

SCIENCE DEPARTMENT
COURSE OUTLINE – Fall 2024

CH2630 (A2): Organic Chemistry II – 3 (3-1-3) 105 Hours for 15 Weeks

Northwestern Polytechnic acknowledges that our campuses are located on Treaty 8 territory, the ancestral and present-day home to many diverse First Nations, Metis, and Inuit people. We are grateful to work, live and learn on the traditional territory of Duncan's First Nation, Horse Lake First Nation and Sturgeon Lake Cree Nation, who are the original caretakers of this land.

We acknowledge the history of this land and we are thankful for the opportunity to walk together in friendship, where we will encourage and promote positive change for present and future generations

INSTRUCTOR: Dr. John Purdie Sloan **PHONE:** 780-539-2004; iPh780-876-1363
OFFICE: Office # J207 **E-MAIL:** jsloan@nwpolytech.ab.ca
OFFICE HOURS: Mondays & Wednesdays 10:00–14:00, and other arranged times.

CALENDAR DESCRIPTION:

2024 Fall Semester
CH2630/Lecture/A2 - Organic Chemistry II | Credits 3.00

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.

PREREQUISITE(S)/COREQUISITE: CH1610 or CH 2610

REQUIRED TEXT/RESOURCE MATERIALS: Not, “Required”, just, “RECOMMENDED”.

Recommended Resource Materials and Texts include:

1. John Purdie Sloan: CH2630 A2 F24 Class Notes.
2. Class References: U-Tube Video Topics: Organic Chemistry Theory & Laboratory Experiments.
3. On-Line Resource Material accessible through Search of Organic Chemistry, Topic-by-Topic. Class members are encouraged to access and share good On-Line Resource Sites.

4. Organic Chemistry Textbooks and Supplementary Resource Material are Expensive. Several Organic Textbooks address similar theory with emphasis on Reaction Mechanism within Functional Groups while covering the main Families of Organic Compounds.

Reference to the Solomons et al Textbook and Study Guide are:

5. Solomons, T.W.G., C.B. Fryhle, S.A. Snyder, *Organic Chemistry*, 12th Edition, Wiley, 2016, including access to the WileyPlus web site at:
<https://edugen.wiley.com/edugen/secure/index.uni> ISBN: 978-1-118-87576-6

Note: The 11th Edition is acceptable; namely:

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> ISBN: 978-1-118-13357-6

6. Organic Chemistry, 12e Study Guide / Student Solutions Manual (12th Edition);
Craig B. Fryhle, Scott A. Snyder, Robert G. Johnson, Jon Antilla, Paperback, 744 Pages.
Published 2016, ISBN: 978-1-119-07732-9

Note: The 11th Edition Solutions Guide to the 11th Edition Textbook is:

Study Guide and Solutions Manual, 11th Edition, authored by Jon Antilla, University of South Florida, Robert Johnson, Xavier University, Craig Fryhle, Graham Solomons, and Scott Snyder. ISBN: 978-1-118-14790-0 is an Optional Item.

7. A Three Ring Binder to Hold: Sloan, J.P., *Organic Chemistry Experiments, Chemistry 2610/2630*, Grande Prairie Regional College, 2024/2025.

8. Molecular Models are highly recommended, namely:
 - Molecular Model Set for Organic Chemistry, Prentice Hall.

Note: Safety glasses, and lab coats are available at the College Bookstore. *Organic Chemistry Experiments*, by John Purdie Sloan, will be given as handouts in advance of each lab period. These are to be inserted in a three-ring binder.

DELIVERY MODE(S):

Organic Chemistry II consists of CH2630 A2, S1 & L1 and is delivered in Lecture, Tutorial and Laboratory Components.

LEARNING OUTCOMES:

The Learning Outcomes of CH2630, Organic Chemistry II, are that Students gain an understanding of:

- H¹ and C¹³ NMR Spectroscopy, FTIR Spectroscopy and Mass Spectroscopy.
- Aromaticity and Aromatic Compounds.
- Electrophilic and Nucleophilic Aromatic Substitution Reactions and the effect of Electron-Withdrawing and Electron-Donating Groups on the Aromatic Ring.

