TX-Chemistry	Scope and Sequence
Unit Lesson	**Objectives**
The Nature of Science	
The Nature of Chemistry	
	Distinguish between science and pseudoscience.
	Describe chemistry and its relationship to other scientific disciplines.
	Give examples of positive and negative impacts of chemistry on society.
	Science Practice: Read a science-related article and write a short evaluation of the article's reliability and scientific worth.
The Progress of Scientific Knowledge	
	Describe the cumulative nature of science and give examples of how a diverse group of scientists have contributed to science.
	Explain why curiosity, creativity, openness, and skepticism are important in the progress of science.
	Analyze how new technologies and experiments affect previous scientific explanations.
	Science Practice: Summarize the history of a scientific discovery.
Hypotheses, Laws, and Theories	
	Differentiate scientific hypotheses, theories, and laws.
	Identify the role of consensus and retesting in the development of theories.
	Give examples of how hypotheses lead to new experimentation.
	Science Practice: Create a chart comparing hypotheses, theories,and laws.
Unit Test	
The Processes of Science	
Scientific Methods	
	Describe how scientists perform experiments and gather data.

TX-Chemistry		Scope and Sequence
Unit	**Lesson**	**Objectives**
		Explain the importance of controlled tests in scientific investigations.
		Show how scientists communicate, share information, and support the importance of peer review.
		Describe the function of models in science, and recognize the usefulness and limitations of models as representations.
		Science Practice: Write a procedure for a controlled investigation to answer a question.
	Safety in Science	
		Demonstrate safe practices while conducting investigations.
		Outline the correct protocol for reporting safety violations and accidents in the lab.
		Use a material safety data sheet (MSDS) to learn about specific chemical hazards and proper chemical disposal.
		Science Practice: Write a safety contract, revising as necessary.
	Tools, Technology, and Measurement	
		Select and use appropriate tools to perform tests and collect data.
		Select and use appropriate technology such as computers and graphing calculators to gather, analyze, interpret, and display data.
		Use the SI system of measurement to convert between standard and metric, and metric and metric, and to recognize approximate representations of measurement.
		Science Practice: Use technology to display data in tables and graphs, and use the graphical representations to interpret the data.
	Using Math to Analyze Data	
		Use mathematical error analysis to analyze data points.
		Explain the difference and relationship between accuracy and precision.
		Create graphs and compare data points graphically.
		Science Practice: Make measurements with accuracy and precision.
	Unit Test	

TX-Chemistry		Scope and Sequence
Unit	**Lesson**	**Objectives**
Matter and Atomic Structure		
	Changes in Matter	
		Differentiate between physical properties and chemical properties of matter.
		Differentiate between extensive and intensive properties of matter, and give examples of each.
		Differentiate between physical changes and chemical changes of matter.
		Science Practice: Identify substances based on their chemical and physical properties.
	Lab: Physical and Chemical Changes	
		Distinguish between chemical changes and physical changes.
		Describe indicators of chemical change.
		Conduct systematic observations during an experiment.
		Science Practice: Write a clear, coherent laboratory report that describes methods used and conclusions made.
	The Structure of the Atom	
		Describe the structure of atoms, and discriminate between the relative sizes and electrical charges of protons, neutrons, and electrons.
		Explain that protons and neutrons have substructures and consist of particles called quarks.
		Identify an element based on the number of protons in an atom.
		Explain the relationship between the number of neutrons in an atom of an element, its mass number, and its isotopes.
		Science Practice: Use math to calculate the average atomic mass of an element from its isotopic composition.
	Unit Test	
Atomic Theory and the Periodic Table		
	The Historical Development of Atomic Theory	

