El Camino College

COURSE OUTLINE OF RECORD - Official

I. GENERAL COURSE INFORMATION

Subject and Number: Chemistry 21A
Descriptive Title: Survey of General and Organic Chemistry

Course Disciplines: Chemistry

Division: Natural Sciences

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

Course Length: [X] **Full Term** [ ] **Other (Specify number of weeks):**
Hours Lecture: **4.00 hours per week** [ ] **TBA**
Hours Laboratory: **2.00 hours per week** [ ] **TBA**
Course Units: **4.00**

Grading Method: **Letter**
Credit Status **Associate Degree Credit**

Transfer CSU: [X] **Effective Date: Prior to July 1992**
Transfer UC: [X] **Effective Date: Prior to July 1992**

General Education:
El Camino College: **1 – Natural Sciences**
Term: Other: Approved

CSU GE:

B1 - Physical Science

Term: Other: Approved

B3 - Laboratory Sciences

Term: Other: Approved

IGETC:

5A - Physical Science with Lab

Term: Fall 1991 Other:

5C - Science Laboratory

Term: Fall 1991 Other:

II. OUTCOMES AND OBJECTIVES

A. COURSE STUDENT LEARNING OUTCOMES (The course student learning outcomes are listed below, along with a representative assessment method for each. Student learning outcomes are not subject to review, revision or approval by the College Curriculum Committee)

1. On a written exercise, given the structures of reactants for a reaction, students will be able to write the correct structures of products and identify the reaction type.
2. 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.
3. 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.

The above SLOs were the most recent available SLOs at the time of course review. For the most current SLO statements, visit the El Camino College SLO webpage at http://www.elcamino.edu/academics/slo/.

B. Course Student Learning Objectives (The major learning objective for students enrolled in this course are listed below, along with a representative assessment method for each)

1. Use the language of general chemistry (vocabulary, nomenclature, formulas and equations) to describe matter and its changes (physical and chemical).

   Essay exams
2. Describe the structure of the atom in terms of the arrangement of subatomic particles and electronic configuration.

   Essay exams
3. Extract information from the periodic table and predict periodic trends.

   Multiple Choice
4. Explain the difference between ionic and covalent bonding and write Lewis structures for molecules and polyatomic ions.

   Objective Exams

5. Predict molecular geometry, bond angles and polarity.

   Completion

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.

   Objective Exams

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.

   Objective Exams

8. Describe the properties of solids, liquids, gases and solutions and relate them to their relative internal energies.

   Essay exams

9. Discuss the factors which affect the rate of reactions and apply Le Chatelier's Principle to equilibria.

   Objective Exams

10. State the properties and definitions of acids, bases, and salts and interpret elementary acid-base equilibria.

    Multiple Choice

11. Analyze the bonding and geometry of carbon compounds in terms of hybridization and type of bonding orbital overlap (pi or sigma).

    True/False

12. Devise mechanisms to show how selected organic reactions take place.

    Objective Exams

13. Determine the nomenclature and write equations for the preparation and important reactions of alkanes, alkenes, alkynes, alcohols and ethers.

    Quizzes

14. State the names of common aromatic compounds and describe the structure and resonance of these compounds.

    Completion

15. Identify a chiral center in an organic compound, identify the different enantiomers.

    Multiple Choice

16. Use common laboratory glassware and equipment to accurately and precisely take measurements.

    Laboratory reports

17. State and apply the rules and procedures for laboratory safety.

    Laboratory reports

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.

    Laboratory reports

III. OUTLINE OF SUBJECT MATTER (Topics are detailed enough to enable a qualified instructor to determine the major areas that should be covered as well as ensure consistency from instructor to instructor and semester to semester.)

Lecture or Lab	Approximate Hours	Topic Number	Major Topic
Lecture	3	I	A. Introduction to Chemistry 1. Important terminology and definitions 2. Matter 3. Physical and chemical properties and changes 4. Energy
Lecture	4	II	A. Measurement 1. Metric System 2. Dimensional analysis 3. Density 4. Temperature scales -^{o}F, ^{o}C, K
Lecture	6	III	A. Atomic Structure and Periodicity 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
Lecture	8	IV	A. Chemical Bonding 1. Ionic bonds 2. Inorganic nomenclature - salts, binary compounds 3. Covalent compounds 4. Lewis structures 5. Geometry of molecules 6. Polarity of molecules
Lecture	8	V	A. Chemical Reactions and Equations 1. Equation Balancing 2. Classification of reactions i. Combination ii. Decomposition iii. Single replacement iv. Double Replacement 3. Prediction of products 4. Introduction to oxidation-reduction
Lecture	3.5	VI	A. Stoichiometry 1. Mole concept and Avogadro's Number 2. Molar mass 3. Reaction stoichiometry 4. Theoretical yield, actual yield, and percent error.

