# Diocese of Greensburg Curriculum
# Chemistry 1

| Unit | Standards | Content | Skills |
|---|---|---|---|
| **Scientific Basics** | **CCSS: English Language Arts 6-12**<br>**CCSS: Grades 9-10**<br>**Capacities of the Literate Individual**<br>**Students Who are College and Career Ready in Reading, Writing, Speaking, Listening, & Language**<br>They demonstrate independence.<br>They build strong content knowledge.<br>They respond to the varying demands of audience, task, purpose, and discipline.<br>They comprehend as well as critique.<br>They value evidence.<br>They use technology and digital media strategically and capably.<br>They come to understand other perspectives and cultures.<br>**Writing**<br>**Text Types and Purposes**<br>**1. Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.**<br>W.9-10.1. Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.<br>W.9-10.1a. Introduce precise claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that establishes clear relationships among claim(s), counterclaims, reasons, and evidence.<br>W.9-10.1e. Provide a concluding statement or section that follows from and supports the argument presented.<br>**Research to Build and Present Knowledge**<br>**7. Conduct short as well as more sustained research projects based on focused questions, demonstrating understanding of the subject under investigation.** | This high school unit of study will focus on the scientific method, laboratory basics, units of measurements, steps to solving mathematical problems, significant figures, and matter.<br><br>In this study, students will review the concepts of the scientific method, SI system, study of matter and its properties.<br>Students' understandings will also address laboratory safety and common techniques, how to take proper measurements, concepts of mass and density, scientific notation, and factor label method. | The student will be able to:<br><br>• Differentiate among element, compound, homogeneous mixture, or heterogeneous mixture.<br>• Identify the smallest part of each pure substance.<br>• Determine the number of each kind of atom in a compound, given the chemical formula.<br>• Differentiate between physically blended and chemically bonded.<br>• Describe the arrangement and distances among particles in the solid, liquid, and gas state.<br>• Relate the physical state of the substance to the temperature at which the substance exists.<br>• Distinguish between physical and chemical properties.<br>• Contrast physical and chemical changes.<br>• Calculate the density of a substance from experimental data.<br>• Contrast the properties of inorganic and organic compounds.<br>• Distinguish between reactants and products of a chemical reaction. |

| Unit | Standards | Content | Skills |
|---|---|---|---|
| | W.9-10.7. Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.<br>**9. Draw evidence from literary or informational texts to support analysis, reflection, and research.**<br>W.9-10.9. Draw evidence from literary or informational texts to support analysis, reflection, and research<br>**Speaking & Listening**<br>**Comprehension and Collaboration**<br>**1. Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.**<br>SL.9-10.1. Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 9–10 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.<br>SL.9-10.1c. Propel conversations by posing and responding to questions that relate the current discussion to broader themes or larger ideas; actively incorporate others into the discussion; and clarify, verify, or challenge ideas and conclusions.<br>**Presentation of Knowledge and Ideas**<br>**4. Present information, findings, and supporting evidence such that listeners can follow the line of reasoning and the organization, development, and style are appropriate to task, purpose, and audience.**<br>SL.9-10.4. Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.<br>**6. Acquire and use accurately a range of general academic and domain-specific words and phrases sufficient for reading, writing, speaking, and listening at the college and career readiness level; demonstrate independence in gathering vocabulary knowledge when considering a word** | | • Use the Law of Conservation of Mass and Energy to prove that the mass remains constant during both physical and chemical changes.<br>• Define a conversion factor.<br>• Convert from one unit to another given a conversion factor using dimensional analysis or factor-label method. |