- Carbanion-Enolate Anion Chemistry in Synthesis and Reactions of Acetoacetic Ester and Diethyl Malonate.
- Synthesis and Reactions of Aldehydes, Ketones, Carboxylic Acids, Derivatives of Carboxylic Acids (Acid Halides, Acid Anhydrides, Esters, Amides and Carboxylate Salts), Phenols and Amines.
- Carbohydrates, Lipids, Amino Acids and Proteins.
- A representative selection of molecules found in agricultural, biological, environmental, industrial, medical, and pharmaceutical applications of organic chemistry, e.g., molecules found in agrochemicals, fibres, food additives, perfumes, polymers, and prescription drugs.

Upon Successful completion of CH2630, Organic Chemistry II, students will have a working knowledge of Organic Chemistry.

TRANSFERABILITY:

Please consult the Alberta Transfer Guide for more information. You may check to ensure the transferability of this course at the Alberta Transfer Guide main page <http://www.transferalberta.ca>.

** 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

EVALUATIONS:

Examination Schedule and Composition of the Final Grade:

1.	Midterm Exam # 1, Friday October 18 -----	20%
2.	Midterm Exam # 2, Friday November 22 -----	20%
2.	Final Exam to be scheduled between December 12 – 19 -----	30%
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 is 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.
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 is available upon request.

GRADING CRITERIA:

Alpha Grade	4-point Equivalent	Percentage Guidelines	Alpha Grade	4-point Equivalent	Percentage Guidelines
A+	4.0	95-100	C+	2.3	67-69
A	4.0	85-94	C	2.0	63-66
A-	3.7	80-84	C-	1.7	60-62
B+	3.3	77-79	D+	1.3	55-59
B	3.0	73-76	D	1.0	50-54
B-	2.7	70-72	F	0.0	00-49

Please note that:

- Most universities will not accept your course for transfer credit **IF** your grade is **less than C-**.

COURSE SCHEDULE/TENTATIVE TIMELINE:

The Course Schedule is:

1. Lectures: Days, Time and Place: CH2630 A2 M, W 8:30 – 9:50 in J203
2. Laboratory Component: Day, Time and Place: CH2630 L1 T 14:30 - 17:20 in J119
3. Tutorial Component: Day, Time and Place CH2630 S1 Fri 11:30 - 12:20 in J203
4. Office Hours: Individual and group assistance will normally be available during regular college business hours outside of formal class lecture, laboratory and tutorial hours.

The Course Schedule consists of Lecture, Laboratory and Tutorial Components. A brief description of these components 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 including H^1 and C^{13} NMR (Nuclear Magnetic Resonance) and IR Infrared Spectroscopy.

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.

Tentative Timetable:

The Tentative Timetable follows the Statement on Academic Misconduct.

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.

STATEMENT ON ACADEMIC MISCONDUCT:

Academic Misconduct will not be tolerated. For a more precise definition of academic misconduct and its consequences, refer to the Student Rights and Responsibilities policy available at <https://www.nwpolytech.ca/about/administration/policies/index.html>.

**Note: all Academic and Administrative policies are available on the same page.

Schedule for Reading, Studying and Practice Problems, On-Line Resource References and 12th Edition of T.W.G. Solomons, C.B. Fryhle & S.A. Snyder, Organic Chemistry.

Ref: T.W.G. Solomons, C.B. Fryhle and S.A. Snyder, Organic Chemistry, **12th Edition, Wiley, 2016.**

FALL SEMESTER

Weeks of September 3, 9 & 16: Spectroscopic Methods of Structure Determination.
Nuclear Magnetic Resonance (NMR) and Mass Spectroscopy (MS):
Tools for Structure Determination. Read and Study Chapter 9, pages 391 – 447.

Problems/Page #'s:	In-Chapter	9.1 to 9.19	
	437	End of Chapter	9.20 to 9.43
	446	Challenge Problems	9.44 to 9.49
	446	Learning Group Problems	1 to 2

Concept Map's:	447	¹ H NMR Spectroscopy.
	446	¹³ C NMR Spectroscopy.
	456	¹³ C NMR and ¹ H NMR Chemical Shift Ranges

Week of Sept 23: Aromatic Compounds. Read and Study Chapter 14, pages 617 – 659.

Problems/Page #'s:	In-Chapter	14.1 to 14.15	
	651	End of Chapter	14.16 to 14.38
	657	Challenge Problems	14.39 to 14.43
	658	Learning Group Problems	1 to 5

Concept Map:	659	Aromatic Compounds.
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Weeks of Sept 30 & Oct 9: Reactions of Aromatic Compounds.
Read and Study Chapter 15, pages 660 – 710.

