Course Description for **P-Chemistry (SCI201/202)**

DEPARTMENT: Science

GRADE: 11-12

LENGTH: One year

CREDITS: 10 (Ten)

PREREQUISITE: Algebra I or equivalent

COURSE DESCRIPTION: The study of matter, structures, reactions, and changes. Students should posses curiosity, the ability to follow instructions, a respect for safety while dealing with chemicals, and knowledge of fundamental mathematics. This is a course designed to prepare the students to continue their studies in science at the college level. This course meets college entrance requirements, and is aligned with the chemistry content standards. The 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 sources 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.

- 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 relate the position of an element in the Periodic Table to its atomic number and atomic mass.

- How to use the Periodic Table to identify metals, semimetals, nonmetals, and halogens.

- How to use the Periodic Table to identify alkali metals, alkaline earth metals and transition metals, and trends in ionization energy, electronegativity, and the relative sizes of ions and atoms.

- How to use the Periodic Table to determine the number of electrons available for bonding.

- The nucleus is much smaller in size than the atom yet contains most of its mass.

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:

- Atoms combine to form molecules by sharing electrons to form covalent or metallic bonds, or by exchanging electrons to form ionic bonds.
- Chemical bonds between atoms in molecules such as H2, CH4, NH3, H2CCH2, N2, Cl2, and many large biological molecules are covalent.
- Salt crystals such as NaCl are repeating patterns of positive and negative ions held together by electrostatic attraction.
- In a liquid the inter-molecular forces are weaker than in a solid, so that the molecules can move in a random pattern relative to one-another.
- How to draw Lewis dot structures.

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 describe chemical reactions by writing balanced equations.
- The quantity one mole is defined so that one mole of carbon 12 atoms has a mass of exactly 12 grams.
- One mole equals 6.02x1023 particles (atoms or molecules).
- How to determine molar mass of a molecule from its chemical formula and a table of atomic masses, and how to convert the mass of a molecular substance to moles, number of particles or volume of gas at standard temperature and pressure.
- How to calculate the masses of reactants and products in a chemical reaction from the mass of one of the reactants or products, and the relevant atomic masses.

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 random motion of molecules and their collisions with a surface create the observable pressure on that surface.
- The random motion of molecules explains the diffusion of gases.
- How to apply the gas laws to relations between the pressure, temperature, and volume of any amount of an ideal gas or any mixture of ideal gases.
- The values and meanings of standard temperature and pressure (STP).
- How to convert between Celsius and Kelvin temperature scales.
- There is no temperature lower than 0 Kelvin.

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 observable properties of acids, bases and salt solutions.
- Acids are hydrogen-ion-donating and bases are hydrogen-ion-accepting substances.
- Strong acids and bases fully dissociate and weak acids and bases partially dissociate.
- How to use the pH scale to characterize acid and base solutions.

Solutions

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

- Definitions of solute and solvent.

- How to describe the dissolving process as a result of random molecular motion.

- Temperature, pressure, and surface area affect the dissolving process.

- How to calculate the concentration of a solute in terms of grams per liter, molarity, parts per million and percent composition.

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 describe temperature and heat flow in terms of the motion of molecules (or atoms).

- Chemical processes can either release (exothermic) or absorb (endothermic) thermal energy.

- Energy is released when a material condenses or freezes and absorbed when a material evaporates or melts.

- How to solve problems involving heat flow and temperature changes, using known values of specific heat, and latent heat of phase change.

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 rate of reaction is the decrease in concentration of reactants or the increase in concentration of products with time.

- How reaction rates depend on such factors as concentration, temperature, and pressure.

- The role a catalyst plays in increasing the reaction rate.

Chemical Equilibrium

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

- How to use LeChatelier's Principle to predict the effect of changes in concentration, temperature and pressure.

- Equilibrium is established when forward and reverse reaction rates are equal.

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:

- Large molecules (polymers) such as proteins, nucleic acids, and starch are formed by repetitive combinations of simple sub-units.

- The bonding characteristics of carbon lead to a large variety of structures ranging from simple hydrocarbons to complex polymers and biological molecules.

- Amino acids are the building blocks 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:

- Protons and neutrons in the nucleus are held together by strong nuclear forces which are stronger than the electromagnetic repulsion between the protons.

- The energy release per gram of material is much larger in nuclear fusion or fission reactions than in chemical reactions: change in mass (calculated by E=mc^2) is small but significant in nuclear reactions.

- Many naturally occurring isotopes of elements are radioactive, as are isotopes formed in nuclear reactions.

- The three most common forms of radioactive decay (alpha, beta, gamma) and how the nucleus changes in each type of decay.

- Alpha, beta, and gamma radiation produce different amounts and kinds of damage in matter and have different penetrations.

GRADING CRITERIA:	**Activities**	**Percentages**
	Daily Assignments/Written Expression and Problem Solving	40%
	Chapter Tests	30%
	Laboratory Experience/Reports	10%
	Library Investigations	10%
	Final Exam	10%

TEXTBOOK: **Modern Chemistry**

Author:	Raymond E. Davis, H. Clark Metcalfe, John E. Williams, Joseph F. Castka
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