

CHEM-240: ORGANIC CHEMISTRY 1

Update to Organic Chemistry Series
Course

- CHEM-240: Organic Chemistry 1
- CHEM-241: Organic Chemistry 2

Effective Term

Fall 2024

CC Approval

03/17/2023

AS Approval

04/11/2023

BOT Approval

04/20/2023

COCI Approval

03/05/2024

SECTION A - Course Data Elements

CB04 Credit Status

Credit - Degree Applicable

Discipline

Minimum Qualifications	And/Or
Chemistry (Master's Degree)	

Subject Code

CHEM - Chemistry

Course Number

240

Department

Chemistry (CHEM)

Division

Science and Engineering (SE)

Full Course Title

Organic Chemistry 1

Short Title

Organic Chemistry 1

CB03 TOP Code

1905.00 - Chemistry, General

CB08 Basic Skills Status

NBS - Not Basic Skills

CB09 SAM Code

E - Non-Occupational

Rationale

Our articulation officer and C-ID recommended we align our Organic Chemistry series with the state standards for TMC. This increases the units from 4 to 5 units for both Organic Chem 1 and 2 (total of 10 units). We are keen to align our courses with the state standard in preparation for the common course numbering system expected soon (AB 1111). Lastly, we would like to offer an AS-T in Chemistry which will be made possible by aligning with the TMC.

Additionally, we updated:

- The book edition to one published more recently.
- The DE modality of Hybrid.

SECTION B - Course Description

Catalog Course Description

The first course of a two-semester sequence designed for pre-professional programs such as chemistry, chemical engineering, medicine and biology. Introduction to organic synthetic pathways, mechanisms, and spectroscopy. Lab work includes qualitative analysis of organic compounds, synthesis, extraction, separation and identification of compounds using physical properties, chemical reactivity, and spectral techniques.

SECTION C - Conditions on Enrollment

Open Entry/Open Exit

No

Repeatability

Not Repeatable

Grading Options

Letter Grade or Pass/No Pass

Allow Audit

Yes

Requisites

Prerequisite(s)

Completion of CHEM-121 with a minimum grade of C.

Requisite Justification

Requisite Description

Course in a Sequence

Subject

Chem

Course

121

Level of Scrutiny

Required by 4-Year Institution

Explanation

Before entering the Organic Chemistry series, almost all CSU and UC (Including Sac State, UC Davis, and UC Berkeley) require completion of the General Chemistry series. At NVC the general Chemistry series concludes with Chem 121.

SECTION D - Course Standards

Is this course variable unit?

No

Units

5.00000

Lecture Hours

54

Lab Hours

108

Outside of Class Hours

108

Total Contact Hours

162

Total Student Hours

270

Distance Education Approval**Is this course offered through Distance Education?**

Yes

Online Delivery Methods

DE Modalities	Permanent or Emergency Only?
Hybrid	Permanent

SECTION E - Course Content**Student Learning Outcomes****Upon satisfactory completion of the course, students will be able to:**

1. Communicate chemical and physical processes at the molecular level and how they relate to the macroscopic environment.
2. Solve synthetic reaction pathways and mechanisms while demonstrating the reasoning clearly and completely.
3. Implement laboratory techniques correctly using appropriate safety procedures and express them clearly in written laboratory reports.

Course Objectives**Upon satisfactory completion of the course, students will be able to:**

1. Solve complex reaction mechanisms.
2. Synthesize compounds starting with simple ingredients.
3. Determine the structure of organic compounds from spectrographic data.
4. Name organic compounds based on their structure.

Course Content**Lecture Content****Carbon Compounds and Chemical bonds.**

1. Introduction to Organic Chemistry.
2. Structure, isomerism, tetrahedral carbon.
3. Ionic and covalent bonds, polar bonds and resonance.
4. Molecular shape, polar molecules and molecular structure.
5. Quantum mechanics, atomic and molecular orbitals and hybridization.

Some Representative Carbon Compounds

1. Alkanes, sigma bonds.
2. Alkenes, alkynes and pi bonds.
3. Functional groups.
4. Acid-base reactions, Brønsted-Lowry and Lewis Theories.

Alkanes and Cycloalkanes.

1. Shapes, nomenclature and physical properties.
2. Conformations of alkanes and cycloalkanes, bond strain.
3. Substituted and polycyclic cycloalkanes.
4. Reactions of alkanes; substitution, halogenation and ring openings.
5. Sources of alkanes; petroleum and some syntheses.

Chemical Reactivity-Ionic, Nucleophilic Substitution and Elimination Reactions.

1. Breaking of bonds, intermediates, carbocations, free radicals and their stabilities.
2. Nucleophilic substitution; rates, kinetics, mechanism, SN1 and SN2 reactions.
3. Elimination reactions, E1 and E2.

Alkenes.

1. Nomenclature.
2. sp^2 hybrids and structure.
3. Hydrogenation of alkenes, cycloalkenes.
4. Syntheses through dehydrohalogenation and dehydration.
5. Carbocation stability and rearrangements.
6. Catalytic affect in hydrogenation or dehydrogenation.
7. Reactions of Alkenes-Addition to the double bond.
8. Markovnikov's Rule, acid catalyzed addition of water, addition of sulfuric acid.
9. Dimerization and alkylation by carbocations.
10. Hydroboration, oxidation, halogenation and halohydrin formation.

