



## DEPARTMENT OF SCIENCE

### FALL 2015 COURSE OUTLINE

### CH2630 A2, Organic Chemistry II

**INSTRUCTOR:** Dr. John P. Sloan      **PHONE:** 780-539-2004  
**OFFICE:** Office # J207      **E-MAIL:** jsloan@gprc.ab.ca

**OFFICE HOURS:** Tues 10:00 – 11:00; Thurs 10:00 – 11:00 & 13:30 – 15:30; Fri 9:30 – 11:20

**DELIVERY MODE(S):** Organic Chemistry II, consists of CH2630 A2, S1 & L1 and is delivered in Lecture, Tutorial and Laboratory Components.

**PREREQUISITE(S)/COREQUISITE:** CH1610 or CH2610

#### REQUIRED TEXT/RESOURCE MATERIALS:

1. Solomons, T.W.G., C.B. Fryhle, S.A. Snyder, *Organic Chemistry*, 11th Edition, Wiley, 2014, including access to the WileyPlus web site at:  
<https://edugen.wiley.com/edugen/secure/index.uni>.
1. A Three Ring Binder to Hold: Sloan, J.P., *Organic Chemistry Experiments, Chemistry 2610/2630*, Grande Prairie Regional College, 2015/2016.
2. Molecular Models are highly recommended, namely: Molecular Model Set for Organic Chemistry, Prentice Hall.
3. The Study Guide and Solutions Manual (978-1-118-14790-0) is an optional item; namely:
  - 3.1 Antila, J., Johnson, R., Fryhle, C., Solomons, T.W.G., and S. A. Snyder, *Study Guide and Solutions Manual to Organic Chemistry*, 11th Edition, 2014;

**Note:** The required Solomons et al Organic Chemistry textbook, safety glasses, and lab coats are available at the College Bookstore. *Organic Chemistry Experiments*, by J.P. Sloan, will be given as hand-outs in advance of each lab period. These are to be inserted in a three ring binder.

**CALENDAR DESCRIPTION:** CH 2630 3(3-1-3)UT 105 Hours Organic Chemistry II

Continuation of the study of structural and chemical properties of the basic functional groups of organic compounds including aromatic compounds, aldehydes, ketones, carboxylic acids and their derivatives and amines. Illustration of these functional groups in natural products such as carbohydrates, amino acids and proteins, nucleic acids and lipids and discussion of the application of spectroscopic methods for structure determination in simple organic molecules.

Prerequisites: CH1610 or CH 2610

Notes: Credit will be granted for only one of CH1630 or CH2630.

Engineering students who take this course will receive 4.5 credits of transfer to University of Alberta.

Transfer to: University of Alberta; University of Calgary; University of Lethbridge; Athabasca University \*; Augustana Faculty, University of Alberta; Concordia University College; Canadian University College; Grant MacEwan University; King's University College

\* An asterisk (\*) beside any transfer institution indicates important transfer information. Consult the Alberta Transfer Guide.

CREDIT/CONTACT HOURS: CH 2630 3(3-1-3)UT 105 Hours Organic Chemistry II

**TRANSFERABILITY: ALBERTA TRANSFER CREDIT**

(Ref: Alberta Council of Admissions and Transfers, updated August 18, 2015)

GPRC:	CH 2610 (3)	CH 2630 (3)
U of Alberta:	CHEM 261 (3) or AUCHE 250 (3)	CHEM 263 (3) or AUCHE 252 (3)
U of Calgary:	CHEM 351 (3)	CHEM 353 (3)
U of Lethbridge:	CHEM 2500 (3)	CHEM 2600 (3)
Grant MacEwan U:	CHEM 261 (3)	CHEM 263 (3)
Athabasca U:	CHEM 350 (3)	CHEM 360 (3)
Canadian UC:	CHEM 241 (3)	CHEM 242 (3)
Concordia UC:	CHEM 261 (3)	CHEM 263 (3)
King's UC:	CHEM 3xx (3)	CHEM 351 (3)

\*\* Grade of D or D+ may not be acceptable for transfer to other post-secondary institutions.

