**Advanced Placement Chemistry**

**Course Syllabus**

**Course Description**

The AP Chemistry course is designed to be the equivalent of the general chemistry course usually taken during the first college year. For some students, this course enables them to undertake, as a freshman, second-year work in the chemistry sequence at their institution or to register in courses in other fields where general chemistry is a prerequisite. For other students, the AP Chemistry course fulfills the laboratory science requirement and frees time for other courses. This course is structured around the six big ideas articulated in the AP Chemistry curriculum framework provided by the College Board. 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. Students in such a course should attain a depth of understanding of fundamentals and a reasonable competence in dealing with chemical problems. The course should contribute to the development of the students’ abilities to think clearly and to express their ideas, orally and in writing, with clarity and logic. The amount of work outside of class depends upon the student and his/her background; however, students should be prepared to spend anywhere from 45 minutes to an hour each night after school on just their Chemistry homework. Those students who are heavily involved in afterschool activities and/or jobs will have to learn to budget their time very carefully. Students MUST have time available immediately after school to get extra help or make up lab work when necessary! Structured tutoring for AP Chemistry is offered every Thursday (may occasionally move to Tuesday depending on activity schedules of our athletes, musicians, thespians, etc). In addition, a minimum of four (4) service hours per semester of peer tutoring time with PSI Chemistry students are required either during the Wednesday late start study hall from 7:30 – 9:00 am or during after school tutoring in G106 from 2:45 – 4:00 pm.

**Big Ideas of AP Chemistry**

**Big Idea 1:** The chemical elements are fundamental building materials of matter, and all matter can be understood in terms of arrangements of atoms. These atoms retain their identity in chemical reactions.

**Big Idea 2:** Chemical and physical properties of materials can be explained by the structure and the arrangement of atoms, ions, or molecules and the forces between them.

**Big Idea 3:** Changes in matter involve the rearrangement and/or reorganization of atoms and/or the transfer of electrons.

**Big Idea 4:** Rates of chemical reactions are determined by details of the molecular collisions.

**Big Idea 5:**The laws of thermodynamics describe the essential role of energy and explain and predict the direction of changes in matter.

**Big Idea 6:** Any bond or intermolecular attraction that can be formed can be broken. These two processes are in a dynamic competition, sensitive to initial conditions and external perturbations.

**Science Practices of AP Chemistry**

Science Practice 1: The student can use representations and models to communicate scientific phenomena and solve scientific problems.

Science Practice 2: Students can use mathematics appropriately.

Science Practice 3: Students can engage in scientific questioning to extend thinking or 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: Students can perform data analysis and evaluation of evidence.

Science Practice 6: The students can work with scientific explanations and theories, in which students should be able to use these better models that are improved through laboratory data to employ scientific theories in their own explanations of the phenomena they observe.

Science Practice 7: The student is able to connect and relate knowledge across various scales, concepts, and representations in and across the domains.

**Course Textbooks**

Abraham, Michael R, Gelder, John I, and Greenbowe, Thomas J, General Chemistry: During Class Interventions and Computer Lab Activities (Volumes 1 and 2), 3rd Ed. Hayden McNeil, 2009

Brown, Theodore L. et al., Chemistry: The Central Science. 10th ed. New York: Prentice Hall, 2006.

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

Hnatow, John, and Ketan Trivedi. High School Chemistry for AP Achievement: An Interactive Multimedia Course on DVD-ROM. Blacksburg, VA: Trivedi

Chemistry, 2012.Randall, Jack. Advanced Chemistry with Vernier. Oregon: Vernier Software and Technology, 2004.

Vonderbrink, Sally. Laboratory Experiments for AP Chemistry. Batavia: Flinn Scientific, 2001.

**Why Take AP Chemistry?**

There are several reasons why a student might want to take AP Chemistry, including (but not limited to!) the following:

1. AP Chemistry will challenge you to the limits of your academic ability. In the past you may have found classes "too easy", and therefore not stimulated you to do your very best. This will not be the case in AP Chemistry.

2. AP Chemistry should allow you to achieve college credit while still enrolled in high school. This will save time and money. Some students who have passed the AP Exam elect to take first year college chemistry anyway, where they find the material an easy review, and achieve top grades while others around them are frustrated and struggling in a class which is too large and / or the instructor is unavailable for help!

3. Regardless of whether or not a student passes the national exam, (s)he may choose to take freshman chemistry in college anyway. Those who have gone this route in the past have found that they have a tremendous advantage over others who have not taken A.P. Chemistry. I have received numerous reports from former students, indicating that while most of their class is struggling with basic concepts, they find almost all of the material to be a review, and as a result are in the top 5% of their class with only modest effort.

