

Ocean Academy Charter High School
Curriculum Guide
Grade 10-11



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Ocean Academy Charter High School Chemistry Curriculum	
Content Area: Science	
Course Title: Chemistry	Grade Level: 10th - 11th Grade
Unit 1: Structure and Properties of Matter	18 Days
Unit 2: The Chemistry of Abiotic Systems	12 Days
Unit 3: Bonding and Chemical Reactions	18 Days
Unit 4: Matter and Energy in Living Systems	12 Days
Unit 5: Nuclear Chemistry	15 Days
Unit 6: Human Impact - The Chemistry of Sustainability	15 Days

Course Introduction:

Chemistry is the study of matter, its properties, and the interactions and transformations that occur between substances. In this high school Chemistry course, students develop an understanding of the structure and behavior of matter by investigating chemical phenomena through laboratory investigations, models, simulations, data analysis, and evidence-based scientific reasoning. Students explore how the arrangement and movement of particles at the atomic and molecular level can be used to explain the observable properties of substances at the macroscopic level.

Students investigate the structure of atoms, the organization of the periodic table, and the relationships between atomic structure and the physical and chemical properties of elements. The periodic table is used as a tool to identify patterns, make predictions, and explain trends in the behavior of elements and compounds. Students examine how atoms interact through different types of chemical bonding and how these interactions influence the properties and behavior of matter.

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A major focus of the course is the study of chemical reactions. Students use models and evidence to understand how atoms are rearranged during chemical reactions and how molecular collisions contribute to reaction processes. They investigate factors that affect reaction rates, including temperature, concentration, surface area, and catalysts, and use quantitative relationships to analyze chemical reactions. Students also explore how matter and energy are conserved throughout chemical processes.

Energy is examined at both the macroscopic and microscopic levels. Students develop an understanding that changes in a system's energy result from energy being transferred into or out of the system. They investigate how energy is associated with the motion and arrangement of particles and how energy changes can be observed during physical and chemical processes. Through laboratory investigations and data analysis, students use evidence to explain and predict energy changes in chemical systems.

Throughout the course, students apply mathematical reasoning, scientific practices, and technology to analyze data, construct and revise models, communicate scientific explanations, and solve problems. Students also apply principles of engineering and optimization to chemical systems by designing, testing, evaluating, and improving solutions to real-world problems involving chemical reactions and materials. Emphasis is placed on connecting chemistry to everyday life, environmental issues, technology, health, industry, and other STEM fields.

By the end of the course, students will have developed a deeper understanding of how matter behaves at the atomic and molecular level and how these microscopic interactions explain the world they observe. Students will use evidence, models, mathematical relationships, and scientific reasoning to investigate chemical questions, explain phenomena, and make informed predictions about chemical systems.

The Chemistry curriculum meets the requirements of the Next Generation Science Standards and helps to prepare students to meet and exceed the standards assessed by the NJDOE state assessments through higher order application of various skills required for complete understanding of chemistry.

Honors Course Description:

Honors Chemistry is a rigorous, comprehensive course designed to provide students with a strong foundation in the fundamental principles and practices of chemistry. The course emphasizes the relationship between atomic and molecular structure, the properties and behavior of matter, chemical bonding, chemical reactions, energy changes, and the factors that influence chemical systems. Students use models, investigations, simulations, mathematical relationships, and data analysis to develop evidence-based explanations of chemical phenomena.

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The Honors curriculum places a strong emphasis on quantitative reasoning, problem solving, and the application of mathematical concepts to chemical situations. Students analyze and interpret data, perform calculations, evaluate experimental results, construct and revise models, and use evidence to support scientific conclusions. Topics include atomic structure and periodic trends, chemical bonding and molecular structure, nomenclature, chemical reactions and stoichiometry, gases and solutions, thermochemistry, reaction rates, equilibrium, acids and bases, and nuclear chemistry.

Laboratory investigations are an integral component of the course. Students engage in frequent hands-on experiments that reinforce conceptual understanding while developing skills in measurement, laboratory safety, experimental design, data collection, analysis, and scientific communication. Students are expected to apply critical thinking and problem-solving strategies to unfamiliar chemical situations and to connect classroom concepts to real-world applications in science, technology, engineering, medicine, environmental science, and industry.

The Honors course is intended for students who are prepared for an accelerated pace, increased depth of content, and greater independence in mathematical and scientific problem solving. Through the integration of laboratory experiences, technology, quantitative analysis, and scientific inquiry, students develop the knowledge and skills necessary for continued study in chemistry and other STEM-related disciplines.

Ocean Academy Charter High School Unit 1 Overview	
Content Area: Science	Unit 1: Structure and Properties of Matter
Target Course/Grade Levels: Chemistry 10-11	Duration: 18 Days
Unit 1 Introduction:	
In this unit of study, students develop an understanding of how the structure and arrangement of atoms and molecules influence the properties and behavior of matter. Students investigate the subatomic structure of atoms and use evidence, models, simulations, and investigations to explain how atomic-level interactions result in observable properties of substances. The periodic table serves as an important tool for identifying patterns, explaining periodic trends, and predicting the physical and chemical properties of elements. Students apply their understanding of atomic and molecular structure to explore chemical bonding and chemical reactions. They use particle-level models to explain how atoms are rearranged during chemical reactions and how molecular collisions influence the rate at which reactions occur. Students investigate the factors that affect reaction rates and examine energy	

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changes associated with chemical processes, developing explanations that connect observable changes to interactions occurring at the molecular level.

Throughout the unit, students communicate scientific and technical information to explain how molecular-level structure and composition contribute to the function and performance of materials. Students make connections between the structure of substances and their uses in designed materials, technologies, and real-world applications. They evaluate how changes in structure can affect a material's properties and consider how scientific knowledge can be applied to the development and improvement of chemical systems and solutions.

Students engage in a variety of science and engineering practices, including developing and using models, planning and conducting investigations, analyzing and interpreting data, applying mathematical reasoning, constructing evidence-based explanations, and designing and evaluating solutions. These practices allow students to investigate chemical phenomena, test ideas, revise their thinking, and communicate their conclusions using appropriate scientific evidence and reasoning.

The unit is organized around key crosscutting concepts, including *structure and function*, *patterns*, *energy and matter*, and *stability and change*. Students use these concepts as lenses for connecting individual chemistry topics and developing a broader understanding of how matter and chemical systems behave. By integrating disciplinary core ideas with science and engineering practices and crosscutting concepts, students demonstrate their ability to explain chemical phenomena, make predictions, analyze evidence, and apply chemistry to real-world problems.

This unit is based on HS-PS1-1, HS-PS1-2, HS-PS1-3, HS-PS2-6, HS-ETS1-3, and HS-ETS1-4.

Standard 9.1 Personal Financial Literacy: This standard outlines the important fiscal knowledge, habits, and skills that must be mastered in order for students to make informed decisions about personal finance. Financial literacy is an integral component of a student's college and career readiness, enabling students to achieve fulfilling, financially-secure, and successful careers.

Standard 9.2 Career Awareness, Exploration, Preparation and Training. This standard outlines the importance of being knowledgeable about one's interests and talents, and being well informed about postsecondary and career options, career planning, and career requirements.

Standard 9.4 Life Literacies and Key Skills. This standard outline key literacies and technical skills such as critical thinking, global and cultural awareness, and technology literacy* that are critical for students to develop to live and work in an interconnected global economy.

Standard 8.1 Computer Science

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Computer Science outlines a comprehensive set of concepts and skills, such as data and analysis, algorithms and programming, and computing systems.

Standard 8.2 Design Thinking

Technology, outlines the technological design concepts and skills essential for technological and engineering literacy. The framework design includes Engineering Design, Ethics and Culture, and the Effects of Technology on the Natural world among the disciplinary concepts

Amistad Law: N.J.S.A.

18A 52:16A-88 Every board of education shall incorporate the information regarding the contributions of African-Americans to our country in an appropriate place in the curriculum of elementary and secondary school students.

Holocaust Law: N.J.S.A.

18A:35-28 Every board of education shall include instruction on the Holocaust and genocide in an appropriate place in the curriculum of all elementary and secondary school pupils. The instruction shall further emphasize the personal responsibility that each citizen bears to fight racism and hatred whenever and wherever it happens.

LGBT and Disabilities Law:

N.J.S.A. 18A:35-4.35 A board of education shall include instruction on the political, economic, and social contributions of persons with disabilities and lesbian, gay, bisexual, and transgender people, in an appropriate place in the curriculum of middle school and high school students as part of the district's implementation of the New Jersey Student Learning Standards
(N.J.S.A.18A:35-4.36) A board of education shall have policies and procedures in place pertaining to the selection of instructional materials to implement the requirements of N.J.S.A. 18A:35-4.35.

Diversity and Inclusion

C.18A:35-4.36a Curriculum to include instruction on diversity and inclusion.

1. The instruction shall:

- (1) highlight and promote diversity, including economic diversity, equity, inclusion, tolerance, and belonging in connection with gender and sexual orientation, race and ethnicity, disabilities, and religious tolerance;
- (2) examine the impact that unconscious bias and economic disparities have at both an individual level and on society as a whole; and
- (3) encourage safe, welcoming, and inclusive environments for all students regardless of race or ethnicity, sexual and gender identities, mental and physical disabilities, and religious beliefs.

Asian Americans and Pacific Islanders (AAPI)

Ensures that the contributions, history, and heritage of Asian Americans and Pacific Islanders (AAPI) are included in the New Jersey Student Learning Standards (NJSLs) for Social Studies in

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kindergarten through Grade 12 (P.L.2021, c.416).

21st Century Themes and Skills

“Twenty-first century themes and skills” means themes such as global awareness; financial, economic, business, and entrepreneurial literacy; civic literacy; health literacy; learning and innovation skills, including creativity and innovation, critical thinking and problem solving, and communication and collaboration; information, media, and technology skills; and life and career skills, including flexibility. Career readiness, life literacies, and key skills education provides students with the necessary skills to make informed career and financial decisions, engage as responsible community members in a digital society, and to successfully meet the challenges and opportunities in an interconnected global economy.”

Unit 1 Focus Standards

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. [Clarification Statement: Examples of properties that could be predicted from patterns could include reactivity of metals, types of bonds formed, numbers of bonds formed, and reactions with oxygen.] [Assessment Boundary: Assessment is limited to main group elements. Assessment does not include quantitative understanding of ionization energy beyond relative trends.]

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. [Clarification Statement: Examples of chemical reactions could include the reaction of sodium and chlorine, of carbon and oxygen, or of carbon and hydrogen.] [Assessment Boundary: Assessment is limited to chemical reactions involving main group elements and combustion reactions.]

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. [Clarification Statement: Emphasis is on understanding the strengths of forces between particles, not on naming specific intermolecular forces (such as dipole-dipole). Examples of particles could include ions, atoms, molecules, and networked materials (such as graphite). Examples of bulk properties of substances could include the melting point and boiling point, vapor pressure, and surface tension.] [Assessment Boundary: Assessment does not include Raoult’s law calculations of vapor pressure.]

HS-PS2-6: Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials. [Clarification Statement: Emphasis is on the attractive and repulsive forces that determine the functioning of the material. Examples could include why electrically conductive materials are often made of metal, flexible but durable materials are made up of long chained molecules, and pharmaceuticals are designed to interact with specific receptors.] [Assessment Boundary: Assessment is limited to provided molecular structures of specific designed materials.]

HS-ETS1-3: Evaluate a solution to a complex real-world problem based on prioritized criteria and

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trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.

