

Course Title:	Honors Chemistry
Grade(s):	10-12, primarily 11th

Course Description
Chemistry is a study of the fundamental structure of matter that serves as a basic understanding of science. Core ideas in the course are matter, energy, atomic and molecular structure, composition, bonding, the periodic law, chemical equations, acid-base reactions, solutions, gas laws, equilibrium, electrochemistry, and nuclear reactions. The course is designed to foster scientific literacy by using real-life examples and case studies that allow students to use the concepts and skills of chemistry to make informed decisions about current issues and situations. Students will be expected to communicate the results of their research and investigations in a variety of ways. A major component of chemistry is extensive laboratory experiences in which students will design experiments, control variables, conduct safe investigations, and analyze data. Students wishing to pursue a career in any of the STEM fields should take chemistry. The honors level of this course, while studying the same concepts and skills as the academic class, challenges students to work at a deeper level, at a faster pace. In addition to the content presented in chemistry, strength in mathematics and basic algebraic operations is necessary for Honors Chemistry. The laboratory experiments are designed to model the chemical world, and the extensive use of mathematics as a tool for that modeling is critical. Honors-level courses are designed to challenge the advanced learner. Students should expect to reach a deeper scope of skills than the academic class: a higher reading stamina, the motivation to revise work, critical thinking skills, and the propensity to finish complex tasks in a timely manner. Students in honors - level classes are expected to have a solid foundation of skills from previous courses and an ability to connect these skills to new learning and apply these skills in problem solving. Students taking an honors-level class have demonstrated the ability to take responsibility for their own learning, work fluidly both independently and collaboratively, and display the propensity to finish complex tasks in a timely manner. These students should consistently aspire to achieve higher-level quality work through self-reflection and self-advocacy. These classes are recommended to students by teachers who have evaluated a student's past practice and achievement.
Approved Curricular Materials/Textbook(s)

Unit Title	Unit Description (Include Unit Objectives)	Unit Pacing
Unit 1: Matter and Atomic Structure	In this unit, students will learn what matter is and how it can be described and classified. They will explore the difference between physical and chemical properties and changes, and practice identifying whether a sample of matter is a mixture, an element, or a compound. The unit also introduces the history and development of the atomic model, showing how scientists' ideas about atoms have changed over time. Students will learn about the three main subatomic particles—protons, neutrons, and electrons—and how they are arranged in the nuclear atom. Building on this, they will discover what makes one element different from another and how isotopes of the same element can vary. This foundation will prepare students for understanding the structure, behavior, and interactions of all matter.	3 weeks (Early to mid-September)
Unit 2: Nomenclature of Compounds and Introduction to Periodic Table	In this unit, students will learn how to identify important patterns on the periodic table and use those patterns to solve basic chemistry problems. They will practice determining the charges of ions and use this knowledge to write correct names and formulas for neutral ionic and covalent compounds. Students will also explore the different properties of ionic and covalent substances, learning what makes each type of compound unique. This unit builds the skills students need to understand chemical structure, bonding, and the behavior of materials.	2.5 weeks (Mid-September to early October)
Unit 3: Reactions	In this unit, students will learn how to write and balance chemical equations by following clear, step-by-step procedures. They will apply the Law of Conservation of Matter to show that atoms are neither created nor destroyed during chemical reactions, demonstrating this by balancing equations correctly. Students will also learn to identify the five main types of chemical reactions and practice converting word equations into balanced chemical equations. In addition, they will develop the skills needed to write molecular equations and then translate them into total ionic and net ionic forms. This unit helps students understand how chemical reactions are represented and how matter behaves during these processes.	4 weeks (October)
Unit 4: Moles	In this unit, students will learn how to work with measurements and chemical calculations that are essential in chemistry. They will practice identifying the number of significant figures in a measurement to ensure that data is reported accurately. Students will also use dimensional analysis to convert between moles,	3 weeks (November)

	volume, mass, and particles, building a strong foundation for solving quantitative problems. In addition, they will calculate percent composition from a chemical formula or experimental data and use this information to determine empirical and molecular formulas. These skills help students understand the quantitative relationships that define chemical substances and reactions.	
Unit 5: Stoichiometry	In this unit, students will build their problem-solving skills by applying mole ratios from balanced chemical equations to carry out stoichiometry calculations and predict how much product can form in a reaction. Students will also learn how to interpret experimental data to identify limiting and excess reagents, helping them understand which reactant controls the amount of product made. Finally, they will use data to calculate percent yield, comparing the amount of product actually produced to the amount expected. This unit strengthens students' ability to analyze and quantify chemical reactions.	3 weeks (December)
Unit 6: Equilibrium	In this unit, students will explore how chemical reactions behave in solutions and at equilibrium. They will learn to calculate the concentration of a substance in molarity and apply solution stoichiometry to solve problems involving reactions that occur in aqueous solutions. Students will also study the difference between forward and reverse reactions and learn how chemical equilibrium is established. They will practice writing equilibrium expressions, calculating the equilibrium constant (K_{eq}), and interpreting whether reactants or products are favored. In addition, students will calculate the reaction quotient (Q) and compare it to K_{eq} to determine the direction a reaction must shift to reach equilibrium. Finally, they will apply Le Chatelier's Principle to predict how changes in concentration, pressure, moles, or the presence of a catalyst will cause a system to shift in order to restore equilibrium. This unit helps students understand the dynamic nature of chemical reactions and the factors that influence their behavior.	4 weeks (January) Intro to unit early January Le Chatelier's Principle end of January
Unit 7: Nuclear	In this unit, students will explore the nature of radiation and its impact on the world around us. They will learn to identify common sources of radiation and discuss both the beneficial uses and potential effects of exposure. Students will study the different types of radiation, compare their properties, and calculate how much of a radioactive sample remains after each half-life. They will also practice writing nuclear decay equations to represent changes within unstable nuclei. The unit will help students understand the difference between acute and chronic radiation	2 weeks (Early to Mid-February)

