

COURSE SYLLABUS



COURSE TITLE: CHEM-231-Organic Chemistry 2

CLASS SECTION: 001A and 001B

TERM: Winter 2025

COURSE CREDITS: 3

DELIVERY METHOD(S): On Lansdowne campus in classroom and Lab

Camosun College respectfully acknowledges that our campuses are situated on the territories of the Lək̓ʷəŋən (Songhees and Kosapsum) and WSÁNEĆ peoples. We honour their knowledge and welcome to all students who seek education here.

INSTRUCTOR DETAILS

NAME: Dr. Larry Lee

EMAIL: leel@camosun.ca

OFFICE: F344B

HOURS: Please see posted schedule on office door F344B or as posted on D2L

As your course instructor, I endeavour to provide an inclusive learning environment. However, if you experience barriers to learning in this course, do not hesitate to discuss them with me. Camosun College is committed to identifying and removing institutional and social barriers that prevent access and impede success.

CALENDAR DESCRIPTION

This course is a continuation of CHEM 230. Topics include: aromatic compounds, aldehydes and ketones, carboxylic acids and derivatives, amines, amino acids and peptides and carbohydrates. The laboratory experiments are mainly directed towards the syntheses of various organic compounds.

PREREQUISITE(S):

All of:

C in CHEM 121

C in CHEM 230

CO-REQUISITE(S):

EQUIVALENCIES:

COURSE LEARNING OUTCOMES / OBJECTIVES

Upon completion of this course a student will be able to:

1. Utilize the specialized vocabulary and nomenclature based on the IUPAC system for organic compounds including aldehydes, ketones, benzene & its derivatives, carboxylic acids and their derivatives, amines, and carbohydrates according to their structures and functional groups present
2. Compare and contrast the general physical properties such as stability, acidity and basicity, melting and boiling point, and water solubility.
3. Describe the chemical properties of the above classes of organic compounds, and relate any differences and similarities.
4. Draw a synthetic route outlining the preparation of some of the compounds above and their reactions, including details such as stereochemistry of selected reactions and mechanisms, stability of transition states, intermediates, products, and factors affecting the outcome.
5. Utilize the concepts of functional group transformations and reaction mechanisms to explain organic reactions.
6. Demonstrate an ability to use the method of retrosynthetic analysis to interconvert the above classes of organic compounds.
7. Communicate an understanding of the phenomena of proton and carbon-13 nuclear magnetic resonance spectroscopy and to interpret and predict the spectroscopic data for the classes of organic compounds listed above.

REQUIRED MATERIALS & RECOMMENDED PREPARATION / INFORMATION

- a. Organic chemistry, 10th edition, John McMurry available Free on Openstax <https://openstax.org/subjects/science> or D2L
- b. Access to Desired to Learn (D2L) <https://online.camosun.ca>
- c. Lab Manual Chem 230 and 231, Camosun College, 2018, by Nasr Khalifa
- d. A molecular model is highly recommended. You can borrow one from Camosun College.
- e. Lab safety glasses are required (Bring your own) and Lab coat is strongly recommended.

COURSE SCHEDULE, TOPICS, AND ASSOCIATED PREPARATION / ACTIVITY / EVALUATION

The following schedule and course components are subject to change with reasonable advance notice, as deemed appropriate by the instructor.

WEEK	DATE RANGE	ACTIVITY or TOPIC	OTHER NOTES
1	Jan 6 – 10	IR spectroscopy	Work sheet 1 Lab
2	Jan 13 – 17	Expt 13 Oxidation reactions	Experiment
3	Jan 20 – 24	Mass Spectroscopy	Work sheet 2
4	Jan 27 – 31	Expt 14 Reduction reactions	Experiment
5	Feb 3 – 7	Expt 11 Grignard reactions	Experiment
6	Feb 10 – 14	NMR Spectroscopy	Worksheet 3
7	Feb 17 – 21	Reading Break	No Labs
8	Feb 24 – 28	Test 1 (Wednesday Feb 26)	Test 1
9	Mar 3– 7	Expt 12 Diels Alder Reactions	Experiment
10	Mar 10– 14	Expt 17 Wittig reactions	Experiment
11	Mar 17 – 21	Expt 18 Condensation reactions with benzaldehyde	Experiment
12	Mar 24- 28	Test 2 (Wednesday March 26)	Test 2
13	Mar 31– Apr 4	Expt 20 Synthesis of Esters	Experiment
14	Apr 7 – Apr 11	REVIEW	REVIEW
15	April 14 - 26	Final exam week	Final

