El Camino College

COURSE OUTLINE OF RECORD - Approved

I. GENERAL COURSE INFORMATION

Subject and Number: **Chemistry 4H**
Descriptive Title: **Honors Beginning Chemistry**

Course Disciplines: **Chemistry**

Division: **Natural Sciences**

Catalog Description: This honors course, intended for students in the Honors Transfer Program, introduces the principles of chemistry, modern concepts of atomic structure and periodicity as a basis for understanding bonding, chemical formulas, chemical equations and chemical reactions, states of matter, important elements and their compounds, solutions, acid-base theories and reactions, net ionic equations, oxidation-reduction, kinetics, and chemical equilibrium, chemical nomenclature, and calculations. Historical and current chemical concepts will be investigated in a required research paper. In the laboratory, emphasis is on observations, measurements, and elementary quantitative experiments with an introduction to qualitative analysis. This course is enriched through extensive rigorous reading, writing, and research assignments.

Note: Students may take either Chemistry 4 or Chemistry 4H. Duplicate credit will not be awarded for Chemistry 4 and Chemistry 4H.

Conditions of Enrollment: **Prerequisite**

Mathematics 80
with a minimum grade of C
or

equivalent
or

qualification by testing (El Camino College Mathematics Placement Test and assessment

Recommended Preparation

eligibility for English 1A or English 1AH

Course Length: [X] **Full Term** [ ] **Other (Specify number of weeks):**
Hours Lecture: **5.00 hours per week** [ ] **TBA**
Hours Laboratory: **4.00 hours per week** [ ] **TBA**
Course Units: **5.00**

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

Transfer CSU:	☒ **Effective Date: 1/23/2017**
Transfer UC:	☒ **Effective Date: Proposed**

General Education:

El Camino College:	**1 – Natural Sciences**	
	Term: Fall 2017	Other:
CSU GE:	**B1 - Physical Science**	
	Term:	Other:
	B3 - Laboratory Sciences	
	Term:	Other:
IGETC:	**5A - Physical Science with Lab**	
	Term:	Other:
	5C - Science Laboratory	
	Term:	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 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.
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. Utilize the language of chemistry, including vocabulary, symbols, formulas, and equations.

    Objective Exams

2. Compare and contrast physical properties, physical changes, chemical properties and chemical changes.

   Essay exams

3. Analyze and solve quantitative problems, including stoichiometry, percent yield, energy and change of temperature, gas laws, the ideal gas equation, Dalton's law of partial pressures, percent abundance of isotopes, density, solution concentration, and colligative properties.

   Objective Exams

4. Compare and contrast ionic and covalent compounds. Evaluate bonding based on the chemical formula, and then correlate compound properties with the structure and types of bonding present.

   Quizzes

5. Given one or the other, generate names or formulas for elements, ions, and compounds.

   Completion

6. Differentiate between five reactions types: combination, decomposition, single replacement, double replacement, and complete oxidation. Given a set of reactants, diagnose the reaction type and predict the products.

   Objective Exams

7. Solve problems and express answers in scientific and decimal notation with correct units and significant figures. Use logarithms to convert among pH, pOH, $[H^+]$, and $[OH^-]$.

   Objective Exams

8. Correlate spontaneity of oxidation-reduction reactions with standard reduction potentials of reactants.

   Multiple Choice

9. Predict the direction of equilibrium shift in equilibrium processes, given a change in concentration, temperature, or volume of substances involved.

   True/False

10. Demonstrate basic laboratory skills, including making, recording, and evaluating observations of chemical systems.

    Laboratory reports

11. Evaluate volumetric laboratory glassware for the correct significant place to be read and record volumes correctly. Evaluate quantitative experimental data, and infer the presence or absence of specific ions in an unknown mixture.

    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	Matter and Energy a) The Scientific Method b) Physical and Chemical Properties c) Physical and Chemical Changes d) Elements, Compounds, and Mixtures e) Laws of Conservation of Mass and Energy

