

- **Brief Course Description:**

Advanced Placement (AP) Chemistry is based upon the College Board's curriculum and is the equivalent of a first year college Chemistry course. The second year chemistry class will utilize the first year chemistry course content as a foundation for discussion of these following complex topics: chemical kinetics, equilibrium, thermodynamics, electrochemistry, materials science, buffer systems, coordination complexes, nuclear chemistry, organic chemistry, and biochemistry. A minimum of one double-class period per week will be devoted to hands-on college level laboratory investigations with classroom demonstrations supplementing the laboratory theme topics. Student assignments will be retained in a spiral carbonless journal that includes laboratory investigations, quizzes, and overviews of chapter readings assignment. It will also include free response questions and multiple-choice problems from past AP examinations. Written examinations will be administered during the first three weeks. Three weeks prior to the AP Chemistry examination, a minimum of six review sessions will be conducted as well as two Saturday sessions whereby students actually practice taking the AP Chemistry examination.

- **Course Title:**
AP Chemistry

- **Course Goals and/or Major Outcomes**

- 1. Demonstrate ability to critique assigned complex problems and utilize critical thinking in generating a solution through dimensional analysis applications.**
- 2. Acquire master of laboratory techniques in manipulating analytical equipment and computers for interpreting of qualitative and quantitative based problems.**
- 3. Demonstrate ability to comprehend, through student centered prayer, how the philosophy of chemistry impacts community, society, health, and environment.**
- 4. Demonstrate understanding of content base instruction, high level cognitive and affective domain thinking and technical skills in completing challenging free-response and multiple-choice questions effectively.**
- 5. Demonstrate ability to utilize a sportsmanlike, competitive and social spirit in resolving team quiz questions amongst highly competitive diverse group setting.**

• **Course Objectives:**

- 1. Students will demonstrate mastery in the application of dimensional analysis and problem solving skills in writing assigned free response and multiple-choice questions associated with current assigned chapters from past Advanced Placement Chemistry examinations.
ESLR addressed: Intellectual growth**
- 2. Students will write prepared written laboratory investigation reports demonstrating their ability to apply scientific methods, manipulate analytical equipment and computers in deriving solutions.
ESLR addressed: Intellectual growth**
- 3. Students will write answers to team quiz questions as a team while utilizing sportsmanship, competitive and social interaction amongst highly competitive classmates.
ESLR addressed: Intellectual growth and Physical development**
- 4. Students will be proactive in daily prayer by presenting a specific scripture to their classmates and demonstrating how the philosophy of chemistry impacts their community, society, health and environment.
ESLR addressed: Social/moral development, Health growth**
- 5. The students will be able to calculate a density value in SI units utilizing scientific notation and significant figures.
Students will write answers to team quiz questions as a team while utilizing sportsmanship, competitive and social interaction amongst highly competitive classmates.
ESLR addressed: Intellectual growth-**
- 6. The student will be able to differentiate between a metal, nonmetal, metalloid and utilize their oxidation states and balance chemical compounds.
ESLR addressed: Intellectual growth**
- 7. The student will be able to utilize Dalton units (used to be atomic mass units) and determine the number of molecules for reactants or products in a balanced double displacement chemical reaction.
ESLR addressed: Intellectual growth**
- 8. The student will be able to utilize the solubility rules in analyzing and solving problems related to precipitation, acid-base reactions, and oxidation-reduction reactions.
ESLR addressed: Intellectual growth**
- 9. The student will be able to utilize standard temperature and standard pressure (STP) in stoichiometric calculations regarding molar mass, density, General Gas Law, Ideal Gas Law, and Real Gas Law.
ESLR addressed: Intellectual growth**
- 10. The student will be able to use knowledge of standard state, Raoult's Law, Hess's Law, and standard enthalpy of formation to calculate ΔH and apply thermodynamics to real world problems.
ESLR addressed: Intellectual growth, Social/moral development, Health growth**

Course Objectives (continued)

