

SYLLABUS FOR AP CHEMISTRY

Mr. Pollard



What is AP Chemistry?

This is an advanced placement course designed to prepare the student for the AP Chemistry exam. The course covers the equivalent of one full year of college level General Chemistry (for science and engineering majors) and will be taught at the level of a first year course at a college or university. The course is a rigorous math-based course, with a strong laboratory component. It is intended for students who have demonstrated a willingness to commit considerable time to studying and completing assignments outside of class, and who have successfully completed a prior course in chemistry during high school.

The course will develop the student's ability to incorporate mathematical skills in the solution of chemistry problems, both through the use of textbook problems and laboratory activities. Significant emphasis will be placed on developing the student's ability to solve problems through dimensional analysis and estimation. Students will be required to do extensive writing, and to keep a thorough and accurate ongoing laboratory notebook.

Since passing the AP exam may qualify the student to by-pass a first-year college chemistry course, AP Chemistry should not be considered "college prep." Rather, this is a college class, with college level expectations for participation and effort. This year AP Chemistry will be taught over two semesters. You will be required to take the AP Chemistry exam in May 2010. Failure to take the AP Chemistry exam will mean that you will not get AP credit for this course (it will count only as a Honors Chemistry II course) and this fact will be reported to any colleges to which you apply or to those who have already accepted you as a student. This may result in the college rescinding their acceptance offer as colleges make such decisions based on the courses you have stated you are taking or have taken. **Realize that you cannot achieve college credit for this course unless you take and pass the AP exam in chemistry.**

PLEASE READ THIS!!!

This course will require a significant commitment of time on your part. This is one of the most (some say it is the most) difficult of the AP exams. You must be willing to give at least 5 hours a week to the study of this material outside of class. If you do not, then your chances of passing the AP exam are "slim to none." I will strive to teach this class like a college level class. Your cries of "...this is too hard. We are just in high school. We're not college students", are understood and *I have empathy* with your distress and stress, but this choice is yours. I will always be available for extra help before and after school and even on special study Saturdays if needed to ease your stress!

A Word About Calculators

You will need a calculator for this course. The TI-83+, 84 or 84+ series will do just fine, since most of you have them for your upper level math courses, but any scientific calculator capable of doing logs, exponents, scientific notation will do.

Brief Course Outline

We will be using the text *Chemistry, The Central Science*, by Brown, Lemay, and Burstein, Tenth Edition, 2006, Prentice Hall Publishing.

Planner

A planner for the entire semester will be given to each student. The planner shows what material is being covered and when, the schedule of tests and labs for the term. If circumstances such as storms create a situation where the schedule gets too far out of synch, then a new planner will be issued.

Methods

Instructional methods will consist of lectures, multimedia presentations, small group problem solving, special projects, laboratory work, and other methods to maximize concept development and student growth in chemistry. Students will be afforded class time for active questioning and for guided problem-solving. AP students will be placed in teams of about 3-5 students. Team members will work together to help each other master the material. Some of the labs may require students to work on portions of their labs after school. Since labs are conducted by pairs of students, missing a lab is not fair to you to your partner since some labs may take two or more days to complete. **AP students should make every effort to be present for labs and schedule routine appointments at a time other than on lab days as indicated on the planner.**

Materials

A 3 inch three ring binder dedicated to the subject of chemistry, divider sheets with tabs, notebook paper, graph paper, a 12 inch ruler with both metric and English scales, blue or black pens, pencils, colored pencils, and a scientific calculator. A special lab notebook will be available **at cost** (about \$11.00) for students to use for their labs. Only this notebook or one exactly like it may be used. Students are required to bring to each class the textbook and these basic items.