Lecture	3	II	Measurements a) The Metric System of Units for Length, Mass and Volume b) Units of Temperature b) Dimensional Analysis and Conversion Factors c) Significant figures in measurements and calculations.
Lecture	6	III	Atomic Structure and Periodicity a) Historical Development of the Atom: Dalton to Rutherford b) Quantum Mechanical Model and Quantum Numbers n, l, m, s c) Orbitals, Orbital Energy Diagrams, and Electron Configurations d) Periodicity
Lecture	7	IV	Chemical Bonding a) Ionic Bonds b) Covalent Bonds c) Lewis Structures d) Geometry of molecules e) Polarity of Molecules
Lecture	9	V	Inorganic Nomenclature a) Binary Compounds b) Salts c) Acids and Bases
Lecture	6	VI	Chemical Formula Concepts a) Mole Concept b) Molar Mass c) Percent Composition d) Determination of Empirical and Molecular Formulas
Lecture	12	VII	Chemical Reactions, Equations, and Stoichiometry a) States of Matter b) Balancing Equations c) Classification of Reactions (Combination, Decomposition, Complete Oxidation, Single Replacement and Double Replacement) d) Stoichiometry, Percent Yield, and Limiting Reactant e) Themochemical Equations
Lecture	5	VIII	Gases a) Gass Laws: Boyle, Charles, Avogadro, Combined, Ideal b) Kinetic Molecular Theory c) Dalton's Law of Partial Pressures d) Gas Stoichiometry
Lecture	6	IX	Liquids and Solids a) Properties b) Intermolecular Forces c) Dynamic Equilibrium d) Types of Crystalline Solids e) Energy and Phase Changes
Lecture	6	X	Solutions a) Characteristics b) Solution Concentrations (Molarity, Molality, Weight Percent) c) Factors Influencing Solubility d) Solution Stoichiometry e) Colligative Properties Including Molar Mass Determinations
Lecture	10	XI	Net Ionic Equations a) Strong, Weak and Non-Electrolytes b) Prediction of Products c) Writing Net Ionic Equations

Lecture	5	XII	Acid-Base Theory and Reactions a) Properties b) Acid-Base Theories (Arrhenius, Bronsted-Lowry, Lewis) c) Bronsted-Lowry Reactions d) Lewis Acid and Bases e) pH and pOH
Lecture	6	XIII	Oxidation and Reduction Reactions a) Oxidation Numbers b) Relative Strengths of Oxidizing and Reducing Agents c) Balancing Redox Reactions d) Electrochemical Cells
Lecture	5	XIV	Chemical Equilibrium and Kinetics a) Introduction to Kinetics i) Factors that Affect the Speed of a Reaciton c) Introduction to Equilibrium i) Le Chatelier's Principle ii) Equilibrium Constant Expressions
Lecture	1	XV	Nuclear Chemistry a) Alpha and Beta Particles b) Applications of Nuclear Chemistry
Lab	72	XVI	Laboratory Experiments and Exercises (Select 13 or more Experiments/Exercises Including all Starred Ones) a) The Laboratory Burner b) *Measurement and the Metric System c) *Observations of Reactions in Aqueous Solutions d) Rates of Chemical Reactions e) *Percent Water in an Unknown Hydrate f) *Common Chemical Reactions g) Charles Law h) *Determination of the Universal Gas Constant, R i) *Acid-Base Titrations (1 or 2 lab periods) j)* Conductivity (demonstration) k) *Qualitative Analysis (2 lab periods) l) Oxidation-Reduction Reactions (demonstration) m) Solution Concentration and Properties n) Nomenclature o)*Lewis Structures and Molecular Models p) NIE excercise
Total Lecture Hours		90	
Total Laboratory Hours		72	
Total Hours		162	

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:

Solder is an alloy of lead and tin. Nitric acid is used to treat 4.77 g of solder, causing the tin to react: $Sn(s) + 4\ HNO_3(aq) \rightarrow SnO_2(s) + 4\ NO_2(g) + 2\ H_2O(l)$.

The NO_2 gas produced has a volume of 1.94 L at 691 torr and 19 °C. Calculate the grams of tin that reacted.

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

1. Explain from the particulate point of view (kinetic molecular theory) why the pressure of a fixed amount of gas at constant temperature decreases when the volume increases in a 300 to 500 word essay.
2. Write a three to five page research paper with a minimum of five sources on the element of your choice. One source must be the Chemical Rubber Company (CRC) Handbook of Chemistry and Physics. Discuss the element's discovery, historical and economic importance, common uses, chemical and physical properties, as well as environmental and/or biological significance.

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

Essay exams

Objective Exams

Quizzes

Laboratory reports

Homework Problems

Term or other papers

Multiple Choice

Matching Items

True/False

V. INSTRUCTIONAL METHODS

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
Problem solving activities
Written work

Estimated Independent Study Hours per Week: 8

VII. TEXTS AND MATERIALS

A. **UP-TO-DATE REPRESENTATIVE TEXTBOOKS**
Cracolice and Peters . Introductory Chemistry. 6th ed. Cengage, 2016.
El Camino Chemistry Faculty. Chem 4 Supplement and Laboratory Manual. ECC Bookstore, 2002.

