Advanced Academic Course (AAC) Chemistry
Overview
2024 – 2025

This document is designed to provide parents/guardians/community an overview of the curriculum taught in the FBISD classroom. This document supports families in understanding the learning goals for the course, and how students will demonstrate what they know and are able to do. The overview offers suggestions or possibilities to reinforce learning at home.

Included at the end of this document, you will find:

- A glossary of curriculum components
- The content area instructional model
- Parent resources for this content area

To advance to a particular grading period, click on a link below.

- Grading Period 1
- Grading Period 2
- Grading Period 3
- Grading Period 4

The process standards describe ways in which students are expected to engage in the content. The Scientific and Engineering Practices (SEPs) describe practices that students need to do in the classroom in order to learn the content. The Recurring Themes and Concepts (RTCs) describe how students need to think about the content in order to learn it.

Scientific and Engineering Practices

C.1A ask questions and define problems based on observations or information from text, phenomena, models, or investigations
C.1B use scientific practices to plan and conduct descriptive, comparative, and experimental investigations and use engineering practices to design solutions to problems
C.1C use appropriate safety equipment and practices during laboratory, classroom, and field investigations as outlined in Texas Education Agency approved safety standards
C.1D use appropriate tools such as Safety Data Sheets (SDS), scientific or graphing calculators, computers and probes, electronic balances, an adequate supply of consumable chemicals, and sufficient scientific glassware such as beakers, Erlenmeyer flasks, pipettes, graduated cylinders, volumetric flasks, and burettes
C.1E collect quantitative data using the International System of Units (SI) and qualitative data as evidence
C.1F organize quantitative and qualitative data using oral or written lab reports, labeled drawings, particle diagrams, charts, tables, graphs, journals, summaries, or technology-based report
C.1G develop and use models to represent phenomena, systems, processes, or solutions to engineering problems
C.1H distinguish among scientific hypotheses, theories, and laws
C.2A identify advantages and limitations of models such as their size, scale, properties, and materials
C.2B analyze data by identifying significant statistical features, patterns, sources of error, and limitations
C.2C use mathematical calculations to assess quantitative relationships in data
C.2D evaluate experimental and engineering designs
C.3A develop explanations and propose solutions supported by data and models and consistent with scientific ideas, principles, and theories
C.3B communicate explanations and solutions individually and collaboratively in a variety of settings and formats
C.3C engage respectfully in scientific argumentation using applied scientific explanations and empirical evidence

C.4A analyze, evaluate, and critique scientific explanations and solutions by using empirical evidence, logical reasoning, and experimental and observational testing, so as to encourage critical thinking by the student
C.4B relate the impact of past and current research on scientific thought and society, including research methodology, cost-benefit analysis, and contributions of diverse scientists as related to the content
C.4C research and explore resources such as museums, libraries, professional organizations, private companies, online platforms, and mentors employed in a science, technology, engineering, and mathematics (STEM) field in order to investigate STEM careers

Recurring Themes and Concepts
Patterns
Systems and System Models
Cause and Effect
Scale, Proportion, and Quantity

Grading Period 1

Unit 1: Atomic Structure

Estimated Date Range: August 8 – September 9
Estimated Time Frame: 22 days

Unit Overview:
The Atomic Structure unit in high school chemistry explores the fundamental principles that govern the structure, properties, and behavior of atoms. Students will examine the historical development of atomic theory, from early models proposed by Dalton, Thomson, Rutherford, and Bohr to the modern quantum mechanical model. They will also delve into the structure of atoms, including their subatomic particles, electron configurations, and the arrangement of elements on the periodic table. The orientation of electrons in atoms of elements determines the arrangement of the periodic table and students will learn the reason for the periodic table's structure and arrangement. Through laboratory investigations, demonstrations, and interactive activities, students will gain a deeper understanding of atomic structure and its significance in explaining the arrangement of the periodic table and chemical behavior.

At home connections:
Here are some ideas for at-home connections to help students explore atomic theory.

