

FREEHOLD REGIONAL HIGH SCHOOL DISTRICT

OFFICE OF CURRICULUM AND INSTRUCTION

MEDICAL SCIENCES SPECIALIZED LEARNING CENTER

AP CHEMISTRY

COURSE PHILOSOPHY

Every individual grows and develops a college level understanding of the chemical sciences. Students are expected to have an affinity for science and the ambition to pursue a career in the chemical sciences or a related field. As part of the Medical Sciences Learning Center, students will be exposed to many aspects of chemistry and how it relates to the body and the medical field in general. The hopes of this course are to spark the students' interest in the chemical sciences as well as provide students with a backbone of knowledge they can use when studying the biochemical systems of the body.

COURSE DESCRIPTION

Grade Level: 10

Department: Medical Sciences Specialized Learning
Center

Course Title: AP Chemistry

Credits: 5

Course Code: 161840

BOARD OF EDUCATION INITIAL ADOPTION DATE: AUGUST 30, 2010

FREEHOLD REGIONAL HIGH SCHOOL DISTRICT

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Course Philosophy

Every individual develops intellectually with the promise of understanding the importance of the chemical sciences. Students selecting careers related to the chemical sciences or wishing to pursue their study of this are in greater detail, possibly medical school, will need to balance judgment with skill and wisdom, develop critical thinking skills and amass an understanding of the interrelationship of chemistry with the environment and global interests. The Advanced Placement program helps in reaching this goal by enabling our talented students to begin their advanced study of chemistry while they are still in high school rather than waiting for college, and even if given college level credit, giving them a requisite head start in their future endeavors.

Course Description

The Medical Sciences AP Chemistry course contains the required units and prescribed laboratory experiences designed to build a content base equivalent to that attained in a typical college Chemistry course. Designed for the student who will likely take the Advanced Placement Test in Chemistry, this curriculum conforms to the prescribed course as delineated by the College Board. Frequent laboratory reports, in-depth analysis chemistry concepts, and overview of the topics studied will include: the structure of matter, the kinetic theory of gases, chemical equilibrium, chemical kinetics, and the basic concepts of thermodynamics. Students will use computers, instrumentation, and techniques found in a college Chemistry laboratory course.

**Freehold Regional High School District
Curriculum Map**

AP Chemistry

Relevant Standards ¹	Enduring Understandings	Essential Questions	Assessments		
			Diagnostic (before)	Formative (during)	Summative (after)
5.1.12.A.2-3 5.1.12.B.1-5 5.1.12.C.1-3 5.1.12.D.2 5.2.12.A.1 5.2.12.A.2	Classification of matter, Accuracy in measurement and Unit Analyses are powerful problem solving tools.	Upon completion of a (n) experiment, how can different results be expressed? How would you classify quantitative and qualitative observations? How is the accuracy and precision of data determined? How is quantitative data expressed with precision and uncertainty? What information is used when choosing the appropriate unit of measure for the task at hand? How is dimensional analysis or factor-label method utilized when converting between units? What are the characteristics that classify matter as a Pure Substance or Mixture? What are the characteristics that classify mixtures as heterogeneous or homogeneous? What characteristics would you use to identify the appropriate method of separation for mixtures?	Summer Assignment	Chapter Test Written Assignments	Projects Mid Terms Final Exam AP Exam
5.1.12.A.2-3 5.1.12.B.1-5 5.2.12.A.1-2 5.2.12.A.3 Unit 2 - History of the Atom and Development of the Periodic Table	The history and development of matter can be explained starting with the Periodic Table down to the three main fundamental particles that make up the building block of matter, the Atom.	What are the main subatomic particles of the atom and what are their characteristics? How would you explain the Law of Conservation of Mass as it pertains to a chemical reaction? Who were the scientists and what were the experiments that led to the development of the atom? What information can you ascertain from the Periodic Table? How would you calculate the number of protons, neutrons, and electrons in an atom? What are the different groups of the Periodic Table? What are the characteristics of these groups? What elements on the Periodic Table form diatomic elements?	Summer Assignment	Chapter Test Written Assignments	Projects Mid Terms Final Exam AP Exam
5.1.12.A.2-3 5.1.12.B.1-5 5.2.12.A.3	Identifying the different types of compounds, naming them and writing formulas are an essential tool vital to success in Chemistry.	What are the characteristics of an ionic compound? What are the rules for naming binary ionic compounds? What are the rules for writing formulas of binary ionic compounds? How can you use the Periodic Table to determine the ion charge of an element? What is a polyatomic ion? What are the rules for naming ionic compounds with polyatomic ions? What are the rules for naming ionic compounds with polyatomic ions? What are the characteristics of a covalent compound? What are the rules for naming binary covalent compounds? What are the rules for writing formulas of binary ionic compounds?	Oral Questions/ Discussion Anticipatory Set Questions	Quizzes Chapter Test Written Assignments Observations Research Assignments Lab Reports	Projects Mid Terms Final Exam AP Exam

Relevant Standards ¹	Enduring Understandings	Essential Questions	Assessments		
			Diagnostic (before)	Formative (during)	Summative (after)
5.1.12.A.2-3 5.1.12.B.1-5 5.2.12.B.3	Unit analysis of a balanced equation utilizes both the mass and mole ratios between the different components of the reaction to answer quantitative questions about reactants and products.	How can mass/weight be used to count the number of particles in a substance? How was the atomic mass of each element determined? What was the standard used? How is the average atomic mass of an element calculated? What do scientists use to count the amount of atoms/molecules/ions/etc. in a sample of an element or compound? What is Avogadro's number and what does it represent? How is the molar mass of a compound calculated? How is the percent of each element in a compound calculated? What is the difference between a Molecular Formula and an Empirical Formula? How is the Empirical/Molecular formula of a compound determined? Why must a chemical equation be balanced? How is unit analysis used to determine the amount of reactants reacted and products produced during a chemical reaction (Stoichiometry)? What do the coefficients in a balanced equation represent? What does a Limiting Reactant determine in a chemical reaction? How can a scientist use percent yield to validate an experiment?	Oral Questions/ Discussion Anticipatory Set Questions	Quizzes Chapter Test Written Assignments Observations Research Assignments Lab Reports	Projects Mid Terms Final Exam AP Exam
5.1.12.A.2-3 5.1.12.B.1-5 5.2.12.A.2 5.2.12.A.5 5.2.12.B.2 5.2.12.B.3	Unit analysis of a balanced equation utilizes both the mass and mole ratios between the different components of the reaction to answer quantitative questions about reactants and products.	Why is water such a unique molecule? Why is water referred to as the "universal" solvent? What makes a solution an electrolyte? How is this tested? What are acids? Bases? How is the concentration of solutions measured? How is this value calculated? How would a scientist prepare a solution? How would a scientist dilute a solution if it had too high of a concentration? What is a precipitate? What are the identifying characteristics of a precipitate reaction? How is the mass of the precipitate calculated? How is the concentration of each ion remaining in solution calculated? What are the differences, and what can you learn from a molecular equation, complete ionic equation, and net ionic equation? What are spectator ions? What is the net ionic equation for an acid-base reaction? What information can be learned from the titration of an acid-base reaction? What are the characteristics of an Oxidation-Reduction reaction? How is the oxidation number of a species determined?	Oral Questions/ Discussion Anticipatory Set Questions	Quizzes Chapter Test Written Assignments Observations Research Assignments Lab Reports	Projects Mid Terms Final Exam AP Exam
5.1.12.A.2-3 5.1.12.B.1-5 5.2.12.C.1 5.2.12.C.2	The Kinetic Molecular Theory is the backbone of the laws and concepts surrounding the different phases of matter.	What are the different units of pressure? How does a manometer measure a contained gas? What are the laws of gases and how are the variables related to one another? How does the ideal gas law relate all variables? What contribution did Avogadro make to the volume of gases at STP? What happens to the total pressure of a mixture of gases in a container when the partial pressure of each gas is changed? How do ideal gases deviate from real gases? How does the Kinetic Molecular Theory relate to the phases of matter? How are the intermolecular forces that hold liquids and solids together determined? What properties of liquids can be attributed to intermolecular forces? What factors affect the strength of intermolecular forces and how does this change	Oral Questions/ Discussion Anticipatory Set Questions	Quizzes Chapter Test Written Assignments Observations Research Assignments Lab Reports	Projects Mid Terms Final Exam AP Exam

Relevant Standards ¹	Enduring Understandings	Essential Questions	Assessments		
			Diagnostic (before)	Formative (during)	Summative (after)
		<p>the properties of the substance?</p> <p>What are the different types of solids and how are the atoms of these different solids organized?</p> <p>How does the sea of electrons allow for the different properties of metals?</p> <p>What are network solids and how are they important to everyday life?</p> <p>What is the difference between the two types of alloys? How does that affect their function?</p> <p>How are phase changes determined by intermolecular forces?</p> <p>What information can be learned from a phase change diagram?</p>			
<p>5.1.12.A.2-3</p> <p>5.1.12.B.1-5</p> <p>5.2.12.C.1</p> <p>5.2.12.D.1</p> <p>5.2.12.D.2</p> <p>5.2.12.D.4</p>	<p>The Law of Conservation of Energy explains how both the system and the surroundings are affected by heat changes during reactions.</p>	<p>What is energy and how does it relate to the Law of Conservation of Energy?</p> <p>How is Energy defined in terms of heat and work?</p> <p>How are exothermic and endothermic reactions defined in terms of the system and surroundings?</p> <p>What is Enthalpy and how is it related to energy?</p> <p>Why is Enthalpy considered a state function?</p> <p>What is heat capacity and how is it measured using Calorimetry?</p> <p>How can calorimetry be used to measure enthalpy?</p> <p>What is bomb calorimetry and how does it differ from constant-pressure calorimetry?</p> <p>How is Hess's Law used to explain how a reactions takes place as well as determine the overall Enthalpy of a reaction?</p> <p>How can Standard Enthalpies of Formation be used to determine the overall Enthalpy of a reaction?</p> <p>When is a reaction classified as a spontaneous process?</p> <p>What is Entropy and how does it relate to the universe?</p> <p>How does entropy apply to the three physical states of matter?</p> <p>How does the Second Law of Thermodynamics relate to the universe and how can it be used to determine the spontaneity of a reaction?</p> <p>What are the important factors involved with determining the sign and magnitude of Entropy?</p> <p>How does Gibbs Free Energy play are role in spontaneity?</p> <p>What factors are used to determine the Entropy of a reaction?</p> <p>How does the Third Law of thermodynamics play a role in calculating the Entropy of a reaction based upon standard Enthalpies?</p> <p>How does equilibrium play an important role with Gibbs Free Energy?</p>	<p>Oral Questions/ Discussion</p> <p>Anticipatory Set Questions</p>	<p>Quizzes Chapter Test Written Assignments Observations Research Assignments Lab Reports</p>	<p>Projects</p> <p>Mid Terms</p> <p>Final Exam</p> <p>AP Exam</p>
<p>5.1.12.A.2-3</p> <p>5.1.12.B.1-5</p> <p>5.2.12.A.1</p> <p>5.2.12.A.3</p> <p>5.2.12.B.1</p>	<p>The electron(s) in an atom are responsible for determining the properties of the element as well as it's placement on the Periodic Table.</p>	<p>How did scientists determine that the electron was the driving force behind the emission of Electromagnetic Radiation?</p> <p>What factors are used to classify Electromagnetic Radiation according to the areas of the Electromagnetic Spectrum?</p> <p>What is meant by quantized energy and how does it apply to light?</p> <p>How does the Photoelectric Effect lead to the concept of dual nature of light?</p> <p>How did Bohr utilize the atomic emissions spectrum to create a model of the atom?</p> <p>How does quantized energy play an important role in the invalidation of Bohr's Model for all atoms other than Hydrogen?</p> <p>How did DeBroglie, Heisenberg, and Schrodinger's principles and equations lead to the quantum-mechanical model of the atom?</p> <p>How are Quantum Numbers used to describe the location of an electron in an</p>	<p>Oral Questions/ Discussion</p> <p>Anticipatory Set Questions</p>	<p>Quizzes Chapter Test Written Assignments Observations Research Assignments Lab Reports</p>	<p>Projects</p> <p>Mid Terms</p> <p>Final Exam</p> <p>AP Exam</p>