Students are cautioned that it is their responsibility to contact the receiving institutions to ensure transferability

## LEARNING OUTCOMES:

The Learning Outcomes of Organic Chemistry II is for students to be aware of their ability to apply their understanding of the theory of Organic Chemistry as presented in the course and as outlined in the Calendar Description and in this course outline. The Learning Outcomes includes the students being able to apply their understanding of Organic Chemistry to related issues and problems in addition to the specific issues and problems directly addressed throughout the course.

## COURSE OBJECTIVES:

The Course Objectives of Organic Chemistry II is for students to become proficient in their understanding of the theory of Organic Chemistry as outlined in the Calendar Description and in this Course Outline.

## EVALUATIONS:

Examination Schedule and Composition of the Final Grade:

1.	Midterm Exam # 1, Friday October 9 -----	15%
2.	Midterm Exam # 2, Friday November 13 -----	20%
2.	Final Exam to be scheduled between December 10 – 19 -----	35%
3.	Laboratory -----	20%
4.	Tutorial Grading Component -----	<u>10%</u>
		100%

Notes:

1. The Mid-Term Exams will be of 1.5 hours duration and the Final Exam will be of 3 hours duration.
2. Between 5 and 15% of exam content will be taken from a combination of weekly assignments, and questions in the organic chemistry textbook by Solomons, Fryhle and Snyder.
3. A pass grade is essential for the Laboratory Component: The minimum Lab Pass Mark is 60%.
4. The Tutorial Grading Component will contribute to 10% of the final grade and will consist of nine assignments with ten questions per assignment.
5. Assistance with assignments will be given upon request.

## GRADING CRITERIA:

The Grades are based on the alpha grading system. The Registrar's Office will convert alpha grades to four-point equivalence for the calculation of grade point averages. Alpha grades, 4-point equivalence, and grade descriptors are as follows:

Alpha Grade	4-Point Equivalence	Percentage Guidelines	Descriptor
A <sup>+</sup>	4.0	90 – 100	Excellent
A	4.0	85 – 90	
A-	3.7	80 – 84	Very Good First Class Standing
B+	3.3	77 – 79	
B	3.0	73 – 76	Good
B-	2.7	70 – 72	
C+	2.3	67 – 69	Satisfactory
C	2.0	63 – 66	
C-	1.7	60 – 62	
D+	1.3	55 – 59	Poor*
D	1.0	50 – 54	Minimal Pass*
F	0.0	0 – 49	Failure
WF	0.0	0	Fail, withdraw after the deadline

## STUDENT RESPONSIBILITIES:

Students are responsible for regular attendance in Lecture, Laboratory, and Tutorial Components of the Organic Chemistry II course. They are also responsible for submission of assignments and laboratory reports according to the course policy; and for attending the exams according to the Exam Schedule. In addition, refer to the College Policy on Student Rights and Responsibilities at: [www.gprc.ab.ca/d/STUDENTRIGHTSRESPONSIBILITIES](http://www.gprc.ab.ca/d/STUDENTRIGHTSRESPONSIBILITIES).

## STATEMENT ON PLAGIARISM AND CHEATING:

Refer to the College Student Misconduct: Academic and Non-Academic Policy at [www.gprc.ab.ca/d/STUDENTMISCONDUCT](http://www.gprc.ab.ca/d/STUDENTMISCONDUCT).

\*\*Note: all Academic and Administrative policies are available at [www.ab.ca/about/administration/policies/](http://www.ab.ca/about/administration/policies/).

## **COURSE SCHEDULE/TENTATIVE TIMELINE:**

The Course Schedule consists of Lecture, Laboratory and Tutorial Components. A brief description of these components and the course schedule is as follows:

### Lecture Component:

Continuation of the study of the fundamental principles of the chemistry of carbon compounds as commenced in Chemistry 2610. The study is based on a reaction mechanism approach to the functional group chemistry of arenes, aldehydes, ketones, carboxylic acids, esters, amides, amino acids and carbohydrates. Topics include: structure and bonding; physical properties; acidity and basicity; conformations of molecules; stereochemistry; addition, elimination and substitution reactions; structure-reactivity relationships; aromaticity and aromatic substitution; and spectroscopic methods for structure determination.

