Chemistry	Unit 1: Matter and Energy (Intro)		Suggested Length: 18-20 days
Essential Questions	***Program of Studies* and Core Content**	**Key Terms and Vocabulary**	**Classroom Instruction and <u>Assessment</u>** ***Student will:***
1. How is matter classified? 2. What is the difference between a physical and chemical property or change & what occurrences signify the type of change occurring in everyday processes? 3. What is the proper and safe way to work with laboratory equipment and chemicals? 4. How do you use laboratory equipment to make accurate observations & how are laboratory observations/ results communicated in report form?	**<u>Program of Studies</u>** *Students will:* ❑ *SI-1 identify and refine questions and identify scientific concepts to guide the design of scientific investigations.* ❑ *SI-2 design and conduct different kinds of scientific investigations for a wide variety of reasons.* ❑ *SI-3 use equipment (e.g., microscopes, lasers), tools (e.g., beakers), techniques (e.g., microscope skills), technology (e.g., computers), and mathematics to improve scientific investigations and communications.* ❑ *SI-5 communicate designs, procedures, and results of scientific investigations.* ❑ *PS-3 investigate how the structure of matter (e.g., outer electrons, type of bond) relates to chemical properties of matter.* ❑ *PS-4 investigate how the structure of matter (e.g., constituent atoms, distances and angles between atoms) relates to physical properties of matter.* ❑ *PS-5 investigate chemical reactions and the release or consumption of energy.* ❑ *PS-7 investigate factors (e.g., temperature, catalysts) affecting reaction rates.* ❑ *PS-10 examine how energy is transferred (e.g., collisions, light waves) and recognize that the total energy of the universe is constant.* **<u>Core Content</u>** Scientific Inquiry Students will: ❑ Formulate testable hypotheses and demonstrate the logical connections between the scientific concepts guiding a hypothesis and the design of an experiment.	❑ Matter ❑ Mass ❑ Element ❑ Compound	❑ Summarize information from the installment “Color” from the <u>World of Chemistry</u> Video Series in writing using the T.R.I.C. scoring guide/outline. DOK 3 ❑ Observe and record data in table form obtained from

Chemistry	Unit 1: Matter and Energy (Intro)		Suggested Length: 18-20 days
Essential Questions	***Program of Studies* and Core Content**	**Key Terms and Vocabulary**	**Classroom Instruction and <u>Assessment</u>** ***Student will:***
5. What are the three ordinary states of matter and how do they differ in the behavior of their individual particles? 6. What is energy and how are its transformations related to physical and chemical changes? 7. What are the names and symbols of common elements?	❑ Use equipment, tools, techniques, technology, and mathematics to improve scientific investigations and communications. ❑ Use evidence, logic, and scientific knowledge to develop and revise scientific explanations and models. ❑ Design and conduct different kinds of scientific investigation ❑ Communicate and defend the designs, procedures, observations, and results of scientific investigations.	❑ Mixture ❑ Atoms ❑ Molecules ❑ Physical property ❑ Chemical property	mixing different combinations of chemicals.
	❑ **SC-HS-1.1.1 Students will classify or make generalizations about elements from data of observed patterns in atomic structure and/or position on the periodic table.** **The periodic table is a consequence of the repeating pattern of outermost electrons. DOK 2**	❑ Laboratory Safety Rules & Equipment ❑ Experimental Steps & Parts ❑ (Laboratory Report Format)	❑ Rank laboratory safety rules in order of importance from 1-10. DOK 2 ❑ Interpret and explain a chosen or assigned laboratory safety rule in poster form to display in the classroom. DOK 3 ❑ Understand and utilize basic laboratory safety practices. DOK 2 ❑ Match pictures of pieces of common laboratory equipment with the correct name. DOK 1
	❑ **SC-HS-1.1.5 Students will explain the role of intermolecular or intramolecular interactions on the physical properties (solubility, density, polarity, boiling/melting points) of compounds.** **The physical properties of compounds reflect the nature of the interactions among molecules. These interactions are determined by the structure of the molecules, including the constituent atoms. DOK 2** ❑ **SC-HS-1.1.8 Students will:** ❑ **explain the importance of chemical reactions in a real-world context;**	❑ Homogeneous ❑ Heterogeneous ❑ Pure substance ❑ Physical change ❑ Chemical change	❑ Generalize 3-4 indicators of chemical change from recorded data of observed chemical reactions. DOK 4 ❑ Identify specific changes/properties as physical or chemical and explain the difference between physical and chemical changes at the macro- and micro-levels. DOK 2 ❑ List several physical properties and specify those properties for a given element or compound. ❑ Categorize "models" of matter (represented with nuts, bolts, washers, etc.) as elements, compounds, or mixtures. DOK 3 ❑ Identify specific samples of matter as elements, compounds, or mixtures based on their known properties. DOK 2 ❑ Follow a prescribed laboratory procedure and properly use laboratory equipment to observe two specific

Chemistry	Unit 1: Matter and Energy (Intro)		Suggested Length: 18-20 days
Essential Questions	***Program of Studies* and Core Content**	**Key Terms and Vocabulary**	**Classroom Instruction and <u>Assessment</u>** ***Student will:***
	❑ **justify conclusions using evidence/data from chemical reactions.** **Chemical reactions (e.g. acids and based, oxidation, combustion of fuels, rusting, tarnishing) occur all around us and in every cell in our bodies. These reactions may release or absorb energy. DOK 3** ❑ **SC-08-4.6.2 Students will:** ❑ **describe or explain energy transfer and energy conservation;** ❑ **evaluate alternative solutions to energy problems.** **Energy can be transferred in many ways, but it can neither be created nor destroyed. DOK 3** ❑ SC-08-4.6.3 Students will understand that all energy can be considered to be kinetic energy, potential energy, or energy contained by a field (e.g., electric, magnetic, gravitational).	❑ Energy ❑ Kinetic Energy ❑ Potential Energy ❑ Mechanical Energy ❑ Thermal Energy ❑ Radiant Energy ❑ Chemical Energy ❑ Endothermic process ❑ Exothermic process	chemical reactions. DOK 2 ❑ Generate as many written observations as possible regarding the substances and changes involved in the laboratory experiment. DOK 3 ❑ Compose several questions raised by observing the reactions during the laboratory experiment and hypothesize answers to those questions. DOK 4 ❑ Identify the forms of energy involved in operating an observed "steam engine" demonstration. DOK 2 ❑ Observe endothermic and exothermic changes and identify specific energy changes as endothermic or exothermic. DOK 2 ❑ Name and identify 25 common elements and symbols. DOK 1 ❑ <u>Elements and Symbols Quiz I</u> DOK 1 ❑ <u>Quiz: "Matter & Energy" (MC, Short Answer/Item,</u> DOK 2, 3, 4 ❑ <u>Open Response-Everyday physical & chemical changes</u> DOK 4 ❑ Written Summary: <u>*Video Program: World of Chemistry-Color*</u> DOK 2, 3 ❑ <u>Laboratory Safety Rules and Equipment Test</u> DOK 2 ❑ Formal Lab Report: "Observing, Questioning" DOK 2, 3, 4