- **Kitchen chemistry**: Have students observe how different substances dissolve or mix in water. Discuss how this relates to the behavior of atoms and molecules.
- **Build atom models**: Use household items like marshmallows, toothpicks, or playdough to construct simple atom models. This helps visualize atomic structure.
- **Observe states of matter**: Experiment with ice, water, and steam to demonstrate how the arrangement and movement of atoms/molecules changes in different states.
- **Balloon static electricity**: Rub balloons on hair or clothing to create static electricity. Explain how this involves the transfer of electrons between atoms.
- **Density experiments**: Compare the density of different household liquids (oil, water, syrup) to discuss how atomic mass and structure affect density.

Concepts within Unit #1 Link to HS Science TEKS	Success Criteria for this concept *Students will…*

Concept #1: Safety (ongoing; embedded throughout the course) C.1A, C.1C, C.1D, and C.1E	• Identify potential hazards in the laboratory, including chemical, physical, and biological hazards, before conducting experiments • Consistently wear appropriate personal protective equipment (PPE), including safety goggles, lab coats, and gloves, during laboratory activities • Use safety equipment such as fire extinguishers, emergency showers, and eye wash stations in case of accidents or emergencies • Follow established safety procedures and guidelines for handling, storing, and disposing of chemicals • Demonstrate understanding of safety protocols, including proper labeling of chemicals, use of fume hoods, and safe handling techniques • Respond effectively to laboratory accidents, spills, fires, and other emergencies, following established emergency protocols
Concept #2: Atomic Theory C.6A, C.6B, C.6D	• Outline the historical progression of atomic theory, highlighting key contributions from scientists such as Democritus, Dalton, Thomson, Rutherford, and Bohr • Identify the three subatomic particles: protons, neutrons, and electrons, and describe their relative masses, electrical charges, and locations within the atom • Compare and contrast different atomic models throughout history, such as the solid sphere model (Democritus), the plum pudding model (Thomson), the nuclear model (Rutherford), and the planetary model (Bohr) • Evaluate atomic models and theories, considering their strengths, weaknesses, and predictive power
Concept #3: The Periodic Table and Periodicity C.5A, C.5B, C.5C	• Accurately describe the layout of the periodic table, including the arrangement of elements into periods and groups • Identify and explain key periodic trends such as atomic radius, ionization energy, electron affinity, electronegativity, and metallic character • Predict and interpret the chemical behavior of elements based on their position in the periodic table and associated periodic trends • Analyze experimental data related to periodic trends, including measurements of atomic properties and trends observed in chemical reactions • Relate periodic trends to everyday phenomena and industrial applications, explaining how knowledge of periodicity informs the design of materials, pharmaceuticals, and chemical processes

Unit 2: Making Predictions

Estimated Date Range: September 10 – October 9
Estimated Time Frame: 20 days

Unit Overview:
This unit introduces students to the naming conventions for ionic and covalent compounds according to International Union of Pure and Applied Chemistry (IUPAC) rules. Additionally, students will explore the mathematical relationship between energy, frequency, and wavelength of light using the electromagnetic spectrum and relate it to the quantization of energy in the emission spectrum. By mastering these concepts, students will develop foundational skills essential for understanding chemical compounds and the behavior of electromagnetic radiation.

At Home Connections:
Electromagnetic Spectrum

Smartphone spectrometer: Have students build a simple spectrometer using their smartphone camera and a diffraction grating (can be made from a CD). They can analyze light sources around their home.
Remote control exploration: Use a smartphone camera to observe the infrared light emitted by TV remote controls when buttons are pressed.
UV light experiments: If available, use a UV flashlight to explore fluorescence in household items like laundry detergents, highlighters, or tonic water.
Microwave demonstrations: Demonstrate microwave properties using a microwave oven and various foods (e.g., marshmallows, chocolate bars) to show non-uniform heating.