HS-ETS1-4: Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Developing and Using Models Modeling in 9-12 builds on K-8 and progresses to using, synthesizing, and developing models to predict and show relationships among variables between systems and their components in the natural and designed worlds. Use a model to predict the relationships between systems or between components of a system. (HS-PS1-1) Using Mathematical and Computational Thinking Mathematical and computational thinking in 9-12 builds on K-8 experiences and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions including trigonometric functions, exponentials and logarithms, and computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical	PS1.A: Structure and Properties of Matter - 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) - The structure and interactions of matter at the bulk scale are determined by electrical forces within and between atoms. (secondary to	Patterns - 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-PS1-5) Structure and Function - Investigating or designing new systems or structures requires a detailed examination of the properties of different materials, the structures of different components, and connections of components to reveal its function and/or solve a problem. (HS-PS2-6) Systems and System Models - Models (e.g., physical, mathematical, computer models) can be used to simulate systems and interactions—including energy, matter, and information flows— within and between systems at

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models of basic assumptions. - Use mathematical models and/or computer simulations to predict the effects of a design solution on systems and/or the interactions between systems. (HS-ETS1-4) Planning and Carrying Out Investigations Planning and carrying out investigations in 9-12 builds on K-8 experiences and progresses to include investigations that provide evidence for and test conceptual, mathematical, physical, and empirical models. - Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for 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) Constructing Explanations and Designing Solutions Constructing explanations and designing solutions in 9-12 builds on K-8	HS-PS2-6) PS1.B: Chemical Reactions - The fact that atoms are conserved, together with knowledge of the chemical properties of the elements involved, can be used to describe and predict chemical reactions. (HS-PS1-2) PS2.B: Types of Interactions - Attraction and repulsion between electric charges at the atomic scale explain the structure, properties, and transformations of matter, as well as the contact forces between material objects. (secondary to HSPS1-1), (secondary to HS-PS1-3), (HS-PS2-6), (secondary to HS-PS1-1), (secondary to HS-PS1-3) ETS1.B: Developing Possible Solutions - When evaluating solutions, it is important to take into account a range of constraints, including cost, safety, reliability, and aesthetics, and to consider social, cultural, and environmental impacts. (HS-ETS1-3) - Both physical models and computers can be used in various ways to aid in the engineering design	different scales. (HS-ETS1-4) ----- <i>Connections to Engineering, Technology, and Applications of Science</i> <i>Influence of Science, Engineering, and Technology on Society and the Natural World</i> New technologies can have deep impacts on society and the environment, including some that were not anticipated. Analysis of costs and benefits is a critical aspect of decisions about technology. (HS-ETS1-1), (HS-ETS1-3)
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experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories. • 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) • Evaluate a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and trade-off considerations. (HS-ETS1-3) Obtaining, Evaluating, and Communicating Information Obtaining, evaluating, and communicating information in 9-12 builds on K-8 and progresses to evaluating the validity and reliability of the claims, methods, and designs.	process. Computers are useful for a variety of purposes, such as running simulations to test different ways of solving a problem or to see which one is most efficient or economical; and in making a persuasive presentation to a client about how a given design will meet his or her needs. (HS-ETS1-4)	
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- Communicate scientific and technical information (e.g. about the process of development and the design and performance of a proposed process or system) in multiple formats (including orally, graphically, textually, and mathematically). (HS-PS2-6)

Interdisciplinary Connections Supporting and Additional Standards Unit 1

[New Jersey Student Learning Standards-Mathematics](#)

[New Jersey Student Learning Standards-ELA](#)

Connections to other DCIs in grades 9-12: • HS.PS3.B (HS-PS1-4), (HS-PS1-6), (HS-PS1-7), (HS-PS1-8) • HS.LS1.C (HS-PS1-1), (HS-PS1-2), (HS-PS1-4), (HS-PS1-7) • HS.ESS2.C (HS-PS1-2), (HS-PS1-3)

Articulation of DCIs across grade levels: • MS.PS1.A (HS-PS1-1), (HS-PS1-2), (HS-PS1-3), (HS-PS1-4), (HS-PS1-5), (HS-PS1-7), (HS-PS1-8), (HS-PS2-6) • MS.PS1.B (HS-PS1-1), (HS-PS1-2), (HS-PS1-4), (HS-PS1-5), (HS-PS1-6), (HS-PS1-7), (HS-PS1-8) • MS.PS2.B (HS-PS1-3), (HS-PS1-4), (HS-PS1-5), (HS-PS2-4), (HS-PS2-5), (HS-PS2-6) • MS.ETS1.A (HS-ETS1-1), (HS-ETS1-2), (HS-ETS1-3), (HS-ETS1-4) • MS.ETS1.B (HS-ETS1-2), (HS-ETS1-3), (HS-ETS1-4) • MS.ETS1.C (HS-ETS1-2), (HS-ETS1-4)

Connections to HS-ETS1.C: Optimizing the Design Solution: • Physical Science: HS-PS1-6, HS-PS2-3

ELA/Literacy -

RI.CR.11-12.1. Accurately cite a range of thorough textual evidence and make relevant connections to strongly support a comprehensive analysis of multiple aspects of what an informational text says explicitly and inferentially, as well as interpretations of the text. (HS-PS1-3), (HS-PS1-5), (HS-PS2-1), (HS-PS2-6)

RI.MF.11-12.6. Synthesize complex information across multiple sources and formats to develop ideas, resolve conflicting information, or develop an interpretation that goes beyond explicit text

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information (e.g., express a personal point of view, new interpretation of the concept). (HS-ETS1-1), (HS-ETS1-3)

RI.AA.9-10.7. Describe and evaluate the argument and specific claims in an informational text, assessing whether the reasoning is valid and the evidence is relevant and sufficient; identify false statements and reasoning. (HS-ETS1-1), (HS-ETS1-3)

W.IW.9-10.2. Write informative/explanatory texts (including the narration of historical events, scientific procedures/ experiments, or technical processes) to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content.

Introduce a topic; organize complex ideas, concepts, and information to make important connections and distinctions; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aid in comprehension.

- A. Develop the topic with well-chosen, relevant, and sufficient facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience's knowledge of the topic.
- B. Use appropriate and varied transitions to link the major sections of the text, create cohesion, and clarify the relationships among complex ideas and concepts.
- C. Use precise language and domain-specific vocabulary to manage the complexity of the topic.
- D. Establish and maintain a style and tone appropriate to the audience and purpose (e.g., formal and objective for academic writing) while attending to the norms and conventions of the discipline in which they are writing.
- E. Provide a concluding paragraph or section that supports the information or explanation presented (e.g., articulating implications or the significance of the topic). (HS-PS1-2), (HS-PS1-5), (HS-PS2-6)

W.WP.9-10.4. Develop and strengthen writing as needed by planning, revising, editing, rewriting, trying a new approach; sustaining effort to complete complex writing tasks; seeking out feedback and reflecting on personal writing progress; consulting a style manual (such as MLA or APA Style), focusing on addressing what is most significant for a specific purpose and audience.. (HS-PS1-2)

W.WR.9-10.5. 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-PS1-6)

W.SE.9-10.6. Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation (MLA or APA Style Manuals). (HS-PS1-3)

Mathematics -

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- **HSN-Q.A.1B:** 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-PS1-4), (HS-PS1-5), (HS-PS1-7), (HS-PS1-8), (HS-PS2-1), (HS-PS2-2), (HS-PS2-4), (HS-PS2-5), (HS-PS2-6)
- **HSN-Q.A.2:** Define appropriate quantities for the purpose of descriptive modeling. (HS-PS2-1), (HS-PS2-2), (HS-PS2-4), (HS-PS2-5), (HS-PS2-6)
- **HSN-Q.A.3:** Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (HS-PS1-2), (HS-PS1-3), (HS-PS1-4), (HS-PS1-5), (HS-PS1-7), (HS-PS1-8)
- **MP.2:** Reason abstractly and quantitatively. (HS-ETS1-1), (HS-ETS1-3), (HS-ETS1-4)
- **MP.4:** Model with mathematics. (HS-ETS1-1), (HS-ETS1-2), (HS-ETS1-3), (HS-ETS1-4)

Unit 1 New Jersey Student Learning Standards Connections: [Career Readiness, Life Literacies, and Key Skills](#)

Disciplinary Concepts

Career Awareness and Planning (9.2)

Creativity and Innovations (9.4)

Critical Thinking and Problem-solving (9.4)

Digital Citizenship (9.4)

Global and Cultural Awareness (9.4)

Information and Media Literacy (9.4)

Core Ideas

Performance Expectations

(Identified with Standard Number and Statement)

There are strategies to improve one's professional value and marketability.

- 9.2.12.CAP.2: Develop college and career readiness skills by participating in opportunities such as structured learning experiences, apprenticeships, and dual enrollment programs.
- 9.2.12.CAP.3: Investigate how continuing education contributes to one's career and personal growth.

Career planning requires purposeful planning based on research, self-knowledge, and informed choices.

- 9.2.12.CAP.4: Evaluate different careers and develop various plans (e.g., costs of public, private, training schools) and timetables for achieving them, including educational/training requirements, costs, loans, and debt repayment.

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	● 9.2.12.CAP.5: Assess and modify a personal plan to support current interests and postsecondary plans. ● 9.2.12.CAP.6: Identify transferable skills in career choices and design alternative career plans based on those skills. ● 9.2.12.CAP.8: Determine job entrance criteria (e.g., education credentials, math/writing/reading comprehension tests, drug tests) used by employers in various industry sectors.
An individual's income and benefit needs and financial plan can change over time.	● 9.2.12.CAP.13: Analyze how the economic, social, and political conditions of a time period can affect the labor market.
With a growth mindset, failure is an important part of success	● 9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a).
Innovative ideas or innovation can lead to career opportunities.	● 9.4.12.CI.2: Identify career pathways that highlight personal talents, skills, and abilities (e.g., 1.4.12prof.CR2b, 2.2.12.LF.8) ● 9.4.12.CI.3: Investigate new challenges and opportunities for personal growth, advancement, and transition (e.g., 2.1.12.PGD.1).
Collaboration with individuals with diverse experiences can aid in the problem-solving process, particularly for global issues where diverse solutions are needed.	● 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.2: Explain the potential benefits of collaborating to enhance critical thinking and problem solving (e.g., 1.3E.12profCR3.a). ● 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). ● 9.4.12.CT.4: Participate in online strategy and planning sessions for course-based, school-based, or other projects and determine the strategies that contribute to effective outcomes.

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Laws govern the use of intellectual property and there are legal consequences to utilizing or sharing another's original works without permission or appropriate credit.	9.4.12.DC.1: Explain the beneficial and harmful effects that intellectual property laws can have on the creation and sharing of content (e.g., 6.1.12.CivicsPR.16.a). 9.4.12.DC.2: Compare and contrast international differences in copyright laws and ethics.
Digital communities influence many aspects of society, especially the workforce. The increased connectivity between people in different cultures and different career fields have changed the nature, content, and responsibilities of many careers.	9.4.12.DC.7: Evaluate the influence of digital communities on the nature, content and responsibilities of careers, and other aspects of society (e.g., 6.1.12.CivicsPD.16.a).
Network connectivity and computing capability extended to objects, sensors and everyday items not normally considered computers allows these devices to generate, exchange, and consume data with minimal human intervention. Technologies such as Artificial Intelligence (AI) and blockchain can help minimize the effect of climate change.	9.4.12.DC.8: Explain how increased network connectivity and computing capabilities of everyday objects allow for innovative technological approaches to climate protection.
Solutions to the problems faced by a global society require the contribution of individuals with different points of view and experiences.	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).
Advanced search techniques can be used with digital and media resources to locate information and to check the credibility and the expertise of sources to answer questions, solve problems, and inform the decision-making.	9.4.12.IML.2: Evaluate digital sources for timeliness, accuracy, perspective, credibility of the source, and relevance of information, in media, data, or other resources (e.g., NJSLA.W8, Social Studies Practice: Gathering and Evaluating Sources.
In order for members of our society to participate productively, information needs to be shared accurately and ethically	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). •

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	9.4.12.IML.6: Use various types of media to produce and store information on climate change for different purposes and audiences with sensitivity to cultural, gender, and age diversity (e.g., NJSLSA.SL5).
Unit 1 New Jersey Student Learning Standards: Computer Science and Design Thinking	
Disciplinary Concepts Impacts of Computing (8.1) Data & Analysis (8.1) Engineering Design (8.2) Interaction of Technology and Humans (8.2) Effects of Technology on the Natural World (8.2)	
Core Ideas	
The design and use of computing technologies and artifacts can positively or negatively affect equitable access to information and opportunities.	8.1.12.IC.1: Evaluate the ways computing impacts personal, ethical, social, economic, and cultural practices. 8.1.12.IC.3: Predict the potential impacts and implications of emerging technologies on larger social, economic, and political structures, using evidence from credible sources.
Large data sets can be transformed, generalized, simplified, and presented in different ways to influence how individuals interpret and understand the underlying information.	8.1.12.DA.5: Create data visualizations from large data sets to summarize, communicate, and support different interpretations of real-world phenomena.
Engineering design is a complex process in which creativity, content knowledge, research, and analysis are used to address local and global problems.	8.2.12.ED.1: Use research to design and create a product or system that addresses a problem and make modifications based on input from potential consumers. 8.2.12.ED.4: Design a product or system that addresses a global problem and document decisions made based on research, constraints, trade-offs, and aesthetic and ethical considerations and share this information with an appropriate audience.
Engineering design evaluation, a process for determining how well a solution meets	8.2.12.ED.5: Evaluate the effectiveness of a product or system based on factors that are

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requirements, involves systematic comparisons between requirements, specifications, and constraints.	related to its requirements, specifications, and constraints (e.g., safety, reliability, economic considerations, quality control, environmental concerns, manufacturability, maintenance and repair, ergonomics). 8.2.12.ED.6: Analyze the effects of changing resources when designing a specific product or system (e.g., materials, energy, tools, capital, labor).
Changes caused by the introduction and use of a new technology can range from gradual to rapid and from subtle to obvious, and can change over time. These changes may vary from society to society as a result of differences in a society's economy, politics, and culture.	8.2.12.ITH.2: Propose an innovation to meet future demands supported by an analysis of the potential costs, benefits, trade-offs, and risks related to the use of the innovation. 8.2.12.ITH.3: Analyze the impact that globalization, social media, and access to open source technologies has had on innovation and on a society's economy, politics, and culture.
Development and modification of any technological system needs to take into account how the operation of the system will affect natural resources and ecosystems. Impacts of technological systems on the environment need to be monitored and must inform decision-making. Many technologies have been designed to have a positive impact on the environment and to monitor environmental change over time.	8.2.12.ETW.1: Evaluate ethical considerations regarding the sustainability of environmental resources that are used for the design, creation, and maintenance of a chosen product. 8.2.12.ETW.2: Synthesize and analyze data collected to monitor the effects of a technological product or system on the environment. 8.2.12.ETW.3: Identify a complex, global environmental or climate change issue, develop a systemic plan of investigation, and propose an innovative sustainable solution.
New Jersey Student Learning Standards: Climate Change Mandate	
Core Ideas	Performance Expectations (Identified with Standard Number and Statement)
Unit 1 Evidence of Student Learning	
Performance Tasks/Use of Technology: Laboratory Safety and Measurement: Complete an introductory laboratory safety investigation using Flinn Scientific resources, followed by hands-on practice with proper measurement,	Other Assessments: Formative - Observation - Homework - Class participation - Graphic Organizers

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significant figures, precision, accuracy, and laboratory equipment.

