

CHEM*2700
ORGANIC CHEMISTRY I
(Winter Semester 2016)

Information Sheet and Course Outline

- **Instructor:** Professor William Tam
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** You are welcome to come to ask me questions in my office and to discuss problems (My availability will be posted on CourseLink).

- **Calendar Description:** This course provides an introduction to organic chemistry through the discussion of stereochemistry and major reaction mechanisms such as nucleophilic substitution and elimination, electrophilic addition, free radical reactions, electrophilic aromatic substitution, nucleophilic addition and nucleophilic acyl substitution.
Prerequisite(s): CHEM*1050.
Restriction(s): This is a Priority Access course. Enrolment may be restricted to particular programs, specializations or semester levels during certain periods. Please see the B.Sc. Academic Advising website (http://www.bsc.uoguelph.ca/current_students/course_info.shtml) for more information.

- **Objectives:** Chemistry CHEM*2700 is an appropriate one-semester course in Organic Chemistry. However, CHEM*2700 and CHEM*3750 have been designed to provide a comprehensive introduction to Organic Chemistry. This will properly serve the students who require a year of Organic Chemistry in addition to their first year General Chemistry. In CHEM*2700, the emphasis is on the understanding of the factors that control reactions and the reaction products. This course is a prerequisite for CHEM*3750.
Specific Learning Objectives:
 - (1) To make the students knowledgeable about the fundamentals of Organic Chemistry.
 - (2) To understand the consequences (reactivity, properties) of the 3-dimensional structures of molecules.
 - (3) To be able to interpret patterns of reactivity on the basis of mechanistic reasoning.
 - (4) To be able to design syntheses of organic molecules of moderate complexity.

- **Lecture Notes/Lecture Slides (10th Edition):**
The lectures notes and lecture slides for CHEM*2700, Organic Chemistry I will be available for download through CourseLink at the beginning of the semester. It is assumed that you are familiar with the organic chemistry materials covered in CHEM*1040 and you may wish to have the notes available to review topic as needed.

- **Textbooks:**
 - (a) *Organic Chemistry*, 11th Edition by T. W. G. Solomons and C. B. Fryhle, John Wiley & Sons, Inc. I recommend that you purchase the textbook as it will effectively supplement the lecture material.
 - (b) *Study Guide and Solutions Manual to Organic Chemistry*, 11th by T.W.G. Solomons, C. B. Fryhle and R. Johnson, John Wiley & Sons, Inc. This guide provides answers to all problems in the text and also offers additional self test problems.
**A combine package of the textbook and the study guide, as well as two molecular model kits, and the Wiley Plus Access Code, is available at the Bookstore for a substantially reduced price. You are encouraged to consider this package. Solomons is also the textbook for CHEM*3750 (Organic Chemistry II) and CHEM*3760 (Organic Chemistry III).
 - (c) If you already have an older edition of the textbook (9th or 10th ed.), I do not recommend you to purchase the 11th edition as there is only very little difference between them.
- **Course Outline and Reading Assignments:**

A detailed outline of the course is shown on p.6-9. The *reading assignments* (see p.6-9) from the Solomons textbook will provide a more detailed perspective of the course material. The number of lectures allocated for each topic is approximate. Problem assignments and answers for the assignments can be downloaded from CourseLink.
- **Molecular Model Kit:** A molecular model kit can be purchased from the Bookstore and will be used in one of the experiments in the Lab. It is very useful to those who have difficulty with stereochemistry.
- **Laboratory:** The lab manual will be available for sale in the Department at the beginning of the semester. Students are also required to have a “Blue Lab Note book” and must provide their own safety goggles (both of these may be purchased in the Department). Students are also required to provide their own lab coats. A student without eye protection will not be permitted to work in the laboratory. Contact lenses are extremely hazardous in a laboratory environment and their use is prohibited in the lab. SAFETY GOGGLES MUST BE WORN AT ALL TIMES IN THE CHEM*2700 LABORATORY.
**For any problems associated with the lab please contact the lab coordinator Dr. Robert Reed, SC3114 (Phone: ext.53805, E-mail: rwreed@uoguelph.ca).
**For TA’s Names, emails, office locations and office hours, please contact the lab coordinator, Dr. Robert Reed.
**Organic Chemistry I labs location: SC2111/2112.
**Students must complete at least 60% of the laboratory work to receive a grade for the course.
**“*The Organic Chem Lab Survival Manual*” by J. W. Zubrick, contains helpful hints on a variety of techniques and apparatus employed in the organic chemistry laboratory. It is available in the Library on 2-hour reserve.

****IMPORTANT NOTE:** Students can only get lab exemptions if the course was taken within the past 12 months. Any student who would like to get lab exemption must get approval from the lab coordinator within the first week of the semester.

