030.205.02 — ORGANIC CHEMISTRY I

Professor C. A. Townsend

Fall 2019 26 Mudd

Lectures: Monday, Wednesday, Friday 10:00-10:50 AM
Conferences: Thursday 9-10:20 AM, various locations to be assigned
Office: 252 Remsen Hall
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Office Hours: Office or Remsen 200 Conference Room: Wednesdays 5:30-7:30 PM

Text, Molecular Models and iClicker:

• P. Bruice, Organic Chemistry, 8th Edn with Solutions Manual; a molecular model kit is strongly recommended
• iClicker unit used for in-class responses to questions (see: http://www.cer.jhu.edu/clickers.html)

How to Succeed in this Course

Organic chemistry is a powerful discipline to both understand the physical world around us and to create new molecular entities for a wide range of purposes. It underlies biochemistry, pharmacology, infectious and parasitic diseases, metabolic and genetic dysfunction, new materials and much more. Introductory Organic Chemistry is a one-year course, but only an introduction. It is cumulative and totally integrated. Understanding, as opposed to brute force and ultimately unsuccessful memorization, depends on seeing the connection of every new chapter to all that has come before. Our text is Bruice’s 8th Edn. (you may also use the 7th Edn.), which was chosen for both its clarity of presentation and quality and number of problems. If you get stuck, you can read that section in another book, visit the Kahn Academy, Wikipedia and other websites, consult your TA, or come to my Office Hours (whatever you do, please do not let the course get away from you!). Do not fall behind. Reading a little ahead, even superficially the first time, is the best safeguard.

Success in this course will come from patient and regular study and working the assigned problems either alone or in small groups, whichever works for you. DO NOT have the Study Guide open at your side. Immediately looking at the answer to a question will defeat the purpose of this exercise and leave you unprepared for examinations, which will have a similar problem-solving format. Some say my exams are more difficult than the questions in the book. This statement is incorrect. The questions are simply different. If you have genuinely figured out answers to the problems in your text (that is, truly understand how to apply the underlying principles, not simply memorize specific cases), especially the more challenging ones at the end of each chapter with minimal resort to the answer book, you will find the exams straightforward, even satisfying.

So, come to class, pay attention, take notes (slides will be posted on BlackBoard and are numbered for easy reference in your notes). Work the in-text problems as you read along. Commit your answers to paper, like a practice exam (but no time pressure). At the end of some chapters are Tutorials. These are excellent and often have very helpful “solved” problems. Take advantage of them! Now tackle the end-of-chapter problems (see recommendations in your syllabus) Set aside time to do this, be patient, turn off electronic distractions, let your mind flow. Once you get to the end of a study session, then only then consult your Study Guide. Look at your written answers and grade yourself. Go back and learn what you need to know to correct your wrong answers. You are now ready for what comes next.

Course Content

For the purpose of exams, the course content is (a) the lectures, which will coordinate with and amplify material in the text (b) the chapters and all sections in Bruice assigned in the syllabus, and (c) any other specific assignments that are made. The outline and order of the topics covered is presented at the end of this syllabus. Some assigned sections will not be covered in class but you are expected to learn on your own. Some sections have been omitted and some will be covered at a later time (for example, most/some parts of Chapter 10).
Grades
Your course grade is based on the following criteria:

- Three comprehensive in-term exams, 100, 100, 100 (300 points)
- Comprehensive final exam, (200 points)
- Quizzes (5 x 10 points = 50 points)
- Lecture attendance**

It is expected that everyone will take all three In-Term Exams and the Final Exam. Final grades will be based on a curve and the distributions will be as equivalent as possible between Sections .01 and .02. After each exam, we will attempt to percentile each raw score, which should give you a rough idea how your individual score translates into a letter grade. These indications should be treated as approximate. That all exams and quizzes “count” will ensure a wide distribution of scores to base final grades. Bear in mind, organic chemistry continually builds on and further interconnects what you have learned. While exams will emphasize the material covered since the previous test, every exam should be thought of as cumulative back to the beginning of the course. They will be constructed in such a way as to emphasize active understanding of the material. To take the exam, you will need a pen (not a pencil). All exams must be written in INK. You cannot use books, scratch paper (other than furnished), calculators, cell phones, or electronic devices of any kind. You may, however, use a molecular model kit (it may not contain any written materials).

