Modesto Junior College

Course Outline of Record Report

10/06/2021

CHEM102 : General Chemistry 2

General Information

Faculty Author:	• Joseph Caddell • Brzezinski, Linda
Attachments:	CHEM 102 DE Addendum Spring 2021 Newest.pdf DE Addendum EFF 5.4.15.pdf CHEM-102_SU15.pdf CHEM102_STANDARD.pdf chem102.pdf CHEM 102_CAR.pdf CHEM 102.pdf ASSIST CAS CHEM 102.pdf TMI_HYBRID_CHEM102.pdf MIN_chem102_09_02_17.pdf MATERIALFEE_CHEM102.pdf COREQ_CHEM102.pdf CID CHEM 120S.pdf Download
Course Code (CB01) :	CHEM102
Course Title (CB02) :	General Chemistry 2
Department:	Chemistry
Proposal Start Date:	MJC Summer 2022
TOP Code (CB03) :	(1905.00) Chemistry, General
CIP Code:	(40.0501) Chemistry, General
SAM Code (CB09) :	Non-Occupational
Distance Education Approved:	No
Course Control Number (CB00) :	CCC000328475
Curriculum Committee Approval Date:	10/07/2014
Board of Trustees Approval Date:	11/12/2014
External Review Approval Date:	01/01/2014
Course Description:	Continuation of CHEM 101 emphasizing kinetics, solutions, equilibrium, acids and bases, acid-base equilibria, electrochemistry, thermodynamics, nuclear chemistry, and coordination chemistry.
Proposal Type:	Mandatory Revision Course update for periodic review.
Faculty Author:	• Joseph Caddell

Discipline(s)

Master Discipline Preferred:

- Chemistry

Bachelors or Associates Discipline Preferred: No value

Course Coding

Basic Skill Status (CB08)

Course is not a basic skills course.

Course Special Class Status (CB13)

Course is not a special class.

Grading

- A-F or P/NP

☐ Allow Students to Gain Credit by Exam/Challenge

Repeatability

0

Course Prior To College Level (CB21)

Not applicable.

Rationale For Credit By Exam/Challenge

No value

Type of Repeat

No value

☐ Allow Students To Audit Course

Course Support Course Status (CB26)

Course is not a support course

Associated Programs

☑ Course is part of a program (CB24)

Associated Program	Award Type	Active

Chemistry for Transfer Degree (In Development)	AS-T Associate of Science for Transfer	MJC Fall 2021
Engineering (In Development)	A.S. Degree	MJC Summer 2022
Biological Sciences	A.S. Degree	MJC Summer 2020 to MJC Summer 2021
Chemistry	A.S. Univ Prep - Area of Emphasis	MJC Summer 2020 to MJC Summer 2021
Chemistry for Transfer Degree	AS-T Associate of Science for Transfer	MJC Summer 2020
CSU General Education Pattern	Certificate of Achievement	MJC Summer 2020 to MJC Summer 2021
General Studies: Emphasis in Natural Sciences	A.A. Degree	MJC Summer 2020
Geology for Transfer Degree	AS-T Associate of Science for Transfer	MJC Summer 2020 to MJC Fall 2021
IGETC Pattern	Certificate of Achievement	MJC Summer 2020 to MJC Summer 2021
MJC-GE Pattern	MJC-GE Pattern	MJC Summer 2020 to MJC Summer 2021

Transferability & Gen. Ed. Options

Course General Education Status (CB25)

Y

Transferability	Transferability Status
Transferable to both UC and CSU	Approved

MJC General Education (MJC-GE)	Categories	Status	Approval Date	Rationale (include Comparable Course, C-ID Descriptor, etc. if applicable.
Area A: Natural Sciences	(MJC-GE:A)	Approved	No value	No Rationale (include Comparable Course, C-ID Descriptor, etc. if applicable. defined.

CSU General Education Breadth Pattern (CSU-GE)	Categories	Status	Approval Date	Rationale (include Comparable Course, C-ID Descriptor, etc. if applicable.
Area B1:Physical Sciences	(CSU-GE:B1)	Approved	No value	No Rationale (include Comparable Course, C-ID Descriptor, etc. if applicable. defined.
Area B3: Laboratory Activity	(CSU-GE:B3)	Approved	No value	

Intersegmental General Education Transfer Curriculum (IGETC) (for CSU and UC)	Categories	Status	Approval Date	Rationale (include Comparable Course, C-ID Descriptor, etc. if applicable.
Area 5A: Physical Sciences	(IGETC: 5A)	Approved	No value	No Rationale (include Comparable Course, C-ID Descriptor, etc. if applicable. defined.
Area 5C: Laboratory Activity	(IGETC: 5C)	Approved	No value	

