CREDIT COURSE OUTLINE

I. COVER PAGE

(1) CHEM 3A	(2) INTRODUCTORY GENERAL CHEMISTRY	(3) 4
Number	Title	Units

(4)	Lecture / Lab Hours:			
	Total Course Hours			
		Total Lec hours:		3.00
		Total Lab hours:		3.00
		Total Contact hours:		108.00
	Lec will generate 0 hour(s) outside work.			
	Lab will generate 0 hour(s) outside work.			
(5)	Grading Basis:	Grading Scale Only		
		Pass/No Pass option		X
		Pass/No Pass only		
(6)	Advisories: Eligibility for English 126 Eligibility for English 125 and			
(7)	Pre-requisites(requires C grade or better): MATH 103 MATH 103			
	Corequisites:			

(8)Classification:			
		Degree applicable:	X
		Non-degree applicable:	
		Basic skills:	
(9)RC	Fulfills AS/AA degree requirement: (area)		
	General education category:		
		Area A Natural Sciences	
	Major:	AGRICULTURE BUSINESS BIOLOGICAL SCIENCE ENGINEERING LIBERAL ARTS & SCIENCES PHYSICAL SCIENCE PLANT & SOIL SCIENCE	
	Certificate of:		
	Certificate in:		
(10)CSU		Baccalaureate:	X
(11)Repeatable: (A course may be repeated three times)			0

(12) Catalog Description:
Composition of matter, physical and chemical changes, fundamental laws and principles, atomic and molecular structure, inorganic nomenclature, chemical formula and reaction calculations, gas laws, bonding, solutions, net ionic equations, acid-base theories, pH, oxidation-reduction reactions and equilibria. Qualitative and quantitative theory and techniques. For applied science and non-science majors.

II. COURSE OUTCOMES:

(Specify the learning skills the student demonstrates through completing the course and link critical thinking skills to specific course content and objectives.)

Upon completion of this course, students will be able to:

I. Use dimensional analysis to solve for an unknown parameter of density, volume, mass, pressure, temperature, molar mass, concentration, or an empirical formula.
II. Construct and balance a chemical reaction and use the reaction to predict stoichiometric quantities.
III. Competent knowledge and understanding of the periodic table and the ability use the periodic table to solve chemical problems.
IV. Understand acid-base reactions and how to calculate pH.
V. Name and draw Lewis diagrams of inorganic and molecular compounds from the formula and vice versa.
VI. Safely conduct laboratory experiments implementing concepts and principles learned in lecture.

III. COURSE OBJECTIVES:

(Specify major objectives in terms of the observable knowledge and/or skills to be attained.)

In the process of completing this course, students will:

I. learn an appreciation for the impact of chemistry on modern society and the relationship between chemistry and other disciplines including agriculture, the medical field, and industry;
II. identify types of matter, recognize physical properties and chemical properties, and a general understanding of the Law of Conservation of Mass and the Law of Conservation of Energy;
III. perform unit conversions using the correct significant figures; between the English and metric systems, temperatures in different units, density, energy, and with SI units;
IV. use the periodic table to identify physical and chemical properties of elements and calculate molar masses of compounds and molecules;
V. learn to recognize the electromagnetic spectrum and have a basic understanding of the quantum mechanical model of the atom;

VI. demonstrate the ability to name inorganic compounds given their formulas, and write formulas given names;
VII. learn to distinguish and identify metals, non-metals, metalloids, and the elements of alkali metals, alkaline earth metals, halogens, noble gases, transition metals, and elements of the lanthanide and actinide;
VIII. differentiate and identify between different types of intramolecular and intermolecular forces of attraction present in various substances based on chemical formulas and structures;
IX. develop techniques used to write Lewis Electron-Dot Formulas and identify the shape using VSEPR method;
X. explain, write and balance chemical equations, and use these equations along with stoichiometry and the mole concept to convert quantities (e.g. grams or moles) of a given substance into quantities of an unknown substance;
XI. learn to calculate, empirical formulas, and percentage composition given the appropriate data;
XII. identify and balance chemical equations of different types of reactions;
XIII. perform calculations involving a limiting reagent and determining the percent yield;
XIV. learn to predict the physical behavior of gases to pressure, temperature, and volume changes;
XV. prepare and solve simple mathematical problems involving formula calculations related to gas laws;
XVI. apply gas laws and stoichiometry to calculate quantities (e.g. moles, volume, grams) of gas produced or consumed during a reaction;
XVII. learn to calculate various parameters of solutions including molarity, dilution techniques, percentage concentration, and density.
XVIII. diagram heating and cooling curves;
XIX. explain state and energy changes accompanying heating and cooling curves;
XX. identify the principles of equilibrium in reversible reactions, saturated solutions, solutions of weak electrolytes and solutions of gases in solving related problems;
XXI. understand solution properties and stoichiometry to calculate quantities (e.g. moles, volume, grams) produced or consumed during a reaction;
XXII. explain colligative properties of solutions (e.g. boiling point elevation, freezing point depression, and osmotic pressure);
XXIII. learn to define and identify acids and bases and be able to perform math calculations involving the pH;
XXIV. identify the nature and applications for electron exchange reactions;
XXV. understand the structure of the atomic nucleus;
XXVI. explain the fundamental types of nuclear radiation and the effects they have on biological systems
XXVII. and demonstrate laboratory skills which include operating an analytical balance; calibrating and/or use fundamental lab equipment such as a thermometer, barometer, buret, pipette; recognizing use and limitations of laboratory glassware; recording and reporting observations; using error analysis techniques to evaluate certainty of data; use safety precautions and general laboratory procedures.