A representative selection of molecules found in agricultural, biological, environmental, industrial, medical, and pharmaceutical applications of organic chemistry will be discussed, e.g., molecules found in agrochemicals, fibres, food additives, perfumes, polymers, and prescription drugs.

### Laboratory Component:

Techniques in organic chemistry; preparation of some organic compounds, and; methods of qualitative organic analysis.

### Tutorial Component:

Problem solving and discussion sessions with weekly problem sets. Regular assignments will be given and marked. There will be nine assignments with each assignment consisting of ten questions.

### **COURSE SCHEDULE:** The Course Schedule is:

1. Lectures: Days, Time and Place: CH2630 A2 T,R 8:30 - 9:50 in J204
2. Laboratory Component: Day, Time and Place: CH2630 L1 M 14:30 - 17:20 in J116
3. Tutorial Component: Day, Time and Place: CH2630 S1 F 11:30 - 12:20 in J204
4. Office Hours: Individual and group assistance will normally be available in office J207 during regular college business hours outside of formal class lecture, laboratory and tutorial hours.

## TENTATIVE TIMELINE:

The Tentative Timetable for CH 2630 A2, Organic Chemistry II, is as follows:

### CH2630 A2, Organic Chemistry II:

#### Schedule for Reading, Studying and Practice Problems

References are to:

T.W.G. Solomons, C.B. Fryhle and S.A. Snyder, Organic Chemistry, 11th Edition, Wiley, 2014.

#### FALL SEMESTER

Weeks of Sept 2 & 7 & 14: Spectroscopic Methods of Structure Determination.

Nuclear Magnetic Resonance (NMR) and Mass Spectroscopy (MS):  
Tools for Structure Determination. Read and Study Chapter 9.

Problems/Page #'s:	In-Chapter	9.1 to 9.21
444	End of Chapter	9.23 to 9.46
455	Challenge Problems	9.47 to 9.52
456	Learning Group Problems	1 to 2

Concept Map's:	455	$^1\text{H}$ NMR Spectroscopy.
	456	$^{13}\text{C}$ NMR Spectroscopy.
	456	$^{13}\text{C}$ NMR and $^1\text{H}$ NMR Chemical Shift Ranges

Week of Sept 21: Aromatic Compounds. Read and Study Chapter 14.

Problems/Page #'s:	In-Chapter	14.1 to 14.15
665	End of Chapter	14.16 to 14.39
666	Challenge Problems	14.40 to 14.44
666	Learning Group Problems	1 to 5

Concept Map: Aromatic Compounds.

Weeks of Sept 28 & Oct 5: Reactions of Aromatic Compounds.

Read and Study Chapter 15.

Problems/Page #	In-Chapter	15.1 to 15.21
713	End of Chapter	15.22 to 15.51
716	Challenge Problems	15.52 to 15.55
717	Learning Group Problems	1 to 3

Concept Map's:

718	Summary of Mechanisms -Electrophilic Aromatic Substitution.
719	Some Synthetic Connections of Benzene and Aryl Derivatives.

Week of Oct 12: Aldehydes and Ketones: Nucleophilic Addition to the Carbonyl Carbon.  
Read and Study Chapter 16.

Problems/page #'s:	In-Chapter	16.1 to 16.21
759	End of Chapter	16.22 to 16.52
773	Challenge Problems	16.53 to 16.54
774	Learning Group Problems	a to f.

Summary of Aldehyde and Ketone Addition Reactions: p 756, Section 16.15.

Summary of Mechanisms:

767	Acetals, Imines, and Enamines: Common Mechanistic Themes in Their Acid-catalyzed Formation from Aldehydes and Ketones.
768-769	Nucleophilic Addition to Aldehydes and Ketones Under Basic Conditions.
770	Some Synthetic Connections of Aldehydes, Ketones, and Other Functional Groups.