Chemistry	Unit 2: Scientific Measurements and Calculations		Suggested Length: 20-22 days
Essential Questions	***Program of Studies* and Core Content**	**Key Terms and Vocabulary**	**Classroom Instruction and <u>Assessment</u>** ***Student will:***
1. What are precision and accuracy of	**<u>Program of Studies</u>** *Students will:* ❑ *SI-1 identify and refine questions and identify scientific concepts to guide the design of scientific investigations.*		

Chemistry	Unit 2: Scientific Measurements and Calculations		Suggested Length: 20-22 days
Essential Questions	***Program of Studies* and Core Content**	**Key Terms and Vocabulary**	**Classroom Instruction and <u>Assessment</u>** ***Student will:***
scientific measurements? 2. How do you determine the accuracy and precision of a measurement? 3. How do you express extremely large or small numbers? 4. What instruments and units are used to express measurements in science? How do you use these instruments and units? 5. What are significant figures and how/why are they used in scientific calculations?	❑ *SI-2 design and conduct different kinds of scientific investigations for a wide variety of reasons.* ❑ *SI-3 use equipment (e.g., microscopes, lasers), tools (e.g., beakers), techniques (e.g., microscope skills), technology (e.g., computers), and mathematics to improve scientific investigations and communications.* ❑ *SI-5 communicate designs, procedures, and results of scientific investigations.* ❑ *AC-1 apply scientific inquiry and conceptual understandings to solving problems of technological design (e.g., styrofoam cups, transistors, computer chips).* ❑ *AC-2 examine the interaction between science and technology.* ❑ *AC-8 analyze how science and technology are necessary but not sufficient for solving local, national, and global issues.* ❑ *AC-9 analyze the role science plays in everyday life and compare different careers in science.* ❑ *PS-4 investigate how the structure of matter (e.g., constituent atoms, distances and angles between atoms) relates to physical properties of matter.* **<u>Core Content</u>** **Science and Technology** Students will apply scientific theory and conceptual understandings to solve problems of technological design and examine the interaction between science and technology. **History and Nature of Science** Students will analyze the role science plays in everyday life and compare different careers in science; recognize that scientific knowledge		

Chemistry	Unit 2: Scientific Measurements and Calculations		Suggested Length: 20-22 days
Essential Questions	***Program of Studies* and Core Content**	**Key Terms and Vocabulary**	**Classroom Instruction and <u>Assessment</u>** ***Student will:***
	comes from empirical standards, logical arguments, and skepticism, and is subject to change as new evidence becomes available; and investigate advances in science and technology that have important and long-lasting effects on science and society.		
	❑ **SC-HS-1.1.5 Students will explain the role of intermolecular or intramolecular interactions on the physical properties (solubility, density, polarity, boiling/melting points) of compounds.** **The physical properties of compounds reflect the nature of the interactions among molecules. These interactions are determined by the structure of the molecules, including the constituent atoms. DOK 2**	❑ Length ❑ Mass ❑ Time ❑ Temperature ❑ Volume ❑ Density ❑ Gram ❑ Meter ❑ Liter ❑ Celsius ❑ Kelvin ❑ Significant Figures ❑ Directly Proportional ❑ Inversely Proportional	❑ Use various instruments to collect quantitative measurements. DOK 1 ❑ Express different quantities in various SI units of measurement. DOK 2 ❑ Express large and small numbers in both regular and scientific notation. DOK 1 ❑ Identify the number of significant figures in various measured quantities. DOK 1 ❑ Correctly round the result of multiple calculations to the correct number of significant figures. DOK 2 ❑ Construct a line graph from data points of two quantities and analyze the data points according to the graph and math equality to determine how two quantities are related. DOK 3 ❑ Use an algebraic equation (for density) to solve for unknown quantities and express results with correct units and in correct number of significant figures. DOK 2 ❑ Make a hypothesis about the relative sugar content of common beverages, use scientific equipment to collect volume & mass data of beverages. DOK 2 ❑ Analyze volume & mass data of common beverages via calculations and line graphs to calculate the percentage of sugar by mass in common beverages & apply the principles of scientific calculations to the results. DOK 2 ❑ Communicate results of laboratory experiment on percent sugar in a formal lab report. DOK 2
	Scientific Inquiry Students will use equipment, tools, technology, and mathematics to improve scientific investigations and communications.	❑ Precision ❑ Accuracy ❑ Qualitative ❑ Quantitative ❑ Scientific notation	❑ Evaluate the relative accuracy & precision of sample measurements. DOK 2 ❑ Classify measurements as qualitative or quantitative. DOK 1

Chemistry	Unit 2: Scientific Measurements and Calculations		Suggested Length: 20-22 days
Essential Questions	***Program of Studies* and Core Content**	**Key Terms and Vocabulary**	**Classroom Instruction and Assessment** *Student will:*
		❑ Exponent ❑ SI System of Units	❑ Summarize information on scientific measurement obtained by viewing the video program World of Chemistry: Measurement—The Foundation of Chemistry DOK 2 ❑ Quiz: Scientific Notation/Significant Figures DOK 1, 2 ❑ Performance Activity: "Determining the Thickness of a Thin Aluminum Sheet" DOK 2, 3 ❑ Written Summary: *Video Program: World of Chemistry: Measurement—The Foundation of Chemistry* DOK 2 ❑ Formal Lab Report: "Determining the % Sugar in Beverages" (Beverage Density Lab) DOK 2,3 ❑ Test: Scientific Measurement & Calculations (MC, Short Answer/Item, Word Mathematical Problems, Open Response on Direct/Inverse Relationships DOK 2, 3

