A.P. Chemistry Syllabus

2013 – 2014
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Appoquinimink High School
Room A208

Section I: Course Overview

AP Chemistry is designed to provide a first year college chemistry experience by providing a depth of conceptual coverage as well as a comparable laboratory experience. AP Chemistry meets daily for a 90 minute block class period with at least 25% of the instructional time being dedicated to hands-on laboratory experience. The A.P. Chemistry curriculum is built around six big ideas, which are intended to provide students with the appropriate conceptual knowledge, as well as seven science practices, which are designed to help students learn to act and think like scientists. The overall goal of this course is to prepare each student with the problem solving skills, laboratory experience, and depth on knowledge necessary to earn an acceptable score on the AP Exam.

Section II: Course Expectations

Due to the large volume of content that must be covered, AP Chemistry is a rigorous course with high expectations for both the students and the instructor. Before signing the course agreement, please read the expectations below regarding the level of commitment that is required of students in this course

It is expected that each student will:

1. Abide by the Appoquinimink School District Code of Conduct and Laboratory Safety Contract at all times.
2. Complete all assigned readings and problems prior to class and arrive in class prepared to ask questions and participate in class discussions.
3. Dedicate significant time outside of class to studying and completing assigned problems. On average, it is expected that each student will plan to dedicate at least one hour of time outside of class each day. Students should also expect to receive an assignment of a reasonable length to complete during scheduled breaks in the school year.
4. Maintain a laboratory notebook in the proper format throughout the course.
5. Consistently put forth his or her best effort and ask for help when needed.
6. Plan to take the AP Exam in May. The cost of the exam is approximately $90.

It is expected that the instructor will:

1. Be prepared for class each day and provide instruction that is aligned with the course requirements as defined by The CollegeBoard.
2. Prepare and implement a lab curriculum that reinforces the content covered in class and is comparable to a first year college chemistry course.
3. Be responsible for laboratory safety by maintaining a clean and safe laboratory environment and informing students of all potential laboratory hazards.
4. Make time available for review and/or help sessions outside of class when requested by students.
5. Provide each student with the opportunity to develop the skills necessary to succeed on the AP exam.

Section III: Course Materials

Textbook
Brown, Theodore L., H. Eugene Lemay, Jr., Bruce E. Bursten, and Catherine J. Murphy. Chemistry: The Central Science. 11th Edition. Upper Saddle River, NJ: Prentice Hall, 2009.

Materials Supplied by the Student

1. a scientific calculator – a graphing calculator is strongly recommended; however, at the minimum each student must have a calculator that is capable of doing scientific notation and logarithms in addition to the four basic functions.
2. 3-Ring Binder – a large (3'' size suggested) binder with dividers is necessary to organize the course materials. Each student's binder should be divided into five sections: (1) Reference, (2) Class Notes, (3) Practice Problems, (4) Lab Handouts, and (5) Tests.
3. 3x5 Index Cards (100) – index cards can be used to make flashcards for the various formulas and equations that must be memorized throughout the course.

Section IV: Grading Policy

I. Product Grades (70% of total grade)

   a. **Unit Exams** – there will be a minimum of four summative unit exams given during each marking period. Each exam will constitute an equal portion of the total marking period grade. The only exception to this policy will be for the exam given on the first day of class, which covers the material from the summer assignment. This exam will combine with the first unit exam to constitute a single unit exam grade in the final average for the first marking period. It is important to note that all exams are cumulative and may draw upon any material that has been previously covered in the course.

II. Process Grades (30% of total grade)

   a. **Quizzes / Graded Problem Sets** – a portion of this grade may consist of in-class quizzes and/or collected work from the assigned problem sets. Collection of these assignments will be unannounced. Late work will not be accepted. While not all homework will be graded, it is essential that students complete the required problems for each chapter at a minimum. Students are strongly encouraged to work additional problems from the selected exercises sections in the textbook as well as from the practice tests provided in class to deepen their level of understanding.

   b. **Test Corrections** – because the mastery of all content is important for successful performance on the A.P. Exam, test corrections are mandatory for all students that do not meet the standard on a unit assessment. Students scoring lower than a B- (80%) on any unit test are required to submit test corrections no more than two days after the graded test has been returned to the student. The successful completion of test corrections will count as a process grade for all students who do not meet the minimum standard of a B- on a unit test. Test corrections are optional for students who score at or above a B- grade on a unit assessment.

   c. **Laboratory Practicum** – experiments are typically conducted in class with a lab partner, but each student is required to independently produce a formal lab report. After a lab is completed, a two day grace period is given for students to complete and submit their formal lab report. Lab reports will not be accepted after the due date except in the case of excused absences from class. Instructions on the proper format for lab reports are summarized in *Appendix C: Lab Report Guidelines*. Students who do not follow these guidelines will be subject to academic penalty. The grading of lab reports will typically assess the student's ability to accurately analyze data, identify sources of error, and draw conclusions from their results. Lab report grades may also reflect performance based components from the experiment. A pre-laboratory assignment may also be included as part of the grade for the formal lab report.