Chemical Bonding

Kitchen chemistry bonding: Have students identify examples of ionic and covalent compounds in their kitchen (e.g. salt for ionic, sugar for covalent). Discuss how the bonding affects properties like solubility.
Crystal growing: Grow sugar or salt crystals at home to explore how atoms/ions arrange themselves in regular patterns due to bonding.
Melting point comparison: Compare melting points of household substances (e.g. ice, butter, chocolate) and relate it to the strength of intermolecular forces.
Soap and water experiments: Explore how soap interacts with water and oil to demonstrate polar and nonpolar interactions.
Research project: Assign students to research and present on how chemical bonding is important in everyday materials (e.g. plastics, ceramics, metals).

Concepts within Unit #2 [Link to HS Science TEKS]	**Success Criteria for this concept** *Students will…*
Concept #1: Electromagnetic Spectrum C.6C, C.6E	• Describe the electromagnetic spectrum, including the range of wavelengths and frequencies of electromagnetic radiation. • Identify regions of the spectrum such as radio waves, microwaves, infrared, visible light, ultraviolet, X-rays, and gamma rays. • Define the terms energy, frequency, and wavelength and understand their units of measurement. • Describe the concept of energy quantization in atoms, explaining how electrons occupy discrete energy levels and transition between them. • Calculate energy, frequency, and wavelength of light using mathematical formulas and appropriate units. • Interpret patterns in emission spectra to understand the quantized nature of energy levels in atoms. • Plan and carry out investigations to collect and analyze data related to emission spectra and energy quantization
Concept #2: Chemical Bonding C.7A, C.7B, C.7C, and C.7D	• Apply International Union of Pure and Applied Chemistry (IUPAC) nomenclature rules to name ionic and covalent compounds • Use appropriate prefixes and suffixes to indicate the number of atoms in covalent compounds, including mono-, di-, tri-, tetra-, etc. • Recognize and apply the concept of ionic charges to determine the chemical formula for ionic compounds • Balance charges to ensure the overall charge neutrality of the compound • Write the chemical formula using the lowest ratio of ions consistent with charge balance • Identify the types of atoms present in the compound and their respective oxidation states, if applicable

	• Demonstrate understanding of Valence Shell Electron Pair Repulsion (VSEPR) theory and its application in predicting molecular geometries • Explain how electron pairs arrange themselves around the central atom to minimize repulsion and achieve maximum stability • Draw accurate electron dot structures for molecules, representing all valence electrons using dots or lines

Grading Period 2

Unit 3: Accounting for Matter

Estimated Date Range: October 16 – November 4
Estimated Time Frame: 13 days

Unit Overview:
This unit explores the fundamental concepts of percent composition and unit conversions in chemistry. Students will learn how to calculate the percent composition of compounds, determining the mass percentage of each element present. The unit will cover the relationship between molecular formulas, molar masses, and percent composition. Students will also study various unit conversion techniques, including dimensional analysis and the use of conversion factors. The unit will address real-world applications of percent composition in fields such as nutrition labeling and environmental science. Through problem-solving exercises, laboratory activities, and data analysis, students will develop skills in quantitative reasoning and chemical calculations. By the end of the unit, students should be able to determine the percent composition of compounds, convert between different units of measurement, and appreciate the importance of these concepts in understanding chemical reactions and formulations.

At home connections:
Percent Composition

- Students can explore percent composition through various hands-on activities at home. They can calculate the percent composition of household items, such as determining the percentage of sugar in different brands of soda by evaporating the liquid and weighing the residue. Baking can serve as a practical example; students can calculate the percent composition of ingredients in a recipe, like the amounts of flour, sugar, and butter in cookies. Using kitchen scales, they can measure and compare the mass of different components in a mixture, such as salt and sand, to determine their percent composition. Additionally, students can analyze nutrition labels on food packages to understand the percent composition of macronutrients like carbohydrates, proteins, and fats. For a more chemistry-focused activity, students could perform a simple experiment with baking soda and vinegar, measuring the mass lost due to carbon dioxide production to calculate the percent composition of carbon in baking soda. These activities help students apply theoretical concepts to real-world scenarios, making the abstract idea of percent composition more tangible and relatable

