FREEHOLD REGIONAL HIGH SCHOOL DISTRICT

OFFICE OF CURRICULUM AND INSTRUCTION

SCIENCE AND ENGINEERING SPECIALIZED LEARNING CENTER

ADVANCED PLACEMENT CHEMISTRY

COURSE PHILOSOPHY

The Advanced Placement Chemistry course is designed to prepare academically talented science students for the Advanced Placement Chemistry examination and to enable these gifted students to develop their science skills and to possibly receive college credit for Chemistry studied in high school. In addition the course is designed to give these students a full appreciation of the principles of Chemistry through the integrated experiences of lab work, problem solving, and class discussions.

COURSE DESCRIPTION

Grade Level: 10

Department: Science & Engineering Specialized Learning Center

Course Title: Advanced Placement Chemistry

Credits: 5

Course Code: 170450

BOARD OF EDUCATION ADOPTION DATE: AUGUST 31, 2009

FREEHOLD REGIONAL HIGH SCHOOL DISTRICT

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`Course Philosophy

The Advanced Placement Chemistry course is designed to prepare academically talented science students for the Advanced Placement Chemistry examination and to enable these gifted students to develop their science skills and to possibly receive college credit for Chemistry studied in high school. In addition the course is designed to give these students a full appreciation of the principles of Chemistry through the integrated experiences of lab work, problem solving, and class discussions.

Chemistry has impacted our lives profoundly in this modern age of Science .Those students selecting careers related to Chemistry should acquire critical thinking skills, application skills, presentation skills, and the skills to "think beyond the box". The SE/Advanced Placement program helps in reaching these goals by providing an opportunity for the students to take a college level Chemistry course in High School.

Course Description

The AP Chemistry course is designed to be the equivalent of the general Chemistry course usually taken during the first college year. For some students, this course enables them to undertake, as freshmen, second year work in the Chemistry sequence at their institution or to register in courses in other fields where general chemistry is a prerequisite. For other students, the AP Chemistry course fulfills the laboratory science requirement and frees time for other courses.

AP Chemistry should meet the objectives of a good Chemistry course. Students in such a course should attain a depth of understanding of fundamentals and a reasonable competence in dealing with chemical problems. The course should contribute to the development of the students' abilities to think clearly and to express their ideas, orally and in writing with clarity and logic. The college course in general chemistry differs qualitatively from the usual first secondary school course in chemistry 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 the students. Quantitative differences appear in the number of topics treated, the time spent on the course by students, and the nature and variety of experiments done in the laboratory.

Students study the structure of matter, kinetic theory of gases, chemical equilibria, chemical kinetics, and the basic concepts of thermo-dynamics. Students use computers, instruments, and techniques found in a college chemistry laboratory course. AP Chemistry is designed to qualify the student for placement and college credit for chemistry.

Freehold Regional High School District
Curriculum Map

Advanced Placement Chemistry

Relevant Standards [1]	Enduring Understandings	Essential Questions	Assessments		
			Diagnostic (before)	Formative (during)	Summative (after)
UNIT 1 5.1 B 1&2, & C; 5.2 B 2; 5.3 A-D; 5.4 1;	Chemistry is a quantitative science. Significant Figures are used in measurements to indicate precision. Dimensional analysis is a powerful tool in problem solving. Matter is divided into two broad categories.	How are mathematical, physical, and computational tools used to make predictions and interpret evidence in order to solve problems in chemistry? How is matter categorized and differentiated?	Pretest from summer assignment Oral Questions/ Discussion Anticipatory Set Questions	Self-study assignments Oral questions & discussions Problem sets Design & perform a lab Quizzes Inquiry manipulative puzzle Use of multimedia presentations	Formal Lab Report Research Paper Scenario Questions Unit Test including multiple choice & free response Performance assessment
UNIT 2 5.1 B 1&2, C; 5.2 B 1-3; 5.3 A & D; 5.4 A; 5.6 A 1,2,5;	Three main fundamental particles make up an atom. Atoms are the building blocks of matter. Elements are the building blocks of molecules & compounds. The periodic table is a helpful tool in chemistry. All compounds are molecules but not all molecules are compounds.	How do the various models of the atom explain its structure and function? How does the periodic table organize matter? How are atoms, elements, compounds and molecules differentiated and what role to they play in reactions?	Pop-quiz on reading assignment		

Relevant Standards [1]	Enduring Understandings	Essential Questions	Assessments		
			Diagnostic (before)	Formative (during)	Summative (after)
UNIT 3 5.1 B 1 & 2, C; 5.2 B 2 & 3; 5.3 A, B & D; 5.4 A 1; 5.6 A 6	A mole is a counting unit in chemistry and represents a very large number. The mass of one mole of substance is known as molar mass. A molecular formula gives the actual number of each element in a compound. A balanced equation gives a lot of quantitative information. Limiting reactants determine the maximum amount of product.	How does the conservation of atoms in chemical reactions lead to the ability to calculate the mass of products and reactants using the mole concept? To what extent do limiting reactants affect a chemical reaction?	Basic problem set on mole conversions and stoichiometry Oral Questions/ Discussion Anticipatory Set Questions Problem set based on pre-reading Questions based on pre-reading	Do now's Oral questions & discussions Cooperative group problem solving Lab activities Pop-quizzes	Formal lab report Group lab practical Take-home test Unit Test including multiple choice & free response
UNIT 4 5.1 B & C; 5.3 A, B; 5.4 B, C; 5.6 A;	Solution concentration can be expressed in several ways. Chemical compounds can be acids, bases or salts. A reaction can be represented by a molecular equation. A reaction can be represented by an ionic equation. Net ionic equations can be used for quantitative equations.	How are solutions formed? How are chemical equations classified and differentiated? How can stoichiometry be used to solve reactions taking place in solution?			
Unit 5 5.1 B & C; 5.2 A & B; 5.3 A-D; 5.4 A & B; 5.6 A; 5.7 B;	Light is form of electromagnetic radiation. The Bohr model is the bases for the present day model of the atom. The Quantum mechanical model of the atom is based on the dual nature of the electron. Electrons are arranged systematically in an atom following a set of rules. There are three types of elements on the periodic table based on electron arrangement	How does the organization of the Periodic Table illustrate commonality and patterns of physical and chemical properties among the elements? To what extent are the physical and chemical properties of matter related to electron configuration?			