TX-Chemistry		Scope and Sequence
Unit	**Lesson**	**Objectives**
		Describe early atomic models including Dalton’s postulates.
		Describe how Thomson’s and Millikan’s research led to the understanding of the electron in the early atomic model.
		Describe how Rutherford’s gold foil experiment led to Rutherford’s nuclear model of the atom.
		Science Practice: Describe, in writing, how a scientist’s creativity resulted in changes in atomic theory.
	The Modern Atomic Theory	
		Describe the experimental basis for Einstein’s explanation of the photoelectric effect.
		Explain Bohr’s model of the atom and how it accounts for the existence of spectral lines.
		Describe the modern (electron cloud) model of the atom.
		Science Practice: Compare Dalton’s atomic model with the current quantum model of the atom.
	Atomic Numbers and Electron Configurations	
		Identify electron configurations as a scientific model, and explain its usefulness and limitations.
		Express the arrangement of electrons of atoms using electron configurations.
		Use atomic orbitals to write quantum numbers for electrons.
		Science Practice: Use specific symbols to represent the arrangement of electrons in atoms.
	The History and Arrangement of the Periodic Table	
		Outline the historical development of the periodic table.
		Describe the arrangement of the periodic table and relate the properties of atoms to their position in the periodic table.
		Use the periodic table to classify elements.
		Science Practice: Predict the properties of elements based on their position on the periodic table.
	Periodic Trends	
		Use the periodic table to predict trends in atomic radii and ionic radii.

TX-Chemistry		Scope and Sequence
Unit	**Lesson**	**Objectives**
		Use the periodic table to identify and explain periodic trends in ionization energy.
		Use the periodic table to identify trends in electronegativity and electron affinity.
		Science Practice: Given two elements, make predictions that compare their radii, ionization energy, electronegativity, and/or electron affinity.
	Unit Test	
Chemical Bonding and Molecules		
	Types of Chemical Bonds	
		Compare and contrast ionic, metallic, and covalent bonds.
		Relate electronegativity and ionization energy to bond formation.
		Science Practice: Create a chart to compare and contrast ionic, metallic, and covalent bonds.
	Nomenclature of Ionic Compounds	
		Predict formulas of stable ionic compounds by balancing charges.
		Name ionic compounds using the International Union of Pure and Applied Chemistry (IUPAC) nomenclature rules.
		Write chemical formulas of ionic compounds and common polyatomic ions.
		Science Practice: Develop vocabulary by using IUPAC rules for naming ionic compounds.
	Covalent Bonding	
		Use the periodic table to determine the number of electrons available for bonding.
		Use the octet rule to predict covalent compounds.
		Construct electron-dot structures (i.e., Lewis structures) to illustrate the arrangement of electrons in covalent structures.
		Explain how covalent bonds affect the properties of covalent compounds.
		Science Practice: Develop and use electron-dot models, and explain their usefulness and limitations.
	Nomenclature of Covalent	

TX-Chemistry		Scope and Sequence
Unit	**Lesson**	**Objectives**
	Compounds	
		Use the International Union of Pure and Applied Chemistry (IUPAC) nomenclature rules to write the names of covalent compounds.
		Write formulas for covalent compounds and interpret those formulas in terms of composition and structure.
		Use IUPAC nomenclature rules to name and write the chemical formulas of acids and bases.
		Science Practice: Develop vocabulary by using IUPAC rules for naming covalent compounds.
	Molecular Geometry	
		Predict molecular structure using the Valence Shell Electron Pair Repulsion (VSEPR) theory.
		Use the hybridization model to predict molecular geometry.
		Science Practice: Predict the shape of simple molecules using the VSEPR theory and Lewis structures.
	Intermolecular Forces	
		Describe hydrogen bonding.
		Describe van der Waals forces, including dipole-dipole forces and London dispersion forces.
		Describe how hydrogen bonding and van der Waals forces affect the volatility, boiling points, and melting points of liquids and solids.
		Science Practice: Give examples of intermolecular forces occurring in nature.
	Unit Test	
Chemical Reactions and Stoichiometry		
	Writing and Balancing Chemical Equations	
		Describe chemical reactions by writing word equations and formula equations.
		Use the law of conservation of mass to balance chemical equations.
		Science Practice: Identify and use special symbols properly in chemical equations.
	Lab: Types of Reactions	