Atomic Structure Investigation: Use the PhET “Build an Atom” simulation to construct atoms and ions and investigate the relationships among protons, neutrons, electrons, atomic number, mass number, and charge.

Rutherford’s Gold Foil Investigation: Use an interactive PhET simulation to model Rutherford’s experiment and analyze evidence that led to the development of the nuclear model of the atom.

Exploring the Quantum Nature of Matter: Examine the development of modern atomic theory through multimedia resources, including NOVA’s exploration of atoms and emerging states of matter such as Bose-Einstein condensates.

Electron Configuration Modeling: Construct and interpret electron configurations using orbital diagrams and energy-level models to explain the arrangement of electrons within atoms.

Electron Configurations of Atoms and Ions: Complete a laboratory-based investigation in which students determine and compare electron configurations for neutral atoms and ions.

Periodic Trends Data Analysis: Collect, organize, graph, and interpret data to identify patterns in atomic radius, ionization energy, electronegativity, and other periodic properties. Students may use graphing applications or data-analysis programs such as Logger Pro to analyze trends.

Physical and Chemical Properties Investigation: Conduct a hands-on laboratory investigation to distinguish between physical and chemical properties and use experimental evidence to

- Projects
- Student Response Systems (ex.Clickers)
- Do-Now/Exit Cards
- Laboratories/Lab Reports
- Notebook
- Writing Assignments
- Graphs, Models, and Tables

Summative

- Chapter/Unit Test
- Writing Assignments
- Presentations
- Laboratory Reports/Practical
- Unit Projects

Benchmark

- Linkit assessment
- Quarterlies
- Mid-Term
- Final Exams
- Performance Assessment

**Alternative
CER (claim, evidence, reasoning)**

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classify and identify changes in matter.

Activity Series of Metals Investigation: Perform a laboratory investigation of metal reactivity by observing single-replacement reactions and using experimental evidence to develop an activity series.

States of Matter Particle Simulation: Use an interactive particle model to investigate how the arrangement, spacing, and motion of particles differ among solids, liquids, and gases.

Molecular Shape Modeling: Use digital molecular modeling simulations to construct three-dimensional molecules and investigate how electron arrangement influences molecular geometry.

Molecular Polarity Investigation: Use an interactive simulation to examine electronegativity, bond polarity, and molecular geometry and determine how these factors influence overall molecular polarity.

Molecules and Light Simulation: Explore how molecules interact with different types of electromagnetic radiation and use the simulation to investigate the relationship between molecular structure, energy, and light absorption.

Molecular Structure and Bonding Applications: Apply concepts of molecular geometry, bonding, polarity, and intermolecular interactions to analyze and explain the properties and behavior of substances.

Unit 1 Knowledge and Skills

Unit 1 Learning Targets

Students will be able to..

- Describe the basic structure of an atom, including the positively charged nucleus

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containing protons and neutrons and the negatively charged electrons surrounding the nucleus.

- Explain that an element is defined by its number of protons and use atomic number to identify and distinguish elements.
- Identify valence electrons and explain how the arrangement of electrons in the outermost energy level influences the chemical behavior and reactivity of an element.
- Interpret the organization of the periodic table and explain how elements are arranged according to their atomic number and recurring patterns in valence electron configurations.
- Use the periodic table to identify and explain patterns in the properties and reactivity of elements, including trends within groups and periods.
- Predict relative atomic size, electronegativity, and reactivity by analyzing an element's position on the periodic table and the attraction between the nucleus and valence electrons.
- Predict the types and numbers of bonds that elements are likely to form based on valence electrons, electronegativity, and the interactions between charged particles.
- Determine the likely charges of stable ions formed by elements within major groups of the periodic table and explain how electron transfer leads to ion formation.
- Distinguish among ionic, covalent, and metallic bonding and relate each type of bonding to the properties and structure of substances.
- Use chemical formulas, electron configurations, and periodic trends to identify and describe the reactants and products involved in a chemical reaction.
- Explain how atoms are rearranged during a chemical reaction while recognizing that the number and type of atoms remain conserved before and after the reaction.
- Analyze how changes in valence electron arrangements and chemical bonding occur as reactants are transformed into products.
- Use patterns of attraction, valence electrons, electronegativity, and periodic trends to predict the types of chemical reactions that are likely to occur, including ionic compound formation and combustion reactions.
- Identify and analyze experimental or observational evidence that supports an explanation of a chemical reaction, including the identities and formulas of reactants and products and the bonds present in each substance.
- Use evidence from laboratory observations, data, chemical formulas, and periodic trends to explain patterns of chemical reactivity at the macroscopic and molecular levels.
- Construct and communicate evidence-based explanations describing how atomic structure, valence electrons, bonding, and periodic trends determine the properties and behavior of substances involved in chemical reactions.
- Develop and use models to represent atomic structure, electron arrangements, bonding, and chemical reactions, revising models when new evidence supports a more accurate explanation.

Unit 1 Enduring Understandings	Unit 1 Essential Questions
<i>Students will know...</i> ● The identity and behavior of an element are determined by the	● How does the arrangement and behavior of subatomic particles determine the properties of an element?

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structure of its atoms, including the number and arrangement of protons, neutrons, and electrons.

- The periodic table organizes elements according to atomic number and reveals recurring patterns in their electron configurations and chemical properties. Elements within the same group often exhibit similar chemical behaviors because of similarities in their valence electrons.
- Interactions between positively and negatively charged particles produce attractive and repulsive forces that influence the structure, properties, and behavior of matter at both the atomic and macroscopic levels.
- The properties and transformations of substances can be explained by examining how atoms interact, rearrange, and form or break chemical bonds.
- Chemical reactions involve the rearrangement of atoms, and the conservation of atoms provides a foundation for representing, balancing, and predicting chemical changes.
- The products and outcomes of chemical reactions can be predicted by considering the chemical properties of the elements and substances involved, as well as the ways in which their atoms interact.
- Some chemical systems reach a dynamic equilibrium in which forward and reverse reactions occur simultaneously, and the conditions of the system determine the relative amounts of reactants and products present.
- Changes in conditions can shift the balance of a chemical system, demonstrating that chemical reactions and their outcomes depend on interactions among particles and the conditions in which those interactions

- How can patterns in the periodic table be used to understand and predict the behavior of elements?
- What evidence has led scientists to revise and refine models of the atom over time?
- How can observable properties of matter provide clues about interactions occurring at the atomic and subatomic levels?
- What distinguishes one element from another at the atomic level?
- How can the periodic table help us predict how different elements will interact or react when combined?
- How do attractive and repulsive forces between particles influence the structure and properties of matter?
- How can scientists describe and predict the degree of disorder or randomness within a chemical system?

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occur.	
Unit 1 Instructional Plan	
Suggested Activities	Resources
• Atomic Structure Visual Project: Develop posters that illustrate the components of the atom, including subatomic particles, their properties, and their arrangement. • Build an Atom Simulation Inquiry: Use an interactive digital model to investigate atomic structure, element identity, isotopes, and ions. • Periodic Table Exploration: Complete a color-coding and pattern-recognition activity to examine the organization of the periodic table and identify groups, periods, and recurring trends. • Laboratory Investigations: Conduct hands-on experiments that reinforce concepts related to atomic structure, elements, properties of matter, and chemical behavior. • Digital Chemistry Resources: Use TED-Ed and Bozeman Science videos to introduce, reinforce, and review key concepts in atomic structure and periodic organization. • Atomic Structure Practice Activities: Apply concepts through guided practice, models, and review activities focused on subatomic particles, atomic notation, and periodic relationships.	• Gizmos • Textbook • Lab materials • YouTube
Unit 1 Suggested Options for Differentiation: Content-specific Accommodations and Modifications for Subgroups	
<i>Multilingual Learners</i> • Speak slowly, distinctly, and write down key terms • Closed Captioning • Emphasize visual literacy • Graphic Organizers • Use charts, graphs and figures	

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- Group projects & cooperative learning
- Partner English learners with strong English speakers
- Consistent routines
- Outlines
- Language-based science games
- Picture glossary
- Root words

Students with 504 Plans

- At the beginning of a course, have a conversation about the value of understanding one's learning profile and/or let students take a learning style survey.
- Explicitly share with students your observations about their learning strengths and challenges as the course progresses.
- Build metacognitive reflection into assignments.
- Instead of relying on large unit tests or exams, build in more frequent forms of assessment.
- Use grade-keeping software and make updated grade reports accessible to students.
- Provide direct personalized feedback to students
- Provide (or assign) some form of study guide for students to review before any quiz or exam.
- Provide scoring rubrics that describe the qualities of excellent work for the various components of each assignment.
- Make a direct connection, orally and in writing, between each class task and its associated learning objective.
- Distribute all important assignment handouts in the same format and structure.
- Establish and rationalize a routine for how class operates
- Post and review daily agendas for all class activities and assignments.
- Consider making available, in the classroom or learning support center, emerging assistive technologies such as text-to-speech screen readers, which are designed to assist students with difficulties decoding or attending to written text.
- Teach students to use some form of course planner or calendar that shows assignment due dates in a clear, graphical format.

Special Education

- At the beginning of a course, have a conversation about the value of understanding one's learning profile and/or let students take a learning style survey.
- Explicitly share with students your observations about their learning strengths and challenges as the course progresses.
- Build metacognitive reflection into assignments.
- Instead of relying on large unit tests or exams, build in more frequent forms of assessment.
- Use grade-keeping software and make updated grade reports accessible to students.
- Provide direct personalized feedback to students
- Provide (or assign) some form of study guide for students to review before any quiz or exam.
- Provide scoring rubrics that describe the qualities of excellent work for the various components of each assignment.
- Make a direct connection, orally and in writing, between each class task and its associated

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learning objective.

- Distribute all important assignment handouts in the same format and structure.
- Establish and rationalize a routine for how class operates
- Post and review daily agendas for all class activities and assignments.
- Consider making available, in the classroom or learning support center, emerging assistive technologies such as text-to-speech screen readers, which are designed to assist students with difficulties decoding or attending to written text.
- Teach students to use some form of course planner or calendar that shows assignment due dates in a clear, graphical format.

Gifted and Talented

- Interdisciplinary and problem-based assignments with planned scope and sequence
- Advance, accelerated, or compacted content
- Abstract and advanced higher-level thinking
- Allowance for individual student interests
- Assignments geared to development in areas of affect, creativity, cognition, and research skills
- Complex, in-depth assignments
- Diverse enrichment that broadens learning
- Variety in types of resources
- Open-ended questions for higher-level thinking
- Higher-level text

Students at Risk of School Failure

- Small group instruction
- Frequent breaks
- Increased parent communication
- Daily log

Diversity and Inclusion:

- Involve families in student learning
- Respect cultural traditions
- Provide students with necessary academic resources and materials
- Allow for alternative assignments
- Provide visuals
- Assign peer tutor
- Collaborate with language professionals and ESL teachers
- Encourage parents to help children maintain their native language at home, while the school helps the child attain proficiency in English.
- Establish a positive connection with parent
- Utilize closed captioning when available
- Provide road maps or outlines for difficult concepts
- Provide sufficient wait time before calling on any student to help keep students who may need more time engaged
- Speak clearly and slowly, avoid slang and idiomatic expressions
- Create a nurturing environment with structured routines

Core Instructional and Supplemental Materials and Resources

Instructional Materials

- Textbook
- Laboratory manuals and equipment

Supplemental Materials

Science Websites:

- American Chemical Society
- Ptable
- Chemical Portal
- PBS Learning Media
- Chemistry library | Science | Khan Academy
- bozemanscience
- News from Science | AAAS
- nsf
- Newsela Science Text sets
- Next Generation Science Standards
- chemspider
- LGBTQ plus Resources
- Individuals with disabilities Resources
- School databases
- Multimedia Resources
- Printers and Computers
- Online Resources and videos
- [Amistad Commission](#)
- [Holocaust Commission](#)
- Interactive Projector
- Rubrics

Intervention Materials

- Guided notes
- Flipped videos
- Leveled Text

Social and Emotional Learning New Jersey SEL

Competencies and Sub-Competencies Social and emotional learning (SEL) involves the process through which children and adults acquire and apply the knowledge, attitudes and skills necessary to understand and manage emotions, set and achieve positive goals, feel and show empathy for others, establish and maintain positive relationships, and make responsible decisions. The purpose of the SEL competencies is to provide schools with guidelines for integrating SEL across grades and subject areas.

