

Grade: 9-12

Unit 1: Atoms, Elements, and Molecules

New Jersey Student Learning Standards

Marking Period	Unit Title	Recommended Instructional Days
1	Unit 1: Atoms, Elements, and Molecules	46
<p>NJSLS - Science: <i>Title</i></p> <ul style="list-style-type: none"> ● HS-PS1: Matter and Its Interactions ● HS-PS2: Motion and Stability: Forces and Interactions ● HS-PS3: Energy 	<p>NJSLS - Science: <i>Performance Expectations</i></p> <ul style="list-style-type: none"> ● HS-PS1-1 - Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms. ● HS-PS1-2 - Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties. ● HS-PS1-3 - Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles. ● HS-PS1-7 - Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction. ● HS-PS2-4 - Use mathematical representations of Newton's Law of Gravitation and Coulomb's Law to describe and predict the gravitational and 	<p>Recommended Activities, Investigations, Interdisciplinary Connections, and/or Student Experiences to Explore NJSLS-S within Unit</p>

	<p>electrostatic forces between objects.</p> <ul style="list-style-type: none"> ● HS-PS3-5 - Develop and use a model of two objects interacting through electric or magnetic fields to illustrate the forces between objects and the changes in energy of the objects due to the interaction. 	
<p>FOUNDATION Disciplinary: <i>Core Idea</i></p>	<p>FOUNDATION Disciplinary: <i>Statement</i></p>	
<ul style="list-style-type: none"> ● HS-PS1.A Structure and Properties of Matter ● HS-PS1.B Chemical Reactions ● HS-PS2.B Types of Interactions ● HS-PS3.B Conservation of Energy and Energy Transfer ● HS-PS3.C Relationship Between Energy and Forces 	<p>Structure and Properties of Matter</p> <ul style="list-style-type: none"> ● Each atom has a charged substructure consisting of a nucleus, which is made of protons and neutrons, surrounded by electrons. (HS-PS1-1) ● The periodic table orders elements horizontally by the number of protons in the atom’s nucleus and places those with similar chemical properties in columns. The repeating patterns of this table reflect patterns of outer electron states. (HS-PS1-1)(HS-PS1-2) ● The structure and interactions of matter at the bulk scale are determined by electrical forces within and between atoms. (HS-PS1-3) <p>Chemical Reactions</p> <ul style="list-style-type: none"> ● The fact that atoms are conserved together with knowledge of the chemical properties of the elements 	<p>Essential Question/s:</p> <ul style="list-style-type: none"> ● What does the emission spectra of elements and electron configurations of atoms reveal about the structure and properties of atoms? ● How are the trends on the periodic table used to identify the atomic structure of elements and predict the properties of elements? ● How does atomic structure relate to bonding patterns? ● What impact does bond type have on the properties of a compound? <p>Activity Description:</p> <p>Science Lab Safety</p> <ul style="list-style-type: none"> ● POGIL Guided Inquiry Activity - Safety First <p>Atomic Structure</p> <ul style="list-style-type: none"> ● POGIL Guided Inquiry Activity - Classification of Matter ● Spotlight on “Nina Vedeneyeva” [LGBTQ+, DEI] ● Hands-On Activity - Exploring Physical and Chemical Changes ● Argument Driven Inquiry Lab - Identification of an Unknown Based on Physical Properties: What type of solution is the unknown liquid? ● Inquiry Lab - Elements: The Building Blocks of Matter ● Analyzing Data - Physical Properties of Gaseous Elements ● CER - Phase Change as a Physical Change ● Analyzing Data - Intensive and Extensive Properties ● Collaborative Group Project - Investigating the Development of the Atomic Theory [DEI]

