Kenilworth Public Schools

Curriculum Guide

Content Area: Chemistry
Grade: 10-11
BOE Approved: 5/11/15

Revision Date: February 2021
Submitted by: Michael Adamcik
BOE Revision Approved: 3/8/21

Chemistry - 10th Grade Scope and Sequence

Unit 1 - Safety, Lab Procedures, and Data Analysis	Unit 2 - Classification	Unit 3 - Atomic Structure	Unit 4 - The Periodic Table	Unit 5 - Chemical Bonding	Unit 6 - Writing and Balancing Chemical Equations
Weeks 1-3	Weeks 4-6	Weeks 7-10	Weeks 11-13	Weeks 14-18	Weeks 19-24
Unit Description: Measurements and observations tools are essential activities in science. It allows for the understanding of concept quantitatively as well as for analyzing data collected during experiments. In this unit, conceptual, mathematical, physical, and computational tools will be utilized. Introductory labs will focus on selecting the appropriate lab equipment and its proper use. Dimensional analysis will be introduced as a way of converting units	*Unit Description:* Everything is made up of matter. Matter has 2 defining qualities: it takes up space and has inertia. All matter is held together by forces. Energy flows between every particles of matter. Matter can be classified based on its properties. In this unit, the different types of matter will be compared. The physical and chemical changes by which matter can undergo will be observed. The basic form of a chemical equation will be introduced.	*Unit Description:* Atoms are the building blocks of matter. By understanding the structure of an atom, one can begin to understand the chemical and physical properties associated with an element. Electron and their energy levels are explored in the use of electron configuration.	*Unit Description:* The periodic table organizes elements based on their properties. It allows trends in physical properties and chemical reactivity to appear. Using the periodic table, the possible formation of chemical compound can be predicted.	*Unit Description:* Chemical bonds hold all compounds together. The electron dot formula of an element will help predict what type of bond will form in a compound. Creating physical models of molecular structures will reinforce this concept. The different types of bonds will be contrasted. Both systems of naming compounds will be utilized when writing the name of a molecular and ionic compound. Oxidation numbers are assigned to elements to help in the formation of compounds.	*Unit Description:* Chemical reactions evident throughout our world. This unit explores the reactions of elements and their compounds. Equations are balanced to ensure the reaction occurs properly. Chemical reactions can be classified using their unique characteristics. The five major types of reactions will be introduced and guidelines for determining chemical equations will be discussed. Labs will be performed to reinforce the various reaction types.
Unit Targets:	*Unit Targets:*	*Unit Targets:*	*Unit Targets:*	*Unit Targets:*	*Unit Targets:*

• Use their learning of safety and lab procedures to make informed decisions when selecting and using equipment or tools. • Transfer their learning of the scientific method and data analysis to solve problems and identify sources of error. • Differentiate between quantitative and qualitative data. • Identify both the independent and dependent variables for an experiment •	• Analyze the properties of matter for the purpose of classification. • Connect the effects of energy transfer with the different states of matter. • Identify classifications of matter (element, compound, homogeneous mixture, and heterogeneous mixture). • Differentiate samples for the purpose of classification. • Connect the arrangement of molecules with the amount of energy transfer through data analysis questions or a conclusion paragraph. • Use the kinetic molecular theory to describe and explain the properties of solids, liquids, and gases.	• Compare the modern atomic model to previous models of the atom • Use atomic models to predict the behaviors of atoms in interactions. • Explain how the properties of isotopes, including half-lives, decay modes, and nuclear resonances, lead to useful applications of isotopes. • Create a Bohr model including subatomic particles from the name of an element on the periodic table. • Formulate electron configurations by analyzing Aufbau diagrams, Hund's rule, and Pauli Exclusion Principle.	• Accurately explain the placement of elements on the periodic table. • Predict patterns in the chemical and physical properties of elements. • Connect the placement of elements on the periodic table to each other and prove the various trends. • Analyze patterns in the periodic trends of atomic size, ionization energy and electronegativity. • Determine the identity of missing elements based upon the properties of the other elements in the group	• Differentiate between covalent, ionic, and metallic bonding in terms of valence electrons. • Develop a reason why metals tend to form positive ions while nonmetals form negative ions. • Calculate formula mass, molar mass and percent compositions. • Predict the oxidation number of an element based on its location on the periodic table. • Apply the concepts of ionic and covalent bonding to effectively represent compounds using chemical formulas and names. • Compare the different types of intermolecular forces and recognize in which types of compounds they are present. • Construct Lewis structures for molecular compounds. • Develop a logical	• Accurately represent chemical reactions using word equations • Formulate and balance skeleton equations using coefficients. • Cite evidence of the indicators of a chemical reaction such as: energy change, color change, production of a gas, formation of a precipitate. • Differentiate reactants products, coefficients, subscripts, and yield signs and what they represent. • Apply the Law of Conservation of Mass to explain why the mass of reactants must equal the mass of products. • Differentiate chemical reactions by one of the five main types: synthesis, decomposition, single replacement, double replacement, and combustion. • Utilize the activity

				argument as to how the "sea of electrons" model and delocalized electrons explain various properties of metals. • Predict the molecular shapes of the compound using the VSEPR theory.	series to determine if a single replacement reaction will occur. • Predict the formation of a precipitate from a solubility table. Communicate how a change in activation energy, concentration, temperature, or addition of a catalyst can affect reaction rate.

Chemistry - 10th Grade Scope and Sequence

Unit 7 -Stoichiometry	Unit 8 - Gas Laws	Unit 9 - Solutions			
Weeks 25-30	Weeks 32-33	Weeks 34-35			
Unit Description: All objects and substances in the natural world are composed of matter. Matter can be changed either physically or chemically, utilizing energy. The conservation of energy can be demonstrated by keeping track of energy as it is transferred from one object to another. In this unit, molar ratio and molar mass will be introduced. Problem solving involving conversions of moles and grams will be established. The concepts of limiting and excess reactants will be discussed.	*Unit Description:* Gases are all around us. This unit will examine the properties of gases in comparison to solids and liquids. Gas law calculations and stoichiometry will be introduced. The factors that affect the relationship between gases, such as temperature, volume and pressure will be explained. The relationship between mass and rate of diffusion will be established.	*Unit Description:* Solutions are important aspects of the human body and daily life. This unit will explore the characteristics of solutions and the factors that will affect solution formation and solubility. Concentrations of solutions will be calculated in terms of molality and molarity and utilize stoichiometry. The concept of chemical equilibrium will be used to summarize the ratio of reactants to products in a reaction. Acids and bases will be introduced. The pH scale will be utilized to determine whether a			

		solution is an acid or a base based on the ion concentrations.			
Unit Targets: • Solve mole conversion problems. • Determine the amount of reactants and products in a chemical reaction using stoichiometry. • Prove the Law of Conservation of Mass is satisfied using a balanced equation. • Conclude the thickness of the piece of aluminum foil and convert the thickness into atoms. • Determine the amount of a product produced by applying quantities to chemical reactions. • Determine the percent yield and formulate hypotheses for errors.	*Unit Targets:* • Apply the Kinetic Molecular Theory to the behavior of gases. • Apply the mathematical models to illustrate the relationships between Pressure (P), Volume, (V) and Temperature (T). • Analyze data and graph representing the relationships between pressure, volume, and temperature of a gas. This includes 5 trials with the given values of P, V, and T depending on each gas laws. • Draw conclusions as the variables change (inverse or direct relationships). • Calculate the unknown variables of various practice problems. • Draw conclusions	*Unit Targets:* • Differentiate between the different types of solutions. • Calculate the concentration of various visual solutions. • Calculate the molarity of a substance. • Prove the solubility of a substance using a solubility curve. • Calculating the pH. • Analyze a solution with litmus paper and pH paper. • Identify various substances as acids or bases and the degrees of acidity and alkalinity based on various indicators.			

	connecting real world situations to gas law relationships.				

Chemistry – 10th Grade Unit 1

Unit Title: Safety, Lab Procedure, and Data Analysis	
Unit Summary: Measurements and observations tools are essential activities in science. It allows for the understanding of concept quantitatively as well as for analyzing data collected during experiments. In this unit, conceptual, mathematical, physical, and computational tools will be utilized. Introductory labs will focus on selecting the appropriate lab equipment and its proper use. Dimensional analysis will be introduced as a way of converting units.	
Primary Interdisciplinary Connections: MP.2, MP.4, HSN-Q.A.1, HSN-Q.A.2, and HSN-Q.A.3	
Career Readiness, Life Literacies, and Key Skills: 9.4.12.CI.1, 9.4.12.CI.2, 9.4.12.CI.3, 9.4.12.CT.1, 9.4.12.CT.2, 9.4.12.CT.4, 9.4.12.TL.2	
Learning Targets	
NJSLS Standards: HS-PS1-1, HS-PS1-2, HS-PS1-3, HS-PS1-4, HS-PS1-5, HS-PS1-6, HS-PS1-7, HS-PS1-8	
Computer Science and Design Thinking Standards: 8.1.12.A.2, 8.1.12.A.3, 8.1.12.A.4, 8.1.12.C.1, 8.1.12.E.1, 8.1.12.E.2	
Climate Change Standards: HS-ESS3-1, HS-ESS3-2, HS-ESS3-3, HS-ESS3-4, HS-ESS3-5, HS-ESS3-6	
ELA Companion Standards: RST.9-10.7, RST.11-12.1, WHST.9-12.2, WHST.9-12.5, WHST.9-12.7, WHST.11-12.8, WHST.9-12.9, SL.11-12.5	
Content Statements:	
1	Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms.
2	Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties.
3	Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles.
4	Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy.
5	Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs.
6	Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium.
7	Use mathematical representations to support the claim that atoms, and therefore mass, are

	conserved during a chemical reaction.
8	Develop models to illustrate the changes in the composition of the nucleus of the atom and the energy released during the processes of fission, fusion, and radioactive decay.

Big Idea: Utilizing proper lab practices and measurement techniques are essential when conducting research in science.

Unit Essential Questions:	**Unit Enduring Understandings:**
• What do we need to do in order to be safe in the laboratory setting? • How do we organize and analyze data? • Can we solve problems without the scientific method?	• Following safety procedures, using protective equipment, and selecting the appropriate laboratory tools will reduce the risk of injury. • Planning, organizing, and analyzing data are essential components of solving problems.

Unit Learning Targets

Students will…

- Use their learning of safety and lab procedures to make informed decisions when selecting and using equipment or tools.
- Transfer their learning of the scientific method and data analysis to solve problems and identify sources of error.
- Differentiate between quantitative and qualitative data.

  Identify both the independent and dependent variables for an experiment.