III. **Marking Period Exams** – a cumulative exam will be given at the completion of each marking period of the course. These timed ninety minute exams may cover any material previously covered in the course and are modeled after the format of the A.P. Exam. The first and second marking period exams will be averaged and recorded as the midterm grade on each student's report card. The third and fourth marking period exams will be averaged and recorded as the final exam grade on each student's report card.

IV. **Calculation of Final Grades** – the final grade for the course shall be calculated using a weighting of 20% for each of the four marking period grades and 5% for each of the four cumulative marking period exams.

V. **College Level Expectations** – Because of the high level of rigor and the accelerated pace required to cover a college-level general chemistry curriculum, all students will be held to higher expectations than in a typical high school course. As a rule, I do not offer extra-credit, I do not allow students to re-take tests, I do not curve unit assessments or marking period grades, and I do not accept late assignments. Students are expected to dedicate a significant amount of time outside of class to master the course material. After school help is available for students who need it, but the student must take the responsibility and seek help when they recognize that it is necessary.

Section V: Absence Policy

If a student is absent, it is his or her responsibility to obtain all make-up work; including class notes. For excused absences, the student will have one day for every day absent to make up the missed work as per the Appoquinimink School District attendance policy found in the student code of conduct. Make-up work that is not completed within the allotted time frame will receive a grade of zero in the gradebook. If a student misses class on the day of a lab, it is required that the student arrange for a time to make up the lab after school. Because laboratory based questions are often included on the AP examination, it is important that students arrange to make up any missed lab work. Deadlines for making up missed labs are flexible.

Section VI: Contact Information and Resources for Parents

If you have any questions or concerns, the best way to contact me is via e-mail. My e-mail address is Andrew.Shatley@appo.k12.de.us. If you do not have access to e-mail or if you wish to contact me by phone, feel free to call me at (302) 449-3840, extension 1208. I cannot always return phone calls immediately, but I will try my best to get back to you by the end of the day.

Please note that I have made a number of resources available to help each student succeed in A.P. Chemistry. The homework section on the class page for A.P. Chemistry on the appohigh.org website includes all of the test dates, lab dates, and assigned homework. As a general rule, I will plan to have all major assignments posted at least two weeks in advance of their due date. I recognize that students may have busy schedules and I encourage them to consider working ahead when they know that they will have planned absences or demanding schedules for other classes, extra-curricular activities, sports, etc.

Practice tests are also available to help students prepare for upcoming unit exams. At the beginning of each new unit, at least one practice test will be given to students to complete on their own in order to prepare for the unit exam. These assignments are optional (not graded) and the solutions will be available electronically so that students may review them on their own outside of class. Completing the practice test should help students gauge their level of understanding at the end of each unit and help them score better on the summative assessments given in class.

I will commit to offer extra-help sessions after school on a weekly basis beginning with the second week of the school year. Extra-help sessions will typically be scheduled for Thursday afternoons from 2:30 – 4:00 (although dates may vary based on the schedule). This is also the recommended time for students to make up missing assignments such as unit exams or laboratory work. When staying after school for extra help, it is required that students provide their own transportation home at or before 4:00. Comprehensive review sessions will also be scheduled before each of the marking period exams (dates TBA).

Parents, please sign the course agreement at the end of this packet and have your child return it to me, acknowledging that you have received and read the syllabus and course expectations. If you have any additional questions or concerns, please write them in the space provided at the bottom of the course agreement. In addition, please take time to read and review the laboratory safety guidelines with your child. After reviewing this information, please sign and return the safety contract located on the reverse side of the course agreement page.

Enclosed:
Appendix A: Outline of Course Topics
Appendix B: Overview of Laboratory Curriculum
Appendix C: Lab Report Guidelines
Appendix D: Appoquinimink School District Safety Agreement
Appendix E: A.P. Chemistry Course Agreement

Appendix A: Outline of Course Topics

The content covered in A.P. Chemistry is organized around six big ideas, which are further broken down into enduring understandings, essential knowledge, and learning objectives which summarize what each student is expected to be able to do after mastering the material. The six big ideas for the course, as identified by The College Board are summarized in the table below:

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 4:** Rates of chemical reactions are determined by details of the molecular collisions.
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 5:** The laws of thermodynamics describe the essential role of energy and explain and predict the direction of changes in matter.
Big Idea 3: Changes in matter involve the rearrangement and/or reorganization of atoms and/or the transfer of electrons.	**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 course outline provided on the following pages represents a chronological account of the concepts as they will be covered in the course. The material covered in the course is grouped into fourteen units; each unit will be assessed with a summative examination.

