

Additional information regarding your rights and resources at: www.rwu.edu/undergraduate/student-life/health-and-counseling/sexual-assault-and-dating-violence/title-ix-rwu

Miscellaneous:

The following are inappropriate during the lecture and examination period: cell phones, PDA's, text messaging, iPods, MP3 players, CD players, sleeping, and talking. *The use of computers (other than to write notes), cell phones, or other communication devices in the classroom is distracting and disrespectful to the professor and other students and is thus prohibited.* Students who do not refrain from texting/emailing in class will be asked to leave the room. All belongings are to be placed at the front of the classroom during exams/ quizzes. Contact with any device which transmits or receives electronic information (cell phone, computer) during a quiz or exam is strictly prohibited. *Violation of this policy will result in a student receiving an automatic "zero" on the quiz or exam.* A second violation will result in dismissal from the course.

Incompletes:

According to the University Catalog: "If a student is unable to complete assigned classroom work by the end of the semester due to documented **extenuating** circumstances, faculty may assign a grade of Incomplete (**I**) if the quality of work already done warrants an extension and provided that the student is able to complete the remaining work. In all cases, faculty stipulate work remaining and the duration of the extension in writing. Such extension shall not exceed one semester. Faculty submit a Change-of-Grade form before the conclusion of the next regular semester.

An Incomplete (**I**) is automatically converted to an **F** unless the Registrar receives a Change-of-Grade before the conclusion of the next regular semester. A student who is unable to complete assigned

work in a non-classroom course may request from faculty an extension not to exceed one additional semester. If a Change-of-Grade form has not been submitted before the end of the second semester, the Incomplete (I) will be converted to an F. Beyond a second semester, change-of-grade requests must be appealed to the college or school Academic Standards Committee.”

Workload:

In preparing for the course, there are four recommended study habits to maintain:

- (1) You must plan to spend **2-3 hours** per lecture (**8-13 hours per week**) studying organic chemistry weekly **and** working on the homework/ text problems.
- (2) I strongly recommend that you read the chapter to be covered in lecture before/ after the lecture on that material. In this way, you can pay more attention to the lecture and understand what is being said. The text is a resource and provides a complimentary explanation of the topics.
- (3) Do as many problems in the text as you possibly can *without* referring to the solutions manual. I will point out the particularly good problems that should draw your attention. A temptation exists to use the solutions manual while “doing” the problems in the text. People read the problems, convince themselves that “they know that” without actually doing the problem, then look up the answer in the manual. All along, they’ve deluded themselves into believing they have done all the problems, when in truth, they haven’t done any. Then comes the test and they can’t answer the questions, but they don’t know why when they “did all the problems”.
- (4) In this semester, we will cover a lot of different reactions. I recommend for some that you make up a set of 4” x 6” flashcards, one for each reaction, definitions, or mechanism. My suggestion would be to put the reaction on one side, and a mechanism on the other. Go over these regularly, **NOT JUST THE NIGHT BEFORE THE TEST!** You will be responsible for these reactions throughout the semester.

Other Helpful Hints:

- 1) Keep up with the material. Read text and do text problems as topics are covered in class.
- 2) Review and rewrite your lecture notes after every lecture.
- 3) Form study groups (maximum of four students).
- 4) Don’t rely upon others to do the text/ problem set problems. Exams are individual grades.
- 5) Don't cram for exams.

Course Topics/ Content from Wade (8th Edition):

It is often difficult to predict where we will be on any given date in the future. We will proceed through the topics according to the text order. Some chapters will be covered in more detail than others. *It is assumed that you know and understand the material from the prerequisite classes.*

Chapter 10: Structure and Synthesis of Alcohols

Chapter 11: Reactions of Alcohols

Chapter 13: Nuclear Magnetic Resonance Spectroscopy

Chapter 14: Ethers, Epoxides, and Thioethers

Chapter 15: Conjugated Systems, Orbital Symmetry, and Ultraviolet Spectroscopy

Chapter 16: Aromatic Compounds

Chapter 17: Reactions of Aromatic Compounds

Chapter 18: Ketones and Aldehydes

Chapter 19: Amines

Chapter 20: Carboxylic Acids

Chapter 21: Carboxylic Acid Derivatives

Chapter 22: Condensations and Alpha Substitutions of Carbonyl Compounds

Chapter 23: Carbohydrates and Nucleic Acids

This syllabus is a guide for this course through the Spring 2018 semester. The instructor of the course reserves the right to modify the contents of this syllabus accordingly as the semester proceeds. Accordingly, any modifications will be communicated to students.

