

Rutgers University
The State University of New Jersey - New Brunswick Campus
Summer III 2022

ORGANIC CHEMISTRY 308 H1/H2 (07/11 – 08/17)

Lecturer: Prof. Emmanuel Hove
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Office: 370 Wright Labs, Busch Campus. Office phone 848 445 3310

Recitation Sections & Instructors: 1. Section H1; TWH, 8:00 AM – 8:50 AM, SEC 207; Jayati Halder

Email: jhaldermal@gmail.com

2. Section H2; TWH, 11:00 AM – 11:50 AM, SEC 117; Emmanuel

Hove

Email: ehove12@chem.rutgers.edu

Lectures: MTWH, 9:00 AM – 10:50 AM, SEC 117;

Office Hours:

Hove; Mon 11:00 AM, Online. Reviews are also at these times.

Jayati; TBA

General: Text Book: *Organic Chemistry* by Thomas N Sorrell 2nd Edition (required) and *Solutions to Exercises Organic Chemistry* by Thomas N Sorrell 2nd Edition (very strongly recommended). Order information for the hard and electronic copies is provided at the end of this document.

Molecular Models maybe used but not shared during exams.

Lectures: MTWH, 9:00 AM – 10:50 AM, SEC 117;

Recitations (2 sections): Meeting times are given above. Look for your section (H1 or H2) in your registration details and in Canvas. Rooms are also listed above.

Exams: **General:** All exams and quizzes are **in person, in class and closed book**. Students are not allowed to share information in any way. The use of **calculators** and **cell phones** is **not allowed** at any time during exams and quizzes. Molecular models may be used.

Midterm exams: There will be two midterm exams (100 - 120 points each), given in person and in class. Dates TBC.

Final Exam: The Final exam (up to 200 points) will be given in person. Dates TBC

Quizzes: Quizzes (10 - 15 min. each) will be given during the scheduled recitation periods. There will be one recitation quiz each week (maximum of 5 quizzes worth a total of 100 points). Each quiz will be worth 20 points.

Grades: The final grade will be determined directly from the total points accumulated from all exams and quizzes out of a maximum of about 550 points.

Missed Exams: All exams must be taken at the scheduled times and in class. If you fail to take an exam or quiz at the scheduled time and place for any reason (illness or death in the family), you must provide a letter of excuse from your academic dean, or you will receive a score of zero (0) for that quiz or exam. There are no make up quizzes. Genuine absences will be given an average of the quizzes attempted.

Conflict Exams: All exams are given during the class time. Therefore, **there are no conflict exams.**

Students with disabilities:

If you have a disability, please make the necessary arrangements for the lecturer to receive a letter of accommodation by the first week of the course, from your College Disability Concerns Coordinator, at, Disability Services (732 932 2848 or dsoffice@rci.rutgers.edu), before the first exam. They will need to arrange for a live proctor ,via WebEx, when you are taking the exam on Canvas.

Homework: **This is a very demanding course!** You must keep up with the material that is being covered. It is recommended that you read the text **before** the material is covered in lecture, then review your notes and the book and **do the assigned problems** immediately afterwards **on the same day**. Some exam questions will be derived from the homework problems directly. Forming small study groups (3-4 students) is recommended, and reading the material in a different textbook is helpful. For review purposes and practice, old quizzes, exams and answer keys will be made available on the Chemistry Department web site for this course (see below).

Reviews Reviews will be held after lecture on Thursdays. The material reviewed will be from material covered during that week. We will be using the old Summer exams and other practice problems, to review the material. The old Summer exams are available on the course Canvas website.

Websites We will be using Canvas ([URL:http://canvas.rutgers.edu/](http://canvas.rutgers.edu/)) as a classroom management system and quizzes testing center. You should check this site regularly. If you check it now, you will find a number of documents posted. You will need a a NetID to log in, so make sure that you have one for this site. If you are registered in this course and are a Rutgers student, you will automatically be a “member” of the online class. Under Modules or Files on Canvas, you will find copies of the past Summer exams and quizzes, additional questions for you to work on based on a current chapter you are studying, keys for the exams you take, etc. Under gradebook is where you will find your quiz scores, exam scores and eventually your final grade. You can also find the syllabus and basic information at www.rutchem.rutgers.edu. Under the Undergrad tab, click on Summer 2022 courses. Click the link for Chem 308 H1/H2

Lecture notes: Lecture notes have been posted on the Canvas web site for this course, in MODULES.

