AP Chemistry

Course Goals

1. To provide college-level chemistry instruction
2. To provide college-level laboratory experience
3. To prepare students for the AP Exam in such a way that they will have the best possible chance for success
4. To provide a structured framework such that an understanding of the big ideas as described in the AP Chemistry Curriculum Framework is achieved. **[CR2]**
5. To provide an opportunity for students to become scientifically literate citizens by connecting their knowledge of chemistry, and science in general, to major societal or technological components. **[CR4]**

Text

Chemistry; Zumdahl Zumdahl DeCoste, 10th edition; Cengage, 2016. **[CR1]**

Labs

Laboratory experience is almost essential to understanding chemistry at the depth requested of you by AP Chemistry. At least one double-period block each week will be dedicated to the performance of laboratory experiments. By the time you have completed this course, you will have completed nearly 18 different laboratory experiments (over approx. 25 days of the 90 allotted for the course [>27% of the course]) most of which will relate directly to topics covered on the AP examination. **[CR5a-b]** You will be requested to write and submit full reports of about a dozen of them in an attempt to prepare you for critical assessment and analysis of data. These labs are chosen specifically for their correlation with the AP curriculum. In addition, six of the nearly 18 different laboratory experiments will be conducted using a guided-inquiry format. **[CR6]**

You will be required to keep a hard-bound laboratory notebook for this class that you will bring with you to class at all times. This will be for the direct entry of laboratory procedures and data as well as the documentation of class demonstrations. **[CR7]** In some rare instances, students that have been able to provide evidence of an equivalent laboratory experience have been allowed to exempt their participation in labs for their college introductory chemistry course (if you end up wanting or needing to take it again).

All of the experiments below will require hands-on work in the laboratory. In collaboration with other students, you will be called upon to collect, process, and manipulate data taken from physical observations, both measured and unmeasured, and then to develop and formally report your conclusions. Students complete a laboratory notebook consisting of procedure, data, data analysis, error analysis, and conclusion for each laboratory. **[CR7]**

Students are expected to be in class on time with the required materials. The AP Chemistry class meets for 90 minutes every day for one full semester. A minimum of 60 minutes per day outside of class is expected. An average of at least one of the 90-minute periods each week will be devoted to laboratory work. Students keep a formal laboratory notebook. This notebook is graded with each lab. Laboratory work counts 20 percent of the total class grade. The notebook goes with the student to the university to evaluate their placement in a college laboratory program. **[CR7]**

Students in AP Chemistry are expected to take the AP Chemistry Exam in May.

Quizzes and Tests

Quizzes will be given to monitor your progress. They may or may not be announced and will be designed to assess and remediate your skills on a given topic. Quizzes will generally last 10 minutes and will take place at the very beginning of class, so don't be late. Occasionally, quizzes may be administered using WebAssign. This may allow you to attempt a quiz multiple times for a better grade; however, you may not receive the exact same quiz each time.

Tests will be given occasionally and will definitely be announced. These tests are comprised of a variety of assessment items ranging from multiple choice to essay type questions similar to the AP Exam you will take in the spring.

Grades

A weighted system will be used to determine your grade. Category percentages are as follows:

Tests	40%
Labs	20%
OWL Assignments	20%
FRQ Notebook	10%
Final Exam	10%

AP Chemistry carries a full quality point. You are expected to earn it (please refer to AP Contract).

A's, 89.5-100; B's, 79.5-89.4; C's, 73.5-79.4; D's, 69.5-73.4; F, below 69.5; I, incomplete.

