



Pine Grove Area

SCHOOL DISTRICT

SCIENCE

ADVANCED PLACEMENT CHEMISTRY

September 18, 2008

I. PHILOSOPHY

The advanced placement chemistry course is designed for qualified college-oriented students, most of whom have a strong interest in science. A strong emphasis is put on the fact that AP Chemistry is a college-level course designed to take the place of two semesters of freshman inorganic chemistry, and, therefore, is fast-paced instruction.

The main objectives of this course are to strengthen student quantitative reasoning and problem-solving skills; hold students responsible for their own learning; have students learn the year's curriculum so that they have a solid foundation in chemistry; have students develop lab skills equivalent to those of college freshman; have students learn to work with other individuals successfully; and encourage a knowledge-based, positive attitude toward science/technology's influence on society.

II. CORE CONCEPTS

1. Matter and Measurement: Distinguish between and utilize: the Classification of Matter, Properties of Matter, Units of Measurement, Uncertainty in Measurement, and Dimensional Analysis to solve scientific problems.
2. Atoms, Molecules, and Ions: Distinguish between and name atoms, molecules, ions, and isotopes.
3. Stoichiometry: Holistically, problem solve using the fundamental ideas of the mole and stoichiometry.
4. Thermochemistry: Apply principles of energy conversion as it pertains to chemical reactions.
5. Electronic Structure of Atoms: Relate the wave nature of light and ideas from quantum theory to atomic structure, electron configurations, chemical bonding, and chemical reactivity.
6. Periodic Properties of the Elements: Recognize and utilize various periodic trends and patterns to predict chemical behavior.
7. Basic Concepts of Chemical Bonding, Molecular Geometry, and Bonding Theories: Utilize knowledge of atomic electronic structure to predict chemical bonding between atoms and ions and the relative geometry of the molecule or compound.
8. Gases, Liquids, Solids, and Intermolecular Forces: Analyze the role of intermolecular forces and the Kinetic Molecular Theory in determining states of matter for any substance.
9. Properties of Solutions: Recognize and convert between various solution concentrations and explain their properties.
10. Chemical Kinetics: Utilize equations to determine reaction rates.
11. Chemical Equilibrium: Apply quantitative and qualitative concepts of chemical equilibrium with a concentration in the area of Le Chatelier's Principle to solve scientific problems.
12. Chemical Thermodynamics: Relate chemical reactions to energy changes within a dynamic system.
13. Electrochemistry: Write electron transfer reactions and differentiate between voltaic and electrolytic cells.

14. Nuclear Chemistry: Write nuclear reactions, predict their products, and explain the impact of nuclear chemistry on society.

15. Organic Chemistry: Recognize and name simple organic compounds and predict products of organic reactions.

III. COURSE OF STUDY

- A. Course Name: Advanced Placement Chemistry
- B. Grade Level: 12th grade
- C. Length of Course: Full Year
 - 1. Frequency: Daily for two full periods a day
 - 2. Duration: 84 minutes total per day
- D. Academic Level: College Preparatory Level
- E. Credits: 2.00
- F. Prerequisites: B average or above in College Preparatory Chemistry and Algebra II
- G. Course Description:

The advanced placement chemistry course will prepare students for the AP Chemistry exam in accordance with the college board requirements. AP Chemistry is a college- level course designed to take the place of two semesters of freshman inorganic chemistry.

Lecture Program: Students will be required to develop their own notes during the interactive lecture conducted daily. Most of the non-lab classes are characterized by a discussion-question type of interaction. The course employs inquiry learning and teaching methods that are student driven prompted by teacher initiated questions. Students are expected to do 1-2 hours of homework a night.

Laboratory Program: Students will work in self-selected lab groups. Formal lab reports are required for each lab, and sometimes statistical analysis of class data is also required. Lab work is designed to be integral to the material currently being covered in the class.

IV. CONTENT: Advanced Placement Chemistry**CORE CONCEPT 1:** Matter and Measurement**MAJOR OBJECTIVES:** Distinguish between and utilize: the classification of matter, properties of matter, units of measurement, uncertainty in measurement, and dimensional analysis to solve scientific problems.

CURRICULUM STANDARD:			
PA State Standard/Student Expectation	Specific Content	Assessments	Resources/Materials
PA Standard 3.4.12. A Apply concepts about the structure and properties of matter Quantify the properties of matter.	Teacher will guide students to: Distinguish between physical and chemical properties and also between simple physical and chemical changes. Differentiate between the three states of matter. Distinguish between elements, compounds, and mixtures. Give the symbols for the elements. Determine the number of significant figures in a measured quantity. Express calculations with the correct amount of significant figures. Convert temperatures among the Fahrenheit, Celsius, and Kelvin scales. Utilize dimensional analysis to convert units. Perform density calculations.	Teacher evaluation of: Student white board work. Student class discussion. Student homework assignments. Student laboratory reports/notebooks. Student workbooks. Student tests/quizzes. Student video presentations. Student electronic portfolios.	Textbook Resources Computer programs/web sites Journals or notebooks Supplemental materials Scientific Calculators

CONTENT: Advanced Placement Chemistry

CORE CONCEPT 2: Atoms, Molecules, Ions, and Isotopes

MAJOR OBJECTIVE: Distinguish between and name atoms, molecules, ions, and isotopes.