Conversions

- Students can explore these concepts through various hands-on activities at home. To understand the concept of a mole, they can count out 6.022×10^{23} grains of rice or sand (scaled down by a factor of 10^{20}) to visualize Avogadro's number. For molar mass and conversions, students can use kitchen scales to measure common household substances like sugar or salt, then calculate the number of moles present. They can also analyze nutrition labels on food packages to convert grams of nutrients to moles. To differentiate between empirical and molecular formulas, students can create models of simple molecules using marshmallows or gumdrops and toothpicks, then identify the simplest whole number ratio (empirical formula) versus the actual molecular structure. Additionally, they can perform a simple experiment with baking soda and vinegar, measuring the mass lost due to carbon dioxide production to determine the empirical formula of baking soda. These activities help make abstract concepts more tangible and relatable, reinforcing students' understanding of moles, molar mass, and chemical formulas.

Concepts within Unit #3 [Link to HS Science TEKS]	Success Criteria for this concept
Concept #1: Percent Composition	• Determine the molar mass of a compound using the periodic table

C.8B, C.8D	• Understand that percent composition is the percentage by mass of each element in a compound • Interpret chemical formulas to determine the number of each type of atom in a compound • Calculate the mass contribution of each element in a compound based on its chemical formula
Concept #2: Conversions C.8A, C.8D	• Understand that a mole is a unit that measures the amount of substance, specifically 6.022 x 10^{23} representative particles (Avogadro's number) • Know that molar mass is the mass of one mole of a substance, expressed in grams per mole (g/mol) • Determine the atomic mass of elements from the periodic table • Calculate the molar mass of compounds by summing the atomic masses of their constituent elements

Unit 4: Chemical Reactions

Estimated Date Range: November 18 – December 20
Estimated Time Frame: 20 days

Unit Overview:
This unit explores the fundamental concepts of chemical reactions, a core principle in chemistry. Students will learn how to represent chemical reactions using symbols and balanced equations, understanding the conservation of mass and atoms. The unit will cover different types of reactions, including combination, decomposition, combustion, single replacement, and double replacement reactions. Students will also study oxidation-reduction reactions and their significance. The unit will address factors affecting reaction rates and chemical equilibrium. Through laboratory experiments, demonstrations, and problem-solving exercises, students will develop skills in predicting products, balancing equations, and analyzing reaction mechanisms. By the end of the unit, students should be able to identify and classify various types of chemical reactions, understand their underlying principles, and appreciate their applications in everyday life and industrial processes.

At home connections:
Types of Reactions

- Students can explore different types of chemical reactions through safe, hands-on activities at home. For combination reactions, they can observe the rusting of iron nails in water. Decomposition reactions can be demonstrated by heating baking soda to produce carbon dioxide. A simple combustion reaction can be observed by safely burning a candle. For single replacement reactions, students can place a copper wire in a solution of silver nitrate to observe the replacement of silver by copper. Double replacement reactions can be demonstrated by mixing vinegar with baking soda to produce carbon dioxide gas. To explore redox reactions, students can create a simple lemon battery using copper and zinc electrodes. These activities help make abstract concepts more tangible, allowing students to observe and classify different types of reactions in everyday contexts. Additionally, students can analyze common household products and their reactions, such as cleaning supplies or cooking ingredients, to identify the types of reactions involved in their use

Stoichiometry

- Students can explore stoichiometry through various hands-on activities at home. They can practice balancing equations using household items like buttons or candies to represent atoms, helping visualize the conservation of mass. For mole ratios, students can use recipes as analogies, calculating the ratios of ingredients and scaling recipes up or down. To understand limiting reagents, they can make s'mores with a limited number of graham crackers, chocolate pieces, and marshmallows, determining which ingredient runs out first. Students can also perform simple experiments, such as reacting baking soda with vinegar, measuring the reactants and products to explore mass relationships. For a more practical application, they can analyze the nutritional information on food labels, converting grams to moles and calculating molar ratios of nutrients. These activities help make the abstract concepts of stoichiometry more tangible and relatable, reinforcing students' understanding of how quantities of substances interact in chemical reactions.

