

# CHEM\*3750 ORGANIC CHEMISTRY II

Fall Semester 2015

## GENERAL INFORMATION AND COURSE OUTLINE

**Instructor:** A. Houmam, MacN123 X56429

**Office Hours:** Tuesday 1:30-3:00 pm and Wednesday. 2:00-3:30 pm.

### **Required Materials:**

- (a) Organic Chemistry II Class Notes, Problem sets and course announcements are available on the course website at:  
[http://www.chemistry.uoguelph.ca/educmat/chm375\\_houmam/](http://www.chemistry.uoguelph.ca/educmat/chm375_houmam/)  
**username:** chem375      **password:** chem375
- (b) Text Book:  
Organic Chemistry (10<sup>th</sup> or 11<sup>th</sup> Edition). T.W. Graham Solomons Graham Solomons and Craig Fryhle (henceforth shortened **SF**) or Graham Solomons, Craig Fryhle and Scott Snyder (henceforth shortened **SFS**)
- (c) Laboratory Manual:  
CHEM\*375 Organic Chemistry II Laboratory Manual  
(lab manual are purchased from the Chemistry Department in SSC 2101 Thursday, Sept. 10, to Wednesday, Sept. 16, from 9:30 AM – 3:30 PM).
- (d) A molecular model set is often useful in “seeing” organic chemistry principles. The Bookstore sells one or maybe two types.

**Method of Presentation** There are three class meetings each week (Monday, Wednesday and Friday at 12:30 to 1:20 pm). We will cover the lecture material following the lecture notes and the sections indicated in **SF** and **SFS**. We will dedicate some of these slots for tutorial as we progress in the semester.

Tutorial time will be used to:

- a) discussion of how to write or understand mechanisms
- b) developing expertise and solving problems related to synthetic chemistry
- c) discussion of (assigned) problems

The option is available to dedicate some tutorial time to new lecture material, depending on the pace of the throughout the term.

In CHEM\*375 we continue the organic chemistry education from CHEM\*104 and CHEM\*270. A knowledge of the reactions, mechanisms, terminology and concepts covered in those courses will be assumed and may be required as part of a satisfactory answer to

examination questions. You should look over past course material and review any reactions as necessary as soon as possible.

**Laboratory** The CHEM\*375 laboratory consists of one three-hour period per week. There are presently 7 laboratory sections. You will be checked in and briefed on the operation of the laboratory during your first scheduled laboratory period. You will also do your first experiment at that time.

**Problem Assignments:** Several problem assignments (ca. 8-10) will be available online during the term. They will consist of problems from **SF** or **SFS** and some generated by your instructor. We should have the opportunity to discuss some of them in the tutorial period, particularly upon your request. Problems from a problem set may be submitted for grading in which case that grade will contribute to your final mark. In these instances, a due date and time will be set (i.e., the beginning of a class) for submission of your solutions. In such a case the final will count for less than 40% of your grade.

**Course Grade** The final grade will be calculated as follows (assuming no problem is assigned for grading):

Item	Value	Comments
Mid-term examination	30%	TBA (covers Chapters 1 and 2)
Final examination	40%	Cumulative; During exam period
Laboratory	30%	Lab grade details and breakdown in the lab.

**Laboratory Evaluation** (See details in your lab Manual)

Notebooks	15%	(Late = 25% per day)
Prelab Quizzes / Reaction Risk	5%	
Sample Submission	2%	
Lab Tests (3 + 5)	8%	

**YOU WILL NOT PASS THE COURSE UNLESS YOU HAVE RECEIVED A PASSING GRADE ON AT LEAST ONE OF: THE MID-TERM EXAM; OR THE FINAL EXAM.**

**ONLY VALID EXCUSES ON MEDICAL OR COMPASSIONATE GROUNDS WILL PREVENT A GRADE OF ZERO FOR ANY MISSED LAB, ASSIGNMENT OR EXAMINATION (SEE CALENDAR SECT. VIII). STUDENTS MAY BE ASKED TO PROVIDE CERTIFICATION OF ILLNESS. CPES POLICY PREVENTS CHANGES TO THE GRADING SCHEME FOR INDIVIDUAL STUDENTS, EXCEPT IN CASE OF ILLNESS. MIDTERM PAPERS MAY BE RETURNED TO THE INSTRUCTOR FOR CORRECTION OF GRADING ERRORS, ONLY WITHIN ONE WEEK OF THE RETURN OF THE GRADED PAPERS. NO ADDITIONS MUST BE MADE AFTER RETURN OF THE PAPER. THE INSTRUCTOR MAY REFUSE TO REGRADE A PAPER, AT HIS DISCRETION. THE USE OF STORED PROGRAMS OR STORED ALPHANUMERIC INFORMATION ON CALCULATORS, DURING EXAMINATIONS OR TESTS, IS NOT ALLOWED.**

## Course Outline

### **1 - INTRODUCTION TO ORGANIC SPECTROSCOPY**

1.  $^1\text{H}$  NMR Spectroscopy
2.  $^{13}\text{C}$  NMR Spectroscopy
3. Infrared (IR) Spectroscopy
4. Other Spectroscopic Methods