- **Communications:** The primary communication between the students and the lecturer concerning issues with the course is through discussions during the lectures (e.g. exams and quizzes coverage, due dates for quizzes, and other announcements related to the course). Although most of the time, announcements and information related to the course will also be posted on CourseLink and/or e-mails to the students, **students are expected to attend EVERY lecture.** This is NOT a DE course. If you miss a lecture, make sure you talk to your classmate to see if there is any important announcement during the lecture that you missed or you are welcome to contact me by phone or e-mail.
E-mail Communication: As per university regulations, all students are required to check their <mail.uoguelph.ca> e-mail account regularly: e-mail is the official route of communication between the University and its students.
- **When You Cannot Meet a Course Requirement:** When you find yourself unable to meet an in-course requirement because of illness or compassionate reason, please advise the course instructor (or designated person, such as a teaching assistant) in writing, with your name, id#, and e-mail contact. See the undergraduate calendar for information on regulations and procedures for Academic Consideration:
<http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-ac.shtml>
- **Drop Date:** The last date to drop one-semester courses, without academic penalty, is Friday, **March 11, 2016 (the fortieth class day).** For regulations and procedures for Dropping Courses, see the Undergraduate Calendar:
<http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-drop.shtml>
- **Accessibility:** The University of Guelph is committed to creating a barrier-free environment. Providing services for students is a shared responsibility among students, faculty and administrators. This relationship is based on respect of individual rights, the dignity of the individual and the University community's shared commitment to an open and supportive learning environment. Students requiring service or accommodation, whether due to an identified, ongoing disability or a short-term disability should contact the Centre for Students with Disabilities as soon as possible.
For more information, contact CSD at 519-824-4120 ext. 56208 or email csd@uoguelph.ca or see the website: www.uoguelph.ca/csd
- **Academic Misconduct:** The University of Guelph is committed to upholding the highest standards of academic integrity and it is the responsibility of all members of the University community – faculty, staff, and students – to be aware of what constitutes academic misconduct and to do as much as possible to prevent academic offences from occurring. University of Guelph students have the responsibility of abiding by the University's policy on academic misconduct regardless of their location of study; faculty, staff and students have the responsibility of supporting an environment that discourages misconduct. Students need to

remain aware that instructors have access to and the right to use electronic and other means of detection.

Please note: Whether or not a student intended to commit academic misconduct is not relevant for a finding of guilt. Hurried or careless submission of assignments does not excuse students from responsibility for verifying the academic integrity of their work before submitting it. Students who are in any doubt as to whether an action on their part could be construed as an academic offence should consult with a faculty member or faculty advisor.

The Academic Misconduct Policy is detailed in the Undergraduate Calendar:

<http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-amisconduct.shtml>

- **Recording of Materials:** Presentations which are made in relation to course work—including lectures—cannot be recorded or copied without the permission of the presenter, whether the instructor, a classmate or guest lecturer. Material recorded with permission is restricted to use for that course unless further permission is granted.
- **Resources:** The Academic Calendars are the source of information about the University of Guelph's procedures, policies and regulations which apply to undergraduate, graduate and diploma programs: <http://www.uoguelph.ca/registrar/calendars/index.cfm?index>
- **Course Web Page:** You can access the course website through Courselink: <https://courselink.uoguelph.ca/shared/login/login.html>.
This web page will be updated regularly. Lecture notes, lecture slides, assignment questions and answers, help sessions and revision materials, as well as exam grades and statistics will be posted. Please visit this website regularly, especially before exams.
- **Lectures:** January 11, 2016 – April 8, 2016, Mondays, Wednesdays & Fridays.
11:30 am – 12:20 pm, WMEM 103 (War Memorial Hall).
- **Help Sessions (optional):** Every Friday, 5:30pm – 6:20pm
Location: MACN 105.
- **Mark Distribution:** The final grade will be obtained as follows:

On-line Quizzes:	9%	(six quizzes in total, 1.5% each)
Lab Grade:	25%	
1 st Midterm Examination:	15%	(date: Saturday, February 6, 2016, Parts 1-2)
2 nd Midterm Examination:	20%	(date: Saturday, March 5, 2016, Parts 1-4)
Final Examination:	31%	(date: Tuesday, April 12, 2016, Parts 1-10)

Online Quizzes: Coverage, due dates and detail information about online quizzes will be posted on CourseLink.

****Examination dates, time and location:**

- ❖ 1st Midterm Exam: Saturday, February 6, 2016, 5:00pm–6:30pm in ROZH 104.
- ❖ 2nd Midterm Exam: Saturday, March 5, 2016, 5:00pm–6:30pm in ROZH 104.
- ❖ Final Exam: Tuesday, April 12, 2016, 2:30pm–4:30pm, location: TBA.

