**Course Description**

Welcome to Advanced Placement Chemistry! This AP Chemistry course is designed to be the equivalent of a general chemistry course taken during the first year of college. AP Chemistry is one of the most challenging science courses you will take, so be prepared to work and learn. This course will consist of lectures, labs, group work, projects (both independent and group), reports, homework, quizzes, discussion, and exams. Again, AP Chemistry is a very rigorous and fast-paced course. **Students are expected to do basic introductory problems (usually assigned in HW), so that class time may be devoted to mastery of content and laboratory concepts.** This course is structured around six Big Ideas and seven science practices as set by the College Board.

**Big Idea 1:**  The chemical elements are fundamental building materials of matter, and all matter can be understood in terms of arrangement of atoms. These atoms retain their identity in chemical reactions.

**Big Idea 2:** Chemical and physical properties of materials can be explained by the structure and the arrangement of atoms, ions, or molecules and the forces between them.

**Big Idea 3:** Changes in matter involve the rearrangement and/or the reorganization of atoms and/or the transfer of electrons.

**Big Idea 4:** Rates of chemical reactions are determined by details of the molecular collisions. (Kinetics)

**Big Idea 5:** The laws of thermodynamics describe the essential role of energy and explain and predict the direction of changes in matter.

**Big Idea 6:** Any bond or intermolecular attraction that can be formed can be broken. These two processes are in a dynamic competition, sensitive to initial conditions and external perturbations. (Equilibrium)

**Textbook**

Zumdahl, Steven and Susan Zumdahl. Chemistry, Ninth Edition. Belmont, CA: Cengage Learning, 2014.

**Required Materials**

3 subject spiral, pens, pencils, graphing calculator, splash proof goggles

**In-Class Assignments**

Class time will consist of bell work, lecture, group work, independent work, and labs. Students are expected to keep their notes, labs, and other assignments in an ORGANIZED 3 subject notebook. This notebook will be checked periodically and graded.

**Homework**

Homework is essential for both content mastery and successful completion of AP Chemistry. Homework will be assigned and due dates will be clearly stated. Late work is not accepted for any reason other than an excused absence. Homework may consist of practice problems, readings, online assignments, or projects. **SHOWING WORK IS REQUIRED. Credit will not be given for answers without work. Credit may still be given for showing work, even if the answer is incorrect.** This directly aligns with grading on the AP Exam. You will need to plan about 3-5 hours a week outside of class to complete your homework assignments. *It is strongly recommended that students form a study group with one or two other students*.

**Quizzes**

Frequent, short, timed quizzes are given as a formative assessment and to check for mastery prior to an exam. The teacher may also give a pre-test to assess student understanding and differentiate appropriately prior to beginning a unit.

**Exams**

Students will be given an exam for each unit and the exam will generally be composed of AP type questions, both multiple choice and free response. A calendar has been included, but the dates of the exams and assignments are subject to change based on unforeseen events in the school day. **MAKE UP POLICY: If a student is absent for an exam, it is the students’ responsibility to make up the exam. If the exam is not made up in a timely manner (within one week upon return) the student will receive a zero for the exam.**

**Laboratory**

Labs are essential to the AP Chemistry course, as data gathered in the lab setting is often used to illustrate conceptual knowledge presented in the lectures. Students will spend a minimum of 25% of instructional time engaging in investigative lab work. Students will keep an organized lab notebook with their data and observations. By keeping a lab notebook, students are given the opportunity to develop, record, and maintain evidence of their verbal, written and graphic communication skills. Students will complete a lab report for each investigation which may be a formal lab report, post lab questions, oral presentations, posters, etc., which will contain information such as purpose, materials used, procedure outlines, data tables, data collection, observations, calculations and graphs, outcomes, and conclusions.

Chemistry Course Outline

**Unit 1: Chemistry Fundamentals (9 days)**

Concepts Covered: An overview of chemistry, the scientific method, units of measurement, uncertainty in measurement, significant figures and calculations, dimensional analysis, temperature, density, and classification of matter.

Activity: Students complete an activity in which they design an experiment to determine if a coin is a pure gold coin worth $5 or a gold-plated nickel. This activity is based on the idea that Josh Tatum gold plated nickels in the 1800s and passed them off as $5 gold coins. Students connect their knowledge of chemistry to society and money in an attempt to prevent monetary fraud.

