AP Chemistry Syllabus

AP Chemistry is a course designed by the College Board Advanced Placement Program to be the equivalent of the general chemistry course usually taken by college freshmen, with emphasis on problem solving and laboratory work. This course has a prerequisite of one year of chemistry and is paced with that expectation. The ideal level prior to this course is our advanced chemistry course which is designed with college chemistry in mind. This includes a math prerequisite so that by the time a student is in AP chemistry they have also completed an Algebra II course.

Students with only the basic general chemistry background (or transfer students) can still be successful if they are aware that they will have to do a little more outside study in the fall semester to “catch up” to the advanced level. In addition, they need to be aware that missing lab skills will be addressed early in the first semester so that they are on an equal footing with the students from the advanced chemistry course.

AP Chemistry is a course that requires a great amount of problem solving, critical thinking, and both independent reading skills and independent study time management skills, so be prepared to study hard if you wish to do well in the course, and on the exam. Our school’s recommendation is at least an hour a night for any AP course that you might take.

Chemistry is not a subject that works with cramming the night before! Your mind needs time to process and bring different components together. Good study habits are crucial for success in a college chemistry course. We will discuss strategies early in the course.

LABORATORY:
Lab is a very important part of the AP Chemistry experience. Analysis of data from AP Chemistry examinees shows that increased laboratory time is correlated with higher AP grades. In each laboratory experiment, you will work in a lab group to physically manipulate equipment and materials in order to make relevant observations and collect data. There will be lab questions on tests so you should be able to communicate an understanding of the lab techniques and analysis.

The course meets on a modified block schedule which includes 3 lecture days and one extended class time of 95 minutes which for most labs is sufficient lab time. Students not finishing a lab will have options for when to come in and finish. You will also have available the department “office hour” time every other Wednesday prior to the school day starting. There are a few labs that starting within this office hour time, even by 15-20 minutes will alleviate any time pressure.

All labs are done in teams to aide in strengthening social skills, communication skills and confidence. All labs require observation and the analysis of the lab when finished. Some labs will require students to prep an inquiry portion. Students will keep a separate laboratory notebook, following the recommended write-up procedure listed in their course lab book. All reports are due one week after the lab is finished allowing time for teams to meet, discuss and reflect on the data including analyzing sources of error.
THE COURSE:
Review of first year material is covered at the beginning of the course in the first unit, and at other times as needed. Please note however, that any review is kept as brief as necessary in order that you will have sufficient amount of time for the new material. Team work is encouraged both in the classroom and outside the classroom in the formation of study groups. You will need a student laboratory notebook with quadrille line pages, and a notebook for class notes and organizing class work and book work. You also need a scientific calculator, although time will be spent in class learning how to take a test without a calculator, since you will not be allowed to use one for the multiple choice part of the AP exam.

To enhance and strengthen problem solving skills, additional college text books are available as resources in the classroom or as checkout from the teacher. In addition, AP study flashcards and net ionic flashcards are used as drills periodically throughout the second semester. Practice exams are used as study aides and students will take several practice exams and discuss strategies for approaching exam questions.

Units of study vary from two-four chapters before a test. Every chapter has two-three homework sets to gauge understanding before an exam. Early homework in a chapter is not graded, but modeled by the students in a cooperative environment. At least one homework assignment in a chapter will be graded and is expected on the due date assigned. The outline of topics is tentative and within each unit specific due dates are assigned to fit the current school calendar. Unit exams are given in the format of the AP exam with two parts, multiple choice and a short answer/problem solving section. It is crucial that you learn early how to approach multiple choice questions, especially those involving calculations without a calculator. We will practice some helpful techniques in class. There may be review material and lab questions on the tests, so that you don't forget in May what you learned in October.

Grading Policy: All points are equal weight and simply accumulate for the semester. Tests will be announced at least one week in advance.


Lab book: “Laboratory Experiments for Advanced Placement Chemistry”
By Sally Ann Vonderbrink, Ph.D., Published by Flinn Scientific, Inc.
Both 1st and 2nd edition are used
In addition, with the addition of inquiry added to our labs, there will be printouts assisting with this aspect of the labs.

The following syllabus is flexible. Labs may be re-arranged depending on school schedules. Some units may go faster or slower than anticipated.
### Course of study FALL semester

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<thead>
<tr>
<th>Time</th>
<th>UNIT</th>
<th>Chapters</th>
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<tbody>
<tr>
<td>3 weeks</td>
<td>Unit 1: Calculations, Atoms, Molecules, Ions</td>
<td>1-3</td>
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Topics: 
- a) Review of basic first year calculations: percent composition, limiting reagent, empirical/molecular formulas from experimental data
- b) Review calculations using stoichiometry with the concept of the mole
- c) Review significant figures in chemistry calculations.