ACADEMIC INTEGRITY AT RUTGERS: Students are expected to maintain the highest level of academic integrity. We will enforce that and you should be familiar with the university policy on academic integrity:

<http://academicintegrity.rutgers.edu/academic-integrity-policy/>

Violations will be reported and enforced according to this policy.

Use of external sources to obtain solutions to homework assignments or exams is cheating and a violation of the University Academic Integrity policy. Cheating in the course may result in penalties ranging from a zero on an assignment to an F for the course, or expulsion from the University. Posting of homework assignments, exams, recorded lectures, or other lecture materials to external sites without the permission of the instructor is a violation of copyright and constitutes a facilitation of dishonesty, which may result in the same penalties as explicit cheating.

Grading

The average grade for the course will be approximately between a C and C+ (grade point average ~ 2.3).

Instructions for Purchasing the CHM307-308 Textbook and Solutions Manual for the Summer 2021

- *Organic Chemistry by Thomas N Sorrell 2nd Edition (this text is required)*
- *Solutions to Exercises Organic Chemistry by Thomas N Sorrell 2nd Edition (this solutions manual is very strongly recommended)*

There are three options for Rutgers students to purchase the text and solutions manual:

1. Rutgers University Book Store

You can purchase through the Rutgers University Book Store, which offers new or used book/solution manuals as well as an option to rent book/solutions manual for the duration of the course. You can also purchase an eBook. Textbook: Rent Used \$47; Rent New \$68; Buy Used \$75; Buy New \$100; eBook \$100

Solutions Manual:

Rent Used \$17.75; Rent New \$30.80; Buy Used \$28; Buy New \$37.35

2. Direct Order of Printed Books from University Science Books = 35% Discount

You can order printed books directly from University Science Books (USB) at a 35% discount:

Print Sorrell Organic Chemistry Textbook: \$88 + Shipping. Includes matching free eBook subscription.

Print Sorrell Org. Chem Solutions Manual: \$25 + Shipping, Includes matching free eBook subscription.

Here are ordering instructions:*

Browse to the USB secure online order page

at <https://www.uscibooks.com/forms/winBookWebOrders.php>

Find the **Sorrell** book listings in the dropdown menu

Fill out the order form using a "Rutgers.edu" email address

Locate the box at the bottom of the form that says ADDITIONAL INSTRUCTIONS AND DISCOUNT CODES

Enter this discount code: **35% off for RUTGERS student**

**Note: Students who order print books from our online website will also be offered a complimentary access code to the eBook.*

**Notes: The online order form automatically lists a 15% discount, but the warehouse will increase the discount to 35% before the order is processed.*

3. Direct Order eBook; 35% Discount + 20% summer discount

RedShelf.com, has created a special portal with discounted prices for CHM307/308 students. These prices are 35% off the regular eBook prices. This summer, you will get an additional 20% reduction off the listed prices effective through August 1, 2020. You can get these prices by ordering directly at: <https://rutgers.redshelf.com/>
Enter code **SUMMER20%OFF** into the Coupon Code box to