### **2 - ALDEHYDES AND KETONES**

1. Synthetic Routes to Aldehydes and Ketones
2. Acidity and Enolization of Aldehydes and Ketones
3. Halogenation of Ketones and Aldehydes - haloform reaction
4. Alkylation Reactions and Enamines
5. The Aldol Condensation
6. Other Related Condensation Reactions - Claisen, Dieckmann, Reformatsky condensations
7. Synthetic Applications of Condensation Reactions - acetoacetate synthesis - malonate synthesis - Robinson annelation
8. The Wittig Olefination of Aldehydes and Ketones
9. Reductive Conversion of  $\text{C}=\text{O}$  to  $\text{CH}_2$

### **3 - CONJUGATION**

1. Terminology and Nomenclature
2. Allyl
3. Conjugated Dienes
4. The Diels Alder Reaction
5. Molecular Orbital Description Of Conjugation

### **4 - BENZENE: AROMATICITY, CONJUGATION AND ASSOCIATED REACTIVITY**

1. Aromaticity  $-(4n + 2)$  rule, resonance energy
2. NMR Spectra of Benzene Derivatives
3. Side Chain Chemistry of Benzene Derivatives -radical bromination
4. Birch Reduction (The destruction of aromaticity)

### **5 - REACTIVITY OF SOME SUBSTITUTED AROMATIC COMPOUNDS**

1. Aromatic Amines
2. Diazonium Salts - Sandmeyer reaction
3. CHEM270 and aromatic synthetic strategies.
4. Aryl Halides - nucleophilic aromatic substitution - benzyne
5. Phenols and Phenyl Ethers

### **6 - SYNTHESIS**

As part of lecture or tutorial sessions, some synthetic strategies will be presented that comprise an effort to tie together the various chapters of this course and of CHEM375.

**Chem\*3750 Lab Schedule FALL 2015.**

WEEK	DATE	EXPERIMENT WEEK
	WEEK OF:	
0	Sept 10	Classes start. No Labs.
1	Sept 14	<i>No labs this week. Drop/add period.</i>
2	Sept 21	CHECK IN/Safety Talk/Equipment review. Safety Exercise. Expt. 1 Benzoin Preparation (Start).
3	Sept 28	Finish Experiment #1. Expt. 2 Benzil Preparation (Oxidation of Benzoin)
4	Oct 5	Expt. 3 Preparation of Tetraphenylcyclopentadieneone. <b>Lab book grading #1.</b>
5	Oct 12	No Labs This Week
6	Oct 19	<b>Test Experiments #1-#3.</b> Expt. 4. Molecular Modeling: Gaussview program. Calculation of Keto/enol tautomers of Acetylacetone. <b>Computer Lab in SC 1303 3:30-4:30pm / 7:00-8:30pm</b>
7	Oct 26	Expt. 5 Preparation of Dimedone. (Start) <b>Lab book grading #2.</b>
8	Nov 2	Expt. 5 Preparation of Dimedone. (Finish) Expt. 6 Preparation of Dibenzalacetone.
9	Nov 9	Expt. 7 Wittig.
10	Nov 16	Expt. 8 Diels-Alder: Benzyne.
11	Nov 23	Locker Check Out & Lab Final Test (all experiments). <b>Hand in Lab Books.</b>
12	Nov 30	Last week of lectures. Check your lab grades.

## Reference Books on Reserve

### Lecture Material

- Organic Chemistry (9<sup>th</sup> and 10<sup>th</sup> ed.). T.W. Graham Solomons Graham Solomons and Craig Fryhle.
- Organic Chemistry, 6<sup>th</sup>, 7<sup>th</sup> and 8<sup>th</sup> ed. T.W.G. Solomons QD253.S65 1996 (or QD 251.2.S66) (2 copies) - written for students - good color in diagrams.
- Organic Chemistry (8<sup>th</sup> ed.). L. G. Wade (QD251.3 .W33 2013) – 2<sup>nd</sup>, 4<sup>th</sup>, 5<sup>th</sup> and 7<sup>th</sup> ed. Also available.
- Organic Chemistry (4<sup>th</sup> ed.) F. A. Carey (QD251.2 .C364 2000)
- Organic Chemistry, 2<sup>nd</sup> ed. K.P.C. Vollhardt QD251.2.V65 1987 -good text.
- Introduction to Organic Chemistry, 4<sup>th</sup> ed. A. Streitwieser, C.H. Heathcock, C.H., E.M. Kosower QD251.2.S76 1992 - good text - slightly higher level
- Principles of Organic Synthesis R. O. C. Norman QD262 N6. - good reference for undergraduate organic principles and synthesis
- Organic Chemistry, 6<sup>th</sup> ed. Morrison and Boyd QD251.2.M67 1992
- Organic Chemistry, 6<sup>th</sup> ed. Fessenden and Fessenden QD251.2.F49 1998
- Organic Chemistry, 6<sup>th</sup> ed. J.M. Hornback QD253.H66 1998

### Lab Material

- Experimental Organic Chemistry L.M. Harwood & C.J. Moody QD261.H265 1989.
- Microscale Organic Laboratory 3<sup>rd</sup> ed. D.W. Mayo, R.M. Pike, P.K. Trumper QD261.M38 1994.
- Operational Organic Chemistry, A Laboratory Course J.W. Lehman QD261.L39.
- Introduction to Organic Laboratory Techniques, A Contemporary Approach D.L. Pavia, G.M. Lampman, G.S. Kriz, R.G. Engel QD261.P38 1988