Effective: Fall 2014
Last Reviewed: 04/24/2019

Course Outline

BASIC COURSE INFORMATION

Course Number: CHEM 201A
Course Title: GENERAL COLLEGE CHEMISTRY I
C-ID Number: C-ID CHEM 110. CHEM 201A+201B = C-ID CHEM 120S

Total Student Hours and Credit			
		Hours/Week	Hours/Term
Lecture Hours	in-class	4.00	72.00
	out-of-class	8.00	144
Lab Hours	in-class	3.00	54.00
	out-of-class	0	0
Activity Hours	in-class		0
	out-of-class	0	0
TBA Hours Per Term			0
Total Student Hours Per Term:			270.00
Hours-per-unit Divisor			54.00
Units of Credit:			5.00

Fall semester term is 18 weeks. Spring semester term is 17 weeks. The term length multiplier is 17.5 weeks. Curriculum is calculated based on 18 weeks.

Catalog Description:
Presents the first semester of a one-year course intended primarily for science and engineering majors in the fundamental principles of chemistry. Topics covered include kinetic-molecular treatment of gases, atomic structure and the periodic law, thermochemistry, chemical bonding, correlation of structure with properties, quantitative relationships in chemical reactions, chemical formulas and equations. Laboratory work includes a study of precision and accuracy, standard methods of gravimetric and volumetric analysis, and computer acquisition and analysis of data.

Schedule Description:
Presents the first semester of a one-year course intended primarily for science and engineering majors in the fundamental principles of chemistry. Topics covered include kinetic-molecular treatment of gases, atomic structure and the periodic law, thermochemistry, chemical bonding, correlation of structure with properties, quantitative relationships in chemical reactions, laboratory activities, and chemical formulas and equations. Prerequisite:

MATH 127 with a minimum grade of C or better; and CHEM 210FL, or one year of High School Chemistry, with a minimum grade of C or better. Transfer:CSU;UC. (Formerly CHEM1A)

Prerequisites:

- MATH 127: INTERMEDIATE ALGEBRA with a minimum grade of C or better
  and
- CHEM 210FL: INTRODUCTORY CHEMISTRY WITH FACILITATOR ASSISTED LEARNING with a minimum grade of C or better
  or
- One year High School Chemistry with a minimum grade of C or better

Division:	Physical Sciences
Department:	Chemistry
Minimal Qualification Discipline Designation (MQDD):	Chemistry
Degree Applicability:	Credit - Degree Applicable

Methods of Instruction:

- Lecture and/or discussion
- Laboratory/Studio/Activity
- Distance Education
- Lecture/Lab

Grading Method:

- Letter Grade Only

Repeatability:	0
Course Cap:	25
Face-to-Face Modality Limit:	25
DE Modality Limit:	25

STUDENT LEARNING OUTCOMES

1. Describe the chemical and physical properties of a chemical substance based on the atomic and molecular structure including orbital theory, the type of chemical bond, and the shape of the molecule.
2. Evaluate and interpret numerical and chemical scientific information.
3. Solve stoichiometry problems, including mass/mass, mass/volume, and volume/volume relationships.

4. Communicate chemical concepts through the use of molecular formulas, structural formulas, and names of compounds.

5. Perform laboratory experiments based on gravimetric, volumetric, qualitative and instrumental analysis techniques, and effectively utilize the appropriate experimental apparatus.

COURSE CONTENT

Objectives:
Upon completion of this course the student will be able to:

1. Describe and utilize the scientific approach to solving problems.
    - Lab Reports
    - Quizzes/Exams
    - Written/Typed Homework
2. Convert between metric, U.S. and International System of units (SI) measurement systems using proper notations.
    - Quizzes/Exams
    - Written/Typed Homework
3. Classify matter into various subgroups.
    - Quizzes/Exams
    - Written/Typed Homework
4. Determine atomic properties from a periodic table.
    - Quizzes/Exams
    - Written/Typed Homework
5. Describe the structure of the atom according to modern atomic theory.
    - Quizzes/Exams
    - Written/Typed Homework
6. Write proper names and formulas for molecular and ionic compounds.
    - Lab Reports
    - Quizzes/Exams
    - Written/Typed Homework
7. Determine empirical formulas and molecular formulas of compounds.
    - Lab Reports
    - Quizzes/Exams
    - Written/Typed Homework
8. Write balanced chemical equations, including net ionic equations, to classify reaction types and predict products of reactions.
    - Lab Reports
    - Quizzes/Exams
    - Written/Typed Homework
9. Apply the mole concept in chemical calculations.
    - Lab Reports
    - Quizzes/Exams
    - Written/Typed Homework
10. Calculate changes in enthalpy for chemical reactions with calorimetry data, Hess's Law, and enthalpies of formation.
    - Lab Reports

