

**SAN DIEGO COMMUNITY COLLEGE DISTRICT
CITY, MESA, AND MIRAMAR COLLEGES
ASSOCIATE DEGREE COURSE OUTLINE**

SECTION I**SUBJECT AREA AND COURSE NUMBER:** Chemistry 100**COURSE TITLE:** Fundamentals of Chemistry**Units: 3**
Letter Grade or Pass/No Pass Option**CATALOG COURSE DESCRIPTION:**

This course is an introductory study of the language and tools of chemistry. Basic concepts of the structure, properties, interactions of matter and energy are studied, both qualitatively and quantitatively. Emphasis is placed on matter, chemical changes, chemical conversions, chemical bonding, and acid-base chemistry. This course is taken by students majoring in nursing, nutrition, or animal health technology and provides a foundation for further coursework in chemistry, in particular for introductory organic chemistry.

REQUISITES:

Corequisite: Completion of or concurrent enrollment in:
CHEM 100L with a grade of "C" or better, or equivalent

Prerequisite:

MATH 046 with a grade of "C" or better, or equivalent or Assessment Skill Level M40

Advisory:

ENGL 049 with a grade of "C" or better, or equivalent or Assessment Skill Level W5
&
ENGL 048 with a grade of "C" or better, or equivalent or Assessment Skill Level R5

Limitation on Enrollment:

This course is not open to students with previous credit for or concurrent enrollment in CHEM 200

Limitation on Enrollment:

This course is not open to students with previous credit for Chemistry 152

FIELD TRIP REQUIREMENTS: May be required

TRANSFER APPLICABILITY: Associate Degree Credit & transfer to CSU and/or private colleges and universities CSU General Education IGETC UC Transfer Course List CHEM 100, 100L and 152, 152L combined: maximum credit, four units. No credit for 100, 100L or 152, 152L if taken after CHEM 200.\parCHEM 100, ENGN 110 and PHYS 100 combined: maximum credit, one course.

TOTAL LECTURE HOURS: 48 - 54**TOTAL LAB HOURS:****STUDENT LEARNING OBJECTIVES:**

Upon successful completion of the course the student will be able to:

1. Use appropriate vocabulary to explain the steps of the scientific method.
2. Compare and contrast the properties of the states of matter, classify matter and explain how it can be altered through chemical and physical changes, and describe how matter and energy interact.
3. Use English, metric and SI units to express measurements of length, volume, mass, density, temperature and energy, and perform unit conversions using dimensional analysis.
4. Explain the key concepts, models and experiments leading to the development of atomic theory.
5. Apply concepts regarding the structure of the nucleus to explain principles of isotopes, nuclear stability and nuclear reactions.
6. Apply the concepts of modern atomic theory to write the electron configurations of the first twenty elements on the periodic table.
7. Use the periodic table of the elements to identify metals, nonmetals, metalloids, groups, periods, atomic numbers and atomic masses, and explain periodic trends in the properties of the elements.
8. Compare and contrast different types of bonding, and use Lewis structures and the valence shell electron pair repulsion (VSEPR) model to determine the shapes and polarities of molecular substances.
9. Describe the effects of bond type and molecular polarity on interparticle forces and the properties of substances.
10. Name and write chemical formulae for binary covalent compounds, simple ionic compounds and acids, and derive quantitative information from the formulae.
11. Classify chemical reactions (combustion, oxidation-reduction, and double replacement) and write balanced chemical equations to express those reactions.
12. Use the mole concept and Avogadro's number to perform mole and stoichiometric calculations.
13. Employ Boyle's Law, Charles' Law and the Ideal Gas Law to study the relationships among pressure, volume, temperature and quantity of gases, and use the kinetic molecular theory to explain these relationships.
14. Explain the factors that affect the formation of solutions and perform concentration calculations, including dilution and solution preparation problems.
15. Describe the properties of acids and bases, and compare and contrast the Arrhenius and Bronsted-Lowry definitions of acids and bases.
16. Explain the concept of equilibrium and apply it to explain the differences between strong and weak electrolytes and between strong and weak acids.
17. Relate pH to hydrogen/hydronium ion and hydroxide ion concentrations and perform pH calculations for strong acids and bases.

SECTION II

1. COURSE OUTLINE AND SCOPE:

A. Outline Of Topics:

The following topics are included in the framework of the course but are not intended as limits on content. The order of presentation and relative emphasis will vary with each instructor.

- I. Scientific Method
 - A. Observations and experimentation
 - B. Hypothesis formulation and testing
 - C. Theory
- II. Matter and energy
 - A. States of matter
 - B. Chemical and physical properties of matter
 - C. Classification of matter
 - D. Chemical and physical changes of matter
 - E. Interaction of matter and energy
- III. Scientific data
 - A. Quantitative values
 1. Scientific notation
 2. Measurement and error
 3. Significant figures
 - B. Units
 1. English versus metric and SI systems

