

COURSE SYLLABUS



COURSE TITLE: CHEM-230: Organic Chemistry 1

CLASS SECTION: 001 A and B

TERM: Fall 2022

COURSE CREDITS: 4

DELIVERY METHOD(S): Lectures and Lab in Class

Camosun College campuses are located on the traditional territories of the Lək̓ʷəŋən and W̱SÁNEĆ peoples. We acknowledge their welcome and graciousness to the students who seek knowledge here.

Learn more about Camosun's [Territorial Acknowledgement](#).

For COVID-19 information please visit <https://legacy.camosun.ca/covid19/index.html>.

Camosun College requires mandatory attendance for the first class meeting of each course. If you do not attend, and do not provide your instructor with a reasonable explanation in advance, you will be removed from the course and the space offered to the next waitlisted student.

INSTRUCTOR DETAILS

NAME: Dr. Larry Lee

EMAIL: leel@camosun.bc.ca

OFFICE: F344B (office hours will be held on-line, for now)

HOURS: Tues and Wed: 9:30–11:30 online only. All other times by appointment only

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 provides a general introduction to the theory and practice of organic chemistry. Topics include: alkanes, stereochemistry, alkyl halides, substitution and elimination reactions, free radical reactions, alcohols, ethers, spectroscopy, alkanes and alkynes. The laboratory experiments are designed to expose students to a wide range of organic laboratory techniques.

PREREQUISITE(S):

One of:

C in CHEM 120

B in CHEM 112 and permission of the Chair

CO-REQUISITE(S):

All of:

C in CHEM 121

EXCLUSION(S):

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 alkanes, cycloalkanes, alkenes, alkynes, alcohols, ethers, epoxides, and alkyl halides according to their structures and functional groups present.
2. Describe the general physical properties such as stability, acidity and basicity, density, melting and boiling point, and water solubility of the above compounds.
3. Describe the chemical properties of the above classes of organic compounds, and explain any differences and similarities.
4. Draw a synthetic scheme outlining the preparation of some of the compounds above and their subsequent reactions, including details such as stereochemistry of some typical 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 apply the method of retrosynthetic analysis based on the knowledge of some general organic reactions of the above compounds.
7. Identify the fundamental differences among the three types of isomerism: structural, geometric, and stereo.
8. Recognize and draw Newman, Fischer, and Haworth projections.
9. Communicate an understanding of the Cahn-Prelog-Ingold sequence rules and to recognize basic differences between enantiomeric and diastereomeric compounds.
10. Communicate an understanding of the phenomena of infrared, ultra violet-visible, and mass 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, Mechanistic Patterns, Ogilvie, 2nd edition, available through Top Hat
<https://app-ca.tophat.com>
- b) Access to Desired to Learn (D2L)
<https://online.camosun.ca>
- c) Lab Manual Chem 230, Camosun College, 2018, by Nasr Khalifa
- d) A molecular model is highly recommended. You can borrow one from Camosun College.
- e) 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	Sept 6 – 9	Lab orientation, review of bonding and naming	Work sheet 1
2	Sept 12 – 16	Melting point analysis	Experiment
3	Sept 19– 23	Chapter 3 conformers (Lab manual Exp 7 Q 1–7)	Work sheet 2 (part 1)
4	Sept 26– 30	Recrystallization and sublimation	Experiment
5	Oct 3 – 7	Chapter 4 Stereoisomers (Lab manual Exp 7 Q 8–15)	Work sheet 2 (part 2)
6	Oct 10– 14	Review, curved arrows, resonance and online virtual lab	Work sheet 3
7	Oct 17 – 21	Chapter 6 Acids and Bases	Work sheet 4
8	Oct 24 – 28	Separation of mixtures	Experiment
9	Oct 31 – Nov 4	Cyclohexene from Cyclohexanol	Experiment
10	Nov 7 – 10	Virtual lab, alkenes and alcohols	Worksheet 5
11	Nov 14 – 18	Substitution reactions (lab) and review	Experiment and Worksheet 6
12	Nov 21–25	Substitution versus elimination reactions,	Worksheet 7
13	Nov 28 – Dec 2	Retrosynthesis	Worksheet 8
14	Dec 5 – 9	Review of Term	
Final	Dec 12 – 20	Final exam week	