Assignments

AP Chemistry is hard enough without missing homework and lab report due dates. AP students will be provided material for each unit that details the overall material that will be covered, homework assignments and due dates, and the dates that lab prep assignments are due. Students who do not turn in a pre-lab assignment on the day indicated will not be allowed to participate in that lab and will receive a "0" for that day. **All assignments are due as scheduled. Assignments submitted later than scheduled (except for absences as noted below) will not be accepted, as this is a Level 3 course. Zeros kill an average!** Students will work together and are strongly encouraged to seek help from the teacher as required, but the recorded solution or answer to the homework problem must be their own work. Quizzes will be administered on a routine basis, but may not be announced. **Please carefully read in the package you have been given about the importance of the lab notebook.**

Evaluation

The student planner shows the schedule of tests. There will be a test after each Unit. Tests count for 50% of the half-term grade. Homework and class participation will count for 10% of the half-term grade, quizzes 20%, and laboratory work/reports, the remaining 20%. Weekly grades are cumulative and will account for 80% of each half term grade with the mid-term/final exam counting for 20% of the half-term grades. The average of both half-term grades will determine the final course grade.

Topic Outline

The following list of topics for an AP course is intended to be a guide to the level and breadth of treatment expected rather than to be a syllabus. The percentage after each major topic indicates the approximate proportion of multiple-choice questions on the examination that pertain to the topic.

I. Structure of Matter (20%)

A. Atomic theory and atomic structure

1. Evidence for the atomic theory
2. Atomic masses; determination by chemical and physical means
3. Atomic number and mass number; isotopes
4. Electron energy levels: atomic spectra, quantum numbers, atomic orbitals
5. Periodic relationships including, for example, atomic radii, ionization energies, electron affinities, oxidation states

B. Chemical bonding

1. Binding forces
 - a. Types: ionic, covalent, metallic, hydrogen bonding, van der Waals (including London dispersion forces)
 - b. Relationships to states, structure, and properties of matter
 - c. Polarity of bonds, electronegativities
2. Molecular models
 - a. Lewis structures
 - b. Valence bond: hybridization of orbitals, resonance, sigma and pi bonds
 - c. VSEPR
3. Geometry of molecules and ions, structural isomerism of simple organic molecules and coordination complexes; dipole moments of molecules; relation of properties to structure

C. Nuclear chemistry: nuclear equations, half-lives, and radioactivity; chemical applications

II. States of Matter (20%)

A. Gases

1. Laws of ideal gases
 - a. Equation of state for an ideal gas
 - b. Partial pressures
2. Kinetic-molecular theory
 - a. Interpretation of ideal gas laws on the basis of this theory
 - b. Avogadro's hypothesis and the mole concept
 - c. Dependence of kinetic energy of molecules on temperature
 - d. Deviations from ideal gas laws

B. Liquids and solids

1. Liquids and solids from the kinetic-molecular viewpoint
2. Phase diagrams of one-component systems
3. Changes of state, including critical points and triple points
4. Structure of solids; lattice energies

C. Solutions

1. Types of solutions and factors affecting solubility
2. Methods of expressing concentration (The use of normalities is not tested.)

3. Raoult's law and colligative properties (nonvolatile solutes); osmosis
4. Non-ideal behavior (qualitative aspects)

III. Reactions (35-40%)

A. Reaction types

1. Acid-base reactions; concepts of Arrhenius, Brønsted-Lowry, and Lewis; coordination complexes; amphoterism
2. Precipitation reactions
3. Oxidation-reduction reactions
 - a. Oxidation number
 - b. The role of the electron in oxidation-reduction
 - c. Electrochemistry: electrolytic and galvanic cells; Faraday's laws; standard half-cell potentials; Nernst equation; prediction of the direction of redox reactions

B. Stoichiometry

1. Ionic and molecular species present in chemical systems: net ionic equations
2. Balancing of equations including those for redox reactions
3. Mass and volume relations with emphasis on the mole concept, including empirical formulas and limiting reactants

