Syllabus

CHEM 2310
Organic Chemistry I
Salt Lake Community College

Instructor **Office**

Phone: **email:**

Office Hours

Class Options

CHEM 2310-001 (CRN-40198) T,H
10:00 am - 11:50 am
SI 298 Redwood Campus

OR

CHEM 2310-402 (CRN-40199) M,W
12:30 pm - 2:20 pm
SI 298 Redwood Campus

Problem Solving - Highly recommended for this class

CHEM 2318-401 (CRN-40201) F
10:00 am - 10:50 am Hybrid - SI 298 & Online

Textbook

Organic Chemistry, Francis A. Carey **11th edition** Chapters 1 – 11 & 14

Student Solutions Manual for Organic Chemistry,Francis A. Carey, **11th edition. The solutions manual is required for this class.**

Make sure your solutions manual edition matches the textbook edition.

IMPORTANT DATES - Fall Semester 2024

August 20th (T) First Day of Class

August 28th (W) Last Day to Add Class

September 2nd (M) Labor Day, No Class

September 10th (T) Last Day to Drop Class, 100% refund

October 17th – 18th (H,F) Fall Break, No Class

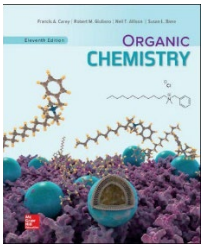
October 22nd (T) Last Day to Withdraw from Class
***Please see me before withdrawing from class**

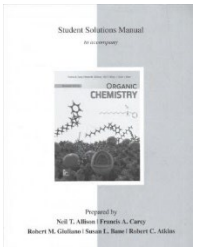
November 27th – 29th (W-F) Thanksgiving Holiday, No Class

December 5th (H), Last Day of Class

December 6th (F), Make-Up Exam Day

December 9th (M), In-Class Portion of Spectroscopy Exam





Exams

We will be covering ten (10) chapter modules each worth 90 points. We will have 7 exams overall with a possible total of 900 points,

- Exam I, chapter **2**, Introduction to Organic Structure and Nomenclature
- Exam II, Chapters **3 & 4**, Organic Molecules Shapes and Stereochemistry.
- Exam III, Chapters **5 & 6**, Substitution Reactions
- Exam IV, Chapters **7 & 8**, Elimination and Addition Reactions
- Exam V, Chapter **9**, Organic Synthesis
- Exam VI, Chapter **11**, Conjugated Systems w/Resonance Theory
- Exam VII, Chapter **14**, Spectroscopic/Spectrometric Identification of Organic Compounds.

Make-up exams will be given to replace your lowest exam score or one missed exam. The make-up exam will be a composite exam that is scheduled on 12/6.

Grading

Midterm Exams	810 points
Spectroscopy Project	90 points
Total Possible Points	900

100% - 94%	A
93% - 90%	A-
89% - 87%	B+
86% - 83%	B
82% - 80%	B-
79% - 77%	C+
76% - 73%	C

Homework

You cannot successfully learn organic chemistry without spending a considerable amount of time working end of chapter homework problems.

Homework will count for **20 point** of each chapter modules and will consist of working assigned end-of-chapter problems in the text book and ALL the Self-Test problems in the solutions manual. **Homework is due with each exam.**

LATE HOMEWORK WILL NOT BE ACCEPTED.

Extra Credit

Students may earn up to 3% extra credit by participating with the ACS-Student Affiliates. More information will be given in class or can be found on the ACS TimeTree app:

Instructor reserves the right to change or modify any content in this syllabus or the course schedule.