Time Frame	Chapters Covered	Topics Covered
Unit One: Basic Chemistry Concepts		
Time frame 1.5 weeks Big Ideas 1 & 2	Ch 1: Introduction: Matter and Measurement Ch 2: Atoms, Molecules, and Ions	classification and properties of matter units of measurement uncertainty in measurement dimensional analysis development of atomic theory understanding basic atomic structure arrangement of the periodic table isotopes and determination of atomic masses mass spectrometry inorganic formulas and nomenclature acid base nomenclature introductory organic nomenclature
Student Activity: Students will be able to analyze mass spectra to identify the element that is represented as well as the approximate masses and abundances of its isotopes. [Learning Objective 1.14]		
Unit Two: Stoichiometry and Chemical Reactions		
Timeframe 1.5 weeks Big Ideas 1 & 3	Ch 3: Stoichiometry: Calculations with Chemical Formulas and Equations	physical and chemical changes balancing chemical equations identifying basic reaction types Avogadro's number and mole calculations determining formula mass and percentage composition determining empirical and molecular formulas stoichiometric relationships calculating limiting reagents and percentage yield
Student Activity: Students will observed demonstrations of chemical reactions, and summarize their observations, create a complete balanced equation for the reaction, and identify the type of reaction that has occurred. [Learning Objective 3.2]		

Unit Three: Solution Chemistry		
Timeframe 2 weeks Big Ideas 1, 2 & 3	Ch 4: Aqueous Reactions and Solution Chemistry Ch 20.1 – 20.2: Oxidation-Reduction Reactions	types of solutions strong and weak electrolytes precipitation reactions and solubility guidelines elementary qualitative analysis writing net-ionic equations calculating solution concentrations solution stoichiometry and titrations identifying oxidizing and reducing agents balancing oxidation-reduction reactions
Student Activity: Given a set of reactions, students will work collaboratively in groups to identify which reactions are redox reactions, balance the equations using the appropriate method, identify which species have been oxidized and reduced, and determine the number of electrons transferred in the reaction. [Learning Objective 3.8]		
Unit Four: Thermodynamics		
Timeframe 2 weeks Big Ideas 3 & 5	Ch 5.1–5.7: Thermochemistry Ch 8.8 Bond Enthalpies Ch 19.1–19.6: Chemical Thermodynamics	enthalpy changes and the first law of thermodynamics determining ΔH_{rxn} using Hess's Law determining ΔH_{rxn} using calorimetry determining ΔH_{rxn} using enthalpies of formation determining ΔH_{rxn} using bond enthalpies reaction spontaneity and reversible processes entropy and the second and third laws of thermodynamics microstates and molecular interpretations of entropy Gibbs free energy and free energy of formation
Student Activity: Students will solve problems by quantitatively determining the values of ΔH, ΔS, and ΔG for a given reaction and then summarize what can be concluded about the reaction from the sign and magnitude of these values. [Learning Objective 5.13]		
Unit Five: Atomic Structure and the Periodic Table		
Timeframe 2 weeks Big Idea 1	Ch 6: Electronic Structure of Atoms Ch 7: Periodic Properties of the Elements	the nature of light and quantized energy atomic spectra and the Bohr Model modern atomic theory, quantum numbers, and atomic orbitals electron configurations and the periodic table Beer's Law and spectrophotometry Mendeleev and the development of the periodic table periodic relationships (including atomic radii, ionic radii, ionization energy, electron affinity, electronegativity, and metallic character) group properties and trends
Student Activity: Students will construct graphs of atomic radii, ionization energies, and electron affinities as a function of atomic number. Based on graphical analysis, students will work in collaborative groups to identify trends, develop explanations for the trends, and describe exceptions. [Learning Objective 1.9]		
Unit Six: Chemical Bonding		
Timeframe 2 weeks Big Ideas 2 & 5	Ch 8.1 – 8.7: Basic Concepts of Chemical Bonding Ch 9: Molecular Geometry and Bonding Theories	types of chemical bonding ionic compounds and lattice energy drawing Lewis structures electronegativity and bond polarity formal charges and resonance structures VSEPR Theory polarity of molecules Valence Bond Theory and orbital hybridization orbital overlap, sigma and pi Bonds Molecular Orbital Theory relationships between bond length and bond order

