

**EL CAMINO COLLEGE**  
**COURSE OUTLINE OF RECORD**

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**I. Course Information****Course Acronym:\***

CHEM

**Course Number:\*** 21A**Descriptive Title:\*** Survey of General and Organic Chemistry**Division:** Natural Sciences**Department:\***

Chemistry

**Course Disciplines:** Chemistry**Catalog Description:\***

The general chemistry topics in the course are units of measurement, atomic structure, the periodic table, inorganic formulas and nomenclature, chemical bonding, common chemical reactions, stoichiometry, states of matter, solutions, introduction to reaction rates and equilibrium, elementary acid-base theory and pH and buffers. The organic chemistry portion of the course studies the properties, nomenclature, common reactions and some reaction mechanisms for several classes of organic compounds. These classes include alkanes, alkenes, alkynes, alcohols, phenols and ethers. There is also an introduction to resonance and stereoisomerism. The emphasis in the laboratory is on observations and measurements.

Note: Students will not receive UC credit for Chemistry 21A if taken after Chemistry 1A or Chemistry 7A.

**Conditions of Enrollment:****Prerequisite:**

Eligibility for Mathematics 80

**Co-requisite:**

**Recommended Preparation:** English1 or Eligibility for English 1A or qualification by appropriate assessment

**Enrollment Limitation:**

**Course Length:** Full Term

**Hours Lecture (per week):** 3

**Hours Laboratory (per week):** 3

**Outside Study Hours:\*** 7

**Total Course Hours:\*** 108

**Course Units:\*** 4

**Grading Method:** Letter Grade only

**Credit Status:** Credit, degree applicable

**Transfer CSU:** Yes

**Effective Date:** Prior to July 1992

**Transfer UC:** Yes

**Effective Date:**

**General Education:**  
**ECC** Area 1 - Natural Sciences

**Term:**

**Other:**

**CSU GE:** Area B1 - Physical Universe and its Life Forms: Physical Science, Area B3 - Physical Universe and its Life Forms: Laborator Activity

**Term:**

**Other:**

**IGETC:** Area 5A - Physical Science, Area 5C - course that incorporate a laboratory

**Term:**

**Other:**

**II. Outcomes and Objectives**

**A. Student Learning Outcomes (SLOs)** (The course student learning outcomes are listed below.)  
***SLO revisions are completed via the SLO Change Form available on the College Curriculum***

*Committee website.*

**Student Learning Outcomes:**

**SLO #1 Names of Chemical Compounds**

On a written exercise, given the names of chemical compounds, students will be able to write the correct reactant formulas, states of matter (when required), identify reaction type, predict the product formulas and balance the chemical equation.

**SLO #2 Molecular Models and Drawings**

Students will be able to create (via molecular models or drawings) accurate representations of compounds. The representations will contain appropriate bonds, lone pairs, and geometry.

**SLO #3 Safety Protocol**

Students will adhere to safety protocol in the laboratory regarding eye protection. Students will follow the proper procedure regarding wearing goggles in the laboratory, and keeping them on to protect their eyes.

**B. Course Objectives** (The major learning objective for in this course are listed below.)

## Course Objectives:

1. Use the language of general chemistry (vocabulary, nomenclature, formulas and equations) to describe matter and its changes (physical and chemical).
2. Describe the structure of the atom in terms of the arrangement of subatomic particles and electronic configuration.
3. Extract information from the periodic table and predict periodic trends.
4. Explain the difference between ionic and covalent bonding and write Lewis structures for molecules and polyatomic ions.
5. Predict molecular geometry, bond angles and polarity.
6. Identify different types of chemical reactions (combination, decomposition, double and single replacement, and combustion). Predict products and write balanced chemical equations representing these reactions.
7. Solve introductory level quantitative problems applied to chemical systems by using dimensional analysis and algebra. These problems include unit conversions, density calculations, stoichiometry and theoretical yield, gas laws relating temperatures, pressures, and volumes of gases, aqueous solution concentrations, and pH.
8. Describe the properties of solids, liquids, gases and solutions and relate them to their relative internal energies.
9. Discuss the factors which affect the rate of reactions and apply Le Chatelier's Principle to equilibria.
10. State the properties and definitions of acids, bases, and salts and interpret elementary acid-base equilibria.
11. Analyze the bonding and geometry of carbon compounds in terms of hybridization and type of bonding orbital overlap ( $\pi$  or  $\sigma$ ).
12. Devise mechanisms to show how selected organic reactions take place.
13. Determine the nomenclature and write equations for the preparation and important reactions of alkanes, alkenes, alkynes, alcohols and ethers.
14. State the names of common aromatic compounds and describe the structure and resonance of these compounds.
15. Identify a chiral center in an organic compound, identify the different enantiomers.