Organic Chemistry 2310 Learning Objectives by Chapter Topics:

Chapter 2 - Alkanes and Cycloalkanes: Introduction to Hydrocarbons

Classes of Hydrocarbons
Electron Waves and Chemical Bonds; the Valence Bond Model
Introduction to Alkanes: Methane, Ethane, and Propane
Hybridization and Bonding in Methane & Ethane
sp2 Hybridization and Bonding in Ethylene
sp Hybridization and Bonding in Acetylene
Isomeric Alkanes
IUPAC Nomenclature of Unbranched Alkanes - Applying the IUPAC Rules
Nomenclature of Alkyl Groups
IUPAC Names of Highly Branched Alkanes & Cycloalkanes
Introduction to Functional Groups
Sources of Alkanes and Cycloalkanes
Physical Properties of Alkanes and Cycloalkanes
Chemical Properties: Combustion of Alkanes - Thermochemistry
Oxidation-Reduction in Organic Chemistry

Chapter 3 - Conformations of Alkanes and Cycloalkanes & an Introduction to Stereochemistry

Conformational Analysis of Ethane & Butane
Conformations of Higher Alkanes
The Shapes of Cycloalkanes: Cyclopropane, Cyclobutane, Cyclopentane & Cyclohexane
Conformations of Cyclohexane
Axial and Equatorial Bonds in Cyclohexane
Conformational Inversion in Cyclohexane
Conformational Analysis of Monosubstituted Cyclohexanes
Disubstituted Cyclohexanes: cis-trans Stereoisomers
Conformational Analysis of Disubstituted Cyclohexanes
Conformations of Medium and Large Rings
Polycyclic Ring Systems; spirocyclic and bicyclic rings
Heterocyclic Compounds

Chapter 4 - Stereoisomers & Chirality

Introduction to Chirality: Enantiomers
Sp3 Carbon Chirality Center
Symmetry in Achiral Structures; Chirality Centers & Points/Planes of Symmetry
Properties of Enantiomers & Optical Activity
Absolute and Relative Configuration
The Cahn-Ingold-Prelog R-S Notational System
Fischer Projections
Chiral Molecules with Two Chirality Centers – Enantiomers & Diastereomers
Achiral Molecules with Two Chirality Centers

Molecules with Multiple Chirality Centers
Chirality of Disubstituted Cyclohexanes
Molecules with Multiple Chirality Centers
Resolution of Enantiomers
Chirality Centers Other Than Carbon
Chiral Drugs

Chapter 5 - Alcohols and Alkyl Halides: Introduction to Reaction & Reaction Mechanisms

Organic Functional Groups
IUPAC Nomenclature of Alkyl Halides & Alcohols
Classes of Alcohols & Alkyl Halides
Bonding in Alcohols & Alkyl Halides
Physical Properties of Alcohols and Alkyl Halides: Intermolecular Forces
Preparation of Alkyl Halides from Alcohols and Hydrogen Halides: the Sn substitution reaction
Mechanism of the Sn1 substitution reaction
Potential Energy Diagrams for Multistep Reactions
Stereochemistry and the SN1 Mechanism
Structure, Bonding, and Stability of Carbocations
Carbocation Rearrangements
Effect of Alcohol Structure on Reaction Rate
Activation Energy
Mechanism of the Sn2 substitution reaction & Hammond's Postulate
Inorganic Methods for Converting Alcohols to Alkyl Halides
Free Radical Halogenation of Alkanes
Mechanism of Free-Radical halogenation of Methane
Structure and Stability of Free Radicals
Sulfonates as Alkyl Halide Surrogates

Chapter 6 - Nucleophilic Substitution

Functional Group Transformation by Nucleophilic Substitution
Relative Reactivity of Halide Leaving Groups
The SN2 Mechanism of Nucleophilic Substitution
Steric Effects in SN2 Reaction Rates
Nucleophiles and Nucleophilicity
The SN1 Mechanism of Nucleophilic Substitution
Carbocation Stability and SN1 Reaction Rates
Stereochemistry of SN1 Reactions
Carbocation Rearrangements in SN1 Reactions
Effect of Solvent on the Rate of Nucleophilic Substitution
Nucleophilic Substitution of Alkyl Sulfonates
Introduction to Organic Synthesis: Retrosynthetic Analysis
Substitution versus Elimination: A Look Ahead

