



**CAMOSUN COLLEGE**  
**School of Arts & Science**  
**Department of Chemistry & Geoscience**

**CHEM-230-002 (A,B,C)**  
**Organic Chemistry 1**  
**Fall 2019**

## **COURSE OUTLINE**

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The course description is online @ <http://camosun.ca/learn/calendar/current/web/chem.html>

⚡ Please note: This outline will not be kept indefinitely. It is recommended students keep this outline for their records, especially to assist in transfer credit to post-secondary institutions.

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### **1. Instructor Information**

(a) Instructor	Larry Lee
(b) Office hours	M (10:00–11:30) W and F (10:00–11:30)
(c) Location	F344B
(d) Phone	250–370–3463 <b>Alternative:</b> _____
(e) E-mail	leel@camosun.bc.ca
(f) Website	Online.camosun.ca (Desired 2 learn – D2L)

### **2. Intended Learning Outcomes**

Upon completion of this course the 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.

### 3. Required Materials

(a)	Texts	Organic chemistry, Mechanistic Patterns, Ogilvie, 1 <sup>st</sup> edition
(b)	Lab	Lab Manual Chem 230, Camosun College, 2018, by Nasr Khalifa
(c)	Other	Student solution manual to the textbook is recommended. A molecular model set is highly recommended. Lab coat is required Safety glass is required

### 4. Course Content and Schedule

Hours of Delivery: 3 hour of lectures and 3 hours of labs. Duration: 15 weeks.		
<b><u>Lectures (001 A,B,C)</u></b>		
12:00-13:20: W, F (F 210)		
<b><u>Labs (A group)</u></b>	<b><u>Labs (B group)</u></b>	<b><u>Labs (C group)</u></b>
10:30 – 13:20 Tue	18:00 – 20:50 Wed	12:00 – 14:50 Thurs
All labs are in <b>F354</b> unless otherwise noted on the F354 door. <b><u>You must go to your registered lab section</u></b> . Only a medical note will grant you permission to work in a non registered lab. Estimated out-of-class: at least 6 hours per week.		

#### 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 ( $\sigma$ ,  $\pi$ ) 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. $\pi$ -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 ( $\text{Cl}_2$ ,  $\text{Br}_2$ , 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)

$\text{S}_{\text{N}}2$  reactions, mechanism, stereochemistry, nucleophilicity, structure of electrophile (p 497 – 510).

$\text{S}_{\text{N}}1$  reactions, mechanism, carbocation stabilization and rearrangement, structure of electrophile, leaving group (halides, sulfonate esters), stereochemistry (p510-520). Solvent effects on nucleophilicity (p521 – 522). Predicting  $\text{S}_{\text{N}}1$  and  $\text{S}_{\text{N}}2$  reactions (p523- p525). Other: Energy diagrams, transition states

Elimination reactions  $\text{E}2$  (P541-552), regioselectivity, Zaitsev product (p542-545), Hofmann product (545-547). Stereochemistry of  $\text{E}2$  (Antiperiplanar) (P547-552).

Elimination reactions  $\text{E}1$  ( p552-556) , regioselectivity, rearrangements. Dehydration and

Dehydrohalogenation (557).  $\text{S}_{\text{N}}1$ ,  $\text{S}_{\text{N}}2$ ,  $\text{E}1$  or  $\text{E}2$  (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)

## 5. Basis of Student Assessment (Weighting)

(a)	On-line assignment	10 %	D2L online quizzes
(b)	Exams (3)	Test 1 – 15%	Oct 11, 2019 (lec 1.5 h)
		Test 2 – 15 %	Nov 29, 2019 (lec 1.5 h)
		Final Exam – 35%	Dec 9 - Dec 20, 2018
(c)	Lab experiment	15% (report) 10% (work sheets)	Due one week after completion of lab

**Class attendance is mandatory.**

**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 given 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.

**At least 75% of the lab** must be completed and a passing grade obtained in order to write the final exam.

You must pass both lecture and lab portion in order to pass the course.  
The final exam at the end of the course will cover all course material.

You must provide your own **safety glasses**. Prescription glasses are OK, but sunglasses are **NOT**. You must wear safety glasses at all times while you are in the lab. You will not be allowed to carry out any experiments without safety glasses or footwear that are noncompliant (sandals, flip flops or open toe shoes).