Chemistry	Unit 3: Atomic Structure		Suggested Length: 24 days
Essential Questions	***Program of Studies* and Core Content**	**Key Terms and Vocabulary**	**Classroom Instruction and Assessment** *Student will:*
1. What is the interior structure of the atom and how was it experimentally determined? 2. How do the individual particles composing an atom contribute to its mass and	**Program of Studies** *Students will:* ❑ *SI-4 use evidence, logic, and scientific knowledge to develop and revise scientific explanations and models.* ❑ *SI-6 review and analyze scientific investigations and explanations of others.* ❑ *AC-10 recognize that scientific knowledge comes from empirical standards, logical arguments, skepticism, and is subject to change as new evidence becomes available.* ❑ *AC-11 investigate advances in science and technology that have important and long-lasting effects on science and society (e.g., Newtonian mechanics, plate tectonics, germ theory, medical and health technology).*		

Chemistry	Unit 3: Atomic Structure		Suggested Length: 24 days
Essential Questions	***Program of Studies* and Core Content**	**Key Terms and Vocabulary**	**Classroom Instruction and <u>Assessment</u>** ***Student will:***
other properties? 3. What is the structural & compositional difference between elements and compounds? 4. How can the mass of a sample of an element or compound be related to the individual number of atoms or molecules contained in the sample?	❑ *PS-1 analyze atomic structure and electric forces.* ❑ *PS-2 examine nuclear structure, nuclear forces, and nuclear reactions (e.g., fission, fusion, radioactivity).* ❑ *PS-4 investigate how the structure of matter (e.g., constituent atoms, distances and angles between atoms) relates to physical properties of matter.* **<u>Core Content</u>** **History and Nature of Science** Students will analyze the role science plays in everyday life and compare different careers in science; recognize that scientific knowledge comes from empirical standards, logical arguments, and skepticism, and is subject to change as new evidence becomes available; and investigate advances in science and technology that have important and long-lasting effects on science and society.	❑ Democritus ❑ J. J. Thomson ❑ Robert Millikan ❑ Ernest Rutherford ❑ Niels Bohr ❑ Cathode Ray Tube Experiment ❑ Gold Foil Experiment ❑ Oil Drop Experiment ❑ Alpha particles ❑ John Dalton ❑ Atomic Theory	❑ Summarize information obtained by watching the video program: <u>World of Chemistry—The Atom</u> DOK 2 ❑ Understand how various scientists and experiments lead to the modern day theory of atomic structure. ❑ Observe a model/demonstration of Rutherford's "Gold Foil Experiment," and use experimental observations to draw conclusions about atomic structure. DOK 3
	❑ SC-08-1.1.2 Students will understand that matter is made of minute particles called atoms, and atoms are composed of even smaller components. The components of an atom have measurable properties such as mass and electrical charge. Each atom has a positively charged nucleus surrounded by negatively charged electrons. The electric force between the nucleus and the electrons holds the atom together.	❑ Atom ❑ Proton ❑ Neutron ❑ Electron	❑ Use the Periodic Table to gather information about the interior structure and composition of atoms of selected elements. DOK 2
	❑ SC-HS-1.1.2 Students will understand that the atom's nucleus is composed of protons and	❑ Atomic number ❑ Mass number	❑ Understand the term isotopes and how it affects John Dalton's original atomic theory. DOK 2

Chemistry	Unit 3: Atomic Structure		Suggested Length: 24 days
Essential Questions	***Program of Studies* and Core Content**	**Key Terms and Vocabulary**	**Classroom Instruction and <u>Assessment</u>** ***Student will:***
	neutrons that are much more massive than electrons. When an element has atoms that differ in the number of neutrons, these atoms are called different isotopes of the element.	❑ Average Atomic Mass ❑ Isotopes ❑ Relative mass ❑ Avogradro's number ❑ Mole ❑ Molar Mass	❑ Use relative abundance data for specific isotopes of an elements to calculate its average atomic mass. DOK 2 ❑ Infer the relationship between relative masses and numbers of individual particles & develop a "unit" to equal the number of particles in a relative mass through the manipulation of a model system of different bean types ("Understanding the Mole" activity). DOK 4 ❑ Relate the model system of beans and its mass-particle relationships to the mole, average atomic mass, and numbers of atoms of elements. DOK 3
	❑ **SC-HS-1.1.1 Students will classify or make generalizations about elements from data of observed patterns in atomic structure and/or position on the periodic table.** **The periodic table is a consequence of the repeating pattern of outermost electrons. DOK 2**	❑ Atom ❑ Molecule ❑ Element ❑ Compound	❑ Convert between amounts of atoms/molecules, moles, and masses for elements and compounds using the factor-label method of conversion. DOK 2 ❑ Weigh out a specific number of atoms of a particular element in the laboratory using scientific equipment and calculations involving mass-mole-atom relationships. ❑ Conduct a laboratory experiment in which a chemical reaction is carried out and analyze the numbers of atoms, moles, and grams of each element reacted and formed using laboratory mass data for each. DOK 2, 3 ❑ <u>Written summary of video program: *World of Chemistry: The Atom*</u> DOK 2 ❑ <u>Quiz: "Atomic Structure"</u> DOK 2 ❑ <u>Performance Activity: "Weighing out Atoms of an Element"</u> DOK 2 ❑ <u>Test: "Atomic Structure & The Mole" (MC, short answer/item, problem solving, & 3 open response questions on isotopes/atomic theory, measuring mole amounts in laboratory, and gaining information using Periodic Table)</u> DOK 2, 3 ❑ <u>Formal Lab Report: "Mole of Iron and Copper"</u> DOK 2

Chemistry	Unit 4: Periodic Table/Bonding		Suggested Length: 20-22 days
Essential Questions	***Program of Studies* and Core Content**	**Key Terms and Vocabulary**	**Classroom Instruction and <u>Assessment</u>** ***Student will:***
	<u>Program of Studies</u> *Students will:*		

