CHEMISTRY 223: ORGANIC REACTIONS
Winter Term 2014

Course instructor: Dr. Cathleen Crudden
CHE 503, Chernoff Hall
email: cruddenc@chem.queensu.ca

Lab instructor: Dr. Jason Vlahakis
CHE 215, Chernoff Hall
email: jason.vlahakis@chem.queensu.ca

Web Site: http://www.chem.queensu.ca/Courses/13/CHEM223.asp

Lectures: Jeffery 127, Tuesday 12:30-1:30, Wednesday 10:30-11:30 and Friday 1:30-2:30

Office Hours: You are welcome to make an appointment by email.


Labs: Labs will be held in Room CHE 118, 1st floor of Chernoff Hall. Lab coats and goggles are mandatory.

Marking: Midterm Exam 1 20% February 12, 7-9 pm, to be confirmed
Midterm Exam 2 20% March 19, 7-9 pm, to be confirmed
Final Exam 35%
Lab Reports 25%

The Department of Chemistry uses a “Number In, Letter Out” grading scheme; per cent grades are used for evaluations during the course then converted to a letter grade at the end of the course. Students must pass BOTH the lecture and the lab components (≥ 50% or D-) 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.

Academic Integrity

Academic integrity is constituted by the five core fundamental values of honesty, trust, fairness, respect and responsibility (see 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/senateandtrustees/principlespriorities.html).
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/2011-2012-calendar/academic-regulations/regulation-1), on the Arts and Science website (see 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

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Learning Hours

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<thead>
<tr>
<th>Teaching method</th>
<th>Average hours per week</th>
<th>Number of weeks</th>
<th>Total hours</th>
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<tbody>
<tr>
<td>In-class hours</td>
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<tr>
<td>Lectures</td>
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<td>12</td>
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<td>Seminars</td>
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<td>Laboratories</td>
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<td>Tutorials</td>
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<td>Group learning</td>
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<td>Individual instruction</td>
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<td>Other</td>
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<td></td>
<td>Private study</td>
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<td></td>
<td>Total learning hours</td>
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<td>141</td>
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Calculators: 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. Students may also use calculators with a Gold Applied Science approval sticker or a Blue Commerce approval sticker as they are considered to be comparable to the Casio 991. Calculators with advanced features or substantial text storage capacity are not permitted unless otherwise approved by the instructor. Communicating calculators are banned.

Tentative Outline of Course Material

Keep in mind that you are responsible for and will be tested on IN CLASS MATERIAL. If you miss a class, please get in touch with me to get copies of my notes. Notes will not be posted but are available on a
one on one basis. Also keep in mind, chem 212 is a prerequisite for this class, and as such, you are expected to be familiar with all of this material.

Specific helpful review material:
Claydon chapter 5 (reaction mechanisms), if this is not sufficient, see "Pushing electrons" by Meeks

Chapter 6, nucleophilic addition to the carbonyl group
- Properties of the carbonyl group
- MO picture of reaction
- Reversible additions to carbonyl compounds: cyanohydrin formation, hydration, ketalization
  Notes for following along in the chapter: borohydride reductions and organometallic additions will be discussed after reversible additions, ignore bisulfite additions

Chapter 11, nucleophilic substitution at the carbonyl group
- Hemiketalization/ketalization continued
- Naturally occurring hemiketals
- Ketals as protecting groups
- Imines and hydrazones
- Iminium ions and reductive amination
- Strecker amino acid synthesis
  Ignore Wittig reaction for now

Chapter 9: Organometallic reagents reacting with carbonyl compounds
- Properties and synthesis of organometallics
- Reactions with carbonyl compounds: aldehydes, ketones, CO₂ (see also Chapter 6 pages 132 and 133)
  Wittig reaction
  Oxidations of carbonyl compounds
  Reductions of carbonyl compounds (Chapter 6, pages 130-132 and Chapter 23, 530-534)

Chapter 10: Esters and related derivatives, interconversions and reactions
- Relative reactivity of esters and derivatives
- Methods of synthesis of esters and derivatives
- Reactions with nucleophiles
- Industrial relevance: polymerization

Chapter 20: Formation and reactions of enols and enolates
- Properties of enols and enolates
- Thermodynamic vs kinetic formation of enolates
- Silylenol ethers
- Bromination of enol ethers
- Hydrolysis of enol ethers
Chapter 25: Alkylation of enolates
- Alkylation of lithium enolates of ketones, esters and acids
- Alkylation of enamines and dicarbonyl compounds
- Alkylation with Michael acceptors (Robinson Annelation, Chapter 26, Page 638)
- Conjugate additions
- Alkylation with Nitroalkanes and nitriles
  *ignore dissolving metal reduction*
  
  *Note this chapter contains a lot of information, be sure to follow lectures carefully*

Chapter 26: Aldol reaction
- Intermolecular reactions
- Intramolecular reactions
- Reactions with esters: Claisen and Dieckmann condensations
  *ignore conjugated Wittig reagents*
  
  *Note this chapter contains a lot of information, be sure to follow lectures carefully*

Chapter 19: Addition reactions of alkenes and alkynes
- Hydrogenations (Chapter 23, pages 534 to 537)
- Additions of HBr and halogens
- Radical reactions (Chapter 37 where appropriate)
- Hydrohalogenation
- Epoxidation
- Hydration (alkenes and alkynes)/ oxymercuration
- Hydroboration/oxidation
- Dihydroxylation, ozonolysis
- Pinacol and semipinacol rearrangements (Chapter 36, page 945-949)

Chapter 34/35 Pericyclic reactions
- Diels Alder reactions
- 2+2 reactions
- Electroyclic reactions
- Sigmatropic reactions