

Tompkins Cortland Community College
Master Course Syllabus

Course Discipline and Number: CHEM 206
Course Title: General Chemistry II

Year: 2024-2025
Credit Hours: 4

Attendance Policy: *To maintain good grades, regular attendance in class is necessary. Absence from class is considered a serious matter and absence never excuses a student from class work. It is the responsibility of all instructors to distribute reasonable attendance policies in writing during the first week of class. Students are required to comply with the attendance policy set by each of their instructors. Students are not penalized if they are unable to attend classes or participate in exams on particular days because of religious beliefs, in accordance with Chapter 161, Section 224-a of the Education Law of the State of New York. Students who plan to be absent from classroom activity for religious reasons should discuss the absence in advance with their instructors. See college catalog for more information.*

Services for Students with Disabilities: *It is the College's policy to provide, on an individual basis, appropriate academic adjustments for students with disabilities, which may affect their ability to fully participate in program or course activities or to meet course requirements. Students with disabilities should contact the Coordinator of Access and Equity Services, to discuss their particular need for accommodations. All course materials are available in alternate formats upon request.*

Course Description

This course is designed to develop and build upon the basic background in organic chemistry learned in CHEM 205. The following topics will be covered: general synthesis, reaction and reaction mechanisms of major organic functional groups: alcohols, ethers, carbonyl compounds [aldehydes, ketones, carboxylic acids and their derivatives, beta di keto compounds, amino compounds, heterocyclic aromatic compounds, and various biological compounds. In addition, Aromatic compounds, the rule of aromaticity and the preparation, reaction, and reaction mechanism of Electrophilic Substitution and Nucleophilic addition. Emphasis will be placed on reaction mechanisms and a survey of biological macromolecules. Brief details about the structure of Carbohydrates, Proteins, Lipids, and Nucleic acids. In addition, of DNA and RNA Sequences, and the Polymerase Chain Reaction (PCR). CHEM 206 fulfills the SUNY General Education Natural Sciences requirement. Prerequisites: CHEM 205; RDNG 116 if required by placement testing; prior completion or concurrent enrollment in ENGL 100. 4 Cr. (3 Lec., 3 Lab.)

Course Context/Audience

This is a higher level chemistry course that is required in the Biotechnology, A.S. degree program. It is appropriate for students planning to transfer to a baccalaureate major in biology, chemistry, physical therapy and for those preparing to matriculate in a chiropractic, physician assistant, or nursing program. It should be accepted as the first course in a two semester sequence of Organic Chemistry for transfer credit.

Basic Skills/Entry Level Expectations

Writing:	WC	College level writing skills are required. See course co-requisites or pre-requisites.
Math:	MC	College level math skills – Course requires college level math skills. See course description for co-requisite and/or prerequisite requirement(s).
Reading:	R4	Before taking this course, students must satisfactorily complete RDNG 116 or have assessment indicating that no reading course was required.

Course Goals

As a result of successfully completing this course, the student will:
1. Master the identification of various organic functional groups, their reactions mechanism.
2. Be expected to demonstrate mastery of the principles of stereochemistry and spectroscopy with all functional groups.
3. Become familiar with and pass standardized-type tests containing organic chemistry problems.
4. Continue to practice safe laboratory principles and procedures.
5. Master the basic techniques of organic synthesis in the laboratory.
6. Become more independent in practicing general laboratory techniques, including preparation of solutions.

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Course Objectives/Topics

Objective/Topic	# Hours
Review of organic chemical reactions, general functional groups, organic reactions, aromaticity, reaction of aromatic compounds, organic molecules in action	3 Hours
Reactions of aromatic compounds, electrophilic substitution reactions, general mechanisms of reactions, theory of the effect of substituents on reactivity and orientation	3 Hours
Aldehydes and ketones I: nucleophilic addition to the carbonyl group, synthesis and physical and chemical properties of aldehydes and ketones, addition reactions of alcohols, amines and organometallic reagents	3 Hours
Aldehydes and ketones II: aldol reactions, keto and enol tautomers, cyclizations, synthesis of alpha, beta-unsaturated carbonyl compounds. Carbonyl alpha substitution reactions.	3 Hours
Carboxylic acids and their derivatives: Nucleophilic addition-elimination at the acyl carbon, nomenclature, preparation, physical and chemical properties, anhydrides, decarboxylation	3 Hours
Synthesis and reactions of beta-dicarbonyl compounds, enolate ion chemistry, condensation reactions, ester synthesis, alkylation of esters, nitriles and dithianes	3 Hours
Amines nomenclature, physical and chemical properties, preparation and reaction of amines, replacement and coupling reactions, sulfa drugs	3 Hours
Alcohol, Phenols and aryl halides: nucleophilic substitutions structure and nomenclature, synthesis and reactions, Claisen rearrangement	3 Hours
Carbohydrates synthesis, degradation, and reactions of monosaccharides, mutarotation, oxidation, and reduction reactions	3 Hours
Lipids fatty acids, terpenes, steroids, prostaglandins, phospholipids, waxes	3 Hours
Amino acids and proteins, synthesis of α -amino acids, primary, secondary, tertiary and quaternary structure of proteins, enzymes, hemoglobin	3 Hours
Nucleic acids, Synthesis of nucleosides, nucleotides and oligonucleotides, RNA and DNA sequences, PCR	3 Hours
General Overview, Chemical Structure - Biological Activity Relationships	3 Hours
Tests and quizzes during the semester	5 Hours
Final Exam	3 Hours
Laboratory Exercises □ Introduction: Organic chemistry lab safety, techniques and methods used in preparation, purification and identification:	
Lab 1 Introduction Organic chemistry lab safety, techniques and methods used in preparation, purification, separation, and identification.	4 Hours
Lab 2 Preparation of p-aminobenzoic acid (PABA): sulfa drugs Synthesis of a vitamin, amide formation, oxidation, amide hydrolysis	4 Hours
Lab 3 Preparation of methyl orange – synthetic dyes Diazotization, diazonium coupling, azo dyes	4 Hours
Lab 4 Polymers and Polymerization: Addition, condensation, and cross-linked polymers. Preparation of different polymers.	4 Hours
Lab 5 Luminol: Fireflies and Photochemistry Chemiluminescence, energy transfer, reduction of a nitro group	4 Hours
Lab 6 Organic Qualitative Analysis A Solubility test	4 Hours
Lab 7 Organic Qualitative Analysis B Tests for the elements nitrogen, sulfur, halides x	4 Hours
Lab 8 Organic Qualitative Analysis Unsaturation tests, aldehyde and ketones, carboxylic acids, phenols, amines, alcohols, esters	4 Hours
Lab 9 Local Anesthetics: preparation of Benzocaine.	3 Hours
Lab 10 Electrophilic Aromatic Substitutions: Nitration of aromatic Derivatives : conditions, positions of the nitration, activation and deactivation. In addition of Sulphonation Reaction.	5 Hours
Reviews/lab quizzes/tests	3 Hours