TX-Chemistry		Scope and Sequence
Unit	**Lesson**	**Objectives**
		Identify the reactants and products of a reaction performed in alaboratory setting.
		Write balanced equations for a reaction performed in a laboratory setting.
		Science Practice: Use experimental data to classify a reaction.
	Molar Masses	
		Define a mole and explain its role in the measurement of matter.
		Explain the relationship between the mole and Avogadro’s number.
		Determine the molar mass of a molecule from its chemical formula.
		Science Practice: Perform math calculations to determine the number of particles in a given sample of a substance.
	Percent Composition and Molecular Formula	
		Solve problems to calculate percent composition.
		Determine the empirical formula and the molecular formula of a substance through calculations.
		Explain the relationship between the empirical formula and the molecular formula of a compound.
		Science Practice: Use math to solve percent composition problems and to determine empirical and molecular formulas.
	Introduction to Stoichiometry	
		Use a balanced equation to write mole ratios correctly to use in stoichiometry problems.
		Perform stoichiometric calculations to determine the mole-to-mole relationships between reactants and products of a reaction.
		Science Practice: Use mathematical procedures, including dimensional analysis and significant figures, when solving mole-to-mole stoichiometry problems.
	Stoichiometric Calculations	
		Use molar mass to write conversion factors that convert between mass and moles.
		Identify and solve stoichiometric problems that relate mass to moles and mass to mass.

TX-Chemistry		Scope and Sequence
Unit	**Lesson**	**Objectives**
		Perform stoichiometric calculations to determine mass relationships between reactants and products of a reaction.
		Science Practice: Use mathematical procedures, including dimensional analysis and significant figures, when solving mole-to-mass, mass-to-mole, and mass-to-mass stoichiometric problems.
	Limiting Reactant and Percent Yield	
		Identify the limiting and excess reactants for a given reaction.
		Use the limiting reactant to predict the theoretical yield of a reaction.
		Calculate the percent yield of a reaction.
		Science Practice: Use mathematical procedures, including dimensional analysis and significant figures, when solving limiting reactant and percent yield stoichiometry problems.
	Lab: Limiting Reactant and Percent Yield	
		Identify the limiting and excess reactants for a given reaction.
		Calculate the theoretical yield for a given reaction.
		Calculate the percent yield for a given reaction.
		Science Practice: Identify and explain sources of error in an experiment.
	Unit Test	
Cumulative Exam		
	Cumulative Exam Review	
	Cumulative Exam	
The Kinetic Molecular Theory and States of Matter		
	Gases	
		Describe the postulates of kinetic-molecular theory.
		Interpret the behavior of ideal gases in terms of kinetic-molecular theory, including diffusion and effusion.

TX-Chemistry		Scope and Sequence
Unit	**Lesson**	**Objectives**
		Describe how kinetic-molecular theory explains the properties of gases, including temperature, pressure, compressibility, and volume.
		Science Practice: Identify the limitations of kinetic-molecular theory.
	Pressure	
		Explain how the motion of molecules relates to pressure.
		List units of pressure and give values for standard temperature and pressure (STP).
		Science Practice: Convert between units of pressure using dimensional analysis.
	Gas Laws	
		State Boyle’s law, Charles’s law, and Gay-Lussac’s law, and apply these laws to calculate the relationships among volume, temperature, and pressure.
		Derive the combined gas law from Boyle’s law, Charles’s law, and Gay-Lussac’s law.
		Define partial pressure.
		Apply Dalton’s law of partial pressures to describe the composition of gases.
		Science Practice: Make a table to compare the various gas laws.
	The Ideal Gas Law	
		Explain how Avogadro’s law, or principle, can be combined with other gas laws to describe the relationships among pressure, temperature, volume, and number of moles of a gas.
		State the ideal gas law, which relates pressure, temperature, and volume of an ideal gas.
		Solve problems using the ideal gas law.
		Science Practice: Use math to solve ideal gas law problems.
	Lab: Boyle’s Law	
		Science Practice: Obtain, evaluate, and communicate information gathered in an investigation about Boyle's law.
		Perform an investigation that demonstrates the relationship between the volume and pressure of a gas.
	Unit Test	