C. Equilibrium

1. Concept of dynamic equilibrium, physical and chemical; Le Chatelier's principle; equilibrium constants
2. Quantitative treatment
 - a. Equilibrium constants for gaseous reactions: K_p , K_c
 - b. Equilibrium constants for reactions in solution
 - (1) Constants for acids and bases; pK; pH
 - (2) Solubility product constants and their application to precipitation and the dissolution of slightly soluble compounds
 - (3) Common ion effect; buffers; hydrolysis

D. Kinetics

1. Concept of rate of reaction
2. Use of experimental data and graphical analysis to determine reactant order, rate constants, and reaction rate laws
3. Effect of temperature change on rates
4. Energy of activation; the role of catalysts
5. The relationship between the rate-determining step and a mechanism

E. Thermodynamics

1. State functions
2. First law: change in enthalpy; heat of formation; heat of reaction; Hess's law; heats of vaporization and fusion; calorimetry
3. Second law: entropy; free energy of formation; free energy of reaction; dependence of change in free energy on enthalpy and entropy changes
4. Relationship of change in free energy to equilibrium constants and electrode potentials

IV. Descriptive Chemistry (10-15%)

Knowledge of specific facts of chemistry is essential for an understanding of principles and concepts. These descriptive facts, including the chemistry involved in environmental and societal issues, should not be isolated from the principles being studied but should be taught throughout the course to illustrate and illuminate the principles. The following areas should be covered:

1. Chemical reactivity and products of chemical reactions
2. Relationships in the periodic table: horizontal, vertical, and diagonal with examples from alkali metals, alkaline earth metals, halogens, and the first series of transition elements
3. Introduction to organic chemistry: hydrocarbons and functional groups (structure, nomenclature, chemical properties).

V. Laboratory (5-10%)

The differences between college chemistry and the usual secondary school chemistry course are especially evident in the laboratory work. The AP Chemistry Examination includes some questions based on experiences and skills students acquire in the laboratory:

- making observations of chemical reactions and substances
- recording data
- calculating and interpreting results based on the quantitative data obtained
- communicating effectively the results of experimental work

Make-up Work

The Parent/Student handbook gives general guidelines for making up missing work. **The primary responsibility for making up missed work rests with the student.** The following specific procedures class should be noted:

- **For absences of fewer than three academic days** - All homework due during the period of absence will be graded by the student and submitted upon return to class. Missed tests and quizzes will be made up **after school** within as short of time as practicable.
- **For longer, unplanned absences** – Students will submit a written proposal with a timetable for the makeup of missed work. The proposal/timetable will be reviewed and approved or amended by the teacher, and must then be executed by the student. Failure to meet the timetable will result in a grade of zero being assigned for that particular piece of homework, quiz, or test.
- **For extended planned absences** – Students are responsible for determining, completing, and submitting all assignments due during the absence **prior to their departure.**
- **Students missing a lab** – If a student has missed a portion of a lab, the student must get with his/her lab partner to obtain the data and discuss the results of the lab. If a student misses an entire lab, a date and time for the makeup of missed labs will be announced in sufficient time for students to arrange their afternoon schedules. Missed lab assignments will be made up after school. If the student misses the makeup lab because of scheduling conflicts, a zero for that lab will be assigned unless prior arrangements have been previously made with me.

PCHS Honor Code

The PCHS Honor Code is based on the premise that PCHS students will not cheat, lie, or steal, nor tolerate those who do. During the Chemistry course, the following expectations will apply:

- **Tests and Quizzes:** All work must be performed individually using only the resources specifically authorized by the teacher. In this regard, use of a calculator is authorized.
- **Lab Reports:** All work must be performed by the student or students submitting the report. Students will generally be assigned to a group for Lab work. Students or students in a group may work cooperatively with one another or with other groups but their lab report may not be a copy of some other student's or group's work.
- **Homework assignments:** Students are encouraged to complete homework assignments cooperatively with other students, teachers, parents, mentors, and tutors as a means to enhance the learning and mastery of the process. By their nature, homework assignments are "open book." **On the other hand, the mere copying of another's work for submission and grading is prohibited by the Honor Code.**