Alcohols, Ethers, Epoxides, and Thiols

1. Reactivity and properties of alcohols.
2. Synthesis and reactions of alcohols.
3. Synthesis and reactions of ethers and epoxides.
4. Synthesis and reactions of thiols.

Stereochemistry

1. Structural and stereoisomers.
2. Chirality, enantiomers and the R-S system.
3. Optical activity and molecules with more than one chiral carbon.
4. Reactions and production of enantiomers, stereospecific reactions.
5. Relative and absolute configurations.
6. Reactions that involve inversion, racemization and resolution.

Alkynes

1. Nomenclature.
2. sp hybrid and structure.
3. Acidity of terminal alkynes, acetylene.
4. Additions to alkynes, metal acetylides.
5. Synthesis and reactions of alkynes.
6. Chemical Reactivity-Free Radical and Addition Polymers.
7. Mechanism of chlorination of alkanes.
8. Stabilities of free radicals and their addition to alkenes.
9. Polymerization.

Lab Content

1. Methods of separation and purification
 - a. Simple and Fractional Distillation
 - b. Liquid-liquid extraction
 - c. Recrystallization
 - d. GC/TLC/Column Chromatography
2. Spectroscopic Identification
 - a. FT-IR
 - b. NMR
 - c. GC-MS
3. Multistep syntheses
 - a. Synthesis of butyl methyl ether from butanol
 - b. Synthesis of Tylenol

Methods of Instruction**Methods of Instruction**

Types	Examples of learning activities
Lab	Lab techniques are taught during a 4 hour lab period once per week.
Lecture	Students attend three hours of lecture per week.
Discussion	Two 1-hour short discussions on the weekly lab or lecture material
Experiments	Students are required to attend a four hour lab period where they do experiments in groups.
Observation and Demonstration	In-class demonstrations and online videos are shown to solidify and expand the lecture material.

Instructor-Initiated Online Contact Types

E-mail Communication
Video or Teleconferencing

Student-Initiated Online Contact Types

Discussions
Group Work

Course design is accessible

Yes

Methods of Evaluation**Methods of Evaluation**

Types	Examples of classroom assessments
Exams/Tests	Exams include but are not limited to questions that are short answer, multiple choice, prediction of the products of reactions, written demonstration of the steps of chemical reactions, and calculations related to percentage of products and prediction of spectroscopic shifts. The final grade will be based upon the sum of the points gained out of the total number of points available (about 650 points). Grades are awarded as 100%-90% A, 89%-80% B, 79%-70% C, 69%-60% D, less than 60% F.
Quizzes	Quizzes reflect what is to be expected on an exam. Therefore, quizzes follow the same format as an exam but with far fewer questions. Quizzes include short answer questions, multiple choice, prediction of the products of reactions, written demonstration of the steps of chemical reactions, and calculations related to percentage of products and prediction of spectroscopic shifts. Quiz grades are based on the sum of the points available for each quiz (10 to 20 points each). Grades are awarded as 100%-90% A, 89%-80% B, 79%-70% C, 69%-60% D, less than 60% F.
Lab Activities	Students will work in groups and share experimental equipment. Students are asked to perform an experiment using proper experimental techniques and then spectroscopically identify their product, analyze it for the percent yield, and calculate its purity. These results are then written up and turned in as lab reports. Each student turns in their own lab report. These reports are graded and turned back to the students. Lab grades are based on the sum of the points available for each lab report (10 to 20 points each). Grades are awarded as 100%-90% A, 89%-80% B, 79%-70% C, 69%-60% D, less than 60% F.

Assignments**Reading Assignments**

Students must read the text and material found online. They must read their lab manual and follow directions to successfully complete the lab.

Writing Assignments

Students must write lab reports each week.

SECTION F - Textbooks and Instructional Materials**Material Type**

Textbook

Author

K. Peter C. Vollhardt, Neil E. Schore

Title

Organic Chemistry: Structure and Function

Edition/Version

8th Edition

Publisher

W. H. Freeman

Year

2018

Rationale

Book update from the previous edition

ISBN #

1319079458

Material Type

Manual

Author

S.E. Fawl

Title

Organic Chemistry I - Laboratory Manual

Publisher

Fountainhead Press

Year

2018

Proposed General Education/Transfer Agreement

Do you wish to propose this course for a Local General Education Area?

No

Do you wish to propose this course for a CSU General Education Area?

No

Do you wish to propose this course for a UC Transferable Course Agreement (UC-TCA)?

No

Course Codes (Admin Only)

CB00 State ID

CCC000313019

CB10 Cooperative Work Experience Status

N - Is Not Part of a Cooperative Work Experience Education Program

CB11 Course Classification Status

Y - Credit Course

CB13 Special Class Status

N - The Course is Not an Approved Special Class

CB23 Funding Agency Category

Y - Not Applicable (Funding Not Used)

CB24 Program Course Status

Program Applicable

Allow Pass/No Pass

Yes

Only Pass/No Pass

No