IV. COURSE OUTLINE:

Lecture Content:

A. Lecture
1. Introduction to chemistry
a. Scientific Method

2. Matter and energy
a. Classifying Matter: Solid, Liquid and Gas
b. Elements, Compounds, and Mixtures
c. Physical and Chemical Properties
d. Physical changes and chemical changes
e. Conservation of Matter
f. Energy and Heat capacity
3. Metric system
a. Scientific Notation
b. Significant figures
c. Basic units of measurement
d. Converting units
e. density
4. Elements, Atoms, and the Periodic Table
a. Atomic theory
b. The nuclear atom
c. Properties of subatomic particles
d. The Periodic Law and the Periodic table
e. Ions and Isotopes
f. Atomic mass
5. Atomic structure: Atoms and ions
a. Molecular view of elements
b. Chemical formulas
c. Writing formulas for ionic and molecular compounds
d. Formula mass
6. Nomenclature of Inorganic Compounds
a. Naming ionic compounds (salts, acids, and bases)
b. Naming molecular compounds
7. Periodic Properties of Elements
a. Trends of the periodic table (size of atoms and ions, electronegativity, and ionization energy)
b. Groups and Periods
c. Similarities in groups
d. Bohrs model of an atom

e. The Quantum-Mechanical Model
1) Quantum numbers
2) Orbital shapes
f. Electron configuration
8. Chemical bonds: ionic, covalent, and metallic
a. Intermolecular bonding
b. Electronegativity
c. Lewis structures
9. Chemical Composition
a. Mole concept
b. Avagadros number
c. Chemical formulas and conversion factors
d. Formula Stoichiometry
e. Empirical formula and molecular formula
f. Limiting reagents
10. Chemical Reactions
a. Equation Stoichiometry
b. Solubility rules
c. Types of reaction
1) Double replacement
2) Single replacement

3) Neutralization
4) precipitation
5) Oxidation reduction
11. Gas Laws and Kinetic Molecular Theory
a. Boyle's Law
b. Charles's Law
c. The Combined Gas Law
d. Avogadro's Law
e. The Ideal Gas Law
f. Dalton's Law
g. Gases in a chemical reaction
12. Liquids and Solids
a. Solutes and solutions
1) Units of concentrations (molarity, molality, normality, percent by mass, percent by volume, ppm, and ppb)
b. Heat of Reactions and Enthalpy
1) Heating and cooling curves (heat of fusion, heat of vaporization, and specific heat)
c. Reaction rates and Chemical Equilibrium
d. Intermolecular and intramolecular bonding
1) Dipole-dipole, dispersion, hydrogen bonding
e. Types of Crystalline Solid: Molecular, Ionic, and Atomic
13. Acids-base theory, Acidity Constants, and pH
a. Definition of acids and bases
b. Acid-base titrations
c. Strong and weak acid and bases
d. The pH scale
e. Buffers
14. Chemical Equilibrium
a. Dynamic equilibrium
b. The rate of a chemical reaction
c. Le Châtelier's Principle
15. Oxidation and Reduction reactions
a. Definition of oxidation and reduction
b. Oxidation states
c. Balancing an oxidation reduction reaction
16. Nuclear Chemistry
a. Radioactivity and the atomic nucleus
b. The Effects of Radiation on Biological Systems

B. Laboratory
1. Orientation, Safety
2. Quantitative Separation of a Mixture
3. Measurement
4. Density
5. Chromatography
6. Atoms and Spectra
7. Formula of a Hydrate
8. Heat of Neutralization
9. Models and Shapes
10. Molar Mass of Unknown gas
11. Titration to determine the percentage of acetic acid in vinegar

12. Acids, bases and pH
13. Ionic reactions
14. Melting points of solids
15. Preparation of Alum
16. Gravimetric analysis of a soluble sulfate

Lab Content:

1. Orientation, safety
2. Quantitative separation of a mixture
3. Measurement
4. Density
5. Chromatography
6. Atoms and spectra
7. Formula of a hydrate
8. Heat of neutralization
9. Models and shapes
10. Molar mass of unknown gas
11. Titration to determine the percentage of acetic acid in vinegar
12. Acids, bases and pH
13. Ionic reactions
14. Melting points of solids
15. Preparation of Alum
16. Gravimetric analysis of a soluble sulfate

V. APPROPRIATE READINGS

Reading assignments may include but are not limited to the following:

I. Sample Text Title:
   1. Recommended - Cracolice, Mark S., Peters, Edward I *Introductory Chemistry,* ed. 4 Brooks/Cole/Cengage, Florence, 2010,
   2. Recommended - Tro, Nivaldo J *Introductory Chemistry,* ed. 3 Prentice Hall, Upper Saddle River, 2009,
   3. Recommended - Burns, Ralph A *Fundamentals of Chemistry in the Laboratory,* ed. 4 Prentice Hall, Upper Saddle River , 2003,

II. Other Readings

___ Global or international materials or concepts are appropriately included in this course
___ Multicultural materials and concepts are appropriately included in this course

If either line is checked, write a paragraph indicating specifically how global/international and/or multicultural materials and concepts relate to content outline and/or readings.

VI. METHODS TO MEASURE STUDENT ACHIEVEMENT AND DETERMINE GRADES:

Students in this course will be graded in at least one of the following four categories. Please check those appropriate. A degree applicable course must have a minimum of one response in category A, B, or C.

A. Writing Check either 1 or 2 below			
X	***1. Substantial writing assignments are required. Check the appropriate boxes below and provide a written description in the space provided.***		
	2. Substantial writing assignments are NOT required. If this box is checked leave this section blank. For degree applicable courses you must complete category B and/or C.		
	a) essay exam(s)	X	d) written homework
	b) term or other paper(s)		e) reading reports
X	c) laboratory report(s)		f) other (specify)

Required assignments may include but are not limited to the following:

B. Problem Solving Computational or non-computational problem-solving demonstrations, including:			
X	a) exam(s)	X	d) laboratory reports
X	b) quizzes		e) field work
X	c) homework problems		f) other (specify):

Required assignments may include but are not limited to the following:
1. Homework assignments are composed of problems where solving equations is a required.
2. Exams and quizzes include problems where solving of equations is required.
3. Laboratory reports include both computational and non-computational problem-solving skills.

C. Skill demonstrations, including:			
	a) class performance(s)		c) performance exams(s)
	b) field work	X	d) other (specify)

Required assignments may include but are not limited to the following:
The students will be required to perform experiments during the weekly three hour lab where their laboratory skills will be graded according to the accuracy of the results, technique and post lab questions.

D. Objective examinations including:			
X	a) multiple choice		d) completion
X	b) true/false	X	e) other (specify):
X	c) matching items		

COURSE GRADE DETERMINATION:
Description/Explanation: Based on the categories checked in A-D, it is the recommendation of the department that the instructor's grading methods fall within the following departmental guidelines; however, the final method of grading is still at the discretion of the individual instructor. The instructor's syllabus must reflect the criteria by which the student's grade has been determined. (A minimum of five (5) grades must be recorded on the final roster.)

If several methods to measure student achievement are used, indicate here the approximate weight or percentage each has in determining student final grades.
Exams (4) 45% Final 15% Quizzes, homework 10% Participation 5% Laboratory 25%

VII. EDUCATIONAL MATERIALS

For degree applicable courses, the adopted texts, as listed in the college bookstore, or instructor-prepared materials have been certified to contain college-level materials.

Validation Language Level (check where applicable):	College-Level Criteria Met YES	NO
Textbook	X	
Reference materials		X
Instructor-prepared materials	X	
Audio-visual materials	X	

Indicate Method of evaluation:

Used readability formulae (grade level 10 or higher)	
Text is used in a college-level course	X
Used grading provided by publisher	
Other: (please explain; relate to Skills Levels)	X Power Point presentations are prepared using the text that is used in a college-level course.

Computation Level (Eligible for MATH 101 level or higher where applicable)	X	
Content		
Breadth of ideas covered clearly meets college-level learning objectives of this course	X	
Presentation of content and/or exercises/projects:		
Requires a variety of problem-solving strategies including inductive and deductive reasoning.	X	
Requires independent thought and study	X	
Applies transferring knowledge and skills appropriately and efficiently to new situations or problems.	X	

List of Reading/Educational Materials
Recommended - Cracolice, Mark S., Peters, Edward I *Introductory Chemistry,* ed. 4 Brooks/Cole/Cengage, Florence, 2010,
Recommended - Tro, Nivaldo J *Introductory Chemistry,* ed. 3 Prentice Hall, Upper Saddle River, 2009,
Recommended - Burns, Ralph A *Fundamentals of Chemistry in the Laboratory,* ed. 4 Prentice Hall, Upper Saddle River , 2003,

Comments:

_____ This course requires special or additional library materials (list attached).

__X__ This course requires special facilities:
Laboratory where students can perform chemistry experiments

Attached Files:

BASIC SKILLS ADVISORIES PAGE The skills listed are those needed for eligibility for English 125, 126, and Math 101. These skills are listed as the outcomes from English 252, 262, and Math 250. In the right hand column, list at least three major basic skills needed at the beginning of the target course and check off the corresponding basic skills listed at the left.