Relevant Standards [1]	Enduring Understandings	Essential Questions	Assessments		
			Diagnostic (before)	Formative (during)	Summative (after)
Unit 6 5.1 A-C; 5.2 B; 5.3 A & D; 5.4 A & B; 5.6 B;	There are 2 major types of bonding. Valence electrons are involved in bonding. Lewis structures indicate bonding and non-bonding electrons. The strength of a covalent bond depends on the type of the covalent bond. Covalent bonds can polar or non polar based on the electronegativities of the atoms. Resonance is the delocalization of the multiple bond due to the pi bonds. Concept of formal charge helps choose the preferred Lewis structure when more than 1 structure for a compound. The VSEPR theory helps predict shape, bond angle & polarity of molecules. Polarity of a molecule need not be the same as the polarity of the bond in the molecule. Covalent bonds can be sigma or pi bonds. Atoms generally use hybrid orbitals for bonding. Intermolecular forces hold molecules together. There are 4 types of intermolecular forces holding molecules & compounds together.	Why do chemical bonds form and what factors determine the types of bonds formed between atoms?	Pre-reading assignment HW questions based on pre-reading assignment	Quizzes Do now's Oral questions & discussions Pop-quizzes Cooperative group problem solving Lab activities	Formal lab reports Unit Test including multiple choice & free response

Relevant Standards [1]	Enduring Understandings	Essential Questions	Assessments		
			Diagnostic (before)	Formative (during)	Summative (after)
Unit 7 5.1 A-C; 5.3 A-D; 5.4 A-C; 5.6 B; 5.7 B	The first Law of Thermodynamics is the law of conservation of energy. Enthalpy is a state function; It is an extensive property. Enthalpy is an extensive property of the system. Heat changes in chemical or physical processes can be calculated using calorimetry. Hess's Law uses the fact that enthalpy is a state function. Formation of any compound results in a change in enthalpy.	Why is there is a natural tendency for a system to move in the direction of disorder or entropy? How does the First Law of Thermodynamics explain what happens when substances are heated in closed systems? How are enthalpy and entropy related?	Pre-reading Discussion questions re reading	Oral questions & discussions Lab activitites Quizzes	Formal lab reports Multiple choice & free response test
Unit 8 5.1 A-C; 5.2 A & B; 5.3 A-D; 5.4 A & B; 5.6 A;	All gases exhibit similar physical properties since they follow a basic set of gas laws. The ideal gas law equation relates pressure, volume, temperature and the number of moles of a gas. R is the universal gas law constant whose units are dependant on pressure and volume units. The density of a gas is related to the molar mass of the gas. The kinetic theory provides an explanation of gas behavior. Gases diffuse from an area of high to low concentration. Gases diffuse through small holes on the surface. All gases are real; Real gases become ideal when they obey the gas laws.	How does the Kinetic Theory of Matter explain the behavior of gases? How do the various gas laws explain the relationship between pressure and volume, volume and temperature, pressure and temperature, and the number of particles in a gas sample?	Problem set based on pre-reading Oral Questions/ Discussion Anticipatory Set Questions	Do now's Oral questions & discussions Pop-quizzes Cooperative group problem solving Lab activities	Formal lab reports Research paper Multiple choice & free response test

Relevant Standards [1]	Enduring Understandings	Essential Questions	Assessments		
			Diagnostic (before)	Formative (during)	Summative (after)
Unit 9 5.1 B & C; 5.2 B; 5.3 A-D; 5.4 B;	Formation of a solution is either exothermic or endothermic. Concentration of a solution can be expressed in several ways. There are several factors that affect solubility. Colligative properties depend on the number of particles present not on the identity.	How do the driving forces of chemical reactions, energy and entropy, affect solution formation? How can the concentration of solutions be calculated in terms of molarity, molality and percent by mass? How do various factors affect solubility?	Reading assignment Discussion based on reading assignment Pre-assigned set of questions based on text book	Oral questions & discussions Pop-quizzes Cooperative group problem solving Lab activities	Formal lab reports Multiple choice & free response test
Unit 10 5.1 B & C; 5.3 A,B & D; 5.4 B; 5.6 B;	Several factors affect the rate of a reaction. There are two types of rate laws. Reaction mechanisms always have a slow step that controls the overall rate of a reaction.	To what extent do factors such as temperature, mixing, concentration, particle size, and surface area affect the rates of chemical reactions and how can this be modeled?			
Unit 11 5.1 A-C; 5.2 B; 5.3 A-D; 5.4 A & B;	All reactions attain a state of equilibrium. There are two types of equilibria. The reaction quotient predicts the direction of equilibrium. Several definitions exist for acids & bases. Acids & bases can be weak or strong. Acid & base dissociation constants determine the strengths of acids & bases. A buffer solution resists changes in pH. The pH of a buffer solution can be found using the Henderson-Hasselbach Equation. The presence of a common ion affects the equilibrium of a system. All insoluble salts have a slight solubility due to which an equilibrium exists between the dissolved & undissolved portion of the salt. Equilibrium constant written for a solubility equilibrium is called the solubility product.	How do chemical reactions attain a state of equilibrium and what factors affect the maintenance of equilibrium? To what extent are acids and bases important in numerous chemical processes that occur around us, from industrial to biological processes, from the laboratory to the environment?			

Relevant Standards [1]	Enduring Understandings	Essential Questions	Assessments		
			Diagnostic (before)	Formative (during)	Summative (after)
Unit 12 5.1 B & C; 5.3 A-D; 5.4 B & C;	A spontaneous process is one that happens with no external influence. The first law of thermodynamics describes the conservation of energy. Entropy measures the disorder in a system. The sign of ΔG controls the entropy of a process. The ΔG & equilibrium are related.	Why is there is a natural tendency for a system to move in the direction of disorder or entropy? How does the First Law of Thermodynamics explain what happens when substances are heated in closed systems? How are enthalpy and entropy related?	Pre-reading	Discussion based on pre-reading Q & A Quizzes Labs	Formal lab report Multiple choice & free response test
Unit 13 5.1 B & C; 5.2 B; 5.3 A-C; 5.4 B;	A spontaneous redox reaction produces an electric current in an electrochemical cell. The sign of the cell potential indicates the spontanaeity of the process. Cell potential is related to free energy change. Change in concentration changes cell potential. An electric current produces a redox reaction in an electrolytic cell so the cell process is not spontaneous and is called electrolysis.	How are oxidation and reduction reactions described? How are oxidation-reduction reactions involved with electrochemical and electrolytic cells?			
Unit 14 5.3 A, C & D; 5.7 A	Heavy nuclei tend to undergo radioactive decay. There are several different types of radioactive decay. Fission & fusion reactions produce an enormous amount of energy.	How do nuclear reactions (fission and fusion) convert very small amounts of matter into energy? How can nuclear reactions be both beneficial and dangerous?	Pre-reading	Discussion based on pre-reading Q & A Quizzes	Research paper Multiple choice & free response test

Relevant Standards [1]	Enduring Understandings	Essential Questions	Assessments		
			Diagnostic (before)	Formative (during)	Summative (after)
Unit 15 5.1 B & C; 5.4 B,C	The study of carbon and its compounds is separate branch of chemistry called organic chemistry. Carbon forms a large number of compounds since it can form four bonds. The common elements found in organic compounds are carbon, hydrogen, oxygen and nitrogen. There are several classes of organic compounds based on functional groups. Functional groups determine reactivity. There is a systematic way of naming organic compounds. Process by which soap is manufactured is called saponification. Esterification produces compounds that have pleasant and unpleasant odors.	To what extent is organic chemistry different from inorganic chemistry? Why is organic chemistry important?	Pre-reading from a given tutorial	Class discussion questions Labs	Take home test including multiple choice & open-ended questions