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 Mon, Tues,, Thurs **In class face-to-face**

Class schedule:	M, T	13:30 – 14:20	F268
	Thurs	12:30 – 13:20	F266

- b) **Scheduled laboratory experiments** are in F354. The instructions for these experiments are available in a laboratory manual that you can purchase from the Camosun College Lansdowne bookstore. It is best practice to read and prepare for the experiment before attempting to do it. Preparation for the lab can be done by preparing a flow diagram containing drawings of the steps involved (to be submitted for grading). Provide a scanned copy (Use Cam Scanner) and submit on D2L.

hours per week:

Lab schedule:	Wed	section B	9:30-12:20	In class face-to-face
	Wed	section A	13:30 - 16:20	

- c) Worksheets will be available on D2L. These are to be submitted prior to a due date and these will be graded.
- d) Weekly quizzes through D2L (Desired to Learn) – There will be weekly quizzes 10–20 questions with specific due dates. These question will mainly be multiple choice based.

Detailed Course Outline:

1. Review and Preview: Chemical Bonding (Chapters 1): covered in CHEM 120

Atomic orbitals, Electronic configuration of an atom (p 2-6), Covalent and Ionic bonding (p 6), Lewis structures, formal charges, exceptions to the octet rule (p 6-11). Overlap of orbitals (s, p) bonds (p.11) Bond polarity, polar covalent bonds, electronegativity (p12-13), Molecular shape, 3D), VSEPR (p14-19) Valence bond approach, hybrid orbitals (sp , sp^2 , sp^3) (p19-26), Resonance structures (p26-32). Not covered in CHEM 120- representation of organic molecules (condensed structure, HNOC rule), Line., wedge and hash structures (p34-38).

2. Functional groups (mainly on hydrocarbons and singly bonded heteroatoms – Chapter 2)

Hydrocarbons and heteroatom functional groups (p 45-53), Intermolecular forces (p54-58), physical properties (boiling point and melting point), solubility, hydrophobicity and hydrophilicity) (p62-66). Naming of alkanes, alkenes, alkynes, and cyclic hydrocarbons.

3. Stereochemistry (conformations) (Chapter 3)

Conformational analysis (rotation about single bonds in acyclic molecules). Newman's projection (p 87-92) * Torsional strain and steric strain in acyclic molecules Strain in cyclic molecules (p 98- 117). Conformation of cyclohexanes, drawing Chair structures. (p102-106). Convert chair to Newman's projection and Newman to Chair structure, ring flip. (p108- P 117).

4. Stereochemistry (Constitutional isomers and Stereoisomers (Chapter 4)

Isomerism: constitutional isomers (p 127), configurational isomers (solid and broken wedges) (p127) Enantiomers and chiral molecules (p128 -139) Nomenclature of enantiomers, the R-S system (140 -152) Diastereomers (p 152-156) , Fischer projection formulas (4.11) Meso compounds (p 157-159) Stereoisomers in Double bonds (Geometric, configurational. E, Z) (p160-162) Physical properties of enantiomers and diastereomers (p 163-164) Optical rotation, optical activity, polarimeter (p 164-167), Optical purity (enantiomeric excess) (168-169) Fischer projections (P170-178) Resolution of a racemic mixture (not in book)

5. Introduction to Organic reaction mechanisms (Chapter 5)

Common reactions types: acid-base (Ch 6) (addition (Ch, 8), Substitution (Ch11), Elimination (Ch12), radical reactions (Ch 19).

- Curved arrows (doubly barbed and singly barbed)
- Curved arrows and bond formation and bond breaking (P194-199)
- Curved arrows and formal charge (p200-203)
- Curved arrows and resonance structures (208-221, 223-226)

6. Acid and Bases in Organic Chemistry (Chapter 6)

Bronsted-Lowry acid bases p 223-240.