** Only valid excuses on medical or compassionate grounds will prevent a grade of zero for a missed examination/quiz. Midterm papers may be submitted to the instructor for correction of grading errors within 5 days of the return of the graded papers. Only papers written in ink may be submitted for re-grading.

**Note that EVERY student in class MUST write two mid-term exams and one final exam: there is no exception. If you missed an exam because of a medical reason, you will need to write a make-up exam as soon as you are recovered. Re-weighting the percentages of the exams will not be allowed.

CHEM*2700 ORGANIC CHEMISTRY I

Course Outline

Part I: Introduction (~ 4 lectures)

- Topics:**
- Bonding & Hybridization – Octet Rule, Hybridization, Bond Length & Bond Strength, Polar Bonds & Polar Molecules
 - Functional Groups – Alkanes, Alkenes, Alkynes, Benzene & Aromatics, Alkyl Halides, Alcohols, Ethers, Aldehydes & Ketones, Carboxylic Acids & Derivatives, Amines
 - Resonance
 - Acidity & Basicity

Reading Assignments (Solomons 11th Ed.): Chapter 1, Sections 1.3 – 1.8, 1.12 – 1.14
Chapter 2, Sections 2.2 – 2.14
Chapter 3, Sections 3.1 – 3.7, 3.10 – 3.15

Part II: Nomenclature, Isomerism & Stereochemistry (~ 4 lectures)

- Topics:**
- Nomenclature of Organic Compounds
 - Alkanes, Alkenes & Alkynes, Alkyl Halides, Ethers, Benzene & Aromatics, Alcohols, Aldehydes & Ketones, Carboxylic Acids & Derivatives, Priorities of Functional Groups in IUPAC System
 - Isomerism – Chain Isomerism, Position Isomerism, Functional Group Isomerism, Tautomerism, Stereoisomerism
 - Stereochemistry – Newman Projection, conformers, Conformation Analysis of Butane, Conformations of Cyclohexanes, Stereochemistry of Double Bonds, Chiral Molecules

Reading Assignments (Solomons 11th Ed.): Chapter 4, Sections 4.1 – 4.13
Chapter 5, Sections 5.1 – 5.14
Chapter 7, Sections 7.1 – 7.2
Chapter 11, Section 11.1
Chapter 14, Section 14.2
Chapter 16, Section 16.2
Chapter 17, Section 17.2

Part III: Nucleophilic Substitutions & Elimination Reactions (~ 5 lectures)

- Topics:**
- S_N2 Reactions – Kinetics, Mechanism, Free Energy Diagram, Stereochemistry, Steric Effect of the Substrate, Reactivity of the Nucleophile, Reactivity of the Leaving Group, Effect of Solvent
 - S_N1 Reactions – Mechanism, Kinetics, Free Energy Diagram, Order of Reactivity of the Substrates, Stereochemistry, Reactivity of the Nucleophile, Reactivity of the Leaving Group, Effect of Solvent, Rearrangement of Carbocations
 - Acidity & Basicity
 - E₁ and E₂ eliminations – Mechanism, Regiochemistry
 - Nucleophilic Substitution vs Elimination

Reading Assignments (Solomons 11th Ed.): Chapter 6, Sections 6.1 – 6.19
Chapter 7, Sections 7.3, 7.5 – 7.8

Part IV: Electrophilic Addition Reactions of Alkenes & Alkynes (~ 4 lectures)

- Topics:**
- Electrophilic Addition of Alkenes
 - Markovnikov's Rule, Addition of Hydrogen Halides, Acid-Catalyzed Hydration, Halogenation, Halohydrin Formation, Electrophilic Epoxidation, Cyclopropanation, Dihydroxylation, Oxymercuration, Hydroboration
 - Electrophilic Addition of Alkynes
 - Addition of Hydrogen Halides, Halogenation, Mercury (II)-Catalyzed Hydration, Hydroboration-Oxidation

Reading Assignments (Solomons 11th Ed.): Chapter 8, Sections 8.1–8.15, 8.17–8.18, 8.20
Chapter 11, Sections 11.14

Part V: Radical Reactions (~ 1 lecture)

- Topics:**
- Radicals – Heterolytic & Homolytic Bond Cleavage, Geometry of Alkyl Radicals, Relative Stability
 - Halogenation of Alkanes – Mechanism, Halogenation of Higher Alkanes
 - Anti-Markovnikov Addition of HBr to Alkenes

- Radical Polymerization of Alkenes

Reading Assignments (Solomons 11th Ed.): Chapter 10, Sections 10.1 – 10.11

Part VI: Electrophilic Aromatic Substitutions (~ 3 lectures)

