

Organic Chemistry II CHM-25B-1

Course Syllabus – Summer School 2026

Course Meeting Times:

Monday, Tuesday, Wednesday, Thursday: 9:00 – 11:30 am GZ 123

<p>Dr. Sinéad M Walsh sineadwalsh@brandeis.edu Office: tba</p>	<p>Office Hours: Monday 11:30 – 12:30 pm Wednesday 11:30 – 12:30 pm and by appointment</p>
--	---

Teaching Assistants: tba

Moodle Site: Check the course site regularly for updates, announcements, readings, lecture handouts *etc*

Course Description

Chem -25B will build on the fundamental principles learned in Organic Chemistry I. We will study new reactions and how they occur, with a primary focus on the mechanistic and synthetic organic chemistry relating to radical reactions, aromatic substitution, addition and substitution at carbonyls, substitution alpha to carbonyls, rearrangements, and pericyclic reactions. The organic chemistry of natural compounds (e.g. peptides, carbohydrates, etc.) is introduced.

Goals of the Course: The course seeks to advance problem-solving skills and critical thinking in the context of a solid foundation in organic chemistry. Students should leave the course with the ability to apply the tools they have learned to solve chemical problems that are somewhat unfamiliar and that combine several of the principles to which they have been exposed, specifically mechanistic and synthetic problems.

Course Delivery

This is a fully in-person lecture course, meeting four times a week on campus. I will be delivering lectures on the whiteboard and engaging the class in problem solving and discussions. Occasionally I will use PowerPoint slides or handouts; in this case, the material will be posted ahead of time on Moodle and/or paper copies will be distributed. No matter what format is used, students are expected to follow along, take notes and ask questions. Occasionally, and with notice, portions of the course material may be pre-recorded and posted on Moodle. Moodle is used extensively, and students are expected to consult the Moodle site regularly for announcements and posted course materials.

Communication

My preferred method of communication is email (in both directions!). When emailing me, please include the course name in the subject line to assist me in quickly determining the context of your communication. I aim to reply within 24 – 48 hours. Emails received after 5pm or on weekends will typically be attended to on the next business day.

Required Materials

1. Textbook: Joel Karty, *Organic Chemistry: Principles and Mechanisms*, 3rd Edition, W.W. Norton, 2022, and the accompanying *Solutions Manual*. This book can be purchased new or used. There is also an ebook option. The 2nd edition of this book is also available and acceptable – there isn't much difference

between these editions, mostly question numbering and topic organization. This version may be available online.

2. Apps or Tools/Equipment

In order to complete work for this course you must have access to the following:

- The internet.
- A laptop or tablet capable of accessing and completing tasks in Moodle, Echo360, Zoom, G-Suite, and Gradescope.
- A method of uploading images of handwritten work to Gradescope. There are many options for this including a scanner, a digital camera that can connect to your computer/tablet, a scanner app on your phone/tablet, the “Notes” app on an iPhone, etc.

Having a textbook is very important for your success in this course. If for any reason you are unable to obtain the textbook or any other resource required for this course, you may find many equivalent resources online (and linked in Moodle). No matter which resource you use, it is very important that you have access to, and complete, practice problems.

If you are having difficulty purchasing course materials, please make an appointment with your Student Financial Services or Academic Services advisor to discuss possible funding options and/or textbook alternatives.

Additional Recommended Materials:

1. A notebook to use while working all practice problems.
 - Writing down your work will help you learn the material and keep track of questions you should ask during office hours.
2. ChemDraw chemistry drawing/molecular modeling software. There is information on the Moodle site about how to obtain this (free to students enrolled in Chem 25).
3. Molecular Modeling Set (highly recommended)
If you have a kit from a previous class, you may continue to use that one. If you are purchasing a kit, you should purchase the following: [Indigo Advanced Molecular Model Set General/Organic Chemistry \(indigostruments.com\)](http://indigostruments.com) or <https://www.darlingmodels.com/kit-3-isbn-978-09648837-4-1-molecular-visions-organic-kit>. This will not be used in class, but many students find it helpful for their own personal use.