Freehold Regional High School District
Course Proficiencies and Pacing

Advanced Placement Chemistry

Unit Title	Unit Understandings and Goals	Recommended Duration
Unit #1: Matter and Measurement	Chemistry is a quantitative science. Significant Figures are used in measurements to indicate precision. Dimensional analysis is a powerful tool in problem solving. Matter is divided into two broad category. 1. Students will understand that scientific processes, unit conversions, data analysis, and safety procedures are essential to comprehensive study of Advanced Placement Chemistry and proper laboratory procedure.	1 week
Unit #2: Elements, Molecules & Ions	Three main fundamental particles make up an atom. Atoms are the building blocks of matter. Elements are the building blocks of molecules & compounds. The periodic table is a helpful tool in chemistry. All compounds are molecules but not all molecules are compounds. 1. Students will understand that subatomic particles define an atom. 2. The periodic table is an important tool in chemistry due to its organized arrangement. 3. All molecules can be represented by a formula that can be written using a set of rules.	2 weeks
Unit #3: Stoichiometry, Calculations with Chemical Formulas	A mole is a counting unit in chemistry and represents a very large number. The mass of one mole of substance is known as molar mass. A molecular formula gives the actual number of each element in a compound. A balanced equation gives a lot of quantitative information. Limiting reactants determine the maximum amount of product. Students will understand that: 1. There are six main types of chemical reactions; 2. The products of a chemical reaction can be predicted using a set of rules. 3. Stoichiometry is a method of problem solving using balanced equations.	2 weeks
Unit #4: Aqueous Reactions & Solution Stoichiometry	Solution concentration can be expressed in several ways. Chemical compounds can be acids, bases or salts. A reaction can be represented by a molecular equation. A reaction can be represented by an ionic equation. Net ionic equations can be used for quantitative equations. Students will understand that: 1. A solution is made up of two parts. 2. Substances soluble in water should be represented in their ionic forms in net ionic equations. 3. Stoichiometry is a method of problem solving in aqueous solutions.	2 weeks

Unit Title	Unit Understandings and Goals	Recommended Duration
Unit #5: Electronic Structure of Atoms, Periodic Properties of the Elements	Light is form of electromagnetic radiation. The Bohr model is the bases for the present day model of the atom. The Quantum mechanical model of the atom is based on the dual nature of the electron. Electrons are arranged systematically in an atom following a set of rules. There are three types of elements on the periodic table based on electron arrangement. 1. Students will understand that electrons are arranged systematically in an atom; 2. There is a relationship between the valence configurations of the atoms and their position on the periodic table. 3. Some physical properties of the atom show a periodic trend.	3 weeks
Unit #6: Basic Concepts of Bonding; Molecular Geometry & Bonding Theories; Intermolecular Forces, Liquids & Solids	There are 2 major types of bonding. Valence electrons are involved in bonding. Lewis structures indicate bonding and non-bonding electrons. The strength of a covalent bond depends on the type of the covalent bond. Covalent bonds can polar or non polar based on the electro negativities of the atoms. Resonance is the delocalization of the multiple bonds due to the pi bonds. Concept of formal charge helps choose the preferred Lewis structure when more than 1 structure for a compound. The VSEPR theory helps predict shape, bond angle & polarity of molecules. Polarity of a molecule need not be the same as the polarity of the bond in the molecule. Covalent bonds can be sigma or pi bonds. Atoms generally use hybrid orbitals for bonding. Intermolecular forces hold molecules together. There are 4 types of intermolecular forces holding molecules & compounds together. Students will understand that: 1. Atoms can bond by transferring or sharing electrons. 2. Lewis structures can used to show bonding and non bonding electron in a molecule. 3. Shapes of molecules can be predicted using the VSEPR Model. 4. Molecules typically use hybrid orbitals for bonding. 5. Molecules are held together by intermolecular forces. 6. Changes in phase of matter can be represented by phase diagrams.	3 weeks
Unit #7: Thermochemistry	The first Law of Thermodynamics is the law of conservation of energy. Enthalpy is a state function; It is an extensive property. Enthalpy is an extensive property of the system. Heat changes in chemical or physical processes can be calculated using calorimetry. Hess's Law uses the fact that enthalpy is a state function. Formation of any compound results in a change in enthalpy. Students will understand that: 1. Thermochemistry is a section of thermodynamics. 2. Enthalpy is a state function. 3. There are several ways to determine the heat of reaction.	1 week

Unit Title	Unit Understandings and Goals	Recommended Duration
Unit #8: Gases	All gases exhibit similar physical properties since they follow a basic set of gas laws. The ideal gas law equation relates pressure, volume, temperature and the number of moles of a gas. R is the universal gas law constant whose units are dependant on pressure and volume units. The density of a gas is related to the molar mass of the gas. The kinetic theory provides an explanation of gas behavior. Gases diffuse from an area of high to low concentration. Gases diffuse through small holes on the surface. All gases are real; Real gases become ideal when they obey the gas laws. Students will understand that: 1. The KMT defines the properties of gases. 2. An ideal gas obeys all of the gas laws. 3. Gases tend to deviate from ideal behavior under certain conditions. 4. The ideal gas equation related pressure, volume, temperature & the # of moles of a gas. 5. Diffusion/Effusion are related to the molar mass of a gas.	2 weeks
Unit #9: Solutions	Formation of a solution is either exothermic or endothermic. Concentration of a solution can be expressed in several ways. There are several factors that affect solubility. Colligative properties depend on the number of particles present not on the identity. 1. Students will understand that several concentration units can be used to specify the concentration of a solution. 2. Colligative properties depend on the # of particles present in the solution, not the identity. 3. The solution process is either endothermic or exothermic.	1 week
Unit #10: Kinetics	Several factors affect the rate of the reaction. There are two types of rate laws. Reaction mechanisms always have a slow step that controls the overall rate of a reaction. 1. Students will understand that chemical kinetics provides the kinetic control for a reaction. 2. The rate of a reaction can be controlled by changing the factors that affect the rate. 3. Rate laws can be integrated or differential. 4. A reaction mechanism shows how a reaction happens. 5. The slow step controls the overall rate of the reaction.	2 weeks
Unit #11: Chemical Equilibrium, Acid-Base Equilibrium & Solubility Equilibrium	All reactions attain a state of equilibrium. There are two types of equilibria. The reaction quotient predicts the direction of equilibrium. Several definitions exist for acids & bases. Acids & bases can be weak or strong. Acid & base dissociation constants determine the strengths of acids & bases. A buffer solution resists changes in pH. The pH of a buffer solution can be found using the Henderson-Hasselbach Equation. The presence of a common ion affects the equilibrium of a system. All insoluble salts have a slight solubility due to which equilibrium exists between the dissolved & undissolved portion of the salt. Equilibrium constant written for solubility equilibrium is called the solubility product.	6 weeks

