

## CHEMISTRY 281 (2009): ORGANIC CHEMISTRY I

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- Dr. David Zechel  
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Office hours: Tuesdays 2:30-4 pm; Thursdays, 1:30 to 3 pm.
- Lab instructor:** Dr. Henryka S. Tilk
- Lectures:** Section B: Mon 16:30 pm, Wed 15:30 pm, Fri 14:30 pm, DUN Aud.  
Section A: Mon 11:30 am, Tue 1:30 pm, Thur 12:30 pm, STID.
- Required textbook:** *Organic Chemistry*, Solomons and Fryhle, 9th ed. (Wiley) + *OrganicView* CD + accompanying *Study Guide and Solutions Manual* + Molecular Models (sold as a package in the bookstore).
- Recommended textbooks:** *Organic Laboratory Techniques*, Fessenden, Fessenden and Feist, 3<sup>rd</sup> ed. (Brooks/Cole) available in the Chemistry Stores, Chernoff Hall (CHE109).
- Lab/Tutorials:** CHEM 281 *Interactive Learning Guide, ILG* (with *Basic Laboratory Chemistry* CD) available in the Chemistry Stores, Chernoff Hall (CHE109).
- Help Desk:** Schedule will be posted on CHEM281 web page under *Help Desk*
- Extra practice problem sets will be available on the CHEM 281 Web site. Solutions will be posted on the CHEM 281 Web site.**
- Review Sessions:** Evening Review Sessions for everyone will be offered before Midterm and Final Exams (time and place tba). Problems will be posted on CHEM281 web site.
- Marking:**
- |           |     |  |
|-----------|-----|--|
| Quizzes   | 5%  | WileyPlus – see ILG                                  |
| Midterm   | 40% | (Saturday, October 31, 2 h long, 10 am, place tba)   |
| Final     | 45% | (3 h long)   |
| Lab Exams | 10% | Lab exam will be part of Midterm and Final (each 5%) |
- Note that you must pass BOTH the lecture (quizzes + midterm + final exam) and the laboratory (Lab Exams) components to pass the course. If you fail to achieve at least half the available marks in either component you will be allocated a mark of 47% or your average mark, whichever is lower.**
- 281 Web Site:** From the Chemistry Web Site at <http://www.chem.queensu.ca>, press the buttons:  
*Undergraduate* → *Courses* → *281*

## Course Outline I (Week 1-6; H. S. Tilk)

### A. What is an Organic Molecule?

S&F 2.1-2.2	Hydrocarbons ("the skeleton")
S&F 2.5-2.13	Functional Groups ("the organs")
S&F 1.1-1.8	Lewis Structures.(review)
S&F 1.9-1.15	Molecular Geometry: Quantum Mechanical Model (review)
S&F 1.17	Structural Formulas
S&F 2.3-2.4	Polar and Non-Polar Compounds
S&F 2.14-2.15	Physical Properties and Intermolecular Forces
S&F 2.16	Infrared Spectroscopy: An Instrumental Method for Detecting Functional Groups

### B. Organic Reactions: General Principles

S&F 3.1	Organic Reaction Mechanisms
S&F 3.2-3.15	Acid-Base Reactions

### C. Stereochemistry I: Conformational Analysis

S&F 4.1-4.2, 4.7-4.9	Conformational Analysis of Alkanes
S&F 4.10-4.15	Conformational Analysis of Cycloalkanes

### D. Stereochemistry II: Chirality

S&F 5.1	Isomerism
S&F 5.2-5.6	Chirality and Enantiomers
S&F 5.7, 7.2	Nomenclature:R/S and E/Z systems
S&F 5.8-5.9	Optical Activity
S&F 5.11-5.14	More Than One Stereocenter: Enantiomers and Diastereomers
S&F 5.15-5.18	More about chirality.Separation of enantiomers

**MIDTERM EXAM (Saturday, October 31, 2009, 10 am, place tba)**

## Course Outline II (Week 7-12; David L. Zechel)

### E. How to Make Organic Molecules? Nucleophilic Substitution and Elimination Reactions

S&F 6.1-6.4	Nucleophilic Substitution Reactions
S&F 6.5-6.8	The Mechanism of S <sub>N</sub> 2 Reactions
S&F 6.9-6.12	The Mechanism of S <sub>N</sub> 1 Reactions
S&F 6.13	S <sub>N</sub> 1 vs. S <sub>N</sub> 2
S&F 11.14	S <sub>N</sub> 1 and S <sub>N</sub> 2 reactions with epoxides
S&F 6.14,7.10-7.12	Functional Group Transformations via Substitution
S&F 6.15-6.17	Elimination Reactions: E1 & E2
S&F 6.18-6.19	Substitution vs. Elimination
S&F 7.3-7.8	Making Alkenes via Elimination Reactions
S&F 7.9	Making Alkynes via Elimination Reactions

### F. Addition to Alkenes and Alkynes; Alcohols and Ethers

S&F 7.13-7.14	Addition to Alkenes: Hydrogenation
S&F 8.1-8.6	Addition to Alkenes: Markovnikov's Rule
S&F 8.7-8.11	Hydroboration-Oxidation: Anti-Markovnikov syn Hydration
S&F 8.12-8.14, 8.18-8.19	Electrophilic addition of halogens to alkenes and alkynes
S&F 8.16-8.18, 8.20, 11.13	Oxidation of Alkenes and Alkynes, Alkene epoxidation
S&F 11.4-11.12	Alcohols and Ethers: Reactivity and Synthesis

## **G. How do we determine the structure of a molecule? $^1\text{H}$ and $^{13}\text{C}$ -nuclear magnetic resonance spectroscopy**

*S&F 9.4*

*S&F 9.2, 9.6, 9.7*

*S&F 9.8*

*S&F 9.9*

*S&F 9.10*

Nuclear Spin

$^1\text{H}$ -NMR: Chemical Shift, Shielding, Integration

Chemical shift equivalent and non-equivalent protons

Signal Splitting: Spin-Spin Coupling

$^{13}\text{C}$ -NMR

## **Academic Integrity & Plagiarism**

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](#))

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), on the Arts and Science website (see <http://www.queensu.ca/calendars/artsci/pg532.html>), 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.