Curricular Requirements		Page(s)
CR1	Students and teachers use a recently published (within the last 10 years) college-level chemistry textbook.	1
CR2	The course is structured around the enduring understandings within the big ideas as described in the AP Chemistry Curriculum Framework.	1
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 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.	7
CR3c	The course provides students with opportunities outside the laboratory environment to meet the learning objectives within Big Idea 3: Chemical reactions.	4
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.	6
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.	8
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.	2
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.	4, 5, 6, 7, 8, 9, 10, 11
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.	4, 5, 6, 7, 8, 9, 10, 11
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.	2

Course Description

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 register in courses in other fields where general chemistry is a prerequisite. 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 successfully completed a year of chemistry who wish to take part in a rigorous and academically challenging course.

CR2—The course is structured around the enduring understandings within the big ideas as described in the AP Chemistry Curriculum Framework.

Big Idea 1: Structure of matter
Big Idea 2: Properties of matter-characteristics, states, and forces of attraction
Big Idea 3: Chemical reactions
Big Idea 4: Rates of chemical reactions
Big Idea 5: Thermodynamics
Big Idea 6: Equilibrium

Textbooks and Lab Books

The College Board. AP Chemistry Guided Inquiry Experiments: Applying the Science Practices. 2013.

Brown, Lemay, Jr., Bursten, Murphy, Woodward, Stoltzfus. Chemistry: The Central Science: Thirteenth Edition, Pearson, 2015. **[CR1]**

Vonderbrink, Sally. Laboratory Experiments for AP Chemistry. Batavia: Flinn Scientific, 2014.

CR1—Students and teachers use a recently published (within the last 10 years) college-level chemistry textbook.

Required Materials

Graphing calculator, splash proof goggles, and a carbon capable laboratory notebook or online lab 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 online or in a Lab Notebook for every lab they perform. A minimum of 25% contact time will be spent doing hands-on laboratory activities. **[CR5a]**

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.

The AP Chemistry Laboratory Report [CR7]

A specific format will be given to the student for each lab. Students must follow that format and label all sections very clearly. AP Chemistry lab reports are much longer and 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.

Late labs will not be accepted. Labs not completed in class must be done at lunch or after school by appointment.

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.

Pre-Lab Work

Pre-lab work is to be completed and turned in on the day the lab is performed.

1. Title

The title should be descriptive. For example, "pH Titration Lab" is a descriptive title and "Experiment 5" is not a descriptive title.

2. Date

This is the date the student performed the experiment.

3. Purpose

A purpose is a statement summarizing the "point" of the lab.

4. Procedure Outline

Students need to write an outline of the procedure. They should use bulleted statements or outline format to make it easy to read. If a student is doing a guided inquiry lab, they may be required to write a full procedure that they develop.

5. Pre-Lab Questions

Students will be given some questions to answer before the lab is done. They will need to either rewrite the question or incorporate the question in the answer. The idea here is that when someone (like a college professor) looks at a student's lab notebook, they should be able to tell what the question was by merely looking at their lab report. It is important to produce a good record of lab work.

6. Data Tables

Students will need to create any data tables or charts necessary for data collection in the lab.

During the Lab

7. Data
Students need to record all their data directly in their lab notebook. They are NOT to be recording data on their separate lab sheet. They need to label all data clearly and always include proper units of measurement. Students should underline, use capital letters, or use any device they choose to help organize this section well. They should space things out neatly and clearly.

Post-Lab Work

8. Calculations and Graphs
Students should show how calculations are carried out. Graphs need to be titled, axes need to be labeled, and units need to be shown on the axis. To receive credit for any graphs, they must be at least ½ page in size.

9. Conclusions
This will vary from lab to lab. Students will usually be given direction as to what to write, but it is expected that all conclusions will be well thought out and well written.

10. Post Lab Error Analysis Questions
Follow the same procedure as for Pre-Lab Questions.

Advanced Placement Chemistry — The Laboratory Notebook
A record of lab work is an important document, which will show the quality of the lab work that students have performed.

