AP Chemistry Syllabus

Curricular Requirements	Page(s)
CR1: Students and teachers use a recently published (within the last 10 years) college-level chemistry textbook.	3
CR2: The course is structured around the enduring understandings within the big ideas as described in the AP Chemistry Curriculum Framework.	2, 5, 6, 7, 8, 9, 10, 11, 12
CR3a: The course provides students with opportunities outside the laboratory environment to meet the learning objectives within Big Idea 1: Structure of matter.	7
CR3b: The course provides student with opportunities outside the laboratory environment to meet the learning objectives within Big Idea 2: Properties of matter-characteristics, states, and forces of attraction.	7
CR3c: The course provides students with opportunities outside the laboratory environment to meet the learning objectives within Big Idea 3: Chemical Reactions.	12
CR3d: The course provides students with opportunities outside the laboratory environment to meet the learning objectives within Big Idea 4: Rates of chemical reactions.	9
CR3e: The course provides students with opportunities outside the laboratory environment to meet the learning objectives within Big Idea 5: Thermodynamics.	10
CR3f: The course provides students with opportunities outside the laboratory environment to meet the learning objectives within Big Idea 6: Equilibrium.	9
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.	11, 12
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.	3, 4
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.	13, 14
CR6: The laboratory investigations used throughout the course allows 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.	13, 14
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.	3

Course Description

Advanced Placement is a long-standing, nation-wide program. This AP Chemistry course is designed to be the equivalent of the general chemistry course usually taken during the first year of college. For most students, the course enables them to undertake, as a freshman, second year work in the chemistry sequence at their institution or to register in courses in other fields where general chemistry is a prerequisite. One of the major functions of an Advanced Placement course is to prepare students for the AP Exam, which is given during May of each school year.

Since this is a college level course taught in high school, it is very demanding, both in time and effort required. The amount of work outside of class depends upon the student and his/her background and study habits. However, students should be prepared to spend anywhere from 45 minutes to an hour on just their chemistry homework. This course is mainly for junior and senior students who have completed a first year chemistry course and are enrolled in an appropriate math class. Much of the work involves solving math type story problems, and students need to have completed Advanced Algebra before they are enrolled in AP Chemistry. Admittance is based on a verbal recommendation from a science teacher.

AP Chemistry students need to come to class each day prepared and ready to work. Homework will be given regularly and should be completed as it is assigned. A study guide will be given for each chapter and must be done on time and thoroughly. During the course, labs related to the topic will be completed to enhance and support the material being studied. Quizzes and exams will be given frequently. Homework assignments are an integral part of the course. Practicing the concepts and sharing the results with your classmates is a daily occurrence.

This course is structured around the six big ideas articulated in the AP Chemistry curriculum framework provided by the College Board. **[CR2]** A special emphasis will be placed on the seven science practices, which capture important aspects of the work that scientists engage in, with learning objectives that combine content with inquiry and reasoning skills. AP Chemistry is open to all students that have completed a year of chemistry who wish to take part in a rigorous and academically challenging course.

Big Ideas [CR2]

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.
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.
3. Changes in matter involve the rearrangement and/or reorganization of atoms and/or the transfer of electrons.
4. Rates of chemical reactions are determined by details of the molecular collisions.
5. The laws of thermodynamics describe the essential role of energy and explain and predict the direction of changes in matter.
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.

Science Practices

1. The Student can use representations and models to communicate scientific phenomena and solve scientific problems.
2. The student can use mathematics appropriately.
3. The student can engage in scientific questioning to extend thinking or to guide investigations within the context of the AP course.
4. The student can plan and implement data collection strategies in relation to a particular scientific question.
5. The student can perform data analysis and evaluation of evidence.
6. The student can work with scientific explanations and theories.
7. The student is able to connect and relate knowledge across various scales, concepts, and representations in and across domains.

Textbook and Lab Books

Zumdahl, Steven and Susan Zumdahl. Chemistry, Eighth Edition. Belmont CA: Cengage Learning, 2012. **[CR1]**
The College Board. AP Chemistry Guided Experiments: Applying the Science Practice. 2013.
Vonderbrink, Sally. Laboratory Experiments for AP Chemistry. Batavia: Flinn Scientific, 2001.
Randall, Jack. Advanced Chemistry with Vernier. Oregon: Vernier Software and Technology, 2004.
Holmquist, Dan and Donald Volz. Chemistry with Calculators. Oregon: Vernier Software and Technology, 2003.