**Lab reports must be handed in no later than one week after the completion of the experimental. No ungraded lab reports will be accepted after the return of graded reports.**

Some lab classes will be used for lectures and tutorials (please note dates on lab schedule)

## 6. Grading System

- Standard Grading System (GPA)
- Competency Based Grading System

## 7. Recommended Materials to Assist Students to Succeed Throughout the Course

The materials for this CHEM 230 and CHEM 231 are purchased as a package that contains the hardcover textbook by Ogilvie, 1<sup>st</sup> edition, the student solution manual, and the on-line e-text book by Ogilvie. Within the on-line component is Chemistry animations and on-line quizzes. There are also self-assess assignments with answers posted on desired to learn (D2L).

Alternative on-line sources are Khan Academy and a virtual organic chemistry textbook.

<https://www2.chemistry.msu.edu/faculty/reusch/virttxtjml/intro1.htm>

A chemistry drawing program is available in all the computers in F358.

The program is called Accelrys draw.

Alternatively, I am available outside my office hours. Please email to schedule appointment.

## 8. College Supports, Services and Policies



### Immediate, Urgent, or Emergency Support

If you or someone you know requires immediate, urgent, or emergency support (e.g. illness, injury, thoughts of suicide, sexual assault, etc.), **SEEK HELP**. Resource contacts @

<http://camosun.ca/about/mental-health/emergency.html> or <http://camosun.ca/services/sexual-violence/get-support.html#urgent>

### College Services

Camosun offers a variety of health and academic support services, including counselling, dental, disability resource centre, help centre, learning skills, sexual violence support & education, library, and writing centre. For more information on each of these services, visit the **STUDENT SERVICES** link on the College website at <http://camosun.ca/>

### College Policies

Camosun strives to provide clear, transparent, and easily accessible policies that exemplify the college's commitment to life-changing learning. It is the student's responsibility to become familiar with the content of College policies. Policies are available on the College website at <http://camosun.ca/about/policies/>. Education and academic policies include, but are not limited to, Academic Progress, Admission, Course Withdrawals, Standards for Awarding Credentials, Involuntary Health and Safety Leave of Absence, Prior Learning Assessment, Medical/Compassionate Withdrawal, Sexual Violence and Misconduct, Student Ancillary Fees, Student Appeals, Student Conduct, and Student Penalties and Fines.

A. GRADING SYSTEMS <http://camosun.ca/about/policies/index.html>

The following two grading systems are used at Camosun College:

1. Standard Grading System (GPA)

Percentage	Grade	Description	Grade Point Equivalency
90-100	A+		9
85-89	A		8
80-84	A-		7
77-79	B+		6
73-76	B		5
70-72	B-		4
65-69	C+		3
60-64	C		2
50-59	D		1
0-49	F	Minimum level has not been achieved.	0

2. Competency Based Grading System (Non GPA)

This grading system is based on satisfactory acquisition of defined skills or successful completion of the course learning outcomes

Grade	Description
COM	The student has met the goals, criteria, or competencies established for this course, practicum or field placement.
DST	The student has met and exceeded, above and beyond expectation, the goals, criteria, or competencies established for this course, practicum or field placement.
NC	The student has not met the goals, criteria or competencies established for this course, practicum or field placement.

B. Temporary Grades

Temporary grades are assigned for specific circumstances and will convert to a final grade according to the grading scheme being used in the course. See Grading Policy at <http://camosun.ca/about/policies/index.html> for information on conversion to final grades, and for additional information on student record and transcript notations.

Temporary Grade	Description
I	<i>Incomplete:</i> A temporary grade assigned when the requirements of a course have not yet been completed due to hardship or extenuating circumstances, such as illness or death in the family.
IP	<i>In progress:</i> A temporary grade assigned for courses that are designed to have an anticipated enrollment that extends beyond one term. No more than two IP grades will be assigned for the same course.
CW	<i>Compulsory Withdrawal:</i> A temporary grade assigned by a Dean when an instructor, after documenting the prescriptive strategies applied and consulting with peers, deems that a student is unsafe to self or others and must be removed from the lab, practicum, worksite, or field placement.