AP Chemistry Unit Overview

Unit 1: Chemistry Fundamentals
Number of Quizzes: 1-2
Number of Exams: 1

Topics Covered:

	Curriculum Framework Articulation:
1. Scientific Method	BI 1.D.1:a
2. Classification of Matter	
a. pure substances vs mixtures	1.A.1:b
b. law of definite proportions	1.A.1:c
c. law of multiple proportions	1.A.1:d
d. chemical and physical changes	3.C.1:b, 3.C.1:c, 5.D:2
3. Nomenclature and formula of binary compounds	1.E.2:b

Unit 5: Thermochemistry

Number of Quizzes:
Number of Exams: 1

Topics Covered:

	Curriculum Framework Articulation:
1. Law of conservation of energy, work, and internal energy	5.B.1, 5.E.2:a
2. Endothermic and exothermic reactions	3.C.2, 5.B.3:e, 5.B.3:f
3. Potential energy diagrams	3.C.2, 5.C.2:c, 5.C.2:d, 5.C.2:e
4. Calorimetry, heat capacity, and specific heat	5.A.2, 5.B.2, 5.B.3:a, 5.B.3:b, 5.B.4
+ H V V ¶ V O D Z	5.B.3:a
6. Heat of formation/combustion	5.C.2:g
7. Bond energies	2.C.1:d, 5.C.1, 5.C.2:a, 5.C.2:b
Labs: [CR5b] & [CR6]	
**Guided Inquiry: + H V V ¶ V / D Z / D E*	LO 3.11, 5.3-5.5, 5.7, 5.8; SP 2, 5, 3, 4, 6
Activity: Online Heating and Cooling Curve Simulations	LO 5.6 & SP 1

Utilizing the eduweb lab simulation website, students heat an unknown and graph its temperature as it cools, giving them the ability to calculate the energy released. **[CR3e]**

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.

Unit 6: Atomic Structure and Periodicity

Number of Quizzes:
Number of Exams: 1

Topics Covered:

	Curriculum Framework Articulation:
1. Electron configuration and the Aufbau Principle	1.B.2:a
2. Valence electrons and Lewis dot structures	1.B.2:c
3. Periodic trends	1.B.1:b, 1.B.1:c, 1.B.2:b, 1.B.2:d, 1.C.1:c, 1.D.1:b, 2.C.1:a, 2.C.1:b
4. Table arrangement based on electronic Properties	1.C.1:a, 1.C.1:b, 1.C.1:d
5. Properties of light and study of waves	1.C.2:e, 1.D.3:a, 5.E.4:b
6. Atomic spectra of hydrogen and energy Levels	1.B.1:d, 1.B.1:e, 1.D.3:b
7. Quantum mechanical model	1.C.2:d
8. Quantum theory and electron orbitals	1.C.2:c
9. Orbital shape and energies	1.C.2:b
10. Spectroscopy	1.D.2:a, 1.D.2:b, 1.D.2:c, 1.D.3:b

Labs: [CR5b] & [CR6]

Topics Covered:	**Curriculum Framework Articulation:**
Spectroscopy Lab	LO 1.5, 1.6, 1.7, 1.8, 1.14, 1.15; SP 1, 6
Activity: Periodic Table Dry Lab	LO 1.9, 1.10, 1.11, 1.12, 1.13; SP 1, 5, 6

Students graph values for atomic radius, electronegativity, and ionization energy to predict trends and explain the organization of the periodic table. **[CR3a]**

CR3a—The course provides students with opportunities outside the laboratory environment to meet the learning objectives within Big Idea 1: Structure of matter.

Unit 7: Chemical Bonding

Number of Quizzes: 1-2
Number of Exams: 1

Topics Covered:

	Curriculum Framework Articulation:
1. Lewis Dot structures	2.C.4:a
2. Resonance structures and formal charge	2.C.4:c, 2.C.4:d, 2.C.4:e
3. Bond polarity and dipole moments	2.C.1:c, 2.C.1:e, 2.C.1:f
4. VSEPR models and molecular shape	2.C.4:b, 2.C.4:e, 2.C.4:f
5. Polarity of molecules	2.C.1:e
6. Lattice energies	1.B.1:a, 1.C.2:a, 2.C.1:d (1-2), 2.C.2:a, 2.C.2:b, 2.D.1:b
7. Hybridization	2.C.4:g
8. Molecular orbitals and diagrams	2.C.4:h, 2.C.4:i

Labs: [CR5b] & [CR6]

**Guided Inquiry:* Bonding Lab	LO 2.1, 2.17, 2.19, 2.20, 5.1, 5.10; SP 1, 3, 4
**Guided Inquiry:* Investigation of Solids	LO 2.22-2.32; SP 1, 3, 4, 6
Activity: Atomic Theory Dry Lab	LO 2.21 & SP 1, 6

Students make drawings of a series of molecules and from those drawings predict geometry, hybridization, and polarity. **[CR3b]**

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.

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.