Required Materials

Calculator and notebook.

Labs

The labs completed require following or developing processes and procedures, taking observations, and data manipulation. See lab list provided for lab details. Students communicate and collaborate in lab groups; however, each student writes a laboratory report for every lab they perform. A minimum of 25% of student contact time will be spent doing hands-on laboratory activities. **[CR5a]** A full list and description of labs is provided later.

Laboratory Reports

A laboratory notebook is required for this course. All completed laboratory experiences must be included in the notebook. **[CR7]** A specific format will be given for each student for each lab. Students must follow that format and label all sections clearly. AP Chemistry lab reports are much more in depth than the ones completed in the first year chemistry course. Therefore, it is important that students don't procrastinate when doing pre-lab and post-lab work.

A laboratory report is a word processed document illustrating your understanding of the experiment. The report should be used to discuss the results, explain the theories and key concepts involved, analyze errors and make an ultimate conclusion about the laboratory experiment. A record of laboratory work is an important document which will show the quality of the laboratory work that you have done.

All lab reports are kept in a notebook. Late labs will be accepted with penalty. Labs not completed in class must be done before/after school by appointment.

Lab reports must include the following components:

Title – The title should be descriptive. Experiment 5 is not a descriptive title.

Partners – Who did you work with?

Date – This is the date (or dates) you performed the experiment

Introduction – Write brief statement of purpose explaining what you are attempting to do. Do not use proper nouns. In this section you should also demonstrate your understanding of what concepts were demonstrated in this experiment. Refer back to the purpose. This section is essential in conveying your conceptual understanding of the experiments and must receive a thorough analysis. You may use whatever (legitimate) format you prefer to **reference** any ideas that are not your own.

Procedure Outline – Write an outline of the procedure. Use bulleted statements or similar outline to make it easy to read. If the lab is guided inquiry, a detailed procedure will be developed.

Data – Organize your data in a neat, orderly form. Label all data very clearly. Use correct significant digits, and always include proper units (g, ml, etc.).

Analysis of Results – You should show how calculations are carried out. Give the equation used and show how your values are substituted into it. Give the calculated values using significant figures. Results may be summarized in a table. If graphs are included, make the graphs an appropriate size. Label all axes and give each graph a title. A spreadsheet program may be used to produce graphs. If experiments are not quantitative, this section may be omitted. If you can calculate a percent error or percent deviation, do so and include it in this section.

Conclusion – Briefly discuss and summarize the **pertinent** results obtained in the experiment. What does the data and calculations show? Make a simple statement concerning what you can conclude from the experiment. How was the purpose of the experiment fulfilled? Why does (or doesn't) the experiment work?

Experimental Sources of Error – What are some specific sources of error, and HOW do they influence the data? Do they make the values obtained larger or smaller than they should be? Which measurement was the least precise? Human error and experimental sources of error exist in every experiment, and should not be mentioned as a source unless they cause a significant fault. Significant digits and mistakes in calculations are NOT a valid source of error. In writing this section, it is sometimes helpful to ask yourself what you would do differently if you were to repeat the experiment and wanted to obtain better precision.

General Schedule

This class meets 4 times a week:

- Two days are 54 minute periods
- Two days are 85 minute blocks

A typical day will include:

- Homework review
- Lecture on new topics
- Demonstrations
- Small group problem solving
- Laboratory experiments or teacher led laboratory demonstrations

Typical Unit of Study:

- Chapter goals / Study Guide
- Lectures /Demonstrations
- Review
- Laboratory
- Exam

Laboratory:

- Laboratory activities are performed to enforce topics
- The student and teacher led laboratory activities cover roughly a block per week **[CR5a]**
- Students have completed the following advanced placement laboratories in Chemistry I as a prerequisite to taking advanced placement chemistry:
    - Determination of the empirical formula of magnesium oxide
    - Finding the ratios of moles of reactants in a chemical reaction
    - Determining molar volume of a gas by water displacement

Examinations:

- Several exams are given each semester
- Homework quizzes are given often
- Students take a cumulative final similar to the AP exam each semester

AP Examination Review

The final ten days of class leading up to the AP Chemistry Exam are used for exam review and practice tests using old AP Chemistry exam materials. Students work in small, cooperative groups to solve a packet of free response problems from previous years or work through AP Exam preparation materials such as a *Princeton Review*. Students practice net ionic equations and are quizzed on their progress. Several practice AP Exams are administered as part of the two-week review prior to the AP Chemistry Exam.