**Chemistry 308 Sections H1 and H2
Course Schedule
Summer 2022**

Date	Chapter	Suggested Problems from Sorrell
07/11 & 12	chpt 13.1–13.6	13: 15,16,18,19,20,25,28,29,30,,33
07/13 & 14	chpt 13.6 + 14.1 – 14.4	13: 28 – 34; 14: 1 - 3, 5, 7
07/18 & 19	chpt 15.1 – 15.5	15: 18, 22-28, 30, 32-34
07/20 & 07/21	chpt 15 + 17.1 – 17.4	17: 25 – 35, 39, 42, 18, 19
07/25	EXAM I CHPT 13, 14, 15; IN CLASS/IN PERSON (EXAM DATE AND COVERAGE TO BE CONFIRMED)	
07/26	chpt 17 + 18.1 – 18.4	18: 1, 3, 4, 5, 11, 13,,16, 17, 10,11, 12, 13, 17,
07/27 & 28	chpt 19.1 – 19.5.	19: 1 - 11, 21 – 23, 27.
08/01 & 08/02	chpt 19 + 20.1 – 20.4.	20: 19 – 22, 24, 28 – 30, 32.
08/03 & 04	chpt 20 + 21.1 - 21.8	21: 1 – 4, 6 – 8, 10 – 12, 20, 22, 23, 25, 28 – 33, 35 – 37, 39.
08/08	EXAM II CHPT 17, 18, 19, 20; IN CANVAS (DATE AND COVERAGE TBC)	
08/09 & 10	chpt 22.1 – 22.5, + 23.1 -23.4	22: 18, 20 – 25, 28, 32 – 35, 38.
08/11 & 12	chpt 23 + CH 24.1 – 24.4	23: 13 - 15, 18 – 25, 28, 29. 24: 19 – 25, 28, 30, 31.
08/15	chpt 24 & CATCH UP	

08/16 CATCH UP AND FINAL EXAM REVIEW.

08/17 FINAL EXAM: COMPREHENSIVE; chpt 13, 14, 15, 17, 18, 19 ,20 ,21, 22, 23, 24.

NOTE: This schedule is subject to change. Any alteration in the schedule or the course, quiz/exam content will be announced in lecture. It is your responsibility to attend lectures and recitations all the time. There will be 100 points allocated to recitation quizzes. No excuses will be accepted for missing these.

The practice problems used in recitation will prove very, very useful for quizzes and exams. Answers to the problems will only be provided in recitation.

CHEM 307 B3/B4 COURSE SCHEDULE Summer 2022: LEARNING GOALS FOR THE COURSE

Reading: Book sections: 1.1-2, 2.1-2.2

- Syllabus; introduction to organic chemistry,
- Atomic structure and the periodic table; valence electrons
- Lewis structures; bonds as shared electron pairs, non-bonding electrons; common
- Bonding patterns for C, N, O, X; formal charge; condensed structures; line-angle structures; use of R to denote substituents
- Pauling electronegativity and polar bonds;

Reading Book sections 2.2-2.4, 10.2a-c

- Introduction to resonance structures
- Atomic orbitals (s, p); molecular orbital theory; bonding and antibonding orbitals, sigma (σ) and pi (π) orbitals; bond strengths
- VSEPR, bond angles, molecular shape and molecular dipoles; wedge dash notations
- Using molecular models
- Orbital hybridization and molecular shape; double and triple bonds
- Delocalized electrons, resonance structures and orbital hybridization

Reading Book sections: 2.5-2.7, 2.8, 1.1b, 1.3-4

- Writing resonance structures practice
- Introduction to IUPAC nomenclature and functional groups: with focus on alkanes, cycloalkanes, alkyl halides and alcohols; constitutional isomers
- Intermolecular forces: van der Waals interactions, electrostatic forces, hydrogen bonds
- Physical properties and intermolecular forces and its effect on life

Reading Book sections: 3.1-3.2

- Conformations of acyclic hydrocarbons; Newman projections; gauche, anti, eclipsed conformations; hyperconjugation as a stabilizing effect;
- Intro to potential energy diagrams; emphasis on line-angle condensed structures; use of wedges and dashes
- Conformations of cyclic hydrocarbons

Reading Assignment Book sections: 3.2-3.4 and 4.1-4.2

- Conformations of cyclohexane and substituted cyclohexanes; drawing chair conformers;
- Equilibria between chair conformers; free energy differences and equilibrium constants
- Configurational isomers: cis and trans-substituted cycloalkanes cis- and trans-decalin.
- Stereoisomers; geometric isomers; cis- and trans-alkenes, alkene nomenclature and E/Z nomenclature.
- Chiral centers, enantiomers and R/S nomenclature; wedge-dash and Fischer representations

Reading Assignment Book sections: 4.2-4.4

- Optical rotation; absolute configurations: L-amino acids and D-sugars
- Molecules with two or more chiral centers; diastereomers and meso compounds
- Acid-base reactions; use of the arrow notation to indicate electron movement
- pKa values: utility to indicate acid and base strengths and K_{eq}