Assumed Prior Knowledge

Organic Chemistry 2 follows on directly from Organic Chemistry 1, and all of the topics from Organic Chemistry 1 are required knowledge for this course. These especially include:

- Relative electronegativities and other periodic trends of common elements: H, B, C, N, O, F, P, S, Cl, Br, I
- Orbitals and hybridization; electron pair and molecular geometries, bond angles, polarity
- Types of bonding and forces: common bonding situations, covalent bonding, ionic bonding, London dispersion forces, dipole—dipole interactions, hydrogen bonding
- Lewis structures, VSEPR theory, formal charges
- RESONANCE!
- Equilibrium constants (understanding of) and measure of thermodynamic equilibria (pH, pKa, for example)
- Drawing structures from names
- Identification of functional groups
- Proton Transfer Reactions, Acids and bases, particularly relative acidity/basicity
- Identification of nucleophiles and electrophiles
- Nucleophilic substitution chemistry
- Elimination chemistry
- Addition reactions to π bonds

Lecture Expectations and Cell Phone Policy

I expect each student to attend *every* lecture and be a *full intellectual participant*. Students should take notes, try to work problems, and ask relevant questions when they have them. You may take notes on paper or on an electronic note-taking device such as an iPad or other tablet. Absolutely no laptops are allowed as there is no reason to use one for this course - it is not feasible to type chemistry notes. Additionally, **cell phones should be turned to silent, put away and must remain out of sight during class** to avoid distracting you or your neighbors, unless they are specifically required (the policy for during quizzes and exams is different – see below). Violation of this policy may result in your being asked to leave the class.

The use of laptops, cell phones and smart watches for calls, text messaging, or browsing social media or any other website not required by me during class is NOT PERMITTED. Additionally, the use of headphones (over the head or in-ear) is NOT PERMITTED at any time during this class. These items are a distraction to you, me, and other students in the class.

During exams & quizzes: During exam and quiz periods, each cell phone and smart watch must be in airplane mode and silent mode and remain visible with the screen side down on the desk or on the floor under your chair. Absolutely no use of a cell phone or smart watch (i.e., checking its screen) is permitted from the time the first paper is handed out until the last paper has been handed in.

Attendance

This is an in-person class. Attendance in-person is expected and will be recorded each day. If you must miss a class, please notify Professor Walsh as soon as possible, but at least 24 hours in advance if possible. You are responsible for the material you miss. The pace of this class is very fast – if you do miss a class, you should aim to be caught up by the next class.

Academic Honor Code / Integrity Policy

Every member of the University community is expected to maintain the highest standards of academic integrity. A student shall not submit work that is falsified or is not the result of the student's own effort. Infringement of academic honesty by a student subjects that student to serious penalties, which may include failure on the assignment, failure in the course, suspension from the University or other sanctions (see section 20 of R&R). Please consult Brandeis University Rights and Responsibilities for all policies and procedures related to academic integrity.

Students may be required to submit work to plagiarism software to verify originality. A student who is in doubt regarding standards of academic honesty as they apply to a specific course or assignment should consult the faculty member responsible for that course or assignment before submitting the work. Allegations of alleged academic dishonesty will be forwarded to the Department of Student Rights and Community Standards. Citation and research assistance can be found at Brandeis Library Guides - Citing Sources (<https://guides.library.brandeis.edu/c.php?g=301723>). What is allowed and is not allowed in terms of resources and group work will be clearly stated for each assignment type in this course and will vary amongst assignments. Be sure to thoroughly read this syllabus and all instructions and complete the assignment as intended by the instructor. Use of AI resources to create work for graded assignments is not allowed. If AI use or another form of academic dishonesty is expected the student may be asked to explain their answer and thought process that resulted in their answer in an in-person meeting with the course instructor.

When in doubt, always verify with me if something is being done properly or is allowable in this class rather than simply making an assumption based on the fact that it was or is currently allowable in another class.

Special Considerations:

Accommodations

Brandeis seeks to welcome and include all students. If you are a student who needs accommodations as outlined in an accommodations letter, I want to support you. In order to provide test accommodations, I need the letter more than 48 hours in advance. I want to provide your accommodations, but cannot do so retroactively. If you have questions about documenting a disability or requesting accommodations, please contact Student Accessibility Support (SAS <https://www.brandeis.edu/accessibility/>) at 781.736.3470 or access@brandeis.edu.

Student Support

Brandeis University is committed to supporting all our students so they can thrive. The following resources are available to help with the many academic and non-academic factors that contribute to student success (finances, health, food supply, housing, mental health counseling, academic advising, physical and social activities, etc.). Please explore the many links on this Support at Brandeis page (<https://www.brandeis.edu/support/undergraduatestudents/browse.html>) to find out more about the resources that Brandeis provides to help you and your classmates to achieve success.