	<p>involved, can be used to describe and predict chemical reactions (HS-PS1-7)</p> <p>Types of Interactions</p> <ul style="list-style-type: none"> • Newton’s law of universal gravitation and Coulomb’s law provide the mathematical models to describe and predict the effects of gravitational and electrostatic forces between distant objects. (HS-PS2-4) • Forces at a distance are explained by fields (gravitational, electric, and magnetic) permeating space that can transfer energy through space. Magnets or electric currents cause magnetic fields; electric charges or changing magnetic fields cause electric fields. (HS-PS2-4) <p>Relationship Between Energy and Forces</p> <ul style="list-style-type: none"> • When two objects interacting through a field change relative position, the energy stored in the field is changed. (HS-PS3-5) 	<ul style="list-style-type: none"> • POGIL Guided Inquiry Activity - Isotopes • Inquiry Lab - Bean Bag Isotopes • Analyzing Data - Explore Atomic Particles • Isotopes and Climate Change - How can the analysis of oxygen and carbon isotopes aid in our understanding of climate change? - Collaborative Group Activity [CLIMATE CHANGE] • POGIL Guided Inquiry Activity - Average Atomic Mass • Analyzing Data - Determine Atomic Mass • POGIL Guided Inquiry Activity -Electron Energy and Light • Inquiry Lab - Evaluate Atomic Spectra • CER - Emission Spectra of Elements • Hands-On Lab - Identifying Elements Using a Flame Test • Engineering Design Challenge - Build a Spectroscope from Household Materials • Inquiry Lab - Evaluate the Bohr Model of the Atom • Interactivity - The Quantum Mechanical Model and Atomic Orbitals • Spotlight on “Martin Gouterman” [LGBTQ+, DEI] • POGIL Guided Inquiry Activity - Electron Configurations • Inquiry Lab - Model Electron Configuration • Analyzing Data - Patterns in Electron Configuration <p>The Periodic Table</p> <ul style="list-style-type: none"> • Inquiry Lab - Develop a Periodic Table • Collaborative Group Activity - Getting to Know the Periodic Table • Spotlight on James Andrew Harris [Amistad, DEI] • Spotlight on Sir Humphrey Davy [LGBTQ+, DEI] • POGIL Guided Inquiry Activity - Cracking the Periodic Table Code • Analyzing Data - Graphing Periodic Properties • CER - Periodic Trends • Inquiry Lab - Elemental Metals, Nonmetals, and Metalloids • Interactivity - Periodic Properties • CER - Electron Configuration and Element Properties • Analyzing Data - Size Trends and Shielding Effect • POGIL Guided Inquiry Activity- Coulombic Attraction • Inquiry Lab - Periodic Trends and Properties • POGIL Guided Inquiry Activity - Periodic Trends • Virtual Lab - Predict Reactivity Using Periodic Trends • CER - Effective Nuclear Charge and Electron Shielding
<p>FOUNDATION Science and Engineering Practices: <i>Core Idea</i></p>	<p>FOUNDATION Science and Engineering Practices: <i>Statement</i></p>	
<ul style="list-style-type: none"> • SEP-2 Planning and Carrying Out Investigations • SEP-4 Developing and Using Mode 	<p>Planning and Carrying Out Investigations</p> <ul style="list-style-type: none"> • Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for 	

