CHINO VALLEY UNIFIED SCHOOL DISTRICT
INSTRUCTIONAL GUIDE
CHEMISTRY ADVANCED PLACEMENT

Course Number	5418
Department	Science
Suggested guidelines	B or better in English 9 or 10 H, Chemistry, and Algebra 2 or higher mathematics or teacher recommendation
Length of Course	Two (2) semesters/One (1) year
Grade Level	11-12
Credit	5 units per semester/10 total credits - physical science
Repeatable	Not repeatable for credit
UC/CSU	Meets “d” laboratory science requirement
Board Approved	November 6, 2008

Description of Course - The Advanced Placement (AP) Chemistry course is designed to be taken only after the successful completion of a first course in high school chemistry. Students enrolled in Chemistry AP attain a depth of understanding of fundamentals and a reasonable competence in dealing with chemical problems. The course contributes to the development of the students’ abilities to think clearly and to express their ideas, orally and in writing, with clarity and logic. This course differs qualitatively from the regular high school Chemistry course with respect to the kind of textbook used, the topics covered, the emphasis on chemical calculations and the mathematical formulation of principles, and the kind of laboratory work done by students. Quantitative differences appear in the number of topics covered, the time spent on the course by students, and the nature and the variety of experiments done in the laboratory. This course fulfills the laboratory science requirement for UC admission and utilizes the Chemistry AP curriculum provided by the College Board.

Rationale for Course - The Chemistry AP course is designed to be the equivalent of the general chemistry course usually taken during the first year of college. For some students, this course enables them to take, as freshman, second-year course work in chemistry at their college or university or to enroll in courses in other fields where general chemistry is a prerequisite.

Student Selection - Admission to an AP course should depend on the student interest in the subject as well as on such formal credentials as an outstanding record of academic performance. Many highly motivated students with less-than-outstanding records have successfully completed AP courses and have obtained college credit, advanced placement, or both, through an AP Examination.

Standard 1 – Students will understand the principles and concepts of the structure of matter.

1.1 Objective: Understand atomic theory and atomic structure.

1.1.1 Performance Indicator: Students will be able to cite evidence for the atomic theory.

1.1.2 Performance Indicator: Students will be able to calculate atomic masses as determined by chemical and physical means.

1.1.3 Performance Indicator: Students will be able to determine atomic number and mass number of an element or an isotope.

1.1.4 Performance Indicator: Students will be able to determine electron energy levels including quantum numbers and atomic orbitals, with knowledge of atomic spectra.

1.1.5 Performance Indicator: Students will be able to determine periodic relationships including atomic radii, ionization energies, electron affinities, and oxidation states.

1.2 Objective: Understand the principles and concepts surrounding chemical bonding.

1.2.1 Performance Indicator: Students will be able to explain types of chemical binding forces including ionic, covalent, metallic, hydrogen bonding, and van der Waals (including London Dispersion forces).

1.2.2 Performance Indicator: Students will be able to explain relationships to states, structure, and properties of matter.

1.2.3 Performance Indicator: Students will be able to determine polarity of bonds and electronegativities.

1.2.4 Performance Indicator: Students will be able to determine and draw Lewis structures.

1.2.5 Performance Indicator: Students will be able to determine different valence bonds, including the hybridization of orbitals resonance, sigma and pi bonds.

1.2.6 Performance Indicator: Students will be able to discuss and use VSEPR theory.

1.2.7 Performance Indicator: Students will be able to determine the geometry of molecules and ions, structural isomerism of simple organic molecules and coordination complexes; dipole moments of molecules; and the relation of the properties to structure.

1.3 Objective: Understand principles and concepts surrounding nuclear chemistry.

1.3.1 Performance Indicator: Students will be able to write nuclear equations.

1.3.2 Performance Indicator: Students will be able to solve problems regarding half-lives.

1.3.3 Performance Indicator: Students will be able to explain radioactivity and chemical applications regarding nuclear chemistry.

Standard 2 - Students will understand principles and concepts regarding the states of matter.

2.1 Objective: Understand the principles and concepts regarding gases.

2.1.1 Performance Indicator: Students will be able to use the laws of ideal gases

2.1.2 Performance Indicator: Students will be able to calculate equations of state for an ideal gas.

2.1.3 Performance Indicator: Students will be able to calculate partial pressures.

2.1.4 Performance Indicator: Students will be able to explain Kinetic Molecular Theory

2.1.5 Performance Indicator: Students will be able to utilize Kinetic Molecular Theory to interpret ideal gas laws

2.1.6 Performance Indicator: Students will be able to utilize Kinetic Molecular Theory to explain Avogadro's hypothesis and the mole concept.

2.1.7 Performance Indicator: Students will be able to explain the dependence of kinetic energy of molecules on temperature.

2.1.8 Performance Indicator: Students will be able to explain deviations of real gases from ideal gas laws.

2.2 Objective: Understand the principles and concepts of liquids and solids.

2.2.1 Performance Indicator: Students will be able to explain liquids and solids form the kinetic-molecular viewpoint.

2.2.2 Performance Indicator: Students will be able to utilize phase diagrams of one-component systems.

2.2.3 Performance Indicator: Students will be able to identify changes of state, including critical points and triple points.

