

SCIENCE DEPARTMENT COURSE OUTLINE – Winter 2024

CH2610 (A3 & B3): Organic Chemistry I– 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 & Thursdays 10:00–11:00, 13:00-14:20 & other arranged times.

CALENDAR DESCRIPTION:

2024 Winter Semester

CH2610/Lecture/A3 & B3 - Organic Chemistry I | Credits 3.00

The correlation of structure and chemical bonding in carbon compounds with the physical properties and chemical reactivity of organic molecules. Discussion will be based on functional groups with emphasis on hydrocarbons and derivatives that contain halogens, oxygen, sulfur and the hydroxyl group. Introduction to stereochemistry, three-dimensional structure, reaction mechanisms, especially addition to double bonds, nucleophilic substitution and elimination reactions, and methods of structure determination. The study covers the functional group chemistry of alkanes, alkenes, alkynes, alcohols, ethers and sulfides.

PREREQUISITE(S)/COREQUISITE:

CH1010 or CH1030 Notes: Credit will be granted for only one of CH1610 or CH2610.

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

Recommended Resource Materials and Texts include:

1. John Purdie Sloan: CH2610 A3 & B3 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, 2023/2024.

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 I, consists of CH2610 A3, B3, S1, S2, S3, L1, L2 & L3 and is delivered in Lecture, Seminar and Laboratory Components.

LEARNING OUTCOMES:

The Learning Outcomes of CH2610, Organic Chemistry I, are that Students gain an understanding of:

- Atomic Structure, the Periodic Table of the Elements, Relative Electronegativities, Bonding.
- Functional Groups and Families of Organic compounds including.
 - Hydrocarbons: Alkanes, Alkenes, Alkynes, Arenes, Cyclic Compounds.
 - Alkyl Halides, Alcohols, Ethers, Amines, Aldehydes, Ketones, Carboxylic Acids, Esters, Amides, Carboxylate Salts, and Sulfides.
- Molecular Structure, Lewis Structures & 3-D Structures e.g., Line-Wedge-Dash 3-D Structures.
- Relative Acidity and Basicity of Organic Compounds.
- IUPAC Nomenclature of Organic Compounds & Conformations of Alkanes & Cycloalkanes.
- Stereochemistry: Organic Molecules in 3-Dimensions, & Cahn-Ingold-Prelog Nomenclature.
- Isomers: Constitutional Isomers, Stereoisomers – Enantiomers & Diastereomers.
- Chiral Compounds and Optical Activity of Chiral Compounds existing as Pairs of Enantiomers.
- Introduction to use of “Curved Arrow Notation” & Resonance & Inductive Electronic Effects.
- Organic Reaction Mechanisms including:
 - S_N2, Substitution Nucleophilic Bimolecular. E-2, Elimination Bimolecular.
 - S_N1, Substitution Nucleophilic Unimolecular. E-1, Elimination Unimolecular.
 - E+ Addition Mechanisms: Electrophilic Addition Mechanisms.
 - Radical, R·, Addition and Substitution Mechanisms.
 - Syn-Additions, Anti-Additions, Nucleophilic Additions.
 - Cleavage Reactions and Oxidation-Reduction Reactions
- Syntheses and Reactions of Alkanes, Alkenes, Alkynes, Alcohols, and Ethers.
- Introduction to Carbonyl Compounds, Organometallic Reagents and Conjugated Dienes.
- Coverage of 69-Organic Reactions finishing with Reaction # 69: The Diels-Alder Reaction.
- 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 CH2610, Organic Chemistry II, students will have a working knowledge of Organic Chemistry and be prepared for studying CH2630, Organic Chemistry II.

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 February 16	-----	20%
2.	Midterm Exam # 2, Friday March 22	-----	20%
2.	Final Exam to be scheduled between April 17 – 24	-----	35%
3.	Laboratory	-----	20%
4.	Tutorial/Seminar/Assignment Grading Component	-----	5%
			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, Practice Exams, and questions in the organic chemistry textbook by Solomons and Fryhle.
3. A pass grade is essential for the Laboratory Component.
4. The Tutorial Grading Component will contribute to 5% 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:

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, Time & Place: CH2610 A3 T, R 11:30 – 12:50 in J202
CH2610 B3 T, R 8:30 – 9:50 in J204
2. Laboratory Component: CH2610 L1 M 14:30 - 17:20 in J119
CH2610 L2 W 14:30 - 17:20 in J119
CH2610 L3 R 14:30 - 17:20 in J119

3. Seminar/Tutorials:	CH2610 S1	F	11:30 - 12:20 in J203
	CH2610 S2	F	8:30 - 9:20 in J203
	CH2610 S3	F	10:00 - 10:50 in J203

4. Office Hours: Individual and group assistance will normally be available during regular college business hours outside formal class lecture, laboratory, and seminar hours.