| Unit | Standards | Content | Skills |
|---|---|---|---|
| | **or phrase important to comprehension or expression.**<br>L.9-10.6. Acquire and use accurately general academic and domain-specific words and phrases, sufficient for reading, writing, speaking, and listening at the college and career readiness level; demonstrate independence in gathering vocabulary knowledge when considering a word or phrase important to comprehension or expression.<br>**CCSS: Mathematics**<br>**CCSS: HS: Num/Quantity Quantities**<br>**HSN-Q.A. Reason quantitatively and use units to solve problems.**<br><br>**CCSS: HS: Algebra**<br>**Seeing Structure in Expressions**<br>**HSA-SSE.B. Write expressions in equivalent forms to solve problems.**<br>**Creating Equations**<br>**HSA-CED.A. Create equations that describe numbers or relationships.**<br>**Reasoning with Equations & Inequalities**<br>**HSA-REI.B. Solve equations and inequalities in one variable.**<br>**HSA-REI.D. Represent and solve equations and inequalities graphically.**<br><br>**Mathematical Practice**<br>**MP.The Standards for Mathematical Practice describe varieties of expertise that mathematics educators at all levels should seek to develop in their students.**<br><br>**NGSS: Science and Engineering Practices**<br>**NGSS: 9-12**<br>**Practice 1. Asking questions (for science) and defining problems (for engineering)**<br>**Asking questions and defining problems in 9–12 builds on K–8 experiences and progresses to formulating, refining, and evaluating empirically testable questions and design problems using models and simulations.** | | |

| Unit | Standards | Content | Skills |
|---|---|---|---|
| | **Practice 3. Planning and carrying out investigations**<br>**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.**<br>.<br>**Practice 4. Analyzing and interpreting data**<br>**Analyzing data in 9–12 builds on K–8 experiences and progresses to introducing more detailed statistical analysis, the comparison of data sets for consistency, and the use of models to generate and analyze data.**<br>**Practice 6. Constructing explanations (for science) and designing solutions (for engineering)**<br>**Constructing explanations and designing solutions in 9–12 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.**<br><br>**Practice 7. Engaging in argument from evidence**<br>**Engaging in argument from evidence in 9–12 builds on K–8 experiences and progresses to using appropriate and sufficient evidence and scientific reasoning to defend and critique claims and explanations about the natural and designed world(s). Arguments may also come from current scientific or historical episodes in science.**<br><br>**Connections to the Nature of Science: Most Closely Associated with Practices**<br>**Scientific Investigations Use a Variety of Methods**<br><br>**Scientific Knowledge is Based on Empirical Evidence**<br><br>**Scientific Knowledge is Open to Revision in Light of New Evidence**<br><br>**Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena** | | |

| Unit | Standards | Content | Skills |
|---|---|---|---|
| |  | | |
| **Structure of Atoms** | **CCSS: English Language Arts 6-12**<br>**CCSS: Grades 9-10**<br>**Capacities of the Literate Individual**<br>**Students Who are College and Career Ready in Reading, Writing, Speaking, Listening, & Language**<br>They demonstrate independence.<br><br>They build strong content knowledge.<br><br>They respond to the varying demands of audience, task, purpose, and discipline.<br><br>They comprehend as well as critique.<br><br>They value evidence.<br><br>They use technology and digital media strategically and capably.<br><br>They come to understand other perspectives and cultures.<br><br>**NGSS: Science Performance Expectations (2013)**<br>**NGSS: HS Physical Sciences**<br>**HS.Structure and Properties of Matter**<br>**Performance Expectations**<br><br>HS-PS1-1. 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. | This high school unit of study will focus on the structure, properties, and composition of matter.<br><br>In this study, students will address the idea that matter has a definite composition, and matter may be individual atoms or combined.<br><br>Students' understandings will also address that the patterns exist because of the properties of atoms. | The student will be able to:<br><br>• Explain how science is a developing field where theories are constantly challenged.<br>• Contrast the contributions of Dalton, Thomson, Rutherford, Bohr, and Schroedinger in the development of the modern understanding of atomic structure.<br>• Contrast the modern understanding of atomic structure with historic understandings.<br>• Use language appropriate to atomic structure including atom, ion, isotope, subatomic particle, atomic number, mass number, average atomic mass, and atomic mass unit.<br>• Identify and calculate the number of protons, neutrons, and electrons in any atom, ion, or isotope given sufficient information<br>• Explain how some isotopes are made of unstable nuclei, which decay over time emitting particles and energy. |