a) Students registered with the Centre for Accessible Learning (CAL) who complete quizzes, tests, and exams with academic accommodations have booking procedures and deadlines with CAL where advanced noticed is required. Deadlines scan be reviewed on the [CAL exams page](http://camosun.ca/services/accessible-learning/exams.html). <http://camosun.ca/services/accessible-learning/exams.html>

a) **Scheduled lectures** are 50 minutes per class on Tues Wed, Thurs In class face-to-face
Scheduled labs are 170 minutes per week (2h and 50 min)

Class schedule:	Lectures	Tues, Thurs	1:30 – 2:20 pm	F210
	Lecture	Fri	1:30 – 2:20 am	F268
	Lab	Wednesday	8:30 – 11:20 am	F354
			2:30 – 5:20 pm	

- c) Spectroscopy Worksheets will be available on D2L. These are to be submitted prior to a due date and these will be graded. **Chapter worksheets** are not graded, but answers will be provided. Students are encouraged to do worksheets to assist with comprehending the organic chemistry associated with this term.
- b) Quizzes through D2L (Desired to Learn) – There will be chapter quizzes 10–20 questions with specific due dates. These question will mainly be multiple choice based.
- c) The textbook is free online and it is a good resource for concepts – use this textbook as a reference for learning.

EVALUATION OF LEARNING

DESCRIPTION	WEIGHTING
Online assessment D2L (all quizzes combined)	15%
Term Test 1 (Wednesday February 26, 2025)*	15%
Term Test 2 (Wednesday March 26, 2025)*	15%
Laboratory (lab reports written and videos)	25%
Final exam	30%
TOTAL	100%
Note: * student may write exam in either lab date. Inform the instructor by email.	

If you have a concern about a grade you have received for an evaluation, please come and see me as soon as possible. Refer to the [Grade Review and Appeals](http://camosun.ca/about/policies/education-academic/e-1-programming-and-instruction/e-1.14.pdf) policy for more information.
<http://camosun.ca/about/policies/education-academic/e-1-programming-and-instruction/e-1.14.pdf>

Detailed Course Outline:

1. Review: Alcohols, Ethers and Epoxides: (Chapter 17, Chapter 18.1-18.9)

-Classification and nomenclature, physical properties: boiling points, solubility in water, preparation of alcohols: hydration of alkenes, oxymercuration and demercuration, hydroboration of alkenes, nucleophilic substitution reactions (**Chapter 10**), acidity and basicity of alcohols, reactions of alkoxide ions, mesylates and tosylates, protecting groups and use in synthesis, substitution reactions of alcohols: reactivity of alcohols toward hydrogen halides, S_N1 vs S_N2 , other reagents to convert alcohols to alkyl halides, elimination reactions of alcohols, oxidation reactions of alcohols, chromium (VI) reagents, potassium permanganate, selective oxidation

-Nomenclature of ethers and epoxides, physical properties of ethers and crown ethers, preparation of ethers: preparation of diethyl ether, Williamson ether synthesis, acid-catalysed Markovnikov addition to alkenes, cyclic ethers, preparation of epoxides, substitution reactions of ethers, substitution reactions of epoxides: mechanism of base-catalysed and acid-catalysed cleavage, anti-hydroxylation of alkenes via epoxides

-Synthetic applications

2. Aldehydes and Ketones: (Chapter 19)

- Nomenclature, physical properties
- Preparation of aldehydes and ketones
- Nucleophilic addition reactions, reversible and irreversible addition reactions; hydrates, hemiacetals, acetals, thioacetals
- Reduction of carbonyl compounds: sodium borohydride, lithium aluminum hydride, catalytic hydrogenation
- Chemical tests for primary and secondary alcohols
- Reactions with ammonia and amines, imines, the Wolff-Kishner reaction
- Raney Nickel reduction, Clemmensen reduction
- Wittig reaction
- Oxidation: using Mn and Cr oxidizing reagents
- Baeyer-Villiger oxidation
- Organometallic compounds; Grignard reagents, alkyllithium reagents, sodium alkynides
- Synthetic methodology and applications