4. AP Chemistry looks great on your transcript or on a letter of recommendation. More and more the best colleges and universities are looking for ways a student has distinguished themselves in high school. Being a "straight A" student no longer carries the weight it once did, and many 4.0 grade average students are finding themselves denied entry at the college of their choice. Taking AP Chemistry is a way of distinguishing yourself in high school.

5. AP Chemistry is an intense course of study where students and the teacher REALLY get to know each other. It is to the student’s advantage for the teacher to know them well when they need a letter of recommendation.

**Materials: Please bring the following to class each day**

3-ring Binder with dividers

Loose-leaf paper AND green engineering paper

Composition Lab Notebook OR Carbonless Student Lab Notebook

Pen (dark ink only) and Pencil

Scientific Calculator or Graphing Calculator (TI 83, 84, or Nspire)Planner

4-pk Expo Markers (for student use)

Red Felt-tip Grading Pens (for student use)

Flash drive – the most storage you can afford, at least 8GB

Recommended but not required: index cards, highlighters, poster-making supplies

**Grading Scale**: Within each Big Idea are a set of Learning Objectives, which define the standard set of knowledge and skills each student must master. Students will rank their learning as they progress towards mastery on a scale from 0 – 5 and self-evaluate after each unit test. These are formative assessments, meaning they change as students demonstrate each skill with more accuracy and consistency. This allows all invested parties (student, teacher, parent, counselor, admin, etc.) to identify strengths and areas for growth. Labs and quizzes are worth 30 – 50 points and tests are worth 100 points, so these assessments have much more impact on the student’s grade than the standards. Unit tests will be administered and graded “AP Style,” meaning there will be a time limit for each section and scores of 75% + on the multiple choice and 50% + on free response will earn an “A”. Therefore it IS possible that a student might have greater than a 100% average. Overall letter grades are assigned based on the following scale.

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| **Grading Scale** | | |
| **Letter Grade** | **Scale Score** | **Percentage Score** |
| A+ | 5.0 | 100 |
| A | 4.5 | 95 |
| A- | 4.0 | 90 |
|  | 3.5 | 85 |
| B | 3.0 | 80 |
|  | 2.5 | 75 |
| C | 2.0 | 70 |
|  | 1.5 | 65 |
| D | 1.0 | 60 |
| Incomplete/  Failing | Below 1.0 | 50 |
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| Modified from 2008 Marzano | | |

**Laboratory**

The labs completed require following or developing processes and procedures, taking observations, and data manipulation. Students communicate and collaborate in lab groups; however, each student maintains their own record or their work in a **Digital Lab Notebook**, DLN, (Google Site or blog) for every lab they perform. During data collection in the lab, students are encouraged to use phones, iPads, or simple pen and paper to record pictures, videos, and observations of their work. Not everything that is recorded needs to be uploaded into the DLN, so students will need to make decisions about what kind information best captures a record of their work. If publishing your work to a global audience online is intimidating, feel free to write a rough draft in a Google Doc and get feedback from your lab group, classmates, and/or your teacher before you publish it in a website of blog. The link to your DLN must be shared with the class through Schoology, but the site belongs to you, the student, so you can take it with you as you move on to the next level in your education/career. A minimum of 25% of face to face student contact time will be spent doing hands-on laboratory activities.

Pay attention to the scoring sheet for each lab. A formal lab report is not required for every lab we do, only about two or three per semester. 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 result in students receiving a PINK SLIP (lay-off notice) and which will assign them to career training to help manage time and work more effectively.**

**Pre-Lab Work: Pre-lab work is to be completed and turned in or posted online before 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. DLNs have the capability to date and time stamp everything you write and every edit you make.

3. Purpose: A purpose is a statement summarizing the “point” of the lab.

4. Procedure Summary: Students need to sketch their work flow of each lab and include a link to the lab handout in their DLN. Rewriting the information from the handout is redundant, inefficient, and unnecessary. Some labs are planned by the teacher; others are planned by students for which they will be required to write out the 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. Most labs require data to be shared with the entire class in a Google Form or Sheet so that more trials can be conducted. Please enter your data promptly so your classmates can gain access to the information they need to complete their work.

**During the Lab**

7. Data: Students need to record all their data directly in their lab notebook or digital device. Label all data clearly and always include proper units of measurement in addition to the amount of uncertainty in each measurement (usually printed on the measuring device itself). Labeled sketches, captioned photos, and annotated videos during the lab process are beneficial during the analysis of results.