CURRICULUM STANDARD:

State Standard/Student Expectation	Specific Content	Assessments	Resources/Materials
<p>PA Standard 3.4. 12. A</p> <p>Apply concepts about the structure and properties of matter</p> <p>Apply rules of systematic nomenclature and formula writing to chemical substances,</p> <p>Classify and identify important classes of compounds.</p>	<p>Teacher will guide students to:</p> <p>Describe the composition of an atom in terms of protons, neutrons and electrons.</p> <p>Give the approximate size, relative mass, and charge of an atom, proton, neutron and electron.</p> <p>Write the chemical symbol for an element, having been given its mass number and atomic number, and perform the reverse operation.</p> <p>Describe the properties of the electron as seen in cathode rays.</p> <p>Describe the means by which J.J. Thomas determined the ratio e/m for the electron.</p> <p>Describe Millikan's oil-drop experiment and indicate what property of the electron he was able to measure,</p> <p>Cite the evidence form studies of radioactivity for the existence of subatomic particles.</p>	<p>Teacher evaluation of:</p> <p>Student white board work.</p> <p>Student class discussion.</p> <p>Student homework assignments.</p> <p>Student laboratory reports/notebooks.</p> <p>Student workbooks.</p> <p>Student tests/quizzes.</p> <p>Student video presentations.</p> <p>Student electronic portfolios.</p>	<p>Textbook Resources</p> <p>Computer programs/web sites</p> <p>Journals or notebooks</p> <p>Supplemental materials</p> <p>Scientific Calculators</p>

CONTENT: Advanced Placement Chemistry

CORE CONCEPT 2: Atoms, Molecules, Ions, and Isotopes

MAJOR OBJECTIVE: Distinguish between and name atoms, molecules, ions, and isotopes.

CURRICULUM STANDARD:			
State Standard/Student Expectation	Specific Content	Assessments	Resources/Materials
PA Standard 3.4. 12. A (CONTINUED)	<p>Use the unit of amu in calculation of masses of atoms.</p> <p>Define the term atomic weight and calculate the atomic weight of an element given its natural distribution of isotopes and isotopic masses.</p> <p>Use the periodic table to determine the atomic number, atomic symbol, and atomic weight of an element.</p> <p>Define the terms group and period and recognize the common groups of elements.</p> <p>Use the periodic table to predict whether an element is metallic, nonmetallic, or metalloid.</p> <p>Define the term molecule and recognize which elements typically combine to form molecules.</p> <p>Distinguish between empirical and molecular formulas.</p> <p>Draw the structural and ball –and-stick-formulas of a substance given its chemical formula and the linkage between atoms.</p>		

CONTENT: Advanced Placement Chemistry

CORE CONCEPT 2: Atoms, Molecules, Ions, and Isotopes

MAJOR OBJECTIVE: Distinguish between and name atoms, molecules, ions, and isotopes.

CURRICULUM STANDARD:			
State Standard/Student Expectation	Specific Content	Assessments	Resources/Materials
PA Standard 3.4. 12. A (CONTINUED)	<p>Use the periodic table to predict the charges of monatomic ions of non-transition elements.</p> <p>Write the simplest formula of an ionic compound having been given the charges of ions from which it is made.</p> <p>Write the name of simple inorganic compounds having been given its chemical formula and perform the reverse reaction.</p> <p>Write and name the polyatomic ions.</p> <p>Write and name acids based on anions whose names end in -ide, -ate, and -ite.</p> <p>Write the name of simple binary molecular compounds and perform the reverse operation.</p> <p>Define the terms hydrocarbon, alkane, and alcohol and be able to name simple alkanes and alcohols, having been given the chemical formula. And perform the reverse operation.</p>		

CONTENT: Advanced Placement Chemistry

CORE CONCEPT 3: Stoichiometry

MAJOR OBJECTIVE: Holistically, problem solve using the fundamental ideas of the mole and stoichiometry.