Labs: Math and Measurement in Science **(SP 2, 5)**, Kool Chromatography **(SP 1,6)**

Exam: September 16, 2016

**Unit 2: Atoms, Ions, and Molecules (5 days)**

Concepts Covered: History of chemistry, fundamental chemical laws, Dalton’s atomic theory, early experiments to characterize the atoms, modern atomic view, molecules and ions, introduction to the periodic table, nomenclature.

Exam: September 30, 2016 (Exam will be over Units 2 and 3)

**Unit 3: Stoichiometry (5 days)**

Concepts Covered: Atomic masses, the mole, molar mass, percent composition, formulas, chemical equations, balancing chemical equations, stoichiometric calculations, limiting reactant.

Activity: Students will complete Lesson 1: Representing Chemical Equations and Stoichiometry from AP Chemistry Guided Inquiry activities for the classroom, in which they use physical models of chemical equations to connect substances to one another. Students will answer questions on the handout both verbally through class discussion and written by responding to questions on the handout. Through this activity, students will answer the Essential Question, “Given the balance equation 2A+B —› 3P, if 6 atoms of “A” react with 2 atoms of “B”, how many atoms of “P” can be made?” **(LO 1.4)**

Labs: Chemical Reactions of Copper and Percent Yield **(SP 6)**

Exam: September 30, 2016 (Exam will be over Units 2 and 3)

**Unit 4: Types of Chemical Reactions and Solution Stoichiometry (10 days)**

Concepts Covered: Properties of water, aqueous solutions, composition of solutions, types of chemical reactions, precipitation reactions, stoichiometry of precipitation reactions, acid-base reactions, redox reactions, balance redox equations.

Activity: Students will be given chemical equation depicted with illustrations rather than formulas and will need to determine the products, reactants, and if the equation is balanced or not. If the equation is not balanced, students will need to balance the equation. **(LO 3.2)**

Labs: Redox Titration Lab **(SP 1,2,3,5)**

Exam: October 14, 2016

**Unit 5: Gases (10 days)**

Concepts Covered: Pressure, Gas Laws (Boyle, Charles, Combined, Ideal), gas stoichiometry, Dalton’s Law of Partial Pressure, kinetic molecular theory of gasses, effusion and diffusion, real gases, derivation of ideal gas law.

Labs: Ideal Gas Law Lab **(SP 1,2,5,6)**

Exam: October 28, 2016

**Unit 6: Thermochemistry (10 days)**

Concepts Covered: Law of conservation of energy, law of work, law of internal energy, endothermic and exothermic reactions, enthalpy and calorimetry, Hess’s law, heat of formation, bond energy.

Activity: Students will conduct an online lab simulation in which they heat an unknown and graph its temperature as the unknown cools, giving them the ability to calculate the energy released. Students will conduct research an the amount of energy released and make a prediction about the unknown. **(LO 5.6)**

Labs: The Hand Warmer Design Challenge: Where does the Heat Come From? (Guided Inquiry) (**SP 2,3,4,5,6)**

Exam: November 11, 2016

**Unit 7: Atomic Structure and Periodicity (10 days)**

Concepts Covered: Electron configuration and the Aufbau principle, valence electrons, Lewis dot structures, periodic trends, table arrangement, properties of light and study of waves, atomic spectrum of Hydrogen, quantum mechanical models, orbital shape and energies, spectroscopy

Labs: What is the Relationship Between Concentration of a Solution and the Amount of Transmitted Light Through the Solution? (Guided Inquiry) **(SP 1,6)**

Exam: December 2, 2016

**Unit 8: Chemical Bonding (10 days)**

Concepts Covered: Lewis dot structures, resonance structures, bond polarity, dipole moments, VSEPR models and molecular shape, polarity of molecules, lattice energy, hybridization, molecular orbitals and diagrams

Activity: Students will illustrate a series of molecules and from their drawings predict geometry, hybridization, and polarity. **(LO 2.1)**

Labs: VSEPR Model Lab **(SP 1,7)**

Exam: December 16, 2016

**Unit 9: Liquids and Solids (9 days)**

Concepts Covered: Structure and bonding, vapor pressure and changes in state, heating and cooling curves, composition of solutions, colloids and suspends, separation techniques, effect on biological systems.