	23.5-23.7 Metallic Bonding	Electron Sea Model for metallic bonding properties of metals, alloys, and magnetism
Student Activity: Students will be given examples of compounds and asked to construct a complete Lewis Structure and to describe the molecule in terms of molecular geometry, polarity, and orbital hybridization. [Learning Objective 2.21]		
Unit Seven: Intermolecular Attractions		
Timeframe 1 week Big Ideas 2 & 5	Ch 11: Intermolecular Forces, Liquids, and Solids	Kinetic-Molecular Theory and solids/liquids London dispersion attraction, dipole-dipole forces, and hydrogen bonds comparing the strength of intermolecular forces physical properties of solids and liquids understanding phase changes and heating curves structure and bonding in solids
Student Activity: Students will examine models of the DNA molecule and identify the role and locations of hydrogen bonding within the double helix structure. The class will discuss how UV light can cause chemical reactions and mutations that may alter the structure of DNA and how the chemical reactions behind the depletion of the ozone layer lead to increased exposure to UV light.		
Unit Eight: Gases		
Timeframe 1.5 Weeks Big Ideas 2 & 3	Ch 10: Gases	applying the gas laws and the ideal gas law gas mixtures and Dalton's Law of partial pressures determining the molar mass of an unknown gas Kinetic-Molecular Theory for gases rates of molecular effusion and diffusion the van der Waals equation and deviations from ideal behavior
Student Activity: Students will solve problems by quantitatively determining volume, pressure, temperature, or the amount of a gas using the appropriate gas law expression. [Learning Objective 2.6]		
Unit Nine: Chemical Kinetics		
Timeframe 2 weeks Big Ideas 4 & 5	Ch 14: Chemical Kinetics	factors affecting reaction rates determining reaction order, rate constants, and rate laws the effects of concentration on rate the effect of temperature on rate catalysts and activation energy reaction mechanisms
Student Activity: Students will be given a data set including concentrations of reactants as a function of time for a given chemical reaction. Based on the data, students will identify the reaction orders with respect to the reactants, determine the overall rate law for the reaction, and calculate the value of the rate constant. [Learning Objective 4.2]		
Unit Ten: Chemical Equilibrium		
Timeframe 2 weeks Big Ideas 5 & 6	Ch 15: Chemical Equilibrium 19.7 Free Energy and the Equilibrium Constant	interpreting and working with equilibrium constants calculating equilibrium constants and concentrations predicting the direction of a reaction using the reaction quotient Le Châtelier's Principle and shifts in equilibrium Using the free energy change to determine an equilibrium constant
Student Activity: Students will be given initial conditions for a reaction with a known equilibrium constant and asked to predict the direction at which the reaction will proceed to reach chemical equilibrium. [Learning Objective 6.4]		
Unit Eleven: Introductory Acid-Base Chemistry		
Timeframe 1.5 weeks Big Ideas 2, 3 & 6	Ch 16.1–16.10: Acid-Base Equilibria	Arrhenius and Bronsted-Lowry classification of acids and bases Properties of strong and weak acids and bases the pH scale, K_a and pK_a calculating the pH of a strong acid or base weak acid and weak base equilibria the relationship between K_a and K_b acid base properties of salt solutions factors affecting acid strength

Student Activity: Students will be able to develop and describe a procedure for determining the concentration of an unknown weak acid as well as it's pKa through titration. [Learning Objective 6.13]		
Unit Twelve: Advanced Acid-Base Chemistry		
Timeframe 2 weeks Big Idea 6	Ch 17.1 – 17.3 Buffers and Acid-Base Titrations	the common-ion effect properties of buffered solutions calculating buffer pH using the Henderson-Hasselbalch equation calculating pH changes in buffered solutions preparation of a buffered solution acid-base titration curves calculating pH values during a titration selecting an indicator for an acid-base titration polyprotic acids
Student Activity: Students will research and identify an example of a commonly observed buffer system and present an explanation that includes the components of the buffer, its buffer capacity, and how the system will resist changes in pH upon the addition of an acid or a base. [Learning Objective 6.20]		
Unit Thirteen: Solutions and Solubility Equilibria		
Timeframe 2 weeks Big Ideas 2 & 6	Ch 13.1–13.3: Properties of Solutions Ch 17.4 – 17.7: Solubility Equilibria	the solution processes and factors affecting solution formation effects of temperature, pressure, and solvent type on solubility saturated, unsaturated, and supersaturated solutions interpreting solubility curves solubility equilibria and the solubility product constant the effect of common ions and pH on solubility qualitative analysis
Student Activity: Students will solve problems by predicting the effect of the addition of a common-ion or a change in pH on the solubility of a salt and to calculate the difference in solubility using the appropriate equilibrium expression. [Learning Objective 6.23]		
Unit Fourteen: Electrochemistry		
Timeframe 1.5 weeks Big Idea 3	Ch 20.1–20.6: Electrochemistry	oxidation-reduction reactions (review) voltaic cells, cell EMF, and half-cell potential the relationship between free energy and electrode potential cell emf under non-standard conditions; the Nernst Equation concentration cells electrolysis
Student Activity: Given a list of possible materials, students will work collaboratively in groups to describe how to construct a voltaic cell and identify the anode, cathode, cell potential, and direction of current flow for the voltaic cell. [Learning Objective 3.12]		
2-3 weeks	Review for the A.P. Exam	
3 weeks	Topics of study after the A.P. Exam may include a selection from among the following topics: Colligative Properties, Organic Chemistry, Nuclear Chemistry, Chemistry of Modern Materials, Environmental Chemistry, Consumer Chemistry	