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Self-Awareness

- Recognize one's feelings and thoughts
- Recognize the impact of one's feelings and thoughts on one's own behavior
- Recognize one's personal traits, strengths and limitations
- Recognize the importance of self-confidence in handling daily tasks and challenges

Self-Management

- Understand and practice strategies for managing one's own emotions, thoughts and behaviors
- Recognize the skills needed to establish and achieve personal and educational goals
- Identify and apply ways to persevere or overcome barriers through alternative methods to achieve one's goals

Social Awareness

- Recognize and identify the thoughts, feelings and perspectives of others
- Demonstrate awareness of the differences among individuals, groups and others' cultural backgrounds
- Demonstrate an understanding of the need for mutual respect when viewpoints differ
- Demonstrate an awareness of the expectations for social interactions in a variety of settings

Responsible Decision-Making

- Develop, implement and model effective problem solving and critical thinking skills
- Identify the consequences associated with one's actions in order to make constructive choices
- Evaluate personal, ethical, safety and civic impact of decisions

Relationship Skills

- Establish and maintain healthy relationships
- Utilize positive communication and social skills to interact effectively with others
- Identify ways to resist inappropriate social pressure
- Demonstrate the ability to prevent and resolve interpersonal conflicts in constructive ways
- Identify who, when, where, or how to seek help for oneself or others when needed

NJDOE Website on Social and Emotional Learning

<http://www.nj.gov/education/students/safety/sandp/sel>

Teacher Notes:

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Unit 2 Overview

Content Area: Science

Unit 2: The Chemistry of Abiotic Systems

Target Course/Grade Levels: 10-11

Duration: 12 Days

Unit 2 Introduction:

In this unit, students investigate how energy is transferred and transformed within chemical and physical systems. They develop and apply models to explain energy at both the macroscopic and particle levels, recognizing that the energy of a system is related to the motion and interactions of its particles. Students examine how changes in particle arrangement, motion, and interactions affect the energy of a system and use quantitative evidence to describe and account for energy changes.

Students engage in laboratory investigations to explore energy transfer and develop explanations based on observations, measurements, and data. Through analyzing and interpreting evidence, students apply the principle of conservation of energy to explain that changes in a system's total energy result from energy transferred into or out of that system. They consider energy associated with particle motion as well as energy stored in the arrangement and interactions of particles, connecting molecular-level processes to observable changes in temperature, phase, and other properties of matter.

The unit also examines the relationship between chemistry and Earth's systems, including the important role of water in weather and climate. Students explore how water's physical and chemical properties influence energy transfer within Earth's systems and investigate how human activities can alter natural systems and produce feedback that affects interconnected environmental processes.

Throughout the unit, students strengthen their ability to use the practices of science and engineering. They construct and revise models, design and conduct investigations, analyze quantitative and qualitative data, develop evidence-based explanations, and communicate scientific arguments. Students use these practices to connect experimental evidence with chemical concepts and to explain phenomena at both the observable and molecular scales.

Students also apply chemical and scientific principles to real-world challenges by identifying major global problems and breaking complex issues into smaller, more manageable components. Using an engineering design approach, they investigate and propose potential solutions while considering scientific evidence, available resources, environmental impacts, practicality, and other relevant constraints. Students recognize that effective solutions require prioritizing criteria, evaluating trade-offs, and using evidence to determine which approaches best address a given problem.

This unit is based on HS-PS3-4, HS-ESS2-5, HS-ESS3-2, and HS-ETS1-3.

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Standard 9.1 Personal Financial Literacy: This standard outlines the important fiscal knowledge, habits, and skills that must be mastered in order for students to make informed decisions about personal finance. Financial literacy is an integral component of a student's college and career readiness, enabling students to achieve fulfilling, financially-secure, and successful careers.

Standard 9.2 Career Awareness, Exploration, Preparation and Training. This standard outlines the importance of being knowledgeable about one's interests and talents, and being well informed about postsecondary and career options, career planning, and career requirements.

Standard 9.4 Life Literacies and Key Skills. This standard outline key literacies and technical skills such as critical thinking, global and cultural awareness, and technology literacy* that are critical for students to develop to live and work in an interconnected global economy.

Standard 8.1 Computer Science

Computer Science outlines a comprehensive set of concepts and skills, such as data and analysis, algorithms and programming, and computing systems.

Standard 8.2 Design Thinking

Technology, outlines the technological design concepts and skills essential for technological and engineering literacy. The framework design includes Engineering Design, Ethics and Culture, and the Effects of Technology on the Natural world among the disciplinary concepts

Amistad Law: N.J.S.A. 18A 52:16A-88 Every board of education shall incorporate the information regarding the contributions of African-Americans to our country in an appropriate place in the curriculum of elementary and secondary school students.

Holocaust Law: N.J.S.A. 18A:35-28 Every board of education shall include instruction on the Holocaust and genocide in an appropriate place in the curriculum of all elementary and secondary school pupils. The instruction shall further emphasize the personal responsibility that each citizen bears to fight racism and hatred whenever and wherever it happens.

LGBT and Disabilities Law: N.J.S.A. 18A:35-4.35 A board of education shall include instruction on the political, economic, and social contributions of persons with disabilities and lesbian, gay, bisexual, and transgender people, in an appropriate place in the curriculum of middle school and high school students as part of the district's implementation of the New Jersey Student Learning Standards (N.J.S.A.18A:35-4.36) A board of education shall have policies and procedures in place pertaining to the selection of instructional materials to implement the requirements of N.J.S.A. 18A:35-4.35.

Diversity and Inclusion C.18A:35-4.36a Curriculum to include instruction on diversity and inclusion.

1. The instruction shall:

(1) highlight and promote diversity, including economic diversity, equity, inclusion,

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- tolerance, and belonging in connection with gender and sexual orientation, race and ethnicity, disabilities, and religious tolerance;
- (2) examine the impact that unconscious bias and economic disparities have at both an individual level and on society as a whole; and
- (3) encourage safe, welcoming, and inclusive environments for all students regardless of race or ethnicity, sexual and gender identities, mental and physical disabilities, and religious beliefs.

Asian Americans and Pacific Islanders (AAPI)

Ensures that the contributions, history, and heritage of Asian Americans and Pacific Islanders (AAPI) are included in the New Jersey Student Learning Standards (NJSLs) for Social Studies in kindergarten through Grade 12 (P.L.2021, c.416).

21st Century Themes and Skills

“Twenty-first century themes and skills” means themes such as global awareness; financial, economic, business, and entrepreneurial literacy; civic literacy; health literacy; learning and innovation skills, including creativity and innovation, critical thinking and problem solving, and communication and collaboration; information, media, and technology skills; and life and career skills, including flexibility. Career readiness, life literacies, and key skills education provides students with the necessary skills to make informed career and financial decisions, engage as responsible community members in a digital society, and to successfully meet the challenges and opportunities in an interconnected global economy.”

Unit 2 Focus Standards <https://www.nj.gov/education/cccs/2020/NJSLs-Science.pdf>

HS-PS3-4: Plan and conduct an investigation to provide evidence that the transfer of thermal energy when two components of different temperature are combined within a closed system results in a more uniform energy distribution among the components in the system (second law of thermodynamics). [Clarification Statement: Emphasis is on analyzing data from student investigations and using mathematical thinking to describe the energy changes both quantitatively and conceptually. Examples of investigations could include mixing liquids at different initial temperatures or adding objects at different temperatures to water.] [Assessment Boundary: Assessment is limited to investigations based on materials and tools provided to students.]

HS-ESS2-5: Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes. [Clarification Statement: Emphasis is on mechanical and chemical investigations with water and a variety of solid materials to provide the evidence for connections between the hydrologic cycle and system interactions commonly known as the rock cycle. Examples of mechanical investigations include stream transportation and deposition using a stream table, erosion using variations in soil moisture content, or frost wedging by the expansion of water as it freezes. Examples of chemical investigations include chemical weathering and recrystallization (by testing the solubility of different materials) or melt generation (by examining how water lowers the melting temperature of most solids).]

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HS-ESS3-2: Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios. **[Clarification Statement: Emphasis is on the conservation, recycling, and reuse of resources (such as minerals and metals) where possible, and on minimizing impacts where it is not. Examples include developing best practices for agricultural soil use, mining (for coal, tar sands, and oil shales), and pumping (for petroleum and natural gas). Science knowledge indicates what can happen in natural systems—not what should happen.]**

HS-ETS1-3: Evaluate a solution to a complex real-world problem-based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.

<https://www.nj.gov/education/aps/cccs/science/safety.htm>

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Planning and Carrying Out Investigations Planning and carrying out investigations in 9-12 builds on K-8 experiences and progresses to include investigations that provide evidence for and test conceptual, mathematical, physical, and empirical models. Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for 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-PS3-4), (HS-ESS2-5)	PS3.B: Conservation of Energy and Energy Transfer - Energy cannot be created or destroyed, but it can be transported from one place to another and transferred between systems. (HSPS3-1), (HS-PS3-4) - Uncontrolled systems always evolve toward more stable states—that is, toward more uniform energy distribution (e.g., water flows downhill, objects hotter than their surrounding environment cool down). (HS-PS3-4) PS3.D: Energy in Chemical Processes - Although energy cannot be destroyed, it can be converted to less useful forms—for example, to thermal energy in the surrounding environment.	Systems and System Models - When investigating or describing a system, the boundaries and initial conditions of the system need to be defined and their inputs and outputs analyzed and described using models. (HS-PS3-4) ----- <i>Connections to Engineering, Technology, and Applications of Science</i> Influence of Engineering, Technology, and Science on Society and the Natural World - Engineers continuously modify these technological systems by applying scientific knowledge and engineering design practices to increase benefits while decreasing costs and risks.

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Engaging in Argument from Evidence Engaging in argument from evidence in 9-12 builds on K-8 experiences and progresses to using appropriate and sufficient evidence and scientific reasoning to defend and critique claims and explanations about natural and designed world(s). Arguments may also come from current scientific or historical episodes in science. - Evaluate competing design solutions to a real-world problem based on scientific ideas and principles, empirical evidence, and logical arguments regarding relevant factors (e.g. economic, societal, environmental, ethical considerations). (HS-ESS3-2) Constructing Explanations and Designing Solutions Constructing explanations and designing solutions 9-12 builds on K - experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles and theories. - Evaluate a solution to a complex real-world problem, based on	(HS-PS3-3), (HS-PS3-4) ESS2.C: The Roles of Water in Earth's Surface Processes - The abundance of liquid water on Earth's surface and its unique combination of physical and chemical properties are central to the planet's dynamics. These properties include water's exceptional capacity to absorb, store, and release large amounts of energy, transmit sunlight, expand upon freezing, dissolve and transport materials, and lower the viscosities and melting points of rocks. (HS-ESS2-5) ESS3.A: Natural Resources - All forms of energy production and other resource extraction have associated economic, social, environmental, and geopolitical costs and risks as well as benefits. New technologies and social regulations can change the balance of these factors. (HS-ESS3-2) ETS1.B: Developing Possible Solutions - When evaluating solutions, it is important to take into account a range of constraints, including cost, safety, reliability, and aesthetics, and to consider	(HS-ESS3-2), (HS-ESS3-4) - Analysis of costs and benefits is a critical aspect of decisions about technology. (HS-ESS3-2) ----- <i>Connections to Nature of Science</i> Science Addresses Questions About the Natural and Material World - Science and technology may raise ethical issues for which science, by itself, does not provide answers and solutions. (HS-ESS3-2) - Science knowledge indicates what can happen in natural systems— not what should happen. The latter involves ethics, values, and human decisions about the use of knowledge. (HS-ESS3-2) - Many decisions are not made using science alone, but rely on social and cultural contexts to resolve issues. (HS-ESS3-2) Influence of Science, Engineering, and Technology on Society and the Natural World - New technologies can have deep impacts on society and the environment, including some that were not anticipated. Analysis of
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scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. (HS-ETS1-3)	social, cultural, and environmental impacts. (secondary to HS-ESS3- 2), (secondary HS-ESS3-4)	costs and benefits is a critical aspect of decisions about technology. (HS-ETS1-1), (HS-ETS1-3)
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Interdisciplinary Connections Supporting and Additional Standards Unit 2

[New Jersey Student Learning Standards-Mathematics](#)

[New Jersey Student Learning Standards-ELA](#)