<ul style="list-style-type: none"> ● SEP-5 Constructing Explanations and Designing Solutions ● SEP-7 Using Mathematics and Computational Thinking 	<p>evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly. (HS- PS1-3)</p> <p>Developing and Using Models</p> <ul style="list-style-type: none"> ● Develop and use a model based on evidence to illustrate the relationships between systems or between components of a system. (HS-PS1-1) (HS-PS3-5) <p>Constructing Explanations and Designing Solutions</p> <ul style="list-style-type: none"> ● Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (HS-PS1-2) <p>Using Mathematics and Computational Thinking</p> <ul style="list-style-type: none"> ● Use mathematical representation of phenomena to support claims. (HS-PS1-7), (HS-PS2-4) 	<ul style="list-style-type: none"> ● Engineering Design Challenge - Growing Crystals in Gels <p>Chemical Bonding</p> <ul style="list-style-type: none"> ● Guided Inquiry Activity - Ions ● Inquiry Lab - Characteristics of Ionic Bonds ● Interactivity - Ions and Electroplating ● Modeling - Electron Dot Structures for Ionic Compounds ● Inquiry Lab - Investigate Metallic Bonds ● Analyzing Data - Patterns in Melting Points of Metals ● CER - Compare Metallic and ionic Structures ● Engineering Design Challenge - Evaluate Metals for a Commercial Application ● Inquiry Lab - Investigate Covalent Bonds ● Analyzing Data - Calculate Bond Polarity ● Argument Driven Inquiry Lab - Bond Character and Molecular Polarity ● Modeling - Electron Dot Structures for Molecular Substances ● Collaborative Group Activity - Lewis Structures ● Analyzing Data - Investigate Molecule Polarity ● Collaborative Group Activity - Chemical Bonds: What makes CO₂ a greenhouse gas, while O₂ and N₂ aren't? [CLIMATE CHANGE] ● POGIL Guided Inquiry Activity - Molecular Geometry ● Hands-on Activity - Modeling the Shapes of Molecules ● Inquiry Lab - Intermolecular Forces ● Virtual Lab - Intermolecular Forces in Liquids ● Argument Driven Inquiry Lab - Temperature Changes Due to Evaporation: Which of the available substances has the strongest intermolecular forces? ● CER - Compare Molecular Compound Properties ● Inquiry Lab - Chemical Names and Formulas ● Analyzing Data - Infer Rules for Naming Compounds ● POGIL Guided Inquiry Activity - Naming Molecular Compounds ● POGIL Guided Inquiry Activity - Naming Ionic Compounds ● POGIL Guided Inquiry Activity - Polyatomic Ions ● CER - Comparing Compound Nomenclature ● Analyzing Data - Infer Rules for Naming Acids ● POGIL Guided Inquiry Activity - Naming Acids <p>Interdisciplinary Connections:</p>
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<p>FOUNDATION Crosscutting Concepts: <i>Core Idea</i></p>	<p>FOUNDATION Crosscutting Concepts: <i>Statement</i></p>	<p>Connections to NJSLS – English Language Arts</p>
<ul style="list-style-type: none"> ● CCC-1 Patterns ● CCC-2 Cause and Effect ● CCC-5 Energy and Matter 	<p>Patterns</p> <ul style="list-style-type: none"> ● Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena. (HS-PS1-1), (HS-PS1-2), (HS-PS1-3), (HS-PS2-4) <p>Cause and Effect</p> <ul style="list-style-type: none"> ● Cause and effect relationships can be suggested and predicted for complex natural and human designed systems by examining what is known about smaller scale mechanisms within the system. (HS-PS3-5) <p>Energy and Matter</p> <ul style="list-style-type: none"> ● The total amount of energy and matter in closed systems is conserved. (HS-PS1-7) 	<ul style="list-style-type: none"> ● RST.9-10.7 Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words. (HS-PS1-1) ● RST.11-12.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. (HS- PS1-3) ● WHST.9-12.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. (HS-PS1-2) ● WHST.9-12.5 Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience. (HS-PS1-2) ● WHST.9-12.7 Conduct short as well as more sustained research projects to answer a question (including a self- generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. (HS-PS1-3) (HS-PS3-5) ● WHST.9-12.8 Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation. (HS-PS1-3)(HS-PS3-5) ● WHST.9-12.9 Draw evidence from informational texts to support analysis, reflection, and research. (HS-PS1-3)(HS-PS3-5) ● SL.11-12.5 Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest. (HS-PS3-5)
<p>Social and Emotional Learning: <i>Competencies</i></p>	<p>Social and Emotional Learning: <i>Sub-Competencies</i></p>	
<ul style="list-style-type: none"> ● Self-Awareness ● Self-Management ● Social Awareness ● Responsible Decision-Making ● Relationship Skills 	<ul style="list-style-type: none"> ● Recognize one’s feelings and thoughts ● Recognize the impact of one’s feelings and thoughts on one’s own behavior ● Understand and practice strategies for managing one’s own emotions, thoughts, and behaviors 	

	<ul style="list-style-type: none"> Recognize and identify the thoughts, feelings, and perspectives of others Demonstrate an awareness of the differences among individuals, groups, and others' cultural background Develop, implement, and model effective problem-solving and critical thinking skills Establish and maintain healthy relationships Utilize positive communication and social skills to interact effectively with others 	<p>Connections to NJSL – Mathematics</p> <ul style="list-style-type: none"> MP.2 Reason abstractly and quantitatively. (HS-PS1-7)(HS-PS2-4)(HS-PS3-5) MP.4 Model with mathematics. (HS-PS2-4)(HS-PS3-5) HSN-Q.A.1 Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. (HS-PS1-2)(HS-PS1-3)(HS-PS1-7)(HS-PS2-4) HSN-Q.A.2 Define appropriate quantities for the purpose of descriptive modeling (HS-PS1-7)(HS-PS2-4) HSN-Q.A.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (HS-PS1-2)(HS-PS1-3)(HS-PS1-7) 	
<p>Assessments (Formative) <i>To show evidence of meeting the standard/s, students will successfully engage within:</i></p>		<p>Assessments (Summative) <i>To show evidence of meeting the standard/s, students will successfully complete:</i></p>	
<p>Formative Assessments:</p> <ul style="list-style-type: none"> Guided Inquiry Activities CER Tasks Virtual Labs Data Analysis Activities Group Discussions Lab Notebook Experience Notebook Engineering Design Challenges Lesson Checks Lesson Quizzes 		<p>Benchmarks:</p> <ul style="list-style-type: none"> Chemistry Diagnostic Assessment Chemistry District Assessments <p>Summative Assessments:</p> <ul style="list-style-type: none"> Unit Assessment - Science Lab Safety Unit Assessment - Atomic Structure Unit Assessment - The Periodic Table Unit Assessment - Chemical Bonding Collaborative Group Project(s) 	
<p>Differentiated Student Access to Content: Teaching and Learning Resources/Materials</p>			
<p>Core Resources</p>	<p>Alternate Core Resources <i>IEP/504/At-Risk/ESL</i></p>	<p>ELL Core Resources</p>	<p>Gifted & Talented Core Resources</p>
<ul style="list-style-type: none"> Experience Chemistry TE Experience Chemistry SE POGIL Activities for High 	<ul style="list-style-type: none"> Auditory Aids Visual Aids Science Glossary and 	<ul style="list-style-type: none"> Multilingual Science Glossary and Thesaurus Picture Glossary 	<ul style="list-style-type: none"> Chemistry for the Gifted and Talented Crash Course