Evidence of Learning

Summative Assessment: Unit Test, Labs

Formative Assessments:

- Quizzes
- Chapter tests
- Homework
- Mini-labs

Science and Engineering Practices

Modeling in 9–12 builds on K–8 and progresses to using, synthesizing, and developing models to predict and show relationships among variables between systems and their components in the natural and designed worlds.

- Develop a model based on evidence to illustrate the relationships between systems or between components of a system. (HS-PS1-4), (HS-PS1-8)
- Use a model to predict the relationships between systems or between components of a system. (HS-PS1-1)

Planning and Carrying Out Investigations

Planning and carrying out investigations in 9–12 builds on K–8

experiences and progresses to include investigations that provide evidence for and test conceptual, mathematical, physical, and empirical models.

- Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly. (HS-PS1-3)

Using Mathematics and Computational Thinking

Mathematical and computational thinking at the 9–12 builds on K–8 and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions including trigonometric functions, exponentials and logarithms, and computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical models of basic assumptions.

- Use mathematical representations of phenomena to support claims. (HS-PS1-7)

Constructing Explanations and Designing Solutions

Constructing explanations and designing solutions in 9–12 builds on K–8 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories.

- Apply scientific principles and evidence to provide an explanation of phenomena and solve design problems, taking into account possible unanticipated effects. (HS-PS1-5)
- Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (HS-PS1-2)
- Refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. (HS-PS1-6)

Disciplinary Core Ideas

PS1.A: Structure and Properties of Matter

- Each atom has a charged substructure consisting of a nucleus, which is made of protons and neutrons, surrounded by electrons. (HS-PS1-1)
- The periodic table orders elements horizontally by the number of protons in the atom's nucleus and places those with similar chemical properties in columns. The repeating patterns of this table reflect patterns of outer electron states. (HS-PS1-1), (HS-PS1-2)
- The structure and interactions of matter at the bulk scale are determined by electrical forces within and between atoms. (HS-PS1-3)
- A stable molecule has less energy than the same set of atoms separated; one must provide at least this energy in order to take the molecule apart. (HS-PS1-4)

PS1.B: Chemical Reactions

- Chemical processes, their rates, and whether or not energy is stored or released can be understood in terms of the collisions of molecules and the rearrangements of atoms into new molecules, with consequent changes in the sum of all bond energies in the set of molecules that are matched by changes in kinetic energy. (HS-PS1-4), (HS-PS1-5)
- In many situations, a dynamic and condition-dependent balance between a reaction and the reverse reaction determines the numbers of all types of molecules present. (HS-PS1-6)
- The fact that atoms are conserved, together with knowledge of the chemical properties of the elements involved, can be used to describe and predict chemical reactions. (HS-PS1-2), (HS-PS1-7)

PS1.C: Nuclear Processes

- Nuclear processes, including fusion, fission, and radioactive decays of unstable nuclei, involve release or absorption of energy. The total number of neutrons plus protons does not change in any nuclear process. (HS-PS1-8)

PS2.B: Types of Interactions

- Attraction and repulsion between electric charges at the atomic scale explain the structure, properties, and transformations of matter, as well as the contact forces between material objects. *(secondary to HS-PS1-1), (secondary to HS-PS1-3)*

ETS1.C: Optimizing the Design Solution

- Criteria may need to be broken down into simpler ones that can be approached systematically, and decisions about the priority of certain criteria over others (trade-offs) may be needed. *(secondary to HS-PS1-6)*

Crosscutting Concepts

Patterns

- Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena. (HS-PS1-1), (HS-PS1-2), (HS-PS1-3), (HS-PS1-5)

Energy and Matter

- In nuclear processes, atoms are not conserved, but the total number of protons plus neutrons is conserved. (HS-PS1-8)
- The total amount of energy and matter in closed systems is conserved. (HS-PS1-7)
- Changes of energy and matter in a system can be described in terms of energy and matter flows into, out of, and within that system. (HS-PS1-4)

Stability and Change

- Much of science deals with constructing explanations of how things change and how they remain stable. (HS-PS1-6)

Connections to Nature of Science

Scientific Knowledge Assumes an Order and Consistency in Natural Systems

- Science assumes the universe is a vast single system in which basic laws are consistent. (HS-PS1-7)

Lesson Plans

Activities/Interdisciplinary Connections	*Timeframe*
• Use the steps of the scientific method to solve a problem • Equipment scavenger hunt • Lab on the scientific method • Analysis of data and graphs	Weeks 1-3
Teacher Resources	*Teacher Note*
• Textbook	

• PowerPoint presentations • Laboratory materials • Technology Tools: -Google Classroom -Seesaw -Pear Deck -BrainPOP -Book Creator -FlipGrid -Kahoot -Kami	

Differentiating Instruction: Students with Disabilities, English Language Learners, and Gifted & Talented Students

Examples of Strategies and Practices that Support Students with Disabilities:
• Use of visual and multisensory formats
• Use of assisted technology
• Use of prompts
• Modification of content and student products
• Testing accommodations
• Authentic assessments

Examples of Strategies and Practices that Support Gifted & Talented Students:
• Adjusting the pace of lessons
• Curriculum compacting
• Inquiry-based instruction
• Independent study
• Higher-order thinking skills
• Interest-based content
• Student-driven instruction
• Real-world problems and scenarios

Examples of Strategies and Practices that Support English Language Learners:
• Pre-teaching of vocabulary and concepts
• Visual learning, including graphic organizers
• Use of cognates to increase comprehension
• Teacher modeling
• Pairing students with beginning English language skills with students who have more advanced English language skills
• Scaffolding
•Word walls
•Sentence frames
•Think-pair-share

•Cooperative learning groups

Chemistry – 10th Grade Unit 2

Unit Title: Classification	
Unit Summary: Everything is made up of matter. Matter has 2 defining qualities: it takes up space and has inertia. All matter is held together by forces. Energy flows between every particles of matter. Matter can be classified based on its properties. In this unit, the different types of matter will be compared. The physical and chemical changes by which matter can undergo will be observed. The basic form of a chemical equation will be introduced.	
Primary Interdisciplinary Connections: MP.2, MP.4, HSN-Q.A.1, HSN-Q.A.2, and HSN-Q.A.3	
Career Readiness, Life Literacies, and Key Skills: 9.4.12.CI.1, 9.4.12.CI.2, 9.4.12.CI.3, 9.4.12.CT.1, 9.4.12.CT.2, 9.4.12.CT.4, 9.4.12.TL.2	
Learning Targets	
NJSLS Standards: HS-PS1-1, HS-PS1-2, HS-PS1-3, HS-PS1-4, HS-PS1-5, HS-PS1-6, HS-PS1-7, HS-PS1-8	
Computer Science and Design Thinking Standards: 8.1.12.A.2, 8.1.12.A.3, 8.1.12.A.4, 8.1.12.C.1, 8.1.12.E.1, 8.1.12.E.2	
Climate Change Standards: HS-ESS3-1, HS-ESS3-2, HS-ESS3-3, HS-ESS3-4, HS-ESS3-5, HS-ESS3-6	
ELA Companion Standards: RST.9-10.7, RST.11-12.1, WHST.9-12.2, WHST.9-12.5, WHST.9-12.7, WHST.11-12.8, WHST.9-12.9, SL.11-12.5	
Content Statements:	
1	Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms.
2	Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties.
3	Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles.
4	Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy.
5	Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs.
6	Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium.
7	Use mathematical representations to support the claim that atoms, and therefore mass, are

	conserved during a chemical reaction.
8	Develop models to illustrate the changes in the composition of the nucleus of the atom and the energy released during the processes of fission, fusion, and radioactive decay.

Big Idea: Analyze and communicate how matter and energy transfer affects all the components of our lives.

Unit Essential Questions:	**Unit Enduring Understandings:**
• What is energy? • How do we classify things in the world around us? • How can the classification of matter help us better understand the physical world?	• Everyday occurrences of changes in matter are related to energy transfer. • The classification of matter based on distinctive properties or characteristics allows for a better understanding of the world around us.

Unit Learning Targets

Students will…

- Analyze the properties of matter for the purpose of classification.
- Connect the effects of energy transfer with the different states of matter.
- Identify classifications of matter (element, compound, homogeneous mixture, and heterogeneous mixture).
- Differentiate samples for the purpose of classification.
- Connect the arrangement of molecules with the amount of energy transfer through data analysis questions or a conclusion paragraph.
- Use the kinetic molecular theory to describe and explain the properties of solids, liquids, and gases.

Science and Engineering Practices

Modeling in 9–12 builds on K–8 and progresses to using, synthesizing, and developing models to predict and show relationships among variables between systems and their components in the natural and designed worlds.

- Develop a model based on evidence to illustrate the relationships between systems or between components of a system. (HS-PS1-4), (HS-PS1-8)
- Use a model to predict the relationships between systems or between components of a system. (HS-PS1-1)

Planning and Carrying Out Investigations

Planning and carrying out investigations in 9–12 builds on K–8

experiences and progresses to include investigations that provide evidence for and test conceptual, mathematical, physical, and empirical models.

- Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly. (HS-PS1-3)

Using Mathematics and Computational Thinking

Mathematical and computational thinking at the 9–12 builds on K–8 and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions including trigonometric functions, exponentials and logarithms, and computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical models of

basic assumptions.

- Use mathematical representations of phenomena to support claims. (HS-PS1-7)

Constructing Explanations and Designing Solutions

Constructing explanations and designing solutions in 9–12 builds on K–8 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories.

