



UNIVERSITY
OF MANITOBA

The University of Manitoba – Department of Chemistry
CHEM 2210 Introductory Organic Chemistry I: Structure and Reactivity
Course Outline Fall Term 2011

A01 MWF 11:30 - 12:20; 200 Fletcher Argue ([Dr. John Sorensen](#))
A02 MWF 1:30 - 2:20; 208 Armes ([Dr. John Sorensen](#))

Instructor: Dr. John Sorensen
Office: 334 Parker Building
Email: John.Sorensen@umanitoba.ca
Tel: 204-474-9504
Fax: 204-474-7608
Office Hours: Monday, Wednesday 3:30 – 5:30
Help Session: Friday 4 – 5:30 **Buller 207**

Lab Supervisor: Dr. Horace Luong
Office: 264B Parker Building
Email: luong@cc.umanitoba.ca
Tel: 204-474-7916
Fax: 204-474-7608
Office Hours: Posted on ANGEL

The CHEM 2210 course uses the ANGEL (<http://umanitoba.ca/angel>) website for communicating with the class and posting problem sets, exams and marks as well as important lab information. Please check ANGEL on a regular basis for important information.

Registration:

Prerequisite: A mark of C or better in CHEM 1310.

It is your responsibility as a student to ensure that you are entitled to be registered in this course.

This means that you have the appropriate prerequisites, as noted in the calendar description, or have permission from the instructor to waive these prerequisites.

This also means that you have not previously taken, or are currently registered in, this course and another that has been identified as “not to be held with” in the course description.

The registration system may have allowed you to register in this course, but it is your responsibility to check. If you are not entitled to be in this course, you will be withdrawn, or the course may not be used in your degree program. There will be no fee adjustment, and this cannot be appealed. Please be sure to read the course description for this and every other course in which you are registered.

CHEM 2210 is a prerequisite for both CHEM 2220 and CHEM/MBIO 2370. Students intending to write the MCAT should be aware that both CHEM 2210 and CHEM 2220 contain material crucial to successfully writing the ‘Biological Sciences’ section of the MCAT.

TEXTBOOKS and Required Material (NEW for 2011!!):

Organic Chemistry David Klein, John Wiley & Sons Publishing is **required**. This textbook is available from the bookstore and comes bundled with “*Organic Chemistry as a Second Language I & II*” by David Klein as an additional resource.

CHEM 2210 Laboratory Manual (2011 Edition).

iClicker handset – available from the University Bookstore

Registration in *Sapling Learning* on-line homework system (<http://saplinglearning.ca>). Detailed instructions will be posted on ANGEL in early September.

Optional but strongly recommended items

Organic Chemistry, *Student Study Guide and Solutions Manual*, David Klein, is not required but is highly recommended. The *Solutions Manual* is available in both hard copy and electronic version from the Bookstore.

Students are strongly encouraged to obtain a molecular model kit from the bookstore. Molecular model kits are allowed in all examinations and tests in this course. The bookstore has in stock the “Darling” model kits.

GENERAL OUTLINE:

The course consists of an introduction to the structure, bonding and functional groups of organic molecules. An introduction to the use of spectroscopic tools to determine molecular structure will cover primarily proton (^1H) and carbon (^{13}C) nuclear magnetic resonance spectroscopy. This material will be followed by a discussion of stereochemistry, organic reaction mechanisms, and a number of common organic reaction types.

