CAMOSUN COLLEGE	**School of Arts & Science** **CHEMISTRY AND GEOSCIENCE DEPARTMENT** **CHEM 230-01** **Organic Chemistry 1** **Fall 2014**

COURSE OUTLINE

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

Ω *Please note: this outline will be electronically stored for five (5) years only. It is strongly recommended students keep this outline for your records.*

1. Instructor Information

(a)	Instructor:	Dr. Nasr Khalifa		
(b)	Office Hours:	M, T, Th 9:30am-10:20am, W, F 10:30-11:20am, T 1:30-2:20pm, and Th 11:30am-12:20pm		
(c)	Location:	F348C		
(d)	Phone:	250-370-3201	Alternative Phone:	
(e)	Email:	khalifa@camosun.bc.ca		
(f)	Website:	http://faculty.camosun.ca/nasrkhalifa		

Course 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, alkenes, and alkynes. The laboratory experiments are designed to expose students to a wide range of organic laboratory techniques.

Credits: 4

Mode and Hours of Delivery: 3 hours of lectures and 3 hours of labs.
Duration: 15 weeks, estimated out-of-class: at least 5 hours per week.

Pre-requisites: ***Chem120 (or Chem112 with a B and permission of the Chair)***
Pre/Co-requisite: Chem121

Prior Learning Assessment Available: Yes

2. Intended Learning Outcomes

(No changes are to be made to this section, unless the Approved Course Description has been forwarded through EDCO for approval.)

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" Eighth Edition, by John McMurry
(b)	Other	"Organic Chemistry Experiments for Chemistry 230 and 231" by N. Khalifa and R. Raap (2014) *****Both texts are REQUIRED*****

4. Course Content and Schedule

Detailed Course Outline:

1. Review and Preview:
Chemical Bonding (Chapters 1, 2); Acid and Base Theory As It Relates To Organic Chemistry (Chapter 2); Alkanes and Cycloalkanes (Chapter 3); Overview of Organic Reactions (Chapter 6)
*** lectures are scheduled to cover topics that were not covered in Chem121, a review problem set will be given)**

-Structural theory of organic chemistry, Lewis structures, Exceptions to the octet rule, formal charges, Atomic orbitals, molecular orbitals, Resonance, hybridization, Molecular geometry, polar and nonpolar molecules, Carbon-carbon covalent bonds, Aromaticity, Functional groups; classification of organic compounds into families, Organic reactions and mechanisms
-Acid and base reactions, Homolysis and heterolysis of bonds to carbon, Use of curved arrows in reaction mechanisms, Carbocations and carboanions, The strength of acids and bases, K_a and pK_a
-Relationship between structure and acidity, Effect of the solvent on acidity, protic and aprotic solvents, Acids and bases in non-aqueous solutions
-IUPAC nomenclature, Physical properties of alkanes and cycloalkanes, Bicyclic and polycyclic alkanes, Synthesis of alkanes and cycloalkanes, Reactions of alkanes

2. Stereochemistry and Chirality: (Chapters 3.6-3.7, 4, 5, 7.4-7.5)
-Conformational analysis of ethane, propane, and butane
-Ring strain in cycloalkanes
-Conformations of cyclohexanes
-Isomerism: constitutional isomers and stereoisomers

-Enantiomers and chiral molecules
-Nomenclature of enantiomers, the R-S system
-Optical activity
-Diastereomers, Fischer projection formulas
-The E, Z designation in alkenes
-Separation of enantiomers; resolution
-Compounds with stereocenters other than carbon

3. Nucleophilic Substitution and Elimination Reactions: (Chapters 10.1, 10.7, 11)
-Organic halides, physical properties
-Nucleophilic substitution reactions, nucleophiles, leaving groups
-Themodynamic and kinetic control of reactions, transition state theory, energy diagrams
-Mechanism for S_N1 and S_N2 reactions, stereochemistry
-Factors affecting the rates of S_N1 and S_N2 reactions, solvent effects
-Elimination reactions of alkyl halides, the E2 and the E1 reactions
-Substitution versus elimination
-Functional group transformations using the S_N2 reaction