Curricular Requirements
CR1 Students and teachers use a recently published (within the last 10 years) college-level chemistry textbook.
CR2 The course is structured around the enduring understandings within the big ideas as described in the AP Chemistry Curriculum Framework.
CR3a The course provides students with opportunities outside the laboratory environment to meet the learning objectives within Big Idea 1: Structure of matter.
CR3b The course provides students with opportunities outside the laboratory environment to meet the learning objectives within Big Idea 2: Properties of matter-characteristics, states, and forces of attraction.
CR3c The course provides students with opportunities outside the laboratory environment to meet the learning objectives within Big Idea 3: Chemical reactions.
CR3d The course provides students with opportunities outside the laboratory environment to meet the learning objectives within Big Idea 4: Rates of chemical reactions.
CR3e The course provides students with opportunities outside the laboratory environment to meet the learning objectives within Big Idea 5: Thermodynamics.
CR3f The course provides students with opportunities outside the laboratory environment to meet the learning objectives within Big Idea 6: Equilibrium.
CR4 The course provides students with the opportunity to connect their knowledge of chemistry and science to major societal or technological components (e.g., concerns, technological advances, innovations) to help them become scientifically literate citizens.
CR5a Students are provided the opportunity to engage in investigative laboratory work integrated throughout the course for a minimum of 25 percent of instructional time.
CR5b Students are provided the opportunity to engage in a minimum of 16 hands-on laboratory experiments integrated throughout the course while using basic laboratory equipment to support the learning objectives listed within the AP Chemistry Curriculum Framework.
CR6 The laboratory investigations used throughout the course allow students to apply the seven science practices defined in the AP Chemistry Curriculum Framework. At minimum, six of the required 16 labs are conducted in a guided-inquiry format.
CR7 The course provides opportunities for students to develop, record, and maintain evidence of their verbal, written, and graphic communication skills through laboratory reports, summaries of literature or scientific investigations, and oral written, and graphic presentations.

Big Ideas in AP Chemistry
Big Idea 1: The chemical elements are fundamental building materials of matter, and all matter can be understood in terms of arrangements 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 reorganization of atoms and/or the transfer of electrons.
Big Idea 4: Rates of chemical reactions are determined by details of the molecular collisions.
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 dynamic competition, sensitive to initial conditions and external perturbations.

Scientific Practices for AP Chemistry
Scientific Practice 1: The student can use representations and models to communicate scientific phenomena and solve scientific problems.
Scientific Practice 2: The student can use mathematics appropriately.
Scientific Practice 3: The student can engage in scientific questioning to extend thinking or to guide investigations within the context of the AP course.
Scientific Practice 4: The student can plan and implement data collection strategies in relation to a particular scientific question. [Note: Data can be collected from many different sources, e.g., investigations, scientific observations, the findings of others, historic reconstruction, and/or archived data.]
Scientific Practice 5: The student can perform data analysis and evaluation of evidence.
Scientific Practice 6: The student can work with scientific explanations and theories.
Scientific Practice 7: The student is able to connect and relate knowledge across various scales, concepts, and representations in and across domains.

Summary of Laboratory Experiments for AP Chemistry

****These can also be found within the Unit Overview below****

1. Indirect Gravimetric Determination of the Percent Composition of a Two Component Mixture **[SP 2,5]**
2. ***Formula of a Hydrate Lab (Guided Inquiry)*** **[SP1,3,4,6]**
3. Cu to Cu Lab **[SP 2,5]**
4. Determination of Heats of Reaction Using Calorimetry **[SP2,5]**
5. ***Determination of the Heat of Formation of MgO (Guided Inquiry)*** **[SP2-7]**
6. ***What's in the Bottle? (Guided Inquiry)*** **[SP1,5,6]**
7. VSEPR Lab **[SP 1,3,6]**
8. Identification of a substance using photoelectron spectroscopy [**SP1,4,6]**
9. Experimental Determination of the Gas Constant, R. **[SP2,4, 5,6]**
10. Determination of the Molar Mass of a Volatile Liquid **[SP2,4,5,6]**
11. Following a Reaction via Thin Layer Chromatography **[SP2,5,6]**
12. Determination of Concentration via Beer's Law **[SP2,5,6]**
13. Determination of the Rate Order for the Decomposition of Blue #1 Food Dye **[SP1,2,4,5,6,7]**
14. Determination of the Equilibrium Constant for the Hydrolysis of Ethyl Acetate **[SP2,4,5,7]**
15. Experimental Determination of the pKa for an Unknown Acid **[SP 2,5]**
16. ***Preparation and Testing of a Buffer Solution (Guided Inquiry)*** **[SP2,5,6]**
17. Experimental Determination of Ksp for a Slightly Soluble Compound **[SP2,4,5]**
18. ***Investigation of Electrochemical Cells (Guided Inquiry)*** **[SP2,5,6]**