**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.

9. Post Lab Analysis Questions: Follow the same procedure as for Pre-Lab Questions.

10. Conclusions: Writing an Effective Conclusion

**Paragraph #1 – Describe your results QUALITATIVELY AND QUANTITATIVELY using the format of CLAIM, EVIDENCE, and REASONING.**

1. In one sentence, summarize your results. For instance, if the purpose of the lab is to determine the concentration of a solution, then your first sentence should state what the concentration of the solution is! For numerical values, always give a measure of accuracy (percent error) and precision (standard deviation). A minimum of 5 trials is required to be able to calculate standard deviations and meaningful averages.
2. State whether or not your hypothesis was supported or refuted by the data and give specific details to prove it.
3. Explain why you think it turned out that way
4. is the experimental value different from the theoretical value?
5. do the results make sense given what you already know?

\*\*Transition

**Paragraph #2 – Error Analysis: Discuss how the errors may have influenced the outcome of your experiment. Do NOT describe what MAY have happened, only what errors you know ACTUALLY took place that skewed your results. For instance, if some of your solution evaporated overnight, how does this influence your measurement of its concentration? Mistakes are not errors. If you make a mistake during data collection, you must redo that trial. If you make a mistake in mathematical calculations, go back and fix it!**

1. Random fluctuations
2. Instrumental limitations
3. Environmental factors
4. Personal limitations

\*\*Transition

**Paragraph #3 – Next Steps**

1. What would you change or do differently?
2. What else could you investigate?
3. What else do you want to know or wonder about?

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| 1. Discuss what you learned from this experiment and how it relates to what we are learning in class and applications in the real world (your world). |
| 1. Explain how the theoretical concepts we are learning in class directly apply to the lab experience. |

\*\*Summary Statement

**Assignments**: Every chapter assigned must be outlined as you read them. The outlines are turned in on the day of the unit test and make up 5% of your test grade. Your homework is to view the lectures on video podcasts each night. While I am working to shorten them, some may take up to an hour to complete. There will be a problem set of about 10 key questions from each chapter assigned at the beginning of the unit and frequently other homework as necessary for practice. There is always the possibility that these problems may be collected, but retakes will not be permitted until these problems have been completed. This means that it is important to work on these problems when they are assigned and not wait until the night before the test. Other assignments will include worksheets, lab reports, projects, and group work. Come to class with your podcasts completed because class time will NOT be used for viewing podcasts or lecturing about the content in the podcasts. There will not always be enough time in class to complete each activity, so you may have to work on them outside of class to finish up. Learning the material is the responsibility of each individual student, therefore completing the assignments is up to YOU, the student. Not everyone will require the

same amount of practice to master the content of the course, but because of the academic rigor of this class, most students have to complete every assignment to be successful. Each student must complete their own work. Students found to be copying assignments or labs will be subject to disciplinary action which may influence their acceptance into colleges or military academies.

**Ticket To a Retake**: Each student has the option to retake each unit test once and will receive the higher score. If you want to retake a unit test, you must meet these conditions:

1. Have all homework from the unit complete, including the chapter outlines and problem set.
2. Complete test corrections from the original test.
3. Schedule a time outside of class to retake the test.

**Attendance**: You are expected to attend class on each scheduled day. If you are absent on the day of a quiz or test and it was announced prior to your absence, then you must complete it the day of your return or it will be considered late. If you know in advance that you are going to be absent, get assignments prior to your absence and turn them in early. AP Chemistry is a tough class to miss and try to make up. Each class begins with a 5-10 minute graded quiz, called the Warm-Up. If you need more time to work out the problems, you should COME EARLY. You will receive a warning for your first tardy, but after that a three-strike policy will be enforced. If you are late three times, you will be expected to make up the time you missed by serving after school detention as well as any other consequences outlined by the student handbook. BE ON TIME!!!

**Make Up:** Two opportunities for makeup labs will be offered unless you make special arrangements IN ADVANCE with me to be gone. You may be working with another teacher or lab group during the makeup lab, but you are still responsible for posting the DLN within one week. Labs must be made up within one week of the absence or a zero will be given. Those who come for lab day without a prelab complete will be asked to sign up for a makeup lab because they have not sufficiently reviewed the procedure to perform the lab safely.

**Extra Help**: Extra help is always available before or after school Monday – Thursday in G106, but one day each week (usually Wednesday) there is tutoring in my classroom is set aside for AP Chem only. You will all help me decide which day works best for the majority of our class, but sometimes attendance will be mandatory for us to finish a lab or prepare for a test. This allows me time to focus on your specific needs without interruption from other students and gives you an opportunity to work with your peers to finish homework, lab calculations and reports, or to prepare for a test.