Relevant Standards ¹	Enduring Understandings	Essential Questions	Assessments		
			Diagnostic (before)	Formative (during)	Summative (after)
		atom? How are electron configuration and orbital diagrams determined based upon the Aufbau Principle, Hund's Rule, and the Pauli Exclusion Principle? What information can you gain about an atom based upon its electron configuration? When atoms are arranged according to their electron configurations several trends are seen; what are these trends and why do they happen?			
5.1.12.A.2-3 5.1.12.B.1-5 5.2.12.A.2 5.2.12.A.3 5.2.12.B.1 5.2.12.C.2	The nature of the valence electrons determines the type and strength of bond that forms.	What factors are used to determine the likelihood in which a bond will form? How can a magnetic field determine the polarity of a molecule? How is electro negativity used to determine polarity of bonds within molecules? How can you predict the formula of an ionic compound? How does the size of atoms as ions compare to the neutral parent atom? What is common thread between isoelectronic atoms? How is the lattice energy of an ionic compound calculated? Why do covalent compounds have ionic character and how is it calculated? How are bond energies used to calculate the Enthalpy of a reaction? What information can be extracted from Lewis Dot Diagrams? How does the VSEPR model determine the shape of a molecule? How is the hybridization of molecular orbitals determined? How are sigmas and pi bonds assigned to the different bonds in molecules?	Oral Questions/ Discussion Anticipatory Set Questions	Quizzes Chapter Test Written Assignments Observations Research Assignments Lab Reports	Projects Mid Terms Final Exam AP Exam
5.1.12.A.2-3 5.1.12.B.1-5 5.2.12.A.2 5.2.12.A.5 5.2.12.C.2	Solutions are a unique combination of a liquid and solid in which the properties and concentration are based upon the nature of the components.	What are the different ways to describe the concentration of a solution? How are they calculated? How is energy involved in solution formation? What factors affect the solubility of a solute in a solvent? How is the Vapor Pressure of Non-Ideal solutions determined? What are the colligate properties of solutions and how do they play a role in solution formation?	Oral Questions/ Discussion Anticipatory Set Questions	Quizzes Chapter Test Written Assignments Observations Research Assignments Lab Reports	Projects Final Exam AP Exam

Relevant Standards ¹	Enduring Understandings	Essential Questions	Assessments		
			Diagnostic (before)	Formative (during)	Summative (after)
5.1.12.A.2-3 5.1.12.B.1-5 5.2.12.B.3 5.2.12.D.4 5.2.12.D.5	The rate of a reaction is unique to the concentrations of the reactants and is affected by several factors.	How is the rate of a reaction determined? How is the rate Law or Rate order determined? How is method of initial rates used to determine the overall rate order of a reaction? How do catalysts affect the rate of a reaction? How is reaction rate important to body functions? How do you determine which step in a mechanism determines the rate of a reaction? Explain how the collision model can graphically determine the rate of a reaction?	Oral Questions/ Discussion Anticipatory Set Questions	Quizzes Chapter Test Written Assignments Observations Research Assignments Lab Reports	Projects Final Exam AP Exam
5.1.12.A.2-3 5.1.12.B.1-5	Equilibrium is a unique state in which the concentrations of all reactants and products remain constant with time.	What conditions determine when a reaction has reached equilibrium? How is the mass action equation used to determine the equilibrium constant for a reaction? How is the mass action equation adjusted to fit reactions dependent upon pressure? How does the reaction quotient compare to the equilibrium constant? What can be determined by comparing the two values? How can ICE charts be utilized to determine the concentration of each component of a reaction at equilibrium? How is Le Chatelier's Principle used to predict the shift in equilibrium given a change in conditions?	Oral Questions/ Discussion Anticipatory Set Questions	Quizzes Chapter Test Written Assignments Observations Research Assignments Lab Reports	Projects Final Exam AP Exam

Relevant Standards ¹	Enduring Understandings	Essential Questions	Assessments		
			Diagnostic (before)	Formative (during)	Summative (after)
5.1.12.A.2-3 5.1.12.B.1-5 5.2.12.A.5 5.2.12.A.6 5.2.12.B.3	Acids and bases are distinguished by both structure and pH.	<p>What are the differences between acids and bases according to the different models? How is the strength of acids and bases determined? What is pH? How is it used to determine the acidity or alkalinity of a substance? How is the pH of weak acid solutions calculated? Weak acid mixtures? Why would it be important to calculate the % dissociation of an acid in a solution? How is the pH of a solution calculated at equilibrium? How is the pOH/pH of weak base solutions calculated? Weak base mixtures? How is the pH of a solution calculated at equilibrium when starting with a basic solution? What are polyprotic acids? How is the pH calculated for this type of species? How can you determine if a salt creates an acidic or basic solution? How does the structure of an acid affect its strength? How does Lewis use Lewis Structures to differentiate between acids and bases? How does the mixing of a salt and acid or base result in the formation of a common ion? What is a buffer and what role does it play in the body? How can calculations prove a buffer solution was created? How can you predict the endpoint of acid-base titration reactions using pH curves? What factors determine the indicator that should be used during acid-base titrations?</p>	<p>Oral Questions/ Discussion</p> <p>Anticipatory Set Questions</p>	<p>Quizzes Chapter Test Written Assignments Observations Research Assignments Lab Reports</p>	<p>Projects Final Exam AP Exam</p>
5.1.12.A.2-3 5.1.12.B.1-5 5.2.12.A.5 5.2.12.B.3	The solubility of substances is affected by different factors that create a shift in equilibrium.	<p>How is the solubility of a salt determined at equilibrium? How is the solubility constant used to compare the solubility of different salts? How would a common ion affect the solubility of a salt during solution preparation? How can K_{sp} be used to determine if a precipitate will form when two solutions are combined? What is a complex ion? How can you determine the reactions in which common ions form?</p>	<p>Oral Questions/ Discussion</p> <p>Anticipatory Set Questions</p>	<p>Quizzes Chapter Test Written Assignments Observations Research Assignments Lab Reports</p>	<p>Projects Final Exam AP Exam</p>

Relevant Standards ¹	Enduring Understandings	Essential Questions	Assessments		
			Diagnostic (before)	Formative (during)	Summative (after)
5.1.12.A.2-3 5.1.12.B.1-5 5.2.12.B.2 5.2.12.B.3 5.2.12.D.4	The electrical output of a chemical cell is determined by the number of electrons transferred during an Oxidation-Reduction reaction.	What is electrochemistry? How does it utilize Red-Ox reactions to explain electron transfer? How is the anode and cathode determined? How does a galvanic cell work? How is the potential of a galvanic cell calculated? How is line notation written for galvanic cells? How does the Nernst equation explain cell potential in terms of Free Energy? How does the concentration of the solutions affect the potential of the cell? How does an electrolytic cell? How does it compare to a galvanic cell?	Oral Questions/ Discussion Anticipatory Set Questions	Quizzes Chapter Test Written Assignments Observations Research Assignments Lab Reports	Projects Final Exam AP Exam
5.1.12.A.2-3 5.1.12.B.1-5 5.2.12.A.1 5.2.12.A.4 5.2.12.D.3	When a nucleus is unstable, it releases energy as a result of radioactive decay.	Why do the nuclei of certain atoms undergo radioactive decay? What are the types of radiation released during radioactive decay? How do the pieces of radioactive decay fit into nuclear reactions? What are the uses of radioactivity as pertaining to the medical field? What is the difference between nuclear fission and nuclear fusion? How are these processes used? What are some positive and negative effects of radiation?	Oral Questions/ Discussion Anticipatory Set Questions	Quizzes Chapter Test Written Assignments Observations Research Assignments Lab Reports	Projects Final Exam AP Exam

Relevant Standards ¹	Enduring Understandings	Essential Questions	Assessments		
			Diagnostic (before)	Formative (during)	Summative (after)
5.1.12.A.2-3 5.1.12.B.1-5 5.2.12.B.3	The nature of compounds is important when predicting the reactants and products of a reaction.	What is a coordination compound? What are the conditions in which coordination compounds are most likely to form? How are the formulas of coordination compounds written?	Oral Questions/ Discussion Anticipatory Set Questions	Quizzes Chapter Test Written Assignments Observations Research Assignments Lab Reports	Projects Final Exam AP Exam
5.1.12.A.2-3 5.1.12.B.1-5	(Optional) Organic compounds are categorized and named according to the functional groups they contain.	How are organic compounds identified? What are the functional groups seen on organic compounds? What is the process for naming and writing formulas of organic compounds?	Oral Questions/ Discussion Anticipatory Set Questions	Quizzes Chapter Test Written Assignments Observations Research Assignments Lab Reports	Projects Final Exam AP Exam

Relevant Standards ¹	Enduring Understandings	Essential Questions	Assessments		
			Diagnostic (before)	Formative (during)	Summative (after)
5.1.12.D.1-3	Students collaboratively complete laboratory experiments utilizing safety as the most important aspect of working in the lab.	<p>What are the important safety concerns to consider before each lab?</p> <p>Why is it important to read over a lab prior to doing the lab?</p> <p>Where is all of the safety equipment located in the lab classroom?</p>	<p>Oral Questions/ Discussion</p> <p>Anticipatory Set Questions</p>	<p>Quizzes Chapter Test Written Assignments Observations Research Assignments Lab Reports</p>	<p>Projects Final Exam AP Exam</p>

**Freehold Regional High School District
Course Proficiencies and Pacing**

AP Chemistry

Unit Title	Unit Understandings and Goals	Recommended Duration
Unit#1: Chemical Foundations	Classification of matter, Accuracy in measurement and Unit Analyses are powerful problem solving tools. 1. Students will be able to complete mathematical computations as related to science and evaluate the meaning of the results.	4 days
Unit#2: History of the Atom and Development of the Periodic Table	The history and development of matter can be explained starting with the Periodic Table down to the three main fundamental particles that make up the building block of matter, the Atom. 1. Students will be able to organize and construct and logical interpretation of the development of the modern Atomic Theory.	4 days
Unit#3: Nomenclature	Identifying the different types of compounds, naming them and writing formulas is an essential tool vital to success in Chemistry. 1. Students will be able to utilize the Periodic Table and the charges of Polyatomic ions to assign chemical names and formulas to compounds.	1 week
Unit#4: The Mole & Stoichiometry	Unit analysis of a balanced equation utilizes both the mass and mole ratios between the different components of the reaction to answer quantitative questions about reactants and products. 1. Students will be able to predict the amounts of reactants and products in a chemical reaction based upon unit analysis.	12 days
Unit#5: Reactions in Solution	Unit analysis of a balanced equation utilizes both the mass and mole ratios between the different components of the reaction to answer quantitative questions about reactants and products. 1. Students will be able to predict the amounts of reactants and products in solution based upon unit analysis.	16 days
Unit #6: Gases	The Kinetic Molecular Theory is the backbone of the laws and concepts surrounding the different phases of matter. 1. Students will be able to apply the Kinetic Molecular Theory as well as the various gas laws to gases under a wide range of conditions and assess the results.	10 days
Unit #7: Thermo chemistry	The Law of Conservation of Energy explains how both the system and the surroundings are affected by heat changes during reactions. 1. Students will be able to relate heat as a transfer between objects at different temperatures.	9 days
Unit #8: Atomic Structure & Periodicity	The electron(s) in an atom are responsible for determining the properties of the element as well as it's placement on the Periodic Table. 1. Students will be able to diagram the progression of electron placement from the Plum Pudding Model through the quantum mechanical model and ending with electron configuration.	13 days
Unit #9: Bonding (Ionic & Covalent)	The nature of the valence electrons determines the type and strength of bond that forms. 1. Students will be able to predict the type of bond that will form between atoms as well as identify the properties of compounds containing each bond.	11 days