- Apply scientific principles and evidence to provide an explanation of phenomena and solve design problems, taking into account possible unanticipated effects. (HS-PS1-5)
- Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (HS-PS1-2)
- Refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. (HS-PS1-6)

Disciplinary Core Ideas

PS1.A: Structure and Properties of Matter

- Each atom has a charged substructure consisting of a nucleus, which is made of protons and neutrons, surrounded by electrons. (HS-PS1-1)
- The periodic table orders elements horizontally by the number of protons in the atom's nucleus and places those with similar chemical properties in columns. The repeating patterns of this table reflect patterns of outer electron states. (HS-PS1-1), (HS-PS1-2)
- The structure and interactions of matter at the bulk scale are determined by electrical forces within and between atoms. (HS-PS1-3)
- A stable molecule has less energy than the same set of atoms separated; one must provide at least this energy in order to take the molecule apart. (HS-PS1-4)

PS1.B: Chemical Reactions

- Chemical processes, their rates, and whether or not energy is stored or released can be understood in terms of the collisions of molecules and the rearrangements of atoms into new molecules, with consequent changes in the sum of all bond energies in the set of molecules that are matched by changes in kinetic energy. (HS-PS1-4), (HS-PS1-5)
- In many situations, a dynamic and condition-dependent balance between a reaction and the reverse reaction determines the numbers of all types of molecules present. (HS-PS1-6)
- The fact that atoms are conserved, together with knowledge of the chemical properties of the elements involved, can be used to describe and predict chemical reactions. (HS-PS1-2), (HS-PS1-7)

PS1.C: Nuclear Processes

- Nuclear processes, including fusion, fission, and radioactive decays of unstable nuclei, involve release or absorption of energy. The total number of neutrons plus protons does not change in any nuclear process. (HS-PS1-8)

PS2.B: Types of Interactions

- Attraction and repulsion between electric charges at the atomic scale explain the structure, properties, and transformations of matter, as well as the contact forces between material objects. *(secondary to HS-*

PS1-1), (secondary to HS-PS1-3)

ETS1.C: Optimizing the Design Solution

- Criteria may need to be broken down into simpler ones that can be approached systematically, and decisions about the priority of certain criteria over others (trade-offs) may be needed. *(secondary to HS-PS1-6)*

Crosscutting Concepts

Patterns

- Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena. (HS-PS1-1), (HS-PS1-2), (HS-PS1-3), (HS-PS1-5)

Energy and Matter

- In nuclear processes, atoms are not conserved, but the total number of protons plus neutrons is conserved. (HS-PS1-8)
- The total amount of energy and matter in closed systems is conserved. (HS-PS1-7)
- Changes of energy and matter in a system can be described in terms of energy and matter flows into, out of, and within that system. (HS-PS1-4)

Stability and Change

- Much of science deals with constructing explanations of how things change and how they remain stable. (HS-PS1-6)

Connections to Nature of Science

Scientific Knowledge Assumes an Order and Consistency in Natural Systems

- Science assumes the universe is a vast single system in which basic laws are consistent. (HS-PS1-7)

Evidence of Learning

Summative Assessment: Unit Test, Labs

Formative Assessments:

- Quizzes
- Chapter tests
- Homework
- Mini-labs

Lesson Plans

Activities/Interdisciplinary Connections	*Timeframe*
• Mixture separation lab • Finding examples at home • Lab on changing states of matter • Conservation of Matter Lab	Weeks 4-6
Teacher Resources	*Teacher Note*
• Textbook	

• PowerPoint presentations • Laboratory materials • Technology Tools: -Google Classroom -Seesaw -Pear Deck -BrainPOP -Book Creator -FlipGrid -Kahoot -Kami	

Differentiating Instruction: Students with Disabilities, English Language Learners, and Gifted & Talented Students

Examples of Strategies and Practices that Support Students with Disabilities:
• Use of visual and multisensory formats
• Use of assisted technology
• Use of prompts
• Modification of content and student products
• Testing accommodations
• Authentic assessments

Examples of Strategies and Practices that Support Gifted & Talented Students:
• Adjusting the pace of lessons
• Curriculum compacting
• Inquiry-based instruction
• Independent study
• Higher-order thinking skills
• Interest-based content
• Student-driven instruction
• Real-world problems and scenarios

Examples of Strategies and Practices that Support English Language Learners:
• Pre-teaching of vocabulary and concepts
• Visual learning, including graphic organizers
• Use of cognates to increase comprehension
• Teacher modeling
• Pairing students with beginning English language skills with students who have more advanced English language skills
• Scaffolding
•Word walls
•Sentence frames
•Think-pair-share

•Cooperative learning groups

Chemistry – 10th Grade Unit 3

Unit Title: Atomic Structure	
Unit Summary: Atoms are the building blocks of matter. By understanding the structure of an atom, one can begin to understand the chemical and physical properties associated with an element. Electron and their energy levels are explored in the use of electron configuration.	
Primary Interdisciplinary Connections: MP.2, MP.4, HSN-Q.A.1, HSN-Q.A.2, and HSN-Q.A.3	
Career Readiness, Life Literacies, and Key Skills: 9.4.12.CI.1, 9.4.12.CI.2, 9.4.12.CI.3, 9.4.12.CT.1, 9.4.12.CT.2, 9.4.12.CT.4, 9.4.12.TL.2	
Learning Targets	
NJSLS Standards: HS-PS1-1, HS-PS1-2, HS-PS1-3, HS-PS1-4, HS-PS1-5, HS-PS1-6, HS-PS1-7, HS-PS1-8	
Computer Science and Design Thinking Standards: 8.1.12.A.2, 8.1.12.A.3, 8.1.12.A.4, 8.1.12.C.1, 8.1.12.E.1, 8.1.12.E.2	
Climate Change Standards: HS-ESS3-1, HS-ESS3-2, HS-ESS3-3, HS-ESS3-4, HS-ESS3-5, HS-ESS3-6	
ELA Companion Standards: RST.9-10.7, RST.11-12.1, WHST.9-12.2, WHST.9-12.5, WHST.9-12.7, WHST.11-12.8, WHST.9-12.9, SL.11-12.5	
Content Statements:	
1	Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms.
2	Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties.
3	Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles.
4	Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy.
5	Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs.
6	Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium.
7	Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.
8	Develop models to illustrate the changes in the composition of the nucleus of the atom and

	the energy released during the processes of fission, fusion, and radioactive decay.

Big Idea: The structure of an atom allows each element on the periodic table to have a unique combination of properties.

Unit Essential Questions:	**Unit Enduring Understandings:**
• How does the modern theory of the atom explain atomic structure? • What causes instability in the nucleus of atoms? • How can a particle exist as a wave causing duality? • What happens when an electron in an atom absorbs or releases energy? • How are electrons configured around a nucleus? • How do current atomic models with electron arrangement compare with previous models?	• Atoms are the fundamental building blocks of all matter**.** • Atoms can be unstable and emit radiation. • Electron movement can be explained by the duality of particles and waves. • Modern atomic theory suggests that electrons may be located in regions of high probability.

Unit Learning Targets

Students will…

- Compare the modern atomic model to previous models of the atom
- Use atomic models to predict the behaviors of atoms in interactions.
- Explain how the properties of isotopes, including half-lives, decay modes, and nuclear resonances, lead to useful applications of isotopes.
- Create a Bohr model including subatomic particles from the name of an element on the periodic table.

  Formulate electron configurations by analyzing Aufbau diagrams, Hund's rule, and Pauli Exclusion Principle.

Science and Engineering Practices

Modeling in 9–12 builds on K–8 and progresses to using, synthesizing, and developing models to predict and show relationships among variables between systems and their components in the natural and designed worlds.

- Develop a model based on evidence to illustrate the relationships between systems or between components of a system. (HS-PS1-4), (HS-PS1-8)
- Use a model to predict the relationships between systems or between components of a system. (HS-PS1-1)

Planning and Carrying Out Investigations

Planning and carrying out investigations in 9–12 builds on K–8

experiences and progresses to include investigations that provide evidence for and test conceptual, mathematical, physical, and empirical models.

- Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost,

risk, time), and refine the design accordingly. (HS-PS1-3)

Using Mathematics and Computational Thinking
Mathematical and computational thinking at the 9–12 builds on K–8 and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions including trigonometric functions, exponentials and logarithms, and computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical models of basic assumptions.

- Use mathematical representations of phenomena to support claims. (HS-PS1-7)

Constructing Explanations and Designing Solutions
Constructing explanations and designing solutions in 9–12 builds on K–8 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories.

- Apply scientific principles and evidence to provide an explanation of phenomena and solve design problems, taking into account possible unanticipated effects. (HS-PS1-5)
- Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (HS-PS1-2)
- Refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. (HS-PS1-6)

Disciplinary Core Ideas

PS1.A: Structure and Properties of Matter

- Each atom has a charged substructure consisting of a nucleus, which is made of protons and neutrons, surrounded by electrons. (HS-PS1-1)
- The periodic table orders elements horizontally by the number of protons in the atom's nucleus and places those with similar chemical properties in columns. The repeating patterns of this table reflect patterns of outer electron states. (HS-PS1-1), (HS-PS1-2)
- The structure and interactions of matter at the bulk scale are determined by electrical forces within and between atoms. (HS-PS1-3)
- A stable molecule has less energy than the same set of atoms separated; one must provide at least this energy in order to take the molecule apart. (HS-PS1-4)

PS1.B: Chemical Reactions

- Chemical processes, their rates, and whether or not energy is stored or released can be understood in terms of the collisions of molecules and the rearrangements of atoms into new molecules, with consequent changes in the sum of all bond energies in the set of molecules that are matched by changes in kinetic energy. (HS-PS1-4), (HS-PS1-5)
- In many situations, a dynamic and condition-dependent balance between a reaction and the reverse reaction determines the numbers of all types of molecules present. (HS-PS1-6)
- The fact that atoms are conserved, together with knowledge of the chemical properties of the elements involved, can be used to describe and predict chemical reactions. (HS-PS1-2), (HS-PS1-7)

PS1.C: Nuclear Processes

- Nuclear processes, including fusion, fission, and radioactive decays of unstable nuclei, involve release or absorption of energy. The total number of neutrons plus protons does not change in any nuclear

process. (HS-PS1-8)

PS2.B: Types of Interactions

- Attraction and repulsion between electric charges at the atomic scale explain the structure, properties, and transformations of matter, as well as the contact forces between material objects. *(secondary to HS-PS1-1), (secondary to HS-PS1-3)*

ETS1.C: Optimizing the Design Solution

- Criteria may need to be broken down into simpler ones that can be approached systematically, and decisions about the priority of certain criteria over others (trade-offs) may be needed. *(secondary to HS-PS1-6)*

Crosscutting Concepts

Patterns

- Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena. (HS-PS1-1), (HS-PS1-2), (HS-PS1-3), (HS-PS1-5)

Energy and Matter

- In nuclear processes, atoms are not conserved, but the total number of protons plus neutrons is conserved. (HS-PS1-8)
- The total amount of energy and matter in closed systems is conserved. (HS-PS1-7)
- Changes of energy and matter in a system can be described in terms of energy and matter flows into, out of, and within that system. (HS-PS1-4)

Stability and Change

- Much of science deals with constructing explanations of how things change and how they remain stable. (HS-PS1-6)

Connections to Nature of Science

Scientific Knowledge Assumes an Order and Consistency in Natural Systems

- Science assumes the universe is a vast single system in which basic laws are consistent. (HS-PS1-7)

Formative Assessments:

- Quizzes
- Chapter tests
- Homework
- Mini-labs

Lesson Plans

Activities/Interdisciplinary Connections	*Timeframe*
• Location of a 1s electron lab • Construction of a model atom • Identifying chemicals in a product mini-lab • Flame test lab	Weeks 7-10