- Quizzes/Exams
- Written/Typed Homework

11. Describe the modern quantum mechanical model of the atom and how this model explains atomic spectroscopy.
    - Quizzes/Exams
    - Written/Typed Homework
12. Determine electron configurations for atoms or ions to explain periodic properties of elements.
    - Quizzes/Exams
    - Written/Typed Homework
13. Construct and evaluate Lewis dot structures, including resonance structures, for atoms, molecules, and ions.
    - Lab Reports
    - Quizzes/Exams
    - Written/Typed Homework
14. Determine molecular geometries of molecules and ions and explain the effect of these shapes upon physical and chemical properties.
    - Lab Reports
    - Quizzes/Exams
    - Written/Typed Homework
15. Determine the hybridization of atoms according to valence bond theory.
    - Lab Reports
    - Quizzes/Exams
    - Written/Typed Homework
16. Complete molecular orbital diagrams for substances composed of second row elements.
    - Quizzes/Exams
    - Written/Typed Homework
17. Explain the physical behavior of gases using postulates of the Kinetic Molecular Theory and relate their behavior to the combined gas law.
    - Quizzes/Exams
    - Written/Typed Homework
18. Use the combined gas law in calculations.
    - Lab Reports
    - Quizzes/Exams
    - Written/Typed Homework
19. Interpret and compare physical properties of substances based on intermolecular forces.
    - Quizzes/Exams
    - Written/Typed Homework
20. Calculate concentrations of solutions.
    - Quizzes/Exams
    - Written/Typed Homework
21. Determine the qualitative and quantitative effects of solutes on the colligative properties of liquids.
    - Quizzes/Exams
    - Written/Typed Homework
22. Collect, manipulate, and present laboratory data by computer-based and standard methods.
    - Lab Reports

23. Perform standard methods of chemical analysis, including gravimetric analysis, titration, and absorption spectroscopy, using proper laboratory techniques in a safe manner.
    - Lab Reports
24. Conduct scientific inquiry in the laboratory using critical thinking skills based on the methods of science and statistical analysis.
    - Lab Reports

Topics & Scope:

1. Introduction to chemistry
    1. Scientific approaches to problems including variations on the scientific method
    2. Classification of matter based on composition
    3. Physical and chemical properties and changes
    4. Proper use of units, measurements, scientific notation, and significant figures in calculations.
    5. Convert between metric, U.S. and International System of units (SI) measurement systems using dimensional analysis
    6. Application of density as a conversion factor

   (Obj 1, 2, 3)
2. Atoms and elements
    1. Modern atomic theory and its connections to physical laws of nature
    2. Properties (mass and charge) of subatomic particles
    3. Patterns in chemical reactivity based on the periodic table
    4. Determination of atomic masses, average atomic masses, and numbers of subatomic particles in isotopes
    5. The mole concept as applied to atomic and molar masses of elements and compounds

   (Obj 4, 5)
3. Molecules, compounds, and chemical reactions
    1. Properties of molecular and ionic compound
    2. Nomenclature and formulas for molecular and ionic compounds
    3. Determining percent composition and molecular and empirical formulas from masses of elements and combustion analysis data
    4. Writing and balancing chemical equations

   (Obj 6, 7, 8)
4. Stoichiometry and reactions in aqueous solutions
    1. Limiting reactant, percent yield and theoretical yield
    2. Solution concentrations and using molarity in stoichiometry calculations
    3. Predicting products of precipitation reactions and the solubility of ionic compounds
    4. Classifying chemical reactions and predicting products in acid/base and reduction/oxidation reactions
    5. Net ionic equations

   (Obj 8, 9)
5. Thermochemistry

1. Energy, heat, and the first law of thermodynamics
2. Enthalpy as a state function
3. Constant pressure calorimetry
4. Enthalpies of reaction, enthalpies of formation, and Hess's Law

