AP Chemistry Syllabus

Curriculum Requirements	Page(s)
1 Students and teachers use a recently published (within the last 10 years) college-level chemistry textbook.	3
2 The course is structured around the enduring understandings within the big ideas as described in the AP Chemistry Curriculum Framework.	2, 4, 6, 7, 8, 9, 10
3 Students are provided with opportunities to meet the learning objectives within each of the big ideas as described in the AP Chemistry Curriculum Framework. These opportunities must occur in addition to those within laboratory investigations.	
a. The course provides students with opportunities outside the laboratory environment to meet in the learning objectives within Big Idea 1: Structure of matter.	4, 6
b. 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.	4, 5, 6, 7, 8, 9
c. The course provides students with opportunities outside the laboratory environment to meet the learning objectives within Big Idea 3: Chemical reactions.	6, 9, 10
d. The course provides students with opportunities outside the laboratory environment to meet the learning objectives within Big Idea 4: Rates of chemical reactions.	8
e. The course provides students with opportunities outside the laboratory environment to meet the learning objectives within Big Idea 5: thermodynamics.	8
f. The course provides students with opportunities outside the laboratory environment to meet the learning objectives within Big Idea 6: Equilibrium.	9
4 The syllabus must describe at least one assignment of activity requiring students to connect their knowledge of chemistry and science to issues that have a societal or technological component.	8,12
5 Students are provided the opportunity to engage in investigative laboratory work integrated throughout the course for a minimum of 25 percent of instructional time, which must include a minimum of 16 hands-on laboratory experiments while using basic laboratory equipment to support the learning objectives listed within the AP Chemistry Curriculum Framework.	
a. 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
b. Students are provided the opportunity to engage in a minimum of 16 hands-on laboratory investigations that use basic laboratory equipment. Molecular modeling may count for one of the 16 hands-on labs	4, 5, 7, 8, 10
6 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

7 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 [CR2]

AP Chemistry is the equivalent of a two-semester college general chemistry course. Prerequisites for this course are one year of high school chemistry and completion of Algebra II. Students in this course are expected to attain a depth of understanding of fundamentals such as atomic structure, bonding models, thermodynamics, acid-base theory, equilibrium, kinetics, electrochemistry, organic chemistry, nuclear chemistry and descriptive chemistry, all of which will be centered and taught around the six big ideas of the AP Curriculum Framework. Students should also attain a reasonable competence in dealing with chemical calculations.

The Big Ideas addressed in this course are:

- ***Big Idea 1:*** *The chemical elements are fundamental building blocks 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 a dynamic competition, sensitive to initial conditions and external perturbations.*

The Science Practices addressed in this course are:

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 appropriate 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.*

This class meets five days a week for 50-55 minutes each day. Laboratory days (once or twice weekly) will require students to spend 50 or more additional minutes either before school, during homeroom and lunch, or after school.

Textbooks and Lab Books [CR1]

Demmin, Peter E. and Hostage, David. Multiple Choice and Free Response Questions in Preparation for the AP Chemistry Examination, fifth edition, 2005.

Flinn Scientific Inc., Flinn Scientific Advanced Inquiry Labs for AP* Chemistry Lab Manual. 2013.

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

Moog, Richard S. Chemistry: A Guided Inquiry, fifth edition. John Wiley and Sons, 2011.

Zumdahl, Steven and Susan Zumdahl, Chemistry, ninth edition. Belmont CA: Cengage Learning, 2013.

Required Materials

Students will use: graphing calculators, splash-proof goggles, carbonless laboratory notebooks.

Laboratory Investigations

Laboratory investigations will be formatted in a more inquiry-based model, with an emphasis on the science practices and learning objectives. Students will spend a minimum of twenty-five percent of class time involved in laboratory investigation and will record their findings in a lab notebook. **[CR5a]** It is important for students to maintain their notebook as many colleges grant credit only with proof of appropriate lab experiences.

Students will work in groups of two in lab and will maintain a bound carbonless copy laboratory manual with all lab procedures, data, results and conclusions. **[CR7]** Data will be communicated within and between groups. The labs performed in this course will be guided-inquiry in style while demonstrations and smaller activities may include inquiry activities, but will be more traditional in structure, allowing for the time needed to discuss findings and present them in class. All lab investigations will be "wet" labs, with many supported by activities and demonstrations in class.