- 11. The student will be able to explain how the Pebble Beach Company utilizes reverse osmosis in recycling water to the golf courses.
ESLR addressed: Intellectual growth, Social/moral development, Health growth**
- 12. The student will be able to utilize the principle of electronic configuration to predict trends in ionization energy, electron affinity, and atomic radius between metals, nonmetals, and metalloids.
ESLR addressed: Intellectual growth**
- 13. The student will be able to utilize the Lewis dot structure in placing valence electrons around atoms and predict their molecular geometric shape by using the VSEPR model.
ESLR addressed: Intellectual growth**
- 14. The student will be able to describe the bonding in the water molecules using sp^3 hybridization electron models.
ESLR addressed: Intellectual growth**
- 15. The student will be able to extract specific data related to critical temperature, critical point, and triple point in a phase diagram of water.
ESLR addressed: Intellectual growth**
- 16. The student will be able to utilize Hess's Law in predicting relative solubilities of simple gas molecules.
ESLR addressed: Intellectual growth**
- 17. The student will be able to apply the proper units of a rate constant and calculate the half-life of a first or second order reaction.
ESLR addressed: Intellectual growth**
- 18. The student will be able to utilize the Haber process in conceptualizing how Le Chatelier's Principle is applied when the effects of concentration, pressure, and temperature affect the position of equilibrium.
ESLR addressed: Intellectual growth**
- 19. The student will be able to utilize logarithms during conversion amongst pH, pOH, H^{1+} , OH^{1-} for acids, bases and polyprotic acids.
ESLR addressed: Intellectual growth**
- 20. The student will be able to solve problems related to the common ion effect and write products and equilibrium expressions (K) and interconvert between solubility and solubility product constants (K_{SP}).
ESLR addressed: Intellectual growth**
- 21. The student will be able to utilize the three laws of thermodynamics and calculate the standard free energy of formation and utilize that value to predict the direction/spontaneity of a chemical reaction.
ESLR addressed: Intellectual growth**
- 22. The student will utilize the standard reduction potential chart and the Nernst equation to determine the cell voltages in various concentration of solutions.
ESLR addressed: Intellectual growth**

Course Objectives (continued)

23. The student will be able to apply the first-rate law and inter connect between half-life of a nuclide and the amount of that nuclide remains at time "T".

ESLR addressed: Intellectual growth

24. The student will be able to identify, name and draw structures for alkanes, alkenes, alkynes, aromatic hydrocarbons and functional groups.

ESLR addressed: Intellectual growth

25. The student will be able to distinguish between the function of polymer structures, protein structure and carbohydrates when describing genetic processes.

ESLR addressed: Intellectual growth

• Course Outline:

- **Unit 1: Chapter 1; Chemical Foundations (1.5 weeks)**
 - 1. Mathematical Review**
 - 2. Cover summer readings and assigned problems from chapter 1,2 and 3**

- **Unit 2: Chapter 2; Atoms, Molecules and Ions (1 week)**
 - 1. Review concepts form first year chemistry**
 - 2. Emphasis on nomenclature and formula writing**

- **Unit 3: Chapter 3; Stoichiometry and part of Chapter 4; Types of Chemical Reactions and Solution Stoichiometry (1.5 – 3 weeks)**
 - 1. Mole concept**
 - 2. Balanced chemical equations**
 - 3.**

- **Unit 4: Chapter 5; Gases (2 weeks)**
 - 1. General properties of gases**
 - 2. Avogadro's law and volume of gases**
 - 3. Standard Temperature and Standard Pressure (STP) and Dalton's Law**
 - 4. Kinetic-molecular theory of gases**

- **Unit 5: Chapter 6; Thermochemistry (2 weeks)**
 - 1. Measurement of heat flow (calorimeter)**
 - 2. Energy**

Course Outline (continued)

- **Unit 6:Chapter 16; Spontaneity, Entropy and Free Energy (2 weeks)**
 1. **Chemical reactions**
 2. **State of system**
 3. **Thermodynamic laws**
 4. **Sign convention**

Unit 6 (continued)

5. **Thermochemistry**
 6. **Entropy**
 7. **Spontaneity**
 8. **Free energy**
- **Unit 7:Chapter 7; Atomic Structure and Periodicity (2 weeks)**
 1. **Atomic spectra**
 2. **The periodic table and electron configuration**
 3. **Trends in physical and chemical properties**
 - **Unit 8:Chapter 8; Bonding-General Concepts (2.5 – 3 weeks)**
and Chapter 9; Covalent Bonding Orbitals
 1. **Bonding models**
 2. **Lewis dot structure**
 3. **Molecular structure**
 4. **VSEPR model**
 - **Unit 9: Chapter 10; Liquids and Solids (1.5 weeks)**
 1. **Intermolecular forces**
 2. **London forces**
 3. **Metallic bonding**
 4. **Vapour pressure**
 5. **Changes of temperature (ΔT)**
 - **Unit 10: Chapter 20; The Representative (2.5 weeks)**
Elements- Group 5A through Group 8A and
part of Chapter 15; Applications of Aqueous Equilibria
 1. **Structure**
 2. **Neutral complexes**
 3. **Geometry**
 4. **Properties**