3. The Chemistry of Benzene and Its Derivatives: (Chapters 15, 16)

- Nomenclature
- Aromaticity, stability of benzene, Huckel's rule
- Aromatic ions
- Resonance and inductive effects of substituents: acidity of phenols, basicity of anilines
- Electrophilic aromatic substitution: electrophiles, first substitution, nitration, halogenation, sulfonation, mechanism of electrophilic aromatic substitution reactions
- Friedel-Crafts alkylation and acylation
- Second substitution, reactivity, orientation
- Third substitution, reinforcement and opposition
- Nucleophilic aromatic substitution reactions, diazonium salts
- Synthetic applications

4. Spectroscopy: (Chapter 13)

- Electromagnetic spectrum
- Nuclear magnetic resonance spectroscopy, ^1H NMR, ^{13}C NMR
- Structure elucidation using IR, UV/VIS, MS, and NMR spectra of alkylhalides, alcohols, alkenes, alkynes, carbonyl compounds, carboxylic acids, aromatic compounds, amines, nitriles

5. Carboxylic Acids and Their Derivatives: (Chapters 20, 21)

- Nomenclature of carboxylic acids
- Physical properties
- Effect of structure on the acidity
- Preparation of carboxylic acids: oxidation of primary alcohols and aldehydes, oxidation of alkenes, oxidation of alkylbenzenes, hydrolysis of nitriles and cyanohydrins, Grignard method
- Reactions of carboxylic acids: reduction, reaction with bases, esterification
- Polyfunctional carboxylic acids: diprotic acids, anhydrides from diprotic acids, β -keto acids, β -diacids
- Derivatives of carboxylic acids: types, reactivity
- Acid halides: nomenclature, preparation, hydrolysis, reactions with nucleophiles
- Anhydrides: nomenclature, preparation, hydrolysis, reactions with nucleophiles,
- Esters: nomenclature, preparation, acid-catalysed and base-catalysed hydrolysis, transesterification, reduction, reactions with nucleophiles, as protecting groups
- Polyesters, hydroxycarboxylic acids
- Lactones: preparation, biological examples
- Amides: nomenclature, preparation, acidity and basicity, representative reactions; hydrolysis, reduction, dehydration, the peptide bond

-Nitriles: nomenclature, preparation, representative reactions; hydrolysis, reduction

6. The Chemistry of Enolate Ions: (Chapters 22, 23)

- Acidity of α -hydrogens of carbonyl compounds
- Keto-enol tautomerization
- Reactions via enols and enolate ions: racemization, halogenation, haloform reaction, Hell-Volhard-Zelinski reaction.
- Aldol condensation: dehydration of product, synthetic applications, crossed aldol condensation, intramolecular aldol condensation, Robinson annelation.
- Ester condensation: Claisen condensation, crossed Claisen condensation, Dieckmann condensation
- Additions to α,β -unsaturated carbonyl compounds: 1,4- vs 1,2-additions, addition of organocopper reagents, Michael addition
- Direct alkylation of active hydrogen compounds
- Synthetic applications

7. The Chemistry of Amines: (Chapter 24)

- Nomenclature, physical properties, preparation, basicity, biologically active amines
- Nitrosation reactions, Sandmeyer reaction
- Azo compounds; synthesis, as dyes

8. Carbohydrates: (Chapter 25)

- Structure; ketoses, aldoses, pyranoses, furanoses
- Fischer projections, D- and L- designation
- Mutarotation of glucose
- Glycosides, the anomeric effect
- Reactions of monosaccharides as alcohols
- The Kiliani-Fischer synthesis
- Disaccharides and polysaccharides

COURSE GUIDELINES & EXPECTATIONS

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Class attendance is highly recommended. It is not mandatory, but a higher success rate is obtainable with showing up to class, taking writing notes (write down what is written on the whiteboard), asking question, and keeping engaged.

Term tests are compulsory and the mark for any single term test or combination of term tests is **not** replaced by the final exam mark except as described below.

D2L quizzes are mandatory and are given a due date.