GRADING SCHEME A (including Mid-Term):

Classroom Participation (<i>iClicker</i>)*	- 5
Sapling On-line homework	- 10
Laboratory Work	- 20
In-Term Test (2 hrs; Date: Wednesday, November 2 nd , 2011 - 7:00 to 9:00 pm)	- 20
Final Examination (3 hrs; scheduled by Student Records Office in the December exam period)	- 45
TOTAL	- 100

GRADING SCHEME B (excluding Mid-Term):

Classroom Participation (<i>iClicker</i>)*	- 5
Sapling On-line homework	- 10
Laboratory Work	- 20
Final Examination (3 hrs; scheduled by Student Records Office in the December exam period)	- 65
TOTAL	- 100

COMMENTS:

NOTE: Introductory Organic Chemistry 1: Structure and Function: CHEM 2210 is a course that requires consistent work throughout the term. In order to achieve success in this course students are advised to give lectures regular attendance and to work diligently at preparing and re-writing lecture notes and practicing problems. It is not possible to obtain a strong performance in this course by 'cramming' for the final examination. **Please note that old copies mid-term and final exams are not normally made available to students.** However, the course instructor will put a copy of the October 2010 Mid-term and December 2010 Final Exam on ANGEL as practice exams.

Preparation for lectures: Students are expected to have read the appropriate sections of the textbook prior to attending lectures. This will enable the course to proceed more smoothly and students to grasp the course content more efficiently. Much of the material in Chapters 1 to 3 has been covered previously in the CHEM 1300 course. Consequently, these chapters will be covered fairly quickly. Students are encouraged to review their CHEM 1300 lectures notes for additional background, especially the sections pertaining to organic functional groups and nomenclature. Students will be responsible for all topics that are covered both in the textbook and in lectures. Some topics in the textbook may not be covered in depth in the lecture and some lecture material may not be found in the textbook. Students will be responsible for all this material on tests and exams.

On-line Homework: In order to help students in CHEM 2210 keep pace with the course material we are using, for the first time in Fall 2011, an on-line homework system as provided by Sapling Learning ([Sapling Canada](#)). A series of assignments and short quizzes will be created in this environment to provide the opportunity to further explore the concepts discussed in lectures. Participation in the on-line homework is **mandatory** for full credit in CHEM 2210. The cost of registering in Sapling Learning is \$29.99 for Fall 2011 and \$49.99 for Fall 2011 Winter 2012 semesters combined. Full details regarding assignment and quiz due dates will be posted on ANGEL in early September 2011.

Textbook Problem Assignments: Will not be formally assigned but are strongly recommended for practice.

Mid-Term Test: The mid-term test is scheduled for Wednesday, November 2nd, 7:00 – 9:00 pm (classrooms will be assigned well in advance of this date). This date is firm and will not be changed. There are two options regarding the mid-term exam and they are outlined below.

OPTION A: Write the mid-term on the day of the test, this will count towards 20 out of your final 100 marks awarded in CHEM 2210. Your final exam will count for 45 (out of a total 100) marks in your overall score.

OPTION B: Do not write the mid-term. In this instance the 20 marks allocated to the mid-term will automatically be applied to your final exam in CHEM 2210. Your final exam will count for **65** out of a total of 100 marks in CHEM 2210.

Should you choose OPTION B it will not be necessary to inform the instructor of CHEM 2210 of your choice. Simply do not show up to the mid-term, no need to provide doctor's notes or any other reason as to why you did not write. A student that is not present at the mid-term will have their marks allocation automatically adjusted for the final exam. Should you choose OPTION A it will not be possible, after the fact, to change your marks allocation for the final exam. The final exam will still have an allocation of 45 (out of 100) and your score on the mid-term will also be used in your final grade calculation.

Note: Although OPTION B may sound like an attractive option, writing a 65 % final exam in an organic chemistry course is *not in your best interest*. The mid-term examination is a very useful measure of how well you understand the concepts of organic chemistry to that point in the course. If you write the mid-term and receive a poor score, you have about 6 weeks to strengthen your performance before the final exam. If you write a 65% final and receive a poor score there is no second chance.