Suggested End-of-Chapter ‘Study’ Text Problems:

Chapter	Problems	Chapter	Problems
10	30-46, 48-54, 56-59	18	37-44, 46-72, 77
11	39-43, 45-60, 62, 63, 65, 66	19	32-35, 37-40, 42-55, 59-62, 65
13	33-36, 38-41, 43, 45, 47, 49-56	20	25-27, 29-42, 44-47
14	29-37, 39-43, 45-48, 50, 53-55	21	42-59, 61-64, 66, 70, 71
15	24-31, 33-37, 39, 40	22	60-75, 77-85
16	26-36, 38, 40-43, 45, 48-51	23	46, 47, 49-52, 54-56, 58, 59, 61-65
17	50-55, 57-60, 62-68, 70, 72, 73, 75-78		

Additional problems for each chapter topic/ section are provided within the chapter also.

CHEMISTRY 302 COURSE SCHEDULE (Subject to change as Semester progresses)

With regards to absence due to religious observance, Roger Williams University welcomes and values people and their perspectives and respects the interests of all members of our community. Students are expected to review their syllabi and notify faculty as far in advance as possible of potential conflicts between course requirements and religious observances. Any student who faces a conflict between the requirements of a course and the observance of his or her religious faith should contact the instructor as early in the semester as possible.

Lecture, Date	Topic	Text Reading
1: 01-24-18	<ul style="list-style-type: none"> Syllabus/ course overview Alcohol acidity (review) Alcohol synthesis (review) 	10.1-10.10
2: 01-26-18	<ul style="list-style-type: none"> Organometallic reactions to form alcohols (review) Carbonyl reduction (review) Alcohol oxidation 	10.9-10.11 11.1-11.4
3: 01-29-18	<ul style="list-style-type: none"> Alcohol oxidation cont'd Alcohol reduction Alcohol conversion to good leaving group 	11.4 11.6 11.5, 11.7
4: 01-31-18	<ul style="list-style-type: none"> Cleavage of hydroxyl group Alkoxide formation and use 	11.7- 11.10
5: 02-02-18	<ul style="list-style-type: none"> Alcohol substitution Synthesis planning (multistep) 	11.5, 11.12-11.14
6: 02-05-18	<ul style="list-style-type: none"> Synthesis problems continued IR, MS (review Ch. 12) with NMR for identification NMR introduction 	Ch. 12 review 13.1-13.4
7: 02-07-18	<ul style="list-style-type: none"> Shielding, Chemical shift, ranges Signal and equivalence Integration 	13.5-13.7, 13.10
8: 02-09-18	<ul style="list-style-type: none"> Coupling/ splitting Interpreting ^1H NMR spectra ^{13}C NMR vs. ^1H NMR 	13.8-13.9, 13.11, 13.12
9: 02-12-18	<ul style="list-style-type: none"> ^{13}C NMR DEPT Spectral exercises 	13.12- 13.14
10: 02-14-18	<ul style="list-style-type: none"> Spectral interpretation and prediction (use of IR, MS, NMR) 	Handout, text problems
11: 02-16-18	<ul style="list-style-type: none"> Ether, epoxide nomenclature, properties Spectroscopy Synthesis 	14.1-14.7
02-19-18	<i>President's Day- No classes</i>	
12: 02-21-18	<i>Last day to withdraw from class without 'W' Monday schedule</i> Exam 1	Ch. 10, 11, 13 & Some Ch. 12, 14
13: 02-23-18	<ul style="list-style-type: none"> Cleavage of ethers Epoxide synthesis Ring opening of epoxides (acid) 	14.8, 14.11-14.12
14: 02-26-18	<ul style="list-style-type: none"> Organometallic epoxide opening Epoxide opening , base Conjugation, reactivity and stability (charged or neutral) 	14.13-14.15 15.1-15.6