A zero is give as the mark for any quiz or final exam not written and for which no official medical excuse is provided. The medical excuse must be dated within the week of the exam and must be handed in within two weeks of the exam date. **The medical excuse must provide sufficient information to establish that the student was not able to write the exam due to his/her medical condition. Students will also be required to give written consent for information about their medical condition to be disclosed to the instructor.** Any such information obtained is treated as confidential.

The final exam at the end of the course will cover all course material.

During the experimental work, students are expected to wear safety glasses and closed toe footwear. No sandals, flip-flops, or bare feet allowed in the labs. It is highly recommended that students wear a lab coat to protect you from acids and bases, and odorous chemicals. All students must abide by laboratory safety rules.

You will be expected to show up for the lab on time. At the beginning of the lab, I will go over safety precautions and any demonstration of experimental techniques.

As Chemistry is a practical science, there are expectations that you attend all the lab periods. No more than one lab maybe missed without a medical excuse as this will compromise the learning outcomes. You must notify the instructor regarding your absence (by email or written note) within the same week of the missed lab, otherwise a zero is given to that lab period.

Students must maintain a lab notebook for CHEM 231 that contains a table of content of experiments, a title for each experiment conducted, page numbers, date of experiment, and name of partner (if solo, then it must be indicated). The notebook must contain the chemical reactions (actual reactions planned for the experiment), a flow diagram of the procedure, a table of date with descriptive titles (table of reagents, product analysis, spectroscopy data if relevant), a short reflective analysis (what was observed at each step of the procedure, errors, and possible changes to the procedure if it was repeated), and answers to post-lab questions (posted on D2L). Most of this work is done to prepare as a pre-laboratory exercise. By preparing for the lab, this will make the lab experience more enjoyable as you become efficient and successful at synthesizing and analyzing the products.

All labs are due within one week of completion of lab work, unless otherwise noted by the instructor or posted on D2L or prior instructor permission has been granted, or an accommodation is in-place. The format of the report will be posted on D2L as Key activities in the weekly lab. You will need to a scan copy of your lab notebook and submit by uploading the scan as a PDF copy to the designated assignment folder in D2L.

Student may share data when working in partners, but each student must submit their own report. In the event, that reports are too similar, a warning or a zero will be given to the report.

Late labs and worksheets will be penalized at 10% for each week late. Once labs or worksheets are returned to students, no late work can be submitted for grading. Answers to worksheets will be posted on day of return.

At least 70% of lab work must be submitted for grading and at least 50% lab score must be obtained to pass this course

All D2L quizzes will be due two weeks from the posted date.

Final exam is schedule April 12-20, 2025 Do not make travel arrangements during this period unless you know your exam schedule.

SCHOOL OR DEPARTMENTAL INFORMATION

A science help center is available for additional help, but please contact me for help.

STUDENT RESPONSIBILITY

Enrolment at Camosun assumes that the student will become a responsible member of the College community. As such, each student will display a positive work ethic, assist in the preservation of College property, and assume responsibility for their education by researching academic requirements and policies; demonstrating courtesy and respect toward others; and respecting expectations concerning attendance, assignments, deadlines, and appointments.

SUPPORTS AND SERVICES FOR STUDENTS

Camosun College offers a number of services to help you succeed in and out of the classroom. For a detailed overview of the supports and services visit camosun.ca/services.

Support Service	Website
Academic Advising	camosun.ca/services/academic-supports/academic-advising
Accessible Learning	camosun.ca/services/academic-supports/accessible-learning
Counselling	camosun.ca/services/health-and-wellness/counselling-centre
Career Services	camosun.ca/services/co-operative-education-and-career-services
Financial Aid and Awards	camosun.ca/registration-records/financial-aid-awards
Help Centres (Math/English/Science)	camosun.ca/services/academic-supports/help-centres
Indigenous Student Support	camosun.ca/programs-courses/iecc/indigenous-student-services
International Student Support	camosun.ca/international
Learning Skills	camosun.ca/services/academic-supports/help-centres/writing-centre-learning-skills
Library	camosun.ca/services/library
Office of Student Support	camosun.ca/services/office-student-support
Ombudsperson	camosun.ca/services/ombudsperson
Registration	camosun.ca/registration-records/registration
Technology Support	camosun.ca/services/its

Support Service	Website
Writing Centre	camosun.ca/services/academic-supports/help-centres/writing-centre-learning-skills

If you have a mental health concern, please contact Counselling to arrange an appointment as soon as possible. Counselling sessions are available at both campuses during business hours. If you need urgent support after-hours, please contact the Vancouver Island Crisis Line at 1-888-494-3888 or call 911.