Course Sequence [CR2]

First Quarter **AP Chemistry Curriculum**

Chapter	Topics Covered	Assignments, Labs, and Activities	Big Ideas [CR2]	Enduring Understanding	Learning Objective
One Chemical Foundations	• Scientific method • Units of Measurement • Uncertainty in Measurement • Significant Figures and Calculations • Dimensional Analysis • Temperature • Density • Classification of Matter	• Assignments: o Chapter Study Guide o Practices Problems • Labs: o Determination of the Density of Water	None		
Two Atoms, Molecules, and Ions	• Fundamental Chemical Laws • Dalton's Atomic Theory • Early Experiments to Characterize an Atom o Thomson o Rutherford • Modern View of Atomic Structure • Mass Spectrometer • Isotopes • Organization of the Periodic Table • Naming Simple Compounds	• Assignments: o Chapter Study Guide o Practices Problems • Activities: o Nomenclature Packet	1 2 3	1.A 1.B 1.E 2.C 3.B	1.1 1.17 2.17 3.5 3.6
Three Stoichiometry	• Counting by Weight • Atomic Masses • The Mole • Molar Mass • Percent Composition of Compounds • Determining the Formula of a Compound • Chemical Equations • Balancing Chemical Equations • Stoichiometric Calculations • Excess and Limiting Reagent	• Assignments: o Chapter Study Guide o Practices Problems • Labs: o Determination of the Percent Water in a Hydrated Crystal o Determination of the Empirical Formula of Copper Iodide	1 3	1.A 1.D 1.E 3.A 3.B	1.1 1.2 1.3 1.4 1.14 1.17 1.18 1.19 3.1 3.3 3.4 3.6

Four Types of Reactions and Solutions Stoichiometry	• Water • Aqueous Solutions • Electrolytes • Composition of Solutions • Types of Chemical Reactions • Precipitations Reactions • Solubility Rules • Describing Reactions in Solution • Stoichiometry of Reactions in Solution • Acid-Base Reactions • Oxidation-Reduction Reactions • Titration	• Assignments: o Chapter Study Guide o Practices Problems • Labs: o Examining the Relationship between the Concentration of a Solution and Absorbance Using a Spectrophotometer o Net Ionic Reactions o Standardization of a Solution Using a Primary Standard o Determination of the Molar Mass of an Unknown Weak Acid by Titration	1 2 3 4 5 6	1.A 1.E 2.A 2.B 2.D 3.A 3.B 3.C 5.D 6.C	1.4 1.17 1.18 2.8 2.9 2.14 3.1 3.2 3.3 3.4 3.8 3.9 3.10
Five Gases	• Pressure • The Gas Laws • Gas Stoichiometry • Kinetic Molecular Theory • Effusion and Diffusion • Real vs. Ideal Gases	• Assignments: o Chapter Study Guide o Practices Problems • Labs: o Determination of the Molar Mass of an Unknown Gas	1 2 5	1.B 1.C 1.D 2.C 2.D 5.C	1.7 1.8 1.15 2.1 2.17 2.18 2.21 2.23 2.24 5.1 5.8
Six Thermochemistry	• The Nature of Energy • Endothermic vs. Exothermic Processes • Enthalpy and Calorimetry • Energy Diagrams • Heating and Cooling Curves • Hess's Law • Standard Enthalpies of Formation	• Assignments: o Chapter Study Guide o Practices Problems • Labs: o Hess's Law	3 5	3.C 5.A 5.C 5.E	2.15 5.3 5.12 5.13 5.14 5.15 5.16 5.17 5.18 6.25