Unit Title	Unit Understandings and Goals	Recommended Duration
	Students will understand that: 1. Chemical reactions can be reversible. 2. Reversible reactions attain a state of equilibrium. 3. Chemical equilibrium is dynamic not static. 4. Reaction quotients can be used to predict the direction of a reaction. 5. Le Chatelier's Principle can be used to predict a how an equilibrium system under stress will react. 6. Acids & bases can be defined in several ways. 7. Dissociation of weak acids/bases results in an equilibrium. 8. Acid & base dissociation constants define the strengths of weak acids &/or bases. 9. A buffer solution resists changes in pH. 10. The common ion effect produces a buffer solution. 11. Titration curves indicate characteristics of several types of acid-base titrations. 12. All insoluble salts have a certain degree of solubility. 13. Precipitation can be predicted using ion product and solubility products values.	
Unit #12: Thermodynamics	A spontaneous process is one that happens with no external influence. The first law of thermodynamics describes the conservation of energy. Entropy measures the disorder in a system. The sign of ΔG controls the entropy of a process. The ΔG & equilibrium are related. Students will understand that: 1. All chemical & physical processes are accompanied by heat and energy changes. 2. There are three basic laws of thermodynamics. 3. The entropy of the universe is always increasing. 4. 4. The sign of ΔG determines the spontaneity of a process.	1 week
Unit #13: Electrochemistry	A spontaneous redox reaction produces an electric current in an electrochemical cell. The sign of the cell potential indicates the spontaneity of the process. Cell potential is related to free energy change. Change in concentration changes cell potential. An electric current produces a redox reaction in an electrolytic cell so the cell process is not spontaneous and is called electrolysis. Students will understand that: 1. A redox reaction produces electrical energy in an electrochemical cell (voltaic cell). 2. Passing electricity through an electrolyte produces a redox reaction in an electrolytic cell. 3. A voltaic cell can produce a cell potential. 4. The process in a voltaic cell is spontaneous. 5. The process in an electrolytic cell is non spontaneous. 6. 6. Cell potential can change with concentration.	1 week

Unit Title	Unit Understandings and Goals	Recommended Duration
Unit #14: Nuclear Chemistry, Coordination Chemistry	Heavy nuclei tend to undergo radioactive decay. There are several different types of radioactive decay. Fission & fusion reactions produce an enormous amount of energy. Students will understand that: 1. There are several fundamental particles. 2. Heavy atoms undergo radioactive decay. 3. Nuclear fission and fusion reactions produce an enormous amount of energy. 4. Nuclear equations can be written for nuclear reactions. 5. Complex ion reactions can be used to characterize the identity of an atom (qualitative analysis).	3 days
Unit #15: Organic Chemistry	The study of carbon and its compounds is separate branch of chemistry called organic chemistry. Carbon forms a large number of compounds since it can form four bonds. The common elements found in organic compounds are carbon, hydrogen, oxygen and nitrogen. There are several classes of organic compounds based on functional groups. Functional groups determine reactivity. There is a systematic way of naming organic compounds. Process by which soap is manufactured is called saponification. Esterification produces compounds that have pleasant and unpleasant odors. Students will understand that: 1. The IUPAC system provides a systematic way of nomenclature for organic compounds. 2. Functional groups characterize organic compounds. 3. Reactivity of organic compounds depends on the type of groups.	1 week
	2-2 1/2 Weeks for AP Test Review; **Weeks following, will be spent doing labs and projects.**	

Freehold Regional High School District
Advanced Placement Chemistry

Unit #1: Matter and Measurement

Enduring Understandings: Chemistry is a quantitative science.
Significant Figures are used in measurements to indicate precision.
Dimensional analysis is a powerful tool in problem solving.
Matter is divided into two broad category.

Essential Questions: How are mathematical, physical, and computational tools used to make predictions and interpret evidence in order to solve problems in chemistry?
How is matter categorized and differentiated?

Unit Goal: Students will understand that scientific processes, unit conversions, data analysis, and safety procedures are essential to comprehensive study of Advanced Placement Chemistry and proper laboratory procedure.

Duration of Unit: 1 weeks

NJCCCS: 5.1 B 1&2, & C; 5.2 B 2; 5.3 A-D; 5.4 1;

Guiding / Topical Questions	Content, Themes, Concepts, and Skills	Instructional Resources and Materials	Teaching Strategies	Assessment Strategies
What is the difference between qualitative and quantitative observations? Give another name for quantitative observations. What is the difference between accuracy and precision? What is an uncertain digit in measurement? How many uncertain digits are allowed in a measurement? What is the factor label method? What is matter?	Read assigned section from text to get answers for the 1st six questions. Solve ap level problems using the factor label method. Apply the concept of significant figures when doing calculations.	Textbook, Problem sets	Student centered lecture on problem solving using dimensional analysis. Labs: Go OverLab Safety procedures Physical Chemical Changes Separate a mixture of sand and salt and find the percent composition of the mixture Post lab discussion	Quiz based on Homework problems set Pop quiz Unit test Lab quiz on safety Formal lab write up Lab presentation Maintain a lab note book
Suggestions on how to differentiate in this unit: A chance to retake quiz & test for averaged points; Alternate Labs				

Freehold Regional High School District
Advanced Placement Chemistry

Unit #2: Elements, Molecules and Ions

Enduring Understandings: Three main fundamental particles make up an atom.
Atoms are the building blocks of matter.
Elements are the building blocks of molecules & compounds.
The periodic table is a helpful tool in chemistry.
All compounds are molecules but not all molecules are compounds.

Essential Questions: How do the various models of the atom explain its structure and function?
How does the periodic table organize matter?
How are atoms, elements, compounds and molecules differentiated and what role to they play in reactions?

Unit Goals: Students will understand that **s**ubatomic particles define an atom.
Students will understand that the periodic table is an important tool in chemistry due to its organized arrangement.
Students will understand that all molecules can be represented by a formula that can be written using a set of rules.

Duration of Unit: 2 weeks

NJCCCS: 5.1 B 1&2, C; 5.2 B 1-3; 5.3 A & D; 5.4 A; 5.6 A 1,2,5;

Guiding / Topical Questions	Content, Themes, Concepts, and Skills	Instructional Resources and Materials	Teaching Strategies	Assessment Strategies
What are the main subatomic particles of the atom and what are their characteristics? What is atomic number & mass number? How do isotopes of an atom differ? Why is atomic weight of an element a weighted average? Which scientist is credited with the modern design of the periodic table? What are the basic features of the periodic table? What are ions and how do they form? What is the difference between ionic and molecular compounds?	Pre reading skills….. Self learn assigned concepts and apply Relevant problem solving Use the periodic table appropriately Write formulas of compounds Name compounds	Textbook, Problem sets Worksheet packets Online resources Teaching transparencies Power point	Demos Student centered lectures using transparencies/power point Lab(s): Find % of water in a hydrate AP type Lab essays will be included as post lab questions Presentations	Quiz based on Homework problems set Pop quiz Unit test Lab quiz Lab presentation Formal lab write up Maintain a lab note book
<u>Suggestions on how to differentiate in this unit</u>: A chance to retake quiz & test for averaged points; cooperative group problem solving; teacher assists individually as needed.				

Freehold Regional High School District
Advanced Placement Chemistry

Unit #3: Stoichiometry, Calculations with Chemical Formulas

Enduring Understandings: A mole is a counting unit in chemistry and represents a very large number.
The mass of one mole of substance is known as molar mass.
A molecular formula gives the actual number of each element in a compound.
A balanced equation gives a lot of quantitative information.
Limiting reactants determine the maximum amount of product.

Essential Questions: How does the conservation of atoms in chemical reactions lead to the ability to calculate the mass of products and reactants using the mole concept?
To what extent do limiting reactants affect a chemical reaction?

Unit Goals: Students will understand that there are six main types of chemical reactions;
Students will understand that the products of a chemical reaction can be predicted using a set of rules.
Students will understand that the stoichiometry is a method of problem solving using balanced equations.