Qualitative estimate of relative acidities (electronegativity, atomic size, induction, hybridization, resonance (P243-256)

Quantitative acidity measurement, pKa) (p257-258)

Predicting acid-base equilibria (p259-261)

Lewis acid bases (p265-266)

7. p-bonds as nucleophiles (chapter 8)

Electrophilic addition reactions to alkenes: Hydrogen halides (HX: p332-335), carbocation formation and stability, regioselectivity, Markovnikov's rule. Addition of water or alcohol (Markovnikov) (P347,349), by oxymercuration, demercuration (p361-356). Addition of halogen (Cl₂, Br₂, neat or with other nucleophiles, water, alcohol), epoxidation of alkenes, hydroboration (Anti-Markovnikov addition), hydrogenation of double bonds (p372-374)

Electrophilic addition to alkynes (p380-384): hydrogen halides, acid catalyzed addition of water, antimarkovnikov addition (p384, 385). Hydrogenation of alkyne to alkane or to alkene (p385, 996-998)

Summary (p386-387)

Double dehydrohalogenation reaction (alkene to alkyne) (location?)

Cycloaddition: Ozonolysis (p1036), Osmium Tetroxide dihydroxylation (p 1036-1037), Potassium dihydroxylation (1037-1038)

8. Free Radical Reactions: (Chapter 19)

Reactions of alkanes with halogens, Initiation, propagation, termination (p 974-976)

Chlorination of methane, mechanism

Halogenation of higher alkanes (p981-983)

Allylic halogenation (p982-985)

Benzylic halogenation (p985-986)

Radical polymerization (p961-994)

9. Nucleophilic Substitution and Elimination Reactions: (Chapter 11 and 12)

S_N2 reactions, mechanism, stereochemistry, nucleophilicity, structure of electrophile (p 497 – 510).

S_N1 reactions, mechanism, carbocation stabilization and rearrangement, structure of electrophile, leaving group (halides, sulfonate esters), stereochemistry (p510-520). Solvent effects on nucleophilicity (p521 – 522).

Predicting S_N1 and S_N2 reactions (p523- p525). Other: Energy diagrams, transition states

Elimination reactions E2 (P541-552), regioselectivity, Zaitsev product (p542-545), Hofmann product (545-547).

Stereochemistry of E2 (Antiperiplanar) (P547-552).

Elimination reactions E1 (p552-556) , regioselectivity, rearrangements. Dehydration and Dehydrohalogenation (557). S_N1, S_N2, E1 or E2 (competition) (p559-561),

Elimination reaction by oxidation of alcohols (p563- 568) Summary p. 569

10.Synthetic methodology and applications

Using acetate to make alcohols, using alkoxides to make ethers, Using epoxides electrophiles (525-528)
Carbon-carbon bond forming reactions (P529-530). Amine synthesis, Gabriel Amine synthesis (P530-532)

EVALUATION OF LEARNING

DESCRIPTION	WEIGHTING
Online assessment D2L (All quizzes combined) * ¹	10%
Term Test 1 (* ² D2L multiple choice online and written in class (Oct 24, 2022 –Mon)	15%
Term Test 2 (* ² D2L multiple choice online and written in class (Nov 21, 2022 –Mon)	15%
Final exam (Written exam)	30%
Laboratory (All work sheets combined)	15%
Laboratory (lab reports from virtual and/or experimental)	15%
* ¹ Note – due to lectures set at 50 min (the written portion will be done in class) * ² The D2L quiz will be done on–line 30 min (Multiple choice)	TOTAL 100%

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>

COURSE GUIDELINES & EXPECTATIONS

All lectures and labs will be face-to-face, unless otherwise noted in the lab schedule or given an order by Camosun College (BC health officer). Class attendance is highly recommended. It is not mandatory, but a higher success rate is obtainable by showing up to class, taking written notes, asking questions, 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.

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.

All labs are due within one week of completion of lab work, unless otherwise noted by the instructor and posted on D2L. The format of the report will be post-lab questions or video format of the experimental work and summary of the data. **All work must be submitted in D2L assignment folder.**

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.