• Model different types of nuclear decay activity • Spectroscopy lab • Electron orbital diagrams	
Teacher Resources	*Teacher Note*
• Textbook • PowerPoint presentations • Laboratory materials • Technology Tools: -Google Classroom -Seesaw -Pear Deck -BrainPOP -Book Creator -FlipGrid -Kahoot -Kami	

Differentiating Instruction: Students with Disabilities, English Language Learners, and Gifted & Talented Students

Examples of Strategies and Practices that Support Students with Disabilities:
• Use of visual and multisensory formats
• Use of assisted technology
• Use of prompts
• Modification of content and student products
• Testing accommodations
• Authentic assessments

Examples of Strategies and Practices that Support Gifted & Talented Students:
• Adjusting the pace of lessons
• Curriculum compacting
• Inquiry-based instruction
• Independent study
• Higher-order thinking skills
• Interest-based content
• Student-driven instruction
• Real-world problems and scenarios

Examples of Strategies and Practices that Support English Language Learners:
• Pre-teaching of vocabulary and concepts
• Visual learning, including graphic organizers
• Use of cognates to increase comprehension
• Teacher modeling

• Pairing students with beginning English language skills with students who have more advanced English language skills • Scaffolding •Word walls •Sentence frames •Think-pair-share •Cooperative learning groups

Chemistry – 10th Grade Unit 4

Unit Title: The Periodic Table	
Unit Summary: The periodic table organizes elements based on their properties. It allows trends in physical properties and chemical reactivity to appear. Using the periodic table, the possible formation of chemical compound can be predicted.	
Primary Interdisciplinary Connections: MP.2, MP.4, HSN-Q.A.1, HSN-Q.A.2, and HSN-Q.A.3	
Career Readiness, Life Literacies, and Key Skills: 9.4.12.CI.1, 9.4.12.CI.2, 9.4.12.CI.3, 9.4.12.CT.1, 9.4.12.CT.2, 9.4.12.CT.4, 9.4.12.TL.2	
Learning Targets	
NJSLS Standards: HS-PS1-1, HS-PS1-2, HS-PS1-3, HS-PS1-4, HS-PS1-5, HS-PS1-6, HS-PS1-7, HS-PS1-8	
Computer Science and Design Thinking Standards: 8.1.12.A.2, 8.1.12.A.3, 8.1.12.A.4, 8.1.12.C.1, 8.1.12.E.1, 8.1.12.E.2	
Climate Change Standards: HS-ESS3-1, HS-ESS3-2, HS-ESS3-3, HS-ESS3-4, HS-ESS3-5, HS-ESS3-6	
ELA Companion Standards: RST.9-10.7, RST.11-12.1, WHST.9-12.2, WHST.9-12.5, WHST.9-12.7, WHST.11-12.8, WHST.9-12.9, SL.11-12.5	
Content Statements:	
1	Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms.
2	Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties.
3	Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles.
4	Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy.
5	Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs.
6	Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium.
7	Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.
8	Develop models to illustrate the changes in the composition of the nucleus of the atom and

	the energy released during the processes of fission, fusion, and radioactive decay.

Big Idea: The placement of elements of the periodic table reveals patterns in chemical and physical properties of elements.

Unit Essential Questions:	**Unit Enduring Understandings:**
• How do properties or characteristics influence the placement of elements on the periodic table? • What is the relationship between an element's placement on the periodic table and its trends? • How can the placement of an element on the periodic table become known when a specific trend is observed?	• The placement of elements on the periodic table is based upon specific properties and characteristics of elements. • The properties and characteristics of elements follow noticeable patterns and trends on the periodic table.

Unit Learning Targets

Students will…

- Accurately explain the placement of elements on the periodic table.
- Predict patterns in the chemical and physical properties of elements.
- Connect the placement of elements on the periodic table to each other and prove the various trends.
- Analyze patterns in the periodic trends of atomic size, ionization energy and electronegativity. Determine the identity of missing elements based upon the properties of the other elements in the group.

Science and Engineering Practices

Modeling in 9–12 builds on K–8 and progresses to using, synthesizing, and developing models to predict and show relationships among variables between systems and their components in the natural and designed worlds.

- Develop a model based on evidence to illustrate the relationships between systems or between components of a system. (HS-PS1-4), (HS-PS1-8)
- Use a model to predict the relationships between systems or between components of a system. (HS-PS1-1)

Planning and Carrying Out Investigations

Planning and carrying out investigations in 9–12 builds on K–8

experiences and progresses to include investigations that provide evidence for and test conceptual, mathematical, physical, and empirical models.

- Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly. (HS-PS1-3)

Using Mathematics and Computational Thinking

Mathematical and computational thinking at the 9–12 builds on K–8 and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions including trigonometric functions, exponentials and logarithms, and computational tools for statistical analysis to analyze, represent, and

model data. Simple computational simulations are created and used based on mathematical models of basic assumptions.

- Use mathematical representations of phenomena to support claims. (HS-PS1-7)

Constructing Explanations and Designing Solutions

Constructing explanations and designing solutions in 9–12 builds on K–8 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories.

- Apply scientific principles and evidence to provide an explanation of phenomena and solve design problems, taking into account possible unanticipated effects. (HS-PS1-5)
- Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (HS-PS1-2)
- Refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. (HS-PS1-6)

Disciplinary Core Ideas

PS1.A: Structure and Properties of Matter

- Each atom has a charged substructure consisting of a nucleus, which is made of protons and neutrons, surrounded by electrons. (HS-PS1-1)
- The periodic table orders elements horizontally by the number of protons in the atom's nucleus and places those with similar chemical properties in columns. The repeating patterns of this table reflect patterns of outer electron states. (HS-PS1-1), (HS-PS1-2)
- The structure and interactions of matter at the bulk scale are determined by electrical forces within and between atoms. (HS-PS1-3)
- A stable molecule has less energy than the same set of atoms separated; one must provide at least this energy in order to take the molecule apart. (HS-PS1-4)

PS1.B: Chemical Reactions

- Chemical processes, their rates, and whether or not energy is stored or released can be understood in terms of the collisions of molecules and the rearrangements of atoms into new molecules, with consequent changes in the sum of all bond energies in the set of molecules that are matched by changes in kinetic energy. (HS-PS1-4), (HS-PS1-5)
- In many situations, a dynamic and condition-dependent balance between a reaction and the reverse reaction determines the numbers of all types of molecules present. (HS-PS1-6)
- The fact that atoms are conserved, together with knowledge of the chemical properties of the elements involved, can be used to describe and predict chemical reactions. (HS-PS1-2), (HS-PS1-7)

PS1.C: Nuclear Processes

- Nuclear processes, including fusion, fission, and radioactive decays of unstable nuclei, involve release or absorption of energy. The total number of neutrons plus protons does not change in any nuclear process. (HS-PS1-8)

PS2.B: Types of Interactions

- Attraction and repulsion between electric charges at the atomic scale explain the structure, properties,

and transformations of matter, as well as the contact forces between material objects. *(secondary to HS-PS1-1), (secondary to HS-PS1-3)*

ETS1.C: Optimizing the Design Solution

- Criteria may need to be broken down into simpler ones that can be approached systematically, and decisions about the priority of certain criteria over others (trade-offs) may be needed. *(secondary to HS-PS1-6)*

Crosscutting Concepts

Patterns

- Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena. (HS-PS1-1), (HS-PS1-2), (HS-PS1-3), (HS-PS1-5)

Energy and Matter

- In nuclear processes, atoms are not conserved, but the total number of protons plus neutrons is conserved. (HS-PS1-8)
- The total amount of energy and matter in closed systems is conserved. (HS-PS1-7)
- Changes of energy and matter in a system can be described in terms of energy and matter flows into, out of, and within that system. (HS-PS1-4)

Stability and Change

- Much of science deals with constructing explanations of how things change and how they remain stable. (HS-PS1-6)

Connections to Nature of Science

Scientific Knowledge Assumes an Order and Consistency in Natural Systems

- Science assumes the universe is a vast single system in which basic laws are consistent. (HS-PS1-7)

- Quizzes
- Chapter tests
- Homework
- Mini-labs

Lesson Plans

Activities/Interdisciplinary Connections	*Timeframe*
• Create your own periodic table • Graph trends on a periodic	Weeks 11-13
Teacher Resources	*Teacher Note*
• Textbook • PowerPoint presentations • Laboratory materials • Technology Tools: -Google Classroom	

-Seesaw -Pear Deck -BrainPOP -Book Creator -FlipGrid -Kahoot -Kami	

Differentiating Instruction: Students with Disabilities, English Language Learners, and Gifted & Talented Students

Examples of Strategies and Practices that Support Students with Disabilities:
• Use of visual and multisensory formats
• Use of assisted technology
• Use of prompts
• Modification of content and student products
• Testing accommodations
• Authentic assessments

Examples of Strategies and Practices that Support Gifted & Talented Students:
• Adjusting the pace of lessons
• Curriculum compacting
• Inquiry-based instruction
• Independent study
• Higher-order thinking skills
• Interest-based content
• Student-driven instruction
• Real-world problems and scenarios

Examples of Strategies and Practices that Support English Language Learners:
• Pre-teaching of vocabulary and concepts
• Visual learning, including graphic organizers
• Use of cognates to increase comprehension
• Teacher modeling
• Pairing students with beginning English language skills with students who have more advanced English language skills
• Scaffolding
•Word walls
•Sentence frames
•Think-pair-share
•Cooperative learning groups

Chemistry – 10th Grade Unit 5

Unit Title: Chemical Bonding	
Unit Summary: Chemical bonds hold all compounds together. The electron dot formula of an element will help predict what type of bond will form in a compound. Creating physical models of molecular structures will reinforce this concept. The different types of bonds will be contrasted. Both systems of naming compounds will be utilized when writing the name of a molecular and ionic compound. Oxidation numbers are assigned to elements to help in the formation of compounds.	
Primary Interdisciplinary Connections: MP.2, MP.4, HSN-Q.A.1, HSN-Q.A.2, and HSN-Q.A.3	
Career Readiness, Life Literacies, and Key Skills: 9.4.12.CI.1, 9.4.12.CI.2, 9.4.12.CI.3, 9.4.12.CT.1, 9.4.12.CT.2, 9.4.12.CT.4, 9.4.12.TL.2	
Learning Targets	
NJSLS Standards: HS-PS1-1, HS-PS1-2, HS-PS1-3, HS-PS1-4, HS-PS1-5, HS-PS1-6, HS-PS1-7, HS-PS1-8	
Computer Science and Design Thinking Standards: 8.1.12.A.2, 8.1.12.A.3, 8.1.12.A.4, 8.1.12.C.1, 8.1.12.E.1, 8.1.12.E.2	
Climate Change Standards: HS-ESS3-1, HS-ESS3-2, HS-ESS3-3, HS-ESS3-4, HS-ESS3-5, HS-ESS3-6	
ELA Companion Standards: RST.9-10.7, RST.11-12.1, WHST.9-12.2, WHST.9-12.5, WHST.9-12.7, WHST.11-12.8, WHST.9-12.9, SL.11-12.5	
Content Statements:	
1	Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms.
2	Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties.
3	Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles.
4	Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy.
5	Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs.
6	Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium.