Appendix B: Overview of Laboratory Curriculum

The laboratory activities conducted in A.P. Chemistry are structured around seven science practices which are designed to help students learn to act and think like scientists. The seven science practices as identified by The College Board include:

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

A.P. Chemistry will include eighteen hands-on laboratory activities, including six experiments which utilize a guided inquiry based approach. Laboratory activities will be integrated throughout the course to reinforce the content being covered in class as well as the seven science practices. A summary of the laboratory curriculum is included on the pages that follow; laboratory experiments have been adapted from the following lab manuals and resources:

- A.P. Chemistry Guided Inquiry Experiments: Applying the Science Processes. 1st Edition. New York, NY: The College Board, 2013
- Beran, J. A., Laboratory Manual for Principles of General Chemistry. 7th Edition. Danvers, MA: John Wiley & Sons, 2004.
- Postma, James M., Julian L. Roberts, Jr., and J. Leland Hollenberg. Chemistry in the Laboratory. 5th Edition. New York, NY: W.H. Freeman, 2000.
- Vonderbrink, Sally Ann. Laboratory Experiments for Advanced Placement Chemistry. 2nd Edition. Batavia, IL: Flinn Scientific, 2006.

Lab #	Lab Title	Science Practice Skills
1	Gravimetric Analysis of a Metal Carbonate [Vonderbrink]	2.1, 2.2, 4.3, 5.2, 6.1
	Description: Students will use methods of gravimetric analysis to determine the empirical formula of an unknown metal carbonate compound.	
2	Using the Principle that Each Substance has Unique Properties to Purify a Mixture: An Experiment Applying Green Chemistry to Purification (guided inquiry) [College Board]	5.2, 2.1, 2.2, 6.1, 5.1, 6.4, 4.2
	Description: Students will use their knowledge of stoichiometry to devise a procedure to identify the relative amounts of sodium carbonate and sodium bicarbonate in a mixture, with a focus on understanding the principles of green chemistry.	
3	An Activity Series [Vonderbrink]	4.3, 5.1, 5.3, 6.1
	Description: Students will observe the reactions of common elements and use their experimental data to construct an activity series for these elements.	
4	How Can We Determine the Actual Percentage of H_2O_2 in a Drugstore Bottle of Hydrogen Peroxide (guided inquiry) [College Board]	2.1, 2.2, 4.2, 6.1, 6.4
	Description: Students will standardize a stock solution of potassium permanganate and then design a procedure to determine the percentage of hydrogen peroxide in a sample through redox titration.	
5	The Hand Warmer Design Challenge: Where Does the Heat Come From? (guided inquiry) [College Board]	1.4, 6.4, 7.2, 4.2, 5.3, 2.2, 2.3, 5.1
	Description: Students will learn the basic methods of calorimetry and use their knowledge to design an experimental procedure to determine which of a series of ionic compounds is most suitable for use in a hand warmer considering the amount of heat transferred, safety, cost, and environmental impact.	

6	Beer's Law and the Concentration of Food Dyes in Cereal	2.2, 2.3, 4.3, 5.1, 5.3
	Description: Students will learn the basic methods of spectrophotometry and create calibration curves for some of the seven FD&C food dyes. Following the extraction of food dyes from a sample of cereal, the concentration of the food dye(s) in the unknown sample will be calculated using Beer's Law as well as the calibration curve.	
7	Models of Molecular Shapes: VSEPR Theory and Orbital Hybridization [Postma]	1.1, 1.2, 6.1, 6.2
	Description: Students will use molecular models to create structures of molecules and use the models to identify each molecule's geometry, polarity, and orbital hybridization.	
8	Paper Chromatography	4.1, 4.3, 5.1, 6.1, 6.2
	Description: Students will use paper chromatography techniques to separate and identify the food dyes present in an unknown drink mix sample.	
9	Determination of the Molar Volume of a Gas [Vonderbrink]	2.2, 4.3, 5.3, 6.2
	Description: Students will collect a sample of hydrogen gas through the reaction of magnesium ribbon with hydrochloric acid. After making the appropriate measurements of volume, temperature, and pressure the value for the molar volume of a gas will be determined and compared to the accepted value.	
10	Molar Mass of a Volatile Liquid [Beran]	2.1, 2.2, 3.3, 4.1, 4.3
	Description: Students will vaporize a small sample of an unknown volatile liquid and apply their knowledge of the gas laws to calculate the molar mass of the unknown and to determine its identity.	
11	Chemical Kinetics [Postma]	2.2, 4.1, 4.3, 5.1, 5.3, 6.1
	Description: Students will experimentally determine the rate law for the reaction of the iodide ion with hydrogen peroxide and then determine the activation energy for the reaction using a graphical analysis.	
12	What is the Rate Law for the Fading of Crystal Violet Using Beer's Law? (guided inquiry) [College Board]	1.4, 6.4, 2.1, 2.2, 4.2, 5.1
	Description: Students will generate a calibration curve for crystal violet and then use their knowledge of spectrophotometry to experimentally find the rate law for the reaction of crystal violet with sodium hydroxide.	
13	Determination of K_{eq} for $FeSCN^{2+}$ [Vonderbrink]	4.3, 5.1, 5.3
	Description: Students will use the methods of spectrophotometry to determine the equilibrium constant for a reaction involving the formation of a complex ion.	
14	Acid-Base Titrations [Vonderbrink]	2.2, 2.3, 4.1, 4.3
	Description: In this multi-part lab, students will complete acid base titrations to (1) create a primary standard of sodium hydroxide, (2) determine the concentration of an unknown strong acid, (3) determine the molar mass of an unknown acid, and (4) identify an unknown weak acid from its experimentally determined pKa value.	
15	How Much Acid is in Fruit Juices and Soft Drinks? (guided inquiry) [College Board]	2.2, 3.1, 4.2, 1.1, 7.1, 5.1, 6.4
	Description: Students will design their own acid base titrations to determine the acid concentration of various fruit juices and carbonate beverages and make predictions about the effect of the acid content of beverages on one's health and diet.	
16	Antacid Analysis [Beran]	2.2, 3.3, 4.3, 5.3, 6.1
	Description: Students will use a back-titration to determine the amount of antacid in various brands of commercially available antacid tablets.	
17	To What Extent Do Common Household Products Have Buffering Activity? (guided inquiry) [College Board]	4.2, 4.3, 5.1, 5.2, 5.3, 6.1, 6.2, 6.4
	Description: Students will use titration procedures to determine whether a series of household products exhibit buffering activity and then attempt to identify the buffer system based on known pKa values.	
18	Molar Solubility and the Common-Ion Effect [Beran]	2.2, 4.3, 6.2
	Description: Students will conduct titrations of saturated solutions of calcium hydroxide to determine the value of the solubility product constant for this compound as well as to observe the effect of the presence of a common-ion on the equilibrium concentration of the calcium ion in solution.	