CURRICULUM STANDARD:

State Standard/Student Expectation	Specific Content	Assessments	Resources/Materials
<p>PA Standard 3.4.12. A</p> <p>Apply concepts about the structure and properties of matter</p> <p>Quantify the properties of matter.</p> <p>Classify and describe, in equation form, types of chemical and/or nuclear reactions.</p>	<p>Teacher will guide students to:</p> <p>Balance chemical equations.</p> <p>Predict the products of a chemical reaction.</p> <p>Predict the products of the combustion reactions.</p> <p>Calculate the formula weight of a substance given its chemical formula.</p> <p>Recognize when to use formula weights and molecular weights in calculation.</p> <p>Calculate molar mass from a chemical formula.</p> <p>Convert between number of moles, mass, and number of particles.</p> <p>Calculate the empirical and molecular formula of a compound.</p> <p>Perform mass to mass calculations.</p>	<p>Teacher evaluation of:</p> <p>Student white board work.</p> <p>Student class discussion.</p> <p>Student homework assignments.</p> <p>Student laboratory reports/ notebooks.</p> <p>Student workbooks.</p> <p>Student tests/quizzes.</p> <p>Student video presentations.</p> <p>Student electronic portfolios.</p>	<p>Textbook Resources</p> <p>Computer programs/web sites</p> <p>Journals or notebooks</p> <p>Supplemental materials</p> <p>Scientific Calculators</p>

CONTENT: Advanced Placement Chemistry

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CURRICULUM STANDARD:			
State Standard/Student Expectation	Specific Content	Assessments	Resources/Materials
PA Standard 3.4.12. A (CONTINUED)	<p>Determine the limiting reagent.</p> <p>Determine theoretical and actual yields.</p> <p>Predict whether a substance is a non-electrolyte, strong electrolyte, or a weak electrolyte from its chemical behavior.</p> <p>Predict the ions formed by electrolytes they dissociate.</p> <p>Identify substances as acids, bases, or salts.</p> <p>Use solubility rules to predict whether a precipitate forms when electrolytic solutions are mixed.</p> <p>Predict the products of metathesis reactions.</p> <p>Identify the spectator ions and write the net ionic equations for solution reactions.</p> <p>Determine whether a chemical reaction involves oxidation and reduction.</p>		

CONTENT: Advanced Placement Chemistry

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CURRICULUM STANDARD:			
State Standard/Student Expectation	Specific Content	Assessments	Resources/Materials
PA Standard 3.4.12. A (CONTINUED)	Use the activity series to predict whether a reaction will occur. Use formulas to convert between molarity, molality, ppm, ppb, volume, mass, and number of moles.		

CONTENT: Advanced Placement Chemistry

CORE CONCEPT 4: Thermochemistry

MAJOR OBJECTIVE: Apply principles of energy conversion as it pertains to chemical reactions.

CURRICULUM STANDARD:

State Standard/Student Expectation	Specific Content	Assessments	Resources/Materials
<p>PA Standard 3.4.12.B</p> <p>Apply and analyze energy sources and conversion and their relationship to heat and temperature.</p> <p>Determine the heat involved in illustrative chemical reactions.</p> <p>Evaluate mathematical formulas that calculate the efficiency of specific chemical and mechanical systems.</p> <p>Apply appropriate thermodynamic concepts to solve problems relating to energy and heat</p>	<p>Teacher will guide students to:</p> <p>Give examples of different forms of energy.</p> <p>List the important units in which energy is expressed and convert form one to another.</p> <p>Define the first law of thermodynamics both verbally and by means of an equation.</p> <p>Describe how the change in internal energy of a system is related to the exchanges of heat and work between the system and its surroundings.</p> <p>Define the term state function and describe its importance.</p> <p>Define enthalpy and relate the enthalpy change in a process occurring at constant pressure to the heat added to or lost by the system during the process.</p> <p>Illustrate and interpret an energy diagram.</p> <p>Utilize formulas to calculate q, ΔT, C, mass, and or ΔH.</p>	<p>Teacher evaluation of:</p> <p>Student white board work.</p> <p>Student class discussion.</p> <p>Student homework assignments.</p> <p>Student laboratory reports/notebooks.</p> <p>Student workbooks.</p> <p>Student tests/quizzes.</p> <p>Student video presentations.</p> <p>Student electronic portfolios.</p>	<p>Textbook resources</p> <p>Computer programs/web sites</p> <p>Journal or notebook</p> <p>Supplemental materials</p>

CONTENT: Advanced Placement Chemistry

CORE CONCEPT 4: Thermochemistry

MAJOR OBJECTIVE: Apply principles of energy conversion as it pertains to chemical reactions.

CURRICULUM STANDARD:			
State Standard/Student Expectation	Specific Content	Assessments	Resources/Materials
PA Standard 3.4.12.B (CONTINUED)	Define the terms heat capacity and specific heat. Define and calculate fuel value. List the major sources of energy on which humankind must depend, and discuss the likely availability of these for the foreseeable future. State Hess's law and apply it to calculate ΔH . Define and illustrate what is meant by the term standard state. Define and utilize standard heat of formation.		