TX-Chemistry		Scope and Sequence
Unit	**Lesson**	**Objectives**
Water and Solutions		
	Reactions in Aqueous Solutions	
		Describe dissociation and ionization.
		Describe reactions in aqueous solutions, including the formation of a precipitate and the production of a gas.
		Distinguish between strong electrolytes, weak electrolytes, and nonelectrolytes.
		Science Practice: Analyze and interpret information to classify electrolytes (into strong, weak, and nonelectrolytes).
	Properties of Water	
		Describe how the structure of water accounts for its polarity.
		Explain why water has unique properties including high surface tension and a high boiling point.
		Describe the unique role of water in chemical and biological systems.
		Science Practice: Explain how the chemistry of water is important to biological systems.
	Solutions and Solubility	
		Describe the dissolving process on the molecular level.
		Identify factors affecting the rate at which a substance dissolves.
		Define solubility and differentiate between saturated, supersaturated, and unsaturated solutions.
		Investigate factors that influence solubility.
		Science Practice: Interpret, analyze, and make inferences from solubility graphs.
	Lab: Solubility	
		Formulate an investigative question to scientifically investigate how temperature affects solubility.
		Investigate how the temperature of a solvent affects the solubility of a solid.
		Accurately read the temperature in °C to know how temperature affects saturation.
		Science Practice: Plan and carry out an investigation to test factors affecting solubility.

TX-Chemistry		Scope and Sequence
Unit	**Lesson**	**Objectives**
	Measures of Concentration: Molarity	
		Define concentration.
		Calculate the concentration of solutions in units of molarity.
		Solve stoichiometry problems involving molarity.
		Use molarity to calculate dilutions of solutions.
		Science Practice: Use mathematics and computational thinking to solve problems involving molarity.
	Unit Test	
Thermodynamics		
	Energy	
		Differentiate among the various forms of energy, including kinetic energy, potential energy, chemical energy, and thermal energy.
		Explain that energy can be transformed from one form to another.
		Describe the law of conservation of energy.
		Science Practice: Integrate concepts from both chemistry and physics to analyze energy transformations and the conservation of energy.
	Heat	
		Relate temperature to the average molecular kinetic energy.
		Describe heat flow in terms of the motion of atoms or molecules.
		Distinguish between exothermic chemical processes and endothermic chemical processes.
		Science Practice: Analyze and interpret information about a reaction to classify the reaction as either an exothermic process or an endothermic process.
	Calorimetry	
		Differentiate between heat capacity and specific heat.

TX-Chemistry		Scope and Sequence
Unit	**Lesson**	**Objectives**
		Solve problems involving heat flow and temperature changes to calculate the specific heat of a substance.
		Define calorimetry and explain how calorimeters work.
		Use calorimetry to calculate the heat of a chemical process.
		Science Practice: Perform mathematical calculations involving heat, mass, temperature change, and specific heat.
	Lab: Calorimetry and Specific Heat	
		Determine the specific heat of a metal using a calorimeter.
		Systematically collect, organize, record, and analyze data.
		Demonstrate safe laboratory practices while using a calorimeter.
		Identify possible sources of procedural and mathematical errors in an experiment.
		Science Practice: Precisely follow a multistep procedure to build and use a calorimeter.
	Thermochemical Equations	
		Understand the use of enthalpy in thermochemistry.
		Use thermochemical equations to calculate energy changes (i.e., enthalpy changes) that occur in a chemical reaction.
		Use thermochemical equations to calculate energy changes (i.e., enthalpy changes) that occur in a combustion reaction.
		Science Practice: Examine books and other sources of information to find standard enthalpies of formation to solve thermochemical problems.
	Enthalpy, Entropy, and Free Energy	
		Compare spontaneous and nonspontaneous reactions.
		Describe and give examples of entropy.
		Differentiate “enthalpy” and “entropy” and describe how enthalpy and entropy affect a reaction's spontaneity.
		Define free energy and use the Gibbs free energy equation to determine whether a reaction is spontaneous.

TX-Chemistry		Scope and Sequence
Unit	**Lesson**	**Objectives**
		Science Practice: Use mathematics to solve problems involving the Gibbs free energy equation.
	Unit Test	
Acids and Bases		
	Properties of Acids and Bases	
		Describe the observable properties of acids.
		Describe the observable properties of bases.
		Describe applications of acids and bases.
		Science Practice: Determine the meaning of the key terms acid and base as they are used in chemistry.
	Arrhenius, Bronsted-Lowry, and Lewis Acids and Bases	
		Describe the Arrhenius definitions of acids and bases.
		Describe the Bronsted-Lowry definitions of acids and bases.
		Identify conjugate acids and conjugate bases in a Bronsted-Lowry acid-base reaction.
		Describe the Lewis definitions of acids and bases.
		Science Practice: Describe how Arrhenius's, Bronsted's, Lowry's, and Lewis's competing interpretations of the same evidence are useful in different ways.
	pH	
		Describe the self-ionization of water.
		Define pH and pOH.
		Convert between pH and hydrogen ion concentration, and between pOH and hydroxide ion concentration.
		Convert between pH and pOH, and between hydrogen ion concentration and hydroxide ion concentration.
		Use the pH scale to characterize the acidity and basicity of solutions.
		Science Practice: Solve scientific problems involving pH using logarithmic functions.