Unit 8: Liquids, Solids, and Solutions

Number of Quizzes: 2
Number of Exams: 1

Topics Covered:

	Curriculum Framework Articulation:
1. Structure and bonding	
a. metals, network, and molecular	2.A.1:a, 2.A.1:d, 2.C.3, 2.D.1:a, 2.D.2:a, 2.D.1:b, 2.D.3, 2.D.4
b. ionic, hydrogen, London, van der Waals	2.A.1:b, 2.B.1:a, 2.B.1:b, 2.B.1:c, 2.B.2:a, 2.B.2:b, 2.B.2:c, 2.B.2:d, 2.B.3:a, 5.D:1
2. Vapor pressure and changes in state	
3. Heating and cooling curves	2.A.1:e, 5.B.3:c, 5.B.3:d
4. Composition of solutions	2.A.1:c, 2.A.3:b, 2.A.3:c, 2.B.3:b
5. Colloids and suspensions	2.A.3:a, 2.A.3:b, 2.A.3:g
6. Separation techniques	2.A.3:e, 2.A.3:f
7. Effect on biological systems	2.B.3:e, 2.D.3, 5.E.4:c
Teacher Lab Demo: Evaporation of liquids	LO 2.11, 2.18, 5.9, 5.12; SP 1, 6
Labs: [CR5b] & [CR6]	
Solution Preparation Lab	LO 2.8, LO 2.9, 2.14, 2.15; SP 1-4
Vapor Pressure of Liquids Lab	LO 2.3, 2.12, 2.13, 2.16; SP 2, 5, 6

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.

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.

Activity: Effect on biological systems **[CR4]**

Students examine a demonstration size model of DNA or an alpha helix, and use their fingers to identify which atoms / base pairs are particularly involved in hydrogen bonding within the molecule, causing the helical structure. Students then discuss how the increased UV light because of ozone depletion can cause chemical reactions and thus mutations and disruption of hydrogen bonding.

Unit 9: Kinetics

Number of Quizzes: 3
Number of Exams: 1

Topics Covered:

	Curriculum Framework Articulation:
1. Rates of reactions	4.A.1:a
2. Factors that effect rates of reactions/ collision theory	4.A.1:b, 4.A.1:c, 4.D.1, 4.D.2
3. Reaction Pathways	4.B.3:a, 4.B.3:b

Topics Covered:	**Curriculum Framework Articulation:**
4. Rate equation determination	4.A.2:a
a. rate constants	4.A.3
b. mechanisms	4.B.1, 4.C.1, 4.C.2, 4.C.3
c. method of initial rates	4.A.2:c
d. integrated rate laws	4.A.2:b, 4.A.3:d
5. Activation energy and Boltzmann Distribution	4.B.2, 4.B.3:c
Teacher Demo: Factors that Effect Rates of Reaction	LO 4.1, 4.8, 4.9; SP 1
Labs: [CR5b] & [CR6]	
**Guided Inquiry:* Determining Order of a Reaction	LO 1.16, 4.2, 4.3, 4.4; SP 2-6
Determining the Activation Energy of a Reaction	LO 4.5, 4.6; SP 2, 5
Activity: Online Kinetics Activity	LO 4.1; SP 1, 3, 6

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.

Using a web based simulation, students will study the elementary steps of a mechanism and how it relates to reaction rate and collision theory. **[CR3d]**

Unit 10: General Equilibrium

Number of Quizzes: 2-3
Number of Exams: 1

Topics Covered:	**Curriculum Framework Articulation:**
1. Characteristics and conditions of chemical equilibrium	6.A.1, 6.A.3:a, 6.A.3:f
2. Equilibrium expression derived from rates	6.A.3:b
3. Factors that affect equilibrium	6.A.3:c
4. Le Chatlier's principle	6.A.3:b, 6.B.1, 6.B.2, 6.C.3:e, 6.C.3:f
5. The equilibrium constant	6.A.3:d, 6.A.3.e, 6.A.4
6. Solving equilibrium problems	6.A.2
Labs: [CR5b] & [CR6]	
Determination of a Kc with Varied Initial Concentrations	LO 5.17, 6.1-6.10; SP 2, 5
Activity: Online Gas Phase Equilibrium Activity	LO 6.8, 6.9; SP 1, 6

CR3d—The course provides students with opportunities outside the laboratory environment to meet the learning objectives within Big Idea 4: Rates of chemical reactions.

CR3f— The course provides students with opportunities outside the laboratory environment to meet the learning objectives within Big Idea 6: Equilibrium.

