

CURRICULUM GUIDE: OFFICIAL COURSE OUTLINE

Course Code	CHEM 201	Course Title	Organic Chemistry I			
Credit Value	4	Department	Mathematics and Science			
No. of weeks	14	Hrs. per week	<i>Lecture</i>	<i>Tutorial</i>	<i>Laboratory</i>	<i>Total</i>
			3	0	3	6
Course Description	Students will study the fundamental aspects of modern organic chemistry as illustrated by the structure, physical and spectroscopic properties and reactions of alkanes, cycloalkanes, alkenes, dienes, alkynes, halogen compounds, alcohols, ethers, aldehydes and ketones. The laboratory component is designed to complement the lecture material and give students experience with basic analytical techniques.					
Prerequisite(s)	ENGL 099, CHEM 102					
Initial Articulation Targets	<i>UBC</i>	<i>SFU</i>	<i>UVic</i>	<i>UNBC</i>	<i>TRU</i>	
	CHEM_V 2nd (4); ALEX CHEM 201 (4) & ALEX CHEM 202 (4) = UBCV CHEM_V 213 (3) & UBCV CHEM_V 223 (3)	CHEM 281 (4), Q	CHEM 231 (1.5)	CHEM 1XX (4); ALEX CHEM 201 (4) & ALEX CHEM 202 (4) = UNBC CHEM 201 (3) & UNBC CHEM 203 (3) & UNBC CHEM 250 (1) & UNBC CHEM 251 (1)	CHEM 2120 (3)	
	For updated information on the transferability of this course, please consult the BC Transfer Guide, www.bctransferguide.ca					
Learning Outcomes	<p>Upon successful completion of this course, the student will be able to:</p> <ul style="list-style-type: none"> Recognize and name organic compounds using the IUPAC system of nomenclature Recognize and name functional groups. Explain the effects of intermolecular forces on the physical properties of organic compounds. Solve problems dealing with the structural basis of organic chemistry. Describe the conditions and products formed in important organic reactions. Describe the mechanisms of the important organic reactions using the correct conventions to represent the movement of electrons. Determine the identity of organic compounds based on spectroscopic evidence. Solve synthetic problems in which simple organic compounds are converted into more complex compounds. Use the knowledge of functional groups to predict their reactivity in organic reactions. 					



Content	Core topics – all of the following will be covered:
	Introduction and Review
	<ul style="list-style-type: none">• Atomic structure, electronegativity, bonding, bond lengths and angles• Bond dissociation energy, polarity of bonds and molecules and intermolecular forces• Acids and bases, molecular orbitals, hybrid orbitals, resonance and functional groups
	Nomenclature, Isomerism and Stereochemistry
	<ul style="list-style-type: none">• IUPAC nomenclature of the important functional groups and structural isomers• Stereochemistry of alkenes and cycloalkanes (cis/trans, E/Z)• Conformational analysis of acyclic compounds (Newman projections)• Ring strain and the conformational analysis of cyclic compounds• Chirality (R/S), optical activity, enantiomers, diastereomers, meso compounds and racemic mixtures• Optical purity, enantiomeric excess and the resolution of racemic mixtures
	Spectroscopy
	<ul style="list-style-type: none">• Determination of the structure of unknown organic compounds from mass spectral data• Determination of the structure of unknown organic compounds from infrared and nuclear magnetic resonance spectral data• Prediction of the infrared and nuclear magnetic resonance spectral data for a specific organic compound
	Overview of Organic Reactions
	<ul style="list-style-type: none">• Common organic reaction types (addition, elimination, substitution, rearrangement and redox)• Reaction mechanisms (polar and free radical reactions) and reactive intermediates• Energy diagrams, reaction kinetics and thermodynamics
	Alkenes and Alkynes
<ul style="list-style-type: none">• Relative stability of alkenes• Electrophilic addition reactions of alkenes, alkynes and dienes• Reduction and oxidation reactions of alkenes, acidity of alkynes• Regioselectivity and stereoselectivity of addition reactions	
Alkyl Halides	
<ul style="list-style-type: none">• Synthesis from alkanes via free radical halogenation• Nucleophilic substitution reactions (SN1/SN2)• Elimination reactions (E1/E2/E1cB)• Synthesis of organometallic compounds (Grignard/Gilman reagents)• Organometallic coupling reactions	
Alcohols	
<ul style="list-style-type: none">• Substitution, elimination and oxidation of alcohols	