Connections to other DCIs in grades 9-12: • HS.ESS1.A (HS-PS3-1), (HS-PS3-4) • HS.ESS2.A (HS-PS3-1), (HS-PS3-2), (HS-PS3-4) • HS.ESS2.D (HS-PS3-4) • HS.PS1.A (HS-ESS2-5), (HS-ESS2-6) • HS.PS1.B (HS-ESS2-5), (HS-ESS2-6) • HS.PS3.B (HS-ESS2-2), (HS-ESS2-3), (HS-ESS2-4), (HS-ESS2-5) • HS.ESS3.C (HS-ESS2-2), (HS-ESS2-4), (HS-ESS2-5), (HS-ESS2-6) • HS.PS3.B (HS-ESS3-2), (HS-ESS3-5) • HS.PS3.D (HS-ESS3-2), (HS-ESS3-5) • HS.LS2.B (HS-ESS3-2), (HS-ESS3-3), (HS-ESS3-6) • HS.LS4.D (HS-ESS3-2), (HS-ESS3-3), (HS-ESS3-4), (HS-ESS3-6) • HS.ESS2.A (HS-ESS3-2), (HS-ESS3-3), (HS-ESS3-6)

Articulation of DCIs across grade levels: • MS.PS3.B (HS-PS3-1), (HS-PS3-3), (HS-PS3-4) • MS.PS1.A (HS-ESS2-3), (HS-ESS2-5), (HS-ESS2-6) • MS.PS4.B (HS-ESS2-2), (HS-ESS2-4), (HS-ESS2-5), (HS-ESS2-6) • MS.ESS2.A (HS-ESS2-1), (HS-ESS2-2), (HS-ESS2-3), (HS-ESS2-4), (HS-ESS2-5), (HS-ESS2-6), (HS-ESS2-7) • MS.ESS2.C (HS-ESS2-1), (HS-ESS2-2), (HS-ESS2-4), (HS-ESS2-5), (HS-ESS2-6), (HS-ESS2-7) • MS.ESS2.D (HS-ESS2-1), (HS-ESS2-2), (HS-ESS2-4), (HS-ESS2-5) • MS.PS3.D (HS-ESS3-2), (HS-ESS3-5) • MS.LS2.A (HS-ESS3-1), (HS-ESS3-2), (HS-ESS3-3) • MS.LS2.B (HS-ESS3-2), (HS-ESS3-3) • MS.LS4.D (HS-ESS3-1), (HS-ESS3-2), (HS-ESS3-3) • MS.ESS3.A (HS-ESS3-1), (HS-ESS3-2), (HS-ESS3-3) • MS.ESS3.C (HS-ESS3-2), (HS-ESS3-3), (HS-ESS3-4), (HS-ESS3-5), (HS-ESS3-6) • MS.ETS1.A (HS-ETS1-1), (HS-ETS1-2), (HS-ETS1-3), (HS-ETS1-4) • MS.ETS1.B (HS-ETS1-2), (HS-ETS1-3), (HS-ETS1-4)

Connections to HS-ETS1.B: Designing Solutions to Engineering Problems: • Earth and Space Science: HS-ESS3-2, HS-ESS3-4

ELA/Literacy -

RI.CR.11-12.1. Accurately cite a range of thorough textual evidence and make relevant connections to strongly support a comprehensive analysis of multiple aspects of what an informational text says explicitly and inferentially, as well as interpretations of the text.
(HS-PS1-3), (HS-PS1-5), (HS-PS2-1), (HS-PS2-6)

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RI.MF.11-12.6. Synthesize complex information across multiple sources and formats to develop ideas, resolve conflicting information, or develop an interpretation that goes beyond explicit text information (e.g., express a personal point of view, new interpretation of the concept). (HS-ETS1-1), (HS-ETS1-3)

RI.AA.9-10.7. Describe and evaluate the argument and specific claims in an informational text, assessing whether the reasoning is valid and the evidence is relevant and sufficient; identify false statements and reasoning. (HS-ETS1-1), (HS-ETS1-3)

W.IW.9-10.2. Write informative/explanatory texts (including the narration of historical events, scientific procedures/ experiments, or technical processes) to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content.

- A. Introduce a topic; organize complex ideas, concepts, and information to make important connections and distinctions; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aid in comprehension.
- B. Develop the topic with well-chosen, relevant, and sufficient facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience's knowledge of the topic.
- C. Use appropriate and varied transitions to link the major sections of the text, create cohesion, and clarify the relationships among complex ideas and concepts.
- D. Use precise language and domain-specific vocabulary to manage the complexity of the topic.
- E. Establish and maintain a style and tone appropriate to the audience and purpose (e.g., formal and objective for academic writing) while attending to the norms and conventions of the discipline in which they are writing.
- F. Provide a concluding paragraph or section that supports the information or explanation presented (e.g., articulating implications or the significance of the topic). (HS-PS1-2), (HS-PS1-5), (HS-PS2-6)

W.WP.9-10.4. Develop and strengthen writing as needed by planning, revising, editing, rewriting, trying a new approach; sustaining effort to complete complex writing tasks; seeking out feedback and reflecting on personal writing progress; consulting a style manual (such as MLA or APA Style), focusing on addressing what is most significant for a specific purpose and audience.. (HS-PS1-2)

W.WR.9-10.5. 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-PS1-6)

W.SE.9-10.6. Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation (MLA or APA Style Manuals). (HS-PS1-3)

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Mathematics -

- **MP.2B:** Reason abstractly and quantitatively. (HS-PS3-1), (HS-PS3-2), (HS-PS3-3), (HS-PS3-4), (HS-PS3-5), (HS-ESS3-1), (HS-ESS3-2), (HS-ESS3-3), (HS-ESS3-4), (HS-ESS3-5), (HS-ESS3-6), (HS-ETS1-1), (HS-ETS1-3), (HS-ETS1-4)
- **MP.4B:** Model with mathematics. (HS-PS3-1), (HS-PS3-2), (HS-PS3-3), (HS-PS3-4), (HS-PS3-5), (HS-ETS1-1), (HS-ETS1-2), (HS-ETS1-3), (HS-ETS1-4)
- **HSN-Q.A.3B:** Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (HS-ESS2-1), (HS-ESS2-2), (HS-ESS2-3), (HS-ESS2-4), (HS-ESS2-5), (HS-ESS2-6)

Unit 2 New Jersey Student Learning Standards Connections: Career Readiness, Life Literacies, and Key Skills

Disciplinary Concepts

Career Awareness and Planning (9.2)

Creativity and Innovations (9.4)

Critical Thinking and Problem-solving (9.4)

Digital Citizenship

Global and Cultural Awareness (9.4)

Information and Media Literacy (9.4)

Core Ideas

Performance Expectations

(Identified with Standard Number and Statement)

There are strategies to improve one's professional value and marketability.

- 9.2.12.CAP.2: Develop college and career readiness skills by participating in opportunities such as structured learning experiences, apprenticeships, and dual enrollment programs.
- 9.2.12.CAP.3: Investigate how continuing education contributes to one's career and personal growth.

Career planning requires purposeful planning based on research, self-knowledge, and informed choices.

- 9.2.12.CAP.4: Evaluate different careers and develop various plans (e.g., costs of public, private, training schools) and timetables for achieving them, including educational/training requirements, costs, loans, and debt repayment.
- 9.2.12.CAP.5: Assess and modify a personal plan to support current interests and postsecondary plans.

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	9.2.12.CAP.6: Identify transferable skills in career choices and design alternative career plans based on those skills. 9.2.12.CAP.8: Determine job entrance criteria (e.g., education credentials, math/writing/reading comprehension tests, drug tests) used by employers in various industry sectors.
An individual's income and benefit needs and financial plan can change over time.	9.2.12.CAP.13: Analyze how the economic, social, and political conditions of a time period can affect the labor market.
With a growth mindset, failure is an important part of success	9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a).
Innovative ideas or innovation can lead to career opportunities.	9.4.12.CI.2: Identify career pathways that highlight personal talents, skills, and abilities (e.g., 1.4.12prof.CR2b, 2.2.12.LF.8) 9.4.12.CI.3: Investigate new challenges and opportunities for personal growth, advancement, and transition (e.g., 2.1.12.PGD.1).
Collaboration with individuals with diverse experiences can aid in the problem-solving process, particularly for global issues where diverse solutions are needed.	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.2: Explain the potential benefits of collaborating to enhance critical thinking and problem solving (e.g., 1.3E.12profCR3.a). 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). 9.4.12.CT.4: Participate in online strategy and planning sessions for course-based, school-based, or other projects and determine the strategies that contribute to effective outcomes.
Laws govern the use of intellectual property and there are legal consequences to utilizing or	9.4.12.DC.1: Explain the beneficial and harmful effects that intellectual property

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sharing another's original works without permission or appropriate credit.	laws can have on the creation and sharing of content (e.g., 6.1.12.CivicsPR.16.a). 9.4.12.DC.2: Compare and contrast international differences in copyright laws and ethics.
Digital communities influence many aspects of society, especially the workforce. The increased connectivity between people in different cultures and different career fields have changed the nature, content, and responsibilities of many careers.	9.4.12.DC.7: Evaluate the influence of digital communities on the nature, content and responsibilities of careers, and other aspects of society (e.g., 6.1.12.CivicsPD.16.a).
Network connectivity and computing capability extended to objects, sensors and everyday items not normally considered computers allows these devices to generate, exchange, and consume data with minimal human intervention. Technologies such as Artificial Intelligence (AI) and blockchain can help minimize the effect of climate change.	9.4.12.DC.8: Explain how increased network connectivity and computing capabilities of everyday objects allow for innovative technological approaches to climate protection.
Solutions to the problems faced by a global society require the contribution of individuals with different points of view and experiences.	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).
Advanced search techniques can be used with digital and media resources to locate information and to check the credibility and the expertise of sources to answer questions, solve problems, and inform the decision-making.	9.4.12.IML.2: Evaluate digital sources for timeliness, accuracy, perspective, credibility of the source, and relevance of information, in media, data, or other resources (e.g., NJSLA.W8, Social Studies Practice: Gathering and Evaluating Sources.
In order for members of our society to participate productively, information needs to be shared accurately and ethically	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).

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	9.4.12.IML.6: Use various types of media to produce and store information on climate change for different purposes and audiences with sensitivity to cultural, gender, and age diversity (e.g., NJSLSA.SL5).
Unit 2 New Jersey Student Learning Standards: Computer Science and Design Thinking	
Disciplinary Concepts Impacts of Computing (8.1) Data & Analysis (8.1) Engineering Design (8.2) Interaction of Technology and Humans (8.2) Effects of Technology on the Natural World (8.2)	
Core Ideas	
The design and use of computing technologies and artifacts can positively or negatively affect equitable access to information and opportunities.	8.1.12.IC.1: Evaluate the ways computing impacts personal, ethical, social, economic, and cultural practices. 8.1.12.IC.3: Predict the potential impacts and implications of emerging technologies on larger social, economic, and political structures, using evidence from credible sources.
Large data sets can be transformed, generalized, simplified, and presented in different ways to influence how individuals interpret and understand the underlying information.	8.1.12.DA.5: Create data visualizations from large data sets to summarize, communicate, and support different interpretations of real-world phenomena.
Engineering design is a complex process in which creativity, content knowledge, research, and analysis are used to address local and global problems.	8.2.12.ED.1: Use research to design and create a product or system that addresses a problem and make modifications based on input from potential consumers. 8.2.12.ED.4: Design a product or system that addresses a global problem and document decisions made based on research, constraints, trade-offs, and aesthetic and ethical considerations and share this information with an appropriate audience.

