College of San Mateo
Official Course Outline

1. **COURSE ID:** CHEM 192 **TITLE:** Elementary Chemistry **C-ID:** CHEM 101
   Units: 4.0 units **Hours/Semester:** 48.0-54.0 Lecture hours; 48.0-54.0 Lab hours; and 96.0-108.0 Homework hours
   Method of Grading: Letter Grade Only
   Prerequisite: MATH 110 or satisfactory score on District math placement test and other measures as appropriate that indicate proficiency in Elementary Algebra.

2. **COURSE DESIGNATION:**
   Degree Credit
   Transfer credit: CSU; UC
   AA/AS Degree Requirements:
   CSM - GENERAL EDUCATION REQUIREMENTS: E5a. Natural Science
   CSU GE:
   CSU GE Area B: SCIENTIFIC INQUIRY AND QUANTITATIVE REASONING: B1 - Physical Science
   CSU GE Area B: SCIENTIFIC INQUIRY AND QUANTITATIVE REASONING: B3 - Laboratory Activity
   IGETC:
   IGETC Area 5: PHYSICAL AND BIOLOGICAL SCIENCES: A: Physical Science
   IGETC Area 5: PHYSICAL AND BIOLOGICAL SCIENCES: C: Science Laboratory

3. **COURSE DESCRIPTIONS:**
   Catalog Description:
   Comprehensive introductory chemistry course covering basic concepts, theories and laws with emphasis on reasoning and problem solving skills. Topics include but are not limited to chemical nomenclature, stoichiometry, electron configuration, atomic orbitals, molecular geometry and bonding. The laboratory component of this course introduces students to both qualitative techniques and quantitative techniques appropriate for data collection, manipulation and analysis of a variety of chemical systems.

4. **STUDENT LEARNING OUTCOME(S) (SLO'S):**
   Upon successful completion of this course, a student will meet the following outcomes:
   1. At the introductory level, students will become familiar with the nanoscale particle nature of matter including atoms, molecules and ions and the various states they exist in.
   2. Represent the chemical elements and simple chemical compounds, and they will begin the process of depicting a variety of chemical reactions involving elements, compounds and ions.
   3. Solve elementary quantitative problems involving concentrations, behavior and reactions of various chemical substances.

5. **SPECIFIC INSTRUCTIONAL OBJECTIVES:**
   Upon successful completion of this course, a student will be able to:
   1. Explain the difference between a pure substance and a mixture, and give examples of the three states of matter.
   2. Explain the concept of density and provide an example.
   3. Complete, balance, and apply chemical equations.

6. **COURSE CONTENT:**
   Lecture Content:
   1. Introduction to Chemistry
      A. Application of the scientific method.
      B. Gross classifications of matter.
   2. Measurements
      A. Unit on standard systems of units
      B. Measurement devices
      C. Precision and accuracy in measurements.
   3. Atomic Nature of Matter.
      A. Discussion of elements and compounds
      B. Introduction to the periodic table

C. Chemical formula's
4. Properties of Matter.
   A. Physical and chemical properties
   B. Physical and chemical changes
   C. Energy in chemical reactions
5. Early History of Atomic Theory
   A. Discovery of atomic particles
   B. Isotopes
   C. Average atomic mass
6. Chemical Nomenclature
   A. Systematic naming of binary compounds
   B. Polyatomic ions
   C. Ionic compounds versus molecular compounds
7. Formula Mass and the Mole Concept
   A. Avogadro's number
   B. The mole
   C. Molar mass
   D. % composition
   E. Empirical and molecular formulas
8. Chemical Equations
   A. Writing and balancing chemical equations.
   B. Chemical equation symbols
   C. Categories of chemical equations
9. Stoichiometry.
   A. Solving chemical equations mathematically
   B. Limiting reactant, excess reactant
   C. Theoretical yield, actual yield, and % yield
10. Atomic Theory
   A. Electromagnetic radiation
   B. Wave theory versus particle theory
   C. Electronic structure of the atom
   D. Quantum mechanics
   E. Aufbau principle
   F. Atomic orbitals
   G. Electronic configurations
   H. Periodic trends
11. Chemical Bonds and Molecular Structure.
   A. Lewis dot structures
   B. The octet rule
   C. Molecular geometry
   D. VSEPR theory
12. Gases
   A. Gas laws
   B. Gas stoichiometry
   C. Kinetic molecular theory and its application to the gas laws.
13. Solutions
   A. Concentrated and dilute solutions.
   B. Unsaturated, saturated and supersaturated solutions.
   C. Colligative properties
14. Acids and Bases
   A. Arrhenius definition of acids
   B. Arrhenius definition of bases
   C. pH scale

Lab Content:

1. Demonstrate the basic laboratory safety procedures and the proper use of personal laboratory protective equipment.
2. Introduce the basic laboratory glassware and equipment found in general chemistry laboratories.
3. Measure mass and volume of solids and liquids to calculate derived quantities such as density.
4. Perform chemical reactivity tests to be used in the identification of an unknown by comparison.
5. Experimentally demonstrate the law of conservation of mass in open and closed systems.

6. Determine the specific heat of unknown metal samples by calorimetry.
7. Experimentally determine the percent composition of an unknown salt by gravimetry.
8. Collect pressure and volume data to graphically derive the pressure-volume relationship of gases (Boyle's Law).
9. Experimentally determine the effect of temperature on the solubility of salts in water.

7. **REPRESENTATIVE METHODS OF INSTRUCTION:**
Typical methods of instruction may include:
A. Lecture
B. Lab
C. Activity
D. Critique
E. Discussion
F. Experiments
G. Guest Speakers
H. Individualized Instruction
I. Observation and Demonstration

8. **REPRESENTATIVE ASSIGNMENTS**
Representative assignments in this course may include, but are not limited to the following:
Writing Assignments:
- Weekly 3-5 pages laboratory reports

Reading Assignments:
- One chapter per week in college textbook or approximately 20-25 pages depending on the chapter.
- One experiment's background and procedure per week or approximately 4-8 pages depending on the experiment

Other Outside Assignments:
- 10-15 homework problems per chapter

9. **REPRESENTATIVE METHODS OF EVALUATION**
Representative methods of evaluation may include:
A. Class Participation
B. Exams/Tests
C. Homework
D. Lab Activities
E. Papers
F. Projects
G. Quizzes
H. Written examination

10. **REPRESENTATIVE TEXT(S):**
Possible textbooks include:
A. Timberlake, Karen. *Basic Chemistry (4th Edition)*, 4th ed. Pearson, 2014
B. Tro, Nivaldo. *Introductory Chemistry*, 6th ed. Pearson, 2018
C. Timberlake, Karen. *Basic Chemistry*, 3rd ed. Pearson, 2010
Possible manuals include:
A. American Chemical Society. Chemistry in Context Lab Manual, American Chemical Society, 01-08-2014
Other:
A. https://openstax.org/details/books/chemistry-2e
B. https://openstax.org/details/books/chemistry-atoms-first-2e

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