CHEM 281: Organic Chemistry I

Fall term, 2019

Instructors

Prof. John Carran
Chernoff Hall, Rm 511
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Email: carranj@chem.queensu.ca

Office Hours

Set hours during the week (see ONQ), e-mail to schedule appointments outside hours. Use ONQ discussion forum to pose questions outside of work time.

ONQ site

Students registered in the course can access the course ONQ site. The site includes the assignments, your grades, and other materials.

Intended Student Learning Outcomes

At the end of CHEM 281, students will be able to...

- Analyse simple reactions and discuss stereochemistry and regiochemistry of the reactions.
- Name various organic molecules containing a broad spectrum of functional groups
- Interconnect previous knowledge in quantum mechanics, lewis structures and bonding theory and apply that knowledge to bonding in organic molecules.
- Explain trends in polarity of solvents and organic molecules.
- Draw basic reaction mechanisms.
- Use NMR (time permitting) and IR data to analyse and identify simple organic molecules.

Course Outline

Textbook sections covered (Organic Chemistry, Solomons and Fryhle, 12th ed.)

A. What is an Organic Molecule?

Lewis Structures.(review)
Structural Formulas
Molecular Geometry: Quantum Mechanical Model (review)
Hydrocarbons ("the skeleton")
Polar and Non-Polar Compounds
Functional Groups ("the organs")
Physical Properties and Intermolecular Forces

B. Organic Reactions: General Principles

Organic Reaction Mechanisms
Acid-Base Reactions

C. Stereochemistry I: Conformational Analysis
Conformational Analysis of Alkanes
Conformational Analysis of Cycloalkanes

D. Stereochemistry II: Chirality
Isomerism
Chirality and Enantiomers
Nomenclature: R/S and E/Z systems
Optical Activity
More Than One Stereocenter: Enantiomers and Diastereomers
More about chirality. Separation of Enantiomers

E. How to Make Organic Molecules? Nucleophilic Substitution and Elimination Reactions
Nucleophilic Substitution Reactions
The Mechanism of $S_N2$ Reactions
The Mechanism of $S_N1$ Reactions
$S_N1$ vs. $S_N2$
Functional Group Transformations via Substitution
Elimination Reactions: E1 & E2
Substitution vs. Elimination
Making Alkenes via Elimination Reactions
Making Alkynes via Elimination Reactions
$S_N1$ and $S_N2$ reactions with epoxides

F. Addition to Alkenes and Alkynes; Alcohols and Ethers
Addition to Alkenes: Hydrogenation
Addition to Alkenes: Markovnikov's Rule
Hydroboration-Oxidation: Anti-Markovnikov syn Hydration
Electrophilic addition of halogens to alkenes and alkynes
Oxidation of Alkenes and Alkynes, Alkene epoxidation
Alcohols and Ethers: Reactivity and Synthesis

G. NMR spectroscopic analysis of organic molecules
$^1$H-NMR spectroscopy, chemical shift, spin-spin coupling.
$^{13}$C-NMR spectroscopy

Textbook

**Grading Scheme**

- Online assignments: 5%  
  Due: weekly.
- Midterm 1: 15%  
  (Monday "5th" week of term in class).
- Midterm 2: 25%  
  (Friday evening, November 8th)
- Final Exam: 45%  
  Dec
- Virtual lab exams: 10%  
  (questions spread over 2nd midterm and final)

Students must pass BOTH the lecture and lab components to pass the course. If a student does not pass both components of the course, he/she will fail the course and be allocated a letter grade of F.

**Grading Method**

All components of this course will receive numerical percentage marks. The final grade you receive for the course will be derived by converting your numerical course average to a letter grade according to Queen’s Official Grade Conversion Scale:

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<thead>
<tr>
<th>Grade</th>
<th>Numerical Course Average (Range)</th>
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<td>90-100</td>
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<tr>
<td>A</td>
<td>85-89</td>
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<tr>
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<td>49 and below</td>
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**Late Policy**

If you require additional time to complete an assignment please contact me as soon as possible. See below for the Chemistry Department policy on missed quizzes, tests, midterms, presentations, and assignments.

**Department of Chemistry Policy on Missed Quizzes, Tests, Midterms, Presentations, and Assignments**

The Chemistry Department requires that students submit a ‘declaration of extenuating circumstances’ form before being considered for accommodation. The form, and related information, is available at [http://www.chem.queensu.ca/undergraduate/undergraduate-resources/missed-exam-policy](http://www.chem.queensu.ca/undergraduate/undergraduate-resources/missed-exam-policy). Note that this departmental policy does NOT apply to final exams.