- 2. Dimensional analysis
- IV. Atomic theory
 - A. Dalton's theory
 - B. Subatomic particles and isotopes
 - C. Rutherford's alpha-scattering experiment
 - D. Bohr model
 - E. Modern atomic theory
 - 1. Electron configurations
 - 2. Atomic structure and the periodic table
 - 3. Periodicity
- V. Chemical bonding
 - A. Octet rule
 - B. Ionic bonding
 - C. Covalent bonding
 - 1. Lewis structures
 - 2. Bond polarity
 - 3. VSEPR theory
 - 4. Molecular polarity
 - 5. Intermolecular forces
 - 6. Effects on properties of substances
- VI. Nomenclature and chemical formulae
 - A. Inorganic nomenclature
 - 1. Binary covalent compounds
 - 2. Ionic compounds
 - 3. Acids
 - B. Formula writing
 - C. Quantitative aspects of chemical formulae
 - 1. Percent composition
 - 2. Empirical and molecular formulae
- VII. Chemical equations
 - A. Types of chemical reactions
 - 1. Combustion
 - 2. Oxidation-reduction
 - 3. Double replacement
 - B. Writing balanced chemical equations
- VIII. Chemical calculations
 - A. Mole calculations
 - 1. Avogadro's number
 - 2. Molar mass
 - B. Stoichiometry
- IX. Gases
 - A. Kinetic molecular theory
 - B. Gas laws
 - 1. Boyle's Law
 - 2. Charles' Law
 - 3. Ideal Gas Law
 - C. Absolute zero
 - D. Kelvin temperature scale
- X. Solutions
 - A. Solution formation
 - 1. Solute-solvent interactions
 - 2. Electrolytes
 - 3. Rate of dissolving a solid in a liquid
 - 4. Solubility
 - B. Molarity
 - C. Solution preparation calculations
 - 1. Solute mass
 - 2. Dilution
- XI. Acids and bases
 - A. Properties

- B. Acid-base theories
 - 1. Arrhenius theory
 - 2. Bronsted-Lowry theory
 - a. Hydronium ion
 - b. Conjugate acid-base pairs
- C. Equilibrium and acid strength
- D. pH calculations
- E. Buffers in concept
- XII. Nuclear chemistry
 - A. Isotopes
 - B. Nuclear stability
 - C. Nuclear reactions
 - 1. Types of nuclear reactions
 - 2. Applications
 - a. Dating
 - b. Medical applications

B. Reading Assignments:

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

- I. The assigned text book
- II. Instructor packets and/or handouts clarifying course objectives. For example, a handout summarizing inorganic chemical nomenclature would be appropriate.
- III. Selections from the science section of periodicals and newspapers that discuss chemical principles in the course.
- IV. Selection of articles from Internet sites that may supplement topics in the course or provide animations that show key principles.

C. Writing Assignments:

Writing assignments are required and may include, but are not limited to, the following:

- I. Writing of balanced chemical equations.
- II. Writing of common formulas for acid, bases, and salts.
- III. A short essay comparing and contrasting strong vs. weak acids.
- IV. Short essay on the blood's buffering system.
- V. A short essay on the use of radioisotopes in medicine.
- VI. Short essays applying chemical principles to allied health fields.

D. Appropriate Outside Assignments:

Outside assignments may include, but are not limited to, the following:

- I. Problem solving related to pH and buffers and molarity and dilution.
- II. Reading articles that link chemical principles to medicine, nutrition, or any allied health fields.
- III. A short essay on the use of radioisotopes in medicine.
- IV. A short essay on how the buffer system of the blood.
- V. Analyze how a biological reaction is a type of oxidation-reduction.

E. Appropriate Assignments that Demonstrate Critical Thinking:

Critical thinking assignments are required and may include, but are not limited to, the following:

- I. Using dimensional analysis, solve problems related to conversions of drug dosages into different units.
- II. Solving of molarity and dilution problems.
- III. Compare and contrast the effects of different bond types on the nature of intermolecular forces and their effects on properties of substances.
- IV. Short essay explaining the differences between a strong acid and weak acid in terms of equilibrium.

2. METHODS OF EVALUATION:

A student's grade will be based on multiple measures of performance unless the course requires no grade.

Multiple measures may include, but are not limited to, the following:

- I. Performance on written and oral quizzes and examinations that test students' theoretical and practical knowledge of chemistry at the introductory level.
- II. Performance on outside assignments including writing assignments designed to enhance students' interpretive and problem-solving abilities.
- III. Class participation.

3. METHODS OF INSTRUCTION:

Methods of instruction may include, but are not limited to, the following:

- * Lecture
- * Distance Education
- * Other (Specify)
 - * 1. Lectures and demonstrations dealing with the elementary principles of inorganic and physical chemistry.
 - * 2. Group problem solving, discussion and/or critiques.
 - * 3. Computer-assisted or other self-paced instruction.
 - * 4. Field trips or field assignments related to practical uses of the elementary principles of inorganic and physical chemistry.
 - * 5. Peer-led workshops.

4. REQUIRED TEXTS AND SUPPLIES:

Textbooks may include, but are not limited to:

TEXTBOOKS:

1. Goldberg, David. Fundamentals of Chemistry, 5 ed. McGraw-Hill, 2006, ISBN: 007322104X
2. Russo, Steve and Silver, Mike. Introductory Chemistry, 3 ed. Benjamin Cummings, 2006, ISBN: 0805382984
3. Timberlake, Karen. An Introduction to General, Organic, and Biological Chemistry, 10th ed. Benjamin Cummings, 2008, ISBN: 0136019706
4. Tro, Nivaldo J. Introductory Chemistry Essentials, 3 ed. Prentice Hall, 2008, ISBN: 0136019919
5. Zumdahl, Steven. Introductory Chemistry: A Foundation, 6 ed. Houghton Mifflin, 2007, ISBN: 0618803270

MANUALS:

PERIODICALS:

SOFTWARE:

SUPPLIES:

1. Study guides and/or solution manuals to accompany textbooks
2. Supplementary packets prepared by instructors
3. Scientific calculator

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