CONTENT: Advanced Placement Chemistry

CORE CONCEPT 5: Electronic Structure of Atoms

MAJOR OBJECTIVE: Relate the wave nature of light and ideas from quantum theory to atomic structure, electron configurations, chemical bonding, and chemical reactivity.

CURRICULUM STANDARD:

State Standard/Student Expectation	Specific Content	Assessments	Resources/Materials
<p>PA Standard 3.4.12.C</p> <p>Apply the principles of force and motion.</p> <p>Evaluate wave properties of frequency, wavelength, and speed.</p>	<p>Teacher will guide students to:</p> <p>Describe the wave properties and characteristic speed propagation of radiant energy (EMR).</p> <p>Use the relationship $\lambda\nu = c$.</p> <p>Explain the essential feature of Planck's quantum theory.</p> <p>Explain how Einstein accounted for the photoelectric effect.</p> <p>Explain the origin of the expression line spectra.</p> <p>List the assumptions made by Bohr use to create his Hydrogen Model.</p> <p>Calculate the energy differences between any two allowed energy states of an electron.</p> <p>Explain the concept of ionization energy.</p> <p>Calculate the characteristic λ of a particle from a working knowledge of mass and velocity.</p>	<p>Teacher evaluation of:</p> <p>Student white board work.</p> <p>Student class discussion.</p> <p>Student homework assignments.</p> <p>Student laboratory reports/notebooks.</p> <p>Student workbooks.</p> <p>Student tests/quizzes.</p> <p>Student video presentations.</p> <p>Student electronic portfolios.</p>	<p>Textbook resources</p> <p>Computer programs/web sites</p> <p>Journal or notebook</p> <p>Supplemental materials</p>

CONTENT: Advanced Placement Chemistry

CORE CONCEPT 5: Electronic Structure of Atoms

MAJOR OBJECTIVE: Relate the wave nature of light and ideas from quantum theory to atomic structure, electron configurations, chemical bonding, and chemical reactivity

CURRICULUM STANDARD:			
State Standard/Student Expectation	Specific Content	Assessments	Resources/Materials
PA Standard 3.4.12.C (CONTINUED)	<p>Describe the uncertainty principle.</p> <p>Explain the concepts of orbital, electron density, and probability as used in the quantum mechanical model of an atom.</p> <p>Explain the significance of ψ^2.</p> <p>Describe the quantum numbers n, l, m_l, m_s.</p> <p>Describe the shapes of s,p,and d orbitals.</p> <p>State the Pauli Exclusion Principal and Hund's Rule.</p> <p>Write the electron configuration, valence electron configuration , and orbital notation- diagram for any element.</p> <p>Describe what is meant by s, p, d, and f blocks of elements.</p>		

CONTENT: Advanced Placement Chemistry

CORE CONCEPT 6: Periodic Properties of Elements

MAJOR OBJECTIVE: Recognize and utilize various periodic trends and patterns to predict chemical behavior.

CURRICULUM STANDARD:

State Standard/Student Expectation	Specific Content	Assessments	Resources/Materials
<p>PA Standard 3.4.10.A</p> <p>Explain concepts about the structure and properties of matter</p> <p>Explain the repeating patterns of chemical properties by using the repeating patterns of atomic structure within the periodic table.</p>	<p>Teacher will guide students to:</p> <p>Explain why the periodic table can be viewed as a classification scheme.</p> <p>Explain periodic table development from a historical perspective.</p> <p>Define the periodic trends in Z_{eff}.</p> <p>Explain the variations in bonding atomic radii among the elements.</p> <p>Predict relative size of atoms based on their position on the periodic table.</p> <p>Explain the variation in ion size among the elements.</p> <p>Explain the observed changes in values of successive ionization energies for a given atom.</p> <p>Explain the variations in electron affinities among the elements and predict the periodic trends within a family or a period.</p> <p>Describe the periodic trends in metallic and nonmetallic behavior.</p>	<p>Teacher evaluation of:</p> <p>Student white board work.</p> <p>Student class discussion.</p> <p>Student homework assignments.</p> <p>Student laboratory reports/notebooks.</p> <p>Student workbooks.</p> <p>Student tests/quizzes.</p> <p>Student video presentations.</p> <p>Student electronic portfolios.</p>	<p>Textbook resources</p> <p>Computer programs/web sites</p> <p>Journal or notebook</p> <p>Supplemental materials</p>

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MAJOR OBJECTIVE: Recognize and utilize various periodic trends and patterns to predict chemical behavior.