| Unit | Standards | Content | Skills |
|---|---|---|---|
| | HS-PS1-8. 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.<br><br>**HS.Chemical Reactions**<br>**Performance Expectations**<br><br>HS-PS1-2. 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.<br><br>**NGSS: Disciplinary Core Ideas**<br>**NGSS: 9-12**<br>**LS1: From Molecules to Organisms: Structures and Processes**<br>**LS1.A: Structure and Function**<br><br>All cells contain genetic information in the form of DNA molecules. Genes are regions in the DNA that contain the instructions that code for the formation of proteins, which carry out most of the work of cells. (HS-LS1-1)(secondary to HS-LS3-1)<br><br>**LS3: Heredity: Inheritance and Variation of Traits**<br>**LS3.A: Inheritance of Traits**<br><br>Each chromosome consists of a single very long DNA molecule, and each gene on the chromosome is a particular segment of that DNA. The instructions for forming species' characteristics are carried in DNA. All cells in an organism have the same genetic content, but the genes used(expressed) by the cell may be regulated in different ways. Not all DNA codes for a protein; some segments of DNA are involved in regulatory or structural functions, and some have no as-yet known function. (HS-LS3-1)<br><br>**PS1: Matter and Its Interactions**<br>**PS1.A: Structure and Properties of Matter** | | • Contrast the three kinds of emissions (alpha, beta, and gamma), the composition of the emission, and the material required to shield them.<br>• Differentiate between nuclear fission and fusion.<br>• Identify the common uses of nuclear fission and fusion. |

| Unit | Standards | Content | Skills |
|---|---|---|---|
| | Each atom has a charged substructure consisting of a nucleus, which is made of protons and neutrons, surrounded by electrons. (HS-PS1-1)<br><br>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),(HSPS1-2)<br><br>The structure and interactions of matter at the bulk scale are determined by electrical forces within and between atoms. (HSPS1-3),(secondary to HS-PS2-6)<br><br> | | |
| **Electron Behaviors** | **CCSS: English Language Arts 6-12**<br>**CCSS: Grades 9-10**<br>**Capacities of the Literate Individual**<br>**Students Who are College and Career Ready in Reading, Writing, Speaking, Listening, & Language**<br>They demonstrate independence.<br><br>They build strong content knowledge.<br><br>They respond to the varying demands of audience, task, purpose, and discipline.<br><br>They comprehend as well as critique.<br><br>They value evidence.<br><br>They use technology and digital media strategically and capably.<br><br>They come to understand other perspectives and cultures. | This high school unit of study will focus on the behavior and arrangement of electrons.<br><br>In this study students will address the principles of electromagnetic radiation.<br><br>Student understanding will also address the arrangement of electrons using the Quantum Mechanical Model of the Atom. | The student will be able to:<br><br>• Distinguish among energy levels, sublevels, and orbitals.<br>• Use the Aufbau principle to fill an energy level diagram.<br>• Determine both the full and shorthand electron configurations for an atom or ion.<br>• Determine the orbital notation for the electron arrangement in an atom or ion using Hund's rule and Pauli's exclusion principle.<br>• Determine the quantum numbers associated with an electron.<br>• Describe the process that creates atomic spectra.<br>• Explain the uniqueness of atomic spectra. |

| Unit | Standards | Content | Skills |
|---|---|---|---|
| | **NGSS: Science Performance Expectations (2013)**<br>**NGSS: HS Physical Sciences**<br>**HS.Structure and Properties of Matter**<br>**Performance Expectations**<br>HS-PS1-1. 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.<br>**HS.Chemical Reactions**<br>**Performance Expectations**<br>HS-PS1-2. 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.<br>**HS.Waves and Electromagnetic Radiation**<br>**Performance Expectations**<br>HS-PS4-1. Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media.<br>HS-PS4-3. Evaluate the claims, evidence, and reasoning behind the idea that electromagnetic radiation can be described either by a wave model or a particle model, and that for some situations one model is more useful than the other.<br>HS-PS4-4. Evaluate the validity and reliability of claims in published materials of the effects that different frequencies of electromagnetic radiation have when absorbed by matter.<br>HS-PS4-5. Communicate technical information about how some technological devices use the principles of wave behavior and wave interactions with matter to transmit and capture information and energy.*<br>**NGSS: Disciplinary Core Ideas** | | • Provide examples of the common applications of atomic spectra, i.e. analysis of a mixture using atomic spectra.<br>• Describe the relative energies of ultraviolet, visible, infrared, microwave, X-ray, radio, and TV waves.<br>• Distinguish between absorption (excitation) and emission of energy.<br>• Describe the properties of light. (i.e. wavelength, frequency and energy)<br>• Calculate the wavelength, frequency and energy for a given electron transition. |

