

# CHEM R104: GENERAL, ORGANIC, AND BIOLOGICAL CHEMISTRY

---

**Originator**

yma

**College**

Oxnard College

**Discipline (CB01A)**

CHEM - Chemistry

**Course Number (CB01B)**

R104

**Course Title (CB02)**

General, Organic, and Biological Chemistry

**Banner/Short Title**

General, Org, &amp; Bio Chemistry

**Credit Type**

Credit

**Start Term**

Fall 2021

**Catalog Course Description**

This course provides an introduction to the concepts of chemistry in the health sciences. Topics in general chemistry will include the modern view of the atom, molecule structure, chemical formulas, and chemical reactions. Topics in organic chemistry will include hydrocarbons, alcohols, aldehydes, ketones, carboxylic acids, amines, and amides. Topics in biochemistry will include carbohydrates, proteins, lipids, nucleic acids, and metabolism.

**Taxonomy of Programs (TOP) Code (CB03)**

1905.00 - Chemistry, General

**Course Credit Status (CB04)**

D (Credit - Degree Applicable)

**Course Transfer Status (CB05) (select one only)**

A (Transferable to both UC and CSU)

**Course Basic Skills Status (CB08)**

N - The Course is Not a Basic Skills Course

**SAM Priority Code (CB09)**

E - Non-Occupational

**Course Cooperative Work Experience Education Status (CB10)**

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

**Course Classification Status (CB11)**

Y - Credit Course

**Educational Assistance Class Instruction (Approved Special Class) (CB13)**

N - The Course is Not an Approved Special Class

**Course Prior to Transfer Level (CB21)**

Y - Not Applicable

**Course Noncredit Category (CB22)**

Y - Credit Course

**Funding Agency Category (CB23)**

Y - Not Applicable (Funding Not Used)

**Course Program Status (CB24)**

1 - Program Applicable

**General Education Status (CB25)**

Y - Not Applicable

**Support Course Status (CB26)**

N - Course is not a support course

**Field trips**

Will not be required

**Grading method**

Letter Graded

**Does this course require an instructional materials fee?**

No

**Repeatable for Credit**

No

**Is this course part of a family?**

No

**Units and Hours**

**Carnegie Unit Override**

No

**In-Class**

**Lecture**

**Minimum Contact/In-Class Lecture Hours**

70

**Maximum Contact/In-Class Lecture Hours**

70

**Activity**

**Laboratory**

**Minimum Contact/In-Class Laboratory Hours**

52.5

**Maximum Contact/In-Class Laboratory Hours**

52.5

**Total in-Class**

**Total in-Class**

**Total Minimum Contact/In-Class Hours**

122.5

**Total Maximum Contact/In-Class Hours**

122.5

**Outside-of-Class****Internship/Cooperative Work Experience**

Paid

Unpaid

**Total Outside-of-Class****Total Outside-of-Class****Minimum Outside-of-Class Hours**

140

**Maximum Outside-of-Class Hours**

140

**Total Student Learning****Total Student Learning****Total Minimum Student Learning Hours**

262.5

**Total Maximum Student Learning Hours**

262.5

**Minimum Units (CB07)**

5

**Maximum Units (CB06)**

5

**Prerequisites**

MATH R005 or MATH R015

**Entrance Skills****Entrance Skills**

Ability to solve algebraic equations and graph data sets

**Prerequisite Course Objectives**

MATH R005-Simplify algebraic expressions

MATH R005-Graph linear equations by plotting points and using intercepts.

MATH R005-Solve elementary exponential and logarithmic equations and related applications.

**Entrance Skills**

Ability to solve algebraic equations and graph data sets.

**Prerequisite Course Objectives**

MATH R015-Evaluate and simplify algebraic expressions.

MATH R015-Simplify expressions with positive and negative exponents.

MATH R015-Convert decimals to scientific notation and vice versa.

MATH R015-Graph linear functions and write using function notation.

MATH R015-Solve elementary exponential and logarithmic equations.