Chemistry	Unit 4: Periodic Table/Bonding		Suggested Length: 20-22 days
Essential Questions	***Program of Studies* and Core Content**	**Key Terms and Vocabulary**	**Classroom Instruction and <u>Assessment</u>** ***Student will:***
1. How was the periodic table developed and how does it relate to the physical and chemical properties of elements? 2. Why do most atoms form chemical bonds? 3. How are ionic and covalent bonds formed and how does the bond type influence the properties of compounds?	❑ *SI-2 design and conduct different kinds of scientific investigations for a wide variety of reasons.* ❑ *SI-3 use equipment (e.g., microscopes, lasers), tools (e.g., beakers), techniques (e.g., microscope skills), technology (e.g., computers), and mathematics to improve scientific investigations and communications.* ❑ *SI-5 communicate designs, procedures, and results of scientific investigations.* ❑ *PS-3 investigate how the structure of matter (e.g., outer electrons, type of bond) relates to chemical properties of matter.* ❑ *PS-4 investigate how the structure of matter (e.g., constituent atoms, distances and angles between atoms) relates to physical properties of matter.* ❑ *PS-6 examine the transfer of electrons or hydrogen ions between reacting ions, molecules, or atoms.* **<u>Core Content</u>** Scientific Inquiry Students will: ❑ Use equipment, tools, techniques, technology, and mathematics to improve scientific investigations and communications. ❑ Design and conduct different kinds of scientific investigations. ❑ Communicate and defend the designs, procedures, observations, and results of scientific investigations ❑ **SC-HS-1.1.7 Students will:** ❑ **construct diagrams to illustrate ionic or covalent bonding;** ❑ **predict compound formation and bond type as either ionic or covalent (polar, nonpolar) and represent the products**	❑ Ionization energy ❑ Electronegativity ❑ Valence electrons ❑ Ionic bond ❑ Polar covalent bond ❑ Nonpolar covalent	❑ Classify compounds as “ionic” or “covalent” based on physical properties. DOK 2 ❑ Predict element identities/properties based on periodic table information. DOK 3 ❑ Rank and order various lists of elements according to the properties of atomic radius, ionization energy, and

Chemistry	Unit 4: Periodic Table/Bonding		Suggested Length: 20-22 days
Essential Questions	***Program of Studies* and Core Content**	**Key Terms and Vocabulary**	**Classroom Instruction and <u>Assessment</u>** ***Student will:***
	formed with simple chemical formulas. **Bonds between atoms are created when outer electrons are paired by being transferred (ionic) or shared (covalent). A compound is formed when two or more kinds of atoms bind together chemically. DOK 2**	bond ❑ Electron dot structures ❑ Lewis dot structure ❑ Structural formula ❑ Molecule/formula unit	electronegativity using periodic trends. DOK 2 ❑ Predict the type of bond that will form between pairs of given elements based on electronegativity differences. DOK 2 ❑ Relate the degree of electronegativity difference between two elements to potential bond formation. DOK 2 ❑ Represent elements and their valence electrons using electron dot structures. DOK 1 ❑ Understand the basis for forming chemical bonds and the "octet rule." DOK 1
	❑ **SC-HS-1.1.1 Students will classify or make generalizations about elements from data of observed patterns in atomic structure and/or position on the periodic table.** **The periodic table is a consequence of the repeating pattern of outermost electrons. DOK 2**	❑ Periodic table ❑ Period ❑ Group ❑ Periodicity ❑ Noble gas configuration ❑ S,P,D,F block elements ❑ Atomic radius	❑ Illustrate the formation of both ionic and covalent bonds using dot structures. DOK 2 ❑ Use bonding structures/diagrams to predict chemical formulas for compounds formed between pairs of elements. DOK 2 ❑ Assess structural formulas for molecules for numbers of bonds and electron pairs. DOK 2
	❑ SC-HS-1.1.4 Students will understand that in conducting materials, electrons flow easily; whereas, in insulating materials, they can hardly flow at all. Semiconducting materials have intermediate behavior. At low temperatures, some materials become superconductors and offer no resistance to the flow of electrons. ❑ **SC-HS-1.1.5 Students will explain the role of intermolecular or intramolecular interactions on the physical properties (solubility, density, polarity, boiling/melting points) of compounds.** **The physical properties of compounds reflect the nature of the interactions among molecules. These interactions are determined by the structure of the**	❑ Metal ❑ Nonmetal ❑ Metalloid ❑ Conductor ❑ Semiconductor ❑ Malleable ❑ Ductile	❑ Know and use the various organizational groups of elements on the periodic table (group, period, block, etc.) DOK 1 ❑ Summarize information about the development and organization of the periodic table. DOK 2 ❑ Know the periodic table location and the physical properties of metals, nonmetals, and metalloids. DOK 1 ❑ Conduct and observe flame emission colors tests for several common metal ions and use data to identify unknown solutions. DOK 2 ❑ Understand the basis for the periodic table's organization and relate element locations to atomic number, atomic mass, and electron arrangement. DOK 2 ❑ Determine how an element's outer electron configuration relates to its position and grouping on the Periodic Table. DOK 2 ❑ Classify elements as metals or nonmetals based on their

Chemistry	Unit 4: Periodic Table/Bonding		Suggested Length: 20-22 days
Essential Questions	***Program of Studies* and Core Content**	**Key Terms and Vocabulary**	**Classroom Instruction and Assessment** ***Student will:***
	molecules, including the constituent atoms. DOK 2 ❑ SC-HS-1.2.3 Students will understand that the electric force is a universal force that exists between any two charged objects. Opposite charges attract while like charges repel.		position in the Periodic Table. DOK 1 ❑ Generalize bonding patterns for selected groups of metals and nonmetals based upon their electron configurations. DOK 3 ❑ Written Summary of Video Program: *World of Chemistry—The Periodic Table* DOK 2 ❑ Lab Report: *"Flame Tests* DOK 2*"* ❑ Test/Quiz: *"Chemical Bonding/Periodic Table" (including OR on properties of ionic/covalent compounds)* DOK 2, 3

Chemistry	Unit 5: Chemical Language (Writing Formulas/Naming Compounds		Suggested Length: 14 days
Essential Questions	***Program of Studies* and Core Content**	**Key Terms and Vocabulary**	**Classroom Instruction and Assessment** ***Student will:***
1. How is the Periodic Table organized? 2. How can the position of elements on the Periodic Table be used to predict how they form compounds with other elements? 3. How do you predict the formulas of ionic compounds using ionic	**Program of Studies** *Students will:* ❑ *SI-2 design and conduct different kinds of scientific investigations for a wide variety of reasons.* ❑ *SI-3 use equipment (e.g., microscopes, lasers), tools (e.g., beakers), techniques (e.g., microscope skills), technology (e.g., computers), and mathematics to improve scientific investigations and communications.* ❑ *PS-3 investigate how the structure of matter (e.g., outer electrons, type of bond) relates to chemical properties of matter.* ❑ *PS-4 investigate how the structure of matter (e.g., constituent atoms, distances and angles between atoms) relates to physical properties of matter.* ❑ *PS-6 examine the transfer of electrons or hydrogen ions between reacting ions, molecules, or atoms.* **Core Content**		