	<ul style="list-style-type: none">• Formation of alkoxides/phenoxides and the preparation of ethers• Synthesis and cleavage reactions of epoxides <p>Aldehydes and Ketones</p> <ul style="list-style-type: none">• Oxidation and reduction reactions of carbonyl compounds• Reactions with Grignard reagents <p>Additional topics may also be covered, at the discretion of the instructor.</p> <p>Labs (8 from the following list):</p> <ul style="list-style-type: none">• Simple Distillation• Fractional Distillation: Boiling Point and Refractive Index• Liquid-Liquid Extraction: Separation of a Phenol/Acid/Neutral Mixture• Synthesis of tert-Butyl Chloride (SN1) and Synthesis of 1-Bromobutane (SN2)• Analysis by Thin Layer Chromatography• Electrophilic Addition Reaction: Bromination of Alkenes• Recrystallization and Melting Point• Isolation of Caffeine from Tea• Isolation of Eugenol: Steam Distillation of Clove Oil• Analysis of Eugenol by IR and UV• Oxidation of an Alcohol: Borneol to Camphor. Purification by Sublimation• Reduction of a Ketone: Camphor to Isoborneol
Methods of Instruction	Lectures, group discussions, problem solving, hands-on labs, quizzes, assignments, labs, simulations
Required Textbook(s)	The following textbook(s) is/are required, or approved equivalent(s). Klein, David R. Organic Chemistry. 4th Edition, Wiley, 2020. LibreTexts Chemistry. https://chem.libretexts.org/ Liu, Xin. Organic Chemistry I. KPU, 2021. McMurry, John E. Organic Chemistry. 9th Edition, Cengage Learning, 2016. Soderberg, Timothy. Organic Chemistry with a Biological Emphasis Volume I and II. Open Textbook Library. 2022.
Required Equipment and Technology	Students are required to have a computer with internet access. The following resources are provided by the College: <ul style="list-style-type: none">• Office 365• Student email
Homework Hours	At minimum, students can expect one hour of homework for every hour of instructional time.



	<i>Component</i>	<i>% Value</i>	
Evaluation	Quizzes and assignments	10-15%	
	Laboratory experiments and activities	15-20%	
	• Weight divided over 8 labs		
	Midterm exam (2)	30-40%	
	Comprehensive final exam	30-35%	
Completion Requirements	The minimum grade to pass this course is D (50%). Unless otherwise stated, a minimum grade of C- (55%) is required for this course to fulfil a prerequisite.		
Course Designer(s)	Patrick Duffy, Ph.D. Department of Chemistry, Kwantlen Polytechnic University	Consultant(s), <i>if applicable</i>	
Dean's Approval	Barbara Moon, Ph.D., Dean of Arts and Sciences, Alexander College	Dean's Approval Date	June 10, 2015
Curriculum Committee Approval Date	June 10, 2015	First Term Offered	Fall 2016
Last Review Date	September 1, 2024	Next Review Date	September 1, 2029
Revision History	<p>January 24, 2020 -Review and minor revision of topics, texts, and evaluation weighting by Jason Mirzaei, Ph.D. and Miriam Grob, Ph.D. faculty, Chemistry discipline, Alexander College, and Patrick Duffy, Ph.D. Department of Chemistry, Kwantlen Polytechnic University.</p> <p>September 1, 2024 - Lab assignments and assessments detailed by Kelly Cheung.</p>		