



UNIVERSITY
OF MANITOBA

The University of Manitoba – Department of Chemistry
CHEM 2210 Introductory Organic Chemistry I: Structure and Reactivity
Course Outline Fall Term 2019

A01 MWF 11:30 - 12:20; **290 Education** ([Dr. John Sorensen](#))

A02 MWF 1:30 - 2:20; **240 University College** ([Dr. Rebecca Davis](#))

Professor: Dr. John Sorensen (course coordinator) Office: 334 Parker Building Email: John.Sorensen@umanitoba.ca Tel: 204-474-9504 Office Hours: Monday, Wednesday 1:30 – 3:30	Professor: Dr. Rebecca Davis Office: 552 Parker Building Email: Rebecca.Davis@umanitoba.ca Tel: 204-474-6252 Office Hours: Mon, Wed 10 am – 12 pm
Lab Coordinator: Dr. Horace Luong Office: 264B Parker Building Email: Horace.Luong@umanitoba.ca Tel: 204-474-7916 Office Hours: Tuesday – Friday 12:45-2:00 pm	

The CHEM 2210 course uses the UM Learn (<https://universityofmanitoba.desire2learn.com/>) website for communicating with the class and posting problem sets, exams and marks as well as important lab information. Please check UM Learn 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 If you are not entitled to be in this course, you will be withdrawn, or the course may not be used in your degree program.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.

TEXTBOOKS and Required Material:

Organic Chemistry 3rd edition: 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.

Registration in WileyPLUS on-line homework system (<https://www.wileyplus.com/WileyCDA>) is required. The registration code for the on-line homework system comes bundled with the textbook. A stand-alone registration code is also available at the bookstore and comes bundled with a full electronic version of the textbook as well as the “*Second Language*” books.

CHEM 2210 Laboratory Manual (2019 Edition) is **required** for this course. For the lab program, you will need to use either an iClicker or your smart phones with the installed iClicker app to complete the prelab assessment

Optional but strongly recommended items:

Organic Chemistry 3rd edition, *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 also 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. Included is a discussion of stereochemistry and the three-dimensional shape of organic molecules. The use of spectroscopic tools to determine molecular structure will cover primarily proton (¹H) and carbon (¹³C) nuclear magnetic resonance spectroscopy. This material will be followed by a description of organic reaction mechanisms, and a number of common organic reaction types. A particular emphasis will be placed on substitution and elimination reactions.

GRADING SCHEME:

Homework (WILEYPlus)	- 10
Laboratory Work	- 15
Mid-Term Exam (2 hours; Friday October 25th; 6:30 pm – 8:30 pm)	- 20
Lab Examination (1.5 hours; Thursday November 28th; 6:15 pm – 7:45 pm)	- 10
Final Examination (3 hrs; scheduled by Student Records Office in the December exam period)	- 45
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 2018 Mid-term and December 2018 Final Exam on UM Learn 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 and 1310 courses. Consequently, these chapters will not be covered at all. Students are encouraged to review their CHEM 1300 and 1310 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 an on-line homework system called Wiley PLUS that is provided by the company that publishes our textbook ([Wiley Plus](#)). 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 WileyPLUS registration code (at a discounted price) is available bundled with the textbook in the bookstore. A full price WileyPLUS registration code is available for students who do not wish to purchase the textbook.

Office Hours: Dr. Sorensen will hold office hours on Mondays and Wednesdays from 1:30 pm – 3:30 pm in his office (Parker 334). Dr. Davis will hold office hours on Mondays and Wednesdays from 10:00 am – 12:00 am in her office (Parker 552). This is a good opportunity to get some extra help with course content and conceptual material related to CHEM 2210. **The use of e-mail should only be for questions related to course administration.** Conceptual questions that require detailed answers (*i.e.* Can you explain aromaticity?) cannot be answered by e-mail.

Supplemental Instruction: Supplemental instruction for CHEM 2210 will be offered by the Academic Learning Center. This is a *voluntary* drop-in help session that is led by a student leader that has recently taken the course. More information can be found at the Supplemental Instruction [SI Website](#). The SI Schedule for Fall 2019 is below.

Section	Leader Time	Room
A01	Catherine Monday (10:30-11:30 pm)	527 Buller
A01	Catherine Wednesday (2:30-3:30 pm)	215 Tier
A02	Tyler Monday (2:30-3:30 pm)	215 Tier
A02	Tyler Wednesday (2:30-3:30 pm)	215 Tier

Mid-Term Exam: The mid-term Exam is scheduled for **Friday, October 25th 6:30 – 8:30 pm** (classrooms will be assigned well in advance of this date). This date is firm and will not be changed.