***Class Participation:** The Faculty of Science at the University of Manitoba decided to adopt the use of the *iClicker* classroom response system beginning in the Fall 2007 term. The Department of Chemistry uses the *iClicker* in a number of large multi-section classes including CHEM 2210. As a result it is **compulsory** to purchase an *iClicker* response unit and register with the system on-line in order for you to be awarded the class participation grade. We will be using this system consistently throughout the term to assist in evaluating your progress in solving organic chemistry problems. The marks assigned (5/100) to class participation are awarded on a combination of participation *and* number of correct scores. This formula is described below and will be further explained on the first day of class.

Total marks 5 (out of a total of 100):

<i>iClicker</i> questions will be scored in the following fashion:
- for any response to a question the student will be given a score of one (1) point;
- if the student's response is a correct answer, then a second point (1) will be awarded.
Each student will be given a score out of 5 based on their percentage of the maximum number of points available. Students who score 75% or greater of the points available will be given a score of 5 out of 5. Students who score between 50% and 75% of the points available will be given a score of 2.5 out of 5. Students who score less than 50% of the points available will be given a score of 0 out of 5.

Final Examination: All students must write the final examination. The date for the final exam for CHEM 2210 is scheduled by the registrars' office and will take place between December 9th and December 21st, 2011. Failure to write the final regularly scheduled examination without a valid medical certificate or compassionate reason will result in a mark of zero on the final examination (and a grade of F on the course). Deferral of a final examination can only be given by the student's home faculty. The deferred final examination for CHEM 2210 will be written on Wednesday January 12th, 2011 from 2:00 to 5:00 pm.

Final Grade: A total mark of greater than 50% is required for full credit in this course. Marks between 50% and 100% will be graded from C to A+. Students must obtain a grade of C (minimum 50%) or greater to proceed to either CHEM 2220 or CHEM/MBIO 2370. In order to obtain a passing grade in the course, you must earn a minimum 60% grade [12/20] on the laboratory work with no more than two marks of zero on laboratory or on reports, *regardless of your grade on the balance of the course work.*

Below is the formula used for calculating letter grades in CHEM 2210

Grade Point Value	Letter Grade	Numerical Score
4.5	A+	90.0 – 100
4.0	A	80.0 – 89.9
3.5	B+	75.0 – 79.9
3.0	B	67.0 – 74.9
2.5	C+	60.0 – 69.9
2.0	C	50.0 – 59.9
1.0	D	40.0 – 49.9
0.0	F	00.0 – 39.0

Review of Final Exam Script: The Faculty of Science has established a policy to permit students the opportunity to review their final exam script prior to the end of the Grade Appeal period. You must apply to view your exam during the predetermined viewing period. The Application Form can be obtained from the Department of Chemistry General Office (360 Parker).

Schedule of Tests and Examinations:

Test or Examination	Date (2011)
Mid-term Examination	Wednesday, November 2 nd 2011 (7:00 - 9:00 pm)
Final day of classes	Wednesday, December 8 th 2011
Final Examination	Scheduled by Student Records in the December exam period (December 9 th to December 21 st , 2011)
Deferred Examination	Wednesday, January 11 th (2012)

LABORATORY COMPONENT OF CHEM 2210

Laboratories: *Laboratory attendance is compulsory.* Labs start the week of September 26th 2011. All students registered in the laboratory must buy a CHEM 2210 laboratory manual (2011 Edition). The laboratories are in Rooms 264-290 of the Parker Building. Your room and locker number will be assigned by your name on the bulletin board just across from the laboratories.

Laboratory Safety: *Lab coats and safety glasses or goggles must be worn at all times in the laboratory. Contact lenses should never be worn in the laboratory as fumes or splashed chemicals can become trapped behind the lens, or dissolve the lens on contact. Prescription glasses do not provide sufficient protection from chemical splashes; therefore safety glasses or goggles must be worn over top of prescription glasses.*

Marking: Lab report mark breakdowns will be posted on ANGEL Learning. Late reports will be marked at a 10% deduction per day, up to five business days (after which a grade of 0 will be applied).