C-ID: California's Course Identification Numbering System	Categories	Status	Approval Date	Rationale (include Comparable Course, C-ID Descriptor, etc. if applicable.
Chemistry (CHEM)	(BIOT) *CCC	Approved	No value	CHEM 101 + CHEM 120 = C-ID: CHEM 120S

YCCD Intra-district Equivalencies	Categories	Status	Approval Date	Rationale (include Comparable Course, C-ID Descriptor, etc. if applicable.
Columbia College Equivalent Course	(CC)	Approved	No value	CC: CHEM 2B & 2BL; MJC: CHEM 101 + CHEM 102=CC: CHEM 2A + CHEM 2AL + CHEM 2B + CHEM 2BL

Field Trips

Field trips are required.

- (●) Yes
- ( ) No
- ( ) Maybe

Comparable Lower-Division Courses at UC/CSU v2

Courses numbered 100-299 require identification two comparable lower-division courses from CSU or UC from the current institutional catalog (not schedule). At least one course from CSU, and if requesting/maintaining UC general elective transfer, one course from UC. Please identify the CSU campus offering this course. (Term type is indicated in parentheses)

CSU, Stanislaus (SEM)

CSU Catalog Year

2020-2021

Provide the CSU course code (e.g., ENGL 1A) from the most current official Catalog (not schedule). Curriculum changes each year.

CHEM 1110 + CHEM 1112

CSU Course Title

General Chemistry II + General Chemistry II Laboratory

Does course-to-course or lower-division, "major prep" articulation with this course exist for this academic year?

Yes

Select the institution that offers the second comparable course from CSU or UC. If seeking or maintaining UC transferability, you must supply a UC campus. (Term type is indicated in parentheses)

UC Davis (QTR)

CSU/UC Catalog Year

2021-2022

Provide the CSU course code (e.g., ENGL 1A) from the most current official Catalog (not schedule). Curriculum changes each year.

CHE 002B + CHE 002C

CSU Course Title

General Chemistry

Does course-to-course or lower-division, "major prep" articulation with this course exist for this academic year?

Unsure

Select the institution that offers the third comparable course from CSU or UC. If seeking or maintaining UC transferability, you must supply a UC campus if not already provided above. (Term type is indicated in parentheses)

CPSU, San Luis Obispo (QTR)

CSU/UC Catalog Year

2020-2021

Provide the CSU/UC course code (e.g., ENGL 1A) from the current official Catalog (not schedule). Curriculum changes each year.

CHEM 126

CSU Course Title

General Chemistry for Physical Science and Engineering

Does course-to-course or lower-division, "major prep" articulation with this course exist for this academic year?

Yes

Units and Hours

Summary

Minimum Credit Units (CB07)	5
Maximum Credit Units (CB06)	5
Total Course In-Class (Contact) Hours	126
Total Course Out-of-Class Hours	144
Total Student Learning Hours	270

Credit / Non-Credit Options

Course Credit Status (CB04)

Credit - Degree Applicable

Course Non Credit Category (CB22)

Credit Course.

Non-Credit Characteristic

No Value

Course Classification Code (CB11)

Credit Course.

Funding Agency Category (CB23)

Not Applicable.

Cooperative Work Experience Education Status (CB10)

Variable Credit Course

Weekly Student Hours

	In Class	Out of Classs
Lecture Hours	3	6
Laboratory Hours	3	0
Activity Hours	0	0

Course Student Hours

Course Duration (Weeks)	18
Hours per unit divisor	52.5
Course In-Class (Contact) Hours	
Lecture	54
Laboratory	54
Activity	18
Total	126
Course Out-of-Class Hours	
Lecture	108
Laboratory	0
Activity	36
Total	144

Time Commitment Notes for Students

No value

Units and Hours - Weekly Specialty Hours

Activity Name	Type	In Class	Out of Class
Discussion	Activity	1	2

Prerequisites, Corequisites, and Advisories

Prerequisite

CHEM101 - General Chemistry 1 (in-development)

