INFORMATION SHEET AND COURSE OUTLINE
ORGANIC CHEMISTRY I, CHEM*2700
SUMMER SEMESTER, 2019

1. INSTRUCTOR

Dr. R. W. Reed
Rm. 3114 Science Complex
Email: rwreed@uoguelph.ca

- **Information will be sent to you by email using your University of Guelph email account, make sure that you retrieve your mail regularly**.
- **Courselink will be used to post lecture material after each lecture as well as additional study materials.**
- **Dr. Reed be available for consultation and help in my office at any time when the door is open or by appointment. E-mail is the best way to contact.**
- **This course requires approx. 6 hours of lecture and laboratory instruction each week. It is strongly recommended that a minimum of 6 additional hours each week be devoted to study.**

2. LECTURE LOCATION:

The lectures will be in RICH 2520:
Tuesday and Thursday 11:30 - 12:20.

3. TEXTBOOKS AND SUPPLEMENTARY MATERIAL

a) "Organic Chemistry," 11th Ed., by Solomons & Fryle. Reading assignments and some problems will be chosen from it. Solomons is also the text for CHEM*3750, Organic Chemistry II and CHEM*3760, Organic Chemistry III. Identical problems and readings selected from the text may have different numbers in the 10th edition. The course notes and assignments reflect that so that everyone is doing the same problems and reading.

b) "Study Guide and Solutions Manual to Organic Chemistry", 11th Ed., by Solomons. This guide provides answers to all the problems in the text and also offers additional self test problems. Several copies of this guide will be available in the Library on 2-hour reserve but purchasing a copy is highly recommended.

c) **Not Required: Access code to our WileyPlus course session online:**
The online WileyPlus "Organic Chemistry" 12th Ed. by Solomons & Fryle gives you access to the full textbook as well as other resources pertaining to the textbook. AN ACCESS CODE IS INCLUDED IN THE BOOK-PACKAGE AVAILABLE FROM THE BOOKSTORE. You may also choose to purchase it on its own online. (Note: the Study Guide/Solution Manual is NOT available as part of the WileyPlus online but will be on reserve in the library).

d) Molecular Model Kit. A kit may be purchased from the Bookstore and will be of

particular use to those who have difficulty with stereochemistry or plan on taking more organic chemistry.
A combination package of (a), (b), (c) and (d) is available at the Bookstore for a substantially reduced price. You are encouraged to consider this package particularly if you plan on taking CHEM*3750 (and CHEM*3760).

3. LABORATORY:

- The lab manual "CHEM*2700, Organic Chemistry I, Laboratory Manual" will be available for sale in the Department. Students are also required to have a Hard cover Note book and provide their own safety goggles. Students are also required to provide their own lab coats.
- A student without eye protection will not be permitted to work in the laboratory. SAFETY GOGGLES AND LAB COATS MUST BE WORN AT ALL TIMES in the CHEM*2700 laboratory. NO SHORTS. NO SANDALS
- For any problems associated with the lab please contact the coordinator: Dr. Reed, the coordinator office is located in the Science Complex room 3114. Email: rwreed@uoguelph.ca
- Students must attend and complete 60% of the laboratory work to receive a grade for the course.

4. LECTURES

Approximately two thirds of the lectures assigned to the course will be used to cover new material while the remaining lectures will be used to review concepts or topics that are causing difficulties and work on the problem assignments. The organic chemistry of CHEM*2700 builds on the concepts learned in CHEM*1040 and it is assumed that you are familiar with these topics. Since this material will be the starting point for the lectures and assignments, it is left to the student to review the notes from CHEM*1040 that they are no longer familiar with. Some of the terms you may wish to review.

- 1^0 (primary), 2^0 (secondary) and 3^0 (tertiary) when applied to hydrogen's, alcohols, halides and amines.
- the various functional groups with a basic understanding of nomenclature for each of these functional groups.
- general physical and chemical properties associated with each functional group.

5. GRADES

Note that you must obtain > 50% average on the Lecture portion of the course (Lecture Grade) and the Lab portion to get a passing Final Grade:

The course grade will be calculated as follows:
Mid-term June 25 (in class) = 30%, Final Exam 45%, Lab = 25%.
(if you cannot attend the mid-term, your final exam will be 75% of the course grade.)

Final Examination: <u>Thursday Aug 15, 2019 8:30am to 10:30am</u> bring coffee.

If your Lecture Grade is less than 50% your Final Grade will be 49% or 75% Lecture Grade + 25% Lab grade, whichever is lower.