Problems/Page #	In-Chapter	15.1 to 15.19	
	700	End of Chapter	15.20 to 15.56
	706	Challenge Problems	15.57 to 15.66
	707	Learning Group Problems	1 to 3

Concept Map's:		
	709	Summary of Mechanisms -Electrophilic Aromatic Substitution.
	710	Some Synthetic Connections of Benzene and Aryl Derivatives.

Week of October 14: Thanksgiving, October 9. No Classes.

Week of Oct 14 & 21: Aldehydes and Ketones: Nucleophilic Addition to the Carbonyl Carbon. Read and Study Chapter 16, pages 711 – 760.

Problems/page #'s:	In-Chapter	16.1 to 16.21	
	749	End of Chapter	16.22 to 16.55
	755	Challenge Problems	16.56 to 16.57

756 Learning Group Problems a to f.

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

Summary of Mechanisms:

- 757 Acetals, Imines, and Enamines: Common Mechanistic Themes in Their Acid-catalyzed Formation from Aldehydes and Ketones.
758-759 Nucleophilic Addition to Aldehydes and Ketones Under Basic Conditions.
760 Some Synthetic Connections of Aldehydes, Ketones, and Other Functional Groups.

Week of Oct 28 & Nov 4: Carboxylic Acids and Their Derivatives:

3Nucleophilic Addition-Elimination at the Acyl Carbon.

Read and Study Chapter 17, pages 761 – 810.

Problems/page #'s: In-Chapter 17.1 to 17.16
802 End of Chapter 17.17 to 17.49
809 Challenge Problems 17.50 to 17.55
810 Learning Group Problems 1 to 4

Summary of Reactions of Carboxylic Acids and Their Derivatives, Page 798, Section 17.12.

Week of Nov 11: No Classes: November 14, Remembrance Day & November 12-17, Fall Break.

Week of Nov 18: Reactions at the α -Carbon of Carbonyl Compounds: Enols and Enolates.
Read and Study Chapter 18, pages 811 – 848.

Problems/page #'s: In-Chapter 18.1 to 18.14
840 End of Chapter 18.15 to 18.37
845 Challenge Problem 18.38
846 Learning Group Problems 1 to 2

Summary of Reactions of Enolate Chemistry, Page 837, Section 18.10.

848 Summary of Mechanisms: Enolates: α -Substitution.

Condensation and Conjugate Addition Reactions of Carbonyl Compounds:
More Chemistry of Enolates.
Read and Study Chapter 19, pages 849 – 889.

Problems/page #'s: In-Chapter 19.1 to 19.22
878 End of Chapter 19.23 to 19.60
887 Challenge Problem 19.61 to 19.63
887 Learning Group Problems 1 to 2

- 876 Summary of Important Reactions, Page 876, Section 19.9.
889 Synthetic Connections: Some Synthetic Connections Involving Enolates.
888 Summary of Mechanisms: Enolate Reactions with Carbonyl Electrophiles.

Week of Nov 25: Amines. Read and Study Chapter 20, pages 890 – 937.
Problems/Page #'s: In-Chapter 20.1 to 20.18
928 End of Chapter 20.19 to 20.51
935 Challenge Problems 20.52 to 20.56
936 Learning Group Problems 1 to 2

924 Summary of Preparation and Reactions of Amines, Page 924, Section 20.13

Week of Dec 2 & 9: Carbohydrates and Lipids (Optional). Read Chapters 22 & 23,
pages 965 - 1010 and 1011 – 1044.

Problems/Page #'s: In-Chapter 22 22.1 to 22.19
1005 End of Chapter 22.20 to 22.42
1008 Challenge Problems 22.43 to 22.45
1009 Learning Group Problems 1 to 2

1010 Summary and Review Tools: A Summary of Reactions Involving Monosaccharide's.

Problem/Page #'s: In-Chapter 23 23.1 to 23.13
1041 End of Chapter 23.14 to 23.25
1043 Challenge Problems 23.26 to 23.27
1044 Learning Group Problems 1 to 4

Week of Dec 2 & 9: Amino Acids & Proteins & Nucleic Acids & Protein Synthesis (Optional) &
Review.

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

Chapter 24, read pages 1045 - 1089.

Problems/Page #'s: In-Chapter 24.1 to 24.16
1088 End of Chapter 24.17 to 24.23
1089 Challenge Problem 24.24
1089 Learning Group Problems 1 to 2

Chapter 25, read pages 1090 - 1124.

Problems/Page #'s: In-Chapter 25.1 to 25.11
1122 End of Chapter 25.12 to 25.16
1124 Learning Group Problem