Duration of Unit: 2 weeks

NJCCCS: 5.1 B 1 & 2, C; 5.2 B 2 & 3; 5.3 A, B & D; 5.4 A 1; 5.6 A 6

Guiding / Topical Questions	Content, Themes, Concepts, and Skills	Instructional Resources and Materials	Teaching Strategies	Assessment Strategies
What is a mole? What is the meaning of an empirical, molecular & structural formula? Why must a chemical equation be balanced? What do the coefficients in a balanced equation represent? What are mole ratios? What are limiting & excess reactants? What is theoretical, experimental and percent yields?	Pre reading skills….. Self learn assigned concepts and apply Relevant problem solving Lab skills	Textbook, Problem sets Worksheet packets Online resources Teaching transparencies Power point	Demos Student centered lectures using transparencies/power point Labs: Determination of the empirical formula of a compound Determination of mass and mole relationship in a chemical reaction AP type Lab essays will be included as post lab questions Presentations	Quiz based on Homework problems set Pop quiz Unit test Lab quiz Lab presentation Formal lab write up Maintain a lab note book
Suggestions on how to differentiate in this unit: A chance to retake quiz & test for averaged points; cooperative group problem solving; teacher assists individually as needed;				

Freehold Regional High School District
Advanced Placement Chemistry

Unit #4: Aqueous Reactions & Solution Stoichiometry

Enduring Understandings: Solution concentration can be expressed in several ways.
Chemical compounds can be acids, bases or salts.
There are seven main types of chemical reactions.
A reaction can be represented by a molecular equation.
A reaction can be represented by an ionic equation.
Net ionic equations can be used for quantitative equations.

Essential Questions: How are solutions formed?
How are chemical equations classified and differentiated?
How can stoichiometry be used to solve reactions taking place in solution?

Unit Goals: Students will understand that a solution is made up of two parts.
Students will understand that substances soluble in water should be represented in their ionic forms in net ionic equations.
Students will understand that stoichiometry is a method of problem solving in aqueous solutions.

Duration of Unit: 2 weeks

NJCCCS: 5.1 B & C; 5.3 A, B; 5.4 B, C; 5.6 A;

Guiding / Topical Questions	Content, Themes, Concepts, and Skills	Instructional Resources and Materials	Teaching Strategies	Assessment Strategies
How do you express solution concentration? How do you determine solubility? What are acids, bases & salts? How do you classify equations? What are net ionic equations? How can stoichiometry be used to solve problems using a balanced equation?	Pre reading skills….. Self learn assigned concepts and apply Relevant problem solving Lab skills	Textbook, Problem sets Worksheet packets Online resources Teaching transparencies Power point	Demos/Presentations Student centered lectures using transparencies/power point Labs: Determination of molar concentration using an acid base itration Determination of percent yield of a reaction by applying the concept of a limiting reactant Analytical gravimetric analysis: Find the percent of carbonate in the given carbonate by gravimetric analysis Standardize a given solution of KMnO4 by carrying out a redox titration Find the percent of hydrogen peroxide by mass in hydrogen peroxide solution available over the counter. Qualitative Analysis: Identification of cations and anions AP type Lab essays will be included as post lab questions	Quiz based on Homework problems set Pop quiz Unit test Lab quiz Lab presentation Formal lab write up Maintain a lab note book
<u>Suggestions on how to differentiate in this unit</u>: A chance to retake quiz & test for averaged points; cooperative group problem solving; teacher assists individually as needed.				

Freehold Regional High School District
Advanced Placement Chemistry

Unit #5: Electronic Structure of Atoms, Periodic Properties of the Elements

Enduring Understandings: Light is form of electromagnetic radiation.
The Bohr model is the bases for the present day model of the atom.
Matter exhibits dual behavior.
The Quantum mechanical model of the atom is based on the dual nature of the electron.
Electrons are arranged systematically in an atom following a set of rules.
Physical and chemical properties are related to electronic structure.
There are three types of elements on the periodic table based on electron arrangement.

Essential Questions: How does the organization of the Periodic Table illustrate commonality and patterns of physical and chemical properties among the elements?
To what extent are the physical and chemical properties of matter related to electron configuration?

Unit Goals: Students will understand that electrons are arranged systematically in an atom;
Students will understand that there is a relationship between the valence configurations of the atoms and their position on the periodic table.
Students will understand that some physical properties of the atom show a periodic trend.

Duration of Unit: 3 weeks

NJCCCS: 5.1 B & C; 5.2 A & B; 5.3 A-D; 5.4 A & B; 5.6 A; 5.7 B;

Guiding / Topical Questions	Content, Themes, Concepts, and Skills	Instructional Resources and Materials	Teaching Strategies	Assessment Strategies
What is electromagnetic radiation made up of? How does the Bohr model address the fact that energy is quantized? What is the particle-wave duality of matter? How is the quantum mechanical model different from the Bohr model? How do you write electron configurations for atoms & ions? How does electron structure affect ionization energy, electronegativity, etc……? How are elements classified as metals, non-metals or metalloids?	Pre reading skills….. Self learn assigned concepts and apply Relevant problem solving both qualitative and quantitative Lab skills	Textbook, Problem sets Worksheet packets Online resources Teaching transparencies Power point	Demos Student centered lectures using transparencies/power point Labs: Observe bright line spectrum through a spectroscope a. flame tests b. Gas discharge tubes(spectrum tubes) Determination of activity series of metals AP type Lab essays will be included as post lab questions Presentations	Quiz based on Homework problems set Pop quiz Unit test Lab quiz Lab presentation Formal lab write up Maintain a lab note book
Suggestions on how to differentiate in this unit: A chance to retake quiz & test for averaged points; cooperative group problem solving; teacher assists individually as needed.				

Freehold Regional High School District
Advanced Placement Chemistry

Unit #6: Basic Concepts of Bonding; Molecular Geometry & Bonding Theories; Intermolecular Forces, Liquids & Solids

Enduring Understandings: There are 2 major types of bonding; valence electrons are involved in bonding.
Lewis structures indicate bonding and non-bonding electrons.
The strength of a covalent bond depends on the type of the covalent bond.
Covalent bonds can polar or non polar based on the electronegativities of the atoms.
Resonance is the delocalization of the multiple bond due to the pi bonds.
Concept of formal charge helps choose the preferred Lewis structure when more than 1 structure for a compound.
The VSEPR theory helps predict shape, bond angle & polarity of molecules.
Polarity of a molecule need not be the same as the polarity of the bond in the molecule.
Covalent bonds can be sigma or pi bonds.
Atoms generally use hybrid orbitals for bonding.
Intermolecular forces hold molecules together.
There are 4 types of intermolecular forces holding molecules & compounds together.

Essential Questions: Why do chemical bonds form and what factors determine the types of bonds formed between atoms?

Unit Goals: Students will understand that atoms can bond by transferring or sharing electrons.
Students will understand that Lewis structures can used to show bonding and non bonding electron in a molecule.
Students will understand that shapes of molecules can be predicted using the VSEPR Model.
Students will understand that molecules typically use hybrid orbitals for bonding.
Students will understand that molecules are held together by intermolecular forces.
Students will understand that changes in phase of matter can be represented by phase diagrams.