	exposure and how each affects living systems. In addition, students will compare the processes of nuclear fission and fusion and investigate how nuclear power is used as an energy source. This unit provides a foundation for understanding nuclear science and its applications in medicine, energy, and technology.	
Unit 8: Energy	In this unit, students will explore the different ways energy can change during chemical and physical processes. They will learn to distinguish between endothermic and exothermic reactions and explain the role energy plays in each. Students will review the Law of Conservation of Energy and use potential energy diagrams to visualize how energy is absorbed or released, including interpreting and calculating ΔH (enthalpy change). They will define and calculate specific heat, recognizing that each substance has its own unique heat capacity. The unit also introduces Hess's Law, showing how overall enthalpy changes can be determined by combining multiple reactions. Finally, students will apply stoichiometry to enthalpy calculations, allowing them to predict energy changes based on balanced chemical equations. This unit builds a strong foundation for understanding how energy flows through chemical systems.	4 weeks (Mid- February to mid- March)
Unit 9: Light, Electron Configuration and Periodic Trends	In this unit, students will explore the patterns and behaviors of elements and electrons. They will identify trends among the elements, including atomic radius, electronegativity, ionization energy, and ionic size. Students will also study the properties of waves, learning the parts of a wave such as frequency, amplitude, crest, trough, and wavelength, and qualitatively describe the relationships between frequency, energy, and wavelength. They will differentiate between more dangerous (shorter) and less dangerous (longer) waves. The unit covers electron configurations, including how to identify patterns, calculate the number of electrons, and determine an element from its configuration. Students will also learn the fundamental rules that govern electron arrangement: the Aufbau Principle, Hund's Rule, and the Pauli Exclusion Principle. This unit provides a foundation for understanding how the structure of atoms relates to their chemical behavior.	4 weeks (Late March - Late April)
Unit 10: Bonding, Lewis Structures and IMFs	In this unit, students will learn how to represent and predict the behavior of atoms and molecules using Lewis structures and other models. They will draw correct Lewis structures for atoms, molecules, and polyatomic ions, and use electron configurations to determine how many electrons atoms gain or lose to achieve a	3 weeks (Late April - mid May)

	noble gas configuration. Students will apply the octet rule to predict the ions formed during the formation of ionic compounds. They will use VSEPR theory to predict the shapes of molecules and electronegativities to determine the type of bonding between elements. The unit also covers molecular polarity and the difference between polar and nonpolar covalent molecules. Finally, students will identify and describe intermolecular forces (IMFs) and understand how they influence the physical properties of substances.	
Unit 11: Gas Laws ** Supplemental if time	In this unit, students will explore the behavior of gases and the factors that influence them. They will learn why gases are easier to compress than solids or liquids and identify the three main factors that affect gas pressure. Students will examine the relationships among temperature, pressure, and volume, and use these relationships to calculate the amount of gas in a container under specified conditions. The unit also covers real versus ideal gases, helping students understand when gases deviate from ideal behavior. Students will learn how the total pressure of a gas mixture relates to the partial pressures of its components and investigate how the molar mass of a gas affects the rate at which it diffuses and effuses. This unit provides a foundation for understanding the unique properties and behavior of gases.	(3 weeks)
Unit 12: Acids and Bases ** Supplemental if time	In this unit, students will explore the properties and behavior of acids and bases. They will learn how acids and bases are defined according to the Arrhenius, Brønsted-Lowry, and Lewis theories, and how to distinguish between them in different contexts. Students will examine the relationship between $[H^+]$ and $[OH^-]$ in aqueous solutions and classify solutions as neutral, acidic, or basic using pH. They will learn two common methods for measuring pH and identify what determines whether an acid or base is strong or weak. The unit also covers acid-base reactions, including the products formed during neutralization, the point in a titration when neutralization occurs, and how the pH of a solution of a salt can indicate acidity or basicity. Finally, students will identify the components of a buffer and understand how buffers help maintain pH in a solution.	(3 weeks)