16. Use common laboratory glassware and equipment to accurately and precisely take measurements.
17. State and apply the rules and procedures for laboratory safety.
18. Demonstrate the ability to use basic laboratory skills such as taking and recording observations of chemical systems and interpreting qualitative and quantitative experimental data.

### **III. Outline of Subject Matter**

(Topics should be detailed enough to enable an instructor to determine the major areas that should be covered to ensure consistency from instructor to instructor and semester to semester.)

Example:

- I. Main Topic (3 hours, lecture)
  - A. Sub topics
  - B. Sub topics
    1. Super sub topic
    2. Super sub topic

**Major Topics:****I. Introduction to Chemistry (2 hours, lecture)**

1. Important terminology and definitions
2. Matter
3. Physical and chemical properties and changes
4. Energy

**II. Measurement (4 hours, lecture)**

1. Metric System
2. Dimensional analysis
3. Density
4. Temperature scales -°F, °C, K

**III. Atomic Structure and Periodicity (4 hours, lecture)**

1. Dalton's Atomic Theory
2. Subatomic particles
3. The Bohr atom
4. The quantum mechanical model
5. Electronic configurations up to atomic number 36
6. The periodic table and periodicity

**IV. Chemical Bonding (5 hours, lecture)**

1. Ionic bonds
2. Inorganic nomenclature - salts, binary compounds
3. Covalent compounds
4. Lewis structures
5. Geometry of molecules
6. Polarity of molecules

**V. Chemical Reactions and Equations (6 hours, lecture)**

1. Equation Balancing
2. Classification of reactions
  1. Combination
  2. Decomposition
  3. Single replacement
  4. Double Replacement
3. Prediction of products
4. Introduction to oxidation-reduction

**VI. Stoichiometry (2.5 hours, lecture)**

1. Mole concept and Avogadro's Number
2. Molar mass
3. Reaction stoichiometry

3. Reaction stoichiometry
4. Theoretical yield, actual yield, and percent error.

**VII. States of Matter (4 hours, lecture)**

1. Kinetic molecular theory
2. Gas Laws: Boyle's, Charles', Gay-Lusaac's, Combined, Ideal
3. Dalton's law of partial pressure
4. Intermolecular forces
5. Physical properties

**VIII. Solutions (4 hours, lecture)**

1. Characteristics
2. The Dissolving Process
3. Concentrations - molarity, percent
4. Colligative properties - osmosis, boiling point, freezing point

**IX. Reaction Rules and Equilibrium (2.5 hours, lecture)**

1. Concepts
2. Factors affecting rate
3. Le Chatelier's principle

**X. Acids and Bases (4 hours, lecture)**

1. Properties
2. Nomenclature
3. Bronsted-Lowry model
4. pH, pOH and equilibrium constants
5. Buffers

**XI. Alkanes (and Cycloalkanes) (6 hours, lecture)**

1. Structure and bonding
2. Isomers
3. Nomenclature - Common and IUPAC
4. Physical properties
5. Reactions - introduction to organic reactions and reaction mechanisms

**XII. Unsaturated Hydrocarbons (6 hours, lecture)**

1. Structure and bonding
2. Alkenes - nomenclature, reactions, reaction mechanisms
3. Alkynes - nomenclature, reactions
4. Classes of dienes
5. Aromatics - structures, resonance, nomenclature

**XIII. Alcohols, Thiols, Phenols, Ethers (3 hours, lecture)**

1. Structure and Nomenclature
2. Physical Properties
3. Reactions, reaction mechanisms

**XIV. Stereochemistry (1 hour, lecture)**

1. Definitions
2. Showing configurations

**XV. Laboratory Experiments (Select 12 to 14 experiments) (54 hours, lab)**

1. Metric System Problems - by dimensional analysis
2. Introduction to Safety and Laboratory Procedures
3. Lab Measurements and Graphing
4. Physical Properties of Inorganic Substances
5. Lewis Dot Structures and Molecular Models
6. Formula Writing and Names of Compounds
7. Common Chemical Reactions
8. Formulas of Hydrates
9. Collection and Measurement of Hydrogen Gas
10. Equilibrium Systems
11. Solutions
12. Acid-Base Titration, pH and Indicators
13. Molecular Models of Organic Compounds
14. Reactivity of Hydrocarbons