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Engineering design evaluation, a process for determining how well a solution meets requirements, involves systematic comparisons between requirements, specifications, and constraints.	8.2.12.ED.5: Evaluate the effectiveness of a product or system based on factors that are related to its requirements, specifications, and constraints (e.g., safety, reliability, economic considerations, quality control, environmental concerns, manufacturability, maintenance and repair, ergonomics). 8.2.12.ED.6: Analyze the effects of changing resources when designing a specific product or system (e.g., materials, energy, tools, capital, labor).
Changes caused by the introduction and use of a new technology can range from gradual to rapid and from subtle to obvious, and can change over time. These changes may vary from society to society as a result of differences in a society's economy, politics, and culture.	8.2.12.ITH.2: Propose an innovation to meet future demands supported by an analysis of the potential costs, benefits, trade-offs, and risks related to the use of the innovation. 8.2.12.ITH.3: Analyze the impact that globalization, social media, and access to open source technologies has had on innovation and on a society's economy, politics, and culture.
Development and modification of any technological system needs to take into account how the operation of the system will affect natural resources and ecosystems. Impacts of technological systems on the environment need to be monitored and must inform decision-making. Many technologies have been designed to have a positive impact on the environment and to monitor environmental change over time.	8.2.12.ETW.1: Evaluate ethical considerations regarding the sustainability of environmental resources that are used for the design, creation, and maintenance of a chosen product. 8.2.12.ETW.2: Synthesize and analyze data collected to monitor the effects of a technological product or system on the environment. 8.2.12.ETW.3: Identify a complex, global environmental or climate change issue, develop a systemic plan of investigation, and propose an innovative sustainable solution.
New Jersey Student Learning Standards: Climate Change Mandate	
Core Ideas	Performance Expectations (Identified with Standard Number and Statement)
Unit 2 Evidence of Student Learning	
Performance Tasks/Use of Technology: Isotopes and Atomic Mass Exploration:	Other Assessments: Formative Observation

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Use an interactive simulation to investigate isotopes, calculate average atomic mass, and connect subatomic composition to measurable properties. • Energy Transformations Investigation: Explore how energy is transferred and converted between different forms using an interactive digital simulation. • States of Matter Particle Modeling: Use a virtual model to examine how particle spacing, motion, and interactions differ among solids, liquids, and gases. • States of Matter and Intermolecular Forces: Investigate atomic and molecular interactions, potential energy, and dipole behavior through interactive simulations. • Gas Behavior Simulation: Manipulate temperature, pressure, volume, and particle number to investigate relationships among gas variables and explain their behavior at the molecular level. • Melting Point Laboratory: Conduct an experimental investigation to determine the melting point of a substance and analyze how energy input affects changes in state. • NOVA Absolute Zero Exploration: Use multimedia resources to investigate the relationship between temperature, particle motion, and energy as matter approaches extremely low temperatures. • Bose-Einstein Condensate Research Activity: Examine how matter behaves at ultralow temperatures and explore the connection between temperature, particle motion, and unusual states of matter. • Wet Washcloth in Space Demonstration: Analyze a Canadian Space Agency video demonstrating water behavior in microgravity and use particle-level reasoning to explain the observed phenomena. • Glacier Modeling Simulation: Explore	• Homework • Class participation • Graphic Organizers • Projects • Student Response Systems (ex. Clickers) • Do-Now/Exit Cards • Laboratories/Lab Reports • Notebook • Writing Assignments • Graphs, Models, and Tables Summative • Chapter/Unit Test • Writing Assignments • Presentations • Laboratory Reports/Practical • Unit Projects Benchmark • Quarterlies • Mid-Term • Final Exams • Performance Assessment Alternative CER (claim, evidence, reasoning)
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glacier movement and melting through a digital simulation while examining how temperature and energy changes influence Earth systems. • States of Matter Interactive Exploration: Use NOVA's interactive resource to compare the properties and behavior of matter in different physical states. • Molecules and Light Simulation: Investigate how molecules interact with light and connect molecular structure to energy absorption and changes within a system. • Le Châtelier's Principle Laboratory: Conduct an investigation of chemical equilibrium and evaluate how changes in concentration, temperature, or other conditions affect a system. • Super Battery Design Challenge: Use PBS LearningMedia resources to investigate battery technology and evaluate potential solutions based on efficiency, safety, cost, environmental impact, and other design criteria.	
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Unit 2 Knowledge and Skills

Unit 2 Learning Targets

Students will be able to..

- Explain how thermal energy moves between substances or components of a chemical system as a result of temperature differences.
- Use particle-level models to represent how matter and energy behave within a defined system.
- Identify and describe the boundaries of a system, including its initial conditions, energy inputs, and energy outputs.
- Plan and carry out laboratory investigations that examine energy transfer within a closed system.
- Determine which types of measurements and how much data are needed to produce dependable evidence about changes in thermal energy.
- Collect, organize, and analyze experimental data to identify patterns in temperature and energy transfer.
- Evaluate the accuracy and precision of measurements and recognize sources of uncertainty within an investigation.
- Modify experimental procedures or models when data limitations affect the reliability of

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the results.

- Investigate the unique physical and chemical properties of water and explain how these properties influence energy transfer and processes within Earth's systems.
- Develop models of water and energy movement through interconnected Earth systems, identifying system boundaries, starting conditions, inputs, and outputs.
- Design and conduct investigations that use evidence to examine how water interacts with Earth materials and influences surface processes.
- Apply quantitative and qualitative evidence to construct explanations for how energy and matter are transferred within chemical and Earth systems.
- Collaborate with others to plan investigations, evaluate evidence, communicate findings, and revise scientific explanations based on experimental results.

Unit 2 Enduring Understandings	Unit 2 Essential Questions
<i>Students will know...</i> ● Energy is conserved within chemical and physical systems; it may be transferred between objects or systems and transformed from one form to another, but it is never created or eliminated. ● The behavior and properties of water are closely connected to its molecular structure and the interactions among its particles. ● Water plays a critical role in Earth's systems because of its distinctive properties, including its ability to absorb and release significant amounts of thermal energy, transmit sunlight, dissolve substances, expand when it freezes, and influence the movement and properties of Earth materials. ● Scientific models can be used to represent systems at different scales and to trace the movement and transformation of matter, energy, and information within and between systems. ● A useful model of a system identifies its boundaries, starting conditions, inputs, outputs, and interactions with other components. ● When energy is transferred through a system without outside control, it tends to become distributed more evenly, resulting in greater stability within the	● How do the properties of water influence Earth's climate, weather, and other natural processes? ● How does energy move and change within a chemical or physical system? ● What factors should be considered when determining the most effective energy source for a home? ● How can chemistry and engineering help us design homes that meet future energy demands? ● Why is water uniquely suited to support and influence processes on Earth? ● How can we use scientific evidence to evaluate the advantages, limitations, and impacts of different energy choices?

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system.

- Energy may be conserved while becoming less available for useful work as it is dispersed into the surrounding environment, often as thermal energy.
- Scientific investigations can reveal what is possible or likely to occur in natural systems, while decisions about what should occur require consideration of ethics, values, societal priorities, and human judgment.
- Technologies and methods for producing energy or extracting natural resources provide benefits but may also create economic, environmental, social, and geopolitical consequences.
- New technologies can alter interactions between humans and the environment and may produce consequences that were not anticipated when the technology was developed.
- Evaluating technological solutions requires weighing advantages, limitations, risks, costs, and potential benefits rather than relying on a single factor.
- Engineers use an iterative design process to test, evaluate, and modify solutions in order to improve performance while reducing negative impacts and potential risks.
- Scientific knowledge can inform decisions about complex problems, but science alone cannot determine the values or priorities that should guide those decisions.
- Different communities and cultures may approach scientific and technological issues in different ways because decisions are influenced by social, economic, cultural, and environmental considerations.
- Scientific and technological advances can create ethical questions that require people to consider consequences, responsibilities, and competing values in

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addition to scientific evidence.	
Unit 2 Instructional Plan	
Suggested Activities	Resources
● Interactive Science Media: View and analyze selected TED-Ed and Bozeman Science videos to reinforce concepts related to thermodynamics, energy transfer, water properties, and chemical systems. ● Energy and Matter Concept Mapping: Create visual models showing how energy is transferred, transformed, and conserved within chemical and physical systems. ● Thermal Energy Investigation: Conduct laboratory experiments that measure temperature changes and energy transfer between substances and use collected data to support evidence-based conclusions. ● Water Properties CER Investigation: Examine the unusual properties of water and develop a Claim-Evidence-Reasoning (CER) explanation connecting water's molecular structure to its behavior. ● DHMO Investigation: Analyze information about dihydrogen monoxide (water) and evaluate how scientific language and evidence can influence the interpretation of chemical information. ● Thermodynamics Visual Project: Develop an infographic or poster that illustrates key ideas related to energy conservation, energy transfer, system boundaries, and changes in thermal energy. ● Phase Change Laboratory: Investigate heating and cooling curves to determine how energy input affects temperature and changes of state. ● Water and Earth Systems Simulation: Use digital models to investigate how water transfers energy and interacts with	● Gizmos ● Textbook ● Lab materials ● YouTube

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Earth's atmosphere, surface, and materials.

- Energy Resources Research Project: Research and compare energy technologies based on efficiency, environmental impact, cost, availability, safety, and long-term sustainability.
- Engineering Design Challenge: Develop a conceptual plan for a more energy-efficient home and justify design choices using principles of chemistry, energy transfer, and conservation.
- Data Analysis Activity: Analyze experimental temperature and energy data to identify patterns, evaluate measurement precision, and support scientific explanations.
- Model Development and Revision: Construct particle-level models to explain how changes in temperature, phase, and energy affect the motion and arrangement of particles.

Unit 2 Suggested Options for Differentiation: Content-specific Accommodations and Modifications for Subgroups

Multilingual Learners

- Speak slowly, distinctly, and write down key terms
- Closed Captioning
- Emphasize visual literacy
- Graphic Organizers
- Use charts, graphs and figures
- Group projects & cooperative learning
- Partner English learners with strong English speakers
- Consistent routines
- Outlines
- Language-based science games
- Picture glossary
- Root words

Students with 504 Plans

- At the beginning of a course, have a conversation about the value of understanding one's learning profile and/or let students take a learning style survey.
- Explicitly share with students your observations about their learning strengths and challenges as the course progresses.

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- Build metacognitive reflection into assignments.
- Instead of relying on large unit tests or exams, build in more frequent forms of assessment.
- Use grade-keeping software and make updated grade reports accessible to students.
- Provide direct personalized feedback to students
- Provide (or assign) some form of study guide for students to review before any quiz or exam.
- Provide scoring rubrics that describe the qualities of excellent work for the various components of each assignment.
- Make a direct connection, orally and in writing, between each class task and its associated learning objective.
- Distribute all important assignment handouts in the same format and structure.
- Establish and rationalize a routine for how class operates
- Post and review daily agendas for all class activities and assignments.
- Consider making available, in the classroom or learning support center, emerging assistive technologies such as text-to-speech screen readers, which are designed to assist students with difficulties decoding or attending to written text.
- Teach students to use some form of course planner or calendar that shows assignment due dates in a clear, graphical format.

Special Education

- At the beginning of a course, have a conversation about the value of understanding one's learning profile and/or let students take a learning style survey.
- Explicitly share with students your observations about their learning strengths and challenges as the course progresses.
- Build metacognitive reflection into assignments.
- Instead of relying on large unit tests or exams, build in more frequent forms of assessment.
- Use grade-keeping software and make updated grade reports accessible to students.
- Provide direct personalized feedback to students
- Provide (or assign) some form of study guide for students to review before any quiz or exam.
- Provide scoring rubrics that describe the qualities of excellent work for the various components of each assignment.
- Make a direct connection, orally and in writing, between each class task and its associated learning objective.
- Distribute all important assignment handouts in the same format and structure.
- Establish and rationalize a routine for how class operates
- Post and review daily agendas for all class activities and assignments.
- Consider making available, in the classroom or learning support center, emerging assistive technologies such as text-to-speech screen readers, which are designed to assist students with difficulties decoding or attending to written text.
- Teach students to use some form of course planner or calendar that shows assignment due dates in a clear, graphical format.

Gifted and Talented

- Interdisciplinary and problem-based assignments with planned scope and sequence
- Advance, accelerated, or compacted content

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- Abstract and advanced higher-level thinking
- Allowance for individual student interests
- Assignments geared to development in areas of affect, creativity, cognition, and research skills
- Complex, in-depth assignments
- Diverse enrichment that broadens learning
- Variety in types of resources
- Open-ended questions for higher-level thinking
- Higher-level text

Students at Risk of School Failure

- Small group instruction
- Frequent breaks
- Increased parent communication
- Daily log

Diversity and Inclusion:

- Involve families in student learning
- Respect cultural traditions
- Provided students with necessary academic resources and materials
- Allow for alternative assignments
- Provide visuals
- Assign peer tutor
- Collaborate with language professionals and ESL teachers
- Encourage parents to help children maintain their native language at home, while the school helps the child attain proficiency in English.
- Establish a positive connection with parent
- Utilize closed captioning when available
- Provide road maps or outlines for difficult concepts
- Provide sufficient wait time before calling on any student to help keep students who may need more time engaged
- Speak clearly and slowly, avoid slang and idiomatic expressions
- Create a nurturing environment with structured routines

Core Instructional and Supplemental Materials and Resources

Instructional Materials

- Textbook
- Laboratory manuals and equipment

Supplemental Materials

Science Websites:

- American Chemical Society
- Ptable

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- Chemical Portal
- PBS Learning Media
- Chemistry library | Science | Khan Academy
- bozemanscience
- News from Science | AAAS
- nsf
- Newsela Science Text sets
- Next Generation Science Standards
- chemspider
- LGBTQ plus Resources
- Individuals with disabilities Resources
- School databases
- Multimedia Resources
- Printers and Computers
- Online Resources and videos
- [Amistad Commission](#)
- [Holocaust Commission](#)
- Interactive Projector
- Rubrics

Intervention Materials

- Guided notes
- Flipped videos
- Leveled Text

Social and Emotional Learning New Jersey SEL

Competencies and Sub-Competencies Social and emotional learning (SEL) involves the process through which children and adults acquire and apply the knowledge, attitudes and skills necessary to understand and manage emotions, set and achieve positive goals, feel and show empathy for others, establish and maintain positive relationships, and make responsible decisions. The purpose of the SEL competencies is to provide schools with guidelines for integrating SEL across grades and subject areas.