**Requisite Justification****Requisite Type**

Prerequisite

**Requisite**

MATH R005

**Requisite Description**

Course not in a sequence

**Level of Scrutiny/Justification**

Content review

**Requisite Type**

Prerequisite

**Requisite**

MATH R015

**Requisite Description**

Course not in a sequence

**Level of Scrutiny/Justification**

Content review

**Student Learning Outcomes (CSLOs)****Upon satisfactory completion of the course, students will be able to:**

- |    |   |
|----|---|
| 1  | Describe the scientific method and how it is applied in chemistry.                    |
| 2  | Explain the difference among atoms, molecules, ions, chemical compounds, and mixture. |
| 3  | Identify formulas and names of acids, bases, and salts.                               |
| 4  | Analyze the principles of acid-base reaction and oxidation-reduction.                 |
| 5  | Describe the basic nuclear reactions and their medical application.                   |
| 6  | Classify the families of organic compounds according to their functional groups.      |
| 7  | Assess the impact of organic compounds in the human body and modern society.          |
| 8  | Recognize the relationships of carbohydrates, proteins, and lipids in human body.     |
| 9  | Describe the metabolism and biochemical production in the human body.                 |
| 10 | Recognize the basic structures and functions of DNA and RNA.                          |

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

- |    |   |
|----|---|
| 1  | Describe the scientific method and how it is applied in chemistry.                      |
| 2  | Explain the difference among atoms, molecules, ions, chemical compounds, and mixture.   |
| 3  | Describe the solubility and calculation of the mass percent and molarity of a solution. |
| 4  | Identify formulas and names of acids, bases, and salts.                                 |
| 5  | Analyze the principles of acid-base reaction and oxidation-reduction reaction.          |
| 6  | Explain the rate of a chemical reaction and energy associated with a chemical reaction. |
| 7  | Describe the basic nuclear reactions and their medical application.                     |
| 8  | Classify the families of organic compounds according to their functional groups.        |
| 9  | Assess the impact of organic compounds in the human body and modern society.            |
| 10 | Recognize the relationships of carbohydrates, proteins, and lipids in the human body.   |
| 11 | Describe the metabolism and biochemical production in the human body.                   |
| 12 | Recognize the basic structures and functions of DNA and RNA.                            |

## Course Content

### Lecture/Course Content

1. Matter, Measurements, and Calculation
  - a. Definition and Classification of Matter
  - b. Units, significant figures, and Unit Conversion
  - c. Density and Percentage Calculation.
2. Atoms, Molecules, and Periodic Table
  - a. Symbols and Formulas
  - b. Subatomic Particles and Isotopes
  - c. Electronic Configurations of the Elements and the Periodic Table
  - d. Atomic and Molecular Masses
  - e. The Mole Concepts
3. Chemical Bonding
  - a. Naming Covalent and Ionic Compounds
  - b. Shapes of Molecules and Polyatomic Ions
  - c. The Polarity of Covalent Molecules
4. Chemical Reactions
  - a. Chemical Equations
  - b. Types of Chemical Reactions
  - c. Ionic Equations
  - d. Stoichiometry and a Balanced Chemical Equation
  - e. Energy Change and Chemical Reactions
5. The States of Matter
  - a. The Kinetic Molecular Theory of Matter
  - b. The Solid, Liquid, and Gaseous States
  - c. The Gas Laws
  - d. Change of States
6. Solution and Colloids
  - a. Physical States of Solutions
  - b. Solubility
  - c. Solution Concentration and Solution Preparation
  - d. Solution Stoichiometry
7. Reaction Rates and Equilibrium
  - a. Reaction Rates and Molecular Collisions
  - b. Energy Diagrams
  - c. Chemical Equilibrium
  - d. Le Chatelier's Principle
8. Acids, Bases, and Salts
  - a. The Concepts of Acids, Bases, and Salts
  - b. The Self-Ionization of Water
  - c. pH Scale
  - d. Buffers
9. Radioactivity and Nuclear Processes
  - a. Equations for Nuclear Reactions
  - b. Half-life of Nuclei
  - c. The Health Effects of Radiation
10. Hydrocarbons
  - a. Structures of Saturated and Unsaturated Hydrocarbons
  - b. Nomenclature of Alkanes, Alkenes, Alkynes, and Aromatic Compounds
  - c. Substitution of an Alkane
  - d. Addition of an Alkene
11. Alcohols, Phenols, and Ethers
  - a. Nomenclature and Classification of Alcohols
  - b. Physical Properties of Alcohols
  - c. Chemical Reactions of Alcohols
  - d. Nomenclatures of Phenols and Ethers
  - e. Thiols
12. Aldehydes and Ketones