Unit Title	Unit Understandings and Goals	Recommended Duration
Unit #10: Liquids & Solids	<p>The Kinetic Molecular Theory is the backbone of the laws and concepts surrounding the different phases of matter.</p> <p>1. Students will be able to examine the concept of intermolecular forces and apply it to the properties of the states of matter as well as relate them to phase changes.</p>	8 days
Unit #11: Properties of Solutions	<p>Solutions are a unique combination of a liquid and solid in which the properties and concentration are based upon the nature of the components.</p> <p>1. Students will be able to justify the ability of a solute to dissolve in a solvent as well as determine the concentration of the solution in various different units.</p>	10 days
Unit #12: Chemical Kinetics	<p>The rate of a reaction is unique to the concentrations of the reactants and is affected by several factors. Students collaboratively complete laboratory experiments utilizing safety as the most important aspect of working in the lab.</p> <p>1. Students will be able to characterize the rate of a reaction based upon interpreting graphs.</p>	10 days
Unit #13: Equilibrium	<p>Equilibrium is a unique state in which the concentrations of all reactants and products remain constant with time.</p> <p>1. Students will be able to determine the equilibrium expression for chemical reactions as well as the concentrations of each species at equilibrium.</p>	7 days
Unit #14: Acids & Bases	<p>Acids and bases are distinguished by both structure and pH. Students collaboratively complete laboratory experiments utilizing safety as the most important aspect of working in the lab.</p> <p>1. Students will be able to distinguish between acids and bases based upon pH.</p>	12 days
Unit #15: Acid-Base Equilibria	<p>Acids and bases are distinguished by both structure and pH. Students collaboratively complete laboratory experiments utilizing safety as the most important aspect of working in the lab.</p> <p>1. Students will be able to analyze mixtures of acids, bases, and salts according to pH.</p>	7 days
Unit #16: Solubility & Complex Ion Equilibria	<p>The solubility of substances is affected by different factors that create a shift in equilibrium. Students collaboratively complete laboratory experiments utilizing safety as the most important aspect of working in the lab.</p> <p>1. Students will be able to examine solutes and determine their solubility in various substances based upon the equilibrium expression.</p>	7 days
Unit #17: Spontaneity, Entropy, & Free Energy	<p>The Law of Conservation of Energy explains how both the system and the surroundings are affected by heat changes during reactions. Students collaboratively complete laboratory experiments utilizing safety as the most important aspect of working in the lab.</p> <p>1. Students will be able to examine the universe in terms of Entropy and Free Energy.</p>	6 days

Unit #18: Electrochemistry	<p>The electrical output of a chemical cell is determined by the number of electrons transferred during an Oxidation-Reduction reaction. Students collaboratively complete laboratory experiments utilizing safety as the most important aspect of working in the lab.</p> <p>1. Students will be able to design electrochemical cells and evaluate the flow of electrons to determine cell potential.</p>	7 days
Unit #19: The Nucleus	<p>When a nucleus is unstable, it releases energy as a result of radioactive decay.</p> <p>1. Students will be able to assess the impact each type of radioactive decay has on atoms.</p>	3 days
Unit #20: Descriptive Chemistry & Coordination Compounds	<p>The nature of compounds is important when predicting the reactants and products of a reaction.</p> <p>1. Students will be able to predict both the products and the reactants of chemical reactions based upon the information provided.</p>	7 days
Unit #21: Organic Chemistry (Optional)	<p>Organic compounds are categorized and named according to the functional groups they contain.</p> <p>1. Students will be able to evaluate an organic molecule for functional groups and then properly name the molecule.</p>	2 days

Freehold Regional High School District
AP Chemistry
Unit #1: Chemical Foundations

Enduring Understanding: Classification of matter, Accuracy in measurement and Unit Analyses are powerful problem solving tools.

Essential Questions: Upon completion of a (n) experiment, how can different results be expressed? How would you classify quantitative and qualitative observations? How is the accuracy and precision of data determined? How is quantitative data expressed with precision and uncertainty? What information is used when choosing the appropriate unit of measure for the task at hand? How is dimensional analysis or factor-label method utilized when converting between units? What are the characteristics that classify matter as a Pure Substance or Mixture? What are the characteristics that classify mixtures as heterogeneous or homogeneous? What characteristics would you use to identify the appropriate method of separation for mixtures?

Unit Goal: Students will be able to complete mathematical computations as related to science and evaluate the meaning of the results.

Duration of Unit: Summer Assignment/4 days

NJCCCS: 5.1.12.A.2-3, 5.1.12.B.1-5, 5.1.12.C.1-3, 5.1.12.D.2, 5.2.12.A.1, 5.2.12.A.2

Guiding / Topical Questions	Content, Themes, Concepts, and Skills	Instructional Resources and Materials	Teaching Strategies	Assessment Strategies
<p>Upon completion of a(n) experiment, how can different results be expressed?</p> <p>How would you classify quantitative and qualitative observations?</p> <p>How is the accuracy and precision of data determined?</p> <p>How is quantitative data expressed with precision and uncertainty?</p> <p>What information is used when choosing the appropriate unit of measure for the task at hand?</p>	<p>Express results using different units.</p> <p>Classify observations as qualitative or quantitative.</p> <p>Determine the precision and accuracy of an experiment.</p> <p>Express data with the appropriate precision and uncertainty based upon significant figures or instrumentation.</p> <p>Use surroundings to choose the appropriate instrumentation for making measurements.</p>	<p>Current textbook</p> <p>Internet</p> <p>Moodle</p> <p>PowerPoint</p> <p>LCD projector</p> <p>Video Streaming</p>	<p>Lecture</p> <p>Problem Workshop</p>	<p>Written tests and quizzes</p> <p>Read assigned section from text.</p> <p>Outline the reading</p> <p>Complete assigned Chapter Review questions</p> <p>Make a list of questions for clarification</p>
<p>How is dimensional analysis or factor-label method utilized when converting between units?</p>	<p>Utilize the factor-label method when converting between units.</p>			
<p>What are the characteristics that classify matter as a Pure Substance or Mixture?</p> <p>What are the characteristics that classify mixtures as heterogeneous or homogeneous?</p> <p>What characteristics would you use to identify the appropriate method of separation for mixtures?</p>	<p>Classify matter as pure substances or mixtures.</p> <p>Classify mixtures as homogeneous or heterogeneous.</p> <p>Identify the appropriate methods of separation for specific mixtures.</p>			

Suggestions on how to differentiate in this unit:

- Time can be saved by having students complete this section as a summer assignment. Suggest to students the purchase of an AP study guide as an additional resource (Barrons©, Princeton Review©, Kaplan©). Direct students to Moodle Site which includes links to AP Central®, and additional tutorial websites.

Freehold Regional High School District
AP Chemistry
Unit #2: History of the Atom and Development of the Periodic Table

Enduring Understanding: The history and development of matter can be explained starting with the Periodic Table down to the three main fundamental particles that make up the building block of matter, the Atom.

Essential Questions: What are the main subatomic particles of the atom and what are their characteristics? How would you explain the Law of Conservation of Mass as it pertains to a chemical reaction? Who were the scientists and what were the experiments that led to the development of the atom? What information can you ascertain from the Periodic Table? How would you calculate the number of protons, neutrons, and electrons in an atom? What are the different groups of the Periodic Table? What are the characteristics of these groups? What elements on the Periodic Table form diatomic elements?

Unit Goal: Students will be able to organize and construct and logical interpretation of the development of the Modern Atomic Theory.

Duration of Unit: Summer Assignment or 4 days

NJCCCS: 5.1.12.A.2-3, 5.1.12.B.1-5, 5.2.12.A.1-2, 5.2.12.A.3

Guiding / Topical Questions	Content, Themes, Concepts, and Skills	Instructional Resources and Materials	Teaching Strategies	Assessment Strategies
<p>What are the main subatomic particles of the atom and what are their characteristics?</p> <p>How would you explain the Law of Conservation of Mass as it pertains to a chemical reaction?</p> <p>Who were the scientists and what were the experiments that led to the development of the atom?</p>	<p>Identify the main subatomic particles and their characteristics.</p> <p>Explain the Law of Conservation of Mass as it pertains to a chemical reaction.</p> <p>Identify the scientists and the experiments that led to the development of the atom.</p>	<p>Current textbook</p> <p>Internet</p> <p>Moodle</p> <p>PowerPoint</p> <p>LCD projector</p> <p>Video Streaming</p>	<p>Lecture</p> <p>Problem Workshop</p>	<p>Written tests and quizzes</p> <p>Read assigned section from text.</p> <p>Outline the reading</p> <p>Complete assigned Chapter Review questions</p> <p>Make a list of questions for clarification</p>
<p>What information can you ascertain from the Periodic Table?</p> <p>How would you calculate the number of protons, neutrons, and electrons in an atom?</p>	<p>Utilize the Periodic Table for important information.</p> <p>Calculate the number of protons, neutrons, and electrons in an atom.</p>			
<p>What are the different groups of the Periodic Table? What are the characteristics of these groups?</p> <p>What elements on the Periodic Table form diatomic elements?</p>	<p>Identify the different groups of the periodic table and the characteristic properties of each group.</p> <p>Identify the diatomic elements on the Periodic Table.</p>			
<p>Suggestions on how to differentiate in this unit:</p> <ul style="list-style-type: none"> Time can be saved by having students complete this section as a summer assignment. Suggest to students the purchase of an AP study guide as an additional resource (Barrons©, Princeton Review©, Kaplan©). Direct students to Moodle Site which includes links to AP Central®, and additional tutorial websites. 				

Freehold Regional High School District
AP Chemistry
Unit #3: Nomenclature

Enduring Understanding: Identifying the different types of compounds, naming them and writing formulas are an essential tool vital to success in Chemistry.

Essential Questions: What are the characteristics of an ionic compound? What are the rules for naming binary ionic compounds? What are the rules for writing formulas of binary ionic compounds? How can you use the Periodic Table to determine the ion charge of an element? What is a polyatomic ion? What are the rules for naming ionic compounds with polyatomic ions? What are the rules for naming ionic compounds with polyatomic ions? What are the characteristics of a covalent compound? What are the rules for naming binary covalent compounds? What are the rules for writing formulas of binary ionic compounds?

Unit Goal: Students will be able to utilize the Periodic Table and the charges of polyatomic ions to assign chemical names and formulas to compounds.

Duration of Unit: 1 week

NJCCCS: 5.1.12.A.2-3, 5.1.12.B.1-5, 5.2.12.A.3

Guiding / Topical Questions	Content, Themes, Concepts, and Skills	Instructional Resources and Materials	Teaching Strategies	Assessment Strategies
What are the characteristics of an ionic compound? What are the rules for naming binary ionic compounds? What are the rules for writing formulas of binary ionic compounds? How can you use the Periodic Table to determine the ion charge of an element? What is a polyatomic ion? What are the rules for naming ionic compounds with polyatomic ions? What are the rules for writing formulas of ionic compounds with polyatomic ions? What are the characteristics of a covalent compound? What are the rules for naming binary covalent compounds? What are the rules for writing formulas of binary ionic compounds?	Identify the characteristics of an ionic compounds Identify the rules for naming binary ionic compounds. Identify the rules for writing formulas of binary ionic compounds. Utilize the Periodic Table for the charges of ions. Identify the characteristics of a polyatomic ion. Identify the rules for naming ionic compounds with polyatomic ions.	Current textbook Internet Moodle PowerPoint LCD projector Video Streaming	Lecture Problem Workshop	Written tests and quizzes Read assigned section from text. Outline the reading Complete assigned Chapter Review questions Make a list of questions for clarification

Suggestions on how to differentiate in this unit:

- Time can be saved by having students memorize polyatomic ion charges over the summer. This can also be done as an independent study chapter or as part of the summer assignment. Suggest to students the purchase of an AP study guide as an additional resource (Barrons®, Princeton Review®, Kaplan®). Direct students to Moodle Site which includes links to AP Central®, and additional tutorial websites. Provide extra help after school for students.