Chapter 7 - Alkenes: Structure and Preparation by Elimination Reactions

Alkene IUPAC Nomenclature
Structure and Bonding in Alkenes (sp2 hybridized systems)
Isomerism in Alkenes (Cis/Trans & E/Z stereoisomers)
Naming Stereoisomeric Alkenes by the E-Z Notational System
Physical Properties of Alkenes
Relative Stabilities of Alkenes (Zaitsev's order)
Cycloalkenes
Preparation of Alkenes: b-Elimination Reactions
Dehydration of Alcohols
Regioselectivity in Alcohol Dehydration: The Zaitsev Rule
Stereoselectivity in Alcohol Dehydration
The E1 and E2 Mechanisms of Alcohol Dehydration
Rearrangements in Alcohol Dehydration Reactions – Hydride and alkyl Shifts
Dehydrohalogenation of Alkyl Halides
The E2 Mechanism of Dehydrohalogenation of Alkyl Halides
Anti Elimination in E2 Reactions: Stereoelectronic Effects
Isotope Effects and the E2 Mechanism
The E1 Mechanism of Dehydrohalogenation of Alkyl Halides with Weak Bases
Substitution and Elimination as Competing Reactions
Elimination Reactions of Sulfonates

Chapter 8 - Addition Reactions of Alkenes

Hydrogenation of Alkenes
Heats of Hydrogenation
Mechanism and Stereochemistry of Hydrogenation of Alkenes
Electrophilic Addition of Hydrogen Halides to Alkenes
Regioselectivity of Hydrogen Halide Addition: Markovnikov's Rule
Mechanistic Basis for Markovnikov's Rule
Carbocation Rearrangements in Hydrogen Halide Addition to Alkenes
Addition of Sulfuric Acid to Alkenes
Acid-Catalyzed Hydration of Alkenes
Mechanism of Acid-Catalyzed Hydration
Thermodynamics of Addition
Elimination Equilibria Hydroboration-Oxidation of Alkenes
Mechanism and Stereochemistry of Hydroboration-Oxidation
Addition of Halogens to Alkenes
Mechanism and Stereochemistry of Halogen Addition
Conversion of Alkenes to Vicinal Halohydrins
Free-Radical Addition of Hydrogen Bromide to Alkenes
Mechanism Free-Radical Addition of Hydrogen Bromide
Epoxidation of Alkenes Ozonolysis of Alkenes

Chapter 9 - Alkynes

Sources of Alkynes
Nomenclature
Physical Properties of Alkynes
Structure and Bonding in Alkynes: sp Hybridization
Acidity of Acetylene and Terminal Alkynes
Preparation of Alkynes by Alkylation of Acetylene and Terminal Alkynes
Preparation of Alkynes by Elimination Reactions
Addition Reactions of Alkynes
Addition of Hydrogen Halides to Alkynes
Hydrogenation of Alkynes
Metal-Ammonia Reduction of Alkynes
Hydration of Alkynes
Addition of Halogens to Alkynes
Ozonolysis of Alkynes

Chapter 11 - Conjugation in Alkadienes and Allylic Systems

The Allyl Group and Allylic Carbocations
SN1 and SN2 Reactions of Allylic Halides
Allylic Free Radicals
Allylic Halogenation
Allylic Anions
Classes of Dienes: Conjugated and Otherwise
Relative Stabilities of Dienes
Bonding in Conjugated Dienes & Allenes
Preparation of Dienes & Diene Polymers
Addition of Hydrogen Halides to Conjugated Dienes
Halogen Addition to Dienes
The Diels-Alder Reaction
Molecular Orbital Analysis of the Diels–Alder Reaction
The Cope and Claisen Rearrangements

Introduction to Spectroscopy

Principles of Molecular Spectroscopy: Electromagnetic Radiation & Quantized Energy States
Introduction to Infrared Spectroscopy
Infrared Spectra - Characteristic Absorption Frequencies
Interpreting Infrared Spectra
Introduction to H-NMR Spectroscopy
Nuclear Shielding and H-NMR Chemical Shifts
Effects of Molecular Structure on H-NMR Chemical Shifts
Ring Currents—Aromatic and Antiaromatic
Interpreting H-NMR Spectra
Spin-Spin Splitting in H-NMR Spectroscopy: The Ethyl Group, Isopropyl Group & tert-Butyl Group

13-C NMR Spectroscopy
13-C Chemical Shifts and Peak Intensities
H-NMR Coupling
Mass Spectrometry
Interpreting the Mass Spectrum
Molecular Formula as a Clue to Structure