** If your participation and attendance is above 85% based on iClicker reports, you will receive 10 points. If ≥75%, you will receive 5 points. No excuses will be accepted as these attendance levels are lenient. That is, no excuse for dead batteries, forgotten remote, bathroom breaks. Clicker participation will be recorded after the first week of class.

There are no Makeup Exams. If you can document a University-sanctioned absence*** for one midterm, the the RAW PERCENTAGE you receive on the final exam (WITHOUT WEIGHTING) will be used in its place. You must take the comprehensive final examination to pass the course. The date and time are scheduled by the University and are not subject to change. It is your responsibility to resolve any other University-sanctioned conflicts directly. Should you miss the final examination for any University-sanctioned reason, you will be given an Incomplete that can only be changed by completion of a written and/or oral examinations.

*** A University-sanctioned absence is one approved by and reported to me directly by the Dean of Student Life. You must initiate the process to secure University approval of an absence BEFORE the scheduled exam. Health-related absences must be cleared through the Student Health and Wellness Center or other non-relative medical professionals.

No credit (a zero) will be granted for unexcused absences, such as oversleeping, attending the wrong section, forgetting, etc. In special circumstances, documented but otherwise unsanctioned absences may be excused but only with prior authorization from the instructor. For athletes competing in a conflicting legitimate intercollegiate game or meet, your schedule is known in advance and arrangements to take the exam on the road will have to be made in advance with your coach. A valid excuse requires written justification from an appropriate official such as a non-parent physician or the Dean of Student Life. Be sensible, don’t fall behind. If you oversleep, come immediately to the exam rather than missing it.

** Exams **

- 1st exam Thursday, September 26, 2019 (9:00-10:20 AM)
- 2nd exam Thursday, October 17, 2019 (9:00-10:20 AM)
- 3rd exam Thursday, November 14, 2019 (9:00-10:20 AM)
- Final exam: Friday, December 13 (2:00 PM to 5:00 PM, room to be assigned)

All Hour Exams and supplementary classes will take place in Hodson 110.

No electronic devices are to be used during class time, during exams, or during conference.

Regrades
Your examinations are marked according to an explicit key and set of guidelines provided by the Professor to the TAs. All
exams except the Final are returned in Section. If you think that a question has been graded incorrectly, submit the exam to your TA before leaving Section with a brief written statement justifying your request for reconsideration (see below).

In rare instances an addition error of points could have been made; please check for these at once and report any such instance to the TA immediately; it will be corrected on the spot.

The assignment of points and partial credit is to be considered accurate. A “regrade” may be entertained, subject to the following regulations:

1. The entire exam must have been written in ink.

2. The request for regrade must be submitted to your TA by the end of conference when the exam is returned, and must be accompanied by a written statement of the problem. (“I think I deserved more points” is a non-starter.)

3. The entire exam will be regraded—this may result in no change, or a lower or a higher score.

4. Graded exams are scanned before they are handed back. Do not falsify your answer for a regrade.

Advice: The neater and more orderly your exam with the answer clearly visible, the more likely you are to receive full marks. When TAs have to hunt about for your answer, or decipher squiggles and jots, or cast about to guess at your manner of proceeding, it is more likely that the credit you receive will be lower than you might like. Therefore, fill out exam papers in an orderly and straightforward way with clear, to-the-point explanations. Practice this method of answering when writing out your homework exercises. You are encouraged to discuss chemistry and/or the course with your teaching assistant and your instructor. Simple questions or comments can also be sent via e-mail. For administrative questions, see your teaching assistant.