Chemistry	Unit 5: Chemical Language (Writing Formulas/Naming Compounds		Suggested Length: 14 days
Essential Questions	***Program of Studies* and Core Content**	**Key Terms and Vocabulary**	**Classroom Instruction and <u>Assessment</u>** ***Student will:***
charges? 4. How can the empirical formula of any compound be obtained from experimental mass data? 5. How do you name ionic and molecular compounds and use their names to determine their chemical formulas?	❑ **SC-HS-1.1.7 Students will:** ❑ **construct diagrams to illustrate ionic or covalent bonding;** ❑ **predict compound formation and bond type as either ionic or covalent (polar, nonpolar) and rep[resent the products formed with simple chemical formlas.** **Bonds between atoms are created when outer electrons are paired by being transferred (ionic) or shared (covalent). A compound is formed when two or more kinds of atoms bind together chemically. DOK 2** ❑ **SC-HS-1.1.1 Students will classify or make generalizations about elements from data of observed patterns in atomic structure and/or position on the periodic table.** **The periodic table is a consequence of the repeating pattern of outermost electrons. DOK 2** ❑ **SC-HS-1.1.5 Students will explain the role of intermolecular or intramolecular interactions on the physical properties (solubility, density, polarity, boiling/melting points) of compounds.** **The physical properties of compounds reflect the nature of the interactions among molecules. These interactions are determined by the structure of the molecules, including the constituent atoms. DOK 2**	❑ Ionic compound ❑ Binary molecular compound ❑ Empirical formula ❑ Ion ❑ Charge ❑ Monatomic ion ❑ Polyatomic ion	❑ Predict and correctly write the chemical formulas of ionic compounds using charges. DOK 2 ❑ Predict the chemical formula for an ionic compound, then experimentally determine its empirical formula using scientific equipment and calculations. DOK 2 ❑ Use the periodic table determine the group number, period number, ionic charge, metallic character, and other information about representative elements. DOK 1 ❑ Use the names of both ionic and molecular compounds to derive their chemical formula. DOK 2 ❑ <u>Quiz: "Writing Chemical Formulas for Ionic Compounds"</u> DOK 2 ❑ <u>Formal Lab Report: "Determining the Empirical Formula of a Compound"</u> DOK 2 ❑ <u>OR: Compounds in My Cupboard</u> DOK 2, 3 ❑ Use experimental mass data to calculate the empirical formulas of certain compounds. DOK 2 ❑ Classify compounds as ionic or molecular based on their element composition. DOK 2

Chemistry	Unit 6: Chemical Equations/Reactions		Suggested Length: 20-22 days
Essential Questions	***Program of Studies* and Core Content**	**Key Terms and Vocabulary**	**Classroom Instruction and <u>Assessment</u>** ***Student will:***
1. What is the format for representing a chemical reaction with a chemical equation? 2. How are chemical equations balanced to satisfy the law of conservation of matter? 3. What are 5 major types of chemical reactions and their identifying characteristics? 4. How do you predict the products of common chemical reactions?	**<u>Program of Studies</u>** *Students will:* ❑ *SI-2 design and conduct different kinds of scientific investigations for a wide variety of reasons.* ❑ *SI-3 use equipment (e.g., microscopes, lasers), tools (e.g., beakers), techniques (e.g., microscope skills), technology (e.g., computers), and mathematics to improve scientific investigations and communications.* ❑ *SI-4 use evidence, logic, and scientific knowledge to develop and revise scientific explanations and models.* ❑ *PS-3 investigate how the structure of matter (e.g., outer electrons, type of bond) relates to chemical properties of matter.* ❑ *PS-5 investigate chemical reactions and the release or consumption of energy.* ❑ *PS-6 examine the transfer of electrons or hydrogen ions between reacting ions, molecules, or atoms.* ❑ *PS-7 investigate factors (e.g., temperature, catalysts) affecting reaction rates.* **<u>Core Content</u>** Scientific Inquiry Students will: ❑ Use equipment, tools, techniques, technology, and mathematics to improve scientific investigations and communications. ❑ Design and conduct different kinds of scientific investigations. ❑ **SC-HS-1.1.7 Students will:** ❑ **construct diagrams to illustrate ionic or covalent bonding;** ❑ **predict compound formation and bond type as either ionic or covalent (polar, nonpolar) and rep[resent the products**	❑ Law of Conservation of Mass ❑ Subscript ❑ Product ❑ Reactant ❑ Yield	❑ Represent molecular action during a chemical reaction (collisions) and understand how it affects reaction rate. DOK 2 ❑ OR: Chemical Reactions DOK 2, 3

Chemistry	Unit 6: Chemical Equations/Reactions		Suggested Length: 20-22 days
Essential Questions	***Program of Studies* and Core Content**	**Key Terms and Vocabulary**	**Classroom Instruction and <u>Assessment</u>** ***Student will:***
	formed with simple chemical formlas. **Bonds between atoms are created when outer electrons are paired by being transferred (ionic) or shared (covalent). A compound is formed when two or more kinds of atoms bind together chemically. DOK 2** ❑ **SC-HS-1.1.1 Students will classify or make generalizations about elements from data of observed patterns in atomic structure and/or position on the periodic table.** **The periodic table is a consequence of the repeating pattern of outermost electrons. DOK 2** ❑ **SC-HS-1.1 8 Students will:** ❑ **explain the importance of chemical reactions in a real-world context;** ❑ **justify conclusions using evidence/data from chemical reactions.** **Chemical reactions (e.g., acids and bases, oxidation, rusting, tarnishing) occur all around us and in every cell in our bodies. These reactions may release or absorb energy. DOK 3** ❑ **SC-HS-1.1.6 Students will:** ❑ **identify variables that affect reaction rates;** ❑ **predict effects of changes in variables**	❑ Catalyst ❑ Aqueous ❑ Balanced Equation ❑ Coefficient ❑ Synthesis Reaction ❑ Decomposition Reaction ❑ Single Replacement Reaction ❑ Double Replacement Reaction ❑ Combustion Reaction ❑ Rate of Reaction (Effects of temperature, concentration, surface area, catalysts, etc.)	❑ Change written descriptions of chemical reactions into correct equation form. DOK 2 ❑ Balance chemical equations to illustrate the law of conservation of mass. DOK 2 ❑ Translate chemical equations in to a written description of the reaction represented. DOK 2 ❑ Classify as to type chemical reactions given the complete chemical equation. DOK 2 ❑ Predict the outcome/ products of single replacement reactions using the Activity Series. DOK 2, 3 ❑ Perform, observe, and write equations for several single replacement reactions of metals with hydrochloric acid and use data to rank metals in order of reactivity. DOK 2, 3 ❑ Hypothesize the effect of temperature, concentration, and other factors on reaction rate, then read and answer questions regarding these factors. DOK 2, 3 ❑ Carry out a double replacement reaction in the