<p>School Chemistry</p> <ul style="list-style-type: none"> • Argument Driven Inquiry in Chemistry: Lab Investigations for Grades 9-12 • Student Chromebooks • Evidence Notebooks 	<p>Thesaurus</p> <ul style="list-style-type: none"> • Picture Glossary • Manipulatives • Virtual Nerd 	<ul style="list-style-type: none"> • BrainPOP ELL • Khan Academy En Español 	
Supplemental Resources			
<p>Technology:</p> <ul style="list-style-type: none"> • Schoology • Google Apps for Education • SMARTBoard • Calculators <p>Other:</p> <ul style="list-style-type: none"> • Teacher created video tutorials • American Association for the Advancement of Science • American Chemical Society • Concord Consortium: Virtual Simulations • International Technology and Engineering Educators Association • National Earth Science Teachers Association • National Science Digital Library • National Science Teachers Association • North American Association for Environmental Education • Phet: Interactive Simulations • Science NetLinks 			
Differentiated Student Access to Content: Recommended <i>Strategies & Techniques</i>			
Core Resources	Alternate Core Resources <i>IEP/504/At-Risk/ESL</i>	ELL Core Resources	Gifted & Talented Core
<ul style="list-style-type: none"> • Restructure lessons using UDL principles • Structure lessons around questions that are authentic, relate to students' interests, social/family background and knowledge of their community 	<ul style="list-style-type: none"> • Utilize a multi-sensory (VAKT) approach during instruction • Provide alternate presentations of skills by varying the method (repetition, simple 	<ul style="list-style-type: none"> • Provide extended time • Provide preferential seating as needed • Provide positive reinforcement • Check often for understanding of and/or review of course objectives 	<ul style="list-style-type: none"> • Create an enhanced set of introductory activities • Implement a multi-level and multi-dimensional curriculum • Create tiered assignments

<ul style="list-style-type: none"> • Provide students with multiple choices for how they can represent their understandings • Provide opportunities for students to connect with people of similar backgrounds • Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures • Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understanding • Use project-based science learning to connect science with observable phenomena • Structure learning around explaining or solving a social or community-based issue • Collaborate with after-school programs or clubs to extend learning opportunities 	<p>explanations, additional examples, modeling, etc.)</p> <ul style="list-style-type: none"> • Modify test content and/or format • Allow students to retake test or make corrections to test for additional credit • Provide extended time • Provide preferential seating as needed • Review, restate and repeat directions • Provide study guides, and/or break assignments into segments of shorter tasks • Deliver instruction utilizing varied learning styles including audio, visual, and tactile/kinesthetic • Provide individual instruction as needed • Provide modified assessments and/or rubrics when needed 	<ul style="list-style-type: none"> • Provide oral/visual directions/prompts when necessary • Provide students with multiple literacy strategies • Provide supplemental materials including use of an online bilingual dictionary • Offer choices of what students can say when they are called on and aren't sure how to respond • Integrate project-based learning to enhance hands-on activities, peer interaction, rich language use, and opportunities to explore personal interests • Provide modified assessments and/or rubrics when needed • Repeat instructions as needed • Provide individual instruction as needed 	<ul style="list-style-type: none"> • Integrate active teaching/learning opportunities • Incorporate authentic components • Propose interest-based extension activities • Infuse enrichment activities • Build in time for flexible learning groups • Embrace creative questioning • Explore many points of view about contemporary topics and allow opportunity to analyze and evaluate materia • lEncourage self directed learning • Connect students to related talent development opportunities
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<p>NJSLS CAREER READINESS, LIFE LITERACIES & KEY SKILLS</p>	<p>Disciplinary Concept:</p>	
	<p><i>Core Ideas:</i></p>	<p>Creativity and Innovation</p> <ul style="list-style-type: none"> • With a growth mindset, failure is an important part of success. <p>Critical Thinking and Problem-solving</p> <ul style="list-style-type: none"> • Collaboration with individuals with diverse experiences can aid in the problem-solving process, particularly for global issues where diverse solutions are needed. <p>Global and Cultural Awareness</p>