Students will work with traditional equipment in the lab (such as flasks, beakers, burettes, pipettes, etc.) as well as probeware (Vernier LoggerPro and corresponding temperature, pressure and pH probes). Students will also use instruments such as ovens, analytical balances, colorimeters, calorimeters and

spec-20's. Collected data using LoggerPro may be stored on flash drives or e-mailed to students using wireless connections and then recorded in their lab notebooks. The classroom contains six student computers and each student has a Chromebook that is linked to a printer for hard copies of titration curves, etc.

Summer Assignments

Students will complete three assignments over the summer to better prepare them for the speed and rigor of the AP Chemistry curriculum. These assignments can be completed at the student's own pace and answers may be checked using the course web page. They may also contact me through e-mail to ask questions. Their assignment includes:

- Assignment 1: Read and outline chapters 1 and 2 of the textbook.
- Assignment 2: Answer all assigned homework questions from the two chapters mentioned.
- Assignment 3: Practice chapter 1 and 2 skills using the teacher-generated packet.

Course Sequence

* Indicates activities or labs that are inquiry based.

First Six Weeks					Curriculum Alignment		
Chapter(s)	*Topics Covered*	*Activities*	*HW/Problems Assigned*	*Lab Activities* **[CR5b]**	*Big Idea* **[CR2]**	*Enduring Understanding & Essential Knowledge*	*Learning Objective*
One and Two	● The scientific method ● Units of measurement and uncertainty ● Significant figures ● Problem solving methods ● Dimensional analysis ● Classification of matter ● The history of chemistry ● Fundamental laws of chemistry ● Models of the atom ● Molecules and ions ● The periodic table ● Naming compounds	● *Students travel through lab stations and identify chemical and physical changes. **[CR3a]** ● Students solve a "crime" using paper chromatography and discuss separation of mixtures **[CR3b]**	CH1: 1, 3, 21, 22, 30, 31-33, 38, 55, 60, 67, 72, 82, 84, 90, 104, 111, 116 CH2: 34, 39, 41, 46, 48, 53, 56, 59, 68, 72, 80, 86, 94, 102, 112, and AP Review Questions 1-16	"Lab Techniques" *SP4* ● *Students travel around the room to stations with differing measurement devices and determine what level of accuracy and thus how many significant figures can be attained in each. **[CR6]** ● Students observe and answer questions using MSDS sheets.	1 2 3	1.A (1.A.1) 1.B (1.B.1) 1.E (1.E.1, 1.E.2) 2.A (2.A.3) 2.C 3.B (3.B.1)	1.1 1.5 1.6 1.17 1.18 2.7 2.8 2.9 2.10 3.5 3.6
Three	● Atomic mass ● The mole and molar mass ● Percent composition	● Students use a spectrophotometer printout to determine	CH3: 18, 25, 30, 38, 44, 52, 54, 56, 60, 70, 74, 78, 81, 84, 88, 93,	"Determination of the Percent Copper in Pennies" *SP3,4,5* ● *Students create a method of	1	1.A (1.A.1, 1.A.2, 1.A.3) 1.D (1.D.2)	1.1 1.2 1.3