CURRICULUM STANDARD:			
State Standard/Student Expectation	Specific Content	Assessments	Resources/Materials
PA Standard 3.4.10.A (CONTINUED)	<p>Describe the general difference in chemical reactivity between metals and nonmetals.</p> <p>Describe the general and physical chemical behavior of alkali and alkali earth metals, and explain how their chemistry relates to their position on the periodic table.</p> <p>Recognize and write family specific chemical reactions.</p> <p>Explain the very low chemical reactivity of the noble gas elements.</p>		

CONTENT: Advanced Placement Chemistry

CORE CONCEPT 7: Basic Concepts of Chemical Bonding and Molecular Geometry

MAJOR OBJECTIVE: Utilize knowledge of atomic electronic structure to predict chemical bonding between atoms and ions and the relative geometry of the molecule or compound.

CURRICULUM STANDARD:

State Standard/Student Expectation	Specific Content	Assessments	Resources/Materials
<p>PA Standard 3.4.10.A</p> <p>Explain concepts about the structure and properties of matter</p> <p>Explain the formation of compounds and their resulting properties using bonding theories (ionic and covalent).</p>	<p>Teacher will guide students to:</p> <p>Determine the number of valence electrons for any atom and write its Lewis symbol.</p> <p>Recognize when the octet rule applies to the arrangement for electron in the valence shell for an atom.</p> <p>Define lattice energy.</p> <p>Predict the formulas of ionic compounds.</p> <p>Describe a covalent bond in terms of sharing electron density between bonded atoms.</p> <p>Describe the formation of a covalent bond using Lewis symbols.</p> <p>Describe a single, double, and triple covalent bond.</p> <p>Explain the significance of electronegativity in bond polarity.</p>	<p>Teacher evaluation of:</p> <p>Student white board work.</p> <p>Student class discussion.</p> <p>Student homework assignments.</p> <p>Student laboratory reports/ notebooks.</p> <p>Student workbooks.</p> <p>Student tests/quizzes.</p> <p>Student video presentations.</p> <p>Student electronic portfolios.</p>	<p>Textbook resources</p> <p>Computer programs/web sites</p> <p>Journal or notebook</p> <p>Supplemental materials</p>

CONTENT: Advanced Placement Chemistry

CORE CONCEPT 7: Basic Concepts of Chemical Bonding and Molecular Geometry

MAJOR OBJECTIVE: Utilize knowledge of atomic electronic structure to predict chemical bonding between atoms and ions and the relative geometry of the molecule or compound.

CURRICULUM STANDARD:			
State Standard/Student Expectation	Specific Content	Assessments	Resources/Materials
PA Standard 3.4.10.A (CONTINUED)	<p>Predict the bond polarity of covalent bonds.</p> <p>Write resonance forms for molecules or polyatomic ions.</p> <p>Relate bond enthalpies to bond strength and estimate ΔH for reactions.</p> <p>Relate the number of electron domains in the valence shell of an atom in a molecule to the geometrical arrangement around that atom.</p> <p>Explain why nonbonding electron domains exert a greater repulsive interaction on other domains than do bonding electron domains</p> <p>Predict the geometrical structure of a molecule or ion from its Lewis structure.</p> <p>Predict form molecular shape and the electronegativities of the atoms involved, whether a molecule can have a dipole moment.</p>		

CONTENT: Advanced Placement Chemistry

CORE CONCEPT 7: Basic Concepts of Chemical Bonding and Molecular Geometry

MAJOR OBJECTIVE: Utilize knowledge of atomic electronic structure to predict chemical bonding between atoms and ions and the relative geometry of the molecule or compound.

CURRICULUM STANDARD:			
State Standard/Student Expectation	Specific Content	Assessments	Resources/Materials
PA Standard 3.4.10.A (CONTINUED)	Calculate formal charge. Calculate bond order. Explain the concept of hybridization and its relationship to geometrical structure. Assign hybridization to valence orbitals of an atom in a molecule, knowing the number and geometrical arrangement of atoms to which it is bonded. Formulate the bonding in a molecule in terms of π bonds and σ bonds. Define M.O. Theory. Explain the relationship between bonding and anti-bonding molecular orbitals. Construct a M.O. energy level diagram.		

CONTENT: Advanced Placement Chemistry

CORE CONCEPT 8: Gases, Liquids, Solids, and Intermolecular Forces

MAJOR OBJECTIVE: Analyze the role of intermolecular forces and the Kinetic Molecular Theory in determining states of matter for any substance.