Time Spent Outside of Class - Note to Students on Success

The federal definition of the credit hour is as follows:

“... an amount of work represented in intended learning outcomes and verified evidence of student achievement that is an institutional established equivalence that reasonably approximates not less than-

- (1) One hour of classroom or direct faculty instruction and a minimum of two hours of class student work each week for approximately fifteen weeks for one semester or trimester hour of credit, or ten to twelve weeks for one quarter hour of credit, or the equivalent amount of work over a different amount of time.
- (2) At least an equivalent amount of work as required in paragraph (1) of this definition for other academic activities as established by the institution including laboratory work, internships, practica, studio work, and other academic work leading to the award of credit hours.”

In particular for our course, the Department of Education’s standard states that the combined total of in-class and outside-of-class work must equal **36 hours per week for a five-week, four-credit summer course**. This means that you are expected to complete a minimum of 26 hours per week of work outside of class for this lecture course that meets for 10 hours a week.

Grade Calculation

Grading Scale:

Letter Grade	% Range
A	93.0 - 100
A-	90.0 – 92.9
B+	87.0 – 89.9
B	83.0 – 86.9
B-	80.0 – 82.9
C+	77.0 – 79.9
C	73.0 – 76.9
C-	70.0 – 72.9
D+	67.0 – 69.9
D	63.0 – 66.9
D-	60.0 – 62.9
E	Below 59.9

Grade Breakdown:

Item	Grade Percentage
Quiz 1	10
Quiz 2	10
Exam 1	20
Exam 2	20
Final Exam (cumulative)	30
Warm-up Group work	5
In Class & Out of Class Problems	5

Quizzes & Exams

Dates:

Exam	Date
Quiz 1	Monday 7/13
Exam 1	Monday 7/20
Quiz 2	Monday 7/27
Exam 2	Monday 8/3
FINAL	Thursday 8/6

Quizzes & Exams:

There are two 30-minute quizzes during the semester, each worth 10% of the grade administered on the second and fourth Monday of the semester; and two 1-hour exams each worth 20% of the grade, administered on the third and fifth Monday of the semester.

Final Exam:

If your score on the final exam is higher than the average of the 2 in-class exams, then your final exam score will replace both in-class exam scores.

Additional Activities

Occasionally and at my discretion, I will deliver material *via* a pre-recorded video on Moodle. In these instances, there may be an accompanying Moodle or in-person quiz, and/or an accompanying short assignment. These will be announced on Moodle or in class.

TIPS FOR SUCCESS

Problem-Solving: To be successful in this course, it is not enough to simply attend lectures and passively understand the material. It is imperative that you spend a lot of time really working through problems on your own. No-one would expect to become an excellent skier or accomplished musician just by watching someone else practice. So too with organic chemistry. You might feel that you understand a topic, but unless you can actively work through a problem and apply that topic or concept to different problems, then you haven't fully understood it. The key here is pushing your comfort level beyond the examples that are presented in lecture. Your textbook contains many problems that you can use for practice, both in-chapter and end-of-chapter problems. I will post the question numbers that you should be able to attempt for each chapter. It is important to attempt these before looking up the solutions. Become disciplined in this and you will see your understanding improving.

Regular Practice: To extend the analogy from above, regular daily practice is much more beneficial than 12 hours of work at the weekend. Make it a *habit* to spend **at least 2 -3 hours each day** reviewing the lecture, working through some book problems and attempting the practice problems. If you schedule this into your daily planner, it can become part of your routine. An added benefit is that you will identify areas of misunderstanding sooner and can come to office hours to resolve them.

Office Hours: Office hours are a great resource for students. Anecdotally, students who regularly attend office hours see a marked improvement in their performance over the course. Add my office hours to your calendar and plan to attend as often as you can. I am always happy to help.