	● Empirical and molecular formulas ● Combustion Analysis ● Chemical equations ● Balancing equations ● Stoichiometric calculations ● Limiting and excess reactants	the percent of each isotope and their average atomic mass using the relative masses shown in the printout. **[CR3b]**	94, 96, 102, 106, 108, 114, 116, 119, 124, and AP Review Questions 1-17	determining the percent of copper in pre and post 1982 pennies after observing a demonstration of the reaction of a penny with concentrated nitric acid. They test this method and calculate the percent composition of each type of penny. **[CR6]** ●	3	1.E (1.E.1, 1.E.2) 3.A (3.A.1, 3.A.2) 3.B (3.B.1)	1.4 1.14 1.17 1.18 1.19 1.20 3.1 3.2 3.3 3.4 3.5 3.6
Four and Eleven	● Water as a solvent ● Strong and weak electrolytes ● Solutions ● Factors affecting solutions ● Molarity ● Mass percent ● Mole fraction ● Molality	● *****Students predict solubility of household substances, test them in water and mineral oil, and observe demonstration of conductivity. They will organize their data into charts to be posted around the room. **[CR3b]**	CH4: 1, 10, 13, 15, 18, 20, 21, 24, 30, 36, 42, 46, 49, 54, 64, 66, 70, 73, 80, 84, 88, 101, 129, and AP Review Questions 1-15 CH11: 30, 33, 38, 40, 41, 44, 47, 48, 92 and AP Review Questions 1-10	"Precipitation Reactions and Solubility Rules" *SP4,5,6* ● Students observe the products of double replacement reactions, relating the solubility of products formed to class discussion. "What is the Relationship Between the Concentration of a Solution and the Amount of Transmitted Light Through the Solution?" Students utilize dilution techniques and learn about the use of the mass spectrometer. **[CR6]**	1 2 3 5 6	1.A (1.A.3) 1.E (1.E.1, 1.E.2) 2.A (2.A.3) 2.B (2.B.2, 2.B.3) 2.D (2.D.1) 3.A (3.A.1, 3.A.2) 3.B (3.B.1, 3.B.3) 3.C (3.C.1) 5.D (5.D.1, 5.D.2) 6.C (6.C.3)	1.4 1.17 1.18 1.19 2.7 2.8 2.9 2.10 2.13 2.14 2.15 2.16 2.22 2.23 3.1 3.2 3.3 3.4 3.5 3.6 3.8 3.9 3.10 5.9 5.10 6.21 6.23 6.24

Second Six Weeks					Curriculum Alignment		
Chapter(s)	*Topics Covered*	*Activities*	*HW/Problems Assigned*	*Lab Activities* **[CR5b]**	*Big Idea* **[CR2]**	*Enduring Understanding & Essential Knowledge*	*Learning Objective*
Four	● Double replacement reactions and precipitation, gas formation or liquid formation ● Single replacement reactions and the activity series ● Anhydride reactions ● Oxidation-reduction reactions ● Acid-base neutralization ● Complex ion reactions ● Addition and decomposition reactions	● *****Students create a layered effect by separating a nail, salt and hydrated copper sulfate with filter paper in a test tube. Distilled water is added and students observe the ensuing changes over the week. They discuss the types of changes (chemical or physical) and try to write equations describing these changes. **[CR3c]** ● Students play a game called "Equation Land" in which they draw cards and write equations to move forward. **[CR3c]**	Students will utilize teacher-developed worksheets for each type of reaction.	"Seven Solution Mystery" *SP3,4,5* ● *****Students are given seven unknown solutions and are asked to combine them to discover their identities based on ppts. formed. **[CR6]** "Reactions of Copper" *SP2,3,4,5,6* ● Students carry out sequential reactions beginning and ending with solid copper, then determine their percent yield and write equations for the reactions that occurred.	1 2 3 5 6	1.A (1.A.3) 1.E (1.E.1, 1.E.2) 2.A (2.A.1, 2.B (2.B.3) 2.D (2.D.1) 3.A (3.A.1, 3.A.2) 3.B (3.B.1, 3.B.2, 3.B.3) 3.C (3.C.1) 5.D (5.D.2) 6.C (6.C.3)	1.4 1.17 1.18 1.19 2.1 2.3 2.22 2.23 3.1 3.2 3.3 3.4 3.5 3.7 3.6 3.8 3.9 3.10 5.10 6.21 6.23 6.24
Seven	● Electromagnetic spectrum ● The nature of matter ● The atomic spectrum of hydrogen ● The Bohr model ● The quantum mechanical model ● Quantum numbers ● Orbital shapes and energies ● Electron spin	● Students will complete and utilize a flip book of trends and properties as the unit progresses. **[CR3a]** ● Students will practice trends and properties with "What Element Am I?" cards.	CH7: 29, 31, 40, 42, 45, 51, 58, 60, 64, 74, 82, 86, 90, 94, 100, 106, 108, 119, 122, 126, 130, 140, and AP Review Questions 1-15	"How Can Color Be Used to Determine the Mass Percent of Copper in Brass?" *SP2,4,5,6* ● *****Students graphically analyze the absorption spectra of brass solution samples and utilize their redox balancing skills from the last unit. **[CR6]**	1 5	1.B (1.B.1, 1.B.2) 1.C (1.C.1, 1.C.2) 1D (1.D.1, 1.D.3) 5.E (5.E.4)	1.5 1.6 1.9 1.10 1.11 1.12 1.13 1.15 1.16 5.15 5.16