CURRICULUM STANDARD:

State Standard/Student Expectation	Specific Content	Assessments	Resources/Materials
<p>PA Standard 3.4.12.A</p> <p>Explain concepts about the structure and properties of matter.</p> <p>Explain how forces that bind solids, and liquid, and gases effect their properties.</p>	<p>Teacher will guide students to:</p> <p>Describe the general characteristics of gases as compared to other states of matter and list the ways in which gases are distinct.</p> <p>Define and convert between various pressure units.</p> <p>Describe how a gas responds to changes in pressure, volume, temperature, and quantity of gas.</p> <p>Utilize gas law equations.</p> <p>Define and calculate mole fraction and partial pressures of gases.</p> <p>Describe the relationship that exists between average speed of a gas molecule and temperature.</p> <p>Predict rates of effusion and diffusion based on molar mass of a gas.</p>	<p>Teacher evaluation of:</p> <p>Student white board work.</p> <p>Student class discussion.</p> <p>Student homework assignments.</p> <p>Student laboratory reports/notebooks.</p> <p>Student workbooks.</p> <p>Student tests/quizzes.</p> <p>Student video presentations.</p> <p>Student electronic portfolios.</p>	<p>Textbook resources</p> <p>Computer programs/web sites</p> <p>Journal or notebook</p> <p>Supplemental materials</p>

CONTENT: Advanced Placement Chemistry

CORE CONCEPT 8: Gases, Liquids, Solids, and Intermolecular Forces

MAJOR OBJECTIVE: Analyze the role of intermolecular forces and the Kinetic Molecular Theory in determining states of matter for any substance.

CURRICULUM STANDARD:			
State Standard/Student Expectation	Specific Content	Assessments	Resources/Materials
PA Standard 3.4.12.A (CONTINUED)	<p>Use the principles of the Kinetic – Molecular Theory of gases to explain the nature of gas pressure and temperature.</p> <p>Differentiate between and calculate the ideal and real gases.</p> <p>Employ the Kinetic –Molecular Theory to explain the differences in gas, liquid, and solid matter.</p> <p>Describe the various types of intermolecular attractive forces and state the kinds of intermolecular forces expected for a substance given its molecular structure.</p> <p>Explain the meaning of the terms: viscosity, surface tension, critical temperature, and critical pressure.</p> <p>Explain the way in which the vapor pressure of a substance changes with intermolecular forces and temperature.</p> <p>Predict the type of solid.</p>		

CONTENT: Advanced Placement Chemistry

CORE CONCEPT 9: Properties of Solutions

MAJOR OBJECTIVE: Recognize and convert between various solution concentrations and explain their properties.

CURRICULUM STANDARD:

State Standard/Student Expectation	Specific Content	Assessments	Resources/Materials
<p>PA Standard 3.4.12 A</p> <p>Explain concepts about the structure and properties of matter.</p> <p>Explain how the forces that bind solids, liquids and gases affect their properties.</p>	<p>Teacher will guide students to:</p> <p>Describe the energy changes that occur in the solution process.</p> <p>Rationalize the solubility of substance given a set of solubility rules.</p> <p>Determine the role of disorder in the solution process.</p> <p>Define and convert between various solution concentration units.</p> <p>Utilize several concentration based equations to solve scientific problems.</p> <p>Describe how a colloid differs from a true solution.</p> <p>Define unsaturated, saturated, supersaturated, miscible and immiscible.</p>	<p>Teacher evaluation of:</p> <p>Student white board work.</p> <p>Student class discussion.</p> <p>Student homework assignments.</p> <p>Student laboratory reports/notebooks.</p> <p>Student workbooks.</p> <p>Student tests/quizzes.</p> <p>Student video presentations.</p> <p>Student electronic portfolios.</p>	<p>Textbook resources</p> <p>Computer programs/web sites</p> <p>Journal or notebook</p> <p>Supplemental materials</p>

CONTENT: Advanced Placement Chemistry

CORE CONCEPT 10: Chemical Kinetics

MAJOR OBJECTIVE: Utilize equations to determine reaction rates.

CURRICULUM STANDARD:

State Standard/Student Expectation	Specific Content	Assessments	Resources/Materials
<p>PA Standard 3.4.12.A</p> <p>Apply concepts about the structure and properties of matter.</p> <p>Explain how radioactive isotopes that are subject to decay can be used to estimate the age of materials.</p>	<p>Teacher will guide students to:</p> <p>Express the rate of a given reaction in terms of the variation in concentration of a reactant or product substance with time.</p> <p>Calculate the average rate, instantaneous rate, rate constant, reactant concentration, and half life.</p> <p>Determine the rate law, order of the reactants, overall order of the reaction, the rate determining step, activation energy, and the effect of a catalyst on the energy requirements for a reaction.</p> <p>Explain how enzymes act as biological catalysts using the lock-and-key model.</p>	<p>Teacher evaluation of:</p> <p>Student white board work.</p> <p>Student class discussion.</p> <p>Student homework assignments.</p> <p>Student laboratory reports/notebooks.</p> <p>Student workbooks.</p> <p>Student tests/quizzes.</p> <p>Student video presentations.</p> <p>Student electronic portfolios.</p>	<p>Textbook resources</p> <p>Computer programs/web sites</p> <p>Journal or notebook</p> <p>Supplemental materials</p>

CONTENT: Advanced Placement Chemistry

CORE CONCEPT 11: Chemical Equilibrium

MAJOR OBJECTIVE: Apply quantitative and qualitative concepts of chemical equilibrium with a concentration in the area of Le Chatelier's Principle to solve scientific problems.