Self-Awareness

- Recognize one's feelings and thoughts
- Recognize the impact of one's feelings and thoughts on one's own behavior
- Recognize one's personal traits, strengths and limitations
- Recognize the importance of self-confidence in handling daily tasks and challenges

Self-Management

- Understand and practice strategies for managing one's own emotions, thoughts and behaviors

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- Recognize the skills needed to establish and achieve personal and educational goals
- Identify and apply ways to persevere or overcome barriers through alternative methods to achieve one's goals

Social Awareness

- Recognize and identify the thoughts, feelings and perspectives of others
- Demonstrate awareness of the differences among individuals, groups and others' cultural backgrounds
- Demonstrate an understanding of the need for mutual respect when viewpoints differ
- Demonstrate an awareness of the expectations for social interactions in a variety of settings

Responsible Decision-Making

- Develop, implement and model effective problem solving and critical thinking skills
- Identify the consequences associated with one's actions in order to make constructive choices
- Evaluate personal, ethical, safety and civic impact of decisions

Relationship Skills

- Establish and maintain healthy relationships
- Utilize positive communication and social skills to interact effectively with others
- Identify ways to resist inappropriate social pressure
- Demonstrate the ability to prevent and resolve interpersonal conflicts in constructive ways
- Identify who, when, where, or how to seek help for oneself or others when needed

NJDOE Website on Social and Emotional Learning

<http://www.nj.gov/education/students/safety/sandp/sel>

Teacher Notes

Ocean Academy Charter High School
Unit 3 Overview

Content Area: Science

Unit 3: Bonding and Chemical Reactions

Target Course/Grade Levels: 10-11

Duration: 18 Days

Unit 3 Introduction:

In this unit, students explore how the atomic-level structure and interactions of matter can be used to explain observable chemical properties and behavior. They investigate how atoms and

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molecules interact, collide, and rearrange during chemical reactions, using particle-level models to connect microscopic processes to macroscopic observations.

Students examine chemical reactions as dynamic processes in which matter and energy are conserved. They investigate factors that influence reaction rates, including particle collisions, concentration, temperature, and other conditions, and use mathematical relationships and experimental data to describe and predict changes within chemical systems. Students also consider the energy associated with chemical reactions and use evidence to explain how energy is absorbed, released, or transferred during chemical change.

Throughout the unit, students engage in scientific and engineering practices by developing and revising models, designing and conducting laboratory investigations, collecting and analyzing quantitative data, and constructing evidence-based explanations. Mathematical reasoning is used to identify patterns, make predictions, evaluate experimental results, and communicate relationships between variables.

Students also apply chemistry concepts to engineering and real-world challenges. They explore how chemical systems can be optimized by identifying variables, evaluating constraints, analyzing trade-offs, and testing possible solutions. Through an engineering design approach, students consider how changes to reaction conditions can improve efficiency, safety, performance, or sustainability.

The organizing concepts for the unit include patterns, energy and matter, and stability and change. Students use these crosscutting concepts to make connections between atomic structure, molecular interactions, chemical reactions, energy transformations, and the behavior of chemical systems. By the end of the unit, students are expected to demonstrate proficiency in developing and using models, planning and conducting investigations, applying mathematical reasoning, analyzing evidence, constructing explanations, and designing solutions to chemistry-based problems.

This unit is based on HS-PS1-7, HS-PS1-4, HS-PS1-5, HS-PS1-6, and HS-ETS1-2.

Standard 9.1 Personal Financial Literacy: This standard outlines the important fiscal knowledge, habits, and skills that must be mastered in order for students to make informed decisions about personal finance. Financial literacy is an integral component of a student's college and career readiness, enabling students to achieve fulfilling, financially-secure, and successful careers.

Standard 9.2 Career Awareness, Exploration, Preparation and Training. This standard outlines the importance of being knowledgeable about one's interests and talents, and being well informed about postsecondary and career options, career planning, and career requirements.

Standard 9.4 Life Literacies and Key Skills. This standard outline key literacies and technical skills such as critical thinking, global and cultural awareness, and technology literacy* that are critical for students to develop to live and work in an interconnected global economy.

Standard 8.1 Computer Science

Computer Science outlines a comprehensive set of concepts and skills, such as data and analysis, algorithms and programming, and computing systems.

Standard 8.2 Design Thinking

Technology, outlines the technological design concepts and skills essential for technological and engineering literacy. The framework design includes Engineering Design, Ethics and Culture, and the Effects of Technology on the Natural world among the disciplinary concepts

Amistad Law: N.J.S.A. 18A 52:16A-88 Every board of education shall incorporate the information regarding the contributions of African-Americans to our country in an appropriate place in the curriculum of elementary and secondary school students.

Holocaust Law: N.J.S.A. 18A:35-28 Every board of education shall include instruction on the Holocaust and genocide in an appropriate place in the curriculum of all elementary and secondary school pupils. The instruction shall further emphasize the personal responsibility that each citizen bears to fight racism and hatred whenever and wherever it happens.

LGBT and Disabilities Law: N.J.S.A. 18A:35-4.35 A board of education shall include instruction on the political, economic, and social contributions of persons with disabilities and lesbian, gay, bisexual, and transgender people, in an appropriate place in the curriculum of middle school and high school students as part of the district's implementation of the New Jersey Student Learning Standards (N.J.S.A.18A:35-4.36) A board of education shall have policies and procedures in place pertaining to the selection of instructional materials to implement the requirements of N.J.S.A. 18A:35-4.35.

Diversity and Inclusion

C.18A:35-4.36a Curriculum to include instruction on diversity and inclusion.

1. The instruction shall:
 - (1) highlight and promote diversity, including economic diversity, equity, inclusion, tolerance, and belonging in connection with gender and sexual orientation, race and ethnicity, disabilities, and religious tolerance;
 - (2) examine the impact that unconscious bias and economic disparities have at both an individual level and on society as a whole; and
 - (3) encourage safe, welcoming, and inclusive environments for all students regardless of race or ethnicity, sexual and gender identities, mental and physical disabilities, and religious beliefs.

Asian Americans and Pacific Islanders (AAPI)

Ensures that the contributions, history, and heritage of Asian Americans and Pacific Islanders (AAPI) are included in the New Jersey Student Learning Standards (NJSLs) for Social Studies in kindergarten through Grade 12 (P.L.2021, c.416).

21st Century Themes and Skills

“Twenty-first century themes and skills” means themes such as global awareness; financial, economic, business, and entrepreneurial literacy; civic literacy; health literacy; learning and innovation skills, including creativity and innovation, critical thinking and problem solving, and communication and collaboration; information, media, and technology skills; and life and career skills, including flexibility. Career readiness, life literacies, and key skills education provides students with the necessary skills to make informed career and financial decisions, engage as responsible community members in a digital society, and to successfully meet the challenges and opportunities in an interconnected global economy.”

Unit 3 Focus Standards (Major Standards)

<https://www.nj.gov/education/cccs/2020/NJSLs-Science.pdf>

HS-PS1-4: Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy. [Clarification Statement: Emphasis is on the idea that a chemical reaction is a system that affects the energy change. Examples of models could include molecular-level drawings and diagrams of reactions, graphs showing the relative energies of reactants and products, and representations showing energy is conserved.] [Assessment Boundary: Assessment does not include calculating the total bond energy changes during a chemical reaction from the bond energies of reactants and products.]

HS-PS1-5: Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs. [Clarification Statement: Emphasis is on student reasoning that focuses on the number and energy of collisions between molecules.] [Assessment Boundary: Assessment is limited to simple reactions in which there are only two reactants; evidence from temperature, concentration, and rate data; and qualitative relationships between rate and temperature.]

HS-PS1-6: Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium. [Clarification Statement: Emphasis is on the application of Le Chatelier’s Principle and on refining designs of chemical reaction systems, including descriptions of the connection between changes made at the macroscopic level and what happens at the molecular level. Examples of designs could include different ways to increase product formation including adding reactants or removing products.] [Assessment Boundary: Assessment is limited to specifying the change in only one variable at a time. Assessment does not include calculating equilibrium constants and concentrations.]

HS-PS1-7: Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction. [Clarification Statement: Emphasis is on using

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mathematical ideas to communicate the proportional relationships between masses of atoms in the reactants and the products, and the translation of these relationships to the macroscopic scale using the mole as the conversion from the atomic to the macroscopic scale. Emphasis is on assessing students' use of mathematical thinking and not on memorization and rote application of problem-solving techniques.] [Assessment Boundary: Assessment does not include complex chemical reactions.]

HS-ETS1-2: Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

<https://www.nj.gov/education/aps/cccs/science/safety.htm>

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Developing and Using Models Modeling in 9-12 builds on K-8 and progresses to using, synthesizing, and developing models to predict and show relationships among variables between systems and their components in the natural and designed worlds. Develop a model based on evidence to illustrate the relationships between systems or between components of a system. (HS-PS1-4), (HS-PS1-8) Using Mathematics and Computational Thinking Mathematical and computational thinking at the 9-12 builds on K-8 and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions including trigonometric functions, exponentials and logarithms, and computational tools for	PS1.A: Structure and Properties of Matter - A stable molecule has less energy than the same set of atoms separated; one must provide at least this energy in order to take the molecule apart. (HS-PS1-4) PS1.B: Chemical Reactions - Chemical processes, their rates, and whether or not energy is stored or released can be understood in terms of the collisions of molecules and the rearrangements of atoms into new molecules, with consequent changes in the sum of all bond energies in the set of molecules that are matched by changes in kinetic energy. (HS-PS1-4), (HS-PS1-5) - In many situations, a dynamic and condition-dependent	Patterns - 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-PS1-5) Energy and Matter - The total amount of energy and matter in closed systems is conserved. (HS-PS1-7) - Changes of energy and matter in a system can be described in terms of energy and matter flows into, out of, and within that system. (HS-PS1-4) Stability and Change - Much of science deals with constructing explanations of how things change and how they remain stable.

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statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical models of basic assumptions. • Use mathematical representations of phenomena to support claims. (HS-PS1-7) Constructing Explanations and Designing Solutions Constructing explanations and designing solutions in 9-12 builds on K-8 builds on K-8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories. • Apply scientific principles and evidence to provide an explanation of phenomena and solve design problems, taking into account possible unanticipated effects. (HS-PS1-5) • Refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. (HS-PS1-6) • Design a solution to a complex real-world	balance between a reaction and the reverse reaction determines the numbers of all types of molecules present. (HS-PS1-6) • The fact that atoms are conserved, together with knowledge of the chemical properties of the elements involved, can be used to describe and predict chemical reactions. (HS-PS1-2), (HS-PS1-7) ETS1.C: Optimizing the Design Solution • Criteria may need to be broken down into simpler ones that can be approached systematically, and decisions about the priority of certain criteria over others (tradeoffs) may be needed. (secondary to HS-PS1-6), (HS-ETS1-2)	(HS-PS1-6) <i>Connections to Nature of Science</i> Scientific Knowledge Assumes an Order and Consistency in Natural Systems • Science assumes the universe is a vast single system in which basic laws are consistent. (HS-PS1-7)
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problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. (HS-ETS1-2)		
Interdisciplinary Connections Supporting and Additional Standards Unit 3 New Jersey Student Learning Standards-Mathematics New Jersey Student Learning Standards-ELA <i>Connections to other DCIs in grades 9-12:</i> • HS.PS3.A (HS-PS1-4), (HS-PS1-5), (HSPS1-8) • HS.PS3.B (HS-PS1-4), (HS-PS1-6), (HSPS1-7), (HS-PS1-8) • HS.PS3.D (HS-PS1-4), (HS-PS1-8) • HS.LS1.C (HS-PS1-1), (HS-PS1-2), (HS-PS1-4), (HS-PS1-7) • HS.LS2.B (HS-PS1-7) <i>Articulation of DCIs across grade levels:</i> • MS.PS1.A (HS-PS1-1), (HS-PS1-2), (HSPS1-3), (HS-PS1-4), (HS-PS1- 5), (HS-PS1-7), (HS-PS1-8) • MS.PS1.B (HS-PS1-1), (HS-PS1-2), (HS-PS1-4), (HS-PS1-5), (HS-PS1- 6), (HS-PS1-7), (HS-PS1-8) • MS.PS1.C (HS-PS1-8) • MS.PS2.B (HS-PS1-3), (HS-PS1-4), (HS-PS1-5) • MS.PS3.A (HS-PS1-5) • MS.PS3.B (HS-PS1-5) • MS.PS3.D (HS-PS1-4) • MS.LS1.C (HS-PS1-4), (HS-PS1-7) • MS.LS2.B (HS-PS1-7) • MS.ESS2.A (HS-PS1-7), (HS-PS1-8) • MS.ETS1.A (HS-ETS1-1), (HS-ETS1-2), (HS-ETS1-3), (HS-ETS1-4) • MS.ETS1.B (HS-ETS1-2), (HS-ETS1-3), (HS-ETS1-4) • MS.ETS1.C (HS-ETS1-2), (HS-ETS1-4) <i>Connections to HS-ETS1.C: Optimizing the Design Solution:</i> • Physical Science: HS-PS1-6, HS-PS2-3		
ELA/Literacy - RI.CR.9-10.1. Cite a range and thorough textual evidence and make clear and relevant connections, to strongly support an analysis of multiple aspects of what an informational text says explicitly and inferentially, as well as interpretations of the text.(HS-PS1-3), (HS-PS1-5) RI.MF.9-10.6. Analyze, integrate, and evaluate multiple interpretations (e.g., charts, graphs, diagrams, videos) of a single text or text/s presented in different formats (visually, quantitatively) as well as in words in order to address a question or solve a problem. (HS-ETS1-1), (HS-ETS1-3) W.IW.9-10.2. Write informative/explanatory texts (including the narration of historical events, scientific procedures/ experiments, or technical processes) to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content.		