4. Spectroscopy: (Chapters 12, 14.7– 14.9)
-The electromagnetic spectrum
-Absorption spectra, transitions between electronic energy levels
-Ultraviolet spectroscopy, relationship between structure and λ_{max}
-Infrared spectroscopy, molecular vibrations and absorption frequencies,
-IR spectra of alcohols, aldehydes, ketones, carboxylic acids, esters, aromatic compounds
-Mass spectrometry, molecular ions, fragmentation patterns, isotopes
-Use of UV/VIS, IR, and MS spectra to elucidate structures of organic compounds

5. Free Radical Reactions: (Chapter 10.2 – 10.4)
-Homolytic bond dissociation energies
-Reactions of alkanes with halogens
-Chlorination of methane, mechanism
-Halogenation of higher alkanes,
-Geometry of alkyl radicals, stereochemistry of the reactions
-Selectivity in radical substitution reactions
-Radical polymerization

6. Alkenes and Alkynes: (Chapters 7, 8, 9)
-Structure and nomenclature
-Physical properties: stability, boiling point, solubility
-Preparation of alkenes and alkynes
-Polar additions to the carbon-carbon multiple bond: ionic addition, carbocations, addition of halogens,
  -Markovnikov's Rule, Anti-Markovnikov addition of HBr
  -hydration using mercuric acetate, hydroboration, addition of carbenes
-Catalytic hydrogenation: the catalyst, stereochemistry
-Oxidation of alkenes: conversion to diols, cleavage of the double bond
-Alkynes as acids, hydration of alkynes, reduction of alkynes
-Conjugated dienes: 1,2- and 1,4-additions, thermodymanic versus kinetic control **(Chapter 14.2-14.3)**
-The Diels-Alder reaction, stereochemistry **(Chapter 14.4-14.5)**
-Synthetic methodology and applications

7. Alcohols: (Chapter 17, omit phenols; their chemistry will be covered later)
-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
-Acidity and basicity of alcohols
-Reactions of alkoxide ions
-Mesylates and tosylates
-Concept of protecting groups, 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

8. Ethers and Epoxides: (Chapter 18.1 – 18.3, 18.5-18.7)
-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

Chem. 230 Lab Schedule (Fall 2014)
(subject to change)

Week of Sept. 2-5	No labs. Review problem sets
Week of Sept. 8-12	Review/conformations
Week of Sept. 15-19	Exp. 7, stereochemistry and models (week 1)
Week of Sept. 22-26	**Test # 1 (2.5hrs)**
Week of Sept.29-Oct.3	Exp. 1, melting point determination
Week of Oct. 6-10	Exp. 7, stereochemistry and models (week 2)
Week of Oct. 14-17	Spectroscopy I
Week of Oct. 20-24	**Test # 2 (2.5hrs)**
Week of Oct. 27-31	Spectroscopy II (problem set worth 2 lab reports)
Week of Nov. 3-7	Spectroscopy III
Week of Nov.10-14	No Labs (Remembrance day, Nov. 11) **Spectroscopy problem set is due on Nov. 13**
Week of Nov. 17-21	**Test # 3 (2.5hrs)**
Week of Nov. 24-28	Exp. 3, recrystallization and sublimation
Week of Dec. 1-5	No labs. Review/lecture

Grades:

Lab experiments	**30%**
Test 1 Tue. Sept. 23 or Thurs. Sept. 25 (2.5 hrs)	**10%**
Test 2 Tue. Oct. 21 or Thurs. Oct. 23 (2.5 hrs)	**10%**
Test 3 Tue. Nov. 18 or Thurs. Nov. 20 (2.5 hrs)	**10%**
Final Examination (Dec., 3 hrs)	**40%**

	100%

*Final exam at the end of the course will cover **all** course material.
*At least a passing grade on lab marks must be achieved in order to write the final exam.
*You must pass both the lecture portion and the lab portion in order to pass the course.
*You must provide your own **safety glasses**. Prescription glasses are OK, but sunglasses are NOT. You must wear these safety glasses at all times while you are in the lab. You will not be allowed to carry out any experiments without safety glasses.
*Office hours are posted on the door. You can, however, drop by the office any time. You will not be wasting my time if you come for help. I'm here to help you learn.