	● Polyelectronic atoms ● The history of the periodic table ● Periodic trends and properties ● Group trends	**[CR3a]** ● Students will complete "The Shell Model" activity (Chemistry: A Guided Inquiry, Moog) **[CR3a]** ● Analyze PES data with students in class. **[CR3b]**					5.17
Eight and Nine	● Types of chemical bonds ● Electronegativity ● Bond polarity and dipole moments ● Ions; configuration and size ● Localized electron bonding model ● Lewis structures ● Octet exceptions ● VSEPR ● Hybridization ● Molecular Orbital model ● Photoelectron Spectroscopy	● Students will complete "Photoelectron Spectroscopy" activity (Chemistry: A Guided Inquiry, Moog) **[CR3b]** ● Students will complete "The Shell Model III" activity (Chemistry: A Guided Inquiry, Moog) **[CR3b]** ● Students will complete "Bond Order and Bond Strength" activity (Chemistry: A Guided Inquiry, Moog) **[CR3b]**	CH8: 15, 18, 28, 30, 32, 36, 40, 44, 46, 50, 52, 54, 58, 66, 68, 84, 86, 94, 101, 114, 118, 150, 160, and AP Review Questions 1-15 CH9: 18, 29, 37, 40, 46, 63, 71, and AP Review Questions 1-11	"Molecular Geometry" *SP1,3,6,7* ● Students build models of atoms of answer questions about types of bonding, polarity and shape.	1 2 5	1.B (1.B.1, 1.B.2) 1.C (1.C.1) 1.D (1.D.3) 2.C (2.C.1, 2.C.2, 2.C.4) 2.D (2.D.1) 5.C (5.C.1)	1.5 1.6 1.7 1.8 1.9 1.10 1.11 1.15 1.16 2.17 2.18 2.19 2.21 2.22 2.23 2.24 5.1
Third Six Weeks					**Curriculum Alignment**		
Chapter(s)	*Topics Covered*	*Activities*	*HW/Problems Assigned*	*Lab Activities* **[CR5b]**	*Big Idea* **[CR2]**	*Enduring Understanding & Essential Knowledge*	*Learning Objective*
Ten	● Intermolecular forces ● Liquids and solids ● Metallic bonding	● Students will observe and take part in demonstrations	CH10: 12, 17, 26, 36, 39, 42, 46, 52, 59, 66, 77, 82, 96, 99, 100,	"Separation of a Dye Mixture Using Chromatography" *SP1,4,5,6* ● *Students discover a way to	1	1.C (1.C.1)	1.9 1.11

	● Network solids ● Molecular solids ● Ionic solids ● Vapor pressure and changes of state	describing intermolecular forces in liquids, properties of molecular and ionic solids and vapor pressure. **[CR3b]**	102, 111, 118, and AP Review Questions 1-21	separate molecules using their understanding of IMF's. **[CR6]**	2 5 6	2.A (2.A.1, 2.A.3) 2.B (2.B.1, 2.B.2, 2.B.3) 2.C (2.C.2, 2.C.3) 2.D (2.D.1, 2.D.2, 2.D.3, 2.D.4) 5.B (5.B.3) 5.D (5.D.1, 5.D.2, 5.D.3,) 6.A (6.A.1)	2.3 2.7 2.8 2.9 2.10 2.11 2.12 2.13 2.14 2.15 2.16 2.19 2.20 2.19 2.24 2.25 2.26 2.27 2.28 2.29 2.30 2.31 2.32 5.6 5.9 5.10 5.11 6.1
Five	● The kinetic molecular theory ● Pressure ● Gas laws ● Gas stoichiometry ● Effusion and diffusion ● Real Gases ● Atmospheric Chemistry	● Review gas laws using demonstrations and class discussions. Students will summarize collected data and use it to relate properties of temperature, pressure and volume. **[CR3b] & [CR3e]**	CH5: 22, 24, 28, 38, 44, 48, 50, 60, 64, 68, 76, 80, 82, 87, 92, 96, 101, 104, 106, 110, 112, and AP Review Questions 1-16	"Gas Preparation and Properties" *SP1,4,5,6* ● Students will prepare various gas samples and identify the properties of these gases. "Molar Mass of a Volatile Liquid" *SP2,3,4,5,7* ● Students collect mass, volume and pressure data to find the moles of a gas and identify the gas based on its molar mass.	1 2 3	1.A (1.A.2) 2.A (2.A.2) 2.B (2.B.2, 2.B.3) 3.A (3.A.2)	1.2 1.3 2.4 2.5 2.6 2.12 2.13 2.14 2.15 2.16 3.3 3.4