Labs: Vapor Pressure and Enthalpy of Vaporization of Water **(SP 6,7)**

Exam: January 20, 2017

**Unit 10: Kinetics (11 days)**

Concepts Covered: Rates of reactions, factors that effect reactions/collision theory, reaction pathways, rate equation determination, activation energy and Bolttman distribution

Activity: Using a web based simulation, students will study the elementary steps of a mechanism and how it relates to reaction rate and collision theory. Students will then collaborate with groups and together students will summarize their findings in an oral presentation for the entire class. (**LO 4.1)**

Labs: What is the Rate Law of the Fading of Crystal Violet Using Beer’s Law? (Guided Inquiry) **(SP 5,6)**

Exam: February 7, 2017

**Unit 11: General Equilibrium (10 days)**

Concepts Covered: Characteristics and conditions of chemical equilibrium, equilibrium expression derived from rates, factors effecting equilibrium, Le Chatlier’s principle, equilibrium constant, solving equilibrium problems

Activity: As homework, students will be given notes entitled “Equilibrium Made Easy”. In class, students will complete a station activity in which each station has an equilibrium problem. In groups, they must determine the type of equilibrium problem and then determine the missing values by use ICE tables. **(LO 6.5)**

Labs: Can We Make the Colors of the Rainbow? Application of Le Chatelier’s Principle (Guided Inquiry) **(SP 4,6)**

Exam: February 17, 2017

**Unit 12: Acids and Bases (10 days)**

Concepts Covered: Definitions and nature of acids and bases, Kw, pH scale, polyprotic acids, pH of salts, structure of acids and bases

Labs: Determination of Concentration of Vitamin C (Acid-Base Titration) **(SP 4,5,6)**

Exam: March 3, 2017

**Unit 13: Acid-Base Equilibrium (5 days)**

Concepts Covered: Characteristics and capacity of buffers, titrations and pH curves, choosing acid-base indications, pH and solubility, Ksp calculations and solubility product

Labs:To What Extent Do Common Household Products Have Buffering Activity? (Guided Inquiry) **(SP 2,4,6)**

Exam: March 31, 2017 (Exam will be over Units 13, 14, and 15)

**Unit 14: Thermodynamics (5 days)**

Concepts Covered: Laws of thermodynamics, spontaneous process and entropy, spontaneity, enthalpy, free energy, free energy and equilibrium, rate and spontaneity

Labs: Solubility and Determination of Enthalpy, Entropy, and Free Energy of Calcium Hydroxide **(SP 4,5,6)**

Exam: March 31, 2017 (Exam will be over Units 13, 14, and 15)

**Unit 15: Electrochemistry (5 days)**

Concepts Covered: Balancing redox equations, electrochemical cells and voltage, Nernst equation, spontaneous and non spontaneous equations, chemical applications

Labs: Voltaic Cell Lab **(SP 3,4,5)**

Exam: March 31, 2017 (Exam will be over Units 13, 14, and 15)

**AP Exam Review (20 days)**

Concepts Covered: ALL

Labs: The Green Crystal Series (4 Labs done over the course of 4 weeks as a capstone review lab prior to the AP Exam) **(SP 2,5,6)**

Lab 1- Synthesis of Green Crystal Compound (Guided Inquiry) **(SP 2,5,6)**

Lab 2- Determination of % Water in Green Crystal Compound

(Guided Inquiry) **(SP 2,5,6)**

Lab 3- Determination of % Potassium and % Iron in Green Crystal Compound **(SP 2,5,6)**

Lab 4-Empirical Formula of Green Crystal Compound **(SP 2,5,6)**

**SEVEN LABS ARE GUIDED INQUIRY LABS:**

1. The Hand Warmer Design Challenge: Where does the Heat Come From?
2. What is the Relationship Between Concentration of a Solution and the Amount of Transmitted Light Through the Solution?
3. What is the Rate Law of the Fading of Crystal Violet Using Beer’s Law?
4. Can We Make the Colors of the Rainbow? Application of Le Chatelier’s Principle
5. To What Extent Do Common Household Products Have Buffering Activity?
6. Synthesis of Green Crystal Compound
7. Determination of % Water in Green Crystal Compound

**THE AP EXAM IS SCHEDULED FOR MONDAY, MAY 1, 2017. IT IS EXPECTED THAT ALL STUDENTS TAKE THE EXAM, HOWEVER INSTRUCTOR APPROVAL IS REQUIRED.**