15: 02-28-18	<ul style="list-style-type: none"> • Molecular orbital description of conjugation • Allyl cation, radical • Mol. orb. and electronic config. of allyl systems • Reactions of allyl cmpds, Diels- Alder reaction 	15.7-15.11
16: 03-02-18	<ul style="list-style-type: none"> • UV spectroscopy • Benzene structure, properties 	15.13, 15.14 16.1-16.2
17: 03-05-18	<ul style="list-style-type: none"> • Mol. Diagram of benzene • Huckel's rule • Derivation of Huckel's rule 	16.3-16.9
18: 03-07-18	<ul style="list-style-type: none"> • Aromatic ions • Polygon rule • Heteroaromatics 	16.10-16.15
19: 03-09-18	<ul style="list-style-type: none"> • Nomenclature of aromatics • Spectroscopy (review) • Electrophilic aromatic subst. • Halogenations 	16.12-16.15 17.1-17.2
03-11-18 to 03-18-18	<i>Spring Break- No classes</i>	
20: 03-19-18	<ul style="list-style-type: none"> • Nitration • Sulfonation • Alkylation 	17.3, 17.4, 17.10
21: 03-21-18	<ul style="list-style-type: none"> • Acylation • Activating/ deactivating groups • Ortho/para/meta directing groups 	17.5-17.8, 17.11
22: 03-23-18	<p style="text-align: center;"><i>Last day to withdraw from class with a 'W'</i></p> <ul style="list-style-type: none"> • Substituent types cont'd • Organometallic Reagents • Predicting & designing product • Designing multistep synthesis 	17.9, 17.13
23: 03-26-18	<ul style="list-style-type: none"> • Side chain reactions • Nucleophilic aromatic subst. 	17.15- 17.16 17.12
24: 03-28-18	<ul style="list-style-type: none"> • Organometallic coupling • Nomenclature of aldehyde/ ketone • Properties • Spectroscopy (review) 	17.13 18.1-18.4
03-30-18	<i>University holiday- No classes</i>	
25: 04-02-18	<ul style="list-style-type: none"> • RCHO and R₂CO Synthesis (review) • Aldehyde/ ketones from nitriles, reduction • Reactivity of RCHO/R₂CO • Nucleophilic addition, base (cyanohydrin, hydrate) 	18.5- 18.7 18.9-18.11
26: 04-04-18	Exam 2	Ch. 15, 16, 17 & some 14,18
27: 04-06-18	<ul style="list-style-type: none"> • Nucleophilic addition, acid (hydrate, acetal, cyanohydrin) 	18.12-18.14, 18.17
28: 04-09-18	<ul style="list-style-type: none"> • Nucleophilic addition, acid (imine) • Hydrazone, oxime formation • Oxidation and reduction (Wolff- Kishner) • Wittig reaction 	18.12,18.15, 18.16, 18.20
29: 04-11-18	<ul style="list-style-type: none"> • Amine nomenclature, structure, properties • Amine basicity • Spectroscopy (review) • Reactions of amines 	19.1-19.9

30: 04-13-18	<ul style="list-style-type: none"> Hofmann elimination Acylation of amine Diazotization Reductive amination Acylation-reduction 	19.11, 19.12, 19.14, 19.16-19.19
31: 04-16-18	<ul style="list-style-type: none"> Carboxylic acid (CA) nomenclature, properties Acidity Spectroscopy (review) CA Synthesis 	20.1-20.7
32: 04-18-18	<ul style="list-style-type: none"> Nucleophilic acyl substitution Esterification Reduction Acid chloride synthesis 	20.8- 20.10, 20.12, 20.13, 20.15
33: 04-20-18	<ul style="list-style-type: none"> Acid derivative structure, nomenclature Derivative properties, spectroscopy Nucleophilic acyl substitution interconversion, general Acid derivative reactivity 	21.1-21.5
34: 04-23-18	<ul style="list-style-type: none"> Favorable interconversion, web Acid derivatives reduction Organometallic reagent conditions 	21.8-21.9
35: 04-25-18	<ul style="list-style-type: none"> Nitrile formation Overview of acid derivatives 	21.5-21.7, 21.10-21.14
36: 04-27-18	<ul style="list-style-type: none"> Enols and enolate formation (acid/ base) Alkylation 	22.1-22.4
37: 04-30-18	<ul style="list-style-type: none"> Enamine formation Stork reaction Halogenations 	22.4, 22.5
38: 05-02-18	Exam 3	Ch. 19, 20, 21 & Some: Ch. 18, 22
39: 05-04-18	<ul style="list-style-type: none"> Malonic ester synthesis Acetoacetic ester synthesis Aldol condensation with dehydration 	22.16, 22.17, 22.7-22.11
40: 05-07-18	<ul style="list-style-type: none"> Elcb Claisen/ Dieckmann condensation β-dicarbonyl synthesis 	22.8, 22.12-22.15
41: 05-9-18	<ul style="list-style-type: none"> Michael reaction Robinson Annulation Review and wrap-up 	22.18, 22.19
<i>If have time...</i>	<ul style="list-style-type: none"> Carbohydrate classification Erythro & threo Epimers & anomers 	23.1- 23.7
42: TO BE DETERMINED	ACS Full Year Organic FINAL EXAM Covers CHEM 301 and 302 course material <i>Date and Time set by the Registrar</i>	Ch. 1-22

Topics and concepts covered in Chapters 23-26 of the text will be discussed at different points within the semester, when relevant.