Course Description for **Advanced Placement Chemistry (SCI261/262)**

DEPARTMENT: Science

GRADE: 11 and 12

LENGTH: One year

CREDITS: 10 (Ten)

PREREQUISITE: One year of Chemistry and a grade of "B" or better in Algebra I.

COURSE DESCRIPTION: This course meets the objectives of a first year college chemistry course, and is aligned to the advanced chemistry content standards. Students enrolled in this course should understand the fundamentals and attain a reasonable competence in chemical problems. Emphasis will be on chemical calculations and the mathematical formulations of principles supported by the laboratory work done by the students. Students will accumulate specific facts that are essential to enable students to comprehend the development of principles and concepts as applied to practical uses. This course is aligned to the California Science Content Standards.

EXIT CRITERIA: **Investigation and Experimentation**

Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept, and to address the content the other four strands, students should develop their own questions and perform investigations. Students will:

- Select and use appropriate tools and technology (such as computer-linked probes, spread sheets, and graphing calculators) to perform tests, collect data, analyze relationships, and display data.
- Identify and communicate sources of unavoidable experimental error.
- Identify possible reasons for inconsistent results, such as source of error or uncontrolled conditions.
- Formulate explanations using logic and evidence.
- Solve scientific problems using quadratic equations, and simple trigonometric, exponential, and logarithmic functions.
- Distinguish between hypothesis and theory as science terms.

- Recognize the use and limitations of models and theories as scientific representations of reality.

- Read and interpret topographic and geologic maps.

- Analyze the locations, sequences, or time intervals of natural phenomena (e.g., relative ages of rocks, locations of planets over time, and succession of species in an ecosystem).

- Recognize the issues of statistical variability and the need for controlled tests.

- Recognize the cumulative nature of scientific evidence.

- Analyze situations and solve problems that require combining and applying concepts from more than one area of science.

- Investigate a science-based societal issue by researching the literature, analyzing data, and communicating the findings. Examples include irradiation of food, cloning of animals by somatic cell nuclear transfer, choice of energy sources, and land and water use decisions in California.

- Know that when an observation does not agree with an accepted scientific theory, sometimes the observation is mistaken or fraudulent (e.g., Piltdown Man fossil or unidentified flying objects), and sometimes the theory is wrong (e.g., Ptolemaic model of the movement of the sun, moon and planets).

Atomic and Molecular Structure

The Periodic Table displays the elements in increasing atomic number and shows how periodicity of the physical and chemical properties of the elements relates to atomic structure. As a basis for understanding this concept, students know:

- How to use the Periodic Table to identify the lanthanides and actinides, and transactinide elements, and know that the transuranium elements were man made.

- How to relate the position of an element in the periodic table to its quantum electron configuration, and reactivity with other elements in the table.

- The experimental basis for Thomson's discovery of the electron, Rutherford's nuclear atom, Millikan's oil drop experiment, and Einstein's explanation of the photoelectric effect.

- The experimental basis for the development of the quantum theory of atomic structure and the historical importance of the Bohr model of the atom.

- Spectral lines are a result of transitions of electrons between energy levels. Their frequency is related to the energy spacing between levels using Planck's relationship (E=hn).

Chemical Bonds

Biological, chemical, and physical properties of matter result from the ability of atoms to form bonds based on electrostatic forces between electrons and protons, and between atoms and molecules. As a basis for understanding this concept, students know:

- How to predict the shape of simple molecules and their polarity from Lewis dot structures.

- How electronegativity and ionization energy relate to bond formation.

- How to identify solids and liquids held together by Van der Waals forces or hydrogen bonding, and relate these forces to volatility and boiling/melting point temperatures.

Conservation of Matter and Stoichiometry

The conservation of atoms in chemical reactions leads to the principle of conservation of matter and the ability to calculate the mass of products and reactants. As a basis for understanding this concept, students know:

- How to calculate percent yield in a chemical reaction.

- How to identify reactions that involve oxidation and reduction and how to balance oxidation-reduction reactions.

Gases and their Properties

The Kinetic Molecular theory describes the motion of atoms and molecules and explains the properties of gases. As a basis for understanding this concept, students know:

- The kinetic theory of gases relates the absolute temperature of a gas to the average kinetic energy of its molecules or atoms.
- How to solve problems using the ideal gas law in the form PV=nRT.
- How to apply Dalton's Law of Partial Pressures to describe the composition gases, and Graham's Law to describe diffusion of gases.

Acids and Bases

Acids, bases, and salts are three classes of compounds that form ions in water solutions. As a basis for understanding this concept, students know:

- The Arrhenius, Brønsted-Lowry, and Lewis acid-base definitions.
- How to calculate pH from the hydrogen ion concentration.
- Buffers stabilize pH in acid-base reactions.

Solutions

Solutions are homogenous mixtures of two or more substances. As a basis for understanding this concept, students know:

- The relationship between the molality of solute in a solution, and the solution's depressed freezing point or elevated boiling point.
- How molecules in solution are separated or purified by the methods of chromatography and distillation.

Chemical Thermodynamics

Energy is exchanged or transformed in all chemical reactions and physical changes of matter. As a basis for understanding this concept, students know:

- How to apply Hess's Law to calculate enthalpy change in a reaction.

- How to use the Gibbs free energy equation to determine whether a reaction would be spontaneous.

Reaction Rates

Chemical reaction rates depend on factors that influence the frequency of collision of reactant molecules. As a basis for understanding this concept, students know:

- The definition and role of activation energy in a chemical reaction.

Chemical Equilibrium

Chemical equilibrium is a dynamic process at the molecular level. As a basis for understanding this concept, students know:

- How to write and calculate an equilibrium constant expression for a reaction.

Organic and Biochemistry

The bonding characteristics of carbon lead to many different molecules with varied sizes, shapes, and chemical properties, providing the biochemical basis of life. As a basis for understanding this concept, students know:

- The system for naming the ten simplest linear hydrocarbons and isomers containing single bonds, simple hydrocarbons with double and triple bonds, and simple molecules containing a benzene ring.

- How to identify the functional groups which form the basis of alcohols, ketones, ethers, amines, esters, aldehydes, and organic acids.

- The R-group structure of amino acids and how they combine to form the polypeptide backbone structure of proteins.

Nuclear Processes

Nuclear processes are those in which an atomic nucleus changes, including radioactive decay of naturally occurring and man-made isotopes, nuclear fission, and nuclear fusion. As a basis for understanding this concept, students know:

- How to calculate the amount of a radioactive substance remaining after an integral number of half lives have passed.

- Protons and neutrons have substructure and consist of particles called quarks.

GRADING CRITERIA:

Activities	Percentages
Labs	30%
Assessment	40%
Class Assignments	30%

TEXTBOOKS:

Chemistry: The Central Science
Author: Brown, T.L. and LeMay, H.E., Jr.
Publisher: Prentice Hall
Copyright: 1981

Chemical Principles
Author: Masterton, W.L. and Slowinski, E.J.
Publisher: W.B. Saunders
Copyright: 1980

Chemistry One
Author: Knobler, C.M., Trueblood, K.N. and Waser, J.
Publisher: McGraw-Hill
Copyright: 1980

Revised: 4/20/00