UNIVERSITY of GUELPH

CHEM*2700 Organic Chemistry 1

Winter 2020

Section: 01

Department of Chemistry

Credit Weight: 0.50

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1. INSTRUCTOR

Dr. F.-I. Auzanneau
Rm. 126 MacN
Email: fauzanne@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**.

- **This course is available on Courselink, it will be used to post various pieces of information throughout the semester: problem sets, office hours… and to run the 6 Course quizzes.** Students are encouraged to access it regularly.

- I will be available for consultation and help in my office at any time when the door is open or by appointment.

- Regular office hours will also be held by the Instructor Assistant. Location and schedule for those will be posted on courselink

2. LECTURE LOCATION:

The lectures will be presented in ALEX 200, on:

Monday	11:30 - 12:20
Wednesday	11:30 - 12:20
Friday	11:30 - 12:20

Optional Weekly tutorial will be held on Wednesdays from 6-7pm, location TBD

3. TEXTBOOKS AND SUPPLEMENTARY MATERIAL

a) "Organic Chemistry," 12th 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 11th 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", 12th 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.
A link to WileyPlus with additional resources is imbedded in our courselink page.

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.

Combination packages are 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).

e) **Lecture notes and problem sets.** The lecture notes and problem sets will be sold in the Department the first week of classes. The lectures will be based directly on the lecture notes and it is strongly recommended that you read them prior to attending the lecture.

f) **Answers to the problem sets and midterm.** The answers will be available online through Courselink as we progress through the course.

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 "Blue lab Note book" and provide their own safety goggles (both of these may be purchased in the Department together with the lab manual). 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.
- For any problems associated with the lab please contact the coordinator: Rob Reed, the coordinator office is located in the Science Complex room 2517, Phone 53805. Email: rwreed@uoguelph.ca
- Students must 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 times for these review sessions will be

announced throughout the semester. 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° (primary), 2°(secondary) and 3°(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 group.
- general physical and chemical properties associated with each functional group.

5. MARK DISTRIBUTION

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

The Lecture grade will be calculated as follow:

Term Examination 1: 30%
Term Examination 2: 30%
Courselink Quizzes (6): 10%
Final Examination: 30%

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

- If your Lecture Grade is 50% or more your Final Grade will be calculated as follow:

Lecture grade: 75%
Lab work: 25%

Quizzes and Examination dates:

- **Quiz 1 (week 2)**: from Sunday January 12 (1 pm) to Wednesday January 15 (10 pm)
- **Quiz 2 (week 4)**: from Sunday January 26 (1 pm) to Wednesday January 29 (10 pm)
- **Term Examination 1 (week 5): Saturday, February 8, 10:00 – 11:30 am (MACN 105&113)**
- **Quiz 3 (week 6)**: from Sunday February 9 (1 pm) to Wednesday February 12 (10 pm)
- **Quiz 4 (week 8)**: from Sunday March 1 (1 pm) to Wednesday March 4 (10 pm)
- **Term Examination 2 (week 9): Saturday March 7, 10:00 – 11:30 am (MACN 105&113)**
- **Quiz 5 (week 10)**: from Sunday March 15 (1 pm) to Wednesday March 18 (10 pm)
- **Quiz 6 (week 12)**: from Sunday March 29 (1 pm) to Wednesday April 1 (10 pm)
- **Final Examination: Thursday April 9, 2020, 2:30-4:30 pm (TBD)**

ONE alternate midterm will be scheduled for those students who have justified reasons as to why they cannot attend the regularly scheduled midterms above. In order to be eligible to write the alternate examination, **students MUST declare and document their conflict NO LESS THAN 2 WEEKS prior the scheduled examination**. The alternate midterms will take place Friday February 7, 6:30-8:00 pm (MACN118) and Friday March 6, 6:30-8 pm (MACN118).

(a) Term Examination 1
Material included: **Introduction**
Stereochemistry
Nucleophilic Substitutions and Elimination Reactions

(b) Term Examination 2
Material included: **Electrophilic Addition Reactions**
Radical Reactions
Aromatic Compounds

(c) Final examination (during regular exam week)
Material included: Whole course with a slight emphasis on the last part of the course.

6. PRE-EXAM HELP SESSION

Pre-exam help sessions will be held right before the mid terms and exams:

- Friday February 7 (6:00 pm-9:00 pm, ALEX200),
- Friday March 6 (6:00 pm-9:00 pm, ALEX200),
- Wednesday April 8, 3-6pm* for the final examination (*if room is available).

7. 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. Problem assignments available in the lecture notes include questions from the text.

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

2. Stereochemistry (2 lectures)
Reading: Chapters 4 and 5
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, Fischer projections, assigning R and S configurations, multiple chiral centers: diastereoisomers.

3. Nucleophilic Substitutions and Elimination Reactions (4 lectures)
Reading: Chapters 6 and 7
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

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

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

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

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

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 (W'20)

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. These two courses 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.

