El Camino College
COURSE OUTLINE OF RECORD – Official

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.
Prerequisite:	Eligibility for Mathematics 80
Co-requisite:	
Recommended Preparation:	English1 or Eligibility for English 1A or qualification by appropriate assessment
Enrollment Limitation:	
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:	
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.
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.

Major Topics:	**I. Introduction to Chemistry (2 hours, lecture)**
	
	   A. Important terminology and definitions
	   B. Matter
	   C. Physical and chemical properties and changes
	   D. Energy
	
	II. Measurement (4 hours, lecture)
	
	   A. Metric System
	   B. Dimensional analysis
	   C. Density
	   D. Temperature scales -$^{\circ}$F, $^{\circ}$C, K
	
	III. Atomic Structure and Periodicity (4 hours, lecture)
	
	   A. Dalton's Atomic Theory
	   B. Subatomic particles
	   C. The Bohr atom
	   D. The quantum mechanical model
	   E. Electronic configurations up to atomic number 36
	   F. The periodic table and periodicity
	
	IV. Chemical Bonding (5 hours, lecture)
	
	   A. Ionic bonds
	   B. Inorganic nomenclature - salts, binary compounds
	   C. Covalent compounds
	   D. Lewis structures
	   E. Geometry of molecules
	   F. Polarity of molecules
	
	V. Chemical Reactions and Equations (6 hours, lecture)
	
	   A. Equation Balancing
	   B. Classification of reactions
	      a. Combination
	      b. Decomposition
	      c. Single replacement
	      d. Double Replacement
	   C. Prediction of products
	   D. Introduction to oxidation-reduction
	
	VI. Stoichiometry (2.5 hours, lecture)
	
	   A. Mole concept and Avogadro's Number
	   B. Molar mass
	   C. Reaction stoichiometry
	   D. Theoretical yield, actual yield, and percent error.
	
	VII. States of Matter (4 hours, lecture)

A. Kinetic molecular theory
B. Gas Laws: Boyle's, Charles', Gay-Lusaac's, Combined, Ideal
C. Dalton's law of partial pressure
D. Intermolecular forces
E. Physical properties

VIII. Solutions (4 hours, lecture)

A. Characteristics
B. The Dissolving Process
C. Concentrations - molarity, percent
D. Colligative properties - osmosis, boiling point, freezing point

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

A. Concepts
B. Factors affecting rate
C. Le Chatelier's principle

X. Acids and Bases (4 hours, lecture)

A. Properties
B. Nomenclature
C. Bronsted-Lowry model
D. pH, pOH and equilibrium constants
E. Buffers

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

A. Structure and bonding
B. Isomers
C. Nomenclature - Common and IUPAC
D. Physical properties
E. Reactions - introduction to organic reactions and reaction mechanisms

XII. Unsaturated Hydrocarbons (6 hours, lecture)

A. Structure and bonding
B. Alkenes - nomenclature, reactions, reaction mechanisms
C. Alkynes - nomenclature, reactions
D. Classes of dienes
E. Aromatics - structures, resonance, nomenclature

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

A. Structure and Nomenclature
B. Physical Properties
C. Reactions, reaction mechanisms

XIV. Stereochemistry (1 hour, lecture)

A. Definitions

B. Showing configurations

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

    A. Metric System Problems - by dimensional analysis
    B. Introduction to Safety and Laboratory Procedures
    C. Lab Measurements and Graphing
    D. Physical Properties of Inorganic Substances
    E. Lewis Dot Structures and Molecular Models
    F. Formula Writing and Names of Compounds
    G. Common Chemical Reactions
    H. Formulas of Hydrates
    I. Collection and Measurement of Hydrogen Gas

    J. Equilibrium Systems
    K. Solutions
    L. Acid-Base Titration, pH and Indicators
    M. Molecular Models of Organic Compounds

    N. Reactivity of Hydrocarbons

Total Lecture Hours:	54
Total Laboratory Hours:	54
Total Hours:	108
Primary Method of Evaluation:	2) Problem solving demonstrations (computational or non-computational)
Typical Assignment Using Primary Method of Evaluation:	If a sample of gas in a closed container of fixed volume is heated, would you expect the pressure in the container to increase or decrease? In a paragraph, explain why this occurs.
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_4H_9Br? Determine the structure, common name and IUPAC name for each.
Other Evaluation Methods:	Completion, Essay Exams, Homework Problems, Laboratory Reports, Matching Items, Multiple Choice, Objective Exam, Other Exams, Quizzes, True/False, Written Homework
Instructional Methods:	Demonstration, Discussion, Lab, Lecture
If other:	
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.

Up-To-Date Representative Textbooks:	Seager and Slabaugh. <u>Chemistry for Today: General, Organic and Biochemistry</u>. 9th ed. Thomson, 2018. Peller. <u>Catalyst: Chemistry 21A/B Custom Edition for El Camino College</u>. 3rd ed. Prentice Hall, 2011. Discipline Standard
Alternative Textbooks:	
Required Supplementary Readings:	
Other Required Materials:	Safety Goggles Scientific Calculator
Requisite:	Prerequisite
Category:	standard
Requisite course(s): List both prerequisites and corequisites in this box.	Eligibiity for Mathematics 80
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.
Requisite Skill:	
Requisite Skill and Matching Skill(s): Bold the requisite skill(s). If applicable	
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.
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.
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
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