Requisite Skills

Requisite Skills	Description
Differentiate between mixtures and pure substances. Solve complex problems using the principles of dimensional analysis	• CHEM 101 - differentiate between mixtures and pure substances. Solve complex problems using the principles of dimensional analysis.
Describe the development of modern atomic theory. Derive the number of protons neutrons and electrons in an atom from symbolic data. Calculate the atomic weight of an element using natural abundance data. Classify compounds as ionic or molecular by referring to the chemical formula. Name chemical compounds given the correct chemical formula; derive correct chemical formulas from compound names.	• CHEM 101 - describe the development of modern atomic theory. Derive the number of protons neutrons and electrons in an atom from symbolic data. Calculate the atomic weight of an element using natural abundance data. Classify compounds as ionic or molecular by referring to the chemical formula. Name chemical compounds given the correct chemical formula; derive correct chemical formulas from compound names.
identify the type of a chemical reaction from the chemical equation. Determine the molar mass of a compound from the chemical formula. Given the formula of a compound calculate the percentage composition by mass. Determine a chemical formula from mass data. Perform calculations related to the mole concept. Determine the empirical formula of a compound given combustion analysis data. Perform stoichiometric calculations using chemical equations.	• CHEM 101 - identify the type of a chemical reaction from the chemical equation. Determine the molar mass of a compound from the chemical formula. Given the formula of a compound calculate the percentage composition by mass. Determine a chemical formula from mass data. Perform calculations related to the mole concept. Determine the empirical formula of a compound given combustion analysis data. Perform stoichiometric calculations using chemical equations.
Differentiate between electrolytes and nonelectrolytes by referring to chemical formulas. Classify reactions by type by referring to balanced chemical equations. Differentiate between acids and bases as well as the properties of acids and bases. Complete and balance the equations that describe decomposition synthesis displacement and exchange reactions. Convert molecular equations to the corresponding total ionic and net ionic equations.	• CHEM 101 - D. differentiate between electrolytes and nonelectrolytes by referring to chemical formulas. Classify reactions by type by referring to balanced chemical equations. Differentiate between acids and bases as well as the properties of acids and bases. Complete and balance the equations that describe decomposition synthesis displacement and exchange reactions. Convert molecular equations to the corresponding total ionic and net ionic equations.
Identify and balance reduction-oxidation equations. Employ balanced chemical equations to perform quantitative calculations for reactions between solutions.	• CHEM 101 - Identify and balance reduction-oxidation equations. Employ balanced chemical equations to perform quantitative calculations for reactions between solutions.

Define terms related to first law of thermodynamics. Employ the concept of state functions to solve thermochemical problems. Solve quantitative problems by the use of Hess's Law. Demonstrate understanding of the concept of calorimetry by solving appropriate thermochemical problems.	• CHEM 101 - define terms related to first law of thermodynamics. Employ the concept of state functions to solve thermochemical problems. Solve quantitative problems by the use of Hess's Law. Demonstrate understanding of the concept of calorimetry by solving appropriate thermochemical problems.
Demonstrate understanding of the nature of waves by both verbal description and solving quantitative problems. Solve problems that involve the concept of quantization of energy. Solve problems that relate to the Bohr Theory of the atom. Provide verbal descriptions and discuss the important results of the theories of Schroedinger Hund and Pauli. Be able to correctly predict the electron configuration of atoms and ions and draw the corresponding orbital diagrams by referring to the periodic table.	• CHEM 101 - Demonstrate understanding of the nature of waves by both verbal description and solving quantitative problems. Solve problems that involve the concept of quantization of energy. Solve problems that relate to the Bohr Theory of the atom. Provide verbal descriptions and discuss the important results of the theories of Schroedinger Hund and Pauli. Be able to correctly predict the electron configuration of atoms and ions and draw the corresponding orbital diagrams by referring to the periodic table.
describe the concept of effective nuclear charge and explain the effect of this phenomenon on the properties of atoms. Predict the relative sizes ionization energies and electron affinities of atoms and ions based on the position of the element on the periodic table.	• CHEM 101 - describe the concept of effective nuclear charge and explain the effect of this phenomenon on the properties of atoms. Predict the relative sizes ionization energies and electron affinities of atoms and ions based on the position of the element on the periodic table.
Draw correct Lewis structures for elements and ions. Predict relative values of Lattice energy for ionic compounds. Provide (draw) correct Lewis structures for molecules and ions. Predict the relative bond polarity for atoms connected by covalent bonds. Explain the concept of electronegativity and apply this principle to the determination of the polarity of chemical bonds and molecules. Provide resonance structures for ions and molecules. Use bond enthalpies to estimate enthalpy changes for chemical reactions.	• CHEM 101 - draw correct Lewis structures for elements and ions. Predict relative values of Lattice energy for ionic compounds. Provide (draw) correct Lewis structures for molecules and ions. Predict the relative bond polarity for atoms connected by covalent bonds. Explain the concept of electronegativity and apply this principle to the determination of the polarity of chemical bonds and molecules. Provide resonance structures for ions and molecules. Use bond enthalpies to estimate enthalpy changes for chemical reactions.
Employ VSEPR theory to predict the geometry and shape of molecules and ions. Define the concept of valence bond theory and use valance bond theory and the concept of orbital hybridization to describe the bonding patterns in molecules and ions. Employ molecular orbital theory to predict the bond order in binary molecules.	• CHEM 101 - employ VSEPR theory to predict the geometry and shape of molecules and ions. Define the concept of valence bond theory and use valance bond theory and the concept of orbital hybridization to describe the bonding patterns in molecules and ions. Employ molecular orbital theory to predict the bond order in binary molecules.