Important Dates:

- September 13: Last Day to add a course
- October 13: Last Day to drop a course
- October 18: Fall Break
- November 15: Last Day to withdraw from a course
- November 25-December 1: Thanksgiving vacation
- December 6: Classes end

Academic Ethics

Cheating and other forms of academic dishonesty are wrong and corrosive to what a university is and to all intellectual inquiry. The strength of the university depends on personal and academic integrity. Failure creates mistrust and fosters unfair competition. The University will punish cheaters with failure on an assignment, failure in a course, permanent transcript notation, suspension, or expulsion. Offenses may be reported to medical, law, or other professional or graduate schools when a cheater applies.

Violations can include cheating on exams, plagiarism, reuse of assignments without permission, improper use of the internet and electronic devices, unauthorized collaboration, alteration of graded assignments, forgery and falsification, lying, facilitating academic dishonesty, and unfair competition. Ignorance of these rules is not an excuse. Such infractions are considered cause, at the least, for awarding a "0" on the exam in question with additional sanctions that are listed above. Sadly, I have been forced to prosecute one or more students most years I have taught this course.

Working together before an exam is entirely acceptable, but you must complete all exams on your own. You may not have someone else take the exams for you. You may not obtain information from another student or provide information to a student about the exam either by communicating with them or looking at anything that another student has written. You may not allow another student to see anything that you have written during an exam. On every exam, you will sign the following pledge: “I attest that I have completed this exam without unauthorized assistance from any person, materials, or device.” [Signed and dated]

For more information, see the guide on “Academic Ethics for Undergraduates” and the Ethics Board Web site:

http://e-catalog.jhu.edu/undergrad-students/student-life-policies/#Violations_of_acad
Getting Help

There are a number of mechanisms for you to get help. Take advantage of Office Hours for both Prof. Townsend and your TA. In addition, the following services are available:

**Pilot Groups.** Join a PILOT group (a peer facilitated problem solving group). PILOT LINK: [http://academicsupport.jhu.edu/pilot-learning/registration/](http://academicsupport.jhu.edu/pilot-learning/registration/)

**Small Group Tutoring.** The Learning Den is in Gilman Hall. Sign up online at [http://tutoring.jhu.edu](http://tutoring.jhu.edu) (Your User ID and password is your 6-character Hopkins ID (not JHED ID); the two fields are identical)

Sundays - Thursdays, 6 pm - 10 pm. Visit the web site for more information: [http://jhu.edu/academic-assistance/tutoring.html](http://jhu.edu/academic-assistance/tutoring.html).

410-516-8216, tutoring@jhu.edu

**Study Consulting.** 385 Garland Hall Suite 3A
[http://jhu.edu/academic-assistance/studyconsulting.html](http://jhu.edu/academic-assistance/studyconsulting.html)

410-516-5506, fday2@jhu.edu

**Classroom Participation using your iClicker**

To make lectures more interactive, we will use a classroom participation system for in-class voting. The response units that enable you to participate are available from the JHU Barnes & Noble. Your iClicker must be activated on-line on BlackBoard in order to function properly and you must register for this course. Do it ASAP.
Questions? Go to: [http://www.cer.jhu.edu/clickers.htm](http://www.cer.jhu.edu/clickers.htm)

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**Chemistry 030.205.02: Outlines of Lectures, Bruice, 8th Edn.**

1. **Structure, Bonding & Molecular Properties** (5 lectures*)
   - Structure of atoms, atomic orbitals
   - Chemical Bonding (ionic bonds, covalent bonds)
   - Valence-bond theory (hybridization)
   - Molecular Orbital (MO) theory (HOMO and LUMO)
   - Resonance
   - Electronegativity, dipole moments
   - Acids and bases

   *Sections covered: 1.1 - 1.16; 2.1-2.12
   *Suggested problems: 1.49-1.78 (skip 1-51d, 1-72), 2.53-2.64, 2-66-2-68, 2-70, 2-72, 2-74