**Course Overview** : Dates are subject to change due to snow days or other unforeseen circumstances. Structured Tutoring Time on Wednesdays will be utilized to make up time and get back on pace. The teacher CANNOT slow down or there will not be enough time to master all of the concepts before the exam date on May 2nd. Since the TIMED unit exams are 90 minutes and the block is exactly 90 minutes, on test days we will likely need about 15 minutes of extra time so we allow for distribution of tests and supplementary materials. Please plan accordingly.

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| Approximate Dates | TOPICS | Lab |
| August 4 – 7 | Intro to Lab Work, DLN, Moodle, and Schoology | 1. \*\*Go Fish! Investigating Measures of Central Tendency |
| August 10 - 14 | Nomenclature, Structure of Matter  ONLINE NAMING QUIZ DUE 8:30am 08/09/13  Mental Math and Fermi Estimations | 2. \*\*Gatorade Spectoscopy: What is the Relationship Between the Concentration of a Solution and the Amount of Transmitted Light Through the Solution? |
| August 15 | Saturday Starbucks Study Session | 8 – 11 am, Starbucks at Barnes and Tutt |
| August 17 - 21 | Empirical Formulas, Combustion Analysis, Stoichiometry  STOICHIOMETRY UNIT TEST 08/19 | 3. Determination of Mole Relationships in a Chemical Reaction  4. Determination of Percent Water in a Compound and Empirical Formula |
| August 24 – 28 | Types of Reactions  Net Ionic Equations and Solution Stoichiometry | 5. \*\*How Can Color Be Used to Determine the Mass Percent of Copper in Brass? |
| August 31 – September 4 | Redox Reactions | 6. \*\*Redox Titration: How Can We Determine the Actual Percentage of H2O2 in a Drugstore Bottle of Hydrogen Peroxide? |
| September 5 | Saturday Starbucks Study Session | 8 – 11 am, Starbucks at Barnes and Tutt |
| September 4 – 7 | Intro to Equilibrium Expressions and LeChatelier |  |
| September 7 – 18  \*September 7th OFF for Labor Day  \*Parent-Teacher Conferences 09/08 – 09/10 | Electrochemical Cells, Standard Galvanic and Electrolytic Cells  ELECTROCHEMISTRY UNIT TEST 09/24 | 7. Electrochemical Cells: Determine Reactivity Series and Avogadro’s Number |
| September 21 – 24  \*Professional Development 09/25 NO STUDENTS | Thermochemistry: Calorimetry and Enthalpy, H | 8. Identify the Metal Calorimetry Lab |
| September 28 – October 2 | Thermochemistry: Enthalpy, Hess’s Law, Bond Energy | 9. \*\*Handwarmer Design Challenge |
| October 3 | Saturday Starbucks Study Session | 8 – 11 am, Starbucks at Barnes and Tutt |
| October 5 – 9 | Thermodynamics: Entropy S and Free Energy G, Electrochemistry and G  THERMOCHEMISTRY AND THERMODYNAMICS UNIT TEST 10/07 | October 11 Cool Science Festival at UCCS – Polymer Demonstrations  VOLUNTEER OPPORTUNITY |
| October 12 – 23 | FALL BREAK  Organic Nomenclature |  |
| October 13 | Tuesday Starbucks Study Session | 8 – 11 am, Starbucks at Barnes and Tutt |
| October 20 | Tuesday Starbucks Study Session | 8 – 11 am, Starbucks at Barnes and Tutt |
| October 26 – 30 | Gases: KMT and Gas Laws | PhET Sim Gas Properties |
| November 2 - 6 | Gas Stoichiometry | 10. Molar Mass of a Gas |
| November 8 | Saturday Starbucks Study Session | 8 – 11 am, Starbucks at Barnes and Tutt |
| November 9 – 13  November 9 – 13 | GAS LAWS UNIT TEST 11/09  Atomic Theories, Atomic Structure, Mass Spec, Locating Electrons, Bohr Model, Quantum Model | 11. Flame Test for Metals – Atomic Emission Spectroscopy Lab |
| November 16 - 20 | Photoelectron Spectroscopy, Electron Configurations, and Periodic Trends | Guest Speaker and Lab with  Dr Ron Furstenau, USAFA “The Chemistry of Smell” Date: TBD (Oct or Nov)  12. Chemistry of Smell FTIR Lab  Photoelectron Spectroscopy Simulation |
| November 23 – 27 | THANKSGIVING BREAK  Spectroscopy for AP Chem |  |
| November 24 OR 28 (TBD) | Saturday Starbucks Study Session | 8 – 11 am, Starbucks at Barnes and Tutt |
| November 30 – December 4 | Wrap-Up Atomic Structure, Bonding Basics, Coulomb’s Law, Ionic Bonding  ATOMIC STRUCTURE AND PERIODICITY UNIT TEST 12/02  Covalent Bonding, Resonance Structures, Bond Order, and  bonds | 13. Balloon Geometry and Lewis Structures |
| December 7 - 11 | Hrxn ,Dipole Moment, Formal Charge, Polarity  Metallic Bonding, Alloys, Polymers, and Ionic Solids, Chromatography Intro | Electron Density App Exploration  14. Alchemist’s Dream Lab  Polymer Demos |
| December 12 | Saturday Starbucks Study Session | 8 – 11 am, Starbucks at Barnes and Tutt |
| December 14 – 15 | States of Matter: Intermolecular Forces, Vapor Pressure, Phase Changes, KE vs IMFs  BONDING AND IMFS UNIT TEST 12/16 (instead of cumulative final) | \*\*15. Chromatography Lab |
| December 22 – January 4 | CHRISTMAS BREAK  Naming Organic Compounds Review, Molecular Structures |  |
| January 5 – 8 | Colligative Properties, Freezing Point Depression, Boiling Point Elevation  Colligative Properties Quiz 01/08 | 16. \*\*What is in the Bottle  17. \*\*Separating NaHCO3, Na2CO3 |
| January 11 -15 | Kinetics: Rates and the Differentiated Rate Law | Kinetics Simulations  18. \*\*What is the Rate Law of the Fading of Crystal Violet |
| January 16 | Saturday Starbucks Study Session | 8 – 11 am, Starbucks at Barnes and Tutt |
| January 19 – 22  \*January 18 OFF For MLK Day | Integrated Rate Law, Collision Theory, Mechanisms  KINETICS UNIT TEST 01/25 | Demo: Iodine Clock Reaction |

