CREDIT COURSE OUTLINE

I. COVER PAGE

(1) CHEM 1A	(2) GENERAL CHEMISTRY	(3) 5
Number	Title	Units

(4)	Lecture / Lab Hours:			
	Total Course Hours			
		Total Lec hours:		3.00
		Total Lab hours:		6.00
		Total Contact hours:		162.00
	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 125 and Eligibility for English 126			
(7)	Pre-requisites(requires C grade or better): High school chemistry with laboratory component or CHEM 10 or CHEM 3A or equivalent and 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:		
	Certificate of:		
	Certificate in:		
(10)CSU		Baccalaureate:	X
(11)Repeatable: (A course may be repeated three times)			0

(12) Catalog Description:
Basic concepts; atoms, molecules, and ions; formulas and equations;stoichiometry; gas laws; electronic structure of atoms; bonding; atomic orbital and molecular orbital theories; solutions; precipitation reactions; oxidation reduction reactions; introduction to acids and bases; thermochemistry; properties of liquids; solids and crystal structures; solution behavior; colligative properties; associated laboratory experiments; and volumetric and gravimetric analysis methods.

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. Collect and analyze data and have reasonable conclusions. Assessed by the lab practical.
II. Competent knowledge of the periodic table, molecules, and compounds. Assessed from a pre-test administered at the beginning of the semester and the final exam administered at the end of the semester.
III. Ability to apply skills to solve chemical problems especially math skills. Assessed from a pre-test administered at the beginning of the semester and the final exam administered at the end of the semester.

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. Use systematic nomenclature to name and classify chemical species.
II. Predict ionic and covalent bonding between species.
III. Convert from the English to the metric system in weights, volume, and linear measurements.
IV. Calculate molecular weights, formula weights, gas volumes, temperature, pressure concentration of solutions, molarity, empirical and molecular formulas, and percentage composition.
V. Define the structural peroidiity of the elements and discuss the trends in all directions on the periodic chart and the terms for grouping elements, i.e., metalloids, transition elements, inner transition, etc..
VI. Use stoichiometric relationships to calculate quantities of reactants, products, limiting reactants, theoretical yields, percent yields, and chemical formulas.

VII. Describe covalently bonded structures using Lewis theory, valence bond theory (including hybrid orbitals), and molecular orbital theory of diatomic molecules.
VIII. Define the theoretical and mathematical description of ideal gases, including the concepts of temperature and kinetic energy distribution.
IX. Identify types of reactions, predict the outcomes of chemical reactions, and write and blance chemical reactions.
X. Apply the first law of thermodynamics, contrast internal energy and enthalpy, describe how energy changes are related to temperature, atomic motions, and change in chemical bonding and perform thermochemical calculations.
XI. Describe colligative properties of solutions of ionic and non-ionic substances and solve their numerical problems.
XII. Effectively collect, record, and analyze experimental data, recognize the limitations of measurements and identify sources or error, and interpret experimental results and correlate experimental results with the appropriate theory.

IV. COURSE OUTLINE:

Lecture Content:

Expanded Description of Content and Methods:

Content:

Each topic lasts for approximately one week.

A. Matter and energy
1. The laws of conservation of matter and energy
2. States of matter
3. Chemical and physical properties of matter
4. Chemical and physical changes of matter

B. Atoms, molecules, ions, compounds, elements and mixtures

C. Measurements in chemistry
1. Length, mass, volume
2. Significant figures
3. Dimensional analysis
4. Density and specific gravity

D. Stiochiometry, chemical formulas, and equations
1. Formulas of compounds, etc., and what they mean
2. Atomic mass units and isotopes
3. The mole, Avogadro's number, and molar mass
4. Formula weight, molecular weights, and moles
5. Percent composition and formulas of compound
a. Empirical formula
b. Molecular formula
1) Chemical equations and calculations (stoichiometry)
2) Percent purity, yield, and limiting reagent in equations

E. Concentration of solutions
1. Percent by mass and volume
2. Molarity (M) molar concentration
3. Dilution of solutions

F. Physical behavior of gases
1. The relationship of pressure and volume; Boyle's Laws
2. The relationship of volume and temperature. Charles' Gay Lussac Law
3. Temperature (Kelvin absolute scale)
4. STP – standard temperature and pressure
5. Combined gas laws and molar volume
6. Molecular weight calculation and Dalton's law of partial pressures
7. Graham's law of effusion

G. Atomic Structure
1. Fundamental particles of atom
2. History of atomic structure and fundamental particles
3. Atomic number and mass number
4. Nuclear stability and binding energy
5. Atomic spectra and the Bohr atoms
6. Quantum numbers, orbitals, main shells and subshells

H. Chemical periodicity and ionic bonding
1. The periodic table
2. Periodic properties and trends
3. Ionization energy, electron affinity, electronegativity, and size of atoms
5. Metals, non-metals and metalloids