Week of Oct 19 & 26: Carboxylic Acids and Their Derivatives:  
Nucleophilic Addition-Elimination at the Acyl Carbon

Read and Study Chapter 17.

Problems/page #'s:	In-Chapter	17.1 to 17.17
813	End of Chapter	17.18 to 17.48
819	Challenge Problems	17.49 to 17.54
820	Learning Group Problems	1 to 4

Summary of Reactions of Carboxylic Acids and Their Derivatives, Page 809, Section 17.13.

Week of Nov 2: Reactions at the  $\alpha$ -Carbon of Carbonyl Compounds: Enols and Enolates.  
Read and Study Chapter 18.

Problems/page #'s:	In-Chapter	18.1 to 18.14
850	End of Chapter	18.15 to 18.34
854	Challenge Problem	18.35
855	Learning Group Problems	1 to 2

Summary of Reactions of Enolate Chemistry, Page 847, Section 18.10.

857 Summary of Mechanisms: Enolates:  $\alpha$ -Substitution.

Condensation and Conjugate Addition Reactions of Carbonyl Compounds:  
More Chemistry of Enolates.  
Read and Study Chapter 19.

Problems/page #'s:	In-Chapter	19.1 to 19.22
887	End of Chapter	19.23 to 19.57

894 Challenge Problem 19.58 to 19.60  
894 Learning Group Problems 1 to 2

884 Summary of Important Reactions, Page 884, Section 19.9.  
896 Synthetic Connections: Some Synthetic Connections Involving Enolates.  
895 857 Summary of Mechanisms: Enolate Reactions with Carbonyl Electrophiles.

Week of Nov 9: Amines. Read and Study Chapter 20.

Problems/Page #'s: In-Chapter 20.1 to 20.18  
936 End of Chapter 20.19 to 20.49  
941 Challenge Problems 20.50 to 20.54  
942 Learning Group Problems 1 to 2

932 Summary of Preparation and Reactions of Amines, Page 932, Section 20.13

Week of Nov 16: Phenols and Aryl Halides: Nucleophilic Aromatic Substitution.  
Read and Study Chapter 21.

Read Special Topics G between page 978 and 979, Pages G-1 to G-16.  
Carbon-Carbon Bond-Forming and Other Reactions of Transition Metal  
Organometallic Compounds.

Problems/Page #'s: In-Chapter 21.1 to 21.12  
970 End of Chapter 21.13 to 21.33  
973 Challenge Problems 21.34 to 21.43  
975 Learning Group Problems 1 to 2

978 Some Synthetic Connections of Phenols and Related Aromatic Compounds.

Week of Nov 23: Carbohydrates and Lipids (Optional). Read Chapters 22 & 23.

Problems/Page #'s: In-Chapter 22 22.1 to 22.19  
1021 End of Chapter 22.20 to 21.42  
1024 Challenge Problems 22.43 to 22.45  
1025 Learning Group Problems 1 to 2

1026 Summary and Review Tools: A Summary of Reactions Involving Monosaccharide's.

Problem/Page #'s: In-Chapter 23 23.1 to 23.11  
1055 End of Chapter 23.12 to 23.23  
1058 Challenge Problems 22.24 to 22.25  
1058 Learning Group Problems 1 to 4

Week of Nov 30: Amino Acids and Proteins & Nucleic Acids and Protein Synthesis (Optional)

Read Chapters 24 & 25: Amino Acids and Proteins & Nucleic Acids and Protein Synthesis

Chapter 24

Problems/Page #'s:	In-Chapter	24.1 to 24.16
1103	End of Chapter	24.17 to 24.23
1104	Challenge Problem	24.24
1104	Learning Group Problems	1 to 2

Chapter 25

Problems/Page #'s:	In-Chapter	25.1 to 25.11
1137	End of Chapter	25.12 to 25.16
1139	Learning Group Problem	

Week of Dec 7: Review.