Chapter	Topics Covered	Assignments, Labs, and Activities	Big Ideas [CR2]	Enduring Understanding	Learning Objective
Seven Atomic Structure and Periodicity	• Electromagnetic Radiation • The Nature of Matter • The Atomic Spectrum of Hydrogen • The Bohr Model • The Quantum Mechanical Model • Quantum Numbers • Orbital Shapes and Energies • Electron Spin • The Pauli Exclusion Principle • The Aufbau Principle • Hund's Rules • Electron Configurations • Periodic Trends in Atomic Properties	• Assignments: o Chapter Study Guide o Practices Problems • Labs: o Atomic Spectra and Energy Levels • Activities: o Periodic Trends – Students use an interactive periodic table to research period and group trends in atomic radius, ionization energy, and electronegativity to predict trends and rationalize the organization of the periodic table (LO 1.9, 1.10, 1.11, 1.12, 1.13) **[CR3a]**	1 5	1.B 1.C 1.D 5.E	1.5 1.6 1.7 1.8 1.9 1.10 1.12 1.13 1.15
Eight Bonding: General Concepts **Nine** Bonding: Orbitals	• Types of Chemical Bonds o Ionic o Covalent o Polar Covalent • Electronegativity • Bond Polarity and Dipole Moments • Ion s o Electron Configurations o Size • Coulomb's Law • Covalent Bond Energies • The Localized Electron Model • Lewis Structures • Formal Charge • Resonance	• Assignments: o Chapter Study Guide o Practices Problems • Activities: o Investigating Molecular Geometries – Students make drawings of a series of molecules and from those drawings predict geometry, hybridization, and polarity (LO 2.21) **[CR3b]**	1 2 5	1.B 1.C 1.D 2.C 2.D 5.C	1.7 1.8 1.15 2.1 2.17 2.18 2.21 2.23 2.24 5.1 5.8

	• VSEPR Model • Hybridization • Molecular Orbitals				
Ten Liquids and Solids **Eleven** Properties of Solutions	• Intermolecular Forces o London o Dipole o Induced Dipole o H-Bonding • Properties of Liquid State • Structures and Types of Solids o Atomic o Ionic o Metallic o Molecular o Network • Vapor Pressure and change of State • Phase Diagrams • Solution Composition • Types of Solutions • Energy of Solution Formation • Factors Affecting Solubility • Vapor Pressure of Solutions	• Assignments: o Chapter Study Guide o Practices Problems • Labs: o Investigating Intermolecular Forces o Determination of the Heat of Solution	1 2 5 6	1.C 2.A 2.B 2.C 2.D 5.B 5.D 6.A 6.C	1.11 2.1 2.3 2.8 2.9 2.11 2.13 2.14 2.15 2.16 2.19 2.20 2.22 2.23 2.24 2.25 2.26 2.27 2.28 2.29 2.20 2.31 2.32 5.6 5.9 5.10 5.11 6.24

Chapter	Topics Covered	Assignments, Labs, and Activities	Big Ideas [CR2]	Enduring Understanding	Learning Objective
Twelve Chemical Kinetics	• Reaction Rates • Rate Laws • Method of Initial Rates • Integrated Rate Law • Reaction Mechanisms • Activation Energy • Collision Theory • Catalysis • Energy Diagrams	• Assignments: o Chapter Study Guide o Practices Problems • Labs: o Determining the Rate Law for an Iodine Clock Reaction • Activities: o Integrated Rate Law Data Analysis – Students asked to graph concentration vs. time data for different reactions in order to determine the reaction order. (LO 4.2) **[CR3d]**	4	4.A 4.B 4.C 4.D	4.1 4.2 4.3 4.4 4.5 4.6 4.7 4.8 4.9
Thirteen Chemical Equilibrium	• The equilibrium Condition • The Equilibrium Constant • Equilibrium Expressions Involving Pressure • Heterogeneous Equilibrium • Applications of the Equilibrium Constant • Reaction Quotient • Solving Equilibrium Problems • Le Châtelier's Principle	• Assignments: o Chapter Study Guide o Practices Problems • Labs: o Determination of an Equilibrium Constant by Spectrophotometric Analysis • Activities: o On-Line Le Châtelier's Principle Animation – Students manipulate the environment on various reactions to produce a stress on the system to investigate shifts in equilibrium predicted by Le Châtelier's Principle. (LO 6.8, 6.9) **[CR3f]**	6	6.A 6.B	6.1 6.2 6.3 6.4 6.5 6.6 6.7 6.8 6.9 6.10