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| January 25 – 29 | General Equilibrium, Q and K, RICE Tables | Equilibrium Simulations |
| February 1 – 5 | Ksp and Solubility Equilibrium, Common Ion Effect, | 19. Spectrophotometric Determination of Keq |
| February 6 | Saturday Starbucks Study Session | 8 – 11 am, Starbucks at Barnes and Tutt |
| February 8 – 11  \*Parent Teacher Conferences 02/09 – 02/11  \*Professional Development 02/12 NO STUDENTS | Electrochemistry and Equilibrium GENERAL EQUILIBRIUM UNIT TEST 02/10 |  |
| February 16 - 19  \*President’s Day 02/15 | Acid-Base Theory, Equilibrium, Ka, Kb, Kw, and pH, Weak Acid-Base pH Calculations | 20. \*\*How Much Acid is in Fruit Juice and Soft Drinks? |
| February 22 – 26 | Titration Calculations, Equilibrium: Buffers |  |
| February 29 – March 4 | Acid-Base Stoichiometry and RICE Tables | 21. \*\*Buffer Design: The Preparation and Testing of an Effective Buffer |
| March 7 – 11 | Acid-Base Titrations – LAB ALL WEEK! (we will work around the state testing schedule as needed) | \*Students may need to work in the lab while other grade levels are scheduled to take standardized state tests. Please plan for flexibility. |
| March 12 | Saturday Starbucks Study Session | 8 – 11 am, Starbucks at Barnes and Tutt |
| March 14 – 18 | Acid-Base Equilibrium Review  ACID-BASE EQUILIBRIUM UNIT TEST 03/16 |  |
| March 21 – April 1 | SPRING BREAK  **Mandatory Mock Exam**: Please sign up with Mrs. Maze for the date that best suits your family’s schedule | BEGIN WORKING ON YOUR AP CHEM EXAM REVIEW – 30 minutes per day (average) |
| April 4 – May 2 | AP Chem Exam Review and Test-Taking Strategies  \*AFTER APRIL 10\* Mock Exam Results/Evaluation | 22. \*\*Colors of the Rainbow |
| Saturday April 30 | AP Chem Final Review Session | 8am – 2pm at Vista Ridge, G106 |
| Monday, May 2, 2016 | [College Board AP Chem Exam](https://apstudent.collegeboard.org/apcourse/ap-chemistry) | 8 am – 12 pm |
| Possible Post-Exam Activities  \*Professional Development 05/06 NO STUDENTS | Tie-Dye Lab  Write Your MSDS Sheet  Letter of Recommendations  Field Trips: Elitches, Air Force Academy Labs, Bowling, Western Mining Museum, Cripple Creek – Victor Gold Mine | |
| May 19 – 22  VRHS Graduation 05/28 | Final Exam Lab Practical – Acid- Base Titration 05/25 |  |

\*\* Indicates Guided-Inquiry Experiments