**Total Lecture Hours:** 54

**Total Laboratory Hours:** 54

**Total Hours:** 108

**IV. Primary Method of Evaluation and Sample Assignments****A. Primary Method of Evaluation (choose one):**

- 1) Substantial writing assignments
- 2) Problem solving demonstrations (computational or non-computational)
- 3) Skills demonstrations

**Primary Method of Evaluation:** 2) Problem solving demonstrations (computational or non-computational)

**B. Typical Assignment Using Primary Method of Evaluation**

**Typical Assignment Using Primary Method**

If a sample of gas in a closed container of fixed volume is heated, would you expect the



of Evaluation: pressure in the container to increase or decrease? In a paragraph, explain why this occurs.

### C. College-level Critical Thinking Assignments

**Critical Thinking Assignment 1:** Draw the Lewis structure and determine the molecular geometry of phosphorus trifluoride. Is the molecule polar or nonpolar?

**Critical Thinking Assignment 2:** How many structural isomers exist for C<sub>4</sub>H<sub>9</sub>Br? Determine the structure, common name and IUPAC name for each.

### D. Other Typical Assessment and Evaluation Methods

**Examples:** Class Performance, Objective Exam, Clinical Evaluation, Oral Exams, Completion, Other Exams, Embedded Questions, Performance Exams, Essay Exams, Presentation, Fieldwork, Quizzes, Homework Problems, Reading Reports, Journal kept throughout course, Term or Other Papers, Laboratory Reports, True/False, Matching Items, Written Homework, Multiple Choice, Other (specify)

**Other Evaluation Methods:** Completion, Essay Exams, Homework Problems, Laboratory Reports, Matching Items, Multiple Choice, Objective Exam, Other Exams, Quizzes, True/False, Written Homework

### V. Instructional Methods

**Examples:** Lecture, Group Activities, Lab, Role play/simulation, Discussion, Guest Speakers, Multimedia presentations, Field trips, Demonstration, Other (specify)

**Instructional Methods:** Demonstration, Discussion, Lab, Lecture

If other:

**Note:** In compliance with Board Policies 1600 and 3410, Title 5 California Code of Regulations, the Rehabilitation Act of 1973, and Sections 504 and 508 of the Americans with Disabilities Act, instruction delivery shall provide access, full inclusion, and effective communication for students with disabilities.

### VI. Work Outside of Class

**Work Outside of Class:\*** Answer questions, Problem solving activity, Required reading, Skill practice, Study, Written work (such as essay/composition/report/analysis/research)

**If Other:** Reduced the study hours from 8 to 7 with the understanding that the 2 hours of lab was instrumental in supporting the lecture material.

### VII. Texts and Materials

**A. Up-to-date Representative Textbooks: Please use the following format(s):****Printed Text** - Author, Title, Edition, Publisher, Year.**Digital Text (OER Text)** - Author (last name first). Title. Edition or Version (if beyond 1st). Publisher, Publication year or Revision date. URL. License.**Sample:** *Dillon, Dave. Blueprint for Success in College and Career. Version 1.3. Rebus Community, 2018. press.rebus.community/blueprint2/. Licensed under CC BY 4.0.***If you wish to list a text that is more than 5 years old, please annotate it as a “discipline standard”.*****\*Multiple textbooks may be listed.***

**Up-To-Date Representative Textbooks:** Seager and Slabaugh. Chemistry for Today: General, Organic and Biochemistry. 9th ed. Thomson, 2018.