Chemistry	Unit 6: Chemical Equations/Reactions		Suggested Length: 20-22 days
Essential Questions	***Program of Studies* and Core Content**	**Key Terms and Vocabulary**	**Classroom Instruction and <u>Assessment</u>** ***Student will:***
	(concentration, temperature, properties of reactants, surface area, and catalysts) based on evidence/data from chemical reactions. **Rates of chemical reactions vary. Reaction rates depend on concentration, temperature, and properties of reactants. Catalysts speed up chemical reactions. DOK 3**		laboratory, then use mass data to evaluate the ratio of product to reactant and compare it to the theoretical ratio obtained from the reaction's predicted, balanced equation. DOK 2, 3 ❑ **<u>Test: Chemical Equations</u>** DOK 2 ❑ *Formal Lab Report: "Calculations with a Chemical Reaction"* DOK 2, 3

Chemistry	Unit 7: States of Matter/Gas Behavior		Suggested Length: 14 days
Essential Questions	***Program of Studies* and Core Content**	**Key Terms and Vocabulary**	**Classroom Instruction and <u>Assessment</u>** ***Student will:***
1. How does the behavior of atoms and molecules determine the physical properties of solids, liquids, and gases? 2. How are gases different from solids and liquids and why do they exhibit "ideal behavior?" 3. What factors influence the behavior of	**<u>Program of Studies</u>** *Students will:* ❑ *SI-4 use evidence, logic, and scientific knowledge to develop and revise scientific explanations and models.* ❑ *SI-6 review and analyze scientific investigations and explanations of others.* ❑ *PS-4 investigate how the structure of matter (e.g., constituent atoms, distances and angles between atoms) relates to physical properties of matter.* ❑ *PS-10 examine how energy is transferred (e.g., collisions, light waves) and recognize that the total energy of the universe is constant.* ❑ *PS-11 distinguish between types of energy (e.g., kinetic energy, potential energy, energy fields).* ❑ *PS-12 examine how everything tends to become less organized and less orderly over time (e.g., heat moves from hotter to cooler objects).*		

Chemistry	Unit 7: States of Matter/Gas Behavior		Suggested Length: 14 days
Essential Questions	***Program of Studies* and Core Content**	**Key Terms and Vocabulary**	**Classroom Instruction and Assessment** ***Student will:***
gases and what are the mathematical relationships between them?	**Core Content** Scientific Inquiry Students will: ❑ Communicate and defend the designs, procedures, observations, and results of scientific investigations. ❑ **SC-HS-1.1.5 Students will explain the role of intermolecular or intramolecular interactions on the physical properties (solubility, density, polarity, boiling/melting points) of compounds.** **The physical properties of compounds reflect the nature of the interactions among molecules. These interactions are determined by the structure of the molecules, including the constituent atoms. DOK 2** ❑ SC-HS-1.1.3 Students will understand that solids, liquids, and gases differ in the distances between molecules or atoms and therefore the energy that binds them together. In solids, the structure is nearly rigid; in liquids, molecules or atoms move around each other but do not move apart; and in gases, molecules or atoms move almost independently of each other and are relatively far apart. The behavior of gases and the relationship of the variables influencing them can be described and predicted. ❑ **SC-08-4.6.2 Students will:** ❑ **describe or explain energy transfer and energy conservation;** ❑ **evaluate alternative solutions to energy problems.**	❑ Fluid ❑ Surface tension ❑ Boiling ❑ Evaporation ❑ Condensation ❑ Freezing ❑ Melting ❑ Deposition ❑ Sublimation ❑ Diffusion ❑ Kinetic molecular theory ❑ Entropy ❑ Ideal gas ❑ Real gas ❑ Pressure ❑ Mm Hg (torr), atmosphere, kilopascal ❑ Volume ❑ Temperature ❑ Boyle's Law ❑ Charles' Law ❑ Gay-Lussac's Law ❑ Combined Gas Law	❑ Describe the properties of relative density, incompressibility, diffusion ability, fluidity, and unique properties such as surface tension for solids, liquids, and gases and explain the existence of these properties by relating them to the arrangement, energy, and speed of particles at the atomic/molecular level. DOK 1, 2 ❑ Observe temperature changes during melting and freezing of a compound and graph the temperature and time. DOK 1 ❑ Relate phase changes to energy and entropy changes for a system and its surroundings. DOK 2 ❑ Define and know the correct units of measure for pressure, volume, and temperature as related to gases. DOK 1 ❑ Predict changes in pressure, temperature, and/or volume of gases based on increases/decreases of other factors. DOK 2 ❑ Know the patterns of change for Boyle's, Charles', and Gay-Lussac's gas laws. DOK 2 ❑ Evaluate everyday occurrences involving gases in terms of pressure, volume, and temperature changes and identify the gas laws involved in the changes. DOK 2 ❑ Observe the demonstration "Can Crusher," and use gas law terms and principles to explain the observations in writing. DOK 2,3 ❑ Use mathematical equations for the three major gas laws to solve for an unknown variable in gas law situations. DOK 2 ❑ Determine the algebraic equation for the combined gas law using the given equations for Boyle's, Charles', and Gay-Lussac's gas laws and use it to solve for an unknown variable in situations involving changes in