- a. The Nomenclature of Aldehydes and Ketones
- b. Physical and Chemical Properties of Aldehydes and Ketones
13. Carboxylic Acids and Esters
  - a. Nomenclature of Carboxylic Acids and Esters
  - b. The Acidity of a Carboxylic Acid
  - c. Hydrolysis of an Ester
14. Amines and Amides
  - a. The Classification and Nomenclature of Amines and Amides
  - b. Physical and Chemical Properties of Amines
  - c. Amines as Neurotransmitters
  - d. Physical and Chemical Properties of Amides
15. Carbohydrates
  - a. The Stereochemistry of Carbohydrates
  - b. Classification of Carbohydrates
  - c. Important Monosaccharides
  - d. Disaccharides
  - e. Polysaccharides
16. Lipids
  - a. Classification of Lipids
  - b. The Structures and Properties of Fatty Acids
  - c. Waxes
  - d. Phosphoglycerides and Sphingolipids
  - e. Biological Membranes
  - f. Steroids
17. Proteins
  - a. The Amino Acids
  - b. Important Peptides
  - c. Characteristics of Proteins
  - d. The Four-level of Protein Structures
  - e. Hydrolysis and Denaturation of Proteins
18. Enzymes
  - a. Nomenclature and Classification of Enzymes
  - b. The Mechanism of Enzyme Action
  - c. Factors Affecting Enzyme Activity
  - d. Medical Application of Enzymes
19. Nuclei Acids and Protein Synthesis
  - a. Components of Nuclei Acids
  - b. The Structure of DNA and RNA
  - c. The Flow of Genetic Information
  - d. The Genetic Code
  - e. Mutations
20. Nutrition and Energy for Life
  - a. Nutritional Requirements
  - b. The Macronutrients
  - c. Vitamins
  - d. The Flow of Energy in the Biosphere
  - e. Metabolism and Overview of Energy Production
21. Metabolism of Carbohydrates, Lipids, and Proteins
  - a. The Digestion of Carbohydrates
  - b. Glycolysis
  - c. The Citric Acid Cycle
  - d. Glycogen Metabolism
  - e. Fat Mobilization
  - f. The Oxidation of Fatty Acids
  - g. Amino Catabolism: The Fate of the Nitrogen Atoms
  - h. Amino Acid Biosynthesis
22. Fluids

- a. A Comparison of Body Fluids
- b. Oxygen and Carbon Dioxide Transport
- c. Fluid and Electrolyte Balance
- d. Buffer Control of Blood pH