Please see the next page for the Course Topic

Course Topics & Karty Book Sections

Class # & Date	Topic	Details	Karty Textbook Sections (3 rd Edition)
1 Mon7/6	Radical Chemistry	A. Introduction to Radical Chemistry B. Halogenation by Radical Substitution C. Halogenation by Radical Addition D. Radical Reactions of Alkynes	27.1 Homolysis: Curved Arrow Notation and Initiators 27.2 Structure and Stability of Alkyl Radicals 27.4 Radical Halogenation of Alkenes: Synthesis of Alkyl Halides 27.3 Common Elementary Steps That Radicals Undergo 27.5 Radical Addition or HBr: Anti-Markovnikov Addition 27.6 Stereochemistry of Radical Halogenation and HBr Addition 27.8 Organic Synthesis: Organic Radicals in Synthesis
2 Tues7/7	Redox Chemistry	A. Introduction to Redox Reactions B. Reduction Reactions C. Oxidation Reactions	26.8 Syn Dihydroxylation of Alkenes and Alkynes using OsO ₄ 26.9c Oxidative Cleavage Involving Ozone: Ozonolysis 20.3 Catalytic Hydrogenation 20.4 Reactions that reduce C=O to CH ₂ 20.5a Oxidation of Alcohols and Aldehydes 27.7 Dissolving Metal Reductions 19.6 Wolff-Kishner Reduction
3 Weds 7/8	Introduction to Synthesis	A. Introduction to Multistep Synthesis B. Retrosynthetic Analysis C. Things to Watch out For D. Protecting Groups	10.1, 10.2, 10.3 Introduction to Organic Synthesis 11.1 Reactions that Alter the Carbon Skeleton and Retrosynthetic Analysis
4 Thurs 7/9	Electrophilic Aromatic Substitution 1	A. General Mechanism B. Functionalizing Benzene C. Reactions of Substituted Benzenes	24.1 General Mechanism of Electrophilic Aromatic Substitution 24.2 Halogenation 24.3 Friedel-Crafts Alkylation 24.4 Limitations of Friedel-Crafts Alkylation 24.5 Friedel-Crafts Acylation 20.4 Reactions that Reduce C=O to CH ₂ 24.6 Nitration 24.7 Sulfonation 24.8 Organic Synthesis: Consideration of Carbocation Rearrangements and the Synthesis of Primary Alkylbenzenes 24.9 Organic Synthesis: Common Reactions Used Along with EAS Reactions
5 Mon 7/13 QUIZ 1	Electrophilic Aromatic Substitution 2	E. Effect of Benzene Substituents on EAS Reactions – reactivity & regiochemistry D. Effects of Multiple Substituents – steric & electronic effects	25.1 Regiochemistry of EAS: Defining Ortho/Para and Meta Directors 25.2 What Characterizes O, M, P Directors and Why? 25.3 Activation and Deactivation of Benzene toward EAS 25.4 Impact of Substituent Effects on Outcome of EAS Reactions 25.6 Electrophilic Aromatic Substitution on Disubstituted Benzenes 25.10 Organic Synthesis: Considerations of Regiochemistry and Attaching Groups in the Right Order 25.11 Organic Synthesis: Interconverting Ortho/Para and Meta Directors 25.12 Organic Synthesis: Consideration of Protecting Groups
6 Tues 7/14	Nucleophilic Aromatic Substitution Carbonyl Chemistry 1	A. General Mechanisms of NAS A. Introduction to Carbonyl groups	25.9 Nucleophilic Aromatic Substitution Mechanisms 18.1 Overview of the General Mechanism: Addition of Strong Nucleophiles