Freehold Regional High School District
AP Chemistry
Unit #4: The Mole and Stoichiometry

Enduring Understanding: Unit analysis of a balanced equation utilizes both the mass and mole ratios between the different components of the reaction to answer quantitative questions about reactants and products.

Essential Questions: How can mass/weight be used to count the number of particles in a substance? How was the atomic mass of each element determined? What was the standard used? How is the average atomic mass of an element calculated? What do scientists use to count the amount of atoms/molecules/ions/etc. in a sample of an element or compound? What is Avogadro's number and what does it represent? How is the molar mass of a compound calculated? How is the percent of each element in a compound calculated? What is the difference between a Molecular Formula and an Empirical Formula? How is the Empirical/Molecular formula of a compound determined? Why must a chemical equation be balanced? How is unit analysis used to determine the amount of reactants reacted and products produced during a chemical reaction (Stoichiometry)? What do the coefficients in a balanced equation represent? What does a Limiting Reactant determine in a chemical reaction? How can a scientist use percent yield to validate an experiment?

Unit Goal: Students will be able to predict the amounts of reactants and products in a chemical reaction based upon unit analysis.

Duration of Unit: 12 days

NJCCCS: 5.1.12.A.2-3, 5.1.12.B.1-5, 5.2.12.B.3

Guiding / Topical Questions	Content, Themes, Concepts, and Skills	Instructional Resources and Materials	Teaching Strategies	Assessment Strategies
<p>How can mass/weight be used to count the number of particles in a substance?</p> <p>How was the atomic mass of each element determined?</p> <p>What was the standard used?</p> <p>How is the average atomic mass of an element calculated?</p> <p>What do scientists use to count the amount of atoms/molecules/ions/etc. in a sample of an element or compound?</p> <p>What is Avogadro's number and what does it represent?</p> <p>How is the molar mass of a compound calculated?</p> <p>How is the percent of each element in a compound calculated?</p>	<p>Explain what average atomic mass is and how it relates to Carbon-12.</p> <p>Use % abundance and Isotopic Mass to calculate the average atomic mass of elements.</p> <p>Use the atomic mass of elements to determine the number of moles and particles in a designated amount of a substance.</p> <p>Calculate the molar mass of a compound using the atomic masses and number of moles of each atom in the compound.</p> <p>Calculate the Percent of each element in a compound using the moles and atomic mass of each element as well as the molar mass of the compound.</p>	<p>Current textbook</p> <p>Internet</p> <p>Moodle</p> <p>PowerPoint</p> <p>LCD projector</p> <p>Video Streaming</p> <p>Lab Book "Laboratory Experiments for Advanced Placement Chemistry" Second Edition, Vonderbrink</p>	<p>Lecture</p> <p>Problem Workshop</p> <p>Labs:</p> <ul style="list-style-type: none"> • % Composition of a Hydrate • Determine the Empirical & Molecular Formula of a compound • *Percent Yield of a Reaction 	<p>Written tests and quizzes</p> <p>Read assigned section from text.</p> <p>Outline the reading</p> <p>Complete assigned Chapter Review questions</p> <p>Make a list of questions for clarification</p>

Guiding / Topical Questions	Content, Themes, Concepts, and Skills	Instructional Resources and Materials	Teaching Strategies	Assessment Strategies
<p>What is the difference between a Molecular Formula and an Empirical Formula?</p> <p>How is the Empirical/Molecular formula of a compound determined?</p> <p>Why must a chemical equation be balanced?</p> <p>What do the coefficients in a balanced equation represent?</p> <p>How is unit analysis used to determine the amount of reactants reacted and products produced during a chemical reaction (Stoichiometry)?</p>	<p>Classify formulas as Empirical or Molecular.</p> <p>Use molar conversions to determine the Empirical and Molecular Formulas of compounds.</p> <p>Use the definition of the Law of Conservation of Mass to balance chemical equations.</p> <p>Use words to explain a chemical reaction in terms of moles and coefficients.</p> <p>Determine the amounts of reactants reacted and products produced using mole ratios and unit analysis.</p>			
<p>What does a Limiting Reactant determine in a chemical reaction?</p> <p>How can a scientist use percent yield to validate an experiment?</p>	<p>Use mole ratios and a balanced equation to determine the Limiting and Excess reactants in a chemical equation.</p> <p>Calculate the % yield of a chemical reaction and assess the validity of the experiment.</p>			
<p>Suggestions on how to differentiate in this unit:</p> <ul style="list-style-type: none"> Suggest to students the purchase of an AP study guide as an additional resource (Barrons©, Princeton Review©, Kaplan©). Direct students to Moodle Site which includes links to AP Central®, and additional tutorial websites. Provide extra help after school for students. 				

*Optional

Freehold Regional High School District
AP Chemistry
Unit #5: Solution Stoichiometry

Enduring Understanding: Unit analysis of a balanced equation utilizes both the mass and mole ratios between the different components of the reaction to answer quantitative questions about reactants and products.

Essential Questions: Why is water such a unique molecule? Why is water referred to as the “universal” solvent? What makes a solution an electrolyte? How is this tested? What are acids? Bases? How is the concentration of solutions measured? How is this value calculated? How would a scientist prepare a solution? How would a scientist dilute a solution if it had too high of a concentration? What is a precipitate? What are the identifying characteristics of a precipitate reaction? How is the mass of the precipitate calculated? How is the concentration of each ion remaining in solution calculated? What are the differences, and what can you learn from a molecular equation, complete ionic equation, and net ionic equation? What are spectator ions? What is the net ionic equation for an acid-base reaction? What information can be learned from the titration of an acid-base reaction? What are the characteristics of an Oxidation-Reduction reaction? How is the oxidation number of a species determined?

Unit Goal: Students will be able to predict the amounts of reactants and products in solution based upon unit analysis.

Duration of Unit: 16 days

NJCCCS: 5.1.12.A.2-3, 5.1.12.B.1-5, 5.2.12.A.2, 5.2.12.A.5, 5.2.12.B.2, 5.2.12.B.3

Guiding / Topical Questions	Content, Themes, Concepts, and Skills	Instructional Resources and Materials	Teaching Strategies	Assessment Strategies
<p>Why is water such a unique molecule?</p> <p>Why is water referred to as the “universal” solvent?</p> <p>What makes a solution an electrolyte? How is this tested?</p> <p>What are acids? Bases?</p> <p>How is the concentration of solutions measured? How is this value calculated?</p> <p>How would a scientist prepare a solution?</p> <p>How would a scientist dilute a solution if it had too high of a concentration?</p>	<p>Use the structure of water to explain how substances dissolve.</p> <p>Define electrolyte. Use a conductivity apparatus to classify solutes as strong electrolytes, weak electrolytes, or non-electrolytes.</p> <p>Define acids and bases according to the Bronsted-Lowry Model.</p> <p>Classify acids and bases as strong or weak based upon their structure.</p> <p>Use the Molarity equation to calculate the concentration of solutions.</p> <p>Use the molarity calculate to explain in words how to make a solution of a specified concentration.</p> <p>Use the $M_1V_1=M_2V_2$ calculation to determine the amount of water needed to dilute a stock solution to a specified concentration.</p>	<p>Current textbook</p> <p>Internet</p> <p>Moodle</p> <p>PowerPoint</p> <p>LCD projector</p> <p>Video Streaming</p> <p>Lab Book “Laboratory Experiments for Advanced Placement Chemistry” Second Edition, Vonderbrink</p>	<p>Lecture</p> <p>Problem Workshop</p> <p>Labs:</p> <ul style="list-style-type: none"> • Precipitate Reactions • Acid-Base Titration • Red-Ox Titration 	<p>Written tests and quizzes</p> <p>Read assigned section from text.</p> <p>Outline the reading</p> <p>Complete assigned Chapter Review questions</p> <p>Make a list of questions for clarification</p>

Guiding / Topical Questions	Content, Themes, Concepts, and Skills	Instructional Resources and Materials	Teaching Strategies	Assessment Strategies
<p>What is a precipitate?</p> <p>What are the identifying characteristics of a precipitate reaction?</p> <p>How is the mass of the precipitate calculated?</p> <p>How is the concentration of each ion remaining in solution calculated?</p> <p>What are the differences, and what can you learn from a molecular equation, complete ionic equation, and net ionic equation?</p> <p>What are spectator ions?</p>	<p>Define Precipitate. Use solubility rules do designate substances as precipitates or aqueous solutions.</p> <p>Use Stoichiometry and Limiting Reactants to calculate the amount of precipitate that should be produced by a reaction.</p> <p>Use stoichiometry to calculate the concentration of each ion remaining in solution once a reaction has gone to completion.</p> <p>Use ion charges and solubility rules to predict the products of a reaction and their phases.</p> <p>Write Complete Ionic and Net Ionic equations for precipitate reactions.</p> <p>Define and Identify the spectator ions in a precipitate reaction.</p>			
<p>What is the net ionic equation for an acid-base reaction?</p> <p>What information can be learned from the titration of an acid-base reaction?</p> <p>What are the characteristics of an Oxidation-Reduction reaction?</p> <p>How is the oxidation number of a species determined?</p>	<p>Determine the net ionic equation of all acid-base neutralization reactions.</p> <p>Use data gathered during an acid-base titration to calculate the concentration of the unknown titrant.</p> <p>Determine the oxidation numbers of the various species in a Red-Ox reaction, then identify the Reduction and Oxidation half reactions.</p> <p>Use data gathered during a Red-Ox titration to calculate the % composition of an element in a compound.</p>			

Suggestions on how to differentiate in this unit:

- Suggest to students the purchase of an AP study guide as an additional resource (Barrons©, Princeton Review©, Kaplan©). Direct students to Moodle Site which includes links to AP Central®, and additional tutorial websites. Provide extra help after school for students.

*Optional

Freehold Regional High School District
AP Chemistry
Unit #6: Gases

Enduring Understanding: The Kinetic Molecular Theory is the backbone of the laws and concepts surrounding the different phases of matter.

Essential Questions: What are the different units of pressure? How does a manometer measure a contained gas?

What are the laws of gases and how are the variables related to one another? How does the ideal gas law relate all variables?

What contribution did Avogadro make to the volume of gases at STP? What happens to the total pressure of a mixture of gases in a container when the partial pressure of each gas is changed? How do ideal gases deviate from real gases? How does the Kinetic Molecular Theory relate to the phases of matter?

Unit Goal: Students will be able to apply the Kinetic Molecular Theory as well as the various gas laws to gases under a wide range of conditions and assess the results.