COLLEGE-WIDE POLICIES, PROCEDURES, REQUIREMENTS, AND STANDARDS

Academic Integrity

Students are expected to comply with all College policy regarding academic integrity; which is about honest and ethical behaviour in your education journey. The following guide is designed to help you understand your responsibilities: <https://camosun.libguides.com/academicintegrity/welcome>
Please visit <https://camosun.ca/sites/default/files/2021-05/e-1.13.pdf> for Camosun's Academic Integrity policy and details for addressing and resolving matters of academic misconduct.

Academic Accommodations for Students with Disabilities

Camosun College is committed to achieving full accessibility for persons with disabilities. Part of this commitment includes arranging appropriate academic accommodations for students with disabilities to ensure they have an equitable opportunity to participate in all of their academic activities. If you are a student with a documented disability and think you may need accommodations, you are strongly encouraged to contact the Centre for Accessible Learning (CAL) and register as early as possible. Please visit the CAL website for more information about the process of registering with CAL, including important deadlines: <https://camosun.ca/cal>

Academic Progress

Please visit <https://camosun.ca/sites/default/files/2023-02/e-1.1.pdf> for further details on how Camosun College monitors students' academic progress and what steps can be taken if a student is at risk of not meeting the College's academic progress standards.

Course Withdrawals Policy

Please visit <https://camosun.ca/sites/default/files/2021-05/e-2.2.pdf> for further details about course withdrawals. For deadline for fees, course drop dates, and tuition refund, please visit <https://camosun.ca/registration-records/tuition-fees#deadlines>.

Grading Policy

Please visit <https://camosun.ca/sites/default/files/2021-05/e-1.5.pdf> for further details about grading.

Grade Review and Appeals

Please visit <https://camosun.ca/sites/default/files/2021-05/e-1.14.pdf> for policy relating to requests for review and appeal of grades.

Medical / Compassionate Withdrawals

Students who are incapacitated and unable to complete or succeed in their studies by virtue of serious and demonstrated exceptional circumstances may be eligible for a medical/compassionate withdrawal (see [Medical/Compassionate Withdrawals policy](#)). Please visit <https://camosun.ca/services/forms#medical> to learn more about the process involved in a medical/compassionate withdrawal.

Sexual Violence

Camosun is committed to creating a campus culture of safety, respect, and consent. Camosun's Office of Student Support is responsible for offering support to students impacted by sexual violence. Regardless of when or where the sexual violence occurred, students can access support at Camosun. The Office of Student Support will make sure students have a safe and private place to talk and will help them understand what supports are available and their options for next steps. The Office of Student Support respects a student's right to choose what is right for them. For more information see Camosun's Sexualized Violence Policy: <https://camosun.ca/sites/default/files/2021-05/e-2.9.pdf> and camosun.ca/services/sexual-violence-support-and-education.

To contact the Office of Student Support: oss@camosun.ca or by phone: 250-370-3046 or 250-370-3841

Student Misconduct (Non-Academic)

Camosun College is committed to building the academic competency of all students, seeks to empower students to become agents of their own learning, and promotes academic belonging for everyone. Camosun also expects that all students to conduct themselves in a manner that contributes to a positive, supportive, and safe learning environment. Please review Camosun College's Student Misconduct Policy at <https://camosun.ca/sites/default/files/2021-05/e-2.5.pdf> to understand the College's expectations of academic integrity and student behavioural conduct.

Looking for other policies?

The full suite of College policies and directives can be found here: <https://camosun.ca/about/camosun-college-policies-and-directives>

Changes to this Syllabus: Every effort has been made to ensure that information in this syllabus is accurate at the time of publication. The College reserves the right to change courses if it becomes necessary so that course content remains relevant. In such cases, the instructor will give the students clear and timely notice of the changes.