NOTE: There is a Winnipeg Blue Bomber home game at Investors Group Field that evening at 7:30 pm.

Please be certain to take that into account when making arrangements for parking and transportation.

The mid-term test is **mandatory** for all students. Students who fail to write the mid-term exam will be given a grade of '0' (zero) for the test. There is **no deferred mid-term exam**. Students with *University* conflicts (such as another exam that evening) should contact the course coordinator as soon as the conflict is identified. Students who miss the exam for medical reasons must show a valid medical certificate to the course coordinator within two business days. The value associated with the mid-term examination will be transferred to the final examination. The mid-term exam grades will be available online within a week and the exams will be handed back during the next scheduled lab period.

Laboratory Examination: This examination is scheduled for **Thursday, November 28th 6:15 – 7:45 pm** (rooms will be assigned). This examination is **mandatory** for all students in CHEM 2210. Students in the lab exemption section will have their previous lab examination score transferred to this term. Although should they wish, they have the option to write the lab examination with the other students and the most recent score will overwrite the previous score. Lab exempt students must make arrangements with the lab coordinator before November 1 if they wish to write the lab examination. Students who fail to write this examination will be assigned a grade of '0' (zero), and be deemed to have failed the laboratory portion of CHEM 2210. This will result in an automatic grade of F in the course. Students with University conflicts (such as another exam that evening) should contact the lab coordinator as soon as the conflict is identified. Students who miss the laboratory exam for medical reasons must show a valid medical certificate to the lab coordinator within two business days.

VW Policy: If you VW a course you will also be required to immediately withdraw from the lab. **Therefore, students that VW a course will not be eligible for a lab exemption should they choose to re-take the course.**

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 20th, 2019. The final examination is **mandatory** for all students in the course. 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).

Final Grade: A total mark of greater than 55% is required for full credit in this course. Marks between 55% and 100% will be graded from C to A+. Students must obtain a grade of C (minimum 55%) 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 [9/15] on the laboratory work.

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

Numerical Score	Letter Grade	Grade Point Value	Description
90.0 – 100	A+	4.5	Exceptional
80.0 – 89.9	A	4.0	Excellent
75.0 – 79.9	B+	3.5	Very Good
70.0 – 74.9	B	3.0	Good
65.0 – 69.9	C+	2.5	Satisfactory
55.0 – 64.9	C	2.0	Adequate
50.0 – 54.9	D	1.0	Marginal
00.0 – 49.9	F	0.0	Failure

Letter Grade	Description	Expectation in CHEM 2210
A+	Exceptional	A complete mastery of structure and bonding concepts in organic chemistry. The demonstration of outstanding ability to correctly solve advanced problems. An exceptional ability for original thought. A demonstrated ability to analyze unique problems at an advanced level.
A	Excellent	Comprehensive knowledge of structure and bonding concepts in organic chemistry. Demonstration of outstanding ability to apply these concepts to advanced problems. An excellent ability for original thought and analytical analysis of problems.
B+	Very Good	Considerable knowledge of structure and bonding concepts in organic chemistry. Demonstration of excellent ability to apply these concepts to advanced problems. A demonstration of originality of thought and analytical ability.
B	Good	Substantial knowledge of structure and bonding concepts in organic chemistry. Demonstration of superior ability to apply these concepts to basic problems. Some originality of thought and a demonstration of analytical ability.
C+	Satisfactory	An understanding of structure and bonding concepts in organic chemistry. Demonstration of good ability to apply these concepts to basic problems. Chemical structures are rarely drawn incorrectly.
C	Adequate	Evidence of some understanding of structure and bonding in organic chemistry. Demonstration of moderate ability to apply these concepts to basic problems. Chemical structures are occasionally drawn incorrectly with violations of the rules of bonding.
D	Marginal	Some evidence of a minimal understanding the basic concepts of structure and bonding in organic chemistry. Chemical structures are often drawn incorrectly with violations of the rules of bonding. A number of exam questions left blank or only partially completed.
F	Failure	Insufficient evidence of understanding the basic concepts of structure and bonding in organic chemistry. Chemical structures are usually drawn incorrectly with violations of the rules of bonding. A large number of exam questions left blank or mostly incomplete.

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 [here](#) to view your exam during the predetermined viewing period.