TX-Chemistry		Scope and Sequence
Unit	**Lesson**	**Objectives**
	Lab: Measuring pH	
		Create a universal pH indicator using an everyday material.
		Science Practice: Calibrate the scale for a pH indicator by comparing it to data measured using a known scale.
	Equilibria of Acids and Bases	
		Differentiate between the concentration and strength of solutions.
		Compare the strength of acids and their conjugate bases.
		Explain that strong acids and bases fully dissociate and weak acids and bases partially dissociate.
		Explain how the acid-dissociation constant, Ka, and the base-dissociation constant, Kb, relate to the constant for the self-dissociation of water, Kw.
		Science Practice: Use dissociation constants to compare strengths of acids and bases.
	Neutralization Reactions	
		Predict the products of acid-base neutralization reactions.
		Define salt and describe the observable properties of salts and salt solutions.
		Write equations and net ionic equations for neutralization reactions.
		Science Practice: Use domain-specific symbols to correctly write net ionic equations.
	Unit Test	
Oxidation-Reduction and Electrochemistry		
	Oxidation-Reduction	
		Follow rules to assign oxidation numbers to atoms in compounds.
		Define oxidation and reduction, and identify oxidized and reduced species.
		Identify oxidation-reduction (redox) reactions.
		Science Practice: Establish context by describing oxidation-reduction reactions in living and nonliving systems.
	Oxidizing and Reducing Agents	

TX-Chemistry		Scope and Sequence
Unit	**Lesson**	**Objectives**
		Identify oxidizing agents and reducing agents.
		Explain disproportionation.
		Use the relative strengths of oxidizing and reducing agents to predict an oxidation/reduction reaction.
		Science Practice: Analyze the structure of the relationships among oxidation, reduction, oxidizing agents, and reducing agents.
	Balancing Oxidation-Reduction Equations	
		Write half-reactions for oxidation-reduction reactions.
		Use the half-reaction method to balance oxidation-reduction equations.
		Science Practice: Develop the half-reaction procedure to solve scientific problems as an alternate method of balancing equations.
	Unit Test	
Nuclear Chemistry		
	The Nucleus	
		Explain how protons and neutrons in the nucleus are held together by nuclear forces.
		Differentiate chemical and nuclear reactions in terms of energy released.
		Explain why Einstein's equation E = mc2 is used to determine the nuclear binding energy.
		Identify some naturally occurring isotopes of elements that are radioactive.
		Science Practice: Analyze a sequence (i.e., radioactive decay) that is characteristic of natural phenomena.
	Balancing Nuclear Reactions	
		Write symbols for nuclides using mass numbers and atomic numbers.
		Balance nuclear equations by balancing both mass and atomic numbers.
		Science Practice: Determine the meaning of nuclide symbols and use those symbols to balance nuclear equations.
	Nuclear Fission and Nuclear	

TX-Chemistry		Scope and Sequence
Unit	**Lesson**	**Objectives**
	Fusion	
		Explain and compare fission and fusion reactions.
		Relate the role of nuclear fusion to the production of essentially all elements heavier than helium.
		Science Practice: Justify the need for peer review in science.
	Nuclear Energy	
		Describe how nuclear power plants work.
		Describe the issues surrounding nuclear waste.
		Science Practice: Weigh the merits of using nuclear energy to solve society's need for electrical energy by comparing a number of human, economic, and environmental costs and benefits.
	Nuclear Radiation	
		Explain that alpha, beta, and gamma radiation produce different amounts and kinds of damage in matter and describe the effects of each kind of radiation on living things.
		Describe how radiation is measured and detected.
		Describe applications of radiation.
		Science Practice: Describe careers that involve working with radioactive substances.
	Unit Test	
Cumulative Exam		
	Cumulative Exam Review	
	Cumulative Exam	