Duration of Unit: 10 days

NJCCCS: 5.1.12.A.2-3, 5.1.12.B.1-5, 5.2.12.A.2, 5.2.12.C.1, 5.2.12.C.2

Guiding / Topical Questions	Content, Themes, Concepts, and Skills	Instructional Resources and Materials	Teaching Strategies	Assessment Strategies
<p>What are the different units of pressure?</p> <p>How does a manometer measure a contained gas?</p> <p>What are the laws of gases and how are the variables related to one another?</p> <p>How does the ideal gas law relate all variables?</p>	<p>Identify the different standards for pressure and use them to convert between different units.</p> <p>Compare a Barometer to a Manometer.</p> <p>Calculate the pressure of a contained gas in a closed-manometer and an open-manometer.</p> <p>Use Boyle's Law, Charles' Law, and Gay-Lussac's Law to determine the unknown variable, T, P, or V.</p> <p>Combine all of the gas laws to create the Ideal Gas Law.</p> <p>Calculate the Ideal Gas Law constant.</p> <p>Perform Ideal Gas Law calculations to solve for unknown variables, T, V, P, and n.</p> <p>Manipulate the Ideal gas law to solve for Molar Mass and Density of gases.</p>	<p>Current textbook</p> <p>Internet</p> <p>Moodle</p> <p>PowerPoint</p> <p>LCD projector</p> <p>Video Streaming</p> <p>Lab Book "Laboratory Experiments for Advanced Placement Chemistry" Second Edition, Vonderbrink</p>	<p>Lecture</p> <p>Problem Workshop</p> <p>Labs:</p> <ul style="list-style-type: none"> • Molar Volume of a Gas • Determine the Molecular Mass of a Gas 	<p>Written tests and quizzes</p> <p>Read assigned section from text.</p> <p>Outline the reading</p> <p>Complete assigned Chapter Review questions</p> <p>Make a list of questions for clarification</p>
<p>What contribution did Avogadro make to the volume of gases at STP?</p> <p>What happens to the total pressure of a mixture of gases in a container when the partial pressure of each gas is changed?</p> <p>How do ideal gases deviate from real gases?</p> <p>How does the Kinetic Molecular Theory relate to the phases of matter?</p>	<p>Explain how Avogadro used 6.02×10^{23} to determine the volume of 1 mole of gas @ STP.</p> <p>Use Dalton's Law to calculate the pressure of a mixture of gas, or gases collected over water.</p> <p>Explain how van der Waals corrected for the Ideal Gas Law when it came to accounting for ideal gases at high pressure and low temperature.</p> <p>Define each phase of matter as its molecules would appear according to the Kinetic Molecular Theory.</p>			

Guiding / Topical Questions	Content, Themes, Concepts, and Skills	Instructional Resources and Materials	Teaching Strategies	Assessment Strategies
Suggestions on how to differentiate in this unit:				
<ul style="list-style-type: none"> Suggest to students the purchase of an AP study guide as an additional resource (Barrons©, Princeton Review©, Kaplan©). Direct students to Moodle Site which includes links to AP Central®, and additional tutorial websites. Provide extra help after school for students. 				

*Optional

Freehold Regional High School District
AP Chemistry
Unit #7: Thermochemistry

Enduring Understanding: The Law of Conservation of Energy explains how both the system and the surroundings are affected by heat changes during reactions.

Essential Questions: What is energy and how does it relate to the Law of Conservation of Energy? How is Energy defined in terms of heat and work? How are exothermic and endothermic reactions defined in terms of the system and surroundings? What is Enthalpy and how is it related to energy? Why is Enthalpy considered a state function? What is heat capacity and how is it measured using Calorimetry? How can calorimetry be used to measure enthalpy? What is bomb calorimetry and how does it differ from constant-pressure calorimetry? How is Hess's Law used to explain how a reaction takes place as well as determine the overall Enthalpy of a reaction? How can Standard Enthalpies of Formation be used to determine the overall Enthalpy of a reaction?

Unit Goal: Students will be able to relate heat as a transfer between objects at different temperatures.

Duration of Unit: 9 days

NJCCCS: 5.1.12.A.2-3, 5.1.12.B.1-5, 5.2.12.C.1, 5.2.12.D.1, 5.2.12.D.2, 5.2.12.D.4

Guiding / Topical Questions	Content, Themes, Concepts, and Skills	Instructional Resources and Materials	Teaching Strategies	Assessment Strategies
What is energy and how does it relate to the Law of Conservation of Energy? How is Energy defined in terms of heat and work? How are exothermic and endothermic reactions defined in terms of the system and surroundings? What is Enthalpy and how is it related to energy? Why is Enthalpy considered a state function?	Define Energy and relate it to the Law of Conservation of Energy. Use the equation for energy to calculate heat and work for reactions. Define exothermic and endothermic. Use these definitions to supply heat measurements with a + or – designation. Define Enthalpy. Use the equation to perform energy and heat calculations. Define state function; explain why Enthalpy is considered a state function.	Current textbook Internet Moodle PowerPoint LCD projector Video Streaming Lab Book “Laboratory Experiments for Advanced Placement Chemistry” Second Edition, Vonderbrink	Lecture Problem Workshop Labs: <ul style="list-style-type: none"> Coffee Cup Calorimetry 	Written tests and quizzes Read assigned section from text. Outline the reading Complete assigned Chapter Review questions Make a list of questions for clarification

Guiding / Topical Questions	Content, Themes, Concepts, and Skills	Instructional Resources and Materials	Teaching Strategies	Assessment Strategies
<p>What is heat capacity and how is it measured using Calorimetry?</p> <p>How can calorimetry be used to measure enthalpy?</p> <p>What is bomb calorimetry and how does it differ from constant-pressure calorimetry?</p>	<p>Classify substances as insulators or conductors based upon heat capacity.</p> <p>Use the heat capacity, temperature change, and mass of the substance ($q=mc\Delta T$) in order to determine the amount of heat absorbed/released by the substance.</p> <p>Perform constant-pressure calorimetry experiments to measure and calculate heat flow.</p> <p>Explain the difference between a coffee-cup calorimeter and a bomb calorimeter. Explain how a bomb calorimeter works and what it is used for.</p>			
<p>How is Hess's Law used to explain how a reactions takes place as well as determine the overall Enthalpy of a reaction?</p> <p>How can Standard Enthalpies of Formation be used to determine the overall Enthalpy of a reaction?</p>	<p>Use Hess's Law to calculate the overall energy change of a reaction.</p> <p>Use the standard enthalpies of formation to determine the overall energy change of a reaction at standard conditions.</p>			
<p>Suggestions on how to differentiate in this unit:</p> <ul style="list-style-type: none"> Suggest to students the purchase of an AP study guide as an additional resource (Barrons©, Princeton Review©, Kaplan©). Direct students to Moodle Site which includes links to AP Central®, and additional tutorial websites. Provide extra help after school for students. 				

*Optional

Freehold Regional High School District
AP Chemistry
Unit #8: Atomic Structure & Periodicity

Enduring Understanding: The electron(s) in an atom are responsible for determining the properties of the element as well as its placement on the Periodic Table.

Essential Questions: How did scientists determine that the electron was the driving force behind the emission of Electromagnetic Radiation? What factors are used to classify Electromagnetic Radiation according to the areas of the Electromagnetic Spectrum? What is meant by quantized energy and how does it apply to light? How does the Photoelectric Effect lead to the concept of dual nature of light? How did Bohr utilize the atomic emissions spectrum to create a model of the atom? How does quantized energy play an important role in the invalidation of Bohr's Model for all atoms other than Hydrogen? How did DeBroglie, Heisenberg, and Schrodinger's principles and equations lead to the quantum-mechanical model of the atom? How are Quantum Numbers used to describe the location of an electron in an atom? How are electron configuration and orbital diagrams determined based upon the Aufbau Principle, Hund's Rule, and the Pauli Exclusion Principle? What information can you gain about an atom based upon its electron configuration? When atoms are arranged according to their electron configurations several trends are seen; what are these trends and why do they happen?

Unit Goal: Students will be able to diagram the progression of electron placement from the Plum Pudding Model through the quantum mechanical model and ending with electron configuration.

Duration of Unit: 13 days

NJCCCS: 5.1.12.A.2-3, 5.1.12.B.1-5, 5.2.12.A.1, 5.2.12.A.3, 5.2.12.B.1

Guiding / Topical Questions	Content, Themes, Concepts, and Skills	Instructional Resources and Materials	Teaching Strategies	Assessment Strategies
<p>How did scientists determine that the electron was the driving force behind the emission of Electromagnetic Radiation?</p> <p>What factors are used to classify Electromagnetic Radiation according to the areas of the Electromagnetic Spectrum?</p> <p>What is meant by quantized energy and how does it apply to light?</p> <p>How does the Photoelectric Effect lead to the concept of dual nature of light?</p> <p>How did Bohr utilize the atomic emissions spectrum to create a model of the atom?</p> <p>How does quantized energy play an important role in the invalidation of Bohr's Model for all atoms other than Hydrogen?</p> <p>How did DeBroglie, Heisenberg, and Schrodinger's principles and equations lead to the quantum-mechanical model of the atom?</p>	<p>Review: outline the development of the atom from Dalton to Rutherford.</p> <p>Explain how Cathode Ray Tubes led scientists to determine that the electron was responsible for the energy emitted by atoms.</p> <p>List and explain the properties of the 7 sections of the electromagnetic spectrum.</p> <p>Use the speed of light to calculate the wavelength or frequency of light waves ($c=\lambda\nu$).</p> <p>Explain how Max Planck studied light and the relationship he made between energy and quanta, $E=h\nu$, and use it to calculate the Energy of different electromagnetic radiation.</p> <p>Use Bohr's model to calculate energy transitions of electrons and determine the type of EMR emitted by the transition.</p> <p>Explain how DeBroglie, Heisenberg, and Schrodinger revised Bohr's Model to make it more suitable atoms other than Hydrogen.</p> <p>Perform calculations using DeBroglie and Heisenberg's equations.</p>	<p>Current textbook</p> <p>Internet</p> <p>Moodle</p> <p>PowerPoint</p> <p>LCD projector</p> <p>Video Streaming</p> <p>Lab Book</p> <p>"Laboratory Experiments for Advanced Placement Chemistry" Second Edition, Vonderbrink</p>	<p>Lecture</p> <p>Problem Workshop</p> <p>Labs:</p> <ul style="list-style-type: none"> • Flame Tests • Emissions Spectra 	<p>Written tests and quizzes</p> <p>Read assigned section from text.</p> <p>Outline the reading</p> <p>Complete assigned Chapter Review questions</p> <p>Make a list of questions for clarification</p>

Guiding / Topical Questions	Content, Themes, Concepts, and Skills	Instructional Resources and Materials	Teaching Strategies	Assessment Strategies
<p>How are Quantum Numbers used to describe the location of an electron in an atom?</p> <p>How are electron configuration and orbital diagrams determined based upon the Aufbau Principle, Hund's Rule, and the Pauli Exclusion Principle?</p> <p>What information can you gain about an atom based upon its electron configuration?</p> <p>When atoms are arranged according to their electron configurations several trends are seen; what are these trends and why do they happen?</p>	<p>Relate Quantum Numbers to the game Battleship® as they describe the probable location of an electron in an atom.</p> <p>Use the 4 quantum numbers (n, l, m_l, m_s) to show probable locations of the electron in the atom.</p> <p>Use the Aufbau Principle, Hund's Rule, and the Pauli Exclusion Principle to complete orbital diagrams for atoms.</p> <p>Use the above principles and rules to write the ground-state electron configuration of elements including the exceptions.</p> <p>Use electron configuration to determine the valence energy level and number of valence electrons in the atom.</p> <p>Explain the trend of Atomic Radius, Ionization Energy, & Electron Affinity as you go across and down the Periodic Table.</p>			
<p>Suggestions on how to differentiate in this unit:</p> <ul style="list-style-type: none"> Suggest to students the purchase of an AP study guide as an additional resource (Barrons©, Princeton Review©, Kaplan©). Direct students to Moodle Site which includes links to AP Central®, and additional tutorial websites. Provide extra help after school for students. 				

*Optional

Freehold Regional High School District
AP Chemistry
Unit #9: Bonding (Ionic & Covalent)

Enduring Understanding: The nature of the valence electrons determines the type and strength of bond that forms.

Essential Questions: What factors are used to determine the likelihood in which a bond will form? How can a magnetic field determine the polarity of a molecule?
 How is electro negativity used to determine polarity of bonds within molecules? How can you predict the formula of an ionic compound?
 How does the size of atoms as ions compare to the neutral parent atom? What is common thread between isoelectronic atoms?
 How is the lattice energy of an ionic compound calculated? Why do covalent compounds have ionic character and how is it calculated?
 How are bond energies used to calculate the Enthalpy of a reaction? What information can be extracted from Lewis Dot Diagrams?
 How does the VSEPR model determine the shape of a molecule? How is the hybridization of molecular orbital determined?
 How are sigmas and pi bonds assigned to the different bonds in molecules?