					5	5.A (5.A.1)	5.2
Six Seventeen	● Energy ● Enthalpy and calorimetry ● Hess's law ● Enthalpies of formation ● Energy Sources ● Spontaneity ● Entropy and free energy ● Free energy in chemical reactions ● Free energy, equilibrium and work	● Students will complete "Entropy I and II" activities (Chemistry: A Guided Inquiry, Moog) **[CR3e]** ● Students will complete the inquiry activity "In the Bag" to discover and define endothermic and exothermic reactions. **[CR3e]**	CH6: 27, 30, 34, 42, 46, 50, 52, 59, 64, 68, 71, 74, 75, 80, 82, 89, 90 and AP Review Questions 1-15 CH17: 16, 18, 26, 34, 36, 41, 44, 50, 56, 58, 61, 64, 66, 70, 74, and AP Review Questions 1-10	"The Hand Warmer Design Challenge: Where does the Heat Come From?" *SP1,2,4,6,7* ● *Students utilize their knowledge of energy in chemical reactions to design a hand warmer. **[CR6]** "The Heat of Combustion of Magnesium" *SP2,4,5,7* ● Students will utilize Hess's law to determine the heat of reaction.	2 3 5 6	2.B (2.B.3) 3.C (3.C.2) 5.A (5.A.1, 5.A.2) 5.B (5.B.1, 5.B.2, 5.B.3, 5.B.4) 5.C (5.C.2) 5.E (5.E.1, 5.E.2, 5.E.3, 5.E.4, 5.E.5) 6.D (6.D.1)	2.15 2.16 3.11 5.1 5.2 5.3 5.4 5.5 5.6 5.7 5.8 5.12 5.13 5.14 5.15 5.16 5.17 6.25
Fourth Six Weeks					**Curriculum Alignment**		
Chapter(s)	*Topics Covered*	*Activities*	*HW/Problems Assigned*	*Lab Activities* **[CR5b]**	*Big Idea* **[CR2]**	*Enduring Understanding & Essential Knowledge*	*Learning Objective*
Twelve	● Reaction rates ● Rate laws ● The integrated rate law ● Reaction mechanisms ● Catalysis	● Students will introduce the concept of kinetics by performing the lab simulations found at http://introchem.chem.okstate.edu/DCICLA/Mechanisms.pdf . **[CR3d]**	CH12: 13, 20, 24, 29, 30, 31, 32, 36, 37, 40, 42, 45, 48, 57, 59, 60, 61, 63, 64, 68, 76, 80, 82, and AP Review Problems 1-15	"Rate of Decomposition of Calcium Carbonate" *SP3.4.5.6.7* ● *Students will investigate the speed of the chemical reaction between calcium carbonate and hydrochloric acid. **[CR4] & [CR6]** "The Crystal Violet Reaction" *SP1,2,3,4,5,6* ● Students will examine the relationship between a reaction and the changing	4	4.A (4.A.1, 4.A.2, 4.A.3) 4.B (4.B.1, 4.B.2, 4.B.3) 4.C (4.C.1, 4.C.2, 4.C.3) 4.D (4.D.1, 4.D.2)	4.1 4.2 4.3 4.4 4.5 4.6 4.7 4.8 4.9