In the online inquiry activity, students are able to manipulate the environment and produce stresses that verify the tendency of Le Chatelier's principle. **[CR3f]**

Unit 11: Acids and Bases

Number of Quizzes: 2
Number of Exams: 1

Topics Covered:

	Curriculum Framework Articulation:
1. Definition and nature of acids and bases	3.B.2, 6.C.1:c, 6.C.1:d, 6.C.1:e, 6.C.1:f
2. K_w and the pH scale	6.C.1:a, 6.C.1:b, 6.C.1:g
3. pH of strong and weak acids and bases	6.C.1:h
4. Polyprotic acids	6.C.1:n
5. pH of salts	
6. Structure of Acids and Bases	
Labs: [CR5b] & [CR6]	
Determination of a Ka by Half Titration	LO 2.2, 3.7; SP 2, 5

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.

Unit 12: Buffers, Ksp, and Titrations

Number of Quizzes: 2
Number of Exams: 1

Topics Covered:

	Curriculum Framework Articulation:
1. Characteristics and capacity of buffers	6.C.2
2. Titrations and pH curves	6.C.1:i, 6.C.1:j, 6.C.1:k, 6.C.1:l, 6.C.1:m
3. Choosing Acid Base Indicators	
4. pH and solubility	
5. K_{sp} Calculations and Solubility Product	6.C.3:a, 6.C.3:b
Labs: [CR5b] & [CR6]	
Types of Titrations	LO 6.11, 6.12, 6.13, 6.14, 6.15, 6.16, 6.17; SP 2, 5, 6
**Guided Inquiry:* Preparation of a Buffer	LO 6.18, 6.19, 6.20; SP 2, 3, 4, 5
Molar Solubility and Determination of Ksp	LO 6.21, 6.22, 6.23, 6.24; SP 2, 5, 6

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.

Unit 13: Thermodynamics

Number of Quizzes: 3
Number of Exams: 1

Topics Covered:

	Curriculum Framework Articulation:
1. Laws of thermodynamics	
2. Spontaneous process and entropy	5.E.1

Topics Covered:	**Curriculum Framework Articulation:**
3. Spontaneity, enthalpy, and free energy	5.E.2:c, 5.E.3,
4. Free energy	5.E.2:d, 5.E.2:e, 5.E.2:f, 6.C.3:c, 6.D.1:a
5. Free energy and equilibrium	5.E.2, 6.D.1:b, 6.D.1:c, 6.D.1:d
6. Rate and Spontaneity	5.E.2:e, 5.E.5
Labs: [CR5b] & [CR6]	
Solubility and Determination of ΔH°, ΔS°, ΔG° of Calcium Hydroxide	LO 5.12, 5.13, 5.14, 5.18, 6.25; SP 2, 5, 6

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.

Unit 14: Electrochemistry

Number of Quizzes: 2
Number of Exams: 1

Topics Covered:	**Curriculum Framework Articulation:**
1. Balancing redox equations	3.B.3:a, 3.B.3:b, 3.B.3:c, 3.B.3:d
2. Electrochemical cells and voltage	3.C.3:a, 3.C.3:b, 3.C.3:c, 5.E.4:a
3. The Nernst equation	3.C.3:d
4. Spontaneous and non-spontaneous Equations	3.C.3:e
5. Chemical applications	3.C.3:f
Teacher Demo: Lead Storage Battery Demonstration	LO 3.12, 3.13, 5.15; SP 1
Labs: [CR5b] & [CR6]	
Voltaic Cell Lab	LO 3.12, 3.13, 5.16; SP 2, 5

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.

AP Review

Number of Quizzes: 4
Number of Exams: 4

Topics Covered:	**Curriculum Framework Articulation:**
Review of ALL topics	1.A.2:c
4 AP Style Review Exams	
Mock AP	
Labs: [CR5b] & [CR6]	
The Green Crystal Lab	LO 1.2, 2.7, 2.10, 3.7, 3.8, 3.9, 5.11; SP 2, 5, 6

AP Chemistry Lab List

The following labs will be completed during the school year. Guided Inquiry Labs are indicated with an asterisk (*).

Lab: Math and Measurement in Science & Density of an Organic Liquid
Description: Students learn how to measure mass and volume with varied pieces of equipment and focus on the accuracy of those pieces of equipment in their calculation and determination of significant figures. Students also determine the identity of an unknown organic liquid using density determination.

***GUIDED INQUIRY Lab:** Discovery of Physical and Chemical Properties
Description: Students are given the materials to conduct various procedures. They construct a procedure for each of the eight changes to be observed, have their procedures approved by the instructor, and then carry out the procedures. The data collected is used to develop a set of criteria for determining whether a given change is chemical or physical.