All D2L quizzes will be due two weeks from the posted date. There will be one additional opportunity to redo a D2L quiz and the highest grade obtained for that particular quiz will be rewarded. Answers will be available at the end of the due date. No redoing quiz can be done after this period.

All D2L exam multiple choice questions for term test 1 and term test 2 will be available on date of the exam. This will be available for 24 hours and no redo will be available. There will be 10-15 questions for this part and the type of questions will be similar to D2L quizzes.

Final exam is schedule Dec 12-21, 2022. Do not make travel arrangements during this period unless you know your exam schedule.

SCHOOL OR DEPARTMENTAL INFORMATION

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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 <http://camosun.ca/students/>.

Academic Advising	http://camosun.ca/advising
Accessible Learning	http://camosun.ca/accessible-learning
Counselling	http://camosun.ca/counselling
Career Services	http://camosun.ca/coop
Financial Aid and Awards	http://camosun.ca/financialaid
Help Centres (Math/English/Science)	http://camosun.ca/help-centres
Indigenous Student Support	http://camosun.ca/indigenous
International Student Support	http://camosun.ca/international/
Learning Skills	http://camosun.ca/learningskills
Library	http://camosun.ca/services/library/
Office of Student Support	http://camosun.ca/oss
Ombudsperson	http://camosun.ca/ombuds
Registration	http://camosun.ca/registration
Technology Support	http://camosun.ca/its
Writing Centre	http://camosun.ca/writing-centre

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.

Academic Accommodations for Students with Disabilities

The College is committed to providing appropriate and reasonable academic accommodations to students with disabilities (i.e. physical, depression, learning, etc). If you have a disability, the [Centre for Accessible Learning](#) (CAL) can help you document your needs, and where disability-related barriers to access in your courses exist, create an accommodation plan. By making a plan through CAL, you can ensure you have the appropriate academic accommodations you need without disclosing your diagnosis or condition to course instructors. Please visit the CAL website for contacts and to learn how to get started:

<http://camosun.ca/services/accessible-learning/>

Academic Integrity

Please visit <http://camosun.ca/about/policies/education-academic/e-1-programming-and-instruction/e-1.13.pdf> for policy regarding academic expectations and details for addressing and resolving matters of academic misconduct.

Academic Progress

Please visit <http://camosun.ca/about/policies/education-academic/e-1-programming-and-instruction/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 <http://camosun.ca/about/policies/education-academic/e-2-student-services-and-support/e-2.2.pdf> for further details about course withdrawals. For deadline for fees, course drop dates, and tuition refund, please visit <http://camosun.ca/learn/fees/#deadlines>.

Grading Policy

Please visit <http://camosun.ca/about/policies/education-academic/e-1-programming-and-instruction/e-1.5.pdf> for further details about grading.

Grade Review and Appeals

Please visit <http://camosun.ca/about/policies/education-academic/e-1-programming-and-instruction/e-1.14.pdf> for policy relating to requests for review and appeal of grades.

Mandatory Attendance for First Class Meeting of Each Course

Camosun College requires mandatory attendance for the first class meeting of each course. If you do not attend, and do not provide your instructor with a reasonable reason in advance, you will be removed from the course and the space offered to the next waitlisted student. For more information, please see the "Attendance" section under "Registration Policies and Procedures" (<http://camosun.ca/learn/calendar/current/procedures.html>) and the Grading Policy at <http://camosun.ca/about/policies/education-academic/e-1-programming-and-instruction/e-1.5.pdf>.

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. Please visit

<http://camosun.ca/about/policies/education-academic/e-2-student-services-and-support/e-2.8.pdf> to learn more about the process involved in a medical/compassionate withdrawal.

Sexual Violence and Misconduct

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 or misconduct 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 and Misconduct Policy: <http://camosun.ca/about/policies/education-academic/e-2-student-services-and-support/e-2.9.pdf> and camosun.ca/sexual-violence. To contact the Office of Student Support: oss@camosun.ca or by phone: 250-370-3046 or 250-3703841

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 <http://camosun.ca/about/policies/education-academic/e-2-student-services-and-support/e-2.5.pdf> to understand the College's expectations of academic integrity and student behavioural conduct.

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.