2.2.4 Performance Indicator: Students will be able to explain the structure of solids and the significance of lattice energies.

2.3 Objective: Understand principles and concepts of solutions.

2.3.1 Performance Indicator: Students will be able to differentiate types of solutions and factors affecting solubility.

2.3.2 Performance Indicator: Students will be able to utilize various methods of expressing concentration (use of normalities is not tested).

2.3.3 Performance Indicator: Students will be able to utilize Raoult's law and colligative properties (nonvolatile solutes), and their relationship to osmosis.

2.3.4 Performance Indicator: Students will be able to explain nonideal behavior in terms of qualitative aspects.

Standard 3 – Students will understand principles and concepts of reactions.

3.1 Objective: Understand the principles and concepts regarding reaction types.

3.1.1 Performance Indicator: Students will be able to write and interpret acid-base reactions.

3.1.2 Performance Indicator: Students will be able to explain concepts of Arrhenius, Brønsted-Lowry, and Lewis acids and bases.

3.1.3 Performance Indicator: Students will be able to explain coordination complexes and amphoterism.

3.1.4 Performance Indicator: Students will be able to write and explain precipitation reactions.

3.1.5 Performance Indicator: Students will be able to write and explain oxidation-reduction reactions.

3.1.6 Performance Indicator: Students will be able to identify oxidation numbers.

3.1.7 Performance Indicator: Students will be able to explain the role of the electron in oxidation-reduction.

3.1.8 Performance Indicator: Students will understand electrochemistry: identifying electrolytic and galvanic cells; use Faraday's laws; calculate half-cell potentials; use the Nernst equation; and predict the direction of redox reactions.

3.2 Objective: Be able to solve problems of Stoichiometry.

3.2.1 Performance Indicator: Students will be able to identify ionic and molecular species present in chemical systems and write net ionic equations.

3.2.2 Performance Indicator: Students will be able to balance equations, including redox equations.

3.2.3 Performance Indicator: Students will be able to calculate mass and volume with emphasis on the mole concept, including empirical formulas and limiting reactants.

3.3 Objective: Be able to solve equilibrium problems.

3.3.1 Performance Indicator: Students will be able to explain the concepts of physical and chemical dynamic equilibrium; utilize Le Chatelier's principle; and calculate equilibrium concepts.

3.3.2 Performance Indicator: Students will be able to calculate equilibrium constants for gaseous reactions: K_p, K_c.

3.3.3 Performance Indicator: Students will be able to calculate equilibrium constants for acid and base reactions; pK; and pH.

3.3.4 Performance Indicator: Students will be able to calculate solubility product constants and apply them to precipitation and the dissolution of slightly soluble compounds.

3.3.5 Performance Indicator: Students will be able to explain the common ion effect, the utilization of buffers, and hydrolysis.

3.4 Objective: Understand the principles and concepts of kinetics.

3.4.1 Performance Indicator: Students will be able to utilize the concept of rate of reaction.

3.4.2 Performance Indicator: Students will be able to use experimental data and graphical analysis to determine reactant order, rate constants, and reaction rate laws

3.4.3 Performance Indicator: Students will be able to explain the effect of temperature change on rates.

3.4.4 Performance Indicator: Students will be able to calculate the energy of activation, and explain the role of catalysts.

3.4.5 Performance Indicator: Students will be able to define the relationship between the rate-determining step and a mechanism.

3.5 Objective: Be able to state the functions of thermodynamics.

3.5.1 Performance Indicator: Students will be able to use the first law of thermodynamics: calculating changes in enthalpy; calculating heats of formation; calculating heats of reaction; utilizing Hess' Law; calculating heats of vaporization; and solving calorimetry problems.

3.5.2 Performance Indicator: Students will be able to use the second law of thermodynamics: calculating entropy; calculating free energy of formation; calculating free energy of reaction; and, explaining dependence of change in free energy on enthalpy and entropy changes.

3.5.3 Performance Indicator: Students will be able to explain the relationship of change in free energy to equilibrium constants and electrode potentials.

Standard 4 – Students will be able to use descriptive facts of chemistry, including the chemistry involved in environmental and societal issues.

4.1 Objective: Be able to utilize descriptive facts regarding chemical reactivity and products of chemical reactions.

4.1.1 Performance Indicator: Students will be able to utilize descriptive facts regarding chemical reactivity and products of chemical reactions.

4.2 Objective: Be able to utilize descriptive facts regarding relationships in the periodic table.

4.2.1 Performance Indicator: Students will be able to describe relationships and trends on the periodic table regarding the horizontal rows, vertical columns, and diagonals with examples from alkali metals, alkaline earth metals, halogens, and the first series of transition elements.

4.3 Objective: Be able to describe relationships surrounding organic chemistry.

4.3.1 Performance Indicator: Students will be able to explain the structure, nomenclature, and chemical properties of hydrocarbons and functional groups.

Standard 5 – Students will acquire experience and skills in college laboratory coursework.

Skills acquired in the laboratory should include:
- 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.

Because chemistry professors at some institutions ask to see a record of the laboratory work done by an AP students before making a decision about granting credit, placement, or both, in the chemistry program, students should keep a laboratory notebook that includes reports of their laboratory work in such a fashion that the reports can be readily reviewed.