Chemistry	Unit 7: States of Matter/Gas Behavior		Suggested Length: 14 days
Essential Questions	***Program of Studies* and Core Content**	**Key Terms and Vocabulary**	**Classroom Instruction and Assessment** ***Student will:***
	Energy can be transferred in many ways, but it can neither be created nor destroyed. DOK 3 ❑ SC-HS-4.6.6 Students will understand that heat is the manifestation of the random motion and vibrations of atoms		more than two gas parameters. DOK 2 ❑ Written summary of video program: *World of Chemistry: A Matter of State* DOK 2 ❑ Demonstration and written explanation: "*Can Crusher*" activity DOK 2,3 ❑ Lab Activity and Graph Sheet: *"Energy and Entropy: Melting/Freezing of Sodium Thiosulfate Pentahydrate"* DOK 2 ❑ Quiz: "*Gas Laws/States of Matter*"(including open response on properties of s,l, g, and kinetic molecular theory.) DOK 2

Chemistry	Unit 8: Nuclear Chemistry		Suggested Length: 16-18 days
Essential Questions	***Program of Studies* and Core Content**	**Key Terms and Vocabulary**	**Classroom Instruction and Assessment** ***Student will:***
1. What kind of changes do nuclei undergo during nuclear reactions? 2. How do nuclear reactions produce energy and how can that energy be used?	**Program of Studies** *Students will:* ❑ *AC-2 examine the interaction between science and technology.* ❑ *AC-11 investigate advances in science and technology that have important and long-lasting effects on science and society (e.g., Newtonian mechanics, plate tectonics, germ theory, medical and health technology).* ❑ *PS-2 examine nuclear structure, nuclear forces, and nuclear reactions (e.g., fission, fusion, radioactivity).* ❑ *PS-10 examine how energy is transferred (e.g., collisions, light waves) and recognize that the total energy of the universe is constant.* ❑ *PS-13 investigate energy transfer caused when waves and matter interact (e.g., atoms and molecules can absorb and emit light waves).* **Core Content**		

Chemistry	Unit 8: Nuclear Chemistry		Suggested Length: 16-18 days
Essential Questions	***Program of Studies* and Core Content**	**Key Terms and Vocabulary**	**Classroom Instruction and Assessment** ***Student will:***
	Science and Technology Students will apply scientific theory and conceptual understandings to solve problems of technological design and examine the interaction between science and technology. **History and Nature of Science** Students will analyze the role science plays in everyday life and compare different careers in science; recognize that scientific knowledge comes from empirical standards, logical arguments, and skepticism, and is subject to change as new evidence becomes available; and investigate advances in science and technology that have important and long-lasting effects on science and society**.** ❑ SC-HS-2.3.5 Students will explain the difference between alpha and beta decay, fission, and fusion; identify the relationship between nuclear reactions and energy. Nuclear reactions convert a fraction of the mass of interacting particles into energy, and they can release much greater amounts of energy than atomic interactions. Fission (alpha and beta decay) is the splitting of a large nucleus into smaller pieces. Fusion is the joining of two nuclei at extremely high temperature and pressure. Fusion is the process responsible for the energy of the Sun and other stars. DOK 2 ❑ **SC-HS-4.6.4 Students will:** ❑ **describe the components and reservoirs involved in biogeochemical cycles (water, nitrogen, carbon dioxide, and oxygen);** ❑ **explain the movement of matter and energy in biogeochemical cycles and**	❑ Nucleons ❑ Nuclide ❑ Nuclear binding energy ❑ Nuclear reaction ❑ Radioactive decay ❑ Nuclear radiation ❑ Radioactive nuclide ❑ Alpha particle ❑ Beta particle ❑ Positron ❑ Electron capture ❑ Half-life ❑ Nuclear fission ❑ Nuclear fusion ❑ Gamma rays	❑ Explain the relationship between nucleon number and stability of nuclei. ❑ Complete/predict the products of nuclear reactions. ❑ Relate nuclear radiation to the process of radioactive decay & radioactive nuclides, & explain how the radiation can be harmful to people and animals. ❑ Describe and complete radioactive decay equations for alpha emission, beta emission, positron emission, and electron capture. ❑ Define and explain what the half-life of a radioactive nuclide is. ❑ Compare and contrast the penetrating ability and shielding requirements of alpha particles, beta particles, and gamma rays. ❑ Discuss applications of radioactive nuclides. ❑ Distinguish between nuclear fission and nuclear fusion. ❑ Explain how nuclear fission is used in atomic bombs and power plants. ❑ *Quiz: Nuclear Chemistry* ❑ *Open Response: Nuclear Reactions/Equations*

Chemistry	Unit 8: Nuclear Chemistry		Suggested Length: 16-18 days
Essential Questions	***Program of Studies* and Core Content**	**Key Terms and Vocabulary**	**Classroom Instruction and Assessment** *Student will:*
	related phenomena. **The total energy of the universe is constant. Energy can change forms and/or be transferred in many ways, but it can neither be created nor destroyed. Movement of matter between reservoirs is driven by Earth's internal and external sources of energy. These movements are often accompanied by a change in physical and chemical properties of the matter. Carbon, for example, occurs in carbonate rocks such as limestone, in the atmosphere as carbon dioxide gas, in water as dissolved carbon dioxide, and in all organisms as complex molecules that control the chemistry of life. DOK 3** ❑ **SC-HS-4.6.2 Students will;** ❑ **predict wave behavior and energy transfer;** ❑ **apply knowledge of waves to real life phenomena/investigations.** **Waves, including sound and seismic waves, waves on water, and electromagnetic waves, can transfer energy when they interact with matter. Apparent changes in frequency can provide information about relative motion. DOK 3** ❑ SC-HS-4.6.3 Students will understand that electromagnetic waves, including radio waves, microwaves, infrared radiation, visible light, ultraviolet radiation, x-rays, and gamma rays, result when a charged object is accelerated.		