(Obj 10)

6. Quantum Mechanics

1. Properties of electromagnetic radiation and the electromagnetic spectrum
2. Atomic emission spectroscopy
3. Wave-particle properties of matter
4. Modern quantum mechanical model of atoms
5. Quantum numbers, energy levels, and shapes of atomic orbitals

(Obj 11)

7. Periodic properties

1. Electron configurations and valence electrons for atoms and ions
2. Periodic trends in atomic size
3. Effective nuclear charge
4. Trends in ionization energy and electron affinity
5. Lattice energy

(Obj 12)

8. Chemical bonding

1. Ionic, covalent, and metallic bonding types
2. Lewis structures of atoms, molecules, and ions.
3. Electronegativity and bond polarity
4. Resonance and formal charge
5. Bond energy and bond lengths

(Obj 13)

9. Bonding theories

1. Valence Shell Electron Repulsion Theory
2. Molecular shape and polarity
3. Valance bond theory and hybridization
4. Molecular orbital theory

(Obj 14, 15, 16)

10. Gases

1. Properties of gases
2. Gas laws
3. Stoichiometry and gas-forming reactions
4. Partial pressures in gas mixtures
5. Kinetic Molecular Theory
6. Real gases

(Obj 17, 18)

11. Liquids and intermolecular forces

1. Properties of liquids, solids and gases
2. Vaporization, vapor pressure, viscosity, and surface tension
3. Intermolecular forces and their effects on the properties of liquids

4. Phase diagrams, triple points
5. Energy changes for phase transitions

(Obj 19)

12. Solutions
    1. Solubility and solution equilibrium
    2. Concentrations of solutions
    3. Colligative properties as explained by entropy
    4. Calculations involving colligative properties

    (Obj 20, 21)
13. Laboratory:
    1. Safety in the chemistry lab
    2. The scientific approach to problems (qualitative)
    3. Measurements in chemistry, mass, volume, density and significant figures (quantitative)
    4. Computer applications in chemistry: data collection, spreadsheets, and graphing (qualitative)
    5. Determination of a chemical formula (quantitative)
    6. Stoichiometry (qualitative and quantitative)
    7. Types of Reactions (qualitative)
    8. Reactions and properties of acids and bases (qualitative)
    9. Titration of acids (quantitative)
    10. Calorimetry (quantitative)
    11. Beer's Law and concentration (quantitative)
    12. Molecular geometry, polarity, and the effects of molecular shapes (qualitative)
    13. Gas Laws (quantitative)
    14. Properties of solutions and liquids (qualitative)

    (Obj 22, 23, 24)

Assignments:
Examples of independent assignments to fulfill 144 total hours of required out-of-class work:

1. Reading assignments to be given weekly from textbook or other sources. (Obj 3, 9, 19)
2. Homework assignments from textbook or other sources require students to perform stoichiometric calculations. (Obj 9)
3. Laboratory assignments require students prepare tables of data and create graphs of that data. (Obj 22)

Class participation and assignments require and develop critical thinking.

1. Reading assignments require students to use the scientific approach to solving problems and interpret data to solve problems. (Obj 1, 24)
2. Homework assignments require students to gather and assesses relevant information about chemical systems to reach conclusions. (Obj 19, 21)
3. Laboratory assignments require students to collect and interpret data to reach conclusions and solve problems related to the behavior of chemical systems. (Obj 22, 23, 24)

Methods of Evaluation:

- Written/Typed Homework
- Quizzes/Exams
- Lab Reports

Texts, Readings, and Materials:

- **Textbooks**
  Tro, N. *Chemistry: A Molecular Approach* (5/e). Pearson, (2020).
- **Manuals**
  General Chemistry 201A Lab Manual Cuesta College, , 08-01-2019.

Cuesta General Education

Area A - Physical and Life Sciences

IGETC Area 5: Physical Science and Biological Science

5A - Physical Science

5C - Laboratory Activity

CSU GE Area B: Physical Universe and its Life Forms

B1 - Physical Science

B3 - Laboratory Activity

UC Transfer Course

University of California, Santa Barbara

CSU Transfer Course

California Polytechnic State University