Concepts within Unit #4 [Link to HS Science TEKS]	**Success Criteria for this concept** *Students will…*
Concept #1: Types of Reactions C.9B, C.9D	• Use the Brønsted-Lowry definition to identify acids (proton donors) and bases (proton acceptors) • Identify a reaction as an acid-base reaction if it involves the transfer of a proton (H+). • Write balanced chemical equations for neutralization reactions (acid + base → salt + water). • Use indicators to determine whether a solution is acidic or basic. • Apply solubility rules to predict whether a precipitate will form in a double displacement reaction. • Recognize a reaction as a precipitation reaction if it results in the formation of an insoluble solid (precipitate). • Identify all reactants and products in a given chemical equation. • Correctly write and balance chemical equations. • Define the limiting reactant as the reactant that is completely consumed first in a chemical reaction, limiting the amount of products formed.
Concept #2: Stoichiometry C.9A, C.9C	• Ensure the number of atoms of each element is equal on both sides of the equation. • Calculate the molar mass of reactants and products using the periodic table. • Use the coefficients from the balanced equation to determine mole ratios between reactants and products. • Discuss factors that can affect actual yield and thus the percent yield.

Grading Period 3

Unit 5: Solutions

Estimated Date Range: January 9 - February 7
Estimated Time Frame: 21 days

Unit overview:
This unit explores the diverse world of solutions, focusing on their composition and properties. Students will learn to distinguish between electrolytes and nonelectrolytes, understanding how different solutes affect a solution's electrical conductivity. The unit will cover the concepts of unsaturated, saturated, and supersaturated solutions, examining how concentration and temperature influence solubility. Students will investigate the process of dissolution and factors affecting solubility, including pressure for gases. Through laboratory experiments, demonstrations, and problem-solving exercises, students will develop skills in preparing solutions of various concentrations and predicting solubility behaviors. By the end of the unit, students should be able to classify solutions based on their properties, understand the principles of solution equilibrium, and appreciate the importance of solutions in everyday life and industrial applications.

At home connections:
Students can explore solutions through various hands-on activities at home. They can create different types of solutions using common household items, such as dissolving salt or sugar in water to observe solubility. To understand concentration, students can make solutions of varying strengths, like different concentrations of sugar water, and compare their properties. They can investigate factors affecting solubility by dissolving sugar in hot and cold water, observing how temperature impacts the process. For electrolytes and conductivity, students can set up a simple circuit with a battery and LED to test the conductivity of various solutions like tap water, salt water, and sugar water. To explore saturation, they can attempt to create supersaturated solutions using materials like Epsom salts. Additionally, students can analyze the labels on common household products, identifying solutions and their concentrations in everyday items. These activities help make abstract concepts more tangible and relatable, reinforcing students' understanding of solutions in chemistry.

Concepts within Unit #5 [Link to HS Science TEKS]	**Success Criteria for this concept**
Concept #1: Types of Solutions C.11A, C.11B	• Define electrolytes as substances that dissolve in water to produce ions, which conduct electricity. • Define nonelectrolytes as substances that dissolve in water but do not produce ions, thus not conducting electricity. • Identify common examples of electrolytes (e.g., NaCl, KNO3) and nonelectrolytes (e.g., sugar, ethanol). • Demonstrate or explain how to test a solution's conductivity using a conductivity meter or a simple circuit. • Define an unsaturated solution as one that contains less solute than the solvent can dissolve at a given temperature. • Define a saturated solution as one that contains the maximum amount of solute that can dissolve in the solvent at a given temperature. • Define polarity in terms of the distribution of electrical charge over the atoms joined by a bond. • Explain that a molecule is polar if it has a positive and a negative end, resulting in a dipole moment. • Describe the molecular structure of water (H2O), noting the bent shape and the angle between the hydrogen-oxygen-hydrogen atoms. • Explain how the polarity of water molecules allows them to surround and interact with various solute particles, breaking them apart and keeping them in solution.
Concept #2: Solubility C.11C, C.11D, C.11E, and C.11F	• Define molarity (M) as the number of moles of solute per liter of solution. • Understand and use the formula for molarity. • Convert the mass of solute to moles using the molar mass of the solute. • Measure or convert the volume of the solution to liters. • Apply solubility rules to determine whether the products of the reaction are soluble or insoluble in water. • Write the complete ionic equation for the reaction, showing all soluble ionic compounds dissociated into their ions.