B. **ALTERNATIVE TEXTBOOKS**

C. **REQUIRED SUPPLEMENTARY READINGS**

D. **OTHER REQUIRED MATERIALS**
scientific calculator, safety goggles

VIII. CONDITIONS OF ENROLLMENT

A. Requisites (Course and Non-Course Prerequisites and Corequisites)

Requisites	Category and Justification
Course Prerequisite Mathematics-80 or	Computational/Communication Skills
Non-Course Prerequisite or	
Non-Course Prerequisite	

B. Requisite Skills

Requisite Skills
Solve linear equations involving one or more variables. MATH 80 - Carry out numerical operations and manipulate algebraic expressions, including expressions with rational and negative exponents, complex numbers, and logarithms. MATH 80 - Solve problems involving a variety of function types, including linear, quadratic, polynomial, rational, radical, exponential, and logarithmic functions. MATH 80 - Solve a variety of equations and inequalities, as well as systems of equations and inequalities, using algebraic and graphical methods. Types of equations include linear, quadratic, polynomial, rational, radical, exponential and logarithmic equations.
Solve an equation involving absolute values. MATH 80 - Carry out numerical operations and manipulate algebraic expressions, including expressions with rational and negative exponents, complex numbers, and logarithms. MATH 80 - Solve problems involving a variety of function types, including linear, quadratic, polynomial, rational, radical, exponential, and logarithmic functions.
Find the least common denominator of given rational expressions. MATH 80 - Carry out numerical operations and manipulate algebraic expressions, including expressions with rational and negative exponents, complex numbers, and logarithms.
Determine the slope of a line. MATH 80 - Graph a variety of functions and relations and draw connections between these graphs and solutions to problems.
Sketch a line that includes a given point and slope. MATH 80 - Graph a variety of functions and relations and draw connections between these graphs and solutions to problems.
Find the x- and y- intercepts for a given relation. MATH 80 -

Carry out numerical operations and manipulate algebraic expressions, including expressions with rational and negative exponents, complex numbers, and logarithms. MATH 80 - Graph a variety of functions and relations and draw connections between these graphs and solutions to problems.	
Solve simultaneous equations by both substitution and addition. MATH 80 - Solve a variety of equations and inequalities, as well as systems of equations and inequalities, using algebraic and graphical methods. Types of equations include linear, quadratic, polynomial, rational, radical, exponential and logarithmic equations.	
Convert between exponential and logarithm forms given an equation in either format. MATH 80 - Carry out numerical operations and manipulate algebraic expressions, including expressions with rational and negative exponents, complex numbers, and logarithms. MATH 80 - Solve a variety of equations and inequalities, as well as systems of equations and inequalities, using algebraic and graphical methods. Types of equations include linear, quadratic, polynomial, rational, radical, exponential and logarithmic equations.	
Write a sum or difference of logarithms as a single logarithm. MATH 80 - Solve a variety of equations and inequalities, as well as systems of equations and inequalities, using algebraic and graphical methods. Types of equations include linear, quadratic, polynomial, rational, radical, exponential and logarithmic equations.	
Use a calculator to solve a given exponential or logarithmic equation. MATH 80 - Carry out numerical operations and manipulate algebraic expressions, including expressions with rational and negative exponents, complex numbers, and logarithms. MATH 80 - Solve problems involving a variety of function types, including linear, quadratic, polynomial, rational, radical, exponential, and logarithmic functions.	

C. Recommended Preparations (Course and Non-Course)

Recommended Preparation	Category and Justification
Non-Course Recommended Preparation eligibility for English 1A or English 1AH	It is advised that students are able to read and effectively analyze college level texts, and have the ability to write a paper that persuasively proves an original thesis. If students are eligible for English 1A or English 1AH they are more likely to be successful in this course.

D. Recommended Skills

Recommended Skills
Answer essay questions explaining chemical concepts and principles. ENGL A - Read and apply critical thinking skills to college-level expository prose for the purposes of writing and discussion. ENGL 84 - Select and employ reading strategies to interpret the content of a college-level textbook, with special focus on constructing a thesis statement and providing valid support.

E. Enrollment Limitations

Enrollment Limitations and Category	Enrollment Limitations Impact

Course created by Thanh-Thuy Bui on 03/09/2016.

BOARD APPROVAL DATE: 01/23/2017

LAST BOARD APPROVAL DATE:

Last Reviewed and/or Revised by Thanh-Thuy Bui on 03/09/2016

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