CURRICULUM STANDARD:

State Standard/Student Expectation	Specific Content	Assessments	Resources/Materials
<p>PA Standard 3.4.12.A</p> <p>Apply concepts about the structure and properties of matter.</p> <p>Quantify the properties of matter.</p>	<p>Teacher will guide students to:</p> <p>Write the equilibrium constant expression for a chemical system.</p> <p>Interpret and explain K_c.</p> <p>Calculate the reaction quotient and by comparison with K_c determine whether a reaction is at equilibrium.</p> <p>Predict what a change in a variable will do to the equilibrium present.</p> <p>Describe the effect of a catalyst on a system as it approaches equilibrium.</p> <p>List the general properties of acids and bases.</p> <p>Differentiate between the Bronsted-Lowry, and the Arrhenius definition of an acid or a base.</p> <p>Identify the conjugate acid – base pairs of a chemical system.</p>	<p>Teacher evaluation of:</p> <p>Student white board work.</p> <p>Student class discussion.</p> <p>Student homework assignments.</p> <p>Student laboratory reports/ notebooks.</p> <p>Student workbooks.</p> <p>Student tests/quizzes.</p> <p>Student video presentations.</p> <p>Student electronic portfolios.</p>	<p>Textbook resources</p> <p>Computer programs/web sites</p> <p>Journal or notebook</p> <p>Supplemental materials</p>

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CURRICULUM STANDARD:

State Standard/Student Expectation	Specific Content	Assessments	Resources/Materials
PA Standard 3.4.12.A (CONTINUED)	Calculate pH, K_a , K_b , K_{sp} , and percent ionization. Predict whether a salt solution will be acidic, basic or neutral. Explain how bond polarity affects acid strength. Predict the relative strengths of oxyacids, and solutions of metal salts. Discuss the common ion effect in detail. Explain a buffered system. Describe the form of a titration curve. Determine the equivalence point in an acid – base titration. Set up the expression for K_{sp} .		

CONTENT: Advanced Placement Chemistry

CORE CONCEPT 12: Chemical Thermodynamics

MAJOR OBJECTIVE: Relate chemical reactions to energy changes within a dynamic system.

CURRICULUM STANDARD:			
State Standard/Student Expectation	Specific Content	Assessments	Resources/Materials
<p>PA Standard 3.4.12.B</p> <p>Apply and analyze energy sources and conversions and their relationship to heat and temperature.</p> <p>Apply appropriate thermodynamic concepts to solve problems relating to energy and heat</p>	<p>Teacher will guide students to:</p> <p>Define the terms spontaneous, spontaneity, reversible, irreversible as applied them to chemical reactions.</p> <p>Describe how entropy is related to the total number of microstates in a thermodynamic system.</p> <p>State the 0th, 1st, and 2nd law of thermodynamics.</p> <p>Calculate K, ΔS, ΔG, and ΔH.</p> <p>Explain in detail Gibbs Free Energy.</p>	<p>Teacher evaluation of:</p> <p>Student white board work.</p> <p>Student class discussion.</p> <p>Student homework assignments.</p> <p>Student laboratory reports/notebooks.</p> <p>Student workbooks.</p> <p>Student tests/quizzes.</p> <p>Student video presentations.</p> <p>Student electronic portfolios.</p>	<p>Textbook resources</p> <p>Computer programs/web sites</p> <p>Journal or notebook</p> <p>Supplemental materials</p>

CONTENT: Advanced Placement Chemistry

CORE CONCEPT 13: Electrochemistry

MAJOR OBJECTIVE: Write electron transfer reactions and differentiate between voltaic and electrolytic cells.

CURRICULUM STANDARD:

State Standard/Student Expectation	Specific Content	Assessments	Resources/Materials
<p>PA Standard 3.4.12.B</p> <p>Apply and analyze energy sources and conversions and their relationship to heat and temperature.</p> <p>Use knowledge of oxidation and reduction to balance complex reactions.</p>	<p>Teacher will guide students to:</p> <p>Identify the oxidizing agent and reducing agent in a redox reaction.</p> <p>Balance simple oxidation-reduction reactions by oxidation number method and half reaction method.</p> <p>Diagram a simple voltaic and electrolytic cell.</p> <p>Predict reaction spontaneity.</p> <p>Calculate emf.</p> <p>Interconvert E°, ΔG°, and K.</p> <p>Utilize the Nerst Equation.</p> <p>Differentiate between a lead storage battery, dry cell, and the nickel-cadmium cell.</p> <p>Calculate the maximum electrical work required for an electrolytic process.</p>	<p>Teacher evaluation of:</p> <p>Student white board work.</p> <p>Student class discussion.</p> <p>Student homework assignments.</p> <p>Student laboratory reports/notebooks.</p> <p>Student workbooks.</p> <p>Student tests/quizzes.</p> <p>Student video presentations.</p> <p>Student electronic portfolios.</p>	<p>Textbook resources</p> <p>Computer programs/web sites</p> <p>Journal or notebook</p> <p>Supplemental materials</p>

