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

CHEM-230-001 (A and B)
Organic Chemistry 1
Winter 2020

COURSE OUTLINE

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

Ω *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	Dr. Ryan Fradette		
(b) Office hours	M (10:20-12:20), Thurs (3:20-5:20), or by appointment		
(c) Location	F344A		
(d) Phone	250−270−3446	**Alternative:**	
(e) E-mail	fradetter@camosun.bc.ca		
(f) Website	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, 1st 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 glasses are required

4. Course Content and Schedule

Hours of Delivery: 3 hour of lectures and 3 hours of labs. Duration: 15 weeks.

Lectures (001 A,B)

1:30-2:20: Mon F334,Tues F310,Thurs F310

Labs (B group)	**Labs (A group)**
12:30 – 15:20 Wed	18:00 – 20:50 Wed

All labs are in **F354** unless otherwise noted on the F354 door**. You must go to your registered lab section** . Estimated out-of-class: at least 3 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 (σ, π), bonds (p.11). Bond polarity, polar covalent bonds, electronegativity (p12-13), Molecular shape, VSEPR (p14-19). Valence bond theroy, hybrid orbitals (p19-26). Resonance structures (p26-32).
Not covered in CHEM 120- representation of organic molecules (condensed structure, HONC rule). Line, wedge and hash structures (p34-38).

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

Hydrocarbons and heteroatom functional groups (p45-53), 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 (conformational analysis) (Chapter 3)
Conformational analysis (rotation about single bonds in acyclic molecules).
Newman's projection (p87-92) * Torsional strain and steric strain in acyclic molecules
Strain in cyclic molecules (p98- 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 (Geometic, configurational. E, Z) (p160-162)
Physical properties of enantiomers and diasteromers (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

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. π-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 (Cl_2, 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, Anti-Markovnikov addition (p384, 385). Hydrogenation of alkyne to alkane or to alkene (p385, 996-998)
Summary (p386-387)
Double dehydrohalogenation reaction (alkene to alkyne)
Cycloaddition: Ozonolysis (p1036), Osmium Tetroxide dihydroxylation (p 1036-1037), Permanganate 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)

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

5. Basis of Student Assessment (Weighting)

(a)	Quizzes	10 %	3 quizzes (best 2/3 quiz grades will be counted). Wed Jan 29 Tues March 17 Wed Apr 8
(b)	Midterm Exams	Midterm 1 - 15% Midterm 2 - 15%	Feb 12, 2019 (In lab 2h) Mar 25, 2019 (in lab 2h)
(c)	Lab experiments and Worksheets	25%	Due one week after completion of lab
(d)	Final Exam	35%	April 14-22, TBA

Lab attendance is mandatory.

Midterm exams cannot be rewritten, the weight of any missed midterm exam will be transferred to the cumulative final exam. If it is advantageous to the student the Exam mark will be solely derived from the final examination, or a combination of midterm(s) and final.

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.

You may not be allowed to carry out any experiments without safety glasses, lab coat, or footwear that is 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 (10% late penalty, up to 1 week). No ungraded lab reports will be accepted after the return of graded reports.

Some lab classes will be used for midterm exams or tutorials (please note dates on lab schedule)

6. Grading System

[X] 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, 1st 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−assessed assignments with answers posted on D2L.

An excellent online organic basic organic nomenclature practice tool is available for free at http://www.chem.ucalgary.ca/courses/351/WebContent/orgnom/structureToName.html

An alternative 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.

Old editions of various organic chemistry textbooks are available in F358

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	*Incomplete*: 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	*In progress*: 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	*Compulsory Withdrawal*: 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.