Chemistry	Unit 9: Solutions		Suggested Length: 14 days
Essential Questions	***Program of Studies* and Core Content**	**Key Terms and Vocabulary**	**Classroom Instruction and <u>Assessment</u>** ***Student will:***
1. How are solutions different from other types of mixtures? 2. What are the basic parts of a solution? 3. What are the various types and characteristics of different chemical solutions?	**<u>Program of Studies</u>** *Students will:* ❑ *SI-2 design and conduct different kinds of scientific investigations for a wide variety of reasons.* ❑ *SI-3 use equipment (e.g., microscopes, lasers), tools (e.g., beakers), techniques (e.g., microscope skills), technology (e.g., computers), and mathematics to improve scientific investigations and communications.* ❑ *SI-5 communicate designs, procedures, and results of scientific investigations.* ❑ *PS-4 investigate how the structure of matter (e.g., constituent atoms, distances and angles between atoms) relates to physical properties of matter.* ❑ *PS-12 examine how everything tends to become less organized and less orderly over time (e.g., heat moves from hotter to cooler objects).* ❑ *PS-14 investigate electrical energy and conductivity through matter.* **<u>Core Content</u>** Scientific Inquiry Students will: ❑ Formulate testable hypotheses and demonstrate the logical connections between the scientific concepts guiding a hypothesis and the design of an experiment. ❑ Use equipment, tools, techniques, technology, and mathematics to improve scientific investigations and communications. ❑ Communicate and defend the designs, procedures, observations, and results of scientific investigations. ❑ Design and conduct different kinds of scientific investigations.		

Chemistry	Unit 9: Solutions		Suggested Length: 14 days
Essential Questions	***Program of Studies* and Core Content**	**Key Terms and Vocabulary**	**Classroom Instruction and <u>Assessment</u>** ***Student will:***
	❑ **SC-HS-1.1.5 Students will explain the role of intermolecular or intramolecular interactions on the physical properties (solubility, density, polarity, boiling/melting points) of compounds.** **The physical properties of compounds reflect the nature of the interactions among molecules. These interactions are determined by the structure of the molecules, including the constituent atoms. DOK 2** ❑ SC-HS-1.1.4 Students will understand that in conducting materials, electrons flow easily; whereas, in insulating materials, they can hardly flow at all. Semiconducting materials have intermediate behavior. At low temperatures, some materials become superconductors and offer no resistance to the flow of electrons. ❑ SC-HS-4.6.6 Students will understand that heat is the manifestation of the random motion and vibrations of atoms.	❑ Soluble ❑ Solution ❑ Solvent ❑ Solute ❑ Suspension ❑ Colloid ❑ Tyndall effect ❑ Electrolyte ❑ Nonelectrolyte ❑ Concentration ❑ Molarity ❑ Molality ❑ Colligative Property	❑ Observe, compare and contrast the properties of solutions, suspensions, and colloids, and give several examples of each. ❑ Identify the solute and solvent in common solutions. ❑ Measure temperature change during the solution process and relate it to amount of energy absorbed and released by the solute and solvent molecules during the solution process. DOK 2 ❑ Differentiate between the chemical and physical characteristics of electrolytes and nonelectrolytes. ❑ Predict if certain compounds will be nonelectrolytes, weak electrolytes, or strong electrolytes, based upon their chemical formula. ❑ Use a conductivity probe interfaced with a LabPro Data Collection Unit and Calculator to obtain electrical conductivity values for solutions to test of predictions of electrolyte status for certain compounds are accurate or inaccurate. ❑ Define the term concentration. DOK 2 ❑ Distinguish between a dilute and concentrated solution. DOK 2 ❑ Calculate the molarity and molality of common acid and ionic compound solutions. DOK 2 ❑ Design and conduct an experiment to determine the effect of electrolytic and nonelectrolytic solutes on the boiling point of water. DOK 3 ❑ Predict the effect of solutes on the boiling and freezing points of water. DOK 3 ❑ Understand the colligative properties (freezing point depression, boiling point elevation) and the theory to explain them at the molecular level. DOK 2,3 ❑ OR: “Three Types of Mixtures” DOK 2 ❑ *Activity: “Electrolytes vs. Nonelectrolytes”* ❑ Lab: Heat of Soln/Heat of Rxn ❑ Lab Activity: Effect of Solutes on Boiling Point. DOK 2,3

Chemistry	Unit 10: Issues in Chemistry (Feature Articles)		Suggested Length: 12 days
Essential Questions	***Program of Studies* and Core Content**	**Key Terms and Vocabulary**	**Classroom Instruction and Assessment** ***Student will:***
1. What is an issue or topic related to chemistry and/or chemical concepts? 2. How can I research a chosen topic in chemistry and give information to a general audience about that topic through a feature article format?	**Program of Studies** *Students will:* ❑ *AC-1 apply scientific inquiry and conceptual understandings to solving problems of technological design (e.g., styrofoam cups, transistors, computer chips).* ❑ *AC-2 examine the interaction between science and technology.* ❑ *AC-7 use science to investigate natural hazards and human-induced hazards.* ❑ *AC-8 analyze how science and technology are necessary but not sufficient for solving local, national, and global issues.* ❑ *AC-9 analyze the role science plays in everyday life and compare different careers in science.* ❑ *AC-11 investigate advances in science and technology that have important and long-lasting effects on science and society (e.g., Newtonian mechanics, plate tectonics, germ theory, medical and health technology).* **Core Content** **Science and Technology** Students will apply scientific theory and conceptual understandings to solve problems of technological design and examine the interaction between science and technology. ***Personal and Social Perspectives*** Students will explore the impact of scientific knowledge and discoveries on personal and community health; recognize how science influences human population growth, use science to analyze the use of natural resources by an increasing human population; investigate how science can be used to solve environmental quality problems, use science to investigate natural and	❑ Feature article ❑ Lead ❑ Headings ❑ Conclusion ❑ Works cited ❑ Environmental issues ❑ Pollutants	❑ Browse/read through scientific journals such as Science News to identify issues/topics of interest related to chemicals/chemistry. ❑ Research information on a specific topic or issue dealing with an element, compound, or other relevant topic. ❑ Analyze a model feature article for type of lead, conclusion, addressing the audience and other important characteristics. ❑ Use information on writing feature articles and models of feature articles to write a feature article about the researched chemistry topic. ❑ *Feature Article on Chemistry-Related Topic (WP)*

Chemistry	Unit 10: Issues in Chemistry (Feature Articles)		Suggested Length: 12 days
Essential Questions	***Program of Studies* and Core Content**	**Key Terms and Vocabulary**	**Classroom Instruction and Assessment** ***Student will:***
	human-induced hazards; and analyze how science and technology are necessary but not sufficient for solving local, national, and global issues. ***History and Nature of Science*** Students will analyze the role science plays in everyday life and compare different careers in science; recognize that scientific knowledge comes from empirical standards, logical arguments, and skepticism, and is subject to change as new evidence becomes available; and investigate advances in science and technology that have important and long-lasting effects on science and society.		