7	Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.
8	Develop models to illustrate the changes in the composition of the nucleus of the atom and the energy released during the processes of fission, fusion, and radioactive decay.

Big Idea: Learning the atomic structure of an element will allow students to predict what compounds will form and the properties of those compounds.

Unit Essential Questions:	**Unit Enduring Understandings:**
• Why do elements form chemical bonds in nature and how does this determine their properties? • How are the properties of an element determined by its electron arrangement? • How are ionic, covalent, and metallic bonds formed, and how are they characterized? • How are the names and formulas of ionic and covalent compounds written? • How does V.S.E.P.R. Theory allow us to predict molecular geometry? • Why is an understanding of intermolecular forces important?	• The formation of chemical bonds can be explained by the atom's ability to satisfy the Octet Rule and achieve stability. • The type of chemical bond an element forms can be linked to its valence electrons and its location on the periodic table. • Chemical formulas can be used to represent the ratios in which atoms combine to form compounds. • A compound's structure and shape can be determined through an understanding of the interactions between valence electrons. • Intermolecular forces determine the properties of compounds.

Unit Learning Targets

Students will…

- Differentiate between covalent, ionic, and metallic bonding in terms of valence electrons.
- Develop a reason why metals tend to form positive ions while nonmetals form negative ions.
- Calculate formula mass, molar mass and percent compositions.
- Predict the oxidation number of an element based on its location on the periodic table.
- Apply the concepts of ionic and covalent bonding to effectively represent compounds using chemical formulas and names.
- Compare the different types of intermolecular forces and recognize in which types of compounds they are present.
- Construct Lewis structures for molecular compounds.
- Develop a logical argument as to how the "sea of electrons" model and delocalized electrons explain various properties of metals.

  Predict the molecular shapes of the compound using the VSEPR theory.

Science and Engineering Practices

Modeling in 9–12 builds on K–8 and progresses to using, synthesizing, and developing models to predict and show relationships among variables between systems and their components in the natural and designed worlds.

- Develop a model based on evidence to illustrate the relationships between systems or between components of a system. (HS-PS1-4), (HS-PS1-8)

- Use a model to predict the relationships between systems or between components of a system. (HS-PS1-1)

Planning and Carrying Out Investigations

Planning and carrying out investigations in 9–12 builds on K–8

experiences and progresses to include investigations that provide evidence for and test conceptual, mathematical, physical, and empirical models.

- Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly. (HS-PS1-3)

Using Mathematics and Computational Thinking

Mathematical and computational thinking at the 9–12 builds on K–8 and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions including trigonometric functions, exponentials and logarithms, and computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical models of basic assumptions.

- Use mathematical representations of phenomena to support claims. (HS-PS1-7)

Constructing Explanations and Designing Solutions

Constructing explanations and designing solutions in 9–12 builds on K–8 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories.

- Apply scientific principles and evidence to provide an explanation of phenomena and solve design problems, taking into account possible unanticipated effects. (HS-PS1-5)
- Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (HS-PS1-2)
- Refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. (HS-PS1-6)

Disciplinary Core Ideas

PS1.A: Structure and Properties of Matter

- Each atom has a charged substructure consisting of a nucleus, which is made of protons and neutrons, surrounded by electrons. (HS-PS1-1)
- The periodic table orders elements horizontally by the number of protons in the atom's nucleus and places those with similar chemical properties in columns. The repeating patterns of this table reflect patterns of outer electron states. (HS-PS1-1), (HS-PS1-2)
- The structure and interactions of matter at the bulk scale are determined by electrical forces within and between atoms. (HS-PS1-3)
- A stable molecule has less energy than the same set of atoms separated; one must provide at least this energy in order to take the molecule apart. (HS-PS1-4)

PS1.B: Chemical Reactions

- Chemical processes, their rates, and whether or not energy is stored or released can be understood in terms of the collisions of molecules and the rearrangements of atoms into new molecules, with consequent changes in the sum of all bond energies in the set of molecules that are matched by changes in kinetic energy. (HS-PS1-4), (HS-PS1-5)
- In many situations, a dynamic and condition-dependent balance between a reaction and the reverse reaction determines the numbers of all types of molecules present. (HS-PS1-6)
- The fact that atoms are conserved, together with knowledge of the chemical properties of the elements involved, can be used to describe and predict chemical reactions. (HS-PS1-2), (HS-PS1-7)

PS1.C: Nuclear Processes

- Nuclear processes, including fusion, fission, and radioactive decays of unstable nuclei, involve release or absorption of energy. The total number of neutrons plus protons does not change in any nuclear process. (HS-PS1-8)

PS2.B: Types of Interactions

- Attraction and repulsion between electric charges at the atomic scale explain the structure, properties, and transformations of matter, as well as the contact forces between material objects. *(secondary to HS-PS1-1), (secondary to HS-PS1-3)*

ETS1.C: Optimizing the Design Solution

- Criteria may need to be broken down into simpler ones that can be approached systematically, and decisions about the priority of certain criteria over others (trade-offs) may be needed. *(secondary to HS-PS1-6)*

Crosscutting Concepts

Patterns

- Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena. (HS-PS1-1), (HS-PS1-2), (HS-PS1-3), (HS-PS1-5)

Energy and Matter

- In nuclear processes, atoms are not conserved, but the total number of protons plus neutrons is conserved. (HS-PS1-8)
- The total amount of energy and matter in closed systems is conserved. (HS-PS1-7)
- Changes of energy and matter in a system can be described in terms of energy and matter flows into, out of, and within that system. (HS-PS1-4)

Stability and Change

- Much of science deals with constructing explanations of how things change and how they remain stable. (HS-PS1-6)

Connections to Nature of Science

Scientific Knowledge Assumes an Order and Consistency in Natural Systems

- Science assumes the universe is a vast single system in which basic laws are consistent. (HS-PS1-7)

- Quizzes
- Chapter tests
- Homework
- Mini-labs

Lesson Plans	
Activities/Interdisciplinary Connections	*Timeframe*
• Ionic compound lab • Molecular modeling • Practice writing chemical formulas • Ionic bond vs. covalent bonds demos • Metallic bonding demonstration • Determining empirical formula of Magnesium Oxide lab	Weeks 14-18
Teacher Resources	*Teacher Note*
• Textbook • PowerPoint presentations • Laboratory materials • Technology Tools: -Google Classroom -Seesaw -Pear Deck -BrainPOP -Book Creator -FlipGrid -Kahoot -Kami	

Differentiating Instruction: Students with Disabilities, English Language Learners, and Gifted & Talented Students

Examples of Strategies and Practices that Support Students with Disabilities:
• Use of visual and multisensory formats
• Use of assisted technology
• Use of prompts
• Modification of content and student products
• Testing accommodations
• Authentic assessments

Examples of Strategies and Practices that Support Gifted & Talented Students:
• Adjusting the pace of lessons
• Curriculum compacting
• Inquiry-based instruction
• Independent study
• Higher-order thinking skills
• Interest-based content

• Student-driven instruction
• Real-world problems and scenarios

Examples of Strategies and Practices that Support English Language Learners:
• Pre-teaching of vocabulary and concepts
• Visual learning, including graphic organizers
• Use of cognates to increase comprehension
• Teacher modeling
• Pairing students with beginning English language skills with students who have more advanced English language skills
• Scaffolding
•Word walls
•Sentence frames
•Think-pair-share
•Cooperative learning groups

Chemistry – 10th Grade Unit 6

Unit Title: Writing and Balancing Chemical Equations	
Unit Summary: Chemical reactions evident throughout our world. This unit explores the reactions of elements and their compounds. Equations are balanced to ensure the reaction occurs properly. Chemical reactions can be classified using their unique characteristics. The five major types of reactions will be introduced and guidelines for determining chemical equations will be discussed. Labs will be performed to reinforce the various reaction types.	
Primary Interdisciplinary Connections: MP.2, MP.4, HSN-Q.A.1, HSN-Q.A.2, and HSN-Q.A.3	
Career Readiness, Life Literacies, and Key Skills: 9.4.12.CI.1, 9.4.12.CI.2, 9.4.12.CI.3, 9.4.12.CT.1, 9.4.12.CT.2, 9.4.12.CT.4, 9.4.12.TL.2	
Learning Targets	
NJSLS Standards: HS-PS1-1, HS-PS1-2, HS-PS1-3, HS-PS1-4, HS-PS1-5, HS-PS1-6, HS-PS1-7, HS-PS1-8	
Computer Science and Design Thinking Standards: 8.1.12.A.2, 8.1.12.A.3, 8.1.12.A.4, 8.1.12.C.1, 8.1.12.E.1, 8.1.12.E.2	
Climate Change Standards: HS-ESS3-1, HS-ESS3-2, HS-ESS3-3, HS-ESS3-4, HS-ESS3-5, HS-ESS3-6	
ELA Companion Standards: RST.9-10.7, RST.11-12.1, WHST.9-12.2, WHST.9-12.5, WHST.9-12.7, WHST.11-12.8, WHST.9-12.9, SL.11-12.5	
Content Statements:	
1	Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms.
2	Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties.
3	Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles.
4	Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy.
5	Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs.
6	Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium.
7	Use mathematical representations to support the claim that atoms, and therefore mass, are

	conserved during a chemical reaction.
8	Develop models to illustrate the changes in the composition of the nucleus of the atom and the energy released during the processes of fission, fusion, and radioactive decay.

Big Idea: Chemical changes that transpire can be portrayed both quantitatively and qualitatively by completing and balancing chemical reactions.

Unit Essential Questions:	**Unit Enduring Understandings:**
• Why must the mass of reactants equal the mass of products in a chemical reaction? • What characteristics are used to classify chemical reactions? • What are the different types of chemical reactions that can occur?	• Chemical equations are used to represent chemical reactions and show that mass can neither be created nor destroyed. • There are different types of chemical reactions that occur in everyday life.