(eligibility for English 126) (as outcomes for English 262) __X__ Using phonetic, structural, contextual, and dictionary skills to attack and understand words. __X__ Applying word analysis skills to reading in context. __X__ Using adequate basic functional vocabulary skills. _____ Using textbook study skills and outlining skills. __X__ Using a full range of literal comprehension skills and basic analytical skills such as predicting, inferring, concluding, and evaluating.	1. Students are required to read a college level textbook. 2. Students are required to use outlining skills and specific textbook study skills. 3. Students are required to read lab manuals and understand safety procedures. 4. Basic analytical skills are required for good comprehension of reading.
(eligibility for English 125) (as outcomes for English 252) __X__ Writing complete English sentences and avoiding errors most of the time. __X__ Using the conventions of English writing: capitalization, punctuation, spelling, etc. __X__ Using verbs correctly in present, past, future, and present perfect tenses, and using the correct forms of common irregular verbs. __X__ Expanding and developing basic sentence structure with appropriate modification. __X__ Combining sentences using coordination, subordination, and phrases. __X__ Expressing the writer's ideas in short personal papers utilizing the writing process in their development.	1. Written answers are part of the homework assignments. 2. Lab reports are required which necessitate the ability to write well organized and coherent laboratory summaries. 3. Exams require explanations for chemical equilibria and writing calculations coherently.

Check the appropriate spaces.
_____ Eligibility for Math 101 is advisory for the target course.
__X__ Eligibility for English 126 is advisory for the target course.
__X__ Eligibility for English 125 is advisory for the target course.
If the reviewers determine that an advisory or advisories in Basic Skills are all that are necessary for success in the target course, stop here, provide the required signatures, and forward this form to the department chair, the appropriate associate dean, and the curriculum committee.

CONTENT REVIEW	
MATH 103 INTERMEDIATE ALGEBRA	
Simplify and/or factor mathematical expressions into forms more conducive to analysis.	
Solve equations introduced in Intermediate Algebra.	
Graph functions and relations introduced in Intermediate Algebra.	
Apply Intermediate Algebra topics to solve real-life problems.	

REQUISITES	
Subject Prerequisite -- MATH 103 INTERMEDIATE ALGEBRA	
• Simplify and/or factor mathematical expressions into forms more conducive to analysis.	• learn an appreciation for the impact of chemistry on modern society and the relationship between chemistry and other disciplines including agriculture, the medical field, and industry;
Subject Prerequisite -- MATH 103 INTERMEDIATE ALGEBRA	
• Simplify and/or factor mathematical expressions into forms more conducive to analysis. • Solve equations introduced in Intermediate Algebra. • Apply Intermediate Algebra topics to solve real-life problems.	• perform calculations involving a limiting reagent and determining the percent yield; • apply gas laws and stoichiometry to calculate quantities (e.g. moles, volume, grams) of gas produced or consumed during a reaction; • learn to calculate various parameters of solutions including molarity, dilution techniques, percentage concentration, and density.

ESTABLISHING PREREQUISITES OR COREQUISITES

Every prerequisite or corequisite requires content review plus justification of at least one of the seven kinds below. Prerequisite courses in communication and math outside of their disciplines require justification through statistical evidence. Kinds of justification that may establish a prerequisite are listed below.

Check one of the following that apply. Documentation may be attached.

1. _____ The prerequisite/corequisite is required by law or government regulations.
   Explain or cite regulation numbers:
2. _____ The health or safety of the students in this course requires the prerequisite.
   Justification: Indicate how this is so.
3. _____ The safety or equipment operation skills learned in the prerequisite course are required for the successful or safe completion of this course.
   Justification: Indicate how this is so.
4. _____ The prerequisite is required in order for the course to be accepted for transfer to the UC or CSU systems.
   Justification: Indicate how this is so.
5. _____ Significant statistical evidence indicates that the absence of the prerequisite course is related to unsatisfactory performance in the target course.
   Justification: Cite the statistical evidence from the research.
6. _____ The prerequisite course is part of a sequence of courses within or across a discipline.
7. __X__ Three CSU/UC campuses require an equivalent prerequisite or corequisite for a course equivalent to the target course:
   CSU Long Beach, Chem 101 Math 112 CSU Humboldt Chem 107 Math 44 CSU San Bernardino Chem 205 Math 90 CSU Fresno Chem 3A Math 75 (Calculus I)