General Education Goals - Critical Thinking & Social/Global Awareness

CRITICAL THINKING OUTCOMES	HOW DOES THE COURSE ADDRESS THE OUTCOMES (Include required or recommended instructional resources, strategies, learning activities, assignments, etc., that must or could be used to address the goal/outcomes)
<p>Students will be able to</p> <ul style="list-style-type: none"> ➤ develop meaningful questions to address problems or issues. ➤ gather, interpret, and evaluate relevant sources of information. ➤ reach informed conclusions and solutions. ➤ consider analytically the viewpoints of self and others. 	N/A
SOCIAL/GLOBAL AWARENESS OUTCOMES	HOW DOES THE COURSE ADDRESS THE OUTCOMES (Include required or recommended instructional resources, strategies, learning activities, assignments, etc., that must or could be used to address the goal/outcomes)
<ul style="list-style-type: none"> ➤ Students will begin to understand how their lives are shaped by the complex world in which they live. ➤ Students will understand that their actions have social, economic and environmental consequences. 	N/A

Instructional Methods

Presentation of basic functional groups is beneficial by going into detail about nomenclature, characteristics, synthesis methods and reactions. Periodic reviews of functional group reactions helps to reinforce the principles learned in CHEM 205. Use of Power Point and the overhead projector provides a visible way of reinforcing the mechanisms of the reactions encountered in organic chemistry. In addition, placing students into groups to solve a variety of "group problems" helps to increase problem solving skills and solidifies their understanding of chemical reactions.

Methods of Assessment/Evaluation

Method	% Course Grade
3-5 Exams	60%
Homework	5%
Lab Reports and attendance	20%
Lab Exam	10%
Quizzes (lab and lectures)	5%

Text(s)

Required: Organic Chemistry, John McMurry, 8th Edition, Brooks/Cole [Cengage learning].

Required: Introduction to Organic Chemistry Techniques, small scales approach, D. Pavia, G Lampman, G Kriz and R. Engel, Latest Edition, © 2002.

Optional: Study Guide and Solution Manual for McMurry Organic Chemistry, 8th Edition.

Bibliography

Traynham (© 1997) Organic Nomenclature. Prentice Hall Publishers: Upper Saddle River, NJ. (A simple concise resource that lists the rules of nomenclature, provides examples and solutions).

Young (© 2000) Practical Spectroscopy. Harcourt College Publishers: Fort Worth, TX. (Great resource for spectroscopy, providing basic information on the different types of spectroscopy and spectra from 100 compounds).

Kampmeier, Varma-Nelson, and Wedegaertner (© 2001) Peer-Led Team Learning Organic Chemistry. Prentice Hall Publishers: Upper Saddle River, NJ.

(A nice collection of problems in organic chemistry that serves as a great source of group problems. There is no answer key, but the problems are intended to invoke thought and application of organic principles - not just rote memorization).

John McMurry (© 2006) Organic Chemistry A Biological Approach. 2nd edition (2011), Thomson Brooks/cole. USA. This book is for the student interested in correlate organic chemistry reactions and life sciences. It focuses on those reactions that have a direct counterpart in biological chemistry.

Other Learning Resources

Audiovisual Cassettes are located in the school library.
Electronic - On-Line Organic Chemistry (OCOL) CD-ROM. This is helpful as a study tool for organic reaction mastery and test preparation (including preparation for MCAT exams). - Chem Draw. This is an extremely helpful program for writing chemical structures and for reinforcing nomenclature. - Molecular Modeling Set. This is an extremely helpful tool for students to understand and conceptualize compounds in three dimensions. - Visit the book web site. Visit www.colby.edu/chemistry/ochem/demos . Generally, the organic chemistry web sites. - www.sjsu.edu/depts/chemistry - www.ehs.cornell.edu Useful for Environmental Health and Chemical Safety.
Other No resources specified