| Unit | Standards | Content | Skills |
|---|---|---|---|
| | **NGSS: 9-12**<br>**ESS1: Earth's Place in the Universe**<br>**ESS1.A: The Universe and Its Stars**<br>The study of stars' light spectra and brightness is used to identify compositional elements of stars, their movements, and their distances from Earth. (HS-ESS1-2),(HS-ESS1-3)<br>The Big Bang theory is supported by observations of distant galaxies receding from our own, of the measured composition of stars and non-stellar gases, and of the maps of spectra of the primordial radiation (cosmic microwave background) that still fills the universe.(HSESS1-2)<br>**ESS2: Earth's Systems**<br>**ESS2.D: Weather and Climate**<br>The foundation for Earth's global climate systems is the electromagnetic radiation from the sun, as well as its reflection, absorption, storage, and redistribution among the atmosphere, ocean, and land systems, and this energy's re-radiation into space.(HS-ESS2-4)<br> | | |

| Unit | Standards | Content | Skills |
|---|---|---|---|
| **Atomic Interaction** | **CCSS: English Language Arts 6-12**<br>**CCSS: Grades 9-10**<br>**Capacities of the Literate Individual**<br>**Students Who are College and Career Ready in Reading, Writing, Speaking, Listening, & Language**<br>They demonstrate independence.<br><br>They build strong content knowledge.<br><br>They respond to the varying demands of audience, task, purpose, and discipline.<br><br>They comprehend as well as critique.<br><br>They value evidence.<br><br>They use technology and digital media strategically and capably.<br><br>They come to understand other perspectives and cultures.<br><br>**NGSS: Science Performance Expectations (2013)**<br>**NGSS: HS Physical Sciences**<br>**HS.Structure and Properties of Matter**<br>**Performance Expectations**<br><br>HS-PS1-1. 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.<br><br>HS-PS1-3. 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.<br><br>HS-PS2-6. Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials.*<br><br>**HS.Chemical Reactions** | This high school unit of study will focus on the interaction between atoms.<br><br>In this study, students will address the idea that bonds are created by transferring or sharing electrons.<br><br>Students' understandings will also address that the behaviors and patterns exist on the periodic table and the role it plays in bonding, in particular electronegativity. | The students will be able to:<br><br>• Determine the number of valence electrons in an atom from its position in the Periodic Table.<br>• Describe how atoms interact with one another by transferring and sharing valence electrons.<br>• Use electronegativity values to determine whether a compound is ionic, polar or nonpolar covalent.<br>• Illustrate neutral atoms and ions using electron dot notation. e. Illustrate ionic and covalent bonds utilizing electron dot notation<br>• Use appropriate materials to build adequate models of simple molecules and polyatomic ions representing the shapes of these species.<br>• Describe van der Waals forces (London forces and dipole-dipole forces) and hydrogen bonds.<br>• Identify and differentiate among the linear, bent, and tetrahedral shapes.<br>• Predict the shape of a molecule from its chemical formula.<br>• Predict the polarity of a molecule given its shape and types of bonds<br>• Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of |