Unit Learning Targets

Students will…

- Accurately represent chemical reactions using word equations
- Formulate and balance skeleton equations using coefficients.
- Cite evidence of the indicators of a chemical reaction such as: energy change, color change, production of a gas, formation of a precipitate.
- Differentiate reactants products, coefficients, subscripts, and yield signs and what they represent.
- Apply the Law of Conservation of Mass to explain why the mass of reactants must equal the mass of products.
- Differentiate chemical reactions by one of the five main types: synthesis, decomposition, single replacement, double replacement, and combustion.
- Utilize the activity series to determine if a single replacement reaction will occur.
- Predict the formation of a precipitate from a solubility table.

  Communicate how a change in activation energy, concentration, temperature, or addition of a catalyst can affect reaction rate.

Science and Engineering Practices

Modeling in 9–12 builds on K–8 and progresses to using, synthesizing, and developing models to predict and show relationships among variables between systems and their components in the natural and designed worlds.

- Develop a model based on evidence to illustrate the relationships between systems or between components of a system. (HS-PS1-4), (HS-PS1-8)
- Use a model to predict the relationships between systems or between components of a system. (HS-PS1-1)

Planning and Carrying Out Investigations

Planning and carrying out investigations in 9–12 builds on K–8

experiences and progresses to include investigations that provide evidence for and test conceptual, mathematical, physical, and empirical models.

- Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis

for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly. (HS-PS1-3)

Using Mathematics and Computational Thinking
Mathematical and computational thinking at the 9–12 builds on K–8 and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions including trigonometric functions, exponentials and logarithms, and computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical models of basic assumptions.

- Use mathematical representations of phenomena to support claims. (HS-PS1-7)

Constructing Explanations and Designing Solutions
Constructing explanations and designing solutions in 9–12 builds on K–8 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories.

- Apply scientific principles and evidence to provide an explanation of phenomena and solve design problems, taking into account possible unanticipated effects. (HS-PS1-5)
- Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (HS-PS1-2)
- Refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. (HS-PS1-6)

Disciplinary Core Ideas

PS1.A: Structure and Properties of Matter

- Each atom has a charged substructure consisting of a nucleus, which is made of protons and neutrons, surrounded by electrons. (HS-PS1-1)
- The periodic table orders elements horizontally by the number of protons in the atom's nucleus and places those with similar chemical properties in columns. The repeating patterns of this table reflect patterns of outer electron states. (HS-PS1-1), (HS-PS1-2)
- The structure and interactions of matter at the bulk scale are determined by electrical forces within and between atoms. (HS-PS1-3)
- A stable molecule has less energy than the same set of atoms separated; one must provide at least this energy in order to take the molecule apart. (HS-PS1-4)

PS1.B: Chemical Reactions

- Chemical processes, their rates, and whether or not energy is stored or released can be understood in terms of the collisions of molecules and the rearrangements of atoms into new molecules, with consequent changes in the sum of all bond energies in the set of molecules that are matched by changes in kinetic energy. (HS-PS1-4), (HS-PS1-5)
- In many situations, a dynamic and condition-dependent balance between a reaction and the reverse reaction determines the numbers of all types of molecules present. (HS-PS1-6)
- The fact that atoms are conserved, together with knowledge of the chemical properties of the elements involved, can be used to describe and predict chemical reactions. (HS-PS1-2), (HS-PS1-7)

PS1.C: Nuclear Processes

- Nuclear processes, including fusion, fission, and radioactive decays of unstable nuclei, involve release or absorption of energy. The total number of neutrons plus protons does not change in any nuclear process. (HS-PS1-8)

PS2.B: Types of Interactions
- Attraction and repulsion between electric charges at the atomic scale explain the structure, properties, and transformations of matter, as well as the contact forces between material objects. *(secondary to HS-PS1-1), (secondary to HS-PS1-3)*

ETS1.C: Optimizing the Design Solution
- Criteria may need to be broken down into simpler ones that can be approached systematically, and decisions about the priority of certain criteria over others (trade-offs) may be needed. *(secondary to HS-PS1-6)*

Crosscutting Concepts

Patterns
- Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena. (HS-PS1-1), (HS-PS1-2), (HS-PS1-3), (HS-PS1-5)

Energy and Matter
- In nuclear processes, atoms are not conserved, but the total number of protons plus neutrons is conserved. (HS-PS1-8)
- The total amount of energy and matter in closed systems is conserved. (HS-PS1-7)
- Changes of energy and matter in a system can be described in terms of energy and matter flows into, out of, and within that system. (HS-PS1-4)

Stability and Change
- Much of science deals with constructing explanations of how things change and how they remain stable. (HS-PS1-6)

Connections to Nature of Science
Scientific Knowledge Assumes an Order and Consistency in Natural Systems
- Science assumes the universe is a vast single system in which basic laws are consistent. (HS-PS1-7)

- Quizzes
- Chapter tests
- Homework
- Mini-labs

Lesson Plans

Activities/Interdisciplinary Connections	*Timeframe*
• Identify chemical reactions • 5 chemical reaction demos • Practice writing chemical equations	Weeks 19-24

• Practice balancing chemical equations • Distinguishing chemical and physical changes activity • Reaction types virtual lab • Unknown solution solubility lab	
Teacher Resources	*Teacher Note*
• Textbook • PowerPoint presentations • Laboratory materials • Technology Tools: -Google Classroom -Seesaw -Pear Deck -BrainPOP -Book Creator -FlipGrid -Kahoot -Kami	

Differentiating Instruction: Students with Disabilities, English Language Learners, and Gifted & Talented Students

Examples of Strategies and Practices that Support Students with Disabilities:
• Use of visual and multisensory formats
• Use of assisted technology
• Use of prompts
• Modification of content and student products
• Testing accommodations
• Authentic assessments

Examples of Strategies and Practices that Support Gifted & Talented Students:
• Adjusting the pace of lessons
• Curriculum compacting
• Inquiry-based instruction
• Independent study
• Higher-order thinking skills
• Interest-based content
• Student-driven instruction
• Real-world problems and scenarios

Examples of Strategies and Practices that Support English Language Learners:
• Pre-teaching of vocabulary and concepts
• Visual learning, including graphic organizers

• Use of cognates to increase comprehension
• Teacher modeling
• Pairing students with beginning English language skills with students who have more advanced English language skills
• Scaffolding
•Word walls
•Sentence frames
•Think-pair-share
•Cooperative learning groups

Chemistry – 10th Grade Unit 7

Unit Title: Stoichiometry	
Unit Summary: All objects and substances in the natural world are composed of matter. Matter can be changed either physically or chemically, utilizing energy. The conservation of energy can be demonstrated by keeping track of energy as it is transferred from one object to another. In this unit, molar ratio and molar mass will be introduced. Problem solving involving conversions of moles and grams will be established. The concepts of limiting and excess reactants will be discussed.	
Primary Interdisciplinary Connections: MP.2, MP.4, HSN-Q.A.1, HSN-Q.A.2, and HSN-Q.A.3	
Career Readiness, Life Literacies, and Key Skills: 9.4.12.CI.1, 9.4.12.CI.2, 9.4.12.CI.3, 9.4.12.CT.1, 9.4.12.CT.2, 9.4.12.CT.4, 9.4.12.TL.2	
Learning Targets	
NJSLS Standards: HS-PS1-1, HS-PS1-2, HS-PS1-3, HS-PS1-4, HS-PS1-5, HS-PS1-6, HS-PS1-7, HS-PS1-8	
Computer Science and Design Thinking Standards: 8.1.12.A.2, 8.1.12.A.3, 8.1.12.A.4, 8.1.12.C.1, 8.1.12.E.1, 8.1.12.E.2	
Climate Change Standards: HS-ESS3-1, HS-ESS3-2, HS-ESS3-3, HS-ESS3-4, HS-ESS3-5, HS-ESS3-6	
ELA Companion Standards: RST.9-10.7, RST.11-12.1, WHST.9-12.2, WHST.9-12.5, WHST.9-12.7, WHST.11-12.8, WHST.9-12.9, SL.11-12.5	
Content Statements:	
1	Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms.
2	Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties.
3	Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles.
4	Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy.
5	Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs.
6	Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium.
7	Use mathematical representations to support the claim that atoms, and therefore mass, are

	conserved during a chemical reaction.
8	Develop models to illustrate the changes in the composition of the nucleus of the atom and the energy released during the processes of fission, fusion, and radioactive decay.

Big Idea: Stoichiometry allows for the knowledge of elements and compounds to be used to determine the amounts of reactants and products in a chemical reaction.

Unit Essential Questions:	**Unit Enduring Understandings:**
• How can we quantify something that we can't see? How do we know that we are right? • Why is the mole an important measurement of chemistry?	• The mole is the unit for specifying the amount of the material. • Mass and mole ratios between different compounds in a reaction can answer quantitative questions concerning reactants and products.

Unit Learning Targets

Students will…

- Solve mole conversion problems.
- Determine the amount of reactants and products in a chemical reaction using stoichiometry.
- Prove the Law of Conservation of Mass is satisfied using a balanced equation.
- Conclude the thickness of the piece of aluminum foil and convert the thickness into atoms.
- Determine the amount of a product produced by applying quantities to chemical reactions. Determine the percent yield and formulate hypotheses for errors.

Science and Engineering Practices

Modeling in 9–12 builds on K–8 and progresses to using, synthesizing, and developing models to predict and show relationships among variables between systems and their components in the natural and designed worlds.

- Develop a model based on evidence to illustrate the relationships between systems or between components of a system. (HS-PS1-4), (HS-PS1-8)
- Use a model to predict the relationships between systems or between components of a system. (HS-PS1-1)

Planning and Carrying Out Investigations

Planning and carrying out investigations in 9–12 builds on K–8

experiences and progresses to include investigations that provide evidence for and test conceptual, mathematical, physical, and empirical models.

- Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly. (HS-PS1-3)

Using Mathematics and Computational Thinking

Mathematical and computational thinking at the 9–12 builds on K–8 and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions including trigonometric functions, exponentials and logarithms, and computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical models of basic assumptions.

- Use mathematical representations of phenomena to support claims. (HS-PS1-7)

Constructing Explanations and Designing Solutions

Constructing explanations and designing solutions in 9–12 builds on K–8 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories.