- Topics:**
- Benzene & Aromaticity; Substituted Benzene
 - Electrophilic Aromatic Substitutions of Benzene
 - Mechanism, Halogenation, Nitration, Sulfonation, Friedel-Crafts Alkylation, Friedel-Crafts Acylation
 - Electrophilic Aromatic Substitutions of Mono-Substituted Benzene
 - Classification of Different Substituents, Reactivity, Regiochemistry
 - Electrophilic Aromatic Substitutions of Di-Substituted Benzene

Reading Assignments (Solomons 11th Ed.): Chapter 14, Sections 6.1 – 6.19

Chapter 15, Sections 15.1–15.8, 15.10–15.11

Part VII: Nucleophilic Addition Reactions of Carbonyl Compounds (~ 3 lectures)

- Topics:**
- Addition of Hydride
 - Addition of Grignard Reagents
 - Addition of Alcohols –Acetal & Ketal
 - Addition of Primary Amines and Hydrazines
 - Addition of HCN

Reading Assignments (Solomons 11th Ed.): Chapter 12, Sections 12.3, 12.6 – 12.8

Chapter 16, Sections 16.6 – 16.9

Part VIII: Nucleophilic Acyl Substitution Reactions (~ 2 lectures)

- Topics:**
- Relative Reactivity of Carboxylic Acid Derivatives
 - Nucleophilic Acyl Substitutions of Carboxylic Acids, Acid Chlorides, Acid Anhydrides, Esters, Amides, Saponification, Transesterification, Aminolysis
 - Polyesters & Polyamides

Reading Assignments (Solomons 11th Ed.): Chapter 17, Sections 17.1 – 17.9, 17.13

Part IX: Functional Groups Interconversions (~ 2 lectures)

- Topics:**
- New Reactions and New Techniques in Functional Groups Interconversions
 - Hydrogenation, Clemmensen Ketone Reduction, Lindlar Catalyst, Dissolving Metal Reduction, Dehalogenation, Oxidation Cleavage of Alkenes, Ozonolysis, Dehydrohalogenation, Epoxide Ring Opening, Oxidation of Alcohols, Oxidation Cleavage of 1,2-Diols, Williamson Ether Synthesis, Hydrolysis of Nitriles, Dehydration of Amides.

Part X: Summary of Organic Reactions

- Topics:**
- Review and Summary of All the Reactions Covered From Parts I-IX
 - Preparation of Each Functional Groups by Different Methods

CHEM*2700 – 2016W Lectures and Exams Schedules

Week	Date		Lecture	Week	Date ^b		Lecture	
1	Jan.	11 (M)	(1) Part I-1	7	Feb.	29 (M)	(19) Part IV-4	
		13 (W)	(2) Part I-2		Mar.	2 (W)	(20) Revision	
		15 (F)	(3) Part I-3		4 (F)	(21) Revision		
2	Feb.	18 (M)	(4) Part I-4		8	5 ^c (Sat)	2 nd Midterm Exam	
		20 (W)	(5) Part II-1			7 (M)	(22) Part V	
		22 (F)	(6) Part II-2			9 (W)	(23) Part VI-1	
3	Feb.	25 (M)	(7) Part II-3			9	11 ^d (F)	(24) Part VI-2
		27 (W)	(8) Part II-4	14 (M)			(25) Part VI-3	
		29 (F)	(9) Part III-1	16 (W)			(26) Part VII-1	
4	Feb.	1 (M)	(10) Revision	10			18 (F)	(27) Part VII-2
		3 (W)	(11) Revision		21 (M)		(28) Part VII-3	
		5 (F)	(12) Part III-2		23 (W)		(29) Part VIII-1	
5	Feb.	6 ^a (Sat)	1 st Midterm Exam		11		25 ^e (F)	Holiday
		8 (M)	(13) Part III-3			28 (W)	(30) Part VIII-2	
		10 (W)	(14) Part III-4			30 (F)	(31) Part IX-1	
6	Feb.	12 ^b (F)	(15) Part III-5			12	Apr.	1 (M)
		22 (M)	(16) Part IV-1	4 (M)			(33) Revision	
		24 (W)	(17) Part IV-2	6 (W)			(34) Revision	
		26 (F)	(18) Part IV-3					8 (F)

Final Exam: Tuesday, April 12, 2016, 2:30pm–4:30pm, location: TBA.

^a1st Midterm Exam.: Saturday, February 6, 2016, 5:00pm–6:30pm in ROZH 10.

^bFebruary 15 – 19: Winter Break, No Class Scheduled this week.

^c2nd Midterm Exam.: Saturday, March 5, 2016, 5:00pm–6:30pm in ROZH 10.

^dMarch 11th (Friday): 40th class day, last day to drop the course.

^eFriday March 25th, HOLIDAY, No Class Scheduled.