Lab: Stoichiometry Lab
Description: Students determine the correct mole ratio of reactants in an exothermic reaction by mixing different amounts of reactants and graphing temperature changes.

Lab: pH Titration Lab
Description: Students perform a titration and then determine the concentration of an HCl solution by using a potentiometric titration curve and finding the equivalence point. Data is graphed in a graphing program.

Lab: Bleach Lab
Description: Students perform redox titrations to determine the concentration of hypochlorite in household bleach.

Lab: Copper Reaction Lab
Description: Students perform a series of reactions, starting with copper and ending with copper. Students then calculate percent recovered.

TEACHER DEMO: Graham's Law of Diffusion
Description: HCl and NH_3 are placed in either end of a glass tube. Using distance traveled of each gas by looking at formation of NH_4Cl ring, MM of HCl is calculated.

Lab: Molar Mass of a Volatile Liquid
Description: Students use the Dumas method for determination of the molar mass of an unknown volatile liquid.

Lab: Hess's Law Lab
Description: Students perform a series of reactions and calculate enthalpy, proving Hess's law.

Lab: Spectrum and Spectroscopy Lab
Description: Students look at a series of emission spectra and determine the identity of an unknown. They will also receive and analyze IR and mass spectroscopy data.

***GUIDED INQUIRY Lab:** Bonding Lab
Description: Students experimentally investigate ionic and molecular substances deducing properties of their bonds in the process.

***GUIDED INQUIRY Lab:** Investigation of Solids
Description: Students investigate types of solids using various experimental techniques.

Lab: Preparation of Solutions Lab
Description: Students make solutions of specified concentrations gravimetrically and by dilution. Solution concentrations will be checked for accuracy using a spectrophotometer.

TEACHER DEMO: Evaporation of Liquids
Description: Using a data collection device, the teacher will show the temperature curves of evaporation of various liquids and students must deduce the differences based on IMF's.

Lab: Vapor Pressure of Liquids
Description: Students measure the vapor pressure of ethanol at different temperatures to determine ΔH.

***GUIDED INQUIRY Lab:** Determining the Rate Law of a Crystal Violet Reaction
Description: Using colorimetry and Beer's law, students determine the order of a reaction and it's rate law.

Lab: Determining the Activation Energy of the Crystal Violet Reaction
Description: Students use the same set up as in the crystal violet lab, but this time varying temperature to calculate the activation energy with the use of the Arrhenius equation.

Lab: Determining K_c with Various Initial Concentrations
Description: Students use a spectrophotometer to determine the K_c of a series of reactions.

Lab: Determining K_a by Half Titration
Description: Students do a titration in which ½ of the weak acid titrated is neutralized (aka midpoint) and then the K_a is determined.

***GUIDED INQUIRY Lab:** Types of Titrations
Description: Students investigate titration curves by doing titrations of different combinations of weak and strong acids and bases.

***GUIDED INQUIRY Lab:** Preparation of a Buffer
Description: Given a selection of chemicals, students prepare a buffer of a given pH.

Lab: Molar Solubility and Determination of K_{sp}
Description: Students find the K_{sp} of calcium hydroxide doing a potentiometric titration with the addition of methyl orange indicator for verification.

Lab: Solubility and Determination of $\Delta H°$, $\Delta S°$, $\Delta G°$ of Calcium Hydroxide
Description: Students collect and analyze data to determine $\Delta H°$, $\Delta S°$, and $\Delta G°$ of calcium hydroxide.

Lab: Voltaic Cell Lab
Description: Students find the reduction potentials of a series of reactions using voltaic cells/multi-meters and build their own reduction potential table. Dilutions will be made and the Nernst equation will also be tested.

TEACHER DEMO: Lead Storage Battery
Description: Students and teacher will build a battery to solidify knowledge of electrolytic cells in comparison to voltaic cells.

Lab: Green Crystal Lab
Description: A series of labs completed over a 4 week period. Students work at their own pace in pairs. The goal of this lab is to determine the empirical formula of a ferrooxalato crystal. It includes the following experiments.

Experiment 1: Synthesis of the crystal,
Experiment 2: Standardization of $KMnO_4$ by redox titration,
Experiment 3: Determination of % oxalate in crystal by redox titration,
Experiment 4: Standardization of NaOH by acid/base titration,
Experiment 5: Determination of % K^+ and Fe^{3+} by ion exchange chromatography and a double equivalence point titration,
Experiment 6: Determination of the % water in the hydrated crystal.