ORGANIC CHEMISTRY II SYLLABUS, Spring 2024

Instructor: **Dr. Brian Myers**

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Office Hours: MWF from 10–noon or by appointment. Open door or by appointment (virtual is an option). See: http://tinyurl.com/BJMofficehours.

Catalog info: Organic Chemistry 2 (CHEM 2521.03, CRN: 30103) is a 3-credit hour course

Lectures: 1–2 PM in Mathile 248

Text & Equip:

Electronic materials will be available in Canvas (eText, homework, extra problems and other resources). Once you click on the Wiley Course Resource link in our Canvas course, you will be asked to enter a registration code. If you have not purchased one from the ONU Bookstore, you can purchase a code directly from Wiley ($76.95), which will give you access to the materials. Here are the Books/equipment for the course:

1) Required: Klein, 4e + WileyPLUS Access 1 semester: ISBN: 9781119760986 (includes downloadable etext); Student retail including tax: $76.95.

1a) **OR** Highly Recommended: Klein, 4/e Loose Leaf: ISBN: 9781119810643 (covers organic 1 and 2); Student retail including tax: $53.63. Note: A copy is available in the ONU Library Circulation Desk. You should opt to get this on the 1st day because if you decide you need this later it will cost you $144.25. You will need WileyPLUS for homework submissions/problems.

2) Strongly Recommended: Klein, 4e Student Study Guide Loose Leaf: ISBN: 9781119810650 (covers O-CHEM 1 & 2); Student retail including tax: $133.85. Note: A copy is available in the ONU Library Circulation Desk.

2a) **OR** Klein, 4e Student Study Guide electronic version (download). This is a $15 upgrade (use promo code: ONU01) which is available from Wiley through Resources in Canvas. (covers O-CHEM 1 & 2).

3) A Molecular Model kit like Molecular Visions: ISBN 9780964883710 (ONU bookstore: $24.25)

Need Help with the Wileyplus/electronic resources? See FAQs: tinyurl.com/FirstDayTroubleshooting and/or customercare.bncollege.com Call 1-844-932-6657 or bookstorecustomercare@bncollege.com available 7 days/week, 8 am – 11 pm EST.

Course goals: The course is designed so that the student can develop a basic understanding of organic chemistry structures and reactions thereby laying a foundation for further study in the field and closely related disciplines (e.g. biochemistry, molecular biology, and pharmaceutically relevant sciences).

Prerequisites: You must have completed CHEM 2511 or 2611 with a passing grade to enroll in this course. You must be enrolled concurrently in CHEM 2561 or 2661.

Withdraws: This course is a co-requisite with Organic 2 Laboratory Course (which could have also been completed previously). In the event that you need to withdraw from this course, you must also withdraw from CHEM 2561 (Organic 2 laboratory) or CHEM 2661 (Organic 2 laboratory for majors). Alternatively, if you withdraw from the Organic 2 Laboratory course you must also withdraw from this course.

Misconduct: The University expects its students to conduct themselves in a dignified and honorable manner as mature members of the academic community and assumes that individually and collectively they will discourage acts of academic dishonesty. The University also expects cooperation among administrators, faculty, staff, and students in preventing acts of academic dishonesty, in detecting such acts, reporting them, and identifying those who commit them, and in providing appropriate punishment for offenders. The University Code of Academic Student Conduct is found in Appendix F of the Student Handbook: my.onu.edu/student_handbook. To this end, any student deviating from these standards in this course will be penalized to the fullest extent possible.

Incompletes: Incompletes will be given only when the work of the course is substantially completed and when the student's work is of passing quality.

Special accommodations policy:
Students requiring accommodations because of physical and/or learning disabilities should contact their Dean's office prior to or during the first week of classes. The student needs to initiate a discussion of classroom/testing procedure accommodations with the instructor at minimum of **2 days in advance of each exam/quiz**.