Describe the characteristic properties of the gaseous state. Demonstrate understanding of the concept of gas pressure by providing verbal descriptions and solving quantitative problems. Provide definitions of the following gas laws: Boyle's Law Gay-Lussac's Law Charles's Law and Avagadro's Hypothesis and also solve quantitative problems that relate to these laws. Solve quantitative problems related to the Ideal Gas Equation. Solve quantitative problems employing Dalton's Law of Partial Pressures. Define the terms effusion and diffusion; solve quantitative problems involving these concepts. Demonstrate understanding of the concept of Kinetic Molecular Theory by relating these concepts to observable gas properties. Use the van der Waals Equation to predict the properties of real gases.

- CHEM 101 - describe the characteristic properties of the gaseous state. Demonstrate understanding of the concept of gas pressure by providing verbal descriptions and solving quantitative problems. Provide definitions of the following gas laws: Boyle's Law Gay-Lussac's Law Charles's Law and Avagadro's Hypothesis and also solve quantitative problems that relate to these laws. Solve quantitative problems related to the Ideal Gas Equation. Solve quantitative problems employing Dalton's Law of Partial Pressures. Define the terms effusion and diffusion; solve quantitative problems involving these concepts. Demonstrate understanding of the concept of Kinetic Molecular Theory by relating these concepts to observable gas properties. Use the van der Waals Equation to predict the properties of real gases.

Specifications

Methods of Instruction

Methods of Instruction (Typical)	INSTRUCTIONAL METHODS
MOI	1. Relevant material is presented through class lectures and lecture/laboratory demonstrations 2. Students perform laboratory experiments that reinforce and expand upon concepts discussed in lecture

Assignments (Typical)

Evidence of Workload for Course Units (Quantity)

1. Weekly reading assignments from lecture text
2. Chapter Review homework and/or recommended problems
3. Weekly preparation for laboratory including reading and pre-laboratory assignments
4. A complete record of all experimental work performed, and analysis of results

Evidence of Critical Thinking (Quality)

1. What is the pH at each stoichiometric point in the titration of 0.519 M acetic acid with 0.915 M NaOH? Draw a representation of the titration curve.
2. A galvanic cell has the following cell reactions:
   M(s) + 2Zn2+(aq) --> 2Zn(s) + M4+(aq)
   The standard emf of the cell is 0.16 V, what is the standard potential of the M/M4+ redox couple?

Methods of Evaluation (Typical)	Rationale
FORMATIVE EVALUATION	1. Assigned homework and/or quizzes given throughout the semester 2. Examinations given at regular intervals throughout the semester 3. Observation of laboratory technique and safety 4. Laboratory reports required after completion of each experiment 5. Identification of laboratory unknowns

SUMMATIVE EVALUATION	1. A comprehensive final examination

Equipment

No Value

Textbooks

Author	Title	Publisher	Date	ISBN
Zumdahl	Chemistry (10th Ed.)	Cengage	2018	9781305957404
Flowers et. al.	Chemistry 2e	OpenStax	2019	978-1-947172-62-3

Other Instructional Materials

Description	Student must purchase Safety Goggles from the MJC Bookstore (Fog Gard Plus, ANSI Z87.1-1989, SEI Certified)
Author	No value
Citation	No value
Online Educational Resources	No value

Description	CHEM 102 Lab Manual
Author	Caddell, J.
Citation	2021
Online Educational Resources	No value

Textbook Exceptions and Supplementals

Title of Other Material

No Value

Who prepared or published this supplemental material?

No Value

Publish date

No Value

Are any of the textbook editions cited on this proposal considered "Classics" (typically with a publish date more than 5 years old)?

- [ ] Yes
- [x] No

☐ Unsure

If yes, explain why this older text is used in the course. Reasons should focus on content only.

No Value

Materials Fees v2

Is there a materials fee for this course?