### Laboratory or Activity Content

1. Introduction to Measurements:
  - a. Using meter stick, graduated cylinder, and balance to make basic measurements for a subject.
2. Introduction to Scientific Method:
  - a. Studying Metric System, significant figures, and unit conversion.
3. Analysis of Cations using the Flame Test:
  - a. Conducting flame tests for  $\text{Na}^+$ ,  $\text{K}^+$ ,  $\text{Ca}^{2+}$ ,  $\text{Sr}^{2+}$ ,  $\text{Ba}^{2+}$ , and  $\text{Cu}^{2+}$ .
4. Analysis of Anions using the Precipitation:
  - a. Precipitating tests for  $\text{Cl}^-$ ,  $\text{SO}_4^{2-}$ ,  $\text{CO}_3^{2-}$ , and  $\text{NO}_3^-$ .
5. Separation using Chromatography Techniques:
  - a. Separating color ink by Paper Chromatography.
  - b. Separating food color in Kool-Aid by High Performance Liquid Chromatography.
6. Introduction to Molecular Modeling for Inorganic Molecules and Organic Molecules
  - a. Drawing Lewis structure to present a molecule.
  - b. Building a model use balls and sticks.
  - c. Predicting the molecular shape, bond angles, and polarity of a molecule from the model.
7. Boyle's Law and Charles' Law:
  - a. This is a web-based experiment. Boyle's Law and Charles' Law are demonstrated.
8. Classification of Chemical Reactions:
  - a. Observation for each of the following reactions:
    - b. Decomposition of malachite.
    - c. Combination of copper and oxygen.
    - d. Single replacement of copper with silver nitrate.
    - e. Double replacement of baking soda with hydrochloric acid.
9. Solutions and Solubility of Compounds:
  - a. Observing the solubility of various substances in water and non-polar solvents.
  - b. Preparing and observing a colloidal suspension solution.
  - c. Observing of factors that affect the rate at which a solid solute dissolves in water.
  - d. Preparing a saturated solution and observing the formation of a solid.
10. Preparation and Chemical Properties of Soap:
  - a. Preparing soap from vegetable oil and sodium hydroxide.
  - b. Observing the different effect of hard and soft water in a soapy solution.
  - c. Learning how the scum is formed, and limitation of soap in an acid solution.
11. Acids, Bases, pH, Hydrolysis, and Buffers:
  - a. Using pH meter to measure common acids, bases, salts, and household chemicals.
  - b. Making a buffer solution and testing it with acid and base.
12. Synthesis of Aspirin:
  - a. Synthesizing Aspirin from salicylic acid and acetic anhydride.
  - b. Testing and comparing the purity of newly synthesized Aspirin, commercial Aspirin.
13. Identification of Alcohols and Phenol:
  - a. Studying the solubility and acidity of a alcohol and a phenol.
  - b. Using Luca's test, Chromic test, Iodoform test, and Ferric chloride to identify a primary, secondary, tertiary alcohol, or phenol.
14. Identification of Aldehydes and Ketones:
  - a. Using Chromic, Iodoform, Tollen's, and Benedict test to identify an aliphatic aldehyde, aromatic aldehyde, or a ketone.
15. Carbohydrates:
  - a. Using Benedict test to distinguish a reducing sugar or a non-reducing sugar.
16. Isolation and Identification of Proteins:
  - a. Learning how to adjust the pH to an isoelectric point to isolate Casein from milk.
  - b. Using verity chemical tests to identify different proteins.

### Methods of Evaluation

Which of these methods will students use to demonstrate proficiency in the subject matter of this course? (Check all that apply):  
Problem solving exercises

Skills demonstrations

Written expression

**Methods of Evaluation may include, but are not limited to, the following typical classroom assessment techniques/required assignments (check as many as are deemed appropriate):**

Computational homework

Essay exams

Essays

Group projects

Individual projects

Laboratory activities

Laboratory reports

Mathematical proofs

Objective exams

Oral presentations

Projects

Problem-Solving Assignments

Problem-solving exams

Quizzes

Reports/papers

Research papers

Skills demonstrations

Skill tests

Simulations

## Instructional Methodology

**Specify the methods of instruction that may be employed in this course**

Audio-visual presentations

Computer-aided presentations

Collaborative group work

Class activities

Class discussions

Case studies

Distance Education

Demonstrations

Group discussions

Instructor-guided interpretation and analysis

Instructor-guided use of technology

Internet research

Laboratory activities

Lecture

Practica

Small group activities

**Describe specific examples of the methods the instructor will use:**

- The instructor will provide the topics from the HealthLink, such as "Maintaining the pH of blood serum", and guide students to analyze the principles of acid-base reaction on how Le Chatelier's principle can explain the ability of an amphoteric species of bicarbonate to maintain blood pH under either acidosis or alkalosis.
- The instructor will give the lecture and use the whiteboard to show how a correct molecular structure should be drawn, including the location of the chemical bonds on the proper atoms to classify the families of organic compounds according to their functional groups.
- The instructor may provide the links to the videos of the topic lecture or demonstration of experiments to students for classifying the organic functional group and its corresponding family.

## Representative Course Assignments

### Writing Assignments

- Students will be required to complete weekly homework and assignments from the textbook, such as explain the difference among atoms, molecules, ions, chemical compounds, and mixture, or identify formulas and names of acids, bases, and salts.
- Students will be required to write lab reports during lab time to describe the scientific method and how it applied in chemistry. The lab reports will be turned in at the end of each lab session.



- Students may be required to write an essay with the topics related to their careers. The topics of the essay reflect the development of new drugs and the application of new technology in the medical fields.

