

**FOLSOM CORDOVA UNIFIED SCHOOL DISTRICT**

**Final Course Outline  
AP Chemistry**

**DATE:** February 2002

**SUBJECT AREA:** Physical Science

**PROPOSED GRADE LEVEL(s):** 11 or 12

**COURSE LENGTH:** 1 Year

**GRADING:** A-F

**NUMBER OF CREDITS:** 5/semester

**PREREQUISITES:** Algebra 2, Chemistry 1

**NOTE:** This course has been written based on the guidelines set forth by **The College Board Advanced Placement Program** ([www.collegeboard.com](http://www.collegeboard.com)).

**COURSE DESCRIPTION:**

AP Chemistry is an alternative to college Chemistry 1A. It is designed strictly for advanced or gifted students who wish the opportunity to gain college credit for courses while in high school. The chemistry proficiency exam must be passed in order to receive this college credit.

AP Chemistry applies advanced algebra to chemical principles. The course not only stresses the theoretical aspects of qualitative and quantitative chemistry, but also emphasizes laboratory practices applying the theory.

**GENERAL GOALS/PURPOSES:**

1. To provide further challenges and opportunities for gifted and advanced students in their high school curriculum.
2. To provide students the opportunity to receive college credit for coursework completed in high school.
3. To increase student knowledge and skills in the study of chemistry and chemical processes.
4. To combine mathematics, theory and laboratory exploration to gain an understanding of qualitative and quantitative chemistry.

**STUDENT READING COMPONENT:**

Students will be expected to read at the college level with a high level of comprehension.

**STUDENT WRITING COMPONENT:**

Lab assignments will be done on a regular basis and detailed written reports turned in. In addition, a special quantitative research project will be done in May and a formal paper turned in describing the experiment, associated calculations and the outcome.

**STUDENT ORAL COMPONENT:**

1. Students will work collaboratively during laboratory experiments.
2. Classroom discussions with students will be conducted on an ongoing basis discussing current scientific principles learned.

## **DETAILED UNITS OF INSTRUCTION / STATE CONTENT STANDARDS TO BE ADDRESSED:**

Special Note: These units of instruction were arrived at using practice AP tests and course textbook.

These areas of study cover all of the content standards the State of California has set forth for the high school chemistry curriculum. Many of these units of instruction exceed the California State Content Standards in order to meet the requirements of college chemistry courses.

- I. Matter & Measurement.
  - A) The Study of Chemistry
  - B) Classification of Matter
  - C) Properties of Matter
  - D) Units of Measurement
  - E) Uncertainties in Measurement
  - F) Dimensional Analysis
  
- II. Atoms, Molecules and Ions
  - A) The Atomic Theory of Matter
  - B) The Discovery of Atomic Structure
  - C) The Modern View of Atomic Structure
  - D) The Periodic Table
  - E) Molecules and Molecular Compounds
  - F) Ions and Ionic Compounds
  - G) Naming Inorganic Compounds
  
- III. Stoichiometry: Calculations with Chemical Formulas and Equations
  - A) Chemical Equations
  - B) Patterns of Chemical Reactivity
  - C) Atomic and Molecular Weights
  - D) The Mole
  - E) Empirical Formulas from Analyses
  - F) Quantitative Information from Balanced Equations
  - G) Limiting Reactants
  
- IV. Aqueous Reactions and Solutions Stoichiometry
  - A) Solution Composition
  - B) Properties of Solutes in Aqueous Solutions
  - C) Acids, Bases, and Salts
  - D) Ionic Equations
  - E) Metathesis Reactions
  - F) Introduction to Oxidation-Reactions Reactions
  - G) Solution Stoichiometry and Chemical Analysis
  
- V. Thermochemistry
  - A) The Nature of Energy
  - B) The First Law of Thermodynamics
  - C) Enthalpy
  - D) Enthalpies of Reactions
  - E) Calorimetry
  - F) Enthalpies of Formation
  - G) Foods and Fuels

- VI. Electronic Structure of Atoms
  - A) The Wave Nature of Light
  - B) Quantized Energy and Photons
  - C) The Wave Behavior of Matter
  - D) Quantum Mechanics and Atomic Orbitals
  - E) Representation of Orbitals
  - F) Orbitals in Many-Electron Atoms
  - G) Electron Configurations
  - H) Electron Configurations and the Periodic Table
  
- VII. Periodic Properties of the Elements
  - A) Development of the Periodic Table
  - B) Electron Shells and the Sizes of Atoms
  - C) Ionization Energy
  - D) Electron Affinities
  - E) Metals, Nonmetals, and Metalloids
  - F) Group Trends for the Active Metals
  - G) Groups Trends for Selected Nonmetals
  
- VIII. Basic Concepts of Chemical Bonding
  - A) Lewis Symbols and the Octet Rule
  - B) Ionic Bonding
  - C) Size of Ions
  - D) Covalent Bonding
  - E) Bond Polarity and Electronegativity
  - F) Drawing Lewis Structures
  - G) Resonance Structures
  - H) Exceptions to the Octet Rule
  - I) Strengths of Covalent Bonds
  - J) Oxidation Numbers
  