Unit 6: Acids and Bases
Estimated Date Range: February 10 – March 7
Estimated Time Frame: 17 days

Unit Overview:
This unit explores the fundamental concepts of acids and bases, key players in many chemical reactions. Students will learn different definitions of acids and bases, including Arrhenius, Brønsted-Lowry, and Lewis theories, understanding how these definitions evolved and complement each other. The unit will cover important properties of acids and bases, such as pH, strength, and concentration. Students will investigate acid-base reactions, including neutralization, and learn to write and balance these equations. The unit will also address the concept of conjugate acid-base pairs and buffer solutions. Through laboratory experiments, demonstrations, and problem-solving exercises, students will develop skills in measuring pH, performing titrations, and predicting acid-base behavior. By the end of the unit, students should be able to identify and characterize acids and bases, understand their roles in various chemical processes, and appreciate their significance in everyday life and industrial applications.

At home connections:
Students can explore acids and bases through various hands-on activities at home. They can create natural pH indicators using red cabbage juice or turmeric to test the acidity or basicity of common household substances like lemon juice, vinegar, baking soda, and soap. To understand neutralization reactions, students can mix vinegar with baking soda and observe the resulting reaction. They can investigate the effect of acids on different materials by placing eggshells or chalk in vinegar. For a practical application, students can test the pH of soil samples from their garden using homemade indicators or pH paper. They can also explore how acids and bases are used in cooking by examining recipes that use baking soda or cream of tartar. Additionally, students can research and create presentations on the role of acids and bases in everyday products like antacids or cleaning supplies. These activities help make abstract concepts more tangible and relatable, reinforcing students' understanding of acids and bases in chemistry.

Concepts within Unit #6 [Link to HS Science TEKS]	**Success Criteria for this concept**
Concept #1: Acids and Bases C.12A, C.12B, C.12C, C.12D, and C.12E	• Define acids as substances that donate protons (H+) in aqueous solutions. • Define bases as substances that accept protons or produce hydroxide ions (OH-) in aqueous solutions. • Use the prefix "hydro-" followed by the root of the nonmetal's name and the suffix "-ic" acid. • Identify the polyatomic ion in the acid to determine the name. • Recognize common bases that often contain metal cations and hydroxide ions (OH-).

Grading Period 4

Unit 7: Gases
Estimated Date Range: March 17- April 15
Estimated Time Frame: 21 days

Unit Overview:
This unit delves into the properties and behaviors of gases, fundamental to understanding many chemical processes. Students will learn about the physical characteristics of gases, including their low density, high compressibility, and

ability to fill containers completely. The unit will cover the essential gas laws—Boyle's Law, Charles's Law, and Avogadro's Law—and how they relate to pressure, volume, temperature, and the amount of gas. Students will explore the Ideal Gas Law and its applications in calculating the behavior of gases under various conditions. The unit will also address concepts such as partial pressure, Dalton's Law of Partial Pressures, and the kinetic molecular theory. Through laboratory experiments, simulations, and problem-solving exercises, students will develop skills in measuring gas properties and applying gas laws to real-world scenarios. By the end of the unit, students should be able to describe the behavior of gases, understand the relationships between different gas properties, and apply these principles to predict and explain gas behavior in various contexts.