### Critical Thinking Assignments

- Participation of the class discussion of "Why is the prodrug chloramphenicol palmitate less soluble in water than chloramphenicol?" Students will use the solubility rules to describe the reasons using the structural differences between these two compounds and assess the impact of organic compounds in the human body.
- Explaining the difference between atoms and molecules, and comparing the Lewis structures of water and carbon dioxide to illustrate the polarity of these two molecules.

### Reading Assignments

- Reading from the textbook and Lab Manual to describe the scientific method and how it is applied in chemistry.
- Reading from journals related to chemistry, diet, health care; such as the Journal of Chemical and Engineering News, published by American Chemical Society; Popular Science to recognize the relationships among carbohydrates, lipids, and proteins and describe the metabolism and biochemistry in the human body.
- Reading from the Internet, such as [www.acs.org](http://www.acs.org) (<http://www.acs.org>), [www.chemweb.com](http://www.chemweb.com) (<http://www.chemweb.com>), [www.anytimetutor.com](http://www.anytimetutor.com) (<http://www.anytimetutor.com>) to classify the families of organic compounds according to their functional group and recognize the basic structures and functions of DNA, and RNA.

### Skills Demonstrations

Students should demonstrate safely perform the required chemistry experiments in an in-person lab, such as:

- safely use Bunsen burner in the lab setting;
- properly operate a pH meter to measure the pH of an acidic, bases, or a buffer solution;
- properly transfer chemicals from a larger container to a test tube;
- safely transfer organic compounds under the fume hood;
- properly dilute a concentrated solution;
- safely heat test tubes in a water bath;
- properly use a vacuum filtration apparatus.

### Other assignments (if applicable)

- Encourage students to form a study group to solve the unit conversion problems and chemical reactions.
- Help students individually in the instructor's office to show the details of reaction patterns.
- Advise students regarding critical thinking about chemical properties related to the periodic table among atoms, molecules, ions, chemical compounds, and mixture.

## Outside Assignments

### Representative Outside Assignments

- Students will be required to complete weekly homework and reading assignments from the textbook.
- Students may be required to search the internet to write an essay/discussion with the topics related to their careers. The topics of the essay/discussion reflect the development of new diseases, new drugs, and the application of new technology in the medical fields.

## Articulation

### Comparable Courses within the VCCCD

CHEM V30 - Chemistry for Health Sciences

## District General Education

### A. Natural Sciences

#### A2. Physical Science

Approved

**B. Social and Behavioral Sciences**

**C. Humanities**

**D. Language and Rationality**

**E. Health and Physical Education/Kinesiology**

**F. Ethnic Studies/Gender Studies**

**CSU GE-Breadth**

**Area A: English Language Communication and Critical Thinking**

**Area B: Scientific Inquiry and Quantitative Reasoning**

**B1 Physical Science**

Approved

**B3 Laboratory Activity**

Approved

**Area C: Arts and Humanities**

**Area D: Social Sciences**

**Area E: Lifelong Learning and Self-Development**

**CSU Graduation Requirement in U.S. History, Constitution and American Ideals:**

**IGETC**

**Area 1: English Communication**

**Area 2A: Mathematical Concepts & Quantitative Reasoning**

**Area 3: Arts and Humanities**

**Area 4: Social and Behavioral Sciences**

**Area 5: Physical and Biological Sciences**

**Area 6: Languages Other than English (LOTE)**

**Textbooks and Lab Manuals**

**Resource Type**

Textbook

**Description**

Katherine J Dennison; Joseph J Toppong; Danae R Quirk Dorr; Robert L Carret. *General, Organic, and Biochemistry, 10th edition (2018)*. McGraw-Hill. New York City, United States.

---

**Resource Type**

Textbook

**Description**

Kenneth W. Raymond. *General, Organic, and Biological Chemistry*. (2014) or latest edition. John Wiley and Sons, Inc. Hoboken, N.J. United States

---

**Resource Type**

Other Resource Type

**Description**

www.acs.org.

---

**Resource Type**

Other Resource Type

**Description**

www.nursingcenter.com.

---

**Resource Type**

Other Resource Type

**Description**

www.chemweb.com.

---

**Resource Type**

Other Instructional Materials

**Description**

Scientific calculator.

---

**Resource Type**

Other Instructional Materials

**Description**

A box of colored pens or pencils.

---

**Resource Type**

Other Instructional Materials

**Description**

Safety goggles.