Point Breakdown:

3 exams, @ 135 points	405
6 quizzes, @ 45 points	270
Online Homework	125
Final Exam	200
TOTAL	**1000 POINTS**

Grade Scale:	
>870	A
869–760	B
759–650	C
649–580	D

Quizzes & Exams: There will be six 45-point quizzes given during the semester. Each quiz will last 15-20 minutes and will cover the most recent material presented in lecture. There will be three 135-point exams and a 200-point final exam. The exams will cover everything from the first day of class with an emphasis on the material covered since the previous exam. The final exam will be an ACS final which is cumulative for the entire year of organic chemistry.

Makeups: In the event that you feel that you will be unable to attend a scheduled exam/quiz, you must contact me prior to (or as soon as safely feasibly) to discuss your situation (by phone AND email). If an excused absence is granted by the instructor, the instructor reserves the right to 1) provide a makeup exam that contains questions covering material up to the day of the makeup exam, 2) administer a cumulative makeup exam at the end of term, 3) prorate the final, or 4) use other means of evaluation that are agreeable between the instructor and the student. The instructor reserves the right to choose the method of makeup. Unexcused absences including (but not limited to): sleeping through the exam, not informing the instructor in a timely fashion, and vacation travel will result in the score of zero. Departmental policy dictates that makeup exams will not be given to students before the class has taken the exam.

Online Homework (available through Canvas)

We will be using the WileyPLUS system for our online homework. It will be graded. We will multiply your percent correct times 125 to get the score for the course.

Assignment	Due Date		Assignment	Due Date
Ch. 10	1/25 (Thurs.)		Ch. 18	3/19 (Tues.)
Ch. 11	1/29 (Mon.)		Ch. 19	3/26 (Tues.)
Ch. 12	2/08 (Thurs.)		Ch. 20	4/04 (Thurs.)*
Ch. 13	2/15 (Thurs.)		Ch. 21	4/23 (Tues.)
Ch. 16	2/22 (Thurs.)		Ch. 22	4/30 (Tues.)
Ch. 17	2/25 (Sun.)		Ch. 24	5/07 (Tues.)

* Due date is before end of the chapter is covered because of exam.

Class Schedule,* Organic Chemistry 2:

	Date	Topic	Reading
1	01/22 M	Ch. 10 Intro to radical chemistry	10.1 – 10.5
	01/24 W	Ch. 10 Radical reactions	10.6 – 10.9
	01/26 F	Ch. 11 Retro synthesis	11.1 – 11.6
2	01/29 M	Ch. 12 Alcohol nomenclature & review of synthesis	12.1 – 12.4
	01/31 W	Ch. 12 Hydride reduction reagents, Grignard Reagents	12.5 – 12.7
	02/02 F	Ch. 12 Grignard Reactions including retro synthesis	12.5 – 12.7
3	02/05 M	**Quiz 1**. Ch. 12 Silicon protecting groups, $SOCl_2$, PBr_3	12.8 – 12.10
	02/07 W	Ch. 12 Oxidants (oxidizing alcohols)	12.11 – 12.13
	02/09 F	Ch. 13 Ethers & epoxides: naming & synthesis	13.1 – 13.3
4	02/12 M	Ch. 13 Williamson ether synthesis, reactions of ethers	13.4 – 13.9
	02/14 W	Ch. 13 Sharpless asymmetric epoxidation and opening epoxides	13.10 – 13.12
	02/16 F	**Quiz 2.** Ch. 16 Conjugation: additions to dienes (1,2 vs 1,4)	16.1 – 16.4
5	02/19 M	Ch. 16 Diels-Alder reaction	16.5 – 16.10
	02/21 W	Ch. 16 Intramolecular Diels-Alder, Ch. 17. Nomenclature of aromatic compounds	16.11 – 16.13, 17.1 – 17.3
	02/23 F	Ch. 17 Aromaticity, Birch Reduction + molecular orbitals & aromaticity	17.4 – 17.8
6	02/26 M	**Exam 1**	–
	02/28 W	Ch. 18 EAS Mechanisms: Nitration, halogenation, sulfonation	18.1 – 18.3
	03/01 F	Ch. 18 EAS Friedel-Crafts reactions	18.4 – 18.8
7	03/04 M	Ch. 18 Additional reactions on groups next to aromatics	18.9 – 18.11
	03/06 W	Ch. 18 EAS: Adding to rings with E.D.G. & E.W.G.	18.12 – 18.13
	03/08 F	Ch. 18 Nucleophilic aromatic substitution & retrosynthesis	18.14 – 18.15
	03/11 M	No Class: Spring Break	–
	03/13 W	No Class: Spring Break	–
	03/15 F	No Class: Spring Break	–
8	03/18 M**	Ch. 19 Making aldehydes, ketones, & cyanohydrins/acetals**	19.1 – 19.4
	03/20 W**	Ch. 19 Dithianes + imines**	19.5 – 19.8
	03/22 F	**Quiz 3**. Ch. 19 Imines, enamines, Wolff-Kishner reduction	19.9 – 19.11
9	03/25 M	Ch. 19 Wittig and Baeyer-Villiger reactions	19.12 – 19.18
	03/27 W	Ch. 20 Acyl Substitution	20.1 – 20.11
	03/29 F	No Class: Easter	–
10	04/01 M	Ch. 20 Acid chloride synthesis & reactions, anhydrides, Fisher esterification	20.12 – 20.13
	04/03 W	Ch. 20 Hydrolysis of esters, lactones, & amides (synthesis + reactions)	20.14 – 20.15
	04/05 F	**Exam 2**	–
11	04/08 M	Ch. 20 Synthesis of nitriles from amides, reactions of nitriles	20.14 – 20.15
	04/10 W	Ch. 21 Enols & enolates halogenation & alkylation	21.1–21.7
	04/12 F	Ch. 21 Enols and Enolates	21.1–21.7
12	04/15 M	**Quiz 4**. Ch. 21 The aldol reaction	21.1–21.7
	04/16 T	No Class: Honor's Day	–
	04/17 W	Ch. 21 The directed aldol reaction, Claisen, & malonic ester synthesis	21.1–21.7
	04/19 F	Ch. 21 Acetoacetic ester synthesis	21.1–21.7
13	04/22 M	Ch. 21 Michael reaction & Robinson annulation	21.1–21.17
	04/24 W	**Quiz 5.** Ch. 22 Amine nomenclature, synthesis (review)	22.1 – 22.5
	04/26 F	Ch. 22 Gabriel Synthesis, Hoffman Elim., Curtius Rearrangement, Cope Elim.	22.6 – 22.9
14	04/29 M	Ch. 22 Diazotization and Diazonium salts	22.10 – 22.12
	05/01 W	**Exam 3**	–
	05/03 F	Ch. 24 Carbohydrates – introduction & Fisher Projections, Reactions of sugars	24.1 – 24.8
15	05/06 M	Ch. 24 Carbohydrates - Applications/complex & Intro. to Organometallic Chemistry	24.9 – 24.10, 23
	05/08 W	**Quiz 6.** Ch. 23. Organometallic Chemistry (Suzuki, Stille, Grubbs RCM catalysis)	23
	05/10 F	Review	–
	05/14 T	**Final Exam (7–9 PM) Room: TBD (probably Science Annex 105)**	

*Please note this schedule is a best guess estimate of the lecture content for a give date. Tuesday evening time blocks will be used for Supplemental Instruction Sessions. **There will be a guest lecturer or alternate activity for these dates given that I will be attending the ACS National Meeting.

Suggestions:

1) **Your textbook is your primary learning resource.** Read the assigned chapters prior to attending class. In class, I will stress the most important points and clarify difficult material. Lectures will not necessarily cover all the required material, and all the material covered in class will not necessarily be covered in the text. Thus, it is very important to read the text AND attend lecture.
2) **Organic chemistry is a cumulative subject:** Understanding the new material requires that you have mastered earlier material. Therefore, it is extremely important to keep up with the material.
3) **Work the assigned problems!** You cannot learn organic chemistry without doing practice problems. You are responsible for every problem in the text. Make certain that you understand the problem instead of just being able to reproduce the solution. While working problems, it is strongly suggested that you refer back to the text and reread sections of the previous chapters to find the information needed to answer the question. Only use the solutions manual to check problems, not to learn how to do the problems. Consider doing the problem set as if you are going to turn it in to me and do problems each day!
4) **Learn and apply concepts.** Although memorization of some key subject matter is required, it is necessary to learn concepts and apply them to the task at hand. Do not confuse having memorized class material (or solutions to a particular problem) as having learned the concepts. Understanding implies application of the information that has been acquired to solve new problems. One of the best ways to master the material is to build a good set of flashcards to predict reaction products (including the regiochemical and stereochemical outcomes) along with the important features of the mechanism for the reactions.
5) **Use small study groups effectively.** Studying in small groups (2–3 people) can be very beneficial and is strongly recommended. But, do not do the majority of your studying for this course in groups. The most effective way to study with a group is to discuss the issues with which you are having the most difficulty.
6) **Take good class notes by hand.** Pay attention to the topics and material covered in lecture. This way you get a sense of what is important. Consider rewriting your notes adding in some relevant info and/or examples from text. While electronic tablets have been used by some students effectively, the use of paper & pencils/pens has been shown to be more effective. Typing out notes in organic chemistry is not logistically possible.
7) **Study in a quiet environment each day**. Do some studying each day (likely 1–2 hours, which is far superior to 10 hours one day per week). Most successful students prefer to find a time each day away from others and especially electronic devices.
8) **Attend the Supplemental Instruction Sessions:** These optional sessions will be held Tuesday evenings 7–8 PM in Mathile 248 by student Hayden Heche (h-heche@onu.edu). They will include worksheets containing problems. Hayden is not only running the sessions, he is attending lecture, and serving as a tutor.
9) **Contact me:** If you are having difficulty with this course, contact me ASAP. If you do not know where to start asking questions, the question that needs answered is "When can I get in to see my instructor?".

Using cell phones in class is highly disruptive, do not use them during lecture.

Common Course Policies:

Ohio Northern University is dedicated to providing an equitable educational experience for all enrolled students. Universal course policies can be found at: my.onu.edu/registrars_office/policies. Specifically, the following topics are addressed: Academic Dishonesty Policy; Academic Accommodations Policy; ONU Health and Safety Policy; Title IX Policy; and Diversity, Equity, and Inclusion Language.

Course Outcomes

At the end of this course students will be able to:

1. communicate the identity and structure of organic molecules.
2. describe structural and electronic features of organic molecules.
3. classify the reactivity of organic molecules based on their functional group or class.
4. propose viable syntheses of small-sized, organic molecules.

Learning Objectives

At the end of this Module/Unit students will be able to

1. identify the functional groups present in an organic molecule.
2. draw line-bond structures of organic molecules including stereochemistry.
3. name small organic molecules using the IUPAC systematic nomenclature system for molecules containing alkene, alkyl halide, alcohol, phenol, ether, aromatic, aldehyde, ketone, carboxylic acid, ester, acid halide, acid anhydride, amide, and amine, functional groups
4. identity sites of reactivity within a molecule based on acidity, basicity, nucleophilicity, and electrophilicity,
5. locate the stereogenic centers in a molecule.
6. locate the prochiral centers in a molecule.
7. analyze the thermodynamics and kinetics of competing reaction pathways for molecules containing alkene, alkyl halide, alcohol, phenol, ether, aromatic, aldehyde, ketone, carboxylic acid, ester, acid halide, acid anhydride, amide, amine, functional groups.
8. propose reasonable reaction mechanisms for molecules containing alkene, alkyl halide, alcohol, phenol, ether, aromatic, aldehyde, ketone, carboxylic acid, ester, acid halide, acid anhydride, amide, and amine, functional groups using the curved-arrow formalism that account for experimental observations of regiochemistry, stereochemistry, and kinetics.
9. predict products, reagents, and starting materials for the reactions of molecules containing alkene, alkyl halide, alcohol, phenol, ether, aromatic, aldehyde, ketone, carboxylic acid, ester, acid halide, acid anhydride, amide, and amine, functional groups accounting for both regiochemistry and stereochemistry.
10. apply the retrosynthetic formalism when breaking a target molecule into potential synthons and retrons.
11. propose viable synthetic routes to small-sized organic molecules that account for both regiochemistry and stereochemistry.
12. evaluate different proposed synthetic routes in a retrosynthetic tree based on competing undesired reactions, regiochemical control, and stereochemical control.