5. First Day of Classes, W24, Winter Semester: January 8, 2024.

6. Last Day of Classes W23, Winter Semester: April 15, 2024.

7. Final Exams - Scheduled by Registrar: April 17-24, 2024.

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

Lecture Component:

A study of the fundamental principles of the chemistry of carbon compounds. The study is based on a reaction mechanism approach to the functional group chemistry of alkanes, alkenes, alkynes, cycloalkanes, alkyl halides, alcohols and ethers. Topics include structure and bonding; physical properties; acidity and basicity; conformations of molecules; stereochemistry; addition, elimination and substitution reactions; structure-reactivity relationships; and introduction to 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:

Laboratory Techniques in organic chemistry; preparation of some organic compounds, and methods of qualitative organic analysis including Infrared Spectroscopy.

Laboratory Reports are to be submitted within 5-College Days.

Seminar/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.

Practice Mid-Term and Final Exams:

Practice Mid-Term Exam # 1 & # 2 and Final Exams will be posted in MyClass. Solutions to the Practice Exams will be covered in Classroom Settings. The Practice Exams will be based on the same Template used for Mid-Term Exam # 1, Mid-Term Exam & 2, and Final Exam.

Solutions to the 9-Assignments & Practice Mid-Term Exam #'s 1 and 2, and Final Exam:

Detailed Solutions to Nine, “Ten-Question Assignments”, will be Posted in MyClass CH2610 A3 & B3 within the “Assignments”, Tab after each Assignment Due Date.

Detailed Solutions to the, Practice Mid-Term Exam #'s 1 and 2, and Final Exam will be Posted in MyClass CH2610 A3 & B3 within the “Assignments”, Tab after being covered in Classroom Settings.

- Individual and group assistance will normally be available outside class lecture, laboratory, and seminar/tutorial hours.
- Request for assistance is welcome via, personal contact, e-mail, and telephone:
jsloan@nwpolytech.ca iPhone 780-876-1363, and J207-office visits.

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.

CH2610 A3 & B3, Organic Chemistry I:

Schedule Guideline: Reading, Studying & Practice Problems. Topics can be accessed On-Line.

Class Notes: Regular updates and postings to CH2610 A3 & B3 W22, in “CH2610 Class Notes”.

CH2610 Course Guide with References to:

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

On-Line Resources for Organic Chemistry Topics of Class Notes & Solomons Text are available. For Success in Organic Chemistry, Solve many Organic Chemistry Problems.

Recommendation: Access On-Line Resources for Actively Engaging with Organic Chemistry.

WINTER SEMESTER

Weeks of Jan 8 & 15: THE BASICS: Bonding and Molecular Structure:

Read and Study Chapter 1, including the Concept Map on page 54.

Practice Problems: You are encouraged to work all the in-chapter problems, and you are required to complete the assignments 1 to 9. Routinely doing problems in organic chemistry leads to understanding of the theory, and to earning good grades in organic chemistry.

In the words of Solomons and Fryhle:

“One way to check your progress is to work each of the in-chapter problems when you come to it. These problems have been written just for this purpose and are designed to help you decide whether or not you understand the material that has just been explained.”

And, in the words of Wade:

“It’s easy to fool yourself into thinking you understand organic chemistry when you actually do not. As you read through this book, all the facts and ideas may make sense, yet you have not learned to combine and use those facts and ideas. An examination is a painful time to learn that you do not really understand the material.

The best way to understand organic chemistry is to use it. You will certainly need to read and reread all the material in the chapter, but this level of understanding is just the beginning. Problems are provided so you can work with the ideas, applying them to new compounds and new reactions that you have never seen before. By working problems, you force yourself to use the material and fill in the gaps in your understanding. You also increase your level of self-confidence and your ability to do well on exams”.

Problems/Page #'s In-Chapter	1.1 to 1.28
49 End of Chapter	1.29 to 1.50
52 Challenge Problems	1.51 to 1.56
53 Learning Group Problems	1 to 8

Week of Jan 15 & 23: FAMILIES of CARBON COMPOUNDS: Functional Groups, Intermolecular Forces, and Infrared (IR) Spectroscopy.

Read and Study Chapter 2, including the Concept Map on page 103.

Problems/Page #'s: In-Chapter	2.1 to 2.28
99 End of Chapter	2.29 to 2.53
102 Challenge Problems	2.54 to 2.57
102 Learning Group Problems	1 to 8

Week of Jan 23 & 30: AN INTRODUCTION TO ORGANIC REACTIONS
and THEIR MECHANISMS:
ACIDS AND BASES IN ORGANIC CHEMISTRY. Read & Study Chapter 3,
including the Concept Map on page 143.