| Unit | Standards | Content | Skills |
|---|---|---|---|
| | **Performance Expectations**<br><br>HS-PS1-2. 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.<br><br> | | atoms, trends in the periodic table, and knowledge of the patterns of chemical properties.<br>• Apply scientific principles and evidence to provide an explanation of phenomena and solve design problems, taking into account possible unanticipated effects.<br>• Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials.<br>• 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.<br>• 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. |
| **Chemical Reactions** | **CCSS: English Language Arts 6-12**<br>**CCSS: Grades 9-10**<br>**Capacities of the Literate Individual**<br>**Students Who are College and Career Ready in Reading, Writing, Speaking, Listening, & Language**<br><br>They demonstrate independence. | This high school unit of study will focus on chemical reactions.<br>In this study, students will address the idea that matter cannot be created or destroyed.<br><br>Students' understandings will also address the patterns that exist in compounds as well as reactions. | The student will be able to:<br><br>• Distinguish between reactants and products in a chemical reaction.<br>• Write a word or symbolic equation to represent a chemical reaction.<br>• Balance a simple equation. |

| Unit | Standards | Content | Skills |
|---|---|---|---|
| | They build strong content knowledge.<br><br>They respond to the varying demands of audience, task, purpose, and discipline.<br><br>They comprehend as well as critique.<br><br>They value evidence.<br><br>They use technology and digital media strategically and capably.<br><br>**CCSS: Grades 11-12**<br>**Capacities of the Literate Individual**<br>**Students Who are College and Career Ready in Reading, Writing, Speaking, Listening, & Language**<br>They demonstrate independence.<br><br>They build strong content knowledge.<br><br>They respond to the varying demands of audience, task, purpose, and discipline.<br><br>They comprehend as well as critique.<br><br>They value evidence.<br><br>They use technology and digital media strategically and capably.<br><br>They come to understand other perspectives and cultures.<br><br>**NGSS: Science Performance Expectations (2013)**<br>**NGSS: HS Physical Sciences**<br>**HS.Structure and Properties of Matter**<br>**Performance Expectations**<br><br>HS-PS1-1. Use the periodic table as a model to predict the relative properties of elements based on | | • Explain how a balanced chemical equation supports the Law of Conservation of Mass.<br>• Compare the amount and kinds of atoms of reactants and products in a chemical reaction.<br>• Categorize the types of chemical reactions based on the nature of observed changes.<br>• Identify the type of chemical reactions based on the reactants given.<br>• Predict the products of a synthesis, decomposition, single replacement, and double replacement or combustion reaction, for a given combination of reactants.<br>• Write net ionic reactions for precipitation reactions.<br>• 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.<br>• Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.<br>• 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 |

| Unit | Standards | Content | Skills |
|---|---|---|---|
| | the patterns of electrons in the outermost energy level of atoms.<br><br>**HS.Chemical Reactions**<br>**Performance Expectations**<br><br>HS-PS1-2. 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.<br><br>HS-PS1-4. 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.<br><br>HS-PS1-7. Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.<br><br>**HS.Energy**<br>**Performance Expectations**<br><br>HS-PS3-1. Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known.<br><br>**NGSS: HS Life Sciences**<br>**HS.Matter and Energy in Organisms and Ecosystems**<br>**Performance Expectations**<br><br>HS-LS1-5. Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy.<br><br>HS-LS1-6. Construct and revise an explanation based on evidence for how carbon, hydrogen, and oxygen from sugar molecules may combine with other elements to form amino acids and/or other large carbon-based molecules. | | knowledge of the patterns of chemical properties.<br>• Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.<br>• 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. |

| Unit | Standards | Content | Skills |
|---|---|---|---|
| | HS-LS1-7. Use a model to illustrate that cellular respiration is a chemical process whereby the bonds of food molecules and oxygen molecules are broken and the bonds in new compounds are formed resulting in a net transfer of energy.<br><br>HS-LS2-4. Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem.<br><br>**NGSS: Disciplinary Core Ideas**<br>**NGSS: 9-12**<br>**LS1: From Molecules to Organisms: Structures and Processes**<br>**LS1.C: Organization for Matter and Energy Flow in Organisms**<br><br>The process of photosynthesis converts light energy to stored chemical energy by converting carbon dioxide plus water into sugars plus released oxygen. (HS-LS1-5)<br><br>The sugar molecules thus formed contain carbon, hydrogen, and oxygen: their hydrocarbon backbones are used to make amino acids and other carbon-based molecules that can be assembled into larger molecules (suchas proteins or DNA), used for example to form new cells. (HS-LS1-6)<br><br>**ESS2: Earth's Systems**<br>**ESS2.A: Earth Materials and Systems**<br><br>Earth's systems, being dynamic and interacting, cause feedback effects that can increase or decrease the original changes. (HSESS2-1),(HS-ESS2-2)<br><br>**ESS3: Earth and Human Activity**<br>**ESS3.A: Natural Resources**<br><br>All forms of energy production and other resource extraction have associated economic, social, environmental, and geopolitical costs and risks as well as benefits. New technologies and social regulations can change the balance of these factors. (HS-ESS3-2) | | |