Course Outline (continued)

- **Unit 11: Chapter 11; Properties of a Solutions (2 weeks)**
and part of Chapter 4
 1. Solutions
 2. Concentrations
 3. Properties
 4. Percent dissociation of solutes

- **Unit 12: Chapter 12; Chemical; Kinetics (2 weeks)**
 1. Reaction kinetics
 2. Reaction mechanism

- **Unit 13: Chapter 13; Chemical Foundations (1.5 weeks)**
 1. Law of mass action
 2. Calculation of K and equilibrium concentrations
 3. Le Chatelier's Principle and effects of factors on equilibrium rate

- **Unit 14: Chapter 15; Applications of Aqueous (1 week)**
Equilibria and part of Chapter 4
 1. Equations
 2. Predicting
 - i.

- **Unit 15: Chapter 14; Acids and Bases and (2 weeks)**
parts of Chapter 4 and Chapter 15
 1. Water dissociation (K_w)
 2. Strength v. concentration
 3. Acid-base properties
 4. Acid-base reactions
 5. Theories

- **Unit 16: Chapter 17; Electrochemistry and (2 weeks)**
part of Chapter 4
 1. General States
 2. Nernst's equation
 3. Balancing equations
 - i.

- **Unit 17: Chapter 18; The Nucleus: a Chemist's View (1 week)**
and Chapter 22; Introduction to Organic
and Biological Chemistry
 1. Nuclear Chemistry
 2. Organic Chemistry
 3. Biological Chemistry

- **Texts & Supplemental Instructional Materials:**

- **Textbook: Chemistry; 11th Ed., 2008 Ed. Brown/LeMay**
- **Laboratory manual; 22 AP Chemistry Experiments, Vanderbrink 2ND Ed 2008**
- **Supplemental Materials**
 - 1. Textbook**
 - a. Chemistry; Zumdahl, 7th Ed 2007**
 - b. The Molecular Nature of Matter and Change; Silberberg 4th Ed 2006**
 - c. Chemistry; Change 2006**
 - 2. Laboratory Manuals**
 - a. Experimental Chemistry; Hall 2006**
 - b. Microscale: Experiments for General Chemistry; Williamson/Little 1997**
 - c. Flinn Scientific**
 - d. Hope College material**
 - e. Woodrow Wilson TORCH Institute**
 - f. Chemistry Principles in the Laboratory; Slowinski 5th Ed**
 - g. Small Scale Laboratory Assessment Activities; Silberman 5th Ed**
 - h. Zumdahl, 7th Ed**
 - 3. Ancillary Materials**
 - a. AP Chemistry summer institutes**
 - b. Power point**
 - c. Interne Searches**
 - d. Library resources**

• **Key Assignments:**

Topics/Units/Themes/Key Activities
<p>I. Structure of Matter</p> <p>A. Atomic Theory</p> <ol style="list-style-type: none">1. Evidence of atomic theory2. Atomic masses3. Atomic number and mass number: isotopes4. Electron energy levels5. Periodic relationships6. Oxidation states <p>B. Chemical Bonding</p> <p>C. Nuclear Chemistry</p> <p>D. Laboratory Investigations/Demonstrations</p> <p>Lab: Determination of the formula of a compound: Flinn Scientific (AP #1 requirement)</p> <p>Lab: Determination of the percentage of water in a hydrate: Flinn Scientific (AP #2 requirement)</p> <p>Demo: flame test</p> <p>Demo: Reaction between sodium and bromine</p> <p>Demo: Period 3 chlorides/Demonstrations</p> <p>Lab: Synthesis of a coordination compound and its chemical analysis: Flinn Scientific (AP #15 requirement)</p> <p>Lab: Analytical gravimetric determination: Flinn Scientific (AP #16 requirement)</p> <p>Demo: Nuclear Fusion- Flinn Scientific Lab; Determining Nuclear Radiation/Cloud Chamber</p> <p>II. States of Matter</p> <p>A. Gases</p> <p>B. Liquid and Solids</p> <p>C. Solutions</p> <p>D. Laboratory Investigations/Demonstrations</p> <p>Lab: Determination of the molar mass by vapour density; Flinn Scientific (AP #3 requirement)</p> <p>Lab: Determination of the molar volume of a gas; Flinn Scientific (AP #5 requirement)</p> <p>Mole box toolbox handout</p> <p>Lab: A Beer-Lambert Study: Flinn Scientific Lab; Colorimetric Analysis (AP #17 requirement)</p> <p>Lab: Determination of molar mass by freezing point depression; Flinn Scientific (AP #4 requirement)</p>