Lab Report Guidelines

Overview

Throughout the course all students are required to maintain a portfolio that includes a copy of each of their lab reports. The portfolio may be either electronic or hard copy. Instructions for the proper formatting of lab reports are given below; students who do not follow these guidelines will be subject to academic penalty. Unless otherwise stated, students will have two days from the date the experiment is completed to submit their formal lab report. As stated in the grading policy, late work will not be accepted. All formal lab reports should be typed, with all text no larger than font size 12, using single spacing and margins of one inch on all sides. All sections should be written using third person voice.

Organization

I. **Title** – centered and recorded at the top of the page.

II. **Name** – record your name and on the line below it record the name of any student(s) who were included in your lab group for this experiment.

III. **Date** – record the date(s) that the experiment was performed

IV. **Introduction** – the introduction should include three components: (1) a purpose statement, (2) an overview of the experimental procedure that is being conducted, and (3) a discussion of the theory behind the experiment.

   a. Purpose Statement – should include a brief summary of the purpose of the lab as well as any hypotheses that are to be tested in the experiment.

   b. Experimental Procedure – summarize the laboratory method(s) being used in the experiment. It is not necessary to include lengthy, step-by-step instructions as part of your procedure. Instead, this section should provide a synopsis of the techniques that are being used in the experiment, such that any person who understands chemistry will be able to read this section and understand the experimental procedure. For guided inquiry labs, this section must include all necessary components of the experimental design.

   c. Discussion of Theory – in conjunction with the discussion of the purpose and procedure, it should be clear which chemistry concepts and laboratory techniques are being used to analyze the data from the experiment. For example, in one experiment you may discuss the specific laws and/or equations that are being used to determine a compound's chemical formula and in another experiment you may explain how the data that will be collected from a spectrophotometer can be analyzed to determine the molarity of an unknown solution.

V. **Data** – all of your lab group's experimental data should be summarized in this section. This includes any relevant observations made during the experiment. All data should be well organized and clearly labeled. Quantitative measurements should be recorded using the correct number of significant figures and appropriate units should be included with each measurement. Use charts or tables to organize your data when appropriate.

VI. **Data Analysis** – all calculations and graphs should be included in this section. You must show how calculations are being carried out. If you are carrying out the same calculation for multiple trials (i.e. calculating percentage yield for trials 1, 2, and 3), it is only necessary to show a sample calculation for the first trial. Make sure that all calculations are clearly labeled so that the reader can follow your work. When using graphs, be sure to include an appropriate scale, label the axes (including proper units), and give each graph a title (usually "dependent vs. independent"). All graphs must be of an appropriate size in order to observe any trend in the data. Graphs may be completed by hand and included in the lab report, although it is preferable that they be created electronically using appropriate software (such as Microsoft Excel).

VII. **Conclusion** – summarize your experimental results and answer any assigned conclusion questions in this section. The conclusion should be written in paragraph form and should not include numbered sections or bullet points. Be sure to provide adequate detail to support your answers as you discuss your results.

