

## Curriculum Guide

**Course 535:** Advanced Placement Chemistry

**Level:** Grades 11 & 12

*The following Curriculum Guide is structured on the AP Chemistry Course Description published by the CollegeBoard.*

### 1. Course Structure

This full-year course meets six class periods a week. Two of these periods are scheduled back-to-back for laboratory purposes.

### 2. Intended Audience

Advanced Placement Chemistry is an elective course intended for junior/senior students as a second course in chemistry. Students should have an interest in Chemistry and/or should be contemplating studying sciences at the college level. Prerequisites include completion of a first year chemistry course earning a B or better and the recommendation of the first year chemistry instructor.

### 3. Course Goals

Advanced Placement Chemistry is intended to prepare the students to take the AP Chemistry exam in May. The course is designed to be equivalent to the type of general chemistry course offered to first year college students. The course is an intensive and rigorous survey of general chemistry focusing on depth of understanding as well as further development of chemical problem solving skills. The course will also emphasize the importance of lab work and will require the students to develop their ability not only to collect and analyze data, but also to effectively communicate the results of their work.

### 4. Course Objectives

Content:

- I. Properties of Matter
- II. Chemical Reactions and Stoichiometry
- III. Atomic Structure
- IV. Chemical Bonding
- V. States of Matter and Kinetic Theory
- VI. Solutions
- VII. Kinetics
- VIII. Chemical Equilibrium
- IX. Thermodynamics
- X. Acids and Bases
- XI. Reduction-Oxidation Reactions
- XII. Nuclear Chemistry

Skills:

Scientific Inquiry Skills:

- Making observations of chemical reactions and substances
- Predicting products of chemical reactions
- Recording data
- Calculating and interpreting results based on the quantitative data obtained
- Communicating effectively the results of experimental work
- Use appropriate tools and techniques to gather, analyze and interpret data
- Identify reasons for inconsistent results, such as sources of error or uncontrolled conditions
- Analyze sources of error both for impact on sign of error and for procedural improvements
- Communicate and defend a scientific argument
- Select and use appropriate technology to design and conduct scientific investigations.

## 5. Course Outline/ Curriculum Map

### Quarter 1

- I. Matter and Measurement
  - properties of matter, changes and classification
  - uncertainty of measurement: precision, accuracy and experimental error
- II. Atoms and Elements
  - subatomic particles
  - atomic mass, isotopes, atomic weight, molar mass
  - overview of periodic table
- III. Molecules, Ions and Their Compound
  - naming and writing formulas
  - percent composition
  - determining empirical and molecular formula
- IV. Chemical Equations and Stoichiometry
  - balancing equations
  - stoichiometry, limiting reactants and percent yield
  - chemical analysis
- V. Reactions in Aqueous Solutions
  - classifying reactions. predicting products and driving forces
  - net ionics

- intro to acids-base and redox

VI. Thermodynamics: Enthalpy

- calorimetry
- 1<sup>st</sup> Law
- Hess's Law

VII. Atomic Structure

- Plank, Einstein, Bohr
- Quantum view of atom
- Quantum Numbers
- Electron Configuration and Periodic Trends

Quarter 2

VIII. Chemical Bonding and Molecular Structure

- Ionic compounds
- Molecular: Lewis structures for predicting shape, hybridization, bond angles and polarity
- formal charge
- orbitals and bonding theories
- resonance

IX. Carbon Chemistry

- alkanes, alkenes, alkynes, alcohols: naming and isomers
- functional groups

X. Gases and their Properties

- gas laws
- Kinetic-molecular theory
- Real gases

XI. Intermolecular Forces, Liquids and Solids

- Kinetic-molecular theory and states of matter
- intermolecular forces and properties ionic, network, metallic solids
- phase diagrams

XII. Solutions and Their Behavior

- solution process, factors affecting solubility, Henry's Laws
- Colligative properties

Quarter 3

XIII. Chemical Equilibria

- nature of equilibrium and LeChatelier's principle
- Reaction quotient and equilibrium constant
- Using equilibrium constants in calculations

XIV. Chemistry of Acids and Bases and Acid-Base Equilibrium

- Bronsted Concept and conjugate pairs
- Lewis Concept
- pH, pKa, Equilibrium constants and relative strength
- Types of Acid-Base rxns
- Titrations
- Buffers

XV. Relating Solubility and  $K_{sp}$  (Solution Equilibrium)

- solubility product constant
- predicting precipitation

XVI. Chemical Kinetics

- rates and reaction conditions
- determining rate equations
- integrated rate laws
- particle view, collision theory and activation energy
- catalyst
- reaction mechanisms

XVII. Thermodynamics: Entropy and Free Energy

- Entropy (2<sup>nd</sup> & 3<sup>rd</sup> laws) and spontaneity
- Gibbs Free Energy
- $\Delta G$ , K and product favorability

XVIII. Electrochemistry

- Redox
- Electrochemical Cells
- Nonstandard conditions (Nernst)
- Thermodynamics
- Electrolytic Cells

Quarter 4

XIX. Nuclear Chemistry

- radioactivity
- nuclear equations
- half-lives

XX. Descriptive Chemistry

- review of equation writing and predicting products for chemical reactions

XXI. AP Test Preparation

XXII. Independent Projects

## 6. Course Text and Other Materials

The text for this course is:

- Kotz, John C., Treichel, Paul M., Harman, Patrick A., *Chemistry & Chemical Reactivity*, 5<sup>th</sup> Ed., Thomson Learning Inc., (2003).

Support materials include:

- Vonderbrink, Sally Ann, *Laboratory Experiments for Advanced Placement Chemistry*, Flinn Scientific, Inc, (2001).
- Vining, William J., Kotz, John C., Harman, Patrick A., *General Chemistry Interactive CD-ROM, Version 3.0*, Brooks/Cole a division of Thomson Learning Inc., (2003).

## 7. Instructional Methods and Course Activities

Content will be conveyed through:

- Class dialogue and discussion
- Laboratory investigations
- Topic lectures and demonstrations
- Interactive CD-ROM and Power Point Presentations

## 8. Learning Strategies

- The primary instructional mode will include class dialogue/discussion and problem solving accompanied by laboratory experiences carefully selected to complement classroom work and to ensure the mastery of essential laboratory skills.
- Students will be encouraged to approach each learning experience with an objective, critical, and analytical attitude.
- Mathematical problem solving will include careful attention to, and processing of, dimensions.

## 9. Assessment

The assessment of students will occur through:

- Daily evaluation of class preparation and participation
- Laboratory performance including bench work, recording organization, analysis, and reporting of observations and data
- Homework assignments
- Formal testing
- Semester examinations.

## 10. Course Evaluation

The assessment of this course will occur through:

- Evaluation of results on AP test, both within the class and against the national results.
- On-going feedback from current students and from graduates.