Fourteen Acids and Bases	• The Nature of Acids and Bases • Acid-Base Definitions • Acid Strength • The pH Scale • pH probes • Calculating the pH or pOH of Strong Acid or Base Solutions • Calculating the pH or pOH of Weak Acid or Base Solutions • Polyprotic Acids • Acid-Base Properties of Salts • The Effect of Structure on Acid-Base Properties • The Lewis Acid-Base Model	• Assignments: o Chapter Study Guide o Practices Problems • Labs: o Investigating Acidity of Household Products	6	3.B 6.A 6.C	2.1 2.2 3.7 6.1 6.11 6.12 6.14 6.15 6.16
Fifteen Acid-Base Equilibria **Sixteen** Solubility and Complex Ion Equilibria	• The Common Ion Effect • Buffered Solutions • Buffering Capacity • Titrations and pH Curves • Acid-Base Indicators • Solubility Equilibria • Solubility Product • Precipitation and Qualitative Analysis	• Assignments: o Chapter Study Guide o Practices Problems • Labs: o Determination of pK_a for a Weak Acid • Activities: o Spontaneity Table: Given different sets of conditions, the students determine if the situation is thermodynamically favored or not favored looking at entropy, enthalpy, temperature, and Gibbs Free Energy (LO 5.13) **[CR3e]**	1 3 6	1.E 3.A 6.A 6.C	1.20 3.3 6.1 6.12 6.13 6.15 6.16 6.17 6.18 6.19 6.20 6.21 6.22 6.23

Chapter	Topics Covered	Assignments, Labs, and Activities	Big Ideas [CR2]	Enduring Understanding	Learning Objective
Seventeen Spontaneity, Entropy, and Free Energy	• Thermodynamics • Spontaneous Processes • Entropy • Free Energy • The Effect of Temperature on Spontaneity	• Assignments: o Chapter Study Guide o Practices Problems • Labs: o Investigating the Spontaneity of the Solution Formation	2 5 6	2.B 5.A 5.C 5.E 6.D	2.15 5.3 5.12 5.13 5.14 5.15 5.16 5.17 5.18 6.25
Eighteen Electrochemistry	• Balancing Redox Equations • Galvanic Cells • Standard Reduction Potential • Cell Potential and Free Energy • Dependence of Cell Potential on Concentration • Batteries • Corrosion • Electrolysis	• Assignments: o Chapter Study Guide o Practices Problems • Labs: o Constructing Electrochemical Cells o Hydrolysis of Water	3 5 6	3.A 3.B 3.C 5.E 6.A	3.2 3.8 3.12 3.13 5.15 6.1
Nineteen The Nucleus: A Chemist's View	• Nuclear Stability • Radioactive Decay • Nuclear Transformations • Nuclear Fission and Fusion	• Assignments: o Chapter Study Guide o Practices Problems • Activities: o Nuclear Power Project – Students are asked to research and produce a presentation illustrating the pros and cons of nuclear power. **[CR4]**	Nuclear Chemistry		
Twenty Two Organic and Biological	• Alkanes • Alkenes • Alkynes	• Assignments: o Chapter Study Guide o Practices Problems	Organic Chemistry		

Molecules	• Aromatic Hydrocarbons • Hydrocarbon Derivatives • Polymers	• Labs: o Synthesis and Purification of a Compound • Activities: o Pharmaceutical Presentation – Students are asked to research and produce a presentation regarding the production and uses of a drug of their choice. **[CR4]**			
Review	• Review	• Activities: o *Princeton Review* o Old AP Exams o FRQ Practice o Reaction Demonstrations – Students observe a series of chemical reaction and then write appropriately balanced chemical equation (LO 3.2) **[CR3c]** • Labs: o Predicting Products of Chemical Reactions and Writing Chemical Equations o Qualitative Analysis	1 2 3 4 5 6		

AP Chemistry Laboratory List

The following labs will be completed during the school year. **[CR5b]** Guided Inquiry Labs are indicated with an asterisk. **[CR6]**

***Guided Inquiry Lab:** Determination of the Density of Water (SP 1, 4, 5)
Description: Students develop a method to quantitatively determine the density of distilled water at room temperature via algebraic manipulation and graphing.

Lab: Determination of the Percent Water in a Hydrated Crystal (LO 1.2, 1.3, 3.5; SP 2, 5)
Description: Students dehydrate an unknown hydrated salt (given the salt's molar mass) in order to determine the percent composition and mole ratio of water in the substance.

***Guided Inquiry Lab:** Determination of the Empirical Formula of Copper Iodide (LO 1.2, 1.3, 1.19, 3.5; SP 2, 5)
Description: Students quantitatively combine copper metal and gaseous iodine in the hood in order to determine the empirical formula of the compound.

***Guided Inquiry Lab:** Examining the Relationship between the Concentration of a Solution and Absorbance Using a Spectrophotometer (LO 1.15, 1.16, SP 1, 2, 4, 5)
Description: Students practice producing a concentration curve using dyes and a spectrophotometer and use their curve to determine the concentration of an unknown.