Reading Assignment Book sections: 5.2-5.4

- Factors affecting acid/base strength: ion size, electronegativity, resonance, inductive effects, orbital hybridization (the arguments of organic chemistry)
- Lewis acids and Lewis bases
- Reaction Coordinate Diagrams

Reading Assignment Book sections: 6.1 -6.4

- Nucleophilic substitution reactions: a mechanistic overview; energy diagrams
- The SN2 reaction: mechanism (a HOMO-LUMO view), inversion of configuration; leaving groups, nucleophile strength, steric factors, solvent effects
- The SN1 reaction: mechanism, carbocation intermediates and carbocation stability (hyperconjugation), racemic products; solvent effects; carbocation rearrangements

Reading Assignment Book sections: 7.1a-c; 2d

- SN2 vs. SN1: competing reactions under kinetic control
- Substitution reactions of alcohols and ethers in acid: generation of a good leaving group by protonation
- Substitution reactions of alcohols using alkylsulfonyl chlorides (RSO₂Cl); conversion to alkyl halides using phosphorous tribromide or thionyl chloride

Reading Assignment Book sections: 7.2a-c, e

- Synthesis of ethers and epoxides • Substitution reactions of epoxides in acid and base
- Substitution reactions of epoxides in acid and base
- Elimination reactions: a mechanistic overview, energy diagrams, alkene stability

Reading Assignment Book sections: 8.1-8. 3

- E2 reactions of alkyl halides and sulfonate esters; mechanism, stereoselectivity and regioselectivity; competition with SN2 reactions
- E2 reactions of primary alcohols in acid
- E1 reactions of alcohols in acid
- E1 reactions of alkyl halides; competition with SN1 reactions

Reading Assignment Book sections: 9.1-9.2

- Substitution versus elimination: alkyl halides, alcohols
- Electrophilic addition to alkenes: addition of HX, H₂O
- Electrophilic addition of Cl₂, Br₂ to alkenes: stereoselectivity, regioselectivity;
- Halohydrin formation
- Oxymercuration/demercuration: regioselectivity

Reading Assignment Book sections: 9.4- 9.5

- Hydroboration/oxidation: stereoselectivity, regioselectivity
- Alkene polymerization
- Electrophilic addition to alkynes
 - Carbenes: synthesis of cyclopropane rings
- Multi-step synthesis using substitution, elimination and addition reactions:
- strategies, retrosynthetic analysis

Reading Assignment Book sections: 10.1-10.3

- Dienes and polyenes: structure, nomenclature and stabilities
- Molecular orbital descriptions of conjugated dienes and polyenes; UV-VIS absorption by conjugated polyenes, colored organic compounds
- Electrophilic addition to conjugated dienes: kinetic vs thermodynamic control

Reading Assignment Book sections: 10.4, 11.1-11.3

- **The Diels-Alder reaction: mechanism, MO description and HOMOLUMO theory,**
- **stereoselectivity and regioselectivity**
- **Oxidation states in organic chemistry**
- **Catalytic hydrogenation reactions: reduction of alkenes and alkynes**
- **Oxidation reactions of alkenes**
- **Synthesis**

Reading Assignment Book sections: 11.4; 12.1 –

- **Oxidation reactions of alcohols**
- **Nomenclature of carbonyl compounds**
- **Multi-step synthesis and retrosynthetic analysis**
- **Free radical halogenations: mechanism; bond energies and regioselectivities;**
- **the Hammond postulate; selectivity of bromination vs chlorination**

Reading Assignment Book sections: 12.2a-c, 3a-b

- **Reductions of benzyl alcohols, ethers and esters via radical intermediates: stability of the benzyl radical**
- **Alkyne reduction by sodium in liquid ammonia: mechanism, stereoselectivity**
- **Free radical addition reactions: anti-Markovnikov HBr addition, alkene polymerization**

Reading Assignment Book sections: 12.4ac

Oxidation via radical intermediates: fatty acid oxidation, vitamins C and E, anti oxidant food preservatives, anti-oxidants in colored fruits