**Lab Information**

Virtual labs are a component of this course. Students should visit the Labskills and U of A websites to complete the virtual lab techniques and experiments described in the Virtual Lab Guide posted on the CHEM281 ONQ site. These lab techniques and experiments will be examined via multiple choice questions spread over the last 2 written exams in this course. Virtual lab one and two will be examined in midterm 2, and virtual labs 3, 4 and 5 on the Final exam.
**Help Desk**
A help desk and review sessions will be organised near major exam times. Details will be given in class and posted to the ONQ site News forum.

**Calculator Policy**
Calculators acceptable for use during quizzes, tests and examinations are intended to support the basic calculating functions required by most Arts and Science courses. For this purpose, the use of the Casio 991 series calculator is permitted and is the **only approved calculator for Arts and Science students**. This calculator sells for around $25 at the Queen's Campus Bookstore, Staples and other popular suppliers of school and office supplies.

**Academic Integrity**
Academic Integrity is constituted by the five core fundamental values of honesty, trust, fairness, respect and responsibility (see [www.academicintegrity.org](http://www.academicintegrity.org)). These values are central to the building, nurturing and sustaining of an academic community in which all members of the community will thrive. Adherence to the values expressed through academic integrity forms a foundation for the “freedom of inquiry and exchange of ideas” essential to the intellectual life of the University (see the Senate Report on Principles and Priorities [http://www.queensu.ca/secretariat/policies/senate/report-principles-and-priorities](http://www.queensu.ca/secretariat/policies/senate/report-principles-and-priorities)).

Students are responsible for familiarizing themselves with the regulations concerning academic integrity and for ensuring that their assignments conform to the principles of academic integrity. Information on academic integrity is available in the Arts and Science Calendar (see Academic Regulation 1 [http://www.queensu.ca/artsci/academic-calendars/regulations/academic-regulations/regulation-1](http://www.queensu.ca/artsci/academic-calendars/regulations/academic-regulations/regulation-1)), on the Arts and Science website (see [http://www.queensu.ca/artsci/academics/undergraduate/academic-integrity](http://www.queensu.ca/artsci/academics/undergraduate/academic-integrity)), and from the instructor of this course. Departures from academic integrity include plagiarism, use of unauthorized materials, facilitation, forgery and falsification, and are antithetical to the development of an academic community at Queen’s. Given the seriousness of these matters, actions which contravene the regulation on academic integrity carry sanctions that can range from a warning or the loss of grades on an assignment to the failure of a course to a requirement to withdraw from the university.

**Copyright of Course Materials**
All materials associated with this course are copyrighted. This includes in-class handouts, Emailed information, and all documents and information provided on the course Moodle site. These course materials are for the sole use of students registered in the course. These materials shall not be distributed or disseminated to anyone other than students registered in this course. Failure to abide by these conditions is a breach of copyright, and may also constitute a breach of academic integrity under the University Senate’s Academic Integrity policy statement.

**Accessibility Statement**
Queen’s is committed to an inclusive campus community with accessible goods, services, and facilities that respect the dignity and independence of persons with disabilities. Course materials are available in an accessible format or with appropriate communication supports upon request.

Please contact **Meredith Richards in the Department of Chemistry** in one of the following ways:
- Email: ugadm@chem.queensu.ca
- Phone: 613-533-6000 extension 75518
- In person: Chernoff 200
Accommodations Statement
Queen's University is committed to achieving full accessibility for persons with disabilities. Part of this commitment includes arranging academic accommodations for students with disabilities to ensure they have an equitable opportunity to participate in all of their academic activities. If you are a student with a disability and think you may need accommodations, you are strongly encouraged to contact Student Wellness Services (SWS) and register as early as possible. For more information, including important deadlines, please visit the Student Wellness website at: http://www.queensu.ca/studentwellness/accessibility-services/

Statement of the Location and Timing of Final Examinations
As noted in Academic Regulation 8.2.1, “the final examination in any class offered in a term or session (including Summer Term) must be written on the campus on which it was taken, at the end of the appropriate term or session at the time scheduled by the Examinations Office.” The exam period is listed in the key dates prior to the start of the academic year in the Faculty of Arts and Science Academic Calendar and on the Office of the University Registrar’s webpage. A detailed exam schedule for the Fall Term is posted before the Thanksgiving holiday; for the Winter Term it is posted the Friday before Reading Week, and for the Summer Term the window of dates is noted on the Arts and Science Online syllabus prior to the start of the course. Students should delay finalizing any travel plans until after the examination schedule has been posted. Exams will not be moved or deferred to accommodate employment, travel /holiday plans or flight reservations.