At home connections:
Students can explore gas behavior through various hands-on activities at home. They can demonstrate Boyle's Law using a sealed syringe or a balloon in a bottle, observing how volume changes with pressure. Charles's Law can be illustrated by placing a partially inflated balloon in hot and cold water, showing the relationship between temperature and volume. To explore diffusion, students can safely release a small amount of perfume or essential oil in a room and time how long it takes to smell it at different distances. For a practical application of gas laws, students can investigate how tire pressure changes with temperature. They can also create simple barometers using straws and water to measure air pressure changes. To visualize gas particle behavior, students can use marbles or ping pong balls in a clear container, shaking it to simulate increased temperature. These activities help make abstract gas concepts more tangible and relatable, reinforcing students' understanding of gas behavior in everyday situations.

Concepts within Unit #6 [Link to HS Science TEKS]	**Success Criteria for this concept** *Students will…*
Concept #1: Gases C.10A, C.10B, and C.10C	• Understand that the Ideal Gas Law describes the state of an ideal gas under various conditions. • Define the Ideal Gas Law: PV = nRT. • Use the Ideal Gas Law to solve for any one of the variables (P, V, n, T) when the others are known • State Boyle's Law which describes the inverse relationship between pressure and volume at constant temperature and number of moles. • Calculate changes in pressure and volume when one is held constant. • Calculate changes in volume and temperature when one is held constant (Charles' Law). • Calculate changes in volume and number of moles when one is held constant (Avogadro's Law). • Calculate changes in pressure and temperature when one is held constant (Gay-Lussac's Law). • Convert pressure to appropriate units (e.g., atm, kPa) if needed. • Apply Boyle's, Charles's, Avogadro's, and Gay-Lussac's laws to solve problems involving changes in conditions.

Unit 8: Nuclear Chemistry and Thermodynamics

Estimated Date Range: April 16 – May 29
Estimated Time Frame: 21 days

Unit Overview:
This unit explores two fundamental areas of chemistry: nuclear chemistry and thermodynamics. In the nuclear chemistry portion, students will learn about atomic structure, radioactive decay processes, nuclear reactions, and their applications. They'll study different types of radiation, half-life calculations, and the societal impacts of nuclear technology. The thermodynamics section will focus on energy changes in chemical reactions and physical processes. Students will explore concepts such as heat transfer, enthalpy, entropy, and Gibbs free energy. They'll learn to use calorimetry to measure heat changes, apply Hess's law to calculate enthalpies of reaction, and understand the principles of spontaneity in chemical processes. Through laboratory experiments, problem-solving exercises, and real-world applications, students will develop a deeper understanding of energy transformations at both the nuclear and molecular levels. By the end of the unit, students should be able to explain nuclear processes, perform thermochemical calculations, and appreciate the role of energy in chemical systems.

At home connections:
Students can explore nuclear chemistry and thermodynamics through various hands-on activities at home. For nuclear chemistry, they can create models of radioactive decay using dice or coins to simulate half-life, tracking the "decay" of a sample over time. Students can also research and create presentations on the applications of nuclear chemistry in medicine, energy production, or archaeology. To explore thermodynamics, students can conduct simple calorimetry experiments using household materials, such as measuring temperature changes when dissolving salt in water or mixing hot and cold water. They can investigate heat transfer by comparing the cooling rates of different liquids in various containers. For a practical application of enthalpy, students can analyze the calorie content of food items and relate it to the energy released during metabolism. Additionally, they can explore entropy by observing and explaining everyday phenomena like the melting of ice or the mixing of gases. These activities help make abstract concepts more tangible and relatable, reinforcing students' understanding of nuclear chemistry and thermodynamics in everyday contexts.

Concepts within Unit #7 [Link to HS Science TEKS]	**Success Criteria for this concept** *Students will…*
Concept #1: Thermodynamics C.13A, C.13B, C.13C, and C.13D	• Define exothermic reactions as reactions that release energy to the surroundings, usually in the form of heat. • Define endothermic reactions as reactions that absorb energy from the surroundings, usually in the form of heat. • Write balanced chemical equations for reactions, including the energy change (ΔH) in kilojoules (kJ) per mole of reaction. • Draw energy diagrams showing the reactants at a higher energy level than the products, with energy being released during the reaction. • Draw energy diagrams showing the reactants at a lower energy level than the products, with energy being absorbed during the reaction. • Use thermochemical equations to calculate the amount of heat absorbed or released in a reaction based on the number of moles involved.
Concept #2: Radioactivity C.14A	• Write and balance nuclear equations for alpha decay. • Identify the type of decay process and write the corresponding balanced nuclear equation.