Duration of Unit: 3 weeks

NJCCCS: 5.1 A-C; 5.2 B; 5.3 A & D; 5.4 A & B; 5.6 B;

Guiding / Topical Questions	Content, Themes, Concepts, and Skills	Instructional Resources and Materials	Teaching Strategies	Assessment Strategies
What are the major characteristics of the different types of bonding? How do you draw Lewis structures? What are the different types of covalent bonds? Define resonance. What is the difference between the resonance and hybrid structure? When does a covalent bond become polar? How do you predict polarity of a bond? What is the difference between a sigma and pi bond?	Pre reading skills….. Self learn assigned concepts and apply Relevant problem solving Lab skills	Textbook, Problem sets Worksheet packets Online resources Teaching transparencies	Demos Student centered lectures using transparencies/power point Labs: Build molecules or ions (from molecular model kits) Molecules or ions should have the correct shape (as predicted by VSEPR Theory) bond lengths and bond angles	Quiz based on Homework problems set Pop quiz Unit test Lab quiz Lab presentation

Guiding / Topical Questions	Content, Themes, Concepts, and Skills	Instructional Resources and Materials	Teaching Strategies	Assessment Strategies
How do assign formal charge to an atom in a compound or ion? How does VSEPR theory predict molecular shapes & polarity? How do you predict polarity of a molecule? What are the 4 types of intermolecular forces? What type of molecules do they hold together?		Power point	Synthesis of a coordination compound and its chemical analysis AP type Lab essays will be included as post lab questions Presentations	Formal lab write up Maintain a lab note book
<u>Suggestions on how to differentiate in this unit</u>: A chance to retake quiz & test for averaged points; cooperative group problem solving; teacher assists individually as needed.				

Freehold Regional High School District
Advanced Placement Chemistry

Unit #7: Thermochemistry

Enduring Understandings: The first Law of Thermodynamics is the law of conservation of energy.
Enthalpy is a state function; It is an extensive property.
Enthalpy is an extensive property of the system.
Heat changes in chemical or physical processes can be calculated using calorimetry.
Hess's Law uses the fact that enthalpy is a state function.
Formation of any compound results in a change in enthalpy.

Essential Questions: Why is there is a natural tendency for a system to move in the direction of disorder or entropy?
How does the First Law of Thermodynamics explain what happens when substances are heated in closed systems?
How are enthalpy and entropy related?

Unit Goals: Students will understand that thermo chemistry is a section of thermodynamics.
Students will understand that enthalpy is a state function.
Students will understand that there are several ways to determine the heat of reaction.

Duration of Unit: 1 week

NJCCCS: 5.1 A-C; 5.3 A-D; 5.4 A-C; 5.6 B; 5.7 B

Guiding / Topical Questions	Content, Themes, Concepts, and Skills	Instructional Resources and Materials	Teaching Strategies	Assessment Strategies
State the first law of thermodynamics. What are path and state functions? Why is enthalpy an extensive property? How can calorimetry be used to calculate enthalpy changes? What is Hess's Law? Define enthalpy of formation.	Pre reading skills….. Self learn assigned concepts and apply Relevant problem solving Lab skills	Textbook, Problem sets Worksheet packets Online resources Teaching transparencies Power point	Demos Student centered lectures using transparencies/power point Labs: Determination of enthalpy change associated with a reaction Heat of formation Heat of neutralization Determine the specific heat of different metal samples using a coffee cup calorimeter(constant pressure calorimetry) AP type Lab essays will be included as post lab questions Presentations	Quiz based on Homework problems set Pop quiz Unit test Lab quiz Lab presentation Formal lab write up Maintain a lab note book
<u>Suggestions on how to differentiate in this unit</u>: A chance to retake quiz & test for averaged points; cooperative group problem solving; teacher assists individually as needed.				

Freehold Regional High School District
Advanced Placement Chemistry

Unit #8: Gases

Enduring Understandings: All gases exhibit similar physical properties since they follow a basic set of gas laws.
The ideal gas law equation relates pressure, volume, temperature and the number of moles of a gas.
R is the universal gas law constant whose units are dependant on pressure and volume units.
The density of a gas is related to the molar mass of the gas.
The kinetic theory provides an explanation of gas behavior.
Gases diffuse from an area of high to low concentration.
Gases diffuse through small holes on the surface.
All gases are real; Real gases become ideal when they obey the gas laws.

Essential Questions: How does the Kinetic Theory of Matter explain the behavior of gases?
How do the various gas laws explain the relationship between pressure and volume, volume and temperature, pressure and temperature, and the number of particles in a gas sample?

Unit Goals: Students will understand that the KMT defines the properties of gases.
Students will understand that an ideal gas obeys all of the gas laws. Gases tend to deviate from ideal behavior under certain conditions.
Students will understand that the ideal gas equation related pressure, volume, temperature & the # of moles of a gas.
Students will understand that diffusion/Effusion are related to the molar mass of a gas.

Duration of Unit: 2 weeks

NJCCCS: 5.1 A-C; 5.2 A & B; 5.3 A-D; 5.4 A & B; 5.6 A;

Guiding / Topical Questions	Content, Themes, Concepts, and Skills	Instructional Resources and Materials	Teaching Strategies	Assessment Strategies
What are the gas laws? What is the combined gas law equation? How is R calculated and why is it called the universal gas law constant? How is the density of a gas related to its molar mass? What are the postulates of the kinetic theory? What is Graham's law of diffusion and how does it apply to effusion? When does a real gas behave?	Pre reading skills….. Self learn assigned concepts and apply Relevant problem solving Lab skills	Textbook, Problem sets Worksheet packets Online resources Teaching transparencies Power point	Demos / Presentations Student centered lectures using transparencies/power point Activity: Implode a soda can Find the molar mass of butane by collecting butane (from a butane lighter)over water Find the molar volume of hydrogen by collecting hydrogen gas (generated by the reaction between Mg and HCl) Over water in a gas collecting tube. Find the molar mass of a volatile liquid using the Dumas method. Find the rate of effusion of HCl using the Graham's law of effusion. AP type Lab essays will be included as post lab questions	Quiz based on Homework problems set Unit test Lab quiz Lab presentation Formal lab write up Maintain a lab note book

Suggestions on how to differentiate in this unit:
A chance to retake quiz & test for averaged points; cooperative group problem solving; teacher assists individually as needed.

Freehold Regional High School District
Advanced Placement Chemistry

Unit #9: Solutions

Enduring Understandings: Formation of a solution is either exothermic or endothermic.
Concentration of a solution can be expressed in several ways.
There are several factors that affect solubility.
Colligative properties depend on the number of particles present not on the identity.

Essential Questions: How do the driving forces of chemical reactions, energy and entropy, affect solution formation?
How can the concentration of solutions be calculated in terms of molarity, molality and percent by mass?
How do various factors affect solubility?

Unit Goals: Students will understand that several concentration units can be used to specify the concentration of a solution.
Students will understand that colligative properties depend on the # of particles present in the solution, not the identity.
Students will understand that the solution process is either endothermic or exothermic.