		B. Nucleophilic Addition to Ketones and Aldehydes Hydride Nucleophiles Carbon Nucleophiles	18.2 Substituent Effects: Relative Reactivity of Ketones and Aldehydes in Nucleophilic Addition 18.3 Reactions of Hydride Reagents: LiAlH ₄ , NaBH ₄ , NaH 18.4 Reactions of Organometallic Compounds: Alkylolithium Reagents and Grignard Reagents 18.5 Compatibility of Functional Groups in Reactions Involving Alkylolithium and Grignard Reagents 18.6 Wittig Reagents and The Wittig Reaction: Synthesis of Alkenes 18.7 Generating Wittig Reagents 18.8 Direct Addition vs Conjugate Addition 18.9 Lithium Dialkylcuprates and the Selectivity of Organometallic Reagents
7 Weds 7/15	Carbonyl Chemistry 2 Synthesis 2	B. Nucleophilic Addition (contd) Oxygen Nucleophiles Nitrogen Nucleophiles Identifying Strategic Carbon-Carbon Bonds (hand out)	19.1 Weak Nucleophiles as Reagents: Acid and Base Catalysis 19.3 Direct vs Conjugate Addition of Weak Nucleophiles 19.4 Formation and Hydrolysis of Acetals, Imines and Enamines 19.7 Hydrolysis of Nitriles 18.10 Organic Synthesis: Grignard and Alkylolithium Reactions in Synthesis 18.11 Organic Synthesis: Considerations of Direct Addition vs Conjugate Addition 18.12 Organic Synthesis: Considerations of Regiochemistry in the Formation of Alkenes 19.5 Organic Synthesis: Synthesizing Amines via Reductive Amination
8 Thurs 7/16	<i>Catch Up & Review for EXAM 1</i>		
9 Mon 7/20	EXAM 1		
10 Tues 7/21	Carbonyl Chemistry 3	C. Nucleophilic Addition/Elimination to Carboxylic Acid Derivatives Acyl Substitution Chemistry Carboxylic Acid Derivatives Reactions of Strong Nucleophiles	22.1 Introduction to Nucleophilic Addition-Elimination Reactions: Transesterification 22.2 Acyl Substitution Involving other Carboxylic Acid Derivatives: The Thermodynamics of Acyl Substitution 22.3 Reaction of an Ester with Hydroxide (Saponification) and the reverse 22.6 Hydride Reducing Agents: NaBH ₄ and LiAlH ₄ 22.7 Specialized Reducing Agents: DIBAL and LTBA 22.8 Organometallic Reagents
11 Weds 7/22	Carbonyl Chemistry 4 Synthesis 3	C. Nucleophilic Addition/Elimination to Carboxylic Acid Derivatives (contd) Reaction of Weak Nucleophiles D. Using Carbonyl Chemistry in Synthesis	23.1 General Addition-Elimination Mechanism Involving Weak Nucleophiles: Alcoholysis and Hydrolysis of Acid Chlorides 23.2 Relative Reactivities of Acid Derivatives: Rates of Hydrolysis 23.4 Synthesis of Acid Halides: Getting to the top of the Stability Ladder 23.3 Aminolysis of Acid Derivatives 23.7 Base and Acid Catalysis in Nucleophilic Addition-Elimination Reactions
12 Thurs 7/23	Enolate Chemistry 1	A. Introduction B. Reactions of Enolates Alkylation Halogenation Aldol	10.6 Halogenation of α -carbons: 11.3 Alkylation of α -carbons: Regioselectivity and Kinetic vs Thermodynamic Control 19.8 Enolate Nucleophiles: Aldol Additions 19.9 Aldol Condensations

		Michael	19.10 Aldol Reactions Involving Ketones 19.11 Crossed Aldol Reactions 19.12 Intramolecular Aldol Reactions
13 Mon 7/27 QUIZ 2	Enolate Chemistry 2	B. Reactions of Enolates (contd) - Robinson - Claisen - Dieckmann - Decarboxylation - Esters	19.13 The Robinson Annulation 19.14 Organic Synthesis: Aldol and Robinson Annulation Reactions in Synthesis 23.9 Claisen Condensation Reactions 23.10 Organic Synthesis: Decarboxylation, Malonic Ester Synthesis and Acetoacetic Ester Synthesis
14 Tues 7/28	Synthesis 4	(hand-out)	21.1 <i>Considerations When a Synthesis Calls for a New Carbon-Carbon Bond</i> 11.4 <i>Synthetic Traps</i> 11.5 <i>Multistep Syntheses</i> 21.2 <i>Avoiding Synthetic Traps: Selective Reagents and Protecting Groups</i>
15 Weds 7/29	Pericyclic Reactions	A. Introduction B. Pericyclic Reactions	26.1 Curved Arrow Notation & Examples of Diels-Alder Reactions 26.2 Conformation of the Diene in Diels-Alder Reactions 26.3 Substituent Effects on the Reaction Rate of Diels-Alder 26.4 Stereochemistry of Diels-Alder 26.5 Regiochemistry of Diels-Alder 26.10 Organic Synthesis: The Diels-Alder Reaction in Synthesis
16 Thurs 7/30	<i>Catch Up & Review for EXAM 2</i>		
17 Mon 8/3	EXAM 2		
18 Tues 8/4	Natural Product Chemistry	Amino Acids and Peptides, peptide coupling chemistry Carbohydrate Chemistry	
19 Weds 8/5	<i>Review for Final Exam</i>		
20 Thurs 8/6	FINAL EXAM 9am in GZ 123		