No

Provide a cost breakdown for all items provided for a materials fee. Each item must become "tangible personal property" of student upon payment of the fee and completion of the course.

No Value

Explain how these materials are related to the Student Learning Objectives for the course.

No Value

Explain how the materials have continuing value outside the classroom.

No Value

Is the amount of the material the student receives commensurate with the fee paid AND with the amount of material necessary to achieve the Student Learning Objectives for the course AND provided as the district's actual cost?

No Value

If no is checked, explain why.

No Value

If the district is NOT the only source of these materials, explain why the students have to pay a fee to the district rather than supply the materials themselves. (Cost savings? Health/Safety? Consistency/Uniformity?)

No Value

Learning Outcomes and Objectives

Course Objectives

Understand the factors that affect solubility. Calculate changes in vapor pressure, boiling point, freezing point and osmotic pressure with the addition of electrolytic and non-electrolytic solutes.

Identify factors that affect the rates of chemical reactions and explain how these factors work on a molecular level. Graphically determine the order of reaction and predict concentrations after a period of time for a first, second, or zero order reaction. Utilize collision theory, temperature effects, and the Arrhenius equation to explain and/or calculate rates of reaction. Understand the effects of homogeneous and heterogeneous catalysts.

Describe how entropy changes for different processes and how entropy and enthalpy affect the spontaneity of a chemical reaction. Determine the Gibbs free energy of a reaction and use it to determine if a reaction is spontaneous.

Describe the concept of chemical equilibrium, and describe how to shift a chemical reaction in the forward or backward direction.

Use the mass action expression to calculate if a reaction is at equilibrium, if the reaction is favorable or unfavorable, and to determine equilibrium concentrations.

Identify, based on structure, if a substance is an acid or base, and use pH to calculate concentrations of hydronium and hydroxide ions in aqueous solutions. Use acid and base ionization constants to determine relative strengths of these solutions and to calculate pH, pOH, hydronium and hydroxide concentrations. Calculate a titration curve based on experimental data for a strong acid and/or base, a weak acid and/or base. Find the Ka from a titration curve. Utilize molecular structure to predict acid/base properties. Calculate pH and capacity of a buffer solution. Calculate solubility equilibria for a salt solution using Ksp, including factors affecting solubility.

Describe how electrolysis can be used to perform chemical reactions and be able to perform electrolysis calculations. Determine the potential, explain what the parts are in a galvanic cell using cell notation, and give the half reactions and the net reaction. Utilize reaction Gibbs free energy in cell potential calculations. Use the Nernst equation to perform electrochemical calculations. Predict spontaneity of reactions from the electrochemical series.

Calculate the half-life of a nuclear reaction. Balance nuclear reactions and describe applications and hazards of nuclear reactions. Describe the fundamental particles involved in a typical nuclear reaction (alpha, beta, gamma, neutron, proton, positron). Compare and contrast fission and fusion nuclear reactions.

Explain and calculate spontaneity of a chemical process based on the second and third laws of thermodynamics.

Name complex ions and coordination compounds. Describe the stereochemistry of complex ions and coordination compounds.

Name simple alkanes. Identify the functional groups in an organic molecule.

Lab Objectives

Demonstrate safe practice in the chemistry laboratory, including measures to prevent/control fire, explosion, contact with and/or intake of hazardous chemicals or fumes.

Demonstrate the capacity to perform basic statistical analysis of data including standard deviation and confidence limits.

Demonstrate use of Excel (or similar spreadsheet) for graphing and analysis of data.

Create an experimental titration curve for a strong acid, weak acid and diprotic acid.

Determine experimentally how concentration, temperature and a catalyst affect the rate of a reaction and the activation energy.

Determine experimentally the rate law for a reaction and choose the most probable mechanism.

Use qualitative analysis to identify ions based on observations of known reactions.

Experimentally determine the equilibrium constant and use experimental data to explain LeChâtlier's principle.

Demonstrate the ability to evaluate data. Demonstrate the graphical techniques of analyzing experimental data, including determining the slope and graphing and interpreting logarithmic data.

CSLOs

Identify and use chemical laboratory equipment and instrumentation to quantitatively and/or qualitatively determine an unknown.