	• Understand how a radioactive isotope decays through a series of steps, often involving multiple types of decay. • Represent decay series in a sequence of balanced nuclear equations. • Determine the resulting products of decay processes and the type of radiation emitted. • Explain the physical processes behind alpha, beta, and gamma decay and how they affect the nucleus of an atom. • Use diagrams and models to help visualize the emission of alpha, beta, and gamma radiation.
Concept #3: Fission and Fusion C.14B and C.14C	• Define fission as the process in which a heavy nucleus splits into two or more lighter nuclei, along with the release of a significant amount of energy. • Define fusion as the process in which two light nuclei combine to form a heavier nucleus, also releasing a significant amount of energy. • Describe the chain reaction mechanism where one fission event causes further fission events. • Describe the conditions required for fusion, such as extremely high temperatures and pressures, similar to those found in stars. • Identify typical fission products as two smaller nuclei, along with additional neutrons and radiation. • Identify typical fusion products as a single heavier nucleus and often a neutron or proton. • Explain the processes of fission and fusion in terms of atomic and nuclear changes, energy release, and conservation laws. • Communicate why fusion is generally considered more desirable as a future energy source due to its lower environmental impact. • Use diagrams and models to illustrate fission and fusion processes, including energy changes, nuclear reactions, and the products formed.

Glossary of Curriculum Components

Overview– The content in this document provides an overview of the pacing and concepts covered in a subject for the year.

TEKS – Texas Essential Knowledge and Skills (TEKS) are the state standards for what students should know and be able to do.

Unit Overview – The unit overview provides a brief description of the concepts covered in each unit.

Concept – A subtopic of the main topic of the unit.

Success Criteria—a description of what it looks like to be successful in this concept.

Parent Resources

The following resources provide parents with ideas to support students' understanding. For sites that are password protected, your child will receive login information through their campus.

Resource	How it supports parent and students
Texas Experience Science Grade 8	This is the state adopted textbook for grade 8 science. Students sign in through their school account in Clever.
EduSmart	This resource provides hand-on and vocabulary activities that are great to review the concepts learned in the classroom. Students sign in through their school account in Clever.
Khan Academy	This resource contains practice exercises, instructional videos, and a personalized learning dashboard where students can learn and study at their own pace.
NSTA – Science Resources for Parents	This online resource has science activities for middle school students and their families to help support learning at home.
National Geographic Kids	This resource is a fact-filled, magazine created especially for ages 6 – 14. The students go on an amazing adventure in science, nature, culture, archaeology, and space.

Supplemental Resource and Tool designation

TI-Nspire Calculator	This calculator is a standardized technology integration tool used for Science and Mathematics in FBISD.

Instructional Model

An instructional model is the structure in which students engage in a particular content that ensures understanding of that content. In science, the instructional model is the 5E Instructional Model.

The 5E Model is an inquiry-based approach to teaching and learning science concepts over time. It is research-based and emphasizes that children build conceptual understanding and make meaning through experiences. Each “E” represents a stage in a learning cycle.

- Engage: Students interact with a phenomenon that sparks curiosity and assesses prerequisite knowledge or misconceptions.
- Explore: Students begin to interact with the content through hands-on investigations.
- Explain: Students connect the hands-on experience to the instruction of the concept using grade level appropriate academic vocabulary.
- Elaborate: Students apply the concept learned to a new context through problem solving or an additional hands-on experience.
- Evaluate: Evaluation of student understanding and progress occurs throughout the learning cycle.

As students learn each concept in the curriculum, they will have the opportunity to develop conceptual understanding as the teacher navigate the content as telling a story. The graphic below summarizes each component that occurs within each of the 5E stages.