Exemptions: Laboratory exemptions will only be given if the lab has been successfully completed (i.e., receiving a minimum of 60% in the lab and not more than two marks of zero on laboratories or reports) in a regular or summer session not more than two years preceding. Students re-taking CHEM 2210 may apply for a laboratory exemption at the Department of Chemistry General Office, Room 360 Parker Building. Students with a laboratory exemption must still register in the B99 section. Students should also note that a lab exemption may be used only once by a student on repeating the CHEM 2210 course. Please note that the previously obtained lab mark *will be used* in the computation of your final mark in this course. Students who obtain a lab exemption based on study at an institution other than the University of Manitoba or for special case consideration will not have their lab mark used in the computation of their final mark.

Plagiarism: Unauthorized communication during exams is plagiarism and is strictly prohibited. Copying another student's assignment (or an instructor's answer sheet from a previous year) is plagiarism. Plagiarism and other forms of cheating are prohibited. This also applies to the laboratory portion of the course and includes copying from old lab reports and falsifying lab data (e.g. fabricating melting points etc.). Offences are dealt with severely and can result in a notation on your permanent university transcript indicating academic dishonesty. This can restrict your future at this, or any other university, and may affect your career options. The full definition of plagiarism and the possible penalties associated with it are outlined in the General Calendar. If you copy parts of another person's assignment, or find the answer to a problem in a textbook or in the published literature, you must give proper credit to the source. If you are unfamiliar with the issue of plagiarism and the penalties associated with such actions please refer to the table below and the Faculty of Science website: [Faculty of Science Plagiarism Website](#). See also: [Student Resource on Plagiarism](#)

Faculty of Science—Suggested Minimum Penalties for Common Acts of Academic Dishonesty (**Note: Other penalties may apply. Contact the Associate Dean of Science for complete list**).

Act of Academic Dishonesty	Suggested Penalty given by Dept.	Suggested Penalty given by Associate Dean of Science
*unauthorized material used in assignment/quiz/test/examination (first offence)	grade of zero on assignment/quiz/ test/examination	
*unauthorized material used in assignment/quiz/test/examination (first offence with clear intent; second or subsequent offence)	**F-CW plus suspension from all departmental courses for a minimum of one full year	Suspension from all Science courses for a minimum one full year
copying in laboratory report/assignment/quiz/test/examination (first offence)	grade of zero on laboratory report/ assignment/quiz/test/examination	
copying in laboratory report/ assignment/quiz/test/examination (first offence with clear intent; second or subsequent offence)	F-CW plus suspension from all departmental courses for a minimum of one full year	Suspension from all Science courses for a minimum one full year
plagiarism on assignment/ project/laboratory report (first offence)	grade of zero on assignment/project/ laboratory report/	
plagiarism on assignment/project/ laboratory report (first offence with clear intent; second or subsequent offence)	F-CW plus suspension from all departmental courses for a minimum of one full year	Suspension from all Science courses for a minimum one full year
inappropriate communication during a quiz/test/examination (first offence)	grade of zero on quiz/test/examination	
inappropriate communication during a quiz/test/examination (first offence with clear intent;second or subsequent offence)	F-CW plus suspension from all departmental courses for a minimum of one full year	Suspension from all Science courses for a minimum one full year
personation on quiz/test/ examination	F-CW plus suspension from all departmental courses for a minimum of one full year	Suspension from all Science courses for a minimum one full year

*Also includes **possession** of unauthorized aid (e.g. cell phone), regardless of whether or not it was actually used. It is essential that instructors define clearly which aids are permitted in quizzes, tests, examinations, **with all other items being explicitly declared as being unauthorized materials.**

F-CW stands for **Failing grade due to Compulsory Withdrawal from the course for Academic Dishonesty reasons.