Unit Goal: Students will be able to predict the type of bond that will form between atoms as well as identify the properties of compounds containing each bond.

Duration of Unit: 11 days

NJCCCS: 5.1.12.A.2-3, 5.1.12.B.1-5, 5.2.12.A.2, 5.2.12.A.3, 5.2.12.B.1, 5.2.12.C.2

Guiding / Topical Questions	Content, Themes, Concepts, and Skills	Instructional Resources and Materials	Teaching Strategies	Assessment Strategies
<p>What factors are used to determine the likelihood in which a bond will form?</p> <p>How is electro negativity used to identify polarity of bonds withing molecules?</p> <p>How can you predict the formula of an ionic compound?</p> <p>How does the size of atoms as ions compare to the neutral parent atom?</p> <p>What is common thread between isoelectronic atoms?</p> <p>How is the lattice energy of an ionic compound calculated?</p> <p>Why do covalent compounds have ionic character and how is it calculated?</p>	<p>Use Coulomb's Law to calculate the likelihood a bond will form.</p> <p>Use the electro negativity of the atoms in order to determine if a bond is polar or nonpolar.</p> <p>Use electron configuration and valance electrons to predict the combinations of ions in ionic compounds.</p> <p>Compare the size of ions versus their parent atoms; explain the trend that is seen.</p> <p>Use electron configuration to show how isoelectronic atoms gain the same electron configuration as noble gases.</p> <p>Use the different steps of ionic bonding to calculate the lattice energy of the ionic compound.</p> <p>Explain how highly polar bonds can be strong enough that they have an ionic character, and how non-polar bonds are very weak and would have low ionic character.</p>	<p>Current textbook</p> <p>Internet</p> <p>Moodle</p> <p>PowerPoint</p> <p>LCD projector</p> <p>Video Streaming</p> <p>Lab Book "Laboratory Experiments for Advanced Placement Chemistry" Second Edition, Vonderbrink</p>	<p>Lecture</p> <p>Problem Workshop</p> <p>Labs:</p> <ul style="list-style-type: none"> • Lewis Dot Diagrams 	<p>Written tests and quizzes</p> <p>Read assigned section from text.</p> <p>Outline the reading</p> <p>Complete assigned Chapter Review questions</p> <p>Make a list of questions for clarification</p>

Guiding / Topical Questions	Content, Themes, Concepts, and Skills	Instructional Resources and Materials	Teaching Strategies	Assessment Strategies
<p>How are bond energies used to calculate the Enthalpy of a reaction?</p> <p>What information can be extracted from Lewis Dot Diagrams?</p> <p>How does the VSEPR model determine the shape of a molecule?</p> <p>How can a magnetic field determine the polarity of a molecule?</p>	<p>Use the list of bond energies to calculate the enthalpy of the overall reaction.</p> <p>Draw Lewis Dot diagrams, determine the number of bonding and non-bonding pairs of electrons.</p> <p>Use the VSEPR model to determine the shape and bond angles of dot structures.</p> <p>Use the VSEPR model to determine the dipole moment of the molecule as well as how it would behave in a magnetic field based upon its polarity.</p>			
<p>How is the hybridization of molecular orbitals determined?</p> <p>How are sigma and pi bonds assigned to the different bonds in molecules?</p>	<p>Use VSEPR Models to determine the hybridization of the molecule.</p> <p>*Explain the bonding and anti-bonding orbitals in molecules.</p> <p>Use VSEPR Model to determine the number of sigma and pi bonds in molecules.</p>			
<p>Suggestions on how to differentiate in this unit:</p> <ul style="list-style-type: none"> Suggest to students the purchase of an AP study guide as an additional resource (Barrons©, Princeton Review©, Kaplan©). Direct students to Moodle Site which includes links to AP Central®, and additional tutorial websites. Provide extra help after school for students. 				

*Optional – Molecular Orbitals can be taught here, however, it is not a common topic on the AP Exam.

Freehold Regional High School District
AP Chemistry
Unit #10: Liquids & Solids

Enduring Understanding: The Kinetic Molecular Theory is the backbone of the laws and concepts surrounding the different phases of matter.

Essential Questions: How are the intermolecular forces that hold liquids and solids together determined? What properties of liquids can be attributed to intermolecular forces? What factors affect the strength of intermolecular forces and how does this change the properties of the substance? What are the different types of solids and how are the atoms of these different solids organized? How does the sea of electrons allow for the different properties of metals? What are network solids and how are they important to everyday life? What is the difference between the two types of alloys? How does that affect their function? How are phase changes determined by intermolecular forces? What information can be learned from a phase change diagram?

Unit Goal: Students will be able to examine the concept of intermolecular forces and apply it to the properties of the states of matter as well as relate them to phase changes.

Duration of Unit: 8 days

NJCCCS: 5.1.12.A.2-3, 5.1.12.B.1-5, 5.2.12.A.2, 5.2.12.C.1, 5.2.12.C.2

Guiding / Topical Questions	Content, Themes, Concepts, and Skills	Instructional Resources and Materials	Teaching Strategies	Assessment Strategies
<p>How are the intermolecular forces that hold liquids and solids together determined?</p> <p>What properties of liquids can be attributed to intermolecular forces?</p> <p>What factors affect the strength of intermolecular forces and how does this change the properties of the substance?</p>	<p>Use structure and polarity to assign IMFs to different molecules.</p> <p>Use the specific types of IMFs for each molecule to gain insight to its BP, MP, VP, ΔH_{vap}, ΔH_{sol}, etc.</p> <p>Explain how IMFs enable liquids to have properties such as viscosity, surface tension, and vapor pressure.</p>	<p>Current textbook</p> <p>Internet</p> <p>Moodle</p> <p>PowerPoint</p> <p>LCD projector</p> <p>Video Streaming</p>	<p>Lecture</p> <p>Problem Workshop</p> <p>Labs:</p> <ul style="list-style-type: none"> Heating & Cooling Curves 	<p>Written tests and quizzes</p> <p>Read assigned section from text.</p> <p>Outline the reading</p> <p>Complete assigned Chapter Review questions</p> <p>Make a list of questions for clarification</p>
<p>What are the different types of solids and how are the atoms of these different solids organized?</p> <p>How does the sea of electrons allow for the different properties of metals?</p> <p>What are network solids and how are they important to everyday life?</p> <p>What is the difference between the two types of alloys? How does that affect their function?</p>	<p>Compare the number of atoms in the unit cell of a cubic, face-centered, and body-centered closest packed solid arrangements.</p> <p>Explain how metal atoms bond with one another through movement of delocalized electrons.</p> <p>Explain the properties of metals using the sea of electrons as a basis.</p> <p>Explain why Carbon and Silicon create network solids. Describe the properties of these solids.</p> <p>Identify the two types of alloys, describe the structures and explain their function.</p>	<p>Lab Book "Laboratory Experiments for Advanced Placement Chemistry" Second Edition, Vonderbrink</p>		
<p>How are phase changes determined by intermolecular forces?</p> <p>What information can be learned from a phase change diagram?</p>	<p>Use IMFs to explain how phase changes take place, designate them exothermic or endothermic.</p> <p>Create a heating or cooling curve for different substances.</p> <p>Calculate the energy involve with a phase change based upon a heating or cooling curve.</p> <p>Determine critical temperatures of substances using a phase change diagram.</p>			

Suggestions on how to differentiate in this unit:

- Suggest to students the purchase of an AP study guide as an additional resource (Barrons©, Princeton Review©, Kaplan©). Direct students to Moodle Site which includes links to AP Central®, and additional tutorial websites. Provide extra help after school for students.

*Optional

Freehold Regional High School District
AP Chemistry
Unit #11: Properties of Solutions

Enduring Understanding: Solutions are a unique combination of a liquid and solid in which the properties and concentration are based upon the nature of the components.

Essential Questions: What are the different ways to describe the concentration of a solution? How are they calculated? How is energy involved in solution formation?
 What factors affect the solubility of a solute in a solvent? How is the Vapor Pressure of Non-Ideal solutions determined?
 What are the colligative properties of solutions and how do they play a role in solution formation?

Unit Goal: Students will be able to justify the ability of a solute to dissolve in a solvent as well as determine the concentration of the solution in various different units.

Duration of Unit: 10 days

NJCCCS: 5.1.12.A.2-3, 5.1.12.B.1-5, 5.2.12.A.2, 5.2.12.A.5, 5.2.12.C.2

Guiding / Topical Questions	Content, Themes, Concepts, and Skills	Instructional Resources and Materials	Teaching Strategies	Assessment Strategies
What are the different ways to describe the concentration of a solution? How are they calculated? How is energy involved in solution formation?	Calculate the concentration of solutions using Mass Percent, Molarity, molality, and mole fraction. Use polarity to determine if a solution will form. Explain how a solution forms and calculate the heat involved.	Current textbook Internet Moodle PowerPoint LCD projector	Lecture Problem Workshop Labs: <ul style="list-style-type: none"> • Factors affecting solubility & Colligative Properties 	Written tests and quizzes Read assigned section from text. Outline the reading
What factors affect the solubility of a solute in a solvent? How is the Vapor Pressure of Non-Ideal solutions determined?	Describe the factors and how they affect the solubility of different solutes in solvents. Use Raoult's Law to determine the vapor pressure of a solution versus the vapor pressure of the	Video Streaming Lab Book "Laboratory Experiments for Advanced Placement Chemistry" Second Edition, Vonderbrink		Complete assigned Chapter Review questions Make a list of questions for clarification
What are the colligative properties of solutions and how do they play a role in solution formation?	Explain how the number of solute particles play a role in colligative properties. Explain the colligative properties and perform calculations.			

Suggestions on how to differentiate in this unit:

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*Optional

Freehold Regional High School District

AP Chemistry

Unit #12: Chemical Kinetics

Enduring Understandings: The rate of a reaction is unique to the concentrations of the reactants and is affected by several factors.

Students collaboratively complete laboratory experiments utilizing safety as the most important aspect of working in the lab.

Essential Questions: How is the rate of a reaction determined? How is the rate Law or Rate order determined? How is method of initial rates used to determine the overall rate order of a reaction? How do catalysts affect the rate of a reaction? How is reaction rate important to body functions?

How do you determine which step in a mechanism determines the rate of a reaction? Explain how the collision model can graphically determine the rate of a reaction? What are the important safety concerns to consider before each lab? Why is it important to read over a lab prior to doing the lab?

Where is all of the safety equipment located in the lab classroom?

Unit Goal: Students will be able to characterize the rate of a reaction based upon interpreting graphs.

Duration of Unit: 10 days

NJCCCS: 5.1.12.A.2-3, 5.1.12.B.1-5, 5.2.12.B.3, 5.2.12.D.4, 5.2.12.D.5

Guiding / Topical Questions	Content, Themes, Concepts, and Skills	Instructional Resources and Materials	Teaching Strategies	Assessment Strategies
<p>How is the rate of a reaction determined?</p> <p>How is the rate Law or Rate order determined?</p> <p>How is method of initial rates used to determine the overall rate order of a reaction?</p>	<p>Explain that the rate of a reaction can only be determined experimentally by measuring the change in concentration versus the change in time.</p> <p>Use graphing calculators to plot the different axes as they pertain to zero, first, and second order rate reactions to determine the order of the reaction.</p> <p>Use the initial concentrations and the rate of the reaction to determine the order of a reaction.</p>	<p>Current textbook</p> <p>Internet</p> <p>Moodle</p> <p>PowerPoint</p> <p>LCD projector</p> <p>Video Streaming</p>	<p>Lecture</p> <p>Problem Workshop</p> <p>Labs:</p> <ul style="list-style-type: none"> Determine the Rate of a Reaction 	<p>Written tests and quizzes</p> <p>Read assigned section from text.</p> <p>Outline the reading</p> <p>Complete assigned Chapter Review questions</p>
<p>How do catalysts affect the rate of a reaction?</p> <p>How is reaction rate important to body functions?</p> <p>How do you determine which step in a mechanism determines the rate of a reaction?</p> <p>Explain how the collision model can graphically determine the rate of a reaction?</p>	<p>Define catalyst and explain how it affects the rate of a reaction.</p> <p>Relate enzymes to body function and how the body uses enzymes to perform daily tasks.</p> <p>Identify the rate-determining step in the reaction mechanism by identifying the slowest step</p> <p>Use the collision model to graphically determine the rate of a reaction.</p>	<p>Lab Book "Laboratory Experiments for Advanced Placement Chemistry" Second Edition, Vonderbrink</p>		<p>Make a list of questions for clarification</p>

Suggestions on how to differentiate in this unit:

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*Optional

Freehold Regional High School District
AP Chemistry
Unit #13: Chemical Equilibrium

Enduring Understanding: Equilibrium is a unique state in which the concentrations of all reactants and products remain constant with time.

