CHEM-121: GENERAL CHEMISTRY 2

Effective Term
Fall 2026

CC Approval
12/05/2025

AS Approval
12/11/2025

BOT Approval
12/18/2025

COCI Approval
03/05/2026

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
121

Department
Chemistry

Division
Science and Engineering (SE)

Full Course Title
General Chemistry 2

Short Title
General Chemistry 2

CB03 TOP Code
1905.00 - Chemistry, General

CIP Code
40.0501

CB08 Basic Skills Status
NBS - Not Basic Skills

CB09 SAM Code
E - Non-Occupational

Rationale
Update DEI.

SECTION B - Course Description

Catalog Course Description

This course is a continuation of General Chemistry 1. Topics include solutions, acid-base and redox equilibria, thermodynamics, kinetics, pH, buffers, solubility product, complex ions, thermodynamics, electrochemistry, biochemistry and nuclear chemistry.

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-120 with a minimum grade of C.

Requisite Justification

Requisite Description

Course in a Sequence

Subject

CHEM

Course #

120

Level of Scrutiny

Content Review

Upon entering this course, students should be able to:

1. Define and use basic terms and concepts including atom, ion, charge, atomic number, mass number, atomic mass, element, compound, mixture, solution, energy state, molecule, molecular formula, and isotope.
2. Write ionic and covalent formulas, and name simple ionic and covalent compounds
3. Classify chemical reactions and write balanced chemical-reaction equations.
4. Employ the mole concept to determine the amount of material changing in chemical reactions, involving solids, liquids, solutions and gases.
5. Use variations of the ideal gas law to determine the density, formula weight, pressure, and volume of gases.
6. Determine the energy and velocity of gases using the Kinetic Molecular Theory.
7. Draw the structure of compounds based on their electronic configurations using Lewis dot structures and Valence Shell Electron Pair Repulsion Theory. Distinguish between ionic and covalent bonding, and explain the organization and structure of the periodic table.
8. Calculate the energy of transition of electrons between principle quantum numbers using Quantum Theory and determine the shape of atomic orbitals and their hybrids.
9. Apply safety principles in the laboratory. Use balances, pipettes, burettes, and gas burners properly to obtain accurate and reliable measurements. Follow both verbal and written directions describing chemical experimental procedures.
10. Develop and test hypotheses; gather and evaluate evidence; and make appropriate conclusions.

SECTION D - Course Standards

Is this course variable unit?

No

Units
5.00

Lecture Hours
54.00

Lab Hours
108.00

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?
Entirely Online	Permanent
Hybrid	Permanent
Online with Proctored Exams	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 both qualitative and quantitative chemistry problems 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.	Explain the development of chemical principles and concepts based on experiments.
2.	Analyze and solve complex or extended problems involving mathematical skills as well as an ability to place these problems in an environment, biological, economic or social context.
3.	Design a laboratory experiment by defining the problem, collecting data, obtaining results, deriving conclusions, and preparing a report to communicate the information to others in writing.
4.	Explain the concepts related to rates of reaction, activation energies, mechanisms of reactions, as applied to the kinetic molecular theory.
5.	Relate equilibrium information from chemical systems to the free energy, enthalpy and entropy. Determine the equilibrium constants and show how the spontaneity of the system is related to the driving force of the reaction.
6.	Apply the equilibrium system concepts to acid/base, solubility, redox, and complex ion formation reaction systems.
7.	Indicate how an electrochemical cell can be used to establish the standard free energy of a chemical reaction and measure the pH of a system.