5. Basis of Student Assessment (Weighting)

(Should be linked directly to learning outcomes.)

(a)	Assignments	**Lab experiments**	**30%**
(b)	Quizzes		
(c)	Exams	**Test 1 Tue. Sept. 23 or Thurs. Sept. 25 (2.5 hrs)** **Test 2 Tue. Oct. 21 or Thurs. Oct. 23 (2.5 hrs)** **Test 3 Tue. Nov. 18 or Thurs. Nov. 20 (2.5 hrs)** **Final Examination (Dec., 3 hrs)**	**10%** **10%** **10%** **40%** **--------** **100%**
(d)	Other (eg, Attendance, Project, Group Work)		

6. Grading System

(No changes are to be made to this section, unless the Approved Course Description has been forwarded through EDCO for approval.)

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	Minimum level of achievement for which credit is granted; a course with a "D" grade cannot be used as a prerequisite.	1
0-49	F	Minimum level has not been achieved.	0

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 E-1.5 at **camosun.ca** 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, due to design may require a further enrollment in the same course. No more than two IP grades will be assigned for the same course. *(For these courses a final grade will be assigned to either the 3rd course attempt or at the point of course completion.)*
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.

7. Recommended Materials or Services to Assist Students to Succeed Throughout the Course

LEARNING SUPPORT AND SERVICES FOR STUDENTS

There are a variety of services available for students to assist them throughout their learning. This information is available in the College calendar, at Student Services or the College web site at http://camosun.ca.

STUDENT CONDUCT POLICY

There is a Student Conduct Policy **which includes plagiarism**.
It is the student's responsibility to become familiar with the content of this policy. The policy is available in each School Administration Office, at Student Services and on the College web site in the Policy Section.
http://camosun.ca/about/policies/policies.html

Organization of the Lab Report

Title of the experiment: State the title of the experiment you have just carried out.

Date: Write the date on which you did the experiment.

Name: Your name and lab partner's name (if applicable)

Objective: State what you want to achieve by doing the experiment in one or two sentences. Be very brief and to the point.

Procedures: You can write the following: Please refer to Chem. 230/231 lab manual, 2014 Edition. pp. xx-xx. Record any changes to the given procedures.

Data: Organize any data, whether numerical or descriptive, in a **neat table** (or tables if applicable). Report masses of products and their melting points (include the CRC handbook values for comparison). Any relevant data recorded on a rough data sheet should be copied here. Do not forget to write **chemical equations** here.

Discussion and Calculations: In this part of the report, you will make sense out of the data you have obtained. If you obtain a product, calculate the **percentage yield**. (yield, m.pt. are worth one mark each). Provide a physical description of your product. Show **all** the calculations you do, but there is no need to be repetitive. For example, if you perform 3 or 4 titrations using the same two solutions, then you only need to show the calculation for one trial. In cases where you have not obtained the results you were hoping for, provide a very brief explanation.

Conclusion: In no more than two sentences, state what you have achieved by doing the experiment. (Example: The reduction of nitrobenzene using Sn in aqueous HCl, followed by treatment with acetic anhydride, gave acetanilide in 72% yield. The melting point of the recrystallized product is 111-113 ^{o}C).

Answers To Questions: In cases where questions are asked during or at end of experimental procedures, provide the answers here.

* Lab reports should be written in **ink, including all calculations**. The report does not have to be typed. If you are not using a computer to graph data, use graph paper. If your report does not follow the format given above, it may be deemed unacceptable and you may have to resubmit it. The new report will be considered late if it is not submitted on the same due date (see below).
* Lab reports are normally due one week after the assigned date for the experiment. You will be informed in advance if there are any changes to the due date.
* The report is marked out of 10. For every day the report is late, you lose 1 (one) mark.
* Make sure to **staple** the pages of your report together, including any **rough data sheets**. You lose 1 (one) mark if the pages of your report are not stapled together.