Essential Questions: What conditions determine when a reaction has reached equilibrium? How is the mass action equation used to determine the equilibrium constant for a reaction? How is the mass action equation adjusted to fit reactions dependent upon pressure? How does the reaction quotient compare to the equilibrium constant? What can be determined by comparing the two values? How can ICE charts be utilized to determine the concentration of each component of a reaction at equilibrium? How is Le Chatelier's Principle used to predict the shift in equilibrium given a change in conditions?

Unit Goal: Students will be able to determine the equilibrium expression for chemical reactions as well as the concentrations of each species at equilibrium.

Duration of Unit: 7 days

NJCCCS: 5.1.12.A.2-3, 5.1.12.B.1-5

Guiding / Topical Questions	Content, Themes, Concepts, and Skills	Instructional Resources and Materials	Teaching Strategies	Assessment Strategies
<p>What conditions determine when a reaction has reached equilibrium?</p> <p>How is the mass action equation used to determine the equilibrium constant for a reaction?</p> <p>How is the mass action equation adjusted to fit reactions dependent upon pressure?</p>	<p>Explain the conditions necessary for a reaction to be at equilibrium.</p> <p>Use the mass action equation to determine the equilibrium constant.</p>	<p>Current textbook</p> <p>Internet</p> <p>Moodle</p> <p>PowerPoint</p> <p>LCD projector</p>	<p>Lecture</p> <p>Problem Workshop</p> <p>Labs:</p> <ul style="list-style-type: none"> • "Equilibrium" • LeChatelier's Principle 	<p>Written tests and quizzes</p> <p>Read assigned section from text.</p> <p>Outline the reading</p> <p>Complete assigned Chapter Review questions</p> <p>Make a list of questions for clarification</p>
<p>How does the reaction quotient compare to the equilibrium constant? What can be determined by comparing the two values?</p> <p>How can ICE charts be utilized to determine the concentration of each component of a reaction at equilibrium?</p> <p>How is Le Chatelier's Principle used to predict the shift in equilibrium given a change in conditions?</p>	<p>Define catalyst and explain how it affects the rate of a reaction.</p> <p>Relate enzymes to body function and how the body uses enzymes to perform daily tasks.</p> <p>Identify the rate-determining step in the reaction mechanism by identifying the slowest step</p> <p>Use the collision model to graphically determine the rate of a reaction.</p>	<p>Video Streaming</p> <p>Lab Book "Laboratory Experiments for Advanced Placement Chemistry" Second Edition, Vonderbrink</p>		

Suggestions on how to differentiate in this unit:

- Suggest to students the purchase of an AP study guide as an additional resource (Barrons©, Princeton Review©, Kaplan©). Direct students to Moodle Site which includes links to AP Central®, and additional tutorial websites. Provide extra help after school for students.

*Optional

Freehold Regional High School District

AP Chemistry

Unit #14: Acids & Bases

Enduring Understandings: Acids and bases are distinguished by both structure and pH.

Students collaboratively complete laboratory experiments utilizing safety as the most important aspect of working in the lab.

Essential Questions: What are the differences between acids and bases according to the different models? How is the strength of acids and bases determined? What is pH? How is it used to determine the acidity or alkalinity of a substance? How is the pH of weak acid solutions calculated? Weak acid mixtures? Why would it be important to calculate the % dissociation of an acid in a solution? How is the pH of a solution calculated at equilibrium? How is the pOH/pH of weak base solutions calculated? Weak base mixtures? How is the pH of a solution calculated at equilibrium when starting with a basic solution? What are polyprotic acids? How is the pH calculated for this type of species? How can you determine if a salt creates an acidic or basic solution? How does the structure of an acid affect its strength? How does Lewis use Lewis Structures to differentiate between acids and bases? What are the important safety concerns to consider before each lab? Why is it important to read over a lab prior to doing the lab? Where is all of the safety equipment located in the lab classroom?

Unit Goal: Students will be able to distinguish between acids and bases based upon pH.

Duration of Unit: 12 days

NJCCCS: 5.1.12.A.2-3, 5.1.12.B.1-5, 5.2.12.A.5, 5.2.12.A.6, 5.2.12.B.3

Guiding / Topical Questions	Content, Themes, Concepts, and Skills	Instructional Resources and Materials	Teaching Strategies	Assessment Strategies
<p>What are the differences between acids and bases according to the different models?</p> <p>How is the strength of acids and bases determined?</p> <p>What is pH? How is it used to determine the acidity or alkalinity of a substance?</p> <p>How is the pH of weak acid solutions calculated? Weak acid mixtures?</p> <p>Why would it be important to calculate the % dissociation of an acid in a solution?</p>	<p>Explain the differences between acids and bases.</p> <p>Determine the strength of acids and bases</p> <p>Define pH. Use pH to determine the acidity or alkalinity of a substance.</p> <p>Use ICE charts to calculate the pH of weak acids.</p> <p>Use ICE charts to calculate the pH of mixtures of weak acids.</p> <p>Calculate the % dissociation of an acid. Explain what this calculation represents.</p>	<p>Current textbook</p> <p>Internet</p> <p>Moodle</p> <p>PowerPoint</p> <p>LCD projector</p> <p>Video Streaming</p> <p>Lab Book "Laboratory Experiments for Advanced Placement Chemistry" Second Edition, Vonderbrink</p>	<p>Lecture</p> <p>Problem Workshop</p> <p>Labs:</p> <ul style="list-style-type: none"> Acid/Base Equilibrium 	<p>Written tests and quizzes</p> <p>Read assigned section from text.</p> <p>Outline the reading</p> <p>Complete assigned Chapter Review questions</p> <p>Make a list of questions for clarification</p>
<p>How is the pH of a solution calculated at equilibrium?</p> <p>How is the pOH/pH of weak base solutions calculated? Weak base mixtures?</p> <p>How is the pH of a solution calculated at equilibrium when starting with a basic solution?</p>	<p>Calculate the pH of a solution at equilibrium.</p> <p>Calculate pOH.</p> <p>Use pOH to calculate the pH of bases.</p> <p>Use ICE charts to calculate the pH of weak bases and weak base mixtures.</p> <p>Calculate the pH of a base at equilibrium.</p>			

Guiding / Topical Questions	Content, Themes, Concepts, and Skills	Instructional Resources and Materials	Teaching Strategies	Assessment Strategies
<p>What are polyprotic acids? How is the pH calculated for this type of species?</p> <p>How can you determine if a salt creates an acidic or basic solution?</p> <p>How does the structure of an acid affect its strength?</p> <p>How does Lewis use Lewis Structures to differentiate between acids and bases?</p>	<p>Define polyprotic acids and provide examples.</p> <p>Write dissociation reactions for salts and identify them as acids or bases.</p> <p>Explain how the structure of acids affect its strength.</p> <p>Define Lewis' definition of acids and bases.</p> <p>Use Lewis Dot structures to show acids and bases.</p>			
<p><u>Suggestions on how to differentiate in this unit:</u></p> <ul style="list-style-type: none"> Suggest to students the purchase of an AP study guide as an additional resource (Barrons©, Princeton Review©, Kaplan©). Direct students to Moodle Site which includes links to AP Central®, and additional tutorial websites. Provide extra help after school for students. 				

*Optional

Freehold Regional High School District
AP Chemistry
Unit #15: Acid/Base Equilibria

Enduring Understandings: Acids and bases are distinguished by both structure and pH.

Students collaboratively complete laboratory experiments utilizing safety as the most important aspect of working in the lab.

Essential Questions: How does the mixing of a salt and acid or base result in the formation of a common ion? What is a buffer and what role does it play in the body?
 How can calculations prove a buffer solution was created? How can you predict the endpoint of acid-base titration reactions using pH curves?
 What factors determine the indicator that should be used during acid-base titrations? What are the important safety concerns to consider before each lab?
 Why is it important to read over a lab prior to doing the lab? Where is all of the safety equipment located in the lab classroom?

Unit Goal: Students will be able to analyze mixtures of acids, bases, and salts according to pH.

Duration of Unit: 7 days

NJCCCS: 5.1.12.A.2-3, 5.1.12.B.1-5, 5.2.12.A.5, 5.2.12.A.6, 5.2.12.B.3

Guiding / Topical Questions	Content, Themes, Concepts, and Skills	Instructional Resources and Materials	Teaching Strategies	Assessment Strategies
How does the mixing of a salt and acid or base result in the formation of a common ion? What is a buffer and what role does it play in the body? How can calculations prove a buffer solution was created?	Identify the common ion in a mixture of a salt with an acid or base. Explain how the body uses buffers to maintain health. Use calculations to prove that buffers work and do not alter the pH of a solution.	Current textbook Internet Moodle PowerPoint LCD projector	Lecture Problem Workshop Labs: <ul style="list-style-type: none"> • “Salts & Buffers” • “pH Cuves” 	Written tests and quizzes Read assigned section from text. Outline the reading Complete assigned Chapter Review questions
How can you predict the endpoint of acid-base titration reactions using pH curves? What factors determine the indicator that should be used during acid-base titrations?	Predict the endpoint of an acid-base titration using a pH curve. Explain the factors used when selecting the appropriate indicator for an acid-base titration	Video Streaming Lab Book “Laboratory Experiments for Advanced Placement Chemistry” Second Edition, Vonderbrink		Make a list of questions for clarification
<p>Suggestions on how to differentiate in this unit:</p> <ul style="list-style-type: none"> • Suggest to students the purchase of an AP study guide as an additional resource (Barrons©, Princeton Review©, Kaplan©). Direct students to Moodle Site which includes links to AP Central®, and additional tutorial websites. Provide extra help after school for students. 				

*Optional

Freehold Regional High School District
AP Chemistry
Unit #16: Solubility & Complex Ion Equilibria

Enduring Understandings: The solubility of substances is affected by different factors that create a shift in equilibrium.

Students collaboratively complete laboratory experiments utilizing safety as the most important aspect of working in the lab.

Essential Questions: How is the solubility of a salt determined at equilibrium? How is the solubility constant used to compare the solubility of different salts?
 How would a common ion affect the solubility of a salt during solution preparation? How can K_{sp} be used to determine if a precipitate will form when two solutions are combined? What is a complex ion? How can you determine the reactions in which common ions form?
 What are the important safety concerns to consider before each lab? Why is it important to read over a lab prior to doing the lab?
 Where is all of the safety equipment located in the lab classroom?

Unit Goal: Students will be able to examine solutes and determine their solubility in various substances based upon the equilibrium expression.