2. **Alkanes** (3 lectures *)
   - Alkanes as building blocks (constitutional isomers)
   - Functional groups
   - Nomenclature
   - Conformational analysis of alkanes and cycloalkanes (strain)

   *Sections covered: 3.1-3.16
   *Suggested problems: 3.55-3.64, 3.66-3.68, 3.70- 3.87

3. **Sterechemistry** (3 lectures*)
   - *Cis-trans* (E, Z) isomerism and degrees of unsaturation, nomenclature, structure
- Optical activity – enantiomers (asymmetric centers)
- Diastereomers, meso compounds.
- R, S Nomenclature, absolute configuration
- Fischer projections
- Chiral molecules without asymmetric centers

Sections covered: 4.1-4.18
Suggested problems: 4.65-4.67, 4.68a, c, 4.69-4.80, 4.82a, e, f, g, h, 4.84 a, c, d, e, f, 4.85-4.90, 4.92-4.100, 4.103. 4.104

4. Alkenes, Overview of Organic Reaction Mechanisms, and the Addition of HX (3 lectures*)
- Addition of HBr to ethylene
- Thermodynamics, kinetics, energy diagrams, transition states, rate-determining step
- Stability of alkenes, catalytic hydrogenation
- Writing reaction mechanisms
- Hammond postulate

Sections covered: 5.1-5.14
Suggested problems: 5.39-5.41, 5.43-5.49, 5.51-5.60, 5.62

5. Electrophilic Addition to π Bonds (5 lectures*)
- Hyperconjugation and regioselectivity (Markovnikov’s rule)
- Addition of X₂ and HX to π bonds in alkenes, alkynes and dienes
- Carbocations and their rearrangements
- Preparation (mechanistic details are covered under section 8)
- Addition of halogens and water
- Hydration of the double bond
- Epoxide formation
- Catalytic Hydrogenation

Sections covered: 6.1-6.16
Suggested problems: 6.55-6.58, 6.60-6.91, 6.92-6.103

6. The Reactions of Alkynes; Organic Synthesis (2-3 lectures*)
- Structure and Nomenclature
- Reactions of alkynes: addition of hydrogen halides, halogens, hydrogen
- Hydroboration-oxidation and mercuric ion catalyzed addition of water
- The acidity of terminal alkynes, acetylide ions, and synthesis of organic molecules

Sections covered: 7.1-7.12
Suggested problems: 7.29-7.60

7. Conjugated Dienes and Aromaticity, (4 lectures*)
- Delocalization of Electrons (Resonance Structures)
- Benzene and Hückel’s Rule
- Aromaticity and Antiaromaticity
- Electrophilic additions of dienes
- Kinetic vs. thermodynamic control
- Diels-Alder Reaction

Sections covered: 8.1-8.22
Suggested problems: 8.61-8.112

8. Structure Determination (6 lectures*)
• Mass Spectrometry
• Infrared Spectroscopy
• UV and visible spectroscopy, conjugation, and the chemistry of vision
• Nuclear Magnetic Resonance Spectroscopy ($^1$H, $^{13}$C)


9. Nucleophilic Substitutions and Eliminations (5 lectures)
• $S_N1$ and $S_N2$
• $E_1$ and $E_2$; $E_{1cb}$
• Effects of solvent, substrate structure, and nucleophile (base) on reactivity

Sections covered: 9.1-9.17

Alcohols, Ethers and Epoxides (As time allows)
• Synthesis of alkyl halides
• Synthesis of sulfonates
• Dehydration of alcohols
• Reactions of ethers and epoxides

Sections covered: 10.1-10.4, 10.6-10.7
Suggested problems: 10.55-10.62, 10.63a, b, c, d, e, f, g, j, 10.67-10.68, 10.69a, 10.70-10.72, 10.73a, 10.75, 10.77-10.81, 10.83-10.86, 10.90-10.94, 10.96

*The number of lectures is approximate; adjustments will be made as necessary. All in-chapter problems should be worked out.