		<ul style="list-style-type: none"> Solutions to the problems faced by a global society require the contribution of individuals with different points of view and experiences. Digital tools such as artificial intelligence, image enhancement and analysis, and sophisticated computer modeling and simulation create new types of information that may have profound effects on society. These new types of information must be evaluated carefully. <p>Information and Media Literacy</p> <ul style="list-style-type: none"> Digital tools such as artificial intelligence, image enhancement and analysis, and sophisticated computer modeling and simulation create new types of information that may have profound effects on society. These new types of information must be evaluated carefully. In order for members of our society to participate productively, information needs to be shared accurately and ethically. Accurate information may help in making valuable and ethical choices.
	<p><i>Performance Expectation/s:</i></p>	<p>Creativity and Innovation</p> <ul style="list-style-type: none"> 9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a). <p>Critical Thinking and Problem-solving</p> <ul style="list-style-type: none"> 9.4.12.CT.1: Identify problem-solving strategies used in the development of an innovative product or practice (e.g., 1.1.12acc.C1b, 2.2.12.PF.3). 9.4.12.CT.3: Enlist input from a variety of stakeholders (e.g., community members, experts in the field) to design a service learning activity that addresses a local or global issue (e.g., environmental justice). <p>Global and Cultural Awareness</p> <ul style="list-style-type: none"> 9.4.12.GCA.1: Collaborate with individuals to analyze a variety of potential solutions to climate change effects and determine why some solutions (e.g., political, economic, cultural) may work better than others (e.g., SL.11-12.1., HS-ETS1-1, HS-ETS1-2, HS-ETS1-4, 6.3.12.GeoGI.1, 7.1.IH.IPERS.6, 7.1.IL.IPERS.7, 8.2.12.ETW.3). <p>Information and Media Literacy</p> <ul style="list-style-type: none"> 9.4.12.IML.3: Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions (e.g., S-ID.B.6a.,

		<p>8.1.12.DA.5, 7.1.IH.IPRET.8)</p> <ul style="list-style-type: none"> 9.4.12.IML.5: Evaluate, synthesize, and apply information on climate change from various sources appropriately (e.g., 2.1.12.CHSS.6, S.IC.B.4, S.IC.B.6, 8.1.12.DA.1, 6.1.12.GeoHE.14.a, 7.1.AL.PRSNT.2). 9.4.12.IML.7: Develop an argument to support a claim regarding a current workplace or societal/ethical issue such as climate change (e.g., NJLSA.W1, 7.1.AL.PRSNT.4).
	Career Readiness, Life Literacies, & Key Skills Practices	
	<ul style="list-style-type: none"> Act as a responsible and contributing community member and employee. Attend to financial well-being. Consider the environmental, social and economic impacts of decisions. Demonstrate creativity and innovation. Utilize critical thinking to make sense of problems and persevere in solving them. Model integrity, ethical leadership and effective management. Plan education and career paths aligned to personal goals. Use technology to enhance productivity, increase collaboration and communicate effectively. Work productively in teams while using cultural/global competence. 	

New Jersey Legislative Statutes and Administrative Code
(place an "X" before each law/statute if/when present within the curriculum map)

X	Amistad Law: <i>N.J.S.A. 18A 52:16A-88</i>		Holocaust Law: <i>N.J.S.A. 18A:35-28</i>	X	LGBT and Disabilities Law: <i>N.J.S.A. 18A:35-4.35</i>	X	Diversity & Inclusion: <i>N.J.S.A. 18A:35-4.36a</i>	X	Standards in Action: <i>Climate Change</i>
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