8. CHEM*2700 LABORATORY SCHEDULE Winter 2020

WEEK	DATE	EXPERIMENT
1	JAN 6	NO LABS THIS WEEK
2	JAN 13	CHECK IN, SAFETY TRAINING Expt. 1 Thin Layer Chromatography
3	JAN 20	Expt. 2 Fractional Distillation and Gas Chromatography
4	JAN 27	Expt. 3 Molecular Modeling & Computational Chemistry **HAND IN YOUR LAB BOOK**
5	FEB 3	Expt. 4 Steam Distillation. Isolation of Eugenol
6	FEB 10	Expt. 5 Nucleophilic Substitution
XX	FEB 17	**Winter Break**
7	FEB 24	Expt. 6 Kinetics Study: Hydrolysis of *t*-Butyl Chloride. ***test Expt. #1-#5*** **HAND IN YOUR LAB BOOK**
8	MAR 2	Expt. 7 Electrophilic Addition :Bromination of Stilbene

9	MAR 9	Expt. 8 Electrophilic Aromatic Substitution: Friedel-Crafts Alkylation.
10	MAR 16	Expt. 9 Preparation of Triphenylmethanol
11	MAR 23	*Lab Clean & Check Out & Lab Final Test. Hand in Lab Books.*
12	MAR 30	*Check your Lab grade. You may look at your lab book. You may not keep it.*

LABORATORY GRADES

Laboratory Notebook	**10%**
Tests (Week 7 and Week 11)	**8%**
Prelab Assignments	**4%**
Reaction Risk Assessment	**3%**
	25%

Before you arrive at the laboratory:

1. Please read over the experiment. Read your textbook.
2. Prepare your lab book. (Purchase from the bookstore) Title, Date, Reference(s).
3. Complete the prelab assignment on the back of the reaction risk assessment form.
4. Read over the experiment again. Please attempt to grasp the overall chemical process and the sequence of steps involved in the laboratory exercise. Your Teaching Assistant will help you with the fiddley details.

In the Laboratory:

1. Make notes as you work. Use the left-hand pages for rough weights and measures, calculations, scribbles, etc.
2. Keep your work area clean and organized. Clean-up spills immediately.
3. Think ahead. Plan the next steps and equipment needed when you have an idle moment.
4. Clean as you go. Messy kitchens lead to food poisoning and rodent/insect problems. Messy chemists have accidents and sometimes kill people.

You must attend every lab:

In the event that you are too ill to attend your scheduled lab, please contact (e-mail) your T.A. before the start of your lab. Do not bother the over-worked folks in Health Services for a note.
Family emergencies and other serious events such as dangerous driving conditions due to winter storms are indeed valid reasons for missing a lab. Notify your T.A.
Make-up labs are not normally possible. We do not have the space or the available time.
You are still expected to master the subject material from each lab and you will be tested on it.

Please do not copy. Do your own work in your own words.
Please note: Plagiarism or Copying will be reported immediately to the Dean. Do not copy and paste from the web. Any use of websites such as coursehero and other such ***document stealing*** organizations will be dealt with harshly.

Please note: Due to high demand for this course students who receive a passing grade in the Laboratory portion of the course may never repeat the lab.

9. UNIVERSITY STATEMENTS

9.1 Email Communication

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

9.2 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 (or designated person, such as a teaching assistant) in writing, with your name, id#, and e-mail contact. The grounds for Academic Consideration are detailed in the Undergraduate and Graduate Calendars.

Undergraduate Calendar - Academic Consideration and Appeals
https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-ac.shtml

Graduate Calendar - Grounds for Academic Consideration
https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/index.shtml

Associate Diploma Calendar - Academic Consideration, Appeals and Petitions
https://www.uoguelph.ca/registrar/calendars/diploma/current/index.shtml

9.3 Drop Date

Students will have until the last day of classes to drop courses without academic penalty. The deadline to drop two-semester courses will be the last day of classes in the second semester. This applies to all students (undergraduate, graduate and diploma) except for Doctor of Veterinary Medicine and Associate Diploma in Veterinary Technology (conventional and alternative delivery) students. The regulations and procedures for course registration are available in their respective Academic Calendars.

Undergraduate Calendar - Dropping Courses
https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-drop.shtml

Graduate Calendar - Registration Changes
https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/genreg-reg-regchg.shtml

Associate Diploma Calendar - Dropping Courses
https://www.uoguelph.ca/registrar/calendars/diploma/current/c08/c08-drop.shtml

9.4. Copies of Out-of-class Assignments

Keep paper and/or other reliable back-up copies of all out-of-class assignments: you may be asked to resubmit work at any time.

9.5. Accessibility

The University promotes the full participation of students who experience disabilities in their academic programs. To that end, the provision of academic accommodation is a shared responsibility between the University and the student.

When accommodations are needed, the student is required to first register with Student Accessibility Services (SAS). Documentation to substantiate the existence of a disability is required; however, interim accommodations may be possible while that process is underway.

Accommodations are available for both permanent and temporary disabilities. It should be noted that common illnesses such as a cold or the flu do not constitute a disability.

Use of the SAS Exam Centre requires students to book their exams at least 7 days in advance and not later than the 40th Class Day.

For Guelph students, information can be found on the SAS website
https://www.uoguelph.ca/sas

For Ridgetown students, information can be found on the Ridgetown SAS website
https://www.ridgetownc.com/services/accessibilityservices.cfm

9.6. Academic Integrity

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 encourages academic integrity. 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.

Undergraduate Calendar - Academic Misconduct
https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-amisconduct.shtml

Graduate Calendar - Academic Misconduct
https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/index.shtml

9.7. Recording of Materials

Presentations that are made in relation to course work - including lectures - cannot be recorded or copied without the permission of the presenter, whether the instructor, a student, or guest lecturer. Material recorded with permission is restricted to use for that course unless further permission is granted.

9.8. Resources

The Academic Calendars are the source of information about the University of Guelph's procedures, policies, and regulations that apply to undergraduate, graduate, and diploma programs.

Academic Calendars
https://www.uoguelph.ca/academics/calendars