- IX. Molecular Geometry and Bonding Theories
  - A) Molecular Shapes
  - B) The VESPR Model
  - C) Polarity of Molecules
  - D) Covalent Bonding and Orbital Overlap
  - E) Hybrid Orbitals
  - F) Multiple Bonds
  - G) Molecular Orbitals
  - H) Second-Row Diatomic Molecules
  
- X. Gases
  - A) Characteristics of Gases
  - B) Pressure
  - C) The Gas Laws
  - D) The Ideal-Gas Equation
  - E) Further Applications of the Ideal-Gas Equation
  - F) Gas Mixtures and Partial Pressures
  - G) Kinetic-Molecular Theory
  - H) Molecular Effusion and Diffusion
  - I) Real Gases: Deviations from Ideal Behavior

- XI. Intermolecular Forces, Liquids, and Solids
- A) A Molecular Comparison of Liquids and Solids
  - B) Intermolecular Forces
  - C) Some Properties of Liquids
  - D) Phase Changes
  - E) Vapor Pressure
  - F) Phase Diagrams
  - G) Structures of Solids
  - H) Bonding in Solids
- XII. Properties of Solutions
- A) The Solution Process
  - B) Ways of Expressing Concentration
  - C) Saturated Solutions and Solubility
  - D) Factors Effecting Solubility
  - E) Colligative Properties
  - F) Colloids
- XIII. Chemical Kinetics
- A) Reaction Rates
  - B) The Dependence of Rate on Concentration
  - C) The Change of Concentration with Time
  - D) Temperature and Rate
  - E) Reaction Mechanisms
  - F) Catalysts
- XIV. Chemical Equilibrium
- A) The Concept of Equilibrium
  - B) The Equilibrium Constant
  - C) Heterogeneous Equilibria
  - D) Calculating Equilibrium Constants
  - E) Application of Equilibrium Constants
  - F) Le Chatelier's Principle
- XV. Acid-Base Equilibrium
- A) Acids and Bases: A Brief Review
  - B) The Dissociation of Water
  - C) The pH Scale
  - D) Bronsted-Lowry Acids and Bases
  - E) Strong Acids and Bases
  - F) Weak Acids
  - G) Weak Bases
  - H) Relationships Between  $K_a$  and  $K_b$
  - I) Acid-Base Properties of Salt Solutions
  - J) Acid-Base Behavior and Chemical Structure
  - K) Lewis Acids and Bases
- XVI. Additional Aspects of Equilibria
- A) The Common-Ion Effect
  - B) Buffered Solutions
  - C) Acid-Base Titrations
  - D) Solubility Equilibria

- E) Factors that Affect Solubility
  - F) Precipitation and Separation of Ions
  - G) Qualitative Analysis for Metallic Elements
- XVII. Spontaneous Processes
- A) Entropy and the Second Law of Thermodynamics
  - B) A Molecular Interpretation of Entropy
  - C) Calculation of Entropy Changes
  - D) Gibbs Free Energy
  - E) Free Energy and Temperature
  - F) Free Energy and the Equilibrium
- XVIII. Electronegativity
- A) Oxidation-Reduction Reactions
  - B) Balancing Oxidation-Reduction Equations
  - C) Voltaic Cells
  - D) Cells EMF
  - E) Spontaneity of Redox Reactions
  - F) Effect of Concentration on Cell EMF
  - G) Commercial Voltaic Cells
  - H) Electrolysis
  - I) Quantitative Aspects of Electrolysis
  - J) Corrosion
- XIX. Nuclear Chemistry
- A) Radioactivity
  - B) Patterns of Nuclear Stability
  - C) Nuclear Transmutations
  - D) Rates of Radioactive Decay
  - E) Detection of Radioactivity
  - F) Energy Changes in Nuclear Reactions
  - G) Nuclear Fission
  - H) Nuclear Fusion
- XX. The Chemistry of Life: Organic and Biological Chemistry
- A) Introduction to Hydrocarbons
  - B) Alkanes
  - C) Unsaturated Hydrocarbons
  - D) Functional Groups: Alcohols and Ethers
  - E) Compounds with a Carbonyl Group
  - F) Introduction to Biochemistry
  - G) Proteins
  - H) Carbohydrates
  - I) Nucleic Acids

Each of the above units will have laboratory experiences, which demonstrate the principles being taught.

**THIS COURSE WILL PREPARE STUDENTS FOR THE HSEE AND/OR FCUSD EXIT EXAMS IN:**

Reading, Writing, Math and Science

**LAB FEE, IF REQUIRED:** None

**DISTRICT ESLR's TO BE ADDRESSED:**

It is a general goal of this class to promote the District's Expected Student Learning Results by:

1. Developing students' ability to solve practical problems by applying advanced algebra. This will, in turn, make them quicker thinkers as well as sharpen their ability to solve problems using rational logic.
2. Using laboratory equipment to solve problems through scientific inquiry. Lab work done will be done in collaborative groups.
3. Further developing critical thinking skills in students to further help them to be self-directed learners, quality producers and constructive thinkers.