Schedule of Tests and Examinations:

Test or Examination	Date (2019)
Mid-term Examination	Friday, October 25 th 2019 (6:30 – 8:30 pm)
Lab Examination	Thursday, November 28 th 2019 (6:15 – 7:45 pm)
Final day of classes	Friday, December 6 th 2019
Final Examination	December exam period (December 9 th to December 20 th , 2019)

LABORATORY COMPONENT OF CHEM 2210

Please watch the video at: <http://www.horaceluong.com/2210> for a synopsis of the CHEM 2210 laboratory program
Laboratories: *Laboratory attendance is compulsory.* Laboratories start the week of September 16, 2019. All students registered in the laboratory must buy a CHEM 2210 laboratory manual (2019 Edition) and a package of magnetic stir beads. The laboratories are in Rooms 264-290 of the Parker Building. Your room and bench spaces will be assigned by your name on the bulletin board just across from the laboratories by September 13 (Aurora assigns all students to the same room, please ignore the Aurora assignment).

We will be using iClickers for prelab testing starting from the first lab and every week thereafter. For all lab sessions students must bring a registered iClicker remote or their smartphones with the iClicker app installed and registered to complete the assessment. Please register your iClicker accounts through the relevant link on the CHEM 2210 lab section UM Learn site.
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. Full Shoes must be worn in the laboratory.**

Marking: Lab report mark breakdowns are described in the lab manual. Late reports will be marked at a 0.5 mark/hour deduction, up to one week (after which a grade of 0 will be applied). Lab reports are submitted online to UMLearn assignments folder. Grades for the reports are returned within 2 weeks at the latest.

Exemptions: Laboratory exemptions will only be given if the lab has been successfully completed (i.e., receiving a minimum of 70% in the lab) in a regular or summer session not more than one year preceding. Student re-taking CHEM 2210 may apply for a laboratory exemption by completing the laboratory exemption form on the Department of Chemistry homepage. 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 Resources 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	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	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	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 3rd Edition* by Klein Chapter 1 – 3: Background reading and review only. This material is 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* (~ 7 lectures)

Chapter 1: (*As review 1.7 – 1.10*); **Chapter 4:** *Entire Chapter*

The stability of alkanes cycloalkanes and ring strain will be illustrated with heat of combustion data. The conformations of alkanes will also be examined. The energy differences in the conformations of the cyclohexane chairs will be examined in detail and the effect of substitution on the equilibrium between non-degenerate chairs will be described. The effect of 'ring-locking' large substituents will be detailed.

Section 2: Functional Groups (~ 3 lectures)

This section will be used to rationalize the chemistry of the functional groups according to their structure.

Chapter 17: *Aromatic Compounds* *Sections 17.1 – 17.6*

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 22: *Sections 22.1 – 22.3:* The chemistry of amines will be briefly introduced in this section.

Chapter 12: *Sections 12.1 – 12.2* **Chapter 19:** *Sections 19.1 – 19.5;* **Chapter 20:** *Sections 21.1 – 21.3; 21.6 – 20.8*

The structure, physical and chemical properties of oxygen containing functional groups will be described. A description of alcohols will be followed by a discussion of the chemistry of the carbonyl group. Carboxylic acids and their derivatives, such as esters and amides will be included in this section. A rationalization of the difference of the pKa of protons α to ester vs amide will be described in this section.

Section 3: Spectroscopy – Structure elucidation (~ 8 lectures)

Chapter 15: *Entire chapter;* **Chapter 16:** *Entire chapter*

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 spectrometry 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: Stereochemistry (~ 4 lectures)

Chapter 5: *Entire Chapter*

The 3-dimensional shape of organic molecules and the concept of chirality will be described. The concept of chirality will be introduced and the CIP system of assigning absolute configuration will be described. Optical activity will also be covered in this section. Molecules with more than one stereogenic center will also be described.

Section 5: Mechanisms of Organic Reactions (~ 8 lectures)

Chapter 6: *Entire 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. The thermodynamic vs kinetic control of reactions will be described.

Chapter 10: *Section 10.1 – 10.7*

An introduction to radicals and radical halogenation will be used as an illustration of the Hammond postulate. The discussion will focus on "product-like" vs "reactant-like" transition states and the effect on regiochemistry. A brief discussion of the stereochemistry of halogenation as well as the outcome of allylic bromination will be included.

Section 6: Substitution and Elimination Reactions (~ 7 lectures)

Chapter 7: *Entire Chapter*

The use of substitution and elimination reactions for basic functional group interconversions will be introduced. Students will be able to distinguish between the substitution and elimination mechanisms and predict the products when given the starting material and conditions.