Problems/Page #'s:	In-Chapter	3.1 to 3.19
137	End of Chapter	3.20 to 3.43
139	Challenge Problems	3.44 to 3.48
140	Learning Group Problems	1 to 4

Week of Jan 30: NOMENCLATURE and CONFORMATIONS of ALKANES and
CYCLOALKANES.
Read and Study Chapter 4 and read the Concept Map on page 192.

Problems/Page #'s:	In-Chapter	4.1 to 4.22
186	End of Chapter	4.23 to 4.46
188	Challenge Problems	4.47 to 4.51
189	Learning Group Problems	1 to 4

Week of Jan 30 & Feb 5: STEREOCHEMISTRY: CHIRAL MOLECULES.
Read & Study Chapter 5 and read the Concept Map on page 239.

Problems/Page #'s:	In-Chapter	5.1 to 5.32
234	End of Chapter	5.33 to 5.51
237	Challenge Problems	5.52 to 5.55
235	Learning Group Problems	1 to 3

Weeks of Feb 5 & 12: IONIC REACTIONS: Nucleophilic Substitution and Elimination Reactions of
Alkyl Halides. Read and Study Chapter 6 and read the "Summary and Review Tools –
Mechanism Review: Substitution versus Elimination", on page 281.

Problems/Page #'s:	In-Chapter	6.1 to 6.19
284	End of Chapter	6.20 to 6.41
288	Challenge Problems	6.42 to 6.49
290	Learning Group Problems	1 to 2

Week of Feb 20-24: No Classes: Family Day is Feb 19, and Winter Break is Feb 20 - 23.

Week of Feb 26: ALKENES AND ALKYNES I: Properties and Synthesis.
Elimination Reactions of Alkyl Halides. Read and Study Chapter 7, read Summary
and Review Tools on pages 327, 328, 329, 334, 335 and 336.

Problems/Page #/s:	In-Chapter	7.1 to 7.26
329	End of Chapter	7.27 to 7.57
332	Challenge Problems	7.58 to 7.64
333	Learning Group Problems	1 to 4.

Week of March 4: ALKENES & ALKYNES II: Addition Reactions. Read & Study Chapter 8, and read, “Summary and Review Tools; Summary of Alkene Addition Reactions, and Synthetic Connections of Alkynes and Alkenes II”, on page 389 and 390.

Problems/Page #'s:	In-Chapter	8.1 to 8.25
383	End of Chapter	8.26 to 8.61
387	Challenge Problems	8.62 to 8.63
388	Learning Group Problems	1 to 4

Week of March 11: RADICAL REACTIONS. Read and Study Chapter 10, and read the, “Concept Map – Mechanism Review of Radical Reactions”, on page 488.

Problems/Page #'s:	In-Chapter	10.1 to 10.17
492	End of Chapter	10.18 to 10.35
495	Challenge Problems	10.36 to 10.43
496	Learning Group Problems	1 to 2

Week of March 18 & 25: ALCOHOLS & ETHERS: Synthesis & Reactions. Read & Study Chapter 11, and read the “Summary and Review Tools – Some Synthetic Connections of Alkenes, Alkynes, Alcohols, Alkyl Halides and Ethers”, on page 533.

Problems/Page #'s:	In-Chapter	11.1 to 11.24
535	End of Chapter	11.25 to 11.56
539	Challenge Problems	11.57 to 11.60
540	Learning Group Problems	1 to 3

Week of March 25 & April 1: ALCOHOLS FROM CARBONYL COMPOUNDS: OXIDATION-REDUCTION AND ORGANOMETALLIC COMPOUNDS. Read and Study Chapter 12, and read the, “Summary and Review Tools – Synthetic Connections of Alcohols and Carbonyl Compounds”, on pages 570 and 571.

Problems/Page #'s:	In-Chapter	12.1 to 12.8
572	End of Chapter	12.9 to 12.36
577	Challenge Problems	12.37 to 12.39
577	Learning Group Problem	

Week of April 8 & 15: CONJUGATED UNSATURATED SYSTEMS. Read and Study Chapter 13, and read the “Concept Map”, on page 616.
Class Review including Review of the Practice Final Exam

Problems/Page #'s:	In-Chapter	13.1 to 13.17
618	End of Chapter	13.18 to 13.50
623	Challenge Problems	13.51 to 13.54
624	Learning Group Problems	1 to 2

April 15: Last Day of Classes.

Final Exam Schedule: April 17 - 24, 2024.