6. COURSE OUTLINE AND READING ASSIGNMENTS

Below is a detailed outline of the course that emphasizes the mechanistic approach to be taken. The reading assignments in Solomons will provide a different and more detailed perspective of the course material. The lectures allocated for each topic are approximate.

1. Introduction (2 lectures)
Reading: Chapters 1-3. Problem Set #1.
Topics: - review of hybridization, bonds and geometries
- functional groups
- acidity and basicity, resonance and inductive effects

2. Stereochemistry (2 lectures)
Reading: Chapters 4 and 5. Problem Set #2.
Topics: - Conformation and conformational analysis, Newman projections
- Isomerism: constitutional isomers, geometric isomers (geometric Z, E , cis trans), Cahn-Ingold-Prelog sequence rules, Alkene stability
- Optical isomers: enantiomers, optical activity/rotation, Fisher projections, assigning R and S configurations, multiple chiral centers: diastereoisomers.

3. Nucleophilic Substitutions and Elimination Reactions (4 lectures)
Reading: Chapters 6 and 7. Problem Set #3 & #4.
Topics: - S_N1 and S_N2 reactions. Effect of the substrate structure, nucleophile, leaving group, mesylates/tosylates, solvent, stereochemistry, carbocations, reaction coordinates.
- E1 and E2 eliminations, dehydrohalogenation of alkyl halides, dehydration and Wagner-Meerwein rearrangements
- Substitution *vs.* elimination
- Alcohols: conversion to alky halides

4. Electrophilic Addition Reactions (5 lectures)
Reading: Chapter 8. Problem Set #5.
Topics: - alkene and alkyne additions (emphasis on alkenes)
- mechanism and stereochemistry of addition of H_2 cat., HX (Markovnikov's rule), H_2O/H^+, X_2, X_2/H_2O, $Hg(OAc)_2/NaBH_4$, $B_2H_6/H_2O/HO^-$. mCPBA, $CH_2I_2/Zn(Cu)$, OSO_4 and $KMnO_4$, $Pb(OAc)_4$ & $NaIO_4$, tautomerism
- alkynes: reactions of Na, H_2 cat., HX, H_2O/H^+, X_2,

5. Radical Reactions (2 lectures)
Reading: Chapter 10. Problem Set #6.
Topics: - Free radical halogenation of alkanes: mechanism and stereochemistry
- HBr/peroxide addition, polymerization
- Combustion, ozone depletion

6. Electrophilic Aromatic Substitution (3 lectures)
Reading: Chapter 15. Problem Set #6.
Topics: - mechanism of aromatic substitution reactions: halogenation, nitration, sulfonation, Friedel-Craft alkylation and acylation
- substituent effects: o, m, p directing
- H_2/ cat. with aromatics

7. Nucleophilic Addition Reactions (3 lectures)
Reading: Chapter 11 and Chapter 16. Problem Set #7.
Topics: - addition reactions of aldehydes and ketones: H_2O, ROH, RNH_2, HCN
- reduction of carbonyl group $NaBH_4$, $LiAlH_4$.
- addition of Grignard reagents
- oxidation of aldehydes and ketones: $Na_2Cr_2O_7/H_+$

8. Nucleophilic Acyl Substitution Reactions (3 lectures)
Reading: Chapter 17 Problem Set #8.
Topics: - reactions and mechanisms for interconversions of carboxylic acids, acid halides anhydrides, esters lactones and amides
- at least one method of preparation of each functional group (*e.g.* RMgX + CO_2)
- includes esterification, saponification, reduction of esters
- organolithium and Grignard reagents with esters
- polyamides and polyesters biological examples.

CHEM*2700: Learning Objectives (S'16)
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:
- To make the students knowledgeable about the fundamentals of Organic Chemistry.
- To understand the consequences (reactivity, properties) of the 3-dimensional structures of molecules.
- To be able to interpret patterns of reactivity on the basis of mechanistic reasoning.
- To be able to design syntheses of organic molecules of moderate complexity.
- To be able to create and maintain a lab note book.
- To apply time management and organizational skills to complete an experiment in a timely manner.
- To set up and follow reactions and carry out the experiment, work up and purification of the products in a safe, accurate and precise manner.

STATEMENTS

E-mail Communication

As per university regulations, all students are required to check their <uoguelph.ca> e-mail account regularly: e-mail is the official route of communication between the University and its students.

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.

When You Cannot Meet a Course Requirement

When you find yourself unable to meet an in-course requirement because of illness or compassionate reasons, please advise the course instructor 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, July 8**. 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 assistance, whether due to an identified, ongoing disability or a short-term disability should contact the Student Accessibility Services. website:
https://wellness.uoguelph.ca/accessibility/

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