| Unit | Standards | Content | Skills |
|---|---|---|---|
| |  | | |
| **Stoichiometry** | **CCSS: English Language Arts 6-12**<br>**CCSS: Grades 9-10**<br>**Capacities of the Literate Individual**<br>**Students Who are College and Career Ready in Reading, Writing, Speaking, Listening, & Language**<br>They demonstrate independence.<br><br>They build strong content knowledge.<br><br>They respond to the varying demands of audience, task, purpose, and discipline.<br><br>They comprehend as well as critique.<br><br>They value evidence.<br><br>They use technology and digital media strategically and capably.<br><br>They come to understand other perspectives and cultures.<br><br>**CCSS: Mathematics**<br>**CCSS: HS: Num/Quantity**<br>**Quantities**<br>**HSN-Q.A. Reason quantitatively and use units to solve problems.**<br>**Mathematical Practice**<br>**MP.The Standards for Mathematical Practice describe varieties of expertise that mathematics educators at all levels should seek to develop in their students.**<br>**NGSS: Science Performance Expectations (2013)**<br>**NGSS: HS Physical Sciences** | This high school unit of study will focus on the mathematical relationships within compounds as well as chemical reactions.<br><br>In this study, students will address the idea the mole, molar mass, and Avogadro's number.<br><br>Students' understandings will also address mathematical patterns that exist. | The student will be able to:<br><br>• Explain how a balanced chemical equation relates to the law of conservation of mass.<br>• Define the mole and describe its importance.<br>• Describe how Avogadro's number is related to a mole of any substance.<br>• Define and calculate the molar mass of a compound.<br>• Convert among the number of particles, mass, moles, and volume of a substance.<br>• Calculate the percent composition of a substance from its chemical formula.<br>• Calculate the percent composition of a substance from experimental data.<br>• Distinguish between empirical and molecular formulas.<br>• Derive the empirical formula for a compound by using experimentally obtained masses of each element.<br>• Define stoichiometry and describe its importance.<br>• Identify stoichiometric ratios from balanced chemical equations.<br>• Calculate different types of stoichiometry problems. |

| Unit | Standards | Content | Skills |
|---|---|---|---|
| | **HS.Chemical Reactions**<br>**Performance Expectations**<br><br>HS-PS1-6. Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium.*<br><br>HS-PS1-7. Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.<br><br> | | (i.e. mass-mass, mass-volume, volume-volume)<br>• Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium.<br>• Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction. |
| **Particle Arrangement and Behaviors** | **CCSS: English Language Arts 6-12**<br>**CCSS: Grades 9-10**<br>**Capacities of the Literate Individual**<br>**Students Who are College and Career Ready in Reading, Writing, Speaking, Listening, & Language**<br>They demonstrate independence.<br><br>They build strong content knowledge.<br><br>They respond to the varying demands of audience, task, purpose, and discipline.<br><br>They comprehend as well as critique.<br><br>They value evidence.<br><br>They use technology and digital media strategically and capably.<br>**NGSS: Science Performance Expectations (2013)**<br>**NGSS: HS Physical Sciences**<br>**HS.Structure and Properties of Matter** | This high school unit of study will focus on the arrangement of the particles for each state of matter.<br><br>In this study, students will address the idea of the kinetic theory of matter as it applies to the various states of matter.<br><br>Students' understandings will also address the behaviors that exist because of the arrangement of the particles. | The student will be able to:<br><br>• Identify the properties of gases.<br>• Differentiate among the behavior of particles in solids, liquids, and gases.<br>• Explain the effects of temperature, pressure, and volume changes on the behavior of particles.<br>• Define kinetic energy in terms of velocity (or speed) and mass of particles.<br>• Relate molecular motion to temperature and molecular collisions to pressure.<br>• Distinguish between homogeneous and heterogeneous mixtures. Explain how dissolving is different from melting. |