VIII. **Error Analysis** – in this section, you should include a description of the specific sources of error that are present in the experiment and explain how they could influence the data that was obtained in the experiment (i.e. do they make the calculated values larger or smaller than they should be?). In general, when considering sources of error, it is often helpful to consider what you would do differently if you were to repeat the experiment and wanted to obtain better results. Making broad generalizations regarding sources of error is inappropriate and unnecessary and will lead to a deduction of points from the lab grade. Statements such as "human error may have caused our results to be off", "maybe we misread the balance", or "our measurements may not have been accurate" are not acceptable sources of error. When discussing sources of error, human error and instrumental error are not typically considered, as they are assumed to be present to some degree in every experiment. These sources should only be addressed in circumstances where they are known to cause a specific, significant, and obvious fault.

Appoquinimink School District
Science Safety Rules and Contract for Secondary Students

PURPOSE

Science is a hands-on laboratory class. You will be doing many laboratory activities which may require the use of potentially hazardous materials. Safety in the science classroom is the #1 priority for students, teachers, and parents. To ensure a safe science classroom, a list of rules has been developed and provided to you in this student safety contract. These rules **MUST** be followed at all times. Two copies of the contract are provided. One copy must be signed by both you and a parent or guardian and returned to your classroom teacher before you can participate in any activity. The second copy is to be kept as a constant reminder of the safety rules.

As with any school activity, disruptive behavior during science labs falls under the Appoquinimink School District Student Code of Conduct.

GENERAL RULES

1. Follow all written and verbal instructions carefully. If you do not understand a direction or part of a procedure, ask the instructor before proceeding.
2. Never work alone. No student may work in the laboratory without an instructor present.
3. When first entering a science room, do not touch any equipment, chemicals, or other materials in the laboratory area until you are instructed to do so.
4. Perform only those experiments authorized by the instructor. Never do anything in the laboratory that is not called for in the laboratory procedures or by the instructor. Carefully follow all instructions, both written and oral. **Unauthorized experiments are prohibited.**
5. Observe good housekeeping practices. Work areas must be kept clean and tidy at all times. Bring only your laboratory instructions, worksheets, and/or reports to the work area. Other materials (books, purses, backpacks, etc.) will be stored in a designated area.
6. Know the locations and operating procedures of all safety equipment including the first aid kit, eyewash station, safety shower, fire extinguisher, and fire blanket. Know where the fire alarm and the exits are located.
7. Know what to do if there is a fire drill during a laboratory period; containers must be closed, gas valves turned off, fume hoods turned off, and any electrical equipment turned off.
8. Be alert and proceed with caution at all times in the laboratory. Notify the instructor immediately of any unsafe conditions you observe.

9. Dispose of all chemical waste properly. Never mix chemicals in sink drains. Sinks are to be used only for water and those solutions designated by the instructor. Solid chemicals, metals, matches, filter paper, and all other insoluble materials are to be disposed of in the proper waste containers, not in the sink. Check the label of all waste containers twice before adding your chemical waste to the container.
10. Keep hands away from face, eyes, mouth and body while using chemicals. Wash your hands with soap and water after performing all experiments. Clean all work surfaces and apparatus at the end of the experiment. Return all equipment clean and in working order to the designated area.
11. Students are never permitted in the science storage rooms or preparation areas unless given specific permission by their instructor.
12. If you have a medical condition (e.g., allergies, pregnancy, etc.), check with your physician/school nurse prior to working in lab.
13. Handle all living organisms used in a science activity in a humane manner.

CLOTHING

14. Any time chemicals, heat, or glassware are used, students will wear laboratory goggles. **There will be no exceptions to this rule!**
15. Contact lenses should not be worn in the laboratory unless you have permission from your instructor.
16. Dress properly during a laboratory activity. Long hair, dangling jewelry, and loose or baggy clothing are a hazard in the laboratory. Long hair must be tied back and dangling jewelry and loose or baggy clothing must be secured. Shoes must completely cover the foot.

ACCIDENT AND INJURIES

17. Report any accident (spill, breakage, etc.) or injury (cut, burn, etc.) to the instructor immediately, no matter how trivial it may appear.
18. If a chemical splashes in your eye(s) or on your skin, immediately flush with running water from the eyewash station or safety shower for at least 20 minutes. Notify the instructor immediately.

HANDLING CHEMICALS

19. All chemicals in the laboratory are to be considered dangerous. Check the label on chemical bottles twice and take only as much as you need. Do not touch, taste, or smell any chemicals unless specifically instructed to do so. The proper technique for smelling chemical fumes will be demonstrated to you.
20. Never return unused chemicals to their original containers.
21. Acids and bases must be handled with extreme care. You will be shown the proper method for diluting strong acids and bases.
22. Never remove chemicals or other materials from the laboratory area.