				concentrations of reactants.			
Thirteen	● The equilibrium condition ● The equilibrium constant ● Equilibrium and pressure ● Heterogeneous equilibria ● Solving equilibrium problems ● Le Châtelier's principle	● Students will observe a series of three demonstrations to establish a general definition of equilibrium, reversible reactions and stress to systems. **[CR3f]**	CH13: 10, 16, 23, 24, 30, 34, 40, 42, 48, 54, 62, 64, 66, 78, and AP Review Problems 1-16	"Chemical Equilibrium: Finding the Constant, K_c" *SP2 4,5,7* ● Students will utilize Beer's Law to find the equilibrium constant for a reaction involving iron(III) thiocyanate. "Can We Make the Colors of the Rainbow? An Application of Le Châtelier's Principle" *SP4,5,6* ● *****Students will investigate Le Châtelier's principle. **[CR6]**	6	6.A (6.A.1, 6.A.2, 6.A.3, 6.A.4) 6.B (6.B.1, 6.B.2)	6.1 6.2 6.3 6.4 6.5 6.6 6.7 6.8 6.9 6.10
Fourteen Fifteen	● Acids and bases ● Acid strength and the pH scale ● Calculating pH ● Polyprotic acids ● Salt hydrolysis ● Acids and bases in solution ● Buffers ● Titration ● Indicators	● Students observe the titration of a strong acid with a strong base, weak acid and strong base and weak base with a strong acid. They will diagram these titration curves and discuss calculations of quantities along the curve. **[CR3c] & [CR3f]** ● Students will observe the use of different indicators for each titration and make notes of how to figure out appropriate usage of indicators. **[CR3c]** ● *****Students will titrate a sample of mustard to discover the mass of acetic acid in a	CH14: 26, 32, 36, 38, 40, 44, 46, 48, 52, 56, 64, 69, 74, 78, 84, 90, 96, 102, 114, 120, 126, 131, 136, 138, 142, 148, 152, and AP Review Problems 1-14 CH15: 12, 13, 18, 22, 24, 32, 34, 36, 42, 44, 52, 55, 56, 57, 58, 59, 60, 69, 73, 74, 80, and AP Review Problems 1-15	"How Much Acid Is in Fruit Juices and Soft Drinks?" *SP1,2,3,4,5,6,7* ● Students will be introduced to the idea of acids and bases in household solutions and will practice the technique of titration. "Buffers in Household Products" *SP4,5,6* ● *****Students will investigate a variety of household substances to determine which of them exhibit buffering activity. **[CR6]**	1 2 3 6	1.E (1.E.2) 2.B (2.B.2) 3.A (3.A.2) 6.A (6.A.1)	1.18 1.19 1.20 2.12 2.13 2.14 3.3 3.4 6.1

		sample. **[CR3c]**					
Fifth Six Weeks					**Curriculum Alignment**		
Chapter(s)	*Topics Covered*	*Activities*	*HW/Problems Assigned*	*Lab Activities* **[CR5b]**	*Big Idea* **[CR2]**	*Enduring Understanding & Essential Knowledge*	*Learning Objective*
Sixteen	● Solubility equilibria ● Precipitation and qualitative analysis ● Complex ion equilibrium	● Students use an on-line simulation to perform qualitative analysis of a series of solutions. **[CR3c]**	CH16: 10, 15, 22, 24, 28, 32, 34, 38, 40, 48, 50, 54, 56, 62, 74, and AP Review Problems 1-15		6	6.A (6.A.1) 6.C (6.C.3)	6.1 6.21 6.22 6.23 6.24
Eighteen	● Balancing oxidation-reduction reactions ● Galvanic cells ● Standard reduction potentials ● Cell potentials and electrical work ● Cell potentials and concentrations ● Batteries ● Electrolysis	● Students will construct a voltaic cell and diagram it. They will change the concentration of the solutions used and then change the electrodes to view the changes that occur to the voltage of the cell. **[CR3c]**	CH18: 18, 16, 21, 23, 28, 30, 32, 36, 42, 48, 53, 55, 60, 62, 69, 72, 78, 82, 88, 93, 95, 100, 107, 108, and AP Review Problems 1-10	"Electrochemical Cells" *SP2,4,5,7* ● Students construct various electrochemical cells and measure their voltages. Students also carry out the electrolysis of water. "Analysis of Commercial Hydrogen Peroxide" *SP2,3,4,5* ● Students utilize their skills to balance a redox equation and stoichiometry to analyze the amount of hydrogen peroxide is in a commercial bottle.	3 5 6	3.A (3.A.1) 3.B (3.B.3) 3.C (3.C.3) 5.E (5.E.4) 6.A (6.A.1)	3.2 3.8 3.9 3.12 3.13 5.15 5.16 5.17 6.1
Sixth Six Weeks					**Curriculum Alignment**		
Chapter(s)	*Topics Covered*	*Activities*	*HW/Problems Assigned*	*Lab Activities* **[CR5b]**	*Big Idea* **[CR2]**	*Enduring Understanding & Essential Knowledge*	*Learning Objective*