Labs: 
- 1) Intro: review of safety and equipment
- 2) Determination of mass and mole relationship in a chemical reaction
  Finding the ratio of moles of reactants in a chemical equation
- 3) Determination of the empirical formula of silver oxide

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<tr>
<td>3-4 weeks</td>
<td>Unit 2: Chemical Equations</td>
<td>4-5</td>
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Topics: Review first year types of reactions, predict products, write net ionics; including oxidation/reduction, precipitates, gas forming

Labs: 
- 1) Determination of concentration by Redox Titration-
  “analysis of commercial bleach”
- 2) Synthesis and analysis of alum
  Includes: percentage of water in a hydrate; and gravimetric determination of sulfate

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<tr>
<td>2 weeks</td>
<td>Unit 3  Thermo chemistry part 1</td>
<td>6</td>
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Topics: Enthalpy, Hess’s Law, heat capacity, phase diagrams, State functions
First Law; enthalpy changes, heat of formation, heat of reaction, Hess’s law; calorimetry

Lab: 
- 1) Calorimeter- specific heat of metals
- 2) Thermodynamics: Enthalpy of reaction and Hess’s Law
Time | UNIT | Chapters
--- | --- | ---
4 weeks | Unit 4 Structure of atoms | 7-10

Topics: a) Structure of matter: Atomic theory, Periodicity, bonding, isomers  
b) Molecular models, VSEPR, polarity, electronegativity, hybridization, resonance, sigma, pi bonding; relationship of properties to structure  
c) Electron energy levels, atomic spectra  
d) Periodic relationships: atomic radii, ionization energies, electron affinities and oxidation states

Labs: 1) Model kits - identify VSEPR shapes; electron pair/molecular bonding  
2) Chromatography: (paper, column or thin layer)  
3) An activity series (metals and halogens)

Time | UNIT | Chapters
--- | --- | ---
1-2 days | Unit 5 Organic | 11

Topics: Straight chain, branched, functional groups

This is not testable on the exam however you will run into organic formulas and it is helpful to have a basic understanding of them.

Time | UNIT | Chapters
--- | --- | ---
1.5-2 weeks | Unit 6 Gases | 12

Topics: States of matter: Gases  
a) Calculate molar masses from gas density;  
b) Calculate using the ideal gas law, the combined gas law, Dalton’s laws and Graham’s law  
c) Discuss the kinetic molecular theory including interpretation of ideal gas laws based on this theory and deviations from ideal behavior

Labs: 1) Determine the molar mass of a volatile liquid  
2) Determine the Molar volume of a gas

Time | UNIT | Chapters
--- | --- | ---
Until fall finals, finishing labs |

Lab: Separation and Qualitative determination of cations and anions.
Course of study SPRING semester

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<th>Time</th>
<th>UNIT</th>
<th>Chapters</th>
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<tbody>
<tr>
<td>3 weeks</td>
<td>UNIT 7</td>
<td>States of Matter</td>
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Topics: States of Matter: Solutions, liquids, solids, intermolecular forces
a) Calculate molar masses from freezing / boiling point measurements;
b) Calculate mole fractions, molar and molal solutions
c) Interpret phase diagrams
d) Raoult’s Law, factors affecting solubility, colligative properties

Labs: Molar mass by freezing point depressions

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<td>3.5 weeks</td>
<td>Unit 8</td>
<td>Kinetics and Equilibrium</td>
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Topics: a) Kinetic calculations and identify rate orders with graphs;
b) Rate of reaction, rate orders, rate constants, reaction rate laws, effect of temperature on rates, role of catalysts, and energy of activation
c) Relationship between rate-determining step and a possible mechanism
d) Concept of dynamic equilibrium, Le Chatelier’s principle
e) Calculate with equilibrium constants

Labs: 1) Study the kinetics of a reaction and Rates of reaction
2) Equilibrium and Le Chatleier’s Principle
3) Determination of the equilibrium constant for a chemical reaction
   Formation of FeSCN$^{2+}$ (spectrophotometer analysis)

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<td>3 weeks</td>
<td>Unit 9</td>
<td>Equilibria (acid base and solubility)</td>
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Topics: a) Acid base classifications; conjugate pairs; strengths of acid base pairs
   Amphoterism, coordination complexes
b) Concepts of equilibrium constants including $K_{sp}$, $K_a$, $K_b$
c) Interpret titration graphs; Calculate pH, pKa and points on a graph
d) Apply $K_{sp}$ to precipitation and solubility including common ion effect, buffers and hydrolysis

Labs: 1) Determination of the Dissociation constant of a weak acid
2) Determination of the equivalent mass and pK$_a$ of an unknown acid
   includes standardization of a base using KHP as a primary standard
3) Indicator or a buffer lab
4) Determination of the Solubility Product of an Ionic Compound
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<tr>
<td>2.5 weeks</td>
<td>Unit 10</td>
<td>Thermochemistry part 2 and Electrochemistry 19, 20</td>
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Topics:  
Gibbs free energy and entropy; Electrochemistry; cells; Nernst equation  
a) Oxidation-reduction reactions, the role of the electron in reactions  
b) Calculate with thermodynamic and thermochemical equations including Gibb’s free energy and entropy.  
c) Calculate with the Nernst equation, standard electrode potentials and Faraday’s laws of electrolysis, predict direction of a redox equation  
d) Relate changes in free energy to equilibrium constants and electrode potentials

Labs:  
1) Electrochemical cells  
2) Any lab not completed in the last unit due to time  
3) Fun labs- TBA

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<tr>
<td>time until the exam</td>
<td>Review; practice old exams</td>
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In the past we have had a good 3-4 weeks to work on old exams. We start before the last unit is completed and continue until the exam.