Peller. Catalyst: Chemistry 21A/B Custom Edition for El Camino College. 3rd ed. Prentice Hall, 2011. Discipline Standard

**B. Alternative Textbooks: Please use the following format(s): if applicable****Printed Text** - Author, Title, Edition, Publisher, Year.**Digital Text (OER Text)** - Author (last name first). Title. Edition or Version (if beyond 1st). Publisher, Publication year or Revision date. URL. License.**Sample:** *Dillon, Dave. Blueprint for Success in College and Career. Version 1.3. Rebus Community, 2018. press.rebus.community/blueprint2/. Licensed under CC BY 4.0.***If you wish to list a text that is more than 5 years old, please annotate it as a “discipline standard”.*****\*Multiple textbooks may be listed.*****Alternative Textbooks:****C. Required Supplementary Readings****Required Supplementary Readings:****D. Other Required Materials**

**Other Required Materials:** Safety Goggles  
Scientific Calculator

**VIII. Conditions of Enrollment**

**A. Requisites (Course Prerequisites and Corequisites) Skills needed without which a student would be highly unlikely to succeed.**

**Requisite:** Prerequisite

**Category:** standard

**Requisite course(s):** Eligibility for Mathematics 80  
**List both prerequisites and corequisites in this box.**

**Requisite and Matching skill(s):** **Bold the requisite skill. List the corresponding course objective under each skill(s).**

Students are required to use algebra and use graphical analysis to solve problems and interpret data.

**State the definition and answer questions using the following terms: digit, constant, variable, whole number, integer, odd number, even number, factor, divisor, multiple, exponent, power, equals relation, less than relation and absolute value.**

MATH 37/40 - Use the properties of the real numbers to evaluate, simplify, and factor algebraic expressions, including expressions with fractions and radicals.

MATH 37/40 - Solve systems of two linear equations with two variables symbolically, graphically, and numerically.

MATH 37/40 - Perform operations with and simplify rational and radical expressions.

MATH 37/40 - Graph linear equations and systems of linear equations by plotting points or by using intercepts and the slope.

**Perform the operations of addition, subtraction, multiplication, division, and raising to powers.**

MATH 37/40 - Use the properties of the real numbers to evaluate, simplify, and factor algebraic expressions, including expressions with fractions and radicals.

MATH 37/40 - Perform operations with and simplify rational and radical expressions.

**Evaluate expressions with groupings of symbols and mixed operations, including exponentials, using the order of operations.**

MATH 37/40 - Use the properties of the real numbers to evaluate, simplify, and factor algebraic expressions, including expressions with fractions and radicals.

MATH 37/40 - Perform operations with and simplify rational and radical expressions.

MATH 37/40 - Set up and solve application problems using quadratic equations, rational equations and systems of two linear equations with two variables.

**Solve first degree equations in one unknown.**

MATH 37/40 - Use the properties of the real numbers to evaluate, simplify, and factor algebraic expressions, including expressions with fractions and radicals.

MATH 37/40 - Perform operations with and simplify rational and radical expressions.

**B. Requisite Skills: (Non-Course Prerequisite and Corequisites) Skills needed without which a student would be highly unlikely to succeed.**

**Requisite Skill:**

**Requisite Skill and Matching Skill(s):**  
**Bold the requisite skill(s). If applicable**

**C. Recommended Preparations (Course) (Skills with which a student's ability to succeed will be strongly enhanced.)**

**Requisite course:** English 1

**Requisite and Matching skill(s):**  
**Bold the requisite skill. List the corresponding course objective under each skill(s).**

**Students need well-developed reading skills in order to understand and interpret information in their textbooks and writing skills to develop essays and projects.**  
ENGL 1- Summarize, analyze, evaluate, and synthesize college-level texts.  
ENGL 1 -Write a well-reasoned, well-supported expository essay that demonstrates application of the academic writing process.

**D. Recommended Preparation (Non-Course) (Skills with which a student's ability to succeed will be strongly enhanced.)**

**Requisite Skill:** Eligibility for English 1A or qualification by appropriate assessment

**Requisite Skill and Matching skill(s):**  
**Bold the requisite skill. List the corresponding course objective under each skill(s). If applicable**

Summarize, analyze, evaluate, and synthesize college-level texts.  
Write a well-reasoned, well-supported expository essay that demonstrates application of the academic writing process.

**E. Enrollment Limitations**

**Enrollment Limitations and Category:**

**Enrollment Limitations Impact:**

**Course Created by:** Jack L. Wolf

**Date:** 11/08/1971

**Original Board Approval Date:**

**Last Reviewed and/or  
Revised by:** Ana Tontcheva

**Date:** 09/20/2021

**Last Board Approval  
Date:** 12/20/2021 effective FALL 2022