Expected SLO Performance: 0.0

ISLOs GELO	Demonstrate proficiency in NATURAL SCIENCE by doing the following: Explaining how the scientific method is used to solve problems and escribing how scientific discoveries and theories affect human activities
ISLOs Core ISLOs	Students will be prepared to engage a global world while exhibiting a broad sense of diversity, cultural awareness, social responsibility and stewardship. Students will be able to: Interpret and analyze ideas of value and meaning exhibited in literature, religious practices, philosophical perspectives, art, architecture, music, language, performance and other cultural forms. Describe the historical and cultural complexities of the human condition in its global context, including the emergence and perpetuation of inequalities and the interplay of social, political, economic and physical geographies. Analyze and evaluate the value of diversity, especially by collaborating with people of different physical abilities and those with distinct linguistic, cultural, religious, lifestyle, national, and political backgrounds. Demonstrate a pragmatics of ethical principles, effective citizenship, and social responsibility through cross-cultural interactions, volunteerism, and civic engagement.
	Students will generate and develop capabilities for creative expression and effective communication. Students will be able to: Articulate ideas through written, spoken, and visual forms appropriately and effectively in relation to a given audience and social context. Utilize interpersonal and group communication skills, especially those that promote collaborative problem-solving, mutual understanding, and teamwork. Mindfully and respectfully listen to, engage with and formally respond to the ideas of others in meaningful ways. Plan, design, and produce creative forms of expression through music, speech, and the visual and performing arts.
	Students will develop skills that aid in lifelong personal growth and success in the workplace. Students will be able to: Identify and assess individual values, knowledge, skills, and abilities in order to set and achieve lifelong personal, educational, and professional goals. Practice decision-making that builds self-awareness, fosters self-reliance, and nourishes physical, mental, and social health. Apply skills of cooperation, collaboration, negotiation, and group decision-making. Exhibit quality judgment, dependability, and accountability while maintaining flexibility in an ever-changing world.
	Students will develop skills to effectively search for, critically evaluate, and utilize relevant information while demonstrating technological literacy. Students will be able to: Effectively access information and critically evaluate sources of information. Analyze, synthesize and apply information practically and ethically within personal, professional and academic contexts. Identify, utilize and evaluate the value of a variety of technologies relevant to academic and workplace settings.
	Students will develop critical and analytical thinking abilities, cultivate creative faculties that lead to innovative ideas, and employ pragmatic problem-solving skills. Students will be able to: Analyze differences and make connections among intellectual ideas, academic bodies of knowledge and disciplinary fields of study. Develop and expand upon innovative ideas by analyzing current evidence and praxis, employing historical and cultural knowledge, engaging in theoretical inquiry, and utilizing methods of rational inference. Utilize the scientific method and solve problems using qualitative and quantitative data. Demonstrate the ability to make well-considered aesthetic judgments.

Biology UNIVERSITY PREPARATION, EMPHASIS IN BIOLOGICAL SCIENCES, AS	Proficiently use the scientific vocabulary, including the key terms and concepts in biology, chemistry, and mathematics.
	Apply the scientific method of discovery to problem solving situations in biology, mathematics, and chemistry.

Solve abstract and complex chemical problems using General Chemistry ideas (rate laws, equilibrium, thermodynamics and/or electrochemistry) and theories.

Expected SLO Performance: 0.0

ISLOs GELO	Demonstrate proficiency in NATURAL SCIENCE by doing the following: Explaining how the scientific method is used to solve problems and escribing how scientific discoveries and theories affect human activities
ISLOs Core ISLOs	Students will generate and develop capabilities for creative expression and effective communication. Students will be able to: Articulate ideas through written, spoken, and visual forms appropriately and effectively in relation to a given audience and social context. Utilize interpersonal and group communication skills, especially those that promote collaborative problem-solving, mutual understanding, and teamwork. Mindfully and respectfully listen to, engage with and formally respond to the ideas of others in meaningful ways. Plan, design, and produce creative forms of expression through music, speech, and the visual and performing arts.
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	Students will be prepared to engage a global world while exhibiting a broad sense of diversity, cultural awareness, social responsibility and stewardship. Students will be able to: Interpret and analyze ideas of value and meaning exhibited in literature, religious practices, philosophical perspectives, art, architecture, music, language, performance and other cultural forms. Describe the historical and cultural complexities of the human condition in its global context, including the emergence and perpetuation of inequalities and the interplay of social, political, economic and physical geographies. Analyze and evaluate the value of diversity, especially by collaborating with people of different physical abilities and those with distinct linguistic, cultural, religious, lifestyle, national, and political backgrounds. Demonstrate a pragmatics of ethical principles, effective citizenship, and social responsibility through cross-cultural interactions, volunteerism, and civic engagement.
Biology UNIVERSITY PREPARATION, EMPHASIS IN BIOLOGICAL SCIENCES, AS	Proficiently use the scientific vocabulary, including the key terms and concepts in biology, chemistry, and mathematics.
	Apply the scientific method of discovery to problem solving situations in biology, mathematics, and chemistry.