AP Chemistry Unit Overview

Big Idea(s) [CR3a-f]	Text Chapters Including Topics Covered	Laboratory Activities [CR5b & CR6]	Activities/Evaluations
1,3,5 (18 days)	1. Introduction: Matter and Measurement 2. Atoms, Molecules, and Ions 3. Stoichiometry: Calculations with Chemical Formulas and Equations 4. Aqueous Reactions and Solution Stoichiometry 5. Thermochemistry	1. Indirect Gravimetric Determination of the Percent Composition of a Two Component Mixture 2. ***Formula of a Hydrate Lab (Guided Inquiry)*** 3. Cu to Cu Lab -- Students perform various chemical reactions to recover copper 4. Determination of Heats of Reaction Using Calorimetry 5. ***Determination of the Heat of Formation of MgO (Guided Inquiry)***	1. Five (5) homework assignments 2. Three (3) quizzes 3. One (1) unit exam 4. Students conduct simple research investigating the process of copper recycling. (Coincides with Cu to Cu Lab) **[CR3c]**
1-2 (16 days)	6. Electronic Structure of Atoms 7. Periodic Properties of the Elements 8. Basic Concepts of Chemical Bonding 9. Molecular Geometry and Bonding Theories	1. ***What's in the Bottle? (Guided Inquiry)*** 2. VSEPR Lab --Students use molecular models for visual confirmation of molecular shapes 3. Identification of a substance using photoelectron spectroscopy	1. Four (4) homework assignments 2. Three (3) quizzes 3. One (1) unit exam 4. Polarity activity: Students use molecular models to construct various molecules. Students then discuss why the compounds are polar or nonpolar based on their three dimensional structure. (Done in conjuction with VSEPR Lab) **[CR4]**
2 (20 days)	10. Gases 11. Intermolecular Forces, Liquids, and Solids 13. Properties of Solutions	1. Experimental Determination of the Gas Constant, R. 2. Determination of the Molar Mass of a Volatile Liquid 3. ***Determination of Molar Mass via Freezing Point Depression (Guided Inquiry)*** 4. Determination of Concentration via Beer's Law	1. Three (3) homework assignments 2. Two (2) quizzes 3. One (1) unit exam
4,6 (14 days)	14. Chemical Kinetics 15. Chemical Equilibrium	1. Determination of the Rate Order for the Decomposition of Blue #1 Food Dye 2. Determination of the Equilibrium Constant for the Hydrolysis of Ethyl Acetate	1. Two (2) homework assignments 2. One (1) quiz 3. One (1) unit exam 4. Students determine how to maximize the production of ammonia based on LeChatelier's principle **[CR3f]** 5. Students utilize a web-based kinetics simulator to predict and understand reaction kinetics and mechanisms http://www.stolaf.edu/ **[CR3d]**

6 (20 days)	16. Acid-Base Equilibria 17. Additional Aspects of Aqueous Equilibria	1. Experimental Determination of the pKa for an Unknown Acid 2. ***Preparation and Testing of a Buffer Solution (Guided Inquiry)*** 3. Experimental Determination of Ksp for a Slightly Soluble Compound	1. Two (2) homework assignments 2. Two (2) quizzes 3. One (1) unit exam
5 (14 days)	19. Chemical Thermodynamics 20. Electrochemistry	1. ***Experimental Determination of an Activity Series (Guided Inquiry)***	1. Two (2) homework assignments 2. One (1) quiz 3. One (1) unit exam 4. Students predict spontaneity based on thermodynamical parameters (entropy, enthalpy, Gibb's free energy) **[CR3e]**