Note: Non-Science students found guilty of academic dishonesty in Science courses may also be given additional penalties by their Registration Faculty (e.g. an Engineering student taking a Mathematics course may be receive penalties from the Department of Mathematics, Associate Dean of Science plus Dean of Engineering)

CHEM 2210 Course Outline

Chapters are from *Organic Chemistry by Klein Chapter 1 – 3* : Background reading and review only. This material is assumed to have been covered adequately in CHEM 1300 and CHEM 1310. ALSO: throughout CHEM 2210 IUPAC nomenclature of organic molecules will not be taught in lectures nor will it be explicitly examined. Students will be expected to be able to draw a structure given a name and recognize a few common trivial names of molecules.

Section 1: Structure and Bonding in Hydrocarbons *Alkanes, Alkenes, and Alkynes*

Chapter 4: *Section 4.1 – 4.5 (review 1.7–1.9) and 4.9.*

The stability of alkanes cycloalkanes and ring strain will be illustrated with heat of combustion data

Chapter 8: *Sections 8.2 – 8.5*

E vs Z stability and also effect of substitution on double bond as illustrated by heats of combustion.

Chapter 18: *Sections 18.3 – 18.5*

The heat of hydrogenation of benzene will be used to illustrate the concept of aromaticity. A full molecular orbital description of the bonding in benzene will be used to help rationalize aromatic stabilization. The bonding in pyridine and pyrrole will be discussed as further examples of aromatic compounds.

Chapter 10: *Sections 10.1* Brief review of sp bonding in alkynes

Section 2: Functional Groups

Chapter 18: *Sections 18.1 – 18.2*

Chapter 20: *Sections 20.4*

Chapter 21: *Sections 21.1 – 21.3 + 21.6 + 21.12 – 21.13*

This section will be used to rationalize the chemistry of the functional groups according to their structure. The structure and acidity of alcohols will be linked to the structure of aldehydes and ketones along with a discussion of the carbonyl dipole. Carboxylic acids and derivatives will also be discussed including a rationalization of the difference of the pKa of protons α to ester vs amide

Section 3: Spectroscopy – Structure elucidation

Chapter 15: *All but 15.12*

Chapter 16: *Everything Including J values and DEPT*

At the end of this section students will be able to deduce the structure of an organic molecule from a given set of spectroscopic data. The use of Mass Spectroscopy will be introduced *only* as a means to determine the molecular weight of a molecule. Infrared (IR) spectroscopy will be described as a technique that can only give an initial indication of functional groups. Both proton (^1H) and carbon (^{13}C) Nuclear Magnetic Resonance will be described in detail, with an emphasis on the application to structure elucidation.

Section 4: Conformational Analysis and Stereochemistry

Chapter 4: *Section 4.6 – 4.8: 4.10 – 4.12*

Chapter 5: *All but 5.8 and 5.9 (BUT Include Fisher projections)*

Conformational analysis will be included in the same unit as stereochemistry. The energy differences in the conformations of the cyclohexane chairs will be examined in detail. The effect of substitution on the equilibrium between non-degenerate chairs will be examined. The effective 'ring-locking' of large substituents will be described. The 3-dimensional shape of organic molecules and the concept of chirality will be described.

Section 5: Mechanisms of Organic Reactions

Chapter 6: *Section 6.1 – 6.5 (As review) 6.6 – end of chapter*

A comparison of the uni- and bi-molecular substitution mechanisms and with analysis of the accompanying energy diagrams will be the focus of this section.

Chapter 11: *Section 11.1 – 11.5*

An introduction to radicals and the use of radical halogenation as an illustration of the Hammond postulate. The stereochemistry of radical reactions will not be covered.

Section 6: Substitution Reactions

Chapter 7: *Everything*

A set of criteria for determining which mechanism will predominate will be developed. The use of substitution reactions for basic functional group interconversions will be introduced. The use of activating (i.e. Tosyl) and the use of rudimentary protecting groups (i.e. the Gabriel synthesis *Chapter 23.5*) will be included in this section. Students will be able to provide the products for a given reaction when shown the starting material and reagents. Likewise students will be able to provide a set of reagents when provided starting material and products.