---

**Distance Education Addendum****Definitions****Distance Education Modalities**

Hybrid (51%–99% online)

Hybrid (1%–50% online)

100% online

**Faculty Certifications**

Faculty assigned to teach Hybrid or Fully Online sections of this course will receive training in how to satisfy the Federal and state regulations governing regular effective/substantive contact for distance education. The training will include common elements in the district-supported learning management system (LMS), online teaching methods, regular effective/substantive contact, and best practices.

Yes

Faculty assigned to teach Hybrid or Fully Online sections of this course will meet with the EAC Alternate Media Specialist to ensure that the course content meets the required Federal and state accessibility standards for access by students with disabilities. Common areas for discussion include accessibility of PDF files, images, captioning of videos, Power Point presentations, math and scientific notation, and ensuring the use of style mark-up in Word documents.

Yes

## Regular Effective/Substantive Contact

### Hybrid (1%–50% online) Modality:

Method of Instruction	Document typical activities or assignments for each method of instruction
Asynchronous Dialog (e.g., discussion board)	Regular use of asynchronous discussion boards encourages various types of interaction and critical thinking skills among all course participants. Questions and topics posed will allow students to discuss, compare and contrast, identify, and analyze elements of the course outcomes. Students will be required to respond to one another with substantive comments with the intent of creating a dialog. Other discussion boards may be used for Q&A and general class discussion by students and instructor to facilitate student success and strengthen student learning outcomes.
E-mail	E-mail, class announcements and various learning management system tools such as "Message Students Who" and "Assignment Comments", will be used to regularly communicate with all students on matters such as clarification of class content, reminders of upcoming assignments and/or course responsibilities, to provide prompt feedback to students on coursework to facilitate student learning outcomes, or to increase the role of an individual educator in the academic lives of a student. Students will be given multiple ways to email instructor through both the learning management system inbox and faculty provided email accounts.
Face to Face (by student request; cannot be required)	The instructor will hold weekly, scheduled office hours either in person or via-web conferencing, for students to be able to meet and discuss course materials or individual progress. Students can request additional in-person or web conferencing meetings with faculty member as needed. Faculty may encourage online students to form "study groups" in person or online.
Other DE (e.g., recorded lectures)	Faculty will use a variety of ADA compliant tools and media integrated within the learning management system to help students reach SLO competency. Tools may include: <ul style="list-style-type: none"> <li>• Recorded Lectures, Narrated Slides, Screencasts</li> <li>• Instructor created content</li> <li>• OC Online Library Resources</li> <li>• Canvas Peer Review Tool</li> <li>• Canvas Student Groups (Assignments, Discussions)</li> <li>• 3rd Party (Publisher) Tools (MyOpenMath)</li> <li>• Websites and Blogs</li> <li>• Multimedia (YouTube, Films on Demand, 3CMedia, Khan Academy, etc.)</li> </ul>
Synchronous Dialog (e.g., online chat)	Instructor will provide a set time each week where they will be available for synchronous chat and be available in the discussion board and can answer questions in live time.
Video Conferencing	Video tools such as ConferZoom can be used to provide live synchronous or asynchronous sessions with students. ADA compliance will be upheld with Closed Captioning during the session or of the recorded session. Recordings of all live sessions will be made available within the LMS. Video Conferences will be used to facilitate SLOs and student-to-student group meetings will also be encouraged.
Telephone	Students can request for instructor to call or vice versa in order to answer one-on-one questions about course material or student progress.