- Apply scientific principles and evidence to provide an explanation of phenomena and solve design problems, taking into account possible unanticipated effects. (HS-PS1-5)
- Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (HS-PS1-2)
- Refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. (HS-PS1-6)

Disciplinary Core Ideas

PS1.A: Structure and Properties of Matter

- Each atom has a charged substructure consisting of a nucleus, which is made of protons and neutrons, surrounded by electrons. (HS-PS1-1)
- The periodic table orders elements horizontally by the number of protons in the atom's nucleus and places those with similar chemical properties in columns. The repeating patterns of this table reflect patterns of outer electron states. (HS-PS1-1), (HS-PS1-2)
- The structure and interactions of matter at the bulk scale are determined by electrical forces within and between atoms. (HS-PS1-3)
- A stable molecule has less energy than the same set of atoms separated; one must provide at least this energy in order to take the molecule apart. (HS-PS1-4)

PS1.B: Chemical Reactions

- Chemical processes, their rates, and whether or not energy is stored or released can be understood in terms of the collisions of molecules and the rearrangements of atoms into new molecules, with consequent changes in the sum of all bond energies in the set of molecules that are matched by changes in kinetic energy. (HS-PS1-4), (HS-PS1-5)
- In many situations, a dynamic and condition-dependent balance between a reaction and the reverse reaction determines the numbers of all types of molecules present. (HS-PS1-6)
- The fact that atoms are conserved, together with knowledge of the chemical properties of the elements involved, can be used to describe and predict chemical reactions. (HS-PS1-2), (HS-PS1-7)

PS1.C: Nuclear Processes

- Nuclear processes, including fusion, fission, and radioactive decays of unstable nuclei, involve release or absorption of energy. The total number of neutrons plus protons does not change in any nuclear process. (HS-PS1-8)

PS2.B: Types of Interactions

- Attraction and repulsion between electric charges at the atomic scale explain the structure, properties, and transformations of matter, as well as the contact forces between material objects. *(secondary to HS-PS1-1), (secondary to HS-PS1-3)*

ETS1.C: Optimizing the Design Solution

- Criteria may need to be broken down into simpler ones that can be approached systematically, and decisions about the priority of certain criteria over others (trade-offs) may be needed. *(secondary to HS-PS1-6)*

Crosscutting Concepts

Patterns

- Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena. (HS-PS1-1), (HS-PS1-2), (HS-PS1-3), (HS-PS1-5)

Energy and Matter

- In nuclear processes, atoms are not conserved, but the total number of protons plus neutrons is conserved. (HS-PS1-8)
- The total amount of energy and matter in closed systems is conserved. (HS-PS1-7)
- Changes of energy and matter in a system can be described in terms of energy and matter flows into, out of, and within that system. (HS-PS1-4)

Stability and Change

- Much of science deals with constructing explanations of how things change and how they remain stable. (HS-PS1-6)

Connections to Nature of Science

Scientific Knowledge Assumes an Order and Consistency in Natural Systems

- Science assumes the universe is a vast single system in which basic laws are consistent. (HS-PS1-7)

- Quizzes
- Chapter tests
- Homework
- Mini-labs

Lesson Plans

Activities/Interdisciplinary Connections	*Timeframe*
• Popcorn lab • Percent composition mini-lab • Practice stoichiometric conversion problems Unknown solution solubility lab	Weeks 25-30
Teacher Resources	*Teacher Note*
• Textbook • PowerPoint presentations • Laboratory materials • Technology Tools: -Google Classroom -Seesaw	

-Pear Deck -BrainPOP -Book Creator -FlipGrid -Kahoot -Kami	

Differentiating Instruction: Students with Disabilities, English Language Learners, and Gifted & Talented Students

Examples of Strategies and Practices that Support Students with Disabilities:
• Use of visual and multisensory formats
• Use of assisted technology
• Use of prompts
• Modification of content and student products
• Testing accommodations
• Authentic assessments

Examples of Strategies and Practices that Support Gifted & Talented Students:
• Adjusting the pace of lessons
• Curriculum compacting
• Inquiry-based instruction
• Independent study
• Higher-order thinking skills
• Interest-based content
• Student-driven instruction
• Real-world problems and scenarios

Examples of Strategies and Practices that Support English Language Learners:
• Pre-teaching of vocabulary and concepts
• Visual learning, including graphic organizers
• Use of cognates to increase comprehension
• Teacher modeling
• Pairing students with beginning English language skills with students who have more advanced English language skills
• Scaffolding
•Word walls
•Sentence frames
•Think-pair-share
•Cooperative learning groups

Chemistry – 10th Grade Unit 8

Unit Title: Gas Laws	
Unit Summary: Gases are all around us. This unit will examine the properties of gases in comparison to solids and liquids. Gas law calculations and stoichiometry will be introduced. The factors that affect the relationship between gases, such as temperature, volume and pressure will be explained. The relationship between mass and rate of diffusion will be established.	
Primary Interdisciplinary Connections: MP.2, MP.4, HSN-Q.A.1, HSN-Q.A.2, and HSN-Q.A.3	
Career Readiness, Life Literacies, and Key Skills: 9.4.12.CI.1, 9.4.12.CI.2, 9.4.12.CI.3, 9.4.12.CT.1, 9.4.12.CT.2, 9.4.12.CT.4, 9.4.12.TL.2	
Learning Targets	
NJSLS Standards: HS-PS1-1, HS-PS1-2, HS-PS1-3, HS-PS1-4, HS-PS1-5, HS-PS1-6, HS-PS1-7, HS-PS1-8	
Computer Science and Design Thinking Standards: 8.1.12.A.2, 8.1.12.A.3, 8.1.12.A.4, 8.1.12.C.1, 8.1.12.E.1, 8.1.12.E.2	
Climate Change Standards: HS-ESS3-1, HS-ESS3-2, HS-ESS3-3, HS-ESS3-4, HS-ESS3-5, HS-ESS3-6	
ELA Companion Standards: RST.9-10.7, RST.11-12.1, WHST.9-12.2, WHST.9-12.5, WHST.9-12.7, WHST.11-12.8, WHST.9-12.9, SL.11-12.5	
Content Statements:	
1	Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms.
2	Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties.
3	Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles.
4	Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy.
5	Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs.
6	Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium.
7	Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.

8	Develop models to illustrate the changes in the composition of the nucleus of the atom and the energy released during the processes of fission, fusion, and radioactive decay.

Big Idea: The behavior of gases can be explained by the Kinetic Molecular Theory and specific gas laws can be used to illustrate how gas will react under experimental conditions.

Unit Essential Questions:	**Unit Enduring Understandings:**
• How is the Kinetic Molecular Theory used to explain the behavior of matter? • Why are some materials gases at room temperature and standard pressure, while others are solids or liquids? • How do gases respond to changes in temperature, pressure, and volume? • How are gas laws manipulated to mathematically determine unknown variables?	• The behavior of gases is linked to the Kinetic Molecular Theory. • The behavior of gases in the real world can be approximated by mathematical relations between pressure, temperature, volume, and amount.

Unit Learning Targets

Students will…

- Apply the Kinetic Molecular Theory to the behavior of gases.
- Apply the mathematical models to illustrate the relationships between Pressure (P), Volume, (V) and Temperature (T).
- Analyze data and graph representing the relationships between pressure, volume, and temperature of a gas. This includes 5 trials with the given values of P, V, and T depending on each gas laws.
- Draw conclusions as the variables change (inverse or direct relationships).
- Calculate the unknown variables of various practice problems.

  Draw conclusions connecting real world situations to gas law relationships.

Science and Engineering Practices

Modeling in 9–12 builds on K–8 and progresses to using, synthesizing, and developing models to predict and show relationships among variables between systems and their components in the natural and designed worlds.

- Develop a model based on evidence to illustrate the relationships between systems or between components of a system. (HS-PS1-4), (HS-PS1-8)
- Use a model to predict the relationships between systems or between components of a system. (HS-PS1-1)

Planning and Carrying Out Investigations

Planning and carrying out investigations in 9–12 builds on K–8

experiences and progresses to include investigations that provide evidence for and test conceptual, mathematical, physical, and empirical models.

- Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly. (HS-PS1-3)

Using Mathematics and Computational Thinking
Mathematical and computational thinking at the 9–12 builds on K–8 and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions including trigonometric functions, exponentials and logarithms, and computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical models of basic assumptions.

- Use mathematical representations of phenomena to support claims. (HS-PS1-7)

Constructing Explanations and Designing Solutions
Constructing explanations and designing solutions in 9–12 builds on K–8 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories.

- Apply scientific principles and evidence to provide an explanation of phenomena and solve design problems, taking into account possible unanticipated effects. (HS-PS1-5)
- Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (HS-PS1-2)
- Refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. (HS-PS1-6)

Disciplinary Core Ideas

PS1.A: Structure and Properties of Matter

- Each atom has a charged substructure consisting of a nucleus, which is made of protons and neutrons, surrounded by electrons. (HS-PS1-1)
- The periodic table orders elements horizontally by the number of protons in the atom's nucleus and places those with similar chemical properties in columns. The repeating patterns of this table reflect patterns of outer electron states. (HS-PS1-1), (HS-PS1-2)
- The structure and interactions of matter at the bulk scale are determined by electrical forces within and between atoms. (HS-PS1-3)
- A stable molecule has less energy than the same set of atoms separated; one must provide at least this energy in order to take the molecule apart. (HS-PS1-4)

PS1.B: Chemical Reactions

- Chemical processes, their rates, and whether or not energy is stored or released can be understood in terms of the collisions of molecules and the rearrangements of atoms into new molecules, with consequent changes in the sum of all bond energies in the set of molecules that are matched by changes in kinetic energy. (HS-PS1-4), (HS-PS1-5)
- In many situations, a dynamic and condition-dependent balance between a reaction and the reverse reaction determines the numbers of all types of molecules present. (HS-PS1-6)
- The fact that atoms are conserved, together with knowledge of the chemical properties of the elements involved, can be used to describe and predict chemical reactions. (HS-PS1-2), (HS-PS1-7)

PS1.C: Nuclear Processes

- Nuclear processes, including fusion, fission, and radioactive decays of unstable nuclei, involve release or absorption of energy. The total number of neutrons plus protons does not change in any nuclear process. (HS-PS1-8)

PS2.B: Types of Interactions

- Attraction and repulsion between electric charges at the atomic scale explain the structure, properties, and transformations of matter, as well as the contact forces between material objects. *(secondary to HS-PS1-1), (secondary to HS-PS1-3)*

ETS1.C: Optimizing the Design Solution

- Criteria may need to be broken down into simpler ones that can be approached systematically, and decisions about the priority of certain criteria over others (trade-offs) may be needed. *(secondary to HS-PS1-6)*

Crosscutting Concepts

Patterns

- Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena. (HS-PS1-1), (HS-PS1-2), (HS-PS1-3), (HS-PS1-5)