Nineteen Twenty-two	● Nuclear stability ● Radioactive decay and kinetics ● Nuclear transformations ● Detection and uses of radioactivity ● Fission and fusion ● Hydrocarbons ● Hydrocarbon derivatives ● Polymers	● Students will observe the reaction of bromine water with tomato juice to discuss the organic reactions that occur. **[CR3c]**	CH19: 11, 12, 16, 20, 24, 27, 28, 32, 36, 44, 48, 56, and AP Review Problems 1-10 CH22: 13, 14, 20, 21, 26, 32, 34, 43, 48, 51, 60, 72, and AP Review Questions 1-10	"Preparation and Properties of Aspirin" *SP2,3,4,5,7* ● Students prepare and test the properties of aspirin.	2 4 5	2.B (2.B.2) 4.A (4.A.3) 5.D (5.D.3)	2.13 4.2 4.3 4.4 5.D.3
AP Multiple Choice Review Manual by Hostage and Demmin	● All AP topics	● Students will work through this manual during the last six weeks. They will work at home, but review in class.	All questions from each chapter		All	All	All

Inquiry in the AP Chemistry Classroom

The following list of labs will all utilize the inquiry model, in which students will engage in scientifically oriented questioning to formulate answers that are evidence-based. The student will gather said evidence after determining a logical and plausible way of performing the lab.

1. "Lab Techniques"
   Students travel around the room to stations with differing measurement devices and determine what level of accuracy and thus how many significant figures can be attained in each. Students will also reproduce significant digit rules based on their observations.

2. "Determination of the Percent Copper in Pennies"
   Students create a method of determining the percent of copper in pre and post 1982 pennies after observing a demonstration of the reaction of a penny with concentrated nitric acid. They test this method and calculate the percent composition of each type of penny. [CR6]

3. "Seven Solution Mystery"
   Students are given seven unknown solutions and are asked to combine them to discover their identities based on precipitates formed.

4. "How Can Color Be Used to Determine the Mass Percent of Copper in Brass?
   Students graphically analyze the absorption spectra of brass solution samples and utilize their redox balancing skills from the oxidation-reduction unit. They will write their

own procedures and data tables for this lab.

5. "Separation of a Dye Mixture Using Chromatography"
   Students discover a way to separate molecules using their understanding of IMF's. Students will share their self-generated procedures and data with the class to determine how IMF's play a role in the states of matter and processes like distillation and chromatography.

6. "The Hand Warmer Design Challenge: Where does the Heat Come From?"
   Students utilize their knowledge of energy in chemical reactions to design a hand warmer. They will develop a way to gather this information and a way to "market" their product, keeping safety in mind.

7. "Rate of Decomposition of Calcium Carbonate"
   Students will investigate the speed of the chemical reaction between calcium carbonate and hydrochloric acid. They will relate this to the impact acid rain has on the environment and man-made objects like statues and buildings. They will also discuss cave formation.

8. "Can We Make the Colors of the Rainbow? An Application of Le Châtelier's Principle"
   Students will investigate Le Châtelier's principle. They will determine the effect of concentration, temperature and pressure on a chemical equilibrium system. During this lab, students will determine how to test each factor based on demonstrations done in pre-lab activities and classroom demonstrations.

9. "Buffers in Household Products"
   Students will investigate a variety of household substances to determine which of them exhibit buffering activity. Students will design and implement titration strategies from previous units and Pre-AP Chemistry.

According to the new curriculum guide, the AP Chemistry course should contain at least one activity or lab requiring students to connect their knowledge of chemistry and science to issues that have a societal or technological component. To fulfill this requirement, I plan on…

- Relating the composition of coins to the stock market via determination of the percent copper in a penny lab. Students will use calculations to determine how much money the government will save due to their switch to copper coated pennies
- Discussing solution concentrations in medicine, such as IV solutions and normality calculations in dosages for patients.
- Relating modern materials like liquid crystals in cell phone and TV displays and materials used in constructing everything from nonstick cookware to the tensile strength of steel used for skyscrapers to the formation of solid crystalline structures.
- Performing a demonstration of calorimetry by burning food samples and relating the heat produced in the reaction to the calorie content on the packaging information. This will tie into a discussion of the food pyramid and how biological needs are met by healthy eating of organic compounds.
- Discussing the results of the marble statue lab in terms of the weathering effects of acid rain and the formation of caves.
- Having students examine and research their cell phone batteries in relation to electrochemical cells.
- Having students research how materials like hand-warmers are produced with safety measures in mind and how they are marketed.