I. Chemical Bonding
1. Kinds of chemical bonds
2. Ionic bonding, ionic changes, oxidation numbers
3. The covalent bond

a. Polar and nonpolar bonds
b. Lewis dot formulas
c. Octet rule and its limitations
d. Basic motions of bonding theory and resonance

J. Covalent bonding and molecular structure
1. VSEPR Theory and valence bond theory
2. Geometry of molecules from VSEPR or valence bond theory
3. Geometry of polyatomic ions
4. The shape of molecular orbitals
5. Energy level diagram of orbitals
6. Homonuclear diatomic molecules
7. Heteronuclear diatomic molecules

K. Naming inorganic compounds

L. A systematic study of chemical reactions
1. Aqueous solutions, electrolytes, nonelectrolytes and extent of ionization
2. Solubility rules
3. Classification of chemical reactions
a. Combination and decomposition
b. Single and double replacement
c. Metathesis or double replacement

M. Solutions
1. Solutions terminology
2. Concentration units (mole fraction, molality, molarity)
3. Dilution of solutions

N. Thermochemistry
1. Heats of reactions and calorimetry
2. Work
3. The first Law of Thermodynamics
4. Hess's Law
5. Standard enthalpies of formation

O. Acids, Bases, and Salts
1. Arrhenius acids and bases
2. Bronsted-Lowry acids and bases
3. Properties of acids and bases
4. Preparation of acids and bases
5. Concentrations and acid-base reactions in aqueous solutions.

P. Oxidation Reduction Reaction
1. Assigning oxidation numbers
2. Recognizing redox equations by changing in oxidation state
3. Balancing simple redox equations

Q. Liquids and Solids
1. Liquid state, adhesive and cohensive forces
a. Viscosity
b. Surface tension
c. Vapor pressure
d. Boiliing points and freezing points
e. Heat transfer
2. The Solid State
a. Melting point
b. Heating point
c. Sublimation and vapor pressure
d. Crystal structure and amorphous
e. Bonding in solids
f. Metallic bonding and Band Theory

Lab Content:

Lab periods may be devoted to study and review of lecture materials as well as evaluations of student performance; however, this time is primarily for students to carry out specific assigned chemistry experiments in the laboratory. Instructor demonstrations of chemical concepts and procedures are also appropriate in the laboratory period.

Laboratory Experiments may include topics:
1. Scientific measurements: mass and volume
2. Mass and volume relationships
3. Observation of reaction of household chemicals
4. Volumetric analysis
5. Avogadro's number

6. Determination of the molar mass of a gas
7. Calorimetry
8. Emission spectra and electronic structure of atoms
9. Gravimetric analysis
10. Thin layer chromatography

V. APPROPRIATE READINGS

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

I. Sample Text Title:
and
1. Recommended - Nivaldo J. Tro *Chemistry A Molecular Approach,* ed. Second Pearson, New Jersey, 2011, ISBN: 0321651782

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)		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:
Laboratory experiments are written in a report. There are 15 – 18 laboratories performed.

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. After each experiment is performed the students are required to write a lab report. The lab report includes a purpose, reactions and reaction mechanism, data, results, and a conclusion.

2. Homework assignments are composed of problem solving questions.

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 an experiment (laboratory Practical) without the assistance of others. Instead they can only refer to a laboratory notebook they have been keeping notes throughout the semester.

D. Objective examinations including:			
X	a) multiple choice	X	d) completion
X	b) true/false		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.

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)	

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 - Nivaldo J. Tro *Chemistry A Molecular Approach,* ed. Second Pearson, New Jersey, 2011, ISBN: 0321651782

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. __X__ 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.	Students are required to read a college-level textbook with sophisticated vocabulary. Students are required to read lab manuals and understand safety procedures. Basic analytical skills are required for good comprehension of dense readings.

(eligibility for English 125) (as outcomes for English 252) __X__ Writing complete English sentences and avoiding errors most of the time. _____ 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.	Students are required to read a college-level textbook with sophisticated vocabulary. Students are required to read lab manuals and understand safety procedures. Basic analytical skills are required for good comprehension of dense readings.

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	
create a linear equation given a slope and a point or two points; graph linear equations and inequalities and use function notation to find the value of expressions.	
add, subtract, multiply, and divide radical expressions and use exponent properties and conjugate properties to simplify and solve radical expressions.	
complete the square of a quadratic equation and use the quadratic formula to solve any quadratic equation; graph quadratic equations using translations.	
CHEM 10 ELEMENTARY CHEMISTRY	
identify the names and symbols of the most common elements; name inorganic compounds and apply the basic rules to derive a formula of an inorganic compound given the name;	
CHEM 3A INTRODUCTORY GENERAL CHEMISTRY	

REQUISITES
No requisites