Energy and Matter

- In nuclear processes, atoms are not conserved, but the total number of protons plus neutrons is conserved. (HS-PS1-8)
- The total amount of energy and matter in closed systems is conserved. (HS-PS1-7)
- Changes of energy and matter in a system can be described in terms of energy and matter flows into, out of, and within that system. (HS-PS1-4)

Stability and Change

- Much of science deals with constructing explanations of how things change and how they remain stable. (HS-PS1-6)

Connections to Nature of Science

Scientific Knowledge Assumes an Order and Consistency in Natural Systems

- Science assumes the universe is a vast single system in which basic laws are consistent. (HS-PS1-7)

- Quizzes
- Chapter tests
- Homework
- Mini-labs

Lesson Plans

Activities/Interdisciplinary Connections	*Timeframe*
• Gas laws lab • Boyle's law animation • Mass and density of air at different pressures • Growing a balloon in a jar • Wet dry ice lab	Weeks 32-33
Teacher Resources	*Teacher Note*

• Textbook • PowerPoint presentations • Laboratory materials • Technology Tools: -Google Classroom -Seesaw -Pear Deck -BrainPOP -Book Creator -FlipGrid -Kahoot -Kami	

Differentiating Instruction: Students with Disabilities, English Language Learners, and Gifted & Talented Students

Examples of Strategies and Practices that Support Students with Disabilities:
• Use of visual and multisensory formats
• Use of assisted technology
• Use of prompts
• Modification of content and student products
• Testing accommodations
• Authentic assessments

Examples of Strategies and Practices that Support Gifted & Talented Students:
• Adjusting the pace of lessons
• Curriculum compacting
• Inquiry-based instruction
• Independent study
• Higher-order thinking skills
• Interest-based content
• Student-driven instruction
• Real-world problems and scenarios

Examples of Strategies and Practices that Support English Language Learners:
• Pre-teaching of vocabulary and concepts
• Visual learning, including graphic organizers
• Use of cognates to increase comprehension
• Teacher modeling
• Pairing students with beginning English language skills with students who have more advanced English language skills
• Scaffolding
•Word walls
•Sentence frames

•Think-pair-share •Cooperative learning groups

Chemistry – 10th Grade Unit 9

Unit Title: Solutions	
Unit Summary: Solutions are important aspects of the human body and daily life. This unit will explore the characteristics of solutions and the factors that will affect solution formation and solubility. Concentrations of solutions will be calculated in terms of molality and molarity and utilize stoichiometry. The concept of chemical equilibrium will be used to summarize the ratio of reactants to products in a reaction. Acids and bases will be introduced. The pH scale will be utilized to determine whether a solution is an acid or a base based on the ion concentrations.	
Primary Interdisciplinary Connections: MP.2, MP.4, HSN-Q.A.1, HSN-Q.A.2, and HSN-Q.A.3	
Career Readiness, Life Literacies, and Key Skills: 9.4.12.CI.1, 9.4.12.CI.2, 9.4.12.CI.3, 9.4.12.CT.1, 9.4.12.CT.2, 9.4.12.CT.4, 9.4.12.TL.2	
Learning Targets	
NJSLS Standards: HS-PS1-1, HS-PS1-2, HS-PS1-3, HS-PS1-4, HS-PS1-5, HS-PS1-6, HS-PS1-7, HS-PS1-8	
Computer Science and Design Thinking Standards: 8.1.12.A.2, 8.1.12.A.3, 8.1.12.A.4, 8.1.12.C.1, 8.1.12.E.1, 8.1.12.E.2	
Climate Change Standards: HS-ESS3-1, HS-ESS3-2, HS-ESS3-3, HS-ESS3-4, HS-ESS3-5, HS-ESS3-6	
ELA Companion Standards: RST.9-10.7, RST.11-12.1, WHST.9-12.2, WHST.9-12.5, WHST.9-12.7, WHST.11-12.8, WHST.9-12.9, SL.11-12.5	
Content Statements:	
1	Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms.
2	Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties.
3	Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles.
4	Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy.
5	Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs.
6	Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium.

7	Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.
8	Develop models to illustrate the changes in the composition of the nucleus of the atom and the energy released during the processes of fission, fusion, and radioactive decay.

Big Idea: The solubility of a substance can be determined at a specific temperature and interpreted using a solubility curve. Substances can be identified as an acid or a base by evaluating the physical and chemical factors affecting solubility.

Unit Essential Questions:	**Unit Enduring Understandings:**
• What are the various types of concentration that are used to describe a solution? • How can these different forms of concentrations of the solution be calculated? • What factors affect the solubility of a solution? • What are the factors that distinguish between acidity and basicity of a solution?	• Concentration of a solution can be expressed in different ways. • There are different factors that affect the solubility of a solution. • Everyday substances can easily be analyzed to determine whether they are an acid or a base.

Unit Learning Targets

Students will…

- Differentiate between the different types of solutions.
- Calculate the concentration of various visual solutions.
- Calculate the molarity of a substance.
- Prove the solubility of a substance using a solubility curve.
- Calculating the pH.
- Analyze a solution with litmus paper and pH paper.

  Identify various substances as acids or bases and the degrees of acidity and alkalinity based on various indicators.

Science and Engineering Practices

Modeling in 9–12 builds on K–8 and progresses to using, synthesizing, and developing models to predict and show relationships among variables between systems and their components in the natural and designed worlds.

- Develop a model based on evidence to illustrate the relationships between systems or between components of a system. (HS-PS1-4), (HS-PS1-8)
- Use a model to predict the relationships between systems or between components of a system. (HS-PS1-1)

Planning and Carrying Out Investigations

Planning and carrying out investigations in 9–12 builds on K–8

experiences and progresses to include investigations that provide evidence for and test conceptual, mathematical, physical, and empirical models.

- Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce

reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly. (HS-PS1-3)

Using Mathematics and Computational Thinking
Mathematical and computational thinking at the 9–12 builds on K–8 and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions including trigonometric functions, exponentials and logarithms, and computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical models of basic assumptions.

- Use mathematical representations of phenomena to support claims. (HS-PS1-7)

Constructing Explanations and Designing Solutions
Constructing explanations and designing solutions in 9–12 builds on K–8 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories.

- Apply scientific principles and evidence to provide an explanation of phenomena and solve design problems, taking into account possible unanticipated effects. (HS-PS1-5)
- Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (HS-PS1-2)
- Refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. (HS-PS1-6)

Disciplinary Core Ideas

PS1.A: Structure and Properties of Matter

- Each atom has a charged substructure consisting of a nucleus, which is made of protons and neutrons, surrounded by electrons. (HS-PS1-1)
- The periodic table orders elements horizontally by the number of protons in the atom's nucleus and places those with similar chemical properties in columns. The repeating patterns of this table reflect patterns of outer electron states. (HS-PS1-1), (HS-PS1-2)
- The structure and interactions of matter at the bulk scale are determined by electrical forces within and between atoms. (HS-PS1-3)
- A stable molecule has less energy than the same set of atoms separated; one must provide at least this energy in order to take the molecule apart. (HS-PS1-4)

PS1.B: Chemical Reactions

- Chemical processes, their rates, and whether or not energy is stored or released can be understood in terms of the collisions of molecules and the rearrangements of atoms into new molecules, with consequent changes in the sum of all bond energies in the set of molecules that are matched by changes in kinetic energy. (HS-PS1-4), (HS-PS1-5)
- In many situations, a dynamic and condition-dependent balance between a reaction and the reverse reaction determines the numbers of all types of molecules present. (HS-PS1-6)
- The fact that atoms are conserved, together with knowledge of the chemical properties of the elements involved, can be used to describe and predict chemical reactions. (HS-PS1-2), (HS-PS1-7)

PS1.C: Nuclear Processes

- Nuclear processes, including fusion, fission, and radioactive decays of unstable nuclei, involve release

or absorption of energy. The total number of neutrons plus protons does not change in any nuclear process. (HS-PS1-8)

PS2.B: Types of Interactions

- Attraction and repulsion between electric charges at the atomic scale explain the structure, properties, and transformations of matter, as well as the contact forces between material objects. *(secondary to HS-PS1-1), (secondary to HS-PS1-3)*

ETS1.C: Optimizing the Design Solution

- Criteria may need to be broken down into simpler ones that can be approached systematically, and decisions about the priority of certain criteria over others (trade-offs) may be needed. *(secondary to HS-PS1-6)*

Crosscutting Concepts

Patterns

- Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena. (HS-PS1-1), (HS-PS1-2), (HS-PS1-3), (HS-PS1-5)

Energy and Matter

- In nuclear processes, atoms are not conserved, but the total number of protons plus neutrons is conserved. (HS-PS1-8)
- The total amount of energy and matter in closed systems is conserved. (HS-PS1-7)
- Changes of energy and matter in a system can be described in terms of energy and matter flows into, out of, and within that system. (HS-PS1-4)

Stability and Change

- Much of science deals with constructing explanations of how things change and how they remain stable. (HS-PS1-6)

Connections to Nature of Science

Scientific Knowledge Assumes an Order and Consistency in Natural Systems

- Science assumes the universe is a vast single system in which basic laws are consistent. (HS-PS1-7)

- Quizzes
- Chapter tests
- Homework
- Mini-labs

Lesson Plans

Activities/Interdisciplinary Connections	*Timeframe*
• Solubility lab • Molarity solution lab • Testing water of ions • Paper Chromatography	Weeks 34-35

• Is it an acid or base lab?	
Teacher Resources	*Teacher Note*
• Textbook • PowerPoint presentations • Laboratory materials • Technology Tools: -Google Classroom -Seesaw -Pear Deck -BrainPOP -Book Creator -FlipGrid -Kahoot -Kami	

Differentiating Instruction: Students with Disabilities, English Language Learners, and Gifted & Talented Students

Examples of Strategies and Practices that Support Students with Disabilities:
• Use of visual and multisensory formats
• Use of assisted technology
• Use of prompts
• Modification of content and student products
• Testing accommodations
• Authentic assessments

Examples of Strategies and Practices that Support Gifted & Talented Students:
• Adjusting the pace of lessons
• Curriculum compacting
• Inquiry-based instruction
• Independent study
• Higher-order thinking skills
• Interest-based content
• Student-driven instruction
• Real-world problems and scenarios

Examples of Strategies and Practices that Support English Language Learners:
• Pre-teaching of vocabulary and concepts
• Visual learning, including graphic organizers
• Use of cognates to increase comprehension
• Teacher modeling
• Pairing students with beginning English language skills with students who have more advanced English language skills

• Scaffolding •Word walls •Sentence frames •Think-pair-share •Cooperative learning groups