| Unit | Standards | Content | Skills |
|---|---|---|---|
| | **Performance Expectations**<br><br>HS-PS2-6. Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials.*<br><br>**HS.Forces and Interactions**<br>**Performance Expectations**<br><br>HS-PS2-3. Apply scientific and engineering ideas to design, evaluate, and refine a device that minimizes the force on a macroscopic object during a collision.*<br><br>**NGSS: HS Earth & Space Science**<br>**HS.Earth's Systems**<br>**Performance Expectations**<br><br>HS-ESS2-5. Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.<br><br>HS-ESS2-6. Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere.<br><br>**HS.Weather and Climate**<br>**Performance Expectations**<br><br>HS-ESS2-4. Use a model to describe how variations in the flow of energy into and out of Earth's systems result in changes in climate.<br><br> | | • Identify and compare the nine different solute-solvent combinations.<br>• Compare solutions, suspensions, and colloids. d. define kinetic molecular theory and use it to explain differences in real versus ideal gases.<br>• Explain why the boiling point increases and the freezing point decreases when solute particles are dissolved.<br>• Give everyday examples of freezing point depression and boiling point elevations.<br>• Use a model to describe how variations in the flow of energy into and out of Earth's systems result in changes in climate.<br>• Apply scientific and engineering ideas to design, evaluate, and refine a device that minimizes the force on a macroscopic object during a collision. |
| **Ion Interaction** | **CCSS: English Language Arts 6-12**<br>**CCSS: Grades 9-10**<br>**Capacities of the Literate Individual**<br>**Students Who are College and Career Ready in Reading, Writing, Speaking, Listening, & Language** | This high school unit of study will focus on characteristics of aqueous solutions<br><br>In this study, students will address the idea that ions affect the behavior of solutions. | The student will be able to:<br><br>• Distinguish between homogeneous and heterogeneous mixtures.<br>• Explain how dissolving is different from melting. |

| Unit | Standards | Content | Skills |
|---|---|---|---|
| | They demonstrate independence.<br><br>They build strong content knowledge.<br><br>They respond to the varying demands of audience, task, purpose, and discipline.<br><br>They comprehend as well as critique.<br><br>They value evidence.<br><br>They use technology and digital media strategically and capably.<br><br>They come to understand other perspectives and cultures.<br><br>**NGSS: Science Performance Expectations (2013)**<br>**NGSS: HS Physical Sciences**<br>**HS.Structure and Properties of Matter**<br>**Performance Expectations**<br><br>HS-PS1-3. 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.<br><br>HS-PS2-6. Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials.*<br><br>**HS.Chemical Reactions**<br>**Performance Expectations**<br><br>HS-PS1-2. 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. | Students' understandings will also address that the relationships that exist in solutions. | • Identify and compare the nine different solute-solvent combinations.<br>• Compare solutions, suspensions, and colloids.<br>• Explain how stirring, surface area, temperature, and concentration influence the rate of solution formation.<br>• Explain how distillation, crystallization, and chromatography are used to separate solutions into their components.<br>• Apply "like dissolves like" to everyday events. (i.e. actions of detergents and soap)<br>• Interpret a solubility curve.<br>• Explain the relationship between equilibrium and solubility.<br>• Explain why gases become less soluble at higher temperatures, whereas most solids become more soluble.<br>• Explain why a precipitate forms when solutions of two ionic compounds are mixed.<br>• Explain why the boiling point increases and the freezing point decreases when solute particles are dissolved.<br>• Give everyday examples of freezing point depression and boiling point elevations. |

| Unit | Standards | Content | Skills |
| --- | --- | --- | --- |
| | HS-PS1-7. Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.<br>**NGSS: HS Earth & Space Science**<br>**HS.Earth's Systems**<br>**Performance Expectations**<br>HS-ESS2-5. Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.<br> | | |
| | | | |