**Hybrid (51%–99% online) Modality:**

<b>Method of Instruction</b>	<b>Document typical activities or assignments for each method of instruction</b>
Asynchronous Dialog (e.g., discussion board)	Regular use of asynchronous discussion boards encourages various types of interaction and critical thinking skills among all course participants. Questions and topics posed will allow students to discuss, compare and contrast, identify, and analyze elements of the course outcomes. Students will be required to respond to one another with substantive comments with the intent of creating a dialog. Other discussion boards may be used for Q&A and general class discussion by students and instructor to facilitate student success and strengthen student learning outcomes.
E-mail	E-mail, class announcements and various learning management system tools such as "Message Students Who" and "Assignment Comments", will be used to regularly communicate with all students on matters such as clarification of class content, reminders of upcoming assignments and/or course responsibilities, to provide prompt feedback to students on coursework to facilitate student learning outcomes, or to increase the role of an individual educator in the academic lives of a student. Students will be given multiple ways to email instructor through both the learning management system inbox and faculty provided email accounts.
Face to Face (by student request; cannot be required)	The instructor will hold weekly, scheduled office hours either in person or via-web conferencing, for students to be able to meet and discuss course materials or individual progress. Students can request additional in-person or web conferencing meetings with faculty member as needed. Faculty may encourage online students to form "study groups" in person or online.
Other DE (e.g., recorded lectures)	Faculty will use a variety of ADA compliant tools and media integrated within the learning management system to help students reach SLO competency. Tools may include: <ul style="list-style-type: none"> <li>• Recorded Lectures, Narrated Slides, Screencasts</li> <li>• Instructor created content</li> <li>• OC Online Library Resources</li> <li>• Canvas Peer Review Tool</li> <li>• Canvas Student Groups (Assignments, Discussions)</li> <li>• 3rd Party (Publisher) Tools (MyOpenMath)</li> <li>• Websites and Blogs</li> <li>• Multimedia (YouTube, Films on Demand, 3CMedia, Khan Academy, etc.)</li> </ul>
Synchronous Dialog (e.g., online chat)	Instructor will provide a set time each week where they will be available for synchronous chat and be available in the discussion board and can answer questions in live time.
Video Conferencing	Video tools such as ConferZoom can be used to provide live synchronous or asynchronous sessions with students. ADA compliance will be upheld with Closed Captioning during the session or of the recorded session. Recordings of all live sessions will be made available within the LMS. Video Conferences will be used to facilitate SLOs and student-to-student group meetings will also be encouraged.
Telephone	Students can request for instructor to call or vice versa in order to answer one-on-one questions about course material or student progress.

**100% online Modality:**

<b>Method of Instruction</b>	<b>Document typical activities or assignments for each method of instruction</b>
Synchronous Dialog (e.g., online chat)	Synchronous through ConferZoom for the topics related to the course contents. The set-time will be published in the course schedule. The instructor may also provide a set time as office hours each week where she/he will be available for answering questions in live time.

Asynchronous Dialog (e.g., discussion board)	Asynchronous essay/discussion through Canvas related to the course contents. The instructor will use asynchronous discussion boards encourages all students to participate in various types of interaction and critical thinking. Other discussion boards may be used for Q&A and general class discussions by students and instructors to facilitate student success in the course. Except for the midterm and final exam, other course assessments will be conducted through at the asynchronous time, such as upload homework, take a quiz, or conduct simulation experiments.
Face to Face (by student request; cannot be required)	The direct face-to-face contact time with the instructor will be during weekly class meetings, open office hours, and times requested by a student. This time will provide students to discuss and ask questions about the material covered in the course or other concerns in the class, such as individual progress. The instructor will encourage students to form "study groups" online and keep "connected" among students.
E-mail	Email/Canvas LMS communication tools will be used frequently to converse with students, such as giving the feedback of uploaded homework and essay, clarifying course contents, reminding the upcoming class events, and regarding the issues related later homework, grades, absences, etc.
Other DE (e.g., recorded lectures)	The instructor may use a recorded lecture, video, cumulated notes, 3C media, and other external links to integrate with the course contents. ADA compliance will be upheld with Closed Captioning during the session or of the recorded session.
Telephone	Students may request telephone calls for immediate assistant such as registration and grades, etc.
Video Conferencing	ConferZoom help sessions scheduled before or after synchronous time. The instructor may also encourage students to form a study group using other media to facilitate student-to-student interactions.

## Examinations

### Hybrid (1%–50% online) Modality

Online  
On campus

### Hybrid (51%–99% online) Modality

Online  
On campus

## Primary Minimum Qualification

CHEMISTRY

## Review and Approval Dates

### Department Chair

09/02/2020

### Dean

09/02/2020

### Technical Review

09/09/2020

### Curriculum Committee

09/09/2020

### Curriculum Committee

11/25/2020

### CCCCO

MM/DD/YYYY

**Control Number**

CCC000589011

**DOE/accreditation approval date**

MM/DD/YYYY