HANDLING GLASSWARE AND EQUIPMENT

23. Never handle broken glass with your bare hands. Use a brush and dustpan to clean up broken glass. Place broken or waste glassware in the designated glass disposal container.
24. Examine glassware before each use. Never use chipped or cracked glassware. Never use dirty glassware.
25. Do not immerse hot glassware in cold water; it may shatter.
26. When removing an electrical plug from its socket, grasp the plug, not the electrical cord. Hands must be completely dry before touching an electrical switch, plug, or outlet.
27. Report damaged electrical equipment immediately. Look for things such as frayed cords, exposed wires, and loose connections. Do not use damaged electrical equipment.
28. If you do not understand how to use a piece of equipment, ask the instructor for help.

HEATING SUBSTANCES

29. Exercise extreme caution when using a gas burner, hot plate, and candle. Take care that hair, clothing and hands are a safe distance from the flame at all times. Do no put any substance into the flame unless specifically instructed to do so. Never reach over an exposed flame. Light gas (or alcohol) burners only as instructed by the teacher.
30. Never leave a lit burner, hot plate, or candle unattended. Never leave anything that is being heated or is visibly reacting unattended. Always turn the burner or hot plate off when not in use.
31. You will be instructed in the proper method of heating and boiling liquids in test tubes. Do not point the open end of a test tube being heated at yourself or anyone else.
32. Heated metals and glass remain very hot for a long time. They should be set aside to cool and picked up with caution. Use tongs or heat-protective gloves if necessary.
33. Never look into a container that is being heated.
34. Do not place hot apparatus directly on the laboratory desk. Always use an insulating pad. Allow plenty of time for hot apparatus to cool before touching it.

Chemistry Addendum to Appoquinimink School District Science Safety Rules and Contract for Secondary Students

35. Acids must be handled with extreme care. You will be shown the proper method for diluting strong acids. Always add acid to water, swirl or stir the solution and be careful of the heat produced, particularly with sulfuric acid.
36. Handle flammable hazardous liquids over a pan to contain spills. Never dispense flammable liquids anywhere near an open flame or source of heat.
37. You will be instructed in the proper method of heating and boiling liquids in test tubes. Do not point the open end of a test tube being heated at yourself or anyone else.

Appoquinimink School District
Science Safety Contract

STUDENT CONTRACT:

I, ______________________________________, (student's name) have read and agree to follow all of the safety rules set forth in this contract. I realize that I must obey these rules to ensure my own safety, and that of my fellow students and instructors. I will cooperate to the fullest extent with my instructor and fellow students to maintain a safe lab environment. I will also closely follow the oral and written instructions provided by the instructor. Unsafe conduct in the laboratory or misbehavior on my part, may result in being removed from the laboratory, receiving a failing grade, behavior referral, and/or dismissal from the course.

____ ______________

Student Signature Date

QUESTIONS:

- Do you wear contact lenses? ☐ YES ☐ NO
- Are you color blind? ☐ YES ☐ NO
- Do you have allergies ☐ YES ☐ NO

  If so, list specific allergies: ____

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- Are you allergic to latex? ☐ YES ☐ NO
- Do you have any medical conditions we need to be aware of (asthma, seizures, cardiac abnormalities, etc.)?
  ☐ YES ☐ NO

PARENT CONTRACT:

We feel that you should be informed regarding the school's effort to create and maintain a safe science classroom/laboratory environment. With the cooperation of the instructors, parents, and students, a safety instruction program can eliminate, prevent, and correct possible hazards. Read the list of safety rules above. No student will be permitted to perform laboratory activities unless this contract is signed by both the student and parent/guardian and is on file with the teacher. You are now aware of the safety instructions your son/daughter will receive before engaging in any laboratory work.

Your signature on this contract indicates that you have read this Student Safety Contract, are aware of the measures taken to ensure the safety of your son/daughter in the science laboratory, and will instruct your son/daughter to uphold his/her agreement to follow these rules and procedures in the laboratory.

____ ______________

Parent/Guardian Signature Date

Terms of Agreement

A.P. Chemistry
Mr. Andrew Shatley
Appoquinimink High School

As the teacher of this course, I am committed to abiding by this syllabus. The dates and timelines are subject to change based on students' assimilation of the material. Any changes will be communicated to the class by the instructor. By signing this document, you are affirming that you have read and agree to abide by the guidelines, policies, and agreements stated in this syllabus.

As a student in this course, I have read and agree to abide by the guidelines, policies and agreements stated in this syllabus.

Student Name (please print): ____

Student Signature: ____________________________ Date: ___________________

As the parent/guardian, I have reviewed the information presented above and agree to support this student in an effort to follow the guidelines, policies and agreements stated in this syllabus.

Parent Name (please print): ____

Parent Signature: ____________________________ Date: ___________________

E-mail: ____

Phone Contact (best daytime number): ______________________________________

If you have any questions or concerns at this time, please write them in the space below:

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This document should be signed by the student and parent and returned to the instructor no later than Thursday, August 29th, 2013.