III. Reactions

A. Reaction types

B. Stoichiometry

C. Equilibrium

D. Kinetics

E. Thermodynamics

F. Laboratory Investigations/Demonstrations

Lab: Determination of a solution using a primary standard; Flinn Scientific (AP #6 requirement)

Lab: Determination of a concentration by acid-base titration, including a weak acid or a weak base; Flinn Scientific (AP #7 requirement)

Lab: Determination of concentration by oxidation-reduction titration; Flinn Scientific (AP #8 requirement)

Lab: Determination of an electrochemical series; Flinn Scientific (AP#20 requirement)

Lab: Measurement using electrochemical; cells and electroplating; Flinn Scientific (AP #21 requirement)

Lab: Determination of mass and mole relationship in a chemical reaction; Flinn Scientific (AP #9 requirement)

Lab: Determination of the equilibrium constant for a chemical reaction; Flinn Scientific (AP #10 requirement)

Lab: Determination of the appropriate indicators for various acid-base titrations; Flinn Scientific (AP 11 requirement)

Lab: Preparation and properties of buffer solutions; Flinn Scientific (AP # 19 requirement)

Lab: Determination of the rate of a reaction and its order; Flinn Scientific (AP #12 requirement)

Lab: Determination of enthalpy change associated with a reaction; Flinn Scientific (AP #13 requirement)

Lab: Synthesis, isolation, and purification of an ester; Flinn Scientific (AP #22 requirement)

III. Reaction(Continued)

IV. Descriptive Chemistry

A. Reaction types

B. Relationships in the periodic table

C. Introduction to Organic chemistry

D. Introduction to Biochemistry

E. Laboratory Investigations/Demonstrations

**Lab: Separation and qualitative analysis of cations and anions;
Flinn Scientific (AP #14 requirement)**

**Lab: Separation by chromatography; Flinn Scientific
(AP #18 requirement)**

V. Laboratory

A. Making observations of chemical reactions and substances

B. Recording data

**C. Calculating and interpreting results based upon quantitative data
obtained**

D. Communicating effectively results of experimental work

• Instructional Methods and/or Strategies:

- **Lectures**
- **Student teams for laboratory investigations**
- **Chapter reading assignments**
- **Team quizzes**
- **Science Fairs**
- **National and International Exams**
- **Chemistry Olympiad exams**
- **Library research**
- **Internet research**
- **Power point presentations by students**
- **DVD**
- **Assigned student study teams**
- **Evening sessions**
- **VCR**
- **Assigned problems for student presentation in class**
- **Practice past AP Chemistry Examinations**

- **Assessment Methods and/or Tools:**

Assessment Methods	Percentage breakdown
• Assigned chapter (previous AP question) worksheet	7
• Laboratory assignments	25
• Spiral binder resource for notes, quizzes and laboratory assignments	2
• Lecture quizzes	5
• Laboratory quizzes	7
• Chemistry Olympiad	10
• Chemistry Olympiad	2
• Student selected prayer in class	2
• Student presentation of assigned problems to class	12
• Topic papers on current events	8
• Chapter exams	10
• Semester exams	10

Indicate how this AP Chemistry course is different from the standard course.

This Palma High School AP Chemistry course outline, which being presented to the University of California A-G committee for approval, is based upon an already approved College Board AP Chemistry course. This AP Chemistry course outline also reflects the same AP chemistry outline current being used by La Jolla High School , San Diego, Ca., which has also been approved by the University of California A-G committee.