Duration of Unit: 7 days

NJCCCS: 5.1.12.A.2-3, 5.1.12.B.1-5, 5.2.12.A.5, 5.2.12.B.3

Guiding / Topical Questions	Content, Themes, Concepts, and Skills	Instructional Resources and Materials	Teaching Strategies	Assessment Strategies
How is the solubility of a salt determined at equilibrium? How is the solubility constant used to compare the solubility of different salts?	Explain how the solubility of a salt is determined at equilibrium. Calculate the solubility of a salt at equilibrium.	Current textbook Internet Moodle PowerPoint LCD projector	Lecture Problem Workshop Labs: <ul style="list-style-type: none"> • “Solubility Equilibria” 	Written tests and quizzes Read assigned section from text. Outline the reading Complete assigned Chapter Review questions
How would a common ion affect the solubility of a salt during solution preparation? How can K_{sp} be used to determine if a precipitate will form when two solutions are combined?	Describe how the introduction of a common ion affects the solubility of a salt. Use K_{sp} to determine whether or not a precipitate forms during a reaction.	Video Streaming Lab Book “Laboratory Experiments for Advanced Placement Chemistry” Second Edition, Vonderbrink		Make a list of questions for clarification
What is a complex ion? How can you determine the reactions in which common ions form?	Describe a complex ion. Identify the factors that would cause a complex ion to form.			

Suggestions on how to differentiate in this unit:

- Suggest to students the purchase of an AP study guide as an additional resource (Barrons©, Princeton Review©, Kaplan©). Direct students to Moodle Site which includes links to AP Central®, and additional tutorial websites. Provide extra help after school for students.

*Optional

Freehold Regional High School District
AP Chemistry
Unit #17: Spontaneity, Entropy, & Free Energy

Enduring Understandings: The Law of Conservation of Energy explains how both the system and the surroundings are affected by heat changes during reactions.

Students collaboratively complete laboratory experiments utilizing safety as the most important aspect of working in the lab.

Essential Questions: When is a reaction classified as a spontaneous process? What is Entropy and how does it relate to the universe?
 How does entropy apply to the three physical states of matter? How does the Second Law of Thermodynamics relate to the universe and how can it be used to determine the spontaneity of a reaction? What are the important factors involved with determining the sign and magnitude of Entropy?
 How does Gibbs Free Energy play a role in spontaneity? What factors are used to determine the Entropy of a reaction?
 How does the Third Law of thermodynamics play a role in calculating the Entropy of a reaction based upon standard Enthalpies?
 How does equilibrium play an important role with Gibbs free energy? What are the important safety concerns to consider before each lab? Why is it important to read over a lab prior to doing the lab? Where is all of the safety equipment located in the lab classroom?

Unit Goal: Students will be able to examine the universe in terms of Entropy and Free Energy.

Duration of Unit: 6 days

NJCCCS: 5.1.12.A.2-3, 5.1.12.B.1-5, 5.2.12.C.1, 5.2.12.D.1, 5.2.12.D.2, 5.2.12.D.4

Guiding / Topical Questions	Content, Themes, Concepts, and Skills	Instructional Resources and Materials	Teaching Strategies	Assessment Strategies
When is a reaction classified as a spontaneous process?	Explain the characteristics of a spontaneous reaction.	Current textbook	Lecture	Written tests and quizzes
What is Entropy and how does it relate to the universe?	Define entropy and relate it to the universe.	Internet	Problem Workshop	Read assigned section from text.
How does entropy apply to the three physical states of matter?	Describe the three states according to entropy.	Moodle		
How does the Second Law of Thermodynamics relate to the universe and how can it be used to determine the spontaneity of a reaction?	Define the Second Law of Thermodynamics and how it pertains to the spontaneity of a reaction.	PowerPoint	Complete assigned Chapter Review questions	Outline the reading
What are the important factors involved with determining the sign and magnitude of Entropy?	Describe the factors involved in determining the sign and magnitude of entropy.	LCD projector		
How does the Third Law of thermodynamics play a role in calculating the Entropy of a reaction based upon standard Enthalpies?	Define the third Law of Thermodynamics.	Video Streaming		
How does equilibrium play an important role with Gibbs Free Energy?	Explain how to determine Gibbs Free Energy at equilibrium.	Lab Book "Laboratory Experiments for Advanced Placement Chemistry" Second Edition, Vonderbrink	Make a list of questions for clarification	

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Freehold Regional High School District

AP Chemistry

Unit #18: Electrochemistry

Enduring Understandings: The electrical output of a chemical cell is determined by the number of electrons transferred during an Oxidation-Reduction reaction.

Students collaboratively complete laboratory experiments utilizing safety as the most important aspect of working in the lab.

Essential Questions: What is electrochemistry? How does it utilize Red-Ox reactions to explain electron transfer? How is the anode and cathode determined?
 How does a galvanic cell work? How is the potential of a galvanic cell calculated? How is line notation written for galvanic cells?
 How does the Nernst equation explain cell potential in terms of Free Energy? How does the concentration of the solutions affect the potential of the cell?
 How does an electrolytic cell? How does it compare to a galvanic cell? What are the important safety concerns to consider before each lab? Why is it important to read over a lab prior to doing the lab? Where is all of the safety equipment located in the lab classroom?

Unit Goal: Students will be able to design electrochemical cells and evaluate the flow of electrons to determine cell potential.

Duration of Unit: 7 days

NJCCCS: 5.1.12.A.2-3, 5.1.12.B.1-5, 5.2.12.B.2, 5.2.12.B.3, 5.2.12.D.4

Guiding / Topical Questions	Content, Themes, Concepts, and Skills	Instructional Resources and Materials	Teaching Strategies	Assessment Strategies
<p>What is electrochemistry? How does it utilize Red-Ox reactions to explain electron transfer?</p> <p>How is the anode and cathode determined?</p> <p>How does a galvanic cell work? How is the potential of a galvanic cell calculated?</p> <p>How is line notation written for galvanic cells?</p>	<p>Explain the characteristics of a spontaneous reaction.</p> <p>Define entropy and relate it to the universe.</p> <p>Describe the three states according to entropy.</p> <p>Define the Second Law of Thermodynamics and how it pertains to the spontaneity of a reaction.</p> <p>Describe the factors involved in determining the sign and magnitude of entropy.</p>	<p>Current textbook</p> <p>Internet</p> <p>Moodle</p> <p>PowerPoint</p> <p>LCD projector</p> <p>Video Streaming</p> <p>Lab Book "Laboratory Experiments for Advanced Placement Chemistry" Second Edition, Vonderbrink</p>	<p>Lecture</p> <p>Problem Workshop</p> <p>Lab:</p> <p>"Electrochemical Cells"</p>	<p>Written tests and quizzes</p> <p>Read assigned section from text.</p> <p>Outline the reading</p> <p>Complete assigned Chapter Review questions</p> <p>Make a list of questions for clarification</p>
<p>How does the Nernst equation explain cell potential in terms of Free Energy?</p> <p>How does the concentration of the solutions affect the potential of the cell?</p> <p>How does an electrolytic cell? How does it compare to a galvanic cell?</p>	<p>Use the Nernst equation to find the cell potential in terms of Free Energy.</p> <p>Explain how the concentration of solutions affects the potential of the cell.</p> <p>Compare and contrast Galvanic and Electrolytic cells.</p>			

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*Optional

Freehold Regional High School District
AP Chemistry
Unit #19: The Nucleus

Enduring Understanding: When a nucleus is unstable, it releases energy as a result of radioactive decay.

Essential Questions: Why do the nuclei of certain atoms undergo radioactive decay? What are the types of radiation released during radioactive decay?
 How do the pieces of radioactive decay fit into nuclear reactions? What are the uses of radioactivity as pertaining to the medical field?

What is the difference between nuclear fission and nuclear fusion? How are these processes used? What are some positive and negative effects of radiation?

Unit Goal: Students will be able to assess the impact each type of radioactive decay has on atoms.

Duration of Unit: 3 days (Spring Break assignment)

NJCCCS: 5.1.12.A.2-3, 5.1.12.B.1-5, 5.2.12.A.1, 5.2.12.A.4, 5.2.12.D.3

Guiding / Topical Questions	Content, Themes, Concepts, and Skills	Instructional Resources and Materials	Teaching Strategies	Assessment Strategies
Why do the nuclei of certain atoms undergo radioactive decay? What are the types of radiation released during radioactive decay? How do the pieces of radioactive decay fit into nuclear reactions?	Explain why the nuclei of certain atoms undergo radioactive decay. Identify and define the types of radiation released during radioactive decay. Explain how the pieces of radioactive decay fit into nuclear reactions.	Current textbook Internet Moodle PowerPoint LCD projector	Lecture Problem Workshop Lab: Webquest – “Nuclear Radiation”	Written tests and quizzes Read assigned section from text. Outline the reading Complete assigned Chapter Review questions
What are the uses of radioactivity as pertaining to the medical field? What is the difference between nuclear fission and nuclear fusion? How are these processes used? What are some positive and negative effects of radiation?	Identify and explain the uses of radioactivity in the medical field. Compare and Contrast Nuclear Fission and Nuclear Fusion. Identify the positive and negative effects of nuclear radiation.	Video Streaming Lab Book “Laboratory Experiments for Advanced Placement Chemistry” Second Edition, Vonderbrink		Make a list of questions for clarification

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*Optional

Freehold Regional High School District
AP Chemistry
Unit #20: Descriptive Chemistry & Coordination Compounds

Enduring Understanding: The nature of compounds is important when predicting the reactants and products of a reaction.

Essential Questions: What is a coordination compound? What are the conditions in which coordination compounds are most likely to form?
 How are the formulas of coordination compounds written?

Unit Goal: Students will be able to predict both the products and the reactants of chemical reactions based upon the information provided.

Duration of Unit: 7 days

NJCCCS: 5.1.12.A.2-3, 5.1.12.B.1-5, 5.2.12.B.3

Guiding / Topical Questions	Content, Themes, Concepts, and Skills	Instructional Resources and Materials	Teaching Strategies	Assessment Strategies
What is a coordination compound? What are the conditions in which coordination compounds are most likely to form? How are the formulas of coordination compounds written?	Define and describe a coordination compound. Explain the conditions in which a coordination compound is most likely to occur. Write formulas of coordination compounds.	Current textbook Internet Moodle PowerPoint LCD projector Video Streaming Lab Book "Laboratory Experiments for Advanced Placement Chemistry" Second Edition, Vonderbrink	Lecture Problem Workshop www.chemmybear.com	Written tests and quizzes Read assigned section from text. Outline the reading Complete assigned Chapter Review questions Make a list of questions for clarification

Suggestions on how to differentiate in this unit:

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*Optional

Freehold Regional High School District
AP Chemistry
Unit #21: Organic Chemistry (Optional)

Enduring Understanding: Organic compounds are categorized and named according to the functional groups they contain.

Essential Questions: How are organic compounds identified? What are the functional groups seen on organic compounds?
 What is the process for naming and writing formulas of organic compounds?

Unit Goal: Students will be able to evaluate an organic molecule for functional groups and then properly name the molecule.

Duration of Unit: 2 days

NJCCCS: 5.1.12.A.2-3, 5.1.12.B.1-5

Guiding / Topical Questions	Content, Themes, Concepts, and Skills	Instructional Resources and Materials	Teaching Strategies	Assessment Strategies
<p>How are organic compounds identified?</p> <p>What are the functional groups seen on organic compounds?</p> <p>What is the process for naming and writing formulas of organic compounds?</p>	<p>Explain how organic compounds are identified.</p> <p>Identify and name the functional groups of organic compounds.</p> <p>Practice naming and writing formulas of organic compounds.</p>	<p>Current textbook</p> <p>Internet</p> <p>Moodle</p> <p>PowerPoint</p> <p>LCD projector</p> <p>Video Streaming</p> <p>Lab Book "Laboratory Experiments for Advanced Placement Chemistry" Second Edition, Vonderbrink</p>	<p>Lecture</p> <p>Problem Workshop</p> <p>Lab: "Organic Molecules"</p>	<p>Written tests and quizzes</p> <p>Read assigned section from text.</p> <p>Outline the reading</p> <p>Complete assigned Chapter Review questions</p> <p>Make a list of questions for clarification</p>

Suggestions on how to differentiate in this unit:

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*Optional