CONTENT: Advanced Placement Chemistry

CORE CONCEPT 14: Nuclear Chemistry

MAJOR OBJECTIVE: Write nuclear reactions and their predict products; and explain the impact of nuclear chemistry on society.

CURRICULUM STANDARD:

State Standard/Student Expectation	Specific Content	Assessments	Resources/Materials
<p>PA Standard 3.4.12.A</p> <p>Apply concepts about the structure and properties of matter.</p> <p>Apply the conservation of energy to fields as diverse as mechanics, nuclear particles and studies of the origin of the universe.</p> <p>Apply the predictability of nuclear decay to estimate the age of materials that contain radioactive isotopes.</p>	<p>Teacher will guide students to:</p> <p>Write the nuclear symbols for protons, neutrons, electrons, alpha particles, and positrons.</p> <p>Complete and balance nuclear equations, having been given all but one of the particles involved.</p> <p>Write a nuclear reaction.</p> <p>Determine the effects of different types of decay.</p> <p>Calculate binding energies.</p> <p>Use half life, age of an object, or the remaining amount of radioisotope.</p> <p>Use Einstein's relationship $E=mc^2$, to calculate the energy or mass change of a reaction.</p> <p>Explain the operation of a Geiger counter.</p> <p>Explain the penetrating power and effect of various forms of radiation.</p>	<p>Teacher evaluation of:</p> <p>Student white board work.</p> <p>Student class discussion.</p> <p>Student homework assignments.</p> <p>Student laboratory reports/ notebooks.</p> <p>Student workbooks.</p> <p>Student tests/quizzes.</p> <p>Student video presentations.</p> <p>Student electronic portfolios.</p>	<p>Textbook resources</p> <p>Computer programs/web sites</p> <p>Journal or notebook</p> <p>Supplemental materials</p>

CONTENT: Advanced Placement Chemistry

CORE CONCEPT 14: Nuclear Chemistry

MAJOR OBJECTIVE: Write nuclear reactions and their predict products; and explain the impact of nuclear chemistry on society.

CURRICULUM STANDARD:			
State Standard/Student Expectation	Specific Content	Assessments	Resources/Materials
PA Standard 3.4.12.A (CONTINUED)	Define fission and fusion. Describe the operation of a nuclear power plant.		

CONTENT: Advanced Placement Chemistry

CORE CONCEPT 15: Organic Chemistry

MAJOR OBJECTIVE: Recognize and name simple organic compounds and predict products of organic reactions.

CURRICULUM STANDARD:

State Standard/Student Expectation	Specific Content	Assessments	Resources/Materials
<p>PA Standard 3.4.10.A</p> <p>Explain concepts about the structure and properties of matter.</p> <p>Understand that carbon can form several types of compounds.</p>	<p>Teacher will guide students to:</p> <p>List four groups of hydrocarbons and draw the structural formula from each group of alkanes, alkenes, alkynes.</p> <p>Write the names and formulas of the first 10 members of the alkane series.</p> <p>Write the IUPAC name of various hydrocarbons.</p> <p>Give examples of isomerism in organic compounds.</p> <p>Predict the products of addition reactions.</p> <p>Explain in detail the chemistry of aromatic hydrocarbons.</p> <p>Identify and name functional groups.</p>	<p>Teacher evaluation of:</p> <p>Student white board work.</p> <p>Student class discussion.</p> <p>Student homework assignments.</p> <p>Student laboratory reports/ notebooks.</p> <p>Student workbooks.</p> <p>Student tests/quizzes.</p> <p>Student video presentations.</p> <p>Student electronic portfolios.</p>	<p>Textbook resources</p> <p>Computer programs/web sites</p> <p>Journal or notebook</p> <p>Supplemental materials</p>

V. EXPECTED LEVELS OF ACHIEVEMENT

A. Students are expected to reach the proficient level of achievement, including all of the skills noted in the specific content area of this curriculum.

B. Grading system for AP Chemistry is as follows:

Grading Scale	
A	90-100
B	80-89
C	70-79
D	60-69
F	0-59

C. Each student's grade will be determined at the conclusion of each marking period. Progress notes will be issued half-way throughout each marking period for students who are performing below 70%.