Duration of Unit: 1 week

NJCCCS: 5.1 B & C; 5.2 B; 5.3 A-D; 5.4 B;

Guiding / Topical Questions	Content, Themes, Concepts, and Skills	Instructional Resources and Materials	Teaching Strategies	Assessment Strategies
How do calculate ΔH for the solution process? What are the various ways in which concentration of solution can be expressed? What are the factors that affect solubility? How do colligative properties affect physical, properties of a solution?	Pre reading skills….. Self learn assigned concepts and apply Relevant problem solving Lab skills	Textbook, Problem sets Worksheet packets Online resources Teaching transparencies Power point AP questions from previous years' AP tests	Demos Student centered lectures using transparencies/power point Labs: Determine the molar mass of a non volatile solute by freezing point depression and Boiling point elevation method. Find the concentration of the given sodium chloride solution in terms of Molarity, molality, mass percent and mole fraction. Find the concentration of a colored solution using a spec 20 (Beer's Law) AP type Lab essays will be included as post lab questions Presentations	Quiz based on Homework problems set Pop quiz Unit test Lab quiz Lab presentation Formal lab write up Maintain a lab note book
<u>Suggestions on how to differentiate in this unit</u>: A chance to retake quiz & test for averaged points; cooperative group problem solving; teacher assists individually as needed.				

Freehold Regional High School District
Advanced Placement Chemistry

Unit #10: Kinetics

Enduring Understandings: Several factors affect the rate of a reaction.
There are two types of rate laws.
Reaction mechanisms always have a slow step that controls the overall rate of a reaction.

Essential Questions: To what extent do factors such as temperature, mixing, concentration, particle size, and surface area affect the rates of chemical reactions and how can this be modeled?

Unit Goals: Students will understand that several factors affect the rate of the reaction;
Students will understand that rate laws can be written for any chemical reaction.
Students will understand that chemical kinetics provides the kinetic control for a reaction.
Students will understand that the rate of a reaction can be controlled by changing the factors that affect the rate.
Students will understand that rate laws can be integrated or differential.
Students will understand that a reaction mechanism shows how a reaction happens.
Students will understand that the slow step controls the overall rate of the reaction.

Duration of Unit: 2 weeks

NJCCCS: 5.1 B & C; 5.3 A,B & D; 5.4 B; 5.6 B;

Guiding / Topical Questions	Content, Themes, Concepts, and Skills	Instructional Resources and Materials	Teaching Strategies	Assessment Strategies
What factors affect rates of reactions? What is the difference between the differentiated and integrated rate law? What is half-life of a chemical reaction? What is a reaction mechanism?	Pre reading skills….. Self learn assigned concepts and apply Relevant problem solving Lab skills	Textbook, Problem sets Worksheet packets Online resources Teaching transparencies Power point AP questions from previous years' AP tests	Demos Student centered lectures using transparencies/power point Labs: Study the factors that affect the rate of a chemical reaction Determine the order of a reaction in the two reactants experimentallyand write a rate equation--- Iodine clock reaction AP type Lab essays will be included as post lab questions Presentations	Quiz based on Homework problems set Pop quiz Unit test Lab quiz Lab presentation Formal lab write up Maintain a lab note book
<u>Suggestions on how to differentiate in this unit</u>: A chance to retake quiz & test for averaged points; cooperative group problem solving; teacher assists individually as needed.				

Freehold Regional High School District
Advanced Placement Chemistry

Unit #11: Chemical Equilibrium, Acid-Base Equilibrium & Solubility Equilibrium

Enduring Understandings: All reactions attain a state of equilibrium.
There are two types of equilibria.
The reaction quotient predicts the direction of equilibrium.
Le Chatelier's principle can be used to predict how the stress imposed on equilibrium can be releived.
Several definitions exist for acids & bases.
Acids & bases can be weak or strong.
Acid & base dissociation constants determine the strengths of acids & bases.
A buffer solution resists changes in pH.
The pH of a buffer solution can be found using the Henderson-Hasselabach Equation.
The presence of a common ion affects the equilibrium of a system.

Essential Questions: How do chemical reactions attain a state of equilibrium and what factors affect the maintenance of equilibrium?
To what extent are acids and bases important in numerous chemical processes that occur around us, from industrial to biological processes, from the laboratory to the environment?

Unit Goals: Students will understand that chemical reactions can be reversible.
Students will understand that reversible reactions attain a state of equilibrium.
Students will understand that chemical equilibrium is dynamic not static.
Students will understand that reaction quotients can be used to predict the direction of a reaction.
Students will understand that Le Chatelier's Principle can be used to predict a how an equilibrium system under stress will react.
Students will understand that acids & bases can be defined in several ways.
Students will understand that dissociation of weak acids/bases results in an equilibrium.
Students will understand that acid & base dissociation constants define the strengths of weak acids &/or bases.
Students will understand that a buffer solution resists changes in pH.
Students will understand that the common ion effect produces a buffer solution.
Students will understand that titration curves indicate characteristics of several types of acid-base titrations.
Students will understand that all insoluble salts have a certain degree of solubility.
Students will understand that precipitation can be predicted using ion product and solubility products values.

Duration of Unit: 6 weeks

NJCCCS: 5.1 A-C; 5.2 B; 5.3 A-D; 5.4 A & B;

Guiding / Topical Questions	Content, Themes, Concepts, and Skills	Instructional Resources and Materials	Teaching Strategies	Assessment Strategies
What is chemical equilibrium? What is the difference between homogeneous & heterogeneous equilibrium?	Pre reading skills….. Self learn assigned concepts and apply Relevant problem solving Lab skills	Textbook, Problem sets Worksheet packets Online resources Teaching transparencies	Demos Student centered lectures using transparencies/power point Labs: Le Chatelier's Principle	Quiz based on Homework problems set Pop quiz Unit test

Guiding / Topical Questions	Content, Themes, Concepts, and Skills	Instructional Resources and Materials	Teaching Strategies	Assessment Strategies
How do you write equilibrium constants? What is the reaction quotient and how does it help predict the direction of equilibrium. How can equilibrium concentrations be calculated? How do you define an acid and a base? What are conjugate pairs? What is the ion product of water? Why do buffer solutions resist change in pH? How do you predict precipitation in a solubility equilibrium?		Power point AP questions from previous years' AP tests	Find equilibrium constant using spec 20. (Colored solution equilibrium) Standardize the given solution of NaOH and find the value of Ka of a weak acid by carrying out a potentiometric titration. Carry out an acid base titration, measuring pH of the solution using a pH meter and plot a titration curve. Find the molar mass of the given weak acid by titration Determination of appropriate indicators for various acid-base titrations; pH determination Separation and qualitative Analysis of cations and anions Preparation and properties of buffer solutions Hydrolysis of salts Find the Ksp of an insoluble salt. (Lead Iodide) Qualitative Analysis: Identification of cations and anions AP type Lab essays will be included as post lab questions Presentations	Lab quiz Lab presentation Formal lab write up Maintain a lab note book
Suggestions on how to differentiate in this unit: A chance to retake quiz & test for averaged points; cooperative group problem solving; teacher assists individually as needed.				

Freehold Regional High School District
Advanced Placement Chemistry

Unit #12: Thermodynamics

Enduring Understandings: A spontaneous process is one that happens with no external influence.
The first law of thermodynamics describes the conservation of energy.
Entropy measures the disorder in a system.
The sign of ΔG controls the entropy of a process.
The ΔG & equilibrium are related.

Essential Questions: Why is there is a natural tendency for a system to move in the direction of disorder or entropy?
How does the First Law of Thermodynamics explain what happens when substances are heated in closed systems?
How are enthalpy and entropy related?