Course Content

1. Chemical Kinetics
   a. Rate Laws
   b. Activation Energy

   c. Mechanisms
   d. Catalysis
2. Chemical Equilibrium
   a. LeChatlier's Principle
   b. Homogenous Systems
   c. Heterogeneous Systems
3. Acids & Bases
   a. Strong and Weak acids
   b. pH
   c. Buffers
   d. Titration Curves
4. Applications of Aqueous Equilibria
   a. Solubility
   b. pH controlled Solubility
   c. Complex Ions
   d. Amphoterism
5. Spontaneity, Entropy and Free Energy
   a. Effect of Temperature
   b. Work and Efficiency
6. Electrochemistry
   a. Balancing Oxidation-Reduction Reactions
   b. Nernst Equation
   c. Standard State Potentials
7. Nuclear Chemistry
   a. Radioactive Decay
   b. Carbon Dating
   c. Half Life
   d. Nuclear Transformations
8. Organic Chemistry
   a. Nomenclature
   b. Functional Groups
   c. Free-Radical Halogenation
   d. Substitution and Elimination Reactions
9. Topics in Biochemistry May Include
   a. Enzyme Kinetics
   b. Michaelis-Menton Equation
   c. Lineweaver Burke Plot
   d. Biological Buffers
   e. Action Potential
   f. Amino Acids and Zwitterions
   g. Ionic Strength and Osmotic Pressure

Methods of Instruction

Methods of Instruction

Types	Examples of learning activities
Lecture	
Other	Chemical demonstrations. Video presentations. Individual and group problem solving in the classroom. Individual and group laboratory experiments. Peer oriented guided instruction where the students help one another under the guidance of an instructor.

Online Adaptation

Types	Examples of learning activities
Activity	
Directed Study	
Discussion	

Group Work
Individualized Instruction
Journal
Lecture

Instructor-Initiated Online Contact Types

Announcements/Bulletin Boards
Chat Rooms
Discussion Boards
E-mail Communication
Telephone Conversations
Video or Teleconferencing

Student-Initiated Online Contact Types

Chat Rooms
Discussions
Group Work

Course design is accessible

Yes

Methods of Evaluation

Methods of Evaluation

Types	Examples of classroom assessments
Exams/Tests	Four exams will be given, including the final exam. Exams will be fill in, multiple choice, true/false, and short answer, and will be graded on a point scale. A sample question may be, "What is the pH of a 0.1M acetic acid solution?" or "How many steps are required for a fourth order reaction?" or perhaps, "Please draw a working electrochemical cell indicating the composition of the electrodes, cell concentrations, and direction of electron flow."
Other	Regular attendance in the laboratory. All labs will be checked off by the instructor prior to the student leaving the lab.

Assignments

Reading Assignments

Daily reading of text; weekly reading of lab manual (ex: Read Chapter 15,"Chemical Thermodynamics," Sections 15.1 through 15.9 in your text and read the first lab, "The Kinetics of the Acid Decomposition of a Compound.")

Writing Assignments

Problem sets are provided for homework. Laboratory write-ups are assigned weekly. Sample tests/study sheets are provided for each of the four exams.

SECTION F - Textbooks and Instructional Materials

Material Type

Textbook

Author

McMurry & Fay

Title

Chemistry

Edition/Version

6th

Publisher

Prentice Hall

Year
2011

Material Type
Textbook

Author
Chang and Overby

Title
General Chemistry: The Essential Concepts

Edition/Version
6th

Publisher
McGraw-Hill

Year
2010

Material Type
Textbook

Author
Tro

Title
Chemistry: A Molecular Approach

Edition/Version
2nd

Publisher
Prentice Hal

Year
2012

Material Type
Textbook

Author
Atkins & Jones

Title
Chemical Principles

Edition/Version
6th

Publisher
W.H. Freeman

Year
2012

Material Type
Manual

Author
Brown, LeMay, Bursten, Murphy, Woodward, Nelson & Kemp

Title
Laboratory Experiments for Chemistry: The Central Science

Publisher
Prentice Hall

Year
05-18-2008

Material Type
Manual

Author
Postma, Roberts & Holenberg

Title
Chemistry in the Laboratory

Publisher
W.H. Freeman

Year
03-12-2004

Material Type
Manual

Author
Fawl

Title
Laboratory, General Chemistry

Publisher
NVC Reproduction Services

Year
08-22-2012

SECTION G - Diversity, Equity and Inclusivity

How does your course and/or course outline of record reflect strategies for accommodating and engaging diverse student populations, advancing equitable outcomes, and fostering inclusion for all students?

This course supports diverse student populations through the use of multiple representations of concepts, varied applications, and technology. Strategies may also include collaborative learning, transparent assessment practices, low-cost resources, alternative formative assessment, structured opportunities for direct communication with the instructor, and opportunities for students to connect course material to their own experiences, fostering equitable outcomes and an inclusive classroom environment.

Course Codes (Admin Only)

CB00 State ID
CCC000315196

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