Lab: Net Ionic Reactions (LO 3.1, 3.2)
Description: Students produce various precipitates and write the balanced net-ionic equation and name all species present.

Lab: Standardization of a Solution Using a Primary Standard (LO 1.20; SP 2)
Description: Students use a primary standard (KHP) in order to standardize a solution of sodium hydroxide via titration.

***Guided Inquiry Lab:** Determination of the Molar Mass of an Unknown Weak Acid by Titration (LO 1.20; SP 2, 4, 5, 6)
Description: Students use a standardized base solution and titration in order to determine the molar mass of an unknown acid.

***Guided Inquiry Lab:** Determination of the Molar Mass of an Unknown Gas (LO 2.3, 2.5, 5.2; SP 2, 5)
Description: Students develop an experimental method to collect enough information to determine the molar mass of an unknown gaseous compound.

***Guided Inquiry Lab:** Hess's Law (LO 3.11, 5.3, 5.4, 5.5, 5.7, 5.8; SP 2, 3, 4, 5, 6)
Description: Students perform a series of reactions and calculate enthalpy, proving Hess's law.

Lab: Atomic Spectra and Energy Levels (LO 1.9, 1.10, 1.11, 1.12, 1.13; SP 1, 5, 6)
Description: Students look at a series of gas emission spectra using spectroscopes and determine the identity of the unknown and study properties of light.

Lab: Investigating Intermolecular Forces (LO 2.11, 2.13, 2.16, 2.18, 5.9, 5.12; SP 3, 4, 5, 6)
Description: Students analyze how structure influences a substance's surface tension, volatility, and solubility.

Lab: Determination of the Heat of Solution (LO 5.4, 5.8; SP 2, 6)
Description: Students use calorimetry to determine the heat associated with solution formation.

Lab: Determining the Rate Law for an Iodine Clock Reaction (LO 1.16, 4.2, 4.3, 4.4; SP 2, 3, 4, 5, 6)
Description: Students monitor an iodine clock reaction under different initial concentrations of species in order to determine the rate law for the reaction.

Lab: Determination of an Equilibrium Constant by Spectrophotometric Analysis (LO 5.17, 6.1, 6.2, 6.3, 6.4, 6.5, 6.6, 6.7, 6.8, 6.9, 6.10; SP 1, 6)
Description: Students use a spectrophotometer to determine the equilibrium constant for a reaction.

***Guided Inquiry Lab:** Investigating Acidity of Household Products (LO 1.2, 6.20, SP 1, 2, 4, 5, 6, 7)
Description: Students are asked to design and carry out an experiment to test acidity in common household products.

Lab: Determination of pK_a for a Weak Acid Solution (LO 2.2, 3.7; SP 2, 5)
Description: Students do a titration in which ½ of the weak acid is neutralized and then the K_a is determined.

Lab: Investigating the Spontaneity of the Solution Formation (LO 5.12, 5.13, 5.14, 5.18, 6.25; SP 2, 5, 6)
Description: Students collect data and analyze data to determine ΔH^o, ΔS^o, and ΔG^o.

***Guided Inquiry Lab:** Constructing Electrochemical Cells (LO 3.12, 3.13, 5.16; SP 2, 5)
Description: Students find the reduction potentials of a series of reactions using galvanic cells and multimeters to build their own reduction potential table.

***Guided Inquiry Lab:** Hydrolysis of Water (LO 3.1, 3.2, 3.8; SP 5, 6)
Description: Students use are given graphite rods and a 9V battery and asked to induce hydrolysis in water, identifying the cathode, anode, half reactions, and balanced chemical equation.

Lab: Synthesis and Purification of a Compound (SP 2, 4, 5, 6)
Description: Students synthesize and purify a sample of Aspirin and test it for purity using melting point and thin layer chromatography.

Lab: Predicting Products of Chemical Reactions and Writing Chemical Equations (LO 3.1, 3.2; SP 1, 6)
Description: Students perform many different reactions, identify reaction type, and write balanced chemicals equations for each reaction.

***Guided Inquiry Lab:** Qualitative Analysis (LO 3.1, 3.2, 6.21; SP 1, 3, 4)
Description: Students are given 14 unknown bottles and asked to develop an experimental procedure to collect enough data to determine which ions are present in each bottle (given the list of possible cations and anions).