Describe key events in the development of chemistry (rate laws, equilibrium, thermodynamics and/or electrochemistry) and recognize that science is an evolving body of knowledge.

Expected SLO Performance: 0.0

ISLOs Core ISLOs	Students will generate and develop capabilities for creative expression and effective communication. Students will be able to: Articulate ideas through written, spoken, and visual forms appropriately and effectively in relation to a given audience and social context. Utilize interpersonal and group communication skills, especially those that promote collaborative problem-solving, mutual understanding, and teamwork. Mindfully and respectfully listen to, engage with and formally respond to the ideas of others in meaningful ways. Plan, design, and produce creative forms of expression through music, speech, and the visual and performing arts.
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	Students will develop skills that aid in lifelong personal growth and success in the workplace. Students will be able to: Identify and assess individual values, knowledge, skills, and abilities in order to set and achieve lifelong personal, educational, and professional goals. Practice decision-making that builds self-awareness, fosters self-reliance, and nourishes physical, mental, and social health. Apply skills of cooperation, collaboration, negotiation, and group decision-making. Exhibit quality judgment, dependability, and accountability while maintaining flexibility in an ever-changing world.
Biology UNIVERSITY PREPARATION, EMPHASIS IN BIOLOGICAL SCIENCES, AS	Proficiently use the scientific vocabulary, including the key terms and concepts in biology, chemistry, and mathematics.
	Apply the scientific method of discovery to problem solving situations in biology, mathematics, and chemistry.
ISLOs GELO	Demonstrate proficiency in NATURAL SCIENCE by doing the following: Explaining how the scientific method is used to solve problems and escribing how scientific discoveries and theories affect human activities

Content

Course Content

1. Properties of Solutions
    1. Solution composition
    2. Energy of solution formation
    3. Factors affecting solubility
    4. Colligative properites
2. Kinetics
    1. Factors affecting the rate of reaction
    2. Concentration effects and rate laws
    3. Collision theory, temperature effects and the Arrhenius equation
    4. Mechanisms
    5. Homogeneous and heterogeneous catalysts
3. Equilibrium
    1. Dynamic equilibria and the mass action expression
    2. Equilibrium calculations
    3. Le Chatelier's Principle
4. Acids & Bases
    1. Bronstead-Lowery acid and bases and conjugates
    2. Strong and weak acids and bases
    3. pH and equilibrium calculations
5. Aqueous Equilibria
    1. Titration curves
    2. Buffers
    3. Polyprotic acids

    4. Solubility equilibria and factors affecting solubility
    5. Equilibria of complex ions in aqueous solutions.
    6. Selective precipitation of metal ions.
6. Electrochemistry
    1. Half-Reactions and redox equations
    2. Voltaic cells, the Nernst Equation, and Gibbs Free-Energy
    3. Electrolysis
7. Thermodynamics
    1. Second and third laws of thermodynamics
    2. Spontaneity, entropy and Gibbs Free-Energy
    3. Equilibrium and Gibbs Free-Energy
8. Coordination Chemistry
    1. Complex ions and Coordination Compounds
    2. Geometry
9. Descriptive Chemistry
    1. General properties of nonmetals
    2. Sources of oxygen, nitrogen, carbon, halogens, inert gases, silicon, phosphorous, and sulfur
    3. Uses of oxygen, nitrogen, carbon, halogens, inert gases, silicon, phosphorous, and sulfur
10. Nuclear Chemistry
    1. Nuclear reactions
    2. Binding-energy changes for nuclear processes
    3. Half-life of nuclides
    4. Applications
11. Organic Chemistry
    1. Basic nomenclature
    2. Functional groups

Lab Content

1. Safety
2. Measurement tools, precision of measurement and errors
3. Create and use standard curve(s)
4. Titration methods
5. Qualitative techniques and observation that support the topics listed in the course content
6. Quantitative techniques that support the topics listed in the course content

Recommended Course Content

Recommended Course Content

No Value

Recommended Lab Content

No Value

Distance Education (DE) Addendum

Is this course being proposed for Distance Education? If so, select Yes below from the list in the dropdown and complete the questions. If no, select No and skip all questions.

