Tompkins Cortland Community College

Master Course Syllabus

Course Discipline and Number: CHEM 205 **Year: 2024-2025**
Course Title: Organic Chemistry I **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 give students a basic background in organic chemistry. The following topics are covered: bonding and atomic theory, nomenclature, stereochemistry, functional groups, aromaticity, (NMR, MS, IR, UV.) cycloalkane, types of reactions, mechanisms, and spectrometry. Emphasis is placed on the chemistry of alkanes, alkenes, alkynes, alkyl halides, and simple aromatics. Lab exercises include the synthesis, isolation, purification, and identification of organic compounds. CHEM 205 fulfills the SUNY General Education Natural Sciences requirement. Prerequisites: CHEM 102 or CHEM 108; 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. Gain a basic understanding of organic functional groups and reactions type and mechanism.
2. Be able to apply the basic principles of nomenclature to organic compounds.
3. Be able to demonstrate mastery of the principles of stereochemistry and spectroscopy.
4. Gain an appreciation for and practice safe laboratory principles and procedures.
5. Become familiar with the basic techniques of organic synthesis and purification techniques in the laboratory.

Course Objectives/Topics

Objective/Topic	# Hours
Carbon compounds and bonding, structure theory of organic chemistry, chemical bonds, atomic and molecular orbitals, hybridization, importance of the organic compounds in all life aspects	3 Hours
Functional groups and intermolecular forces, types of bonding between atoms, electronegativity, inductive effect and polarity	3 Hours
Types of organic reactions and reactions mechanisms, acid-base catalyzed reactions, energy changes and the relationship between chemical structure and physical and chemical activities	3 Hours
Alkanes and cycloalkanes properties, nomenclature, conformational analysis and introduction to synthesis	3 Hours
Stereochemistry - The biological significance, types of isomerism: constitutional isomers and stereoisomers, enantiomers and chiral molecules and optical activity	3 Hours
Ionic Reactions - nucleophilic substitution and elimination reactions, reactions kinetics and the mechanism of SN1, SN2, E1, and E2 reactions Stereochemistry of SN1 and SN2	3 Hours
Alkenes and Alkynes I - structure and reactivity properties, nomenclature, synthesis, and elimination reactions	3 Hours
Alkenes and Alkynes II - addition reactions and stereochemistry, oxidation, hydroboration, oxymercuration, hydration, halogenation	3 Hours
Radical reactions mechanism, homolytic dissociation, halogination of alkanes, radical addition of alkenes, radical polymerization	3 Hours
NMR, IR, and MS spectroscopy	4 Hours
Alcohols and Ethers - structure, properties, synthesis and reactions	2 Hours
Oxidation- reduction reaction and organometallic compounds; preparation and reaction of organolithium and organomagnesium compounds; alcohol and carbonyl compounds	3 Hours
Conjugated unsaturated systems and UV spectroscopy	3 Hours
Aromatic compounds - benzene and aromaticity	3 Hours
Reactions of aromatic compounds	3 Hours
Introduction to Organic Chemistry lab safety, techniques and methods used in preparation, purification and identification.	2.5 Hours
Lab 1 Preparation of an Ester - Acetylsalicylic acid Asprin and analgesics, Fisher esterification, crystallization, gravity filtration, decolorization	4 Hours
Lab 2 Preparation of an Amide - Acetanilide Crystallization, vacuum filtration, decolorization	4 Hours
Lab 3 Isolation of caffeine from tea leaves or bags. Extraction and distillation.	4 Hours
Lab 4 Introduction to chromatography techniques. TLC Analysis of Analgesic Drugs	4 Hours
Lab 5 Preparation of Isopentyl Acetate (Banana Oil) Esterification, heating under reflux, extraction, and simple distillation	4 Hours
Lab 6 Preparation of Methyl Salicylate (oil of wintergreen) Synthesis of an ester, separation of the liquid layers, extraction, and vacuum distillation	4 Hours
Lab 7 Preparation of Detergent and Soaps - Preparation of soap.	4 Hours
Lab 8 Separation between Acidic, Basic and neutral organic molecules.	4 Hours
Lab 9 Isolation of Essential Oils - Terpins and phenylpropanoids	4 Hours
Lab 10 Halogenation (bromination) of different unsaturated systems.	4 Hours
Reviews/lab quizzes/tests	8 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)
Students will be able to ➢ 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.	NA
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)
➢ 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.	NA

Instructional Methods

Lecture is the most effective way of explaining the principles of Organic Chemistry. Use of Power Point and the overhead provides a visual 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. Having solutions for the group problems available helps groups to get on the right track if they have difficulties in understanding the material.

Methods of Assessment/Evaluation

Method	**% Course Grade**
4-5 Exams plus final	60%
Lab Reports and experiment	20%
Lab Exam and attendance	10%
Quizzes (lab and lecture)	5%
Homework	5%

Text(s)

Required: Organic Chemistry, John McMurry, Thomson/Brooks/Cole. 8th Edition, © 2011

Required: Introduction to Organic Chemistry Techniques, Small Scales Approach, D. Pavia, G. Lampman, G. Kriz, and R. Engel, 2nd Edition, © 2004 Brooks Cole.□□Required: Lab Text, latest edition, 2004.

Optional: Study Guide and Solution Manual for Organic Chemistry, John McMurry, Thomson/Brooks/Cole. Seventh Edition (2008).

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. Thomson Brooks/Cole, USA. 2nd edition, © 2011, 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

Two VCR cassettes are located in the school library. They includes a simple introduction to the concept of organic chemistry, structure, types of reactions and their mechanism.

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