Unit Goals: Students will understand that all chemical & physical processes are accompanied by heat and energy changes.
Students will understand that there are three basic laws of thermodynamics.
Students will understand that the entropy of the universe is always increasing.
Students will understand that the sign of ΔG determines the spontaneity of a process.

Duration of Unit: 1 week

NJCCCS: 5.1 B & C; 5.3 A-D; 5.4 B & C;

Guiding / Topical Questions	Content, Themes, Concepts, and Skills	Instructional Resources and Materials	Teaching Strategies	Assessment Strategies
What are spontaneous processes? How can the first and second laws of thermodynamics be written mathematically as algebraic equations? How is Gibbs Free energy related to enthalpy & entropy? How does Gibbs Free energy related to equilibrium?	Pre reading skills….. Self learn assigned concepts and apply Relevant problem solving Lab skills	Textbook, Problem sets Worksheet packets Online resources Teaching transparencies Power point AP questions from previous years' AP tests	Demos Student centered lectures using transparencies/power point Labs: Entropy of a reaction AP type Lab essays will be included as post lab questions Presentations	Quiz based on Homework problems set Pop quiz Unit test Lab quiz Lab presentation Formal lab write up Maintain a lab note book
<u>Suggestions on how to differentiate in this unit</u>: A chance to retake quiz & test for averaged points; cooperative group problem solving; teacher assists individually as needed.				

Freehold Regional High School District
Advanced Placement Chemistry

Unit #13: Electrochemistry

Enduring Understandings: A spontaneous redox reaction produces an electric current in an electrochemical cell.
The sign of the cell potential indicates the spontanaeity of the process.
Cell potential is related to free energy change.
Change in concentration changes cell potential.
An electric current produces a redox reaction in an electrolytic cell so the cell process is not spontaneous and is called electrolysis.

Essential Questions: How are oxidation and reduction reactions described?
How are oxidation-reduction reactions involved with electrochemical and electrolytic cells?

Unit Goals: Students will understand that a redox reaction produces electrical energy in an electrochemical cell (voltaic cell).
Students will understand that passing electricity through an electrolyte produces a redox reaction in an electrolytic cell.
Students will understand that a voltaic cell can produce a cell potential.
Students will understand that the process in a voltaic cell is spontaneous.
Students will understand that the process in an electrolytic cell is non spontaneous.
Students will understand that cell potential can change with concentration.

Duration of Unit: 3 Days

NJCCCS: 5.1 B & C; 5.2 B; 5.3 A-C; 5.4 B;

Guiding / Topical Questions	Content, Themes, Concepts, and Skills	Instructional Resources and Materials	Teaching Strategies	Assessment Strategies
What is a redox reaction? How can a redox reaction be used to produce an electric current? What is cell potential? How is cell potential related to free energy? How is concentration related to cell potential? What are concentration cells? How can the potential of a concentration cell be calculated? What is the difference between an electrolytic and electrochemical cell.	Pre reading skills….. Self learn assigned concepts and apply Relevant problem solving Lab skills	Textbook, Problem sets Worksheet packets Online resources Teaching transparencies Power point AP questions from previous years' AP tests	Demos Student centered lectures using transparencies/power point Labs: Find the percent of hydrogen peroxide in retail antiseptic hydrogen peroxide. Measurements using electrochemical cells and electroplating AP type Lab essays will be included as post lab questions Presentations	Quiz based on Homework problems set Unit test Lab quiz Lab presentation Formal lab write up Maintain a lab note book
<u>Suggestions on how to differentiate in this unit</u>: A chance to retake quiz & test for averaged points; cooperative group problem solving; teacher assists individually as needed.				

Freehold Regional High School District
Advanced Placement Chemistry

Unit #14: Nuclear Chemistry

Enduring Understandings: Heavy nuclei tend to undergo radioactive decay.
There are several different types of radioactive decay.
Fission & fusion reactions produce an enormous amount of energy.

Essential Questions: How do nuclear reactions (fission and fusion) convert very small amounts of matter into energy?
How can nuclear reactions be both beneficial and dangerous?

Unit Goals: Students will understand that there are several fundamental particles.
Students will understand that heavy atoms undergo radioactive decay.
Students will understand that nuclear fission and fusion reactions produce an enormous amount of energy.
Students will understand that nuclear equations can be written for nuclear reactions.
Students will understand that complex ion reactions can be used to characterize the identity of an atom (qualitative analysis).

Duration of Unit: 1 Week

NJCCCS: 5.3 A, C & D; 5.7 A

Guiding / Topical Questions	Content, Themes, Concepts, and Skills	Instructional Resources and Materials	Teaching Strategies	Assessment Strategies
What causes an atom to undergo radioactive decay? What are the different types of decay reactions? What is half-life? How are nuclear decay reactions written? Why do fission & fusion produce so much energy?	Pre reading skills….. Self learn assigned concepts and apply Relevant problem solving Lab skills	Textbook, Problem sets Worksheet packets Online resources Teaching transparencies Power point AP questions from previous years' AP tests	Demos Student centered lectures using transparencies/power point Project: Long Research paper. AP essay questions Presentations	Quiz based on Homework problems set Pop quiz Unit test Lab quiz Lab presentation Formal lab write up Maintain a lab note book
Suggestions on how to differentiate in this unit: A chance to retake quiz & test for averaged points; cooperative group problem solving; teacher assists individually as needed.				

Freehold Regional High School District
Advanced Placement Chemistry

Unit #15: Organic Chemistry

Enduring Understandings: The study of carbon and its compounds is separate branch of chemistry called organic chemistry.
Carbon forms a large number of compounds since it can form four bonds.
The common elements found in organic compounds are carbon, hydrogen, oxygen and nitrogen.
There are several classes of organic compounds based on functional groups.
Functional groups determine reactivity.
There is a systematic way of naming organic compounds.
Process by which soap is manufactured is called saponification.
Esterification produces compounds that have pleasant and unpleasant odors.

Essential Questions: To what extent is organic chemistry different from inorganic chemistry?
Why is organic chemistry important?

Unit Goals: Students will understand that the IUPAC system provides a systematic way of nomenclature for organic compounds.
Students will understand that functional groups characterize organic compounds.
Students will understand that reactivity of organic compounds depends on the type of groups.

Duration of Unit: 3 Days

NJCCCS: 5.1 B & C; 5.4 B,C

Guiding / Topical Questions	Content, Themes, Concepts, and Skills	Instructional Resources and Materials	Teaching Strategies	Assessment Strategies
Why is organic chemistry a separate branch of chemistry? What are the main classes of organic compounds? What are functional groups? How do functional groups affect reactivity? How do name organic compounds? What is saponification? What is esterification?	Pre reading skills….. Self learn assigned concepts and apply Relevant problem solving Use the periodic table appropriately	Textbook, Problem sets Worksheet packets Online resources Teaching transparencies Power point	Demos Student centered lectures using transparencies/power point Labs: Make soap by the process of saponification Prepare esters by the process of esterification Synthesize an organic compound: Aspirin Find Ka of an organic acid by potentiometric titration AP type Lab essays will be included as post lab questions Presentations	Quiz based on Homework problems set Pop quiz Unit test Lab quiz Lab presentation Formal lab write up Maintain a lab note book
<u>Suggestions on how to differentiate in this unit</u>: A chance to retake quiz & test for averaged points; cooperative group problem solving; teacher assists individually as needed.				