- Yes

Modality Type:

- Hybrid
- Online (ECO)

Methods of Instruction:

- Asynchronous Discussion
- Viewing and Listening to Videos
- Online Activities
- Written Assignments
- Reading Course Materials
- Group Meetings/Review Sessions (hybrid only)
- Synchronous Discussion
- Listening to Audio Materials
- Facilitated Discussions
- Quizzes, Exams, and Surveys
- Multimedia Presentations
- Interactive Activities
- Collaborative Peer/Group Activities

If Other is selected for Methods of Instruction, please describe:

No Value

Describe how the methods of instruction selected above will allow students to meet the course's learning outcomes:

The students will gain knowledge and experience with the theoretical material through either face-to-face, synchronous, or asynchronous lectures as well as either face-to-face or synchronous online discussions. The students will gain experience and knowledge of laboratory techniques and theory through face-to-face laboratory experiments.

Describe how the methods selected will be presented in an accessible way (Title 5 §55206). For information about accessibility standards in online classes, see the OEI Rubric, Section D (Copy this link and paste in a separate browser to visit OEI Rubric: https://onlinenetworkofeducators.org/course-design-academy/online-course-rubric/)

Heading styles are consistently used to aid navigation through the course when using assistive technology. Heading levels (Heading 1, Heading 2, etc.) are used in correct order. Fonts, colors, and formats (bold, italics, etc.) are not used in lieu of heading styles. Lists are created using the bullet or numbered list tool instead of being formatted manually so that lists are recognized when using a screen reader. Links are identified with meaningful and unique text in place of displaying the URL. Column and/or row header cells are designated so that screen readers can read table cells in the correct order. A table caption is included for more complex tables. There is sufficient color contrast between the foreground text and background to avoid difficulties for students with low vision. Color is not used as the only means of conveying information, adding emphasis, indicting action, or otherwise distinguishing a visual element. All images have appropriate alternative text, either explaining instructional value or indicating the image is decorative. Alternative text does not contain "image of", "picture of" or file extension (e.g., ".jpg"). Reading order is correctly set so that content is presented in the proper sequence when using screen readers and other assistive technologies. Slides are created using built-in accessible slide layouts with each slide having a unique title. All text is visible in Outline View to be sure that it can be read by assistive technology. Spreadsheets include labels for the rows and columns, detailed labels for charts, and are accompanied by textual descriptions that draw attention to key cells, trends, and totals. Files and content pages pass any built-in accessibility check available in the software. All video have accurate captions. If a video has no audio or instructionally relevant soundtrack, a note explaining that accompanies the video. Audio files are accompanied by complete and accurate transcripts. Blinking or flashing content, including gifs, are only be used if instructionally needed and not merely for decoration or emphasis. Flashing content does not flash more than three times in any one second period or exceed the general and red flash thresholds. Live broadcast and synchronous video conferences include a means for displaying synchronized captions if requested. Audio and video content is not be set to auto-play. If any audio on a web page does auto-play for more than three seconds, a mechanism is available to pause, stop, and control the volume.

Regular and Effective Contact (REC) Methods and Examples: Select the methods below that ensure regular effective contact (REC) will take place among students and among students and faculty (Title 5 §55204) by being initiated by the instructor, regular and frequent, and meaningful or of an academic nature. Select the methods of REC that may be used:

No Value

REC Among students: How will students interact with each other in the course? What methods will be used? Check all that apply.

- Discussion Boards
- Q & A Discussion Boards
- Third-Party Tools (e.g. FlipGrid, VoiceThread, etc...)

REC Among students and faculty: How will faculty interact with students in the course? What methods will be used? Check all that apply

- Announcements
- Assignment Feedback
- Discussion Boards
- Email
- Video Conferencing Technology (e.g. Zoom, MS Teams, etc...)
- Office Hours
- The Online Course Syllabus

Other Methods of REC among students and among students and faculty. Please describe and provide example(s).

No Value

In hybrid or teleclass courses, describe what parts of the course are done face-to-face and what parts are done online.

The laboratories will take place face-to-face. The lectures will be face-to-face, online synchronous, or online asynchronous. The discussions will be either face-to-face or online synchronous.

Checkoff List

Does this proposal meet the five development criteria as stated in the CCCCO Program and Course Approval Handbook (PCAH)?

Yes

Are library resources needed for this course?

No library resources are needed for this course.

Do you have any special concerns/needs or comments? If yes, describe.

No Value

Have you included documentation, if necessary, by uploading file(s) in the Cover Info tab? For example, advisory committee meeting minutes, C-ID descriptor, etc.)

Yes, I have uploaded file(s).

If this is a new course, have you attached the completed class capacity form, with required approvals, and uploaded the file in the Cover Info tab?

No, this is not a new course

If you are requesting Distance Education, did you complete the DE addendum tab?

Yes

If requesting transferability, have you completed the comparable courses field?

Yes

Add any additional comments you want reviewers to read.

No Value