Lecture	6	VII	A. States of Matter 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
Lecture	6	VIII	A. Solutions 1. Characteristics 2. The Dissolving Process 3. Concentrations - molarity, percent 4. Colligative properties - osmosis, boiling point, freezing point
Lecture	2.5	IX	A. Reaction Rules and Equilibrium 1. Concepts 2. Factors affecting rate 3. Le Chatelier's principle
Lecture	5	X	A. Acids and Bases 1. Properties 2. Nomenclature 3. Bronsted-Lowry model 4. pH, pOH and equilibrium constants 5. Buffers
Lecture	7	XI	A. Alkanes (and Cycloalkanes) 1. Structure and bonding 2. Isomers 3. Nomenclature - Common and IUPAC 4. Physical properties 5. Reactions - introduction to organic reactions
Lecture	8	XII	A. Unsaturated Hydrocarbons 1. Structure and bonding 2. Alkenes - nomenclature, reactions, reaction mechanisms 3. Alkynes - nomenclature, reactions 4. Classes of dienes 5. Aromatics - stuctures, resonance, nomenclature
Lecture	4	XIII	A. Alcohols, Thiols, Phenols, Ethers 1. Structure and Nomenclature 2. Physical Properties 3. Reactions, reaction mechanisms
Lecture	1	XIV	A. Stereochemistry 1. Definitions 2. Showing configurations

Lab	36	XV	A. Laboratory Experiments (Select 12 to 14 experiments) 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		72	
Total Laboratory Hours		36	
Total Hours		108	

IV. PRIMARY METHOD OF EVALUATION AND SAMPLE ASSIGNMENTS

A. **PRIMARY METHOD OF EVALUATION:**

Problem solving demonstrations (computational or non-computational)

B. **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.

C. **COLLEGE-LEVEL CRITICAL THINKING ASSIGNMENTS:**

1. Draw the Lewis structure and determine the molecular geometry of phosphorus trifluoride. Is the molecule polar or nonpolar?
2. How many structural isomers exist for C_4H_9Br? Determine the structure, common name and IUPAC name for each.

D. **OTHER TYPICAL ASSESSMENT AND EVALUATION METHODS:**

Essay exams

Objective Exams

Other exams

Quizzes

Written homework

Laboratory reports

Homework Problems

Multiple Choice

Completion

Matching Items

True/False

V. INSTRUCTIONAL METHODS

Demonstration
Discussion
Laboratory
Lecture

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

Study
Answer questions
Skill practice
Required reading
Problem solving activities
Written work
Other (specify)
Reduced the study hours from 8 to 7 with the understanding that the 2 hours of lab was instrumental in supporting the lecture material.

Estimated Independent Study Hours per Week: 7

VII. TEXTS AND MATERIALS

A. **UP-TO-DATE REPRESENTATIVE TEXTBOOKS**
Campbell. Chemistry 21A Packet. 5th ed. STS Printing, 0.
Seager and Slabaugh. Chemistry for Today: General, Organic and Biochemistry. 8th ed. Thomson, 2014.

Peller. Exploring Chemistry: Laboratory Experiments in General, Organic, and Biological Chemistry. 3rd ed. Prentice Hall, 2011.

B. **ALTERNATIVE TEXTBOOKS**

C. **REQUIRED SUPPLEMENTARY READINGS**

D. **OTHER REQUIRED MATERIALS**
Safety Goggles
Scientific Calculator

VIII. CONDITIONS OF ENROLLMENT

A. Requisites (Course and Non-Course Prerequisites)

Requisites	Category and Justification
Non-Course Prerequisite	Students are required to use algebra and use graphical analysis to solve problems and interpret data.

B. Requisite Skills

Requisite Skills
1. 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 40 - Use the properties of the real numbers to evaluate, simplify, and factor algebraic expressions, including expressions with fractions and radicals. MATH 43 - Solve systems of two linear equations with two variables symbolically, graphically and numerically.. MATH 43 - Perform operations with and simplify rational and radical expressions. MATH 40 - Graph linear equations and systems of linear equations by plotting points or by using intercepts and the slope.
2. Perform the operations of addition, subtraction, multiplication, division, and raising to powers. MATH 40 - Use the properties of the real numbers to evaluate, simplify, and factor algebraic expressions, including expressions with fractions and radicals. MATH 43 - Perform operations with and simplify rational and radical expressions.
3. Evaluate expressions with groupings of symbols and mixed operations, including exponentials, using the order of operations. MATH 40 - Use the properties of the real numbers to evaluate, simplify, and factor algebraic expressions, including expressions with fractions and radicals. MATH 43 - Perform operations with and simplify rational and radical expressions. MATH 43 - Set up and solve application problems using quadratic equations, rational equations and systems of two linear equations with two variables.
4. Solve first degree equations in one unknown. MATH 40 - Use the properties of the real numbers to evaluate, simplify, and factor algebraic expressions, including expressions with fractions and radicals. MATH 43 - Perform operations with and simplify rational and radical expressions.

C. Recommended Preparations (Course and Non-Course)

Recommended Preparation	Category and Justification

D. Recommended Skills

Recommended Skills

E. Enrollment Limitations

Enrollment Limitations and Category	Enrollment Limitations Impact

Course created by Jack L. Wolf on 11/08/1971.

BOARD APPROVAL DATE:

LAST BOARD APPROVAL DATE:

Last Reviewed and/or Revised by Soshanna Potter on 01/15/2015

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