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- A. Introduce a topic; organize complex ideas, concepts, and information to make important connections and distinctions; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aid in comprehension.
- B. Develop the topic with well-chosen, relevant, and sufficient facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience's knowledge of the topic.
- C. Use appropriate and varied transitions to link the major sections of the text, create cohesion, and clarify the relationships among complex ideas and concepts.
- D. Use precise language and domain-specific vocabulary to manage the complexity of the topic.
- E. Establish and maintain a style and tone appropriate to the audience and purpose (e.g., formal and objective for academic writing) while attending to the norms and conventions of the discipline in which they are writing.
- F. Provide a concluding paragraph or section that supports the information or explanation presented (e.g., articulating implications or the significance of the topic).. (HS-PS1-2), (HS-PS1-5)

W.WR.9-10.5. 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-PS1-6)

SL.UM.9-10.5. Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance findings, reasoning, and evidence and to add interest. (HS-PS1-4)

Mathematics -

- **MP.2** Reason abstractly and quantitatively. (HS-PS1-5), (HS-PS1-7)
- **MP.4** Model with mathematics. . (HS-PS1-4), (HS-PS1-8), (HS-ETS1-1), (HS-ETS1-2), (HS-ETS1-3), (HS-ETS1-4)
- **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-PS1-4), (HS-PS1-5), (HS-PS1-7), (HS-PS1-8)
- **HSN-Q.A.2** Define appropriate quantities for the purpose of descriptive modeling. (HS-PS1-4), (HS-PS1-7), (HS-PS1-8)
- **HSN-Q.A.3** Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (HS-PS1-2), (HS-PS1-3), (HS-PS1-4), (HS-PS1-5), (HS-PS1-7), (HS-PS1-8)

Unit 3 New Jersey Student Learning Standards Connections: Career Readiness, Life Literacies, and Key Skills

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Disciplinary Concepts Career Awareness and Planning (9.2) Creativity and Innovations (9.4) Critical Thinking and Problem-solving (9.4) Digital Citizenship Global and Cultural Awareness (9.4) Information and Media Literacy (9.4)	
Core Ideas	Performance Expectations (Identified with Standard Number and Statement)
There are strategies to improve one's professional value and marketability.	9.2.12.CAP.2: Develop college and career readiness skills by participating in opportunities such as structured learning experiences, apprenticeships, and dual enrollment programs. 9.2.12.CAP.3: Investigate how continuing education contributes to one's career and personal growth.
Career planning requires purposeful planning based on research, self-knowledge, and informed choices.	9.2.12.CAP.4: Evaluate different careers and develop various plans (e.g., costs of public, private, training schools) and timetables for achieving them, including educational/training requirements, costs, loans, and debt repayment. 9.2.12.CAP.5: Assess and modify a personal plan to support current interests and postsecondary plans. 9.2.12.CAP.6: Identify transferable skills in career choices and design alternative career plans based on those skills. 9.2.12.CAP.8: Determine job entrance criteria (e.g., education credentials, math/writing/reading comprehension tests, drug tests) used by employers in various industry sectors.
An individual's income and benefit needs and financial plan can change over time.	9.2.12.CAP.13: Analyze how the economic, social, and political conditions of a time period can affect the labor market.
With a growth mindset, failure is an important part of success	9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a).

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Innovative ideas or innovation can lead to career opportunities.	● 9.4.12.CI.2: Identify career pathways that highlight personal talents, skills, and abilities (e.g., 1.4.12prof.CR2b, 2.2.12.LF.8) ● 9.4.12.CI.3: Investigate new challenges and opportunities for personal growth, advancement, and transition (e.g., 2.1.12.PGD.1).
Collaboration with individuals with diverse experiences can aid in the problem-solving process, particularly for global issues where diverse solutions are needed.	● 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.2: Explain the potential benefits of collaborating to enhance critical thinking and problem solving (e.g., 1.3E.12profCR3.a). ● 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). ● 9.4.12.CT.4: Participate in online strategy and planning sessions for course-based, school-based, or other projects and determine the strategies that contribute to effective outcomes.
Laws govern the use of intellectual property and there are legal consequences to utilizing or sharing another's original works without permission or appropriate credit.	● 9.4.12.DC.1: Explain the beneficial and harmful effects that intellectual property laws can have on the creation and sharing of content (e.g., 6.1.12.CivicsPR.16.a). ● 9.4.12.DC.2: Compare and contrast international differences in copyright laws and ethics.
Digital communities influence many aspects of society, especially the workforce. The increased connectivity between people in different cultures and different career fields have changed the nature, content, and responsibilities of many careers.	● 9.4.12.DC.7: Evaluate the influence of digital communities on the nature, content and responsibilities of careers, and other aspects of society (e.g., 6.1.12.CivicsPD.16.a).
Network connectivity and computing capability extended to objects, sensors and everyday items not normally considered computers allows these devices to generate, exchange,	● 9.4.12.DC.8: Explain how increased network connectivity and computing capabilities of everyday objects allow for innovative

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and consume data with minimal human intervention. Technologies such as Artificial Intelligence (AI) and blockchain can help minimize the effect of climate change.	technological approaches to climate protection.
Solutions to the problems faced by a global society require the contribution of individuals with different points of view and experiences.	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).
Advanced search techniques can be used with digital and media resources to locate information and to check the credibility and the expertise of sources to answer questions, solve problems, and inform the decision-making.	9.4.12.IML.2: Evaluate digital sources for timeliness, accuracy, perspective, credibility of the source, and relevance of information, in media, data, or other resources (e.g., NJSLSA.W8, Social Studies Practice: Gathering and Evaluating Sources).
In order for members of our society to participate productively, information needs to be shared accurately and ethically	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.6: Use various types of media to produce and store information on climate change for different purposes and audiences with sensitivity to cultural, gender, and age diversity (e.g., NJSLSA.SL5).
Unit 3 New Jersey Student Learning Standards: Computer Science and Design Thinking	
Disciplinary Concepts Impacts of Computing (8.1) Data & Analysis (8.1) Engineering Design (8.2) Interaction of Technology and Humans (8.2) Effects of Technology on the Natural World (8.2)	
Core Ideas	

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The design and use of computing technologies and artifacts can positively or negatively affect equitable access to information and opportunities.	8.1.12.IC.1: Evaluate the ways computing impacts personal, ethical, social, economic, and cultural practices. 8.1.12.IC.3: Predict the potential impacts and implications of emerging technologies on larger social, economic, and political structures, using evidence from credible sources.
Large data sets can be transformed, generalized, simplified, and presented in different ways to influence how individuals interpret and understand the underlying information.	8.1.12.DA.5: Create data visualizations from large data sets to summarize, communicate, and support different interpretations of real-world phenomena.
Engineering design is a complex process in which creativity, content knowledge, research, and analysis are used to address local and global problems.	8.2.12.ED.1: Use research to design and create a product or system that addresses a problem and make modifications based on input from potential consumers. 8.2.12.ED.4: Design a product or system that addresses a global problem and document decisions made based on research, constraints, trade-offs, and aesthetic and ethical considerations and share this information with an appropriate audience.
Engineering design evaluation, a process for determining how well a solution meets requirements, involves systematic comparisons between requirements, specifications, and constraints.	8.2.12.ED.5: Evaluate the effectiveness of a product or system based on factors that are related to its requirements, specifications, and constraints (e.g., safety, reliability, economic considerations, quality control, environmental concerns, manufacturability, maintenance and repair, ergonomics). 8.2.12.ED.6: Analyze the effects of changing resources when designing a specific product or system (e.g., materials, energy, tools, capital, labor).
Changes caused by the introduction and use of a new technology can range from gradual to rapid and from subtle to obvious, and can change over time. These changes may vary from society to society as a result of differences in a society's economy, politics, and culture.	8.2.12.ITH.2: Propose an innovation to meet future demands supported by an analysis of the potential costs, benefits, trade-offs, and risks related to the use of the innovation. 8.2.12.ITH.3: Analyze the impact that globalization, social media, and access to open source technologies has had on

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	innovation and on a society's economy, politics, and culture.
Development and modification of any technological system needs to take into account how the operation of the system will affect natural resources and ecosystems. Impacts of technological systems on the environment need to be monitored and must inform decision-making. Many technologies have been designed to have a positive impact on the environment and to monitor environmental change over time.	8.2.12.ETW.1: Evaluate ethical considerations regarding the sustainability of environmental resources that are used for the design, creation, and maintenance of a chosen product. 8.2.12.ETW.2: Synthesize and analyze data collected to monitor the effects of a technological product or system on the environment. 8.2.12.ETW.3: Identify a complex, global environmental or climate change issue, develop a systemic plan of investigation, and propose an innovative sustainable solution.
New Jersey Student Learning Standards: Climate Change Mandate	
Core Ideas	Performance Expectations (Identified with Standard Number and Statement)
Unit 3 Evidence of Student Learning	
Performance Tasks/Use of Technology: - Molecular Structure and Bonding Simulation: Explore atomic interactions, bonding, and intermolecular forces using interactive PhET simulations. - Chemical Formula and Nomenclature Investigation: Practice identifying compounds and applying systematic rules to write chemical names and formulas. - Solubility and Electrical Conductivity Laboratory: Investigate how different substances behave in solution and relate conductivity to the presence and movement of ions. - Build-a-Molecule Modeling Activity: Construct molecular models to explore chemical formulas, molecular structures, and isomerism using an interactive simulation. - Balancing Chemical Equations Simulation: Use digital models to	Other Assessments: Formative - Observation - Homework - Class participation - Graphic Organizers - Projects - Student Response Systems (ex.Clickers) - Do-Now/Exit Cards - Laboratories/Lab Reports - Notebook - Writing Assignments - Graphs, Models, and Tables Summative - Chapter/Unit Test - Writing Assignments - Presentations - Laboratory Reports/Practical - Unit Projects

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practice conserving atoms and determining appropriate coefficients for chemical equations. • Types of Chemical Reactions Laboratory: Conduct a series of reactions, classify reaction types, and use observations to identify evidence of chemical change. • Reaction Patterns Investigation: Analyze observable changes during chemical reactions and connect experimental evidence to reactants, products, and reaction patterns. • Cation and Anion Identification Laboratory: Use qualitative tests and observations to determine the identities of unknown ions present in aqueous solutions. • Surface Tension Investigation: Examine the effects of intermolecular forces on the behavior of liquids through hands-on experimentation and data collection. • Composition of Hydrates Laboratory: Experimentally determine the amount of water present in a hydrated compound and use quantitative data to establish its composition. • Reaction Rates Interactive Simulation: Investigate how concentration, temperature, and other factors influence the frequency and effectiveness of particle collisions and the rate of chemical reactions. • Bags of Reactions Laboratory: Observe chemical reactions in a controlled system while monitoring evidence of energy transfer, gas production, temperature change, and formation of new substances.	Benchmark • Linkit assessment • Quarterlies • Mid-Term • Final Exams • Performance Assessment Alternative CER (claim, evidence, reasoning)
Unit 3 Knowledge and Skills	
Unit 3 Learning Targets	
<i>Students will be able to..</i> • Explain how chemical reactions conserve atoms and mass, using balanced equations and	

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mathematical representations as evidence.

- Use mole relationships to connect the number and mass of particles at the atomic level to measurable quantities at the macroscopic level.
- Calculate and interpret quantitative relationships among reactants and products using chemical formulas, balanced equations, and proportional reasoning.
- Analyze the chemical properties of substances to predict how elements and compounds are likely to interact and form new products.
- Develop and use particle-level models to represent how atoms are rearranged and how matter and energy change during chemical reactions.
- Explain energy changes in chemical systems by describing how energy is transferred into, out of, or within a system.
- Compare the energy of bonded atoms in stable molecules with the energy of those atoms when separated, using the formation and breaking of chemical bonds to explain energy changes.
- Use bond energies and experimental evidence to determine whether a chemical reaction absorbs or releases energy.
- Explain how reaction rates are affected by factors such as temperature and concentration by relating these changes to particle collisions and collision frequency.
- Analyze experimental data to identify patterns between reaction conditions and reaction rates and use those patterns to support evidence-based claims about cause and effect.
- Design and conduct investigations that examine how changes in reaction conditions influence the rate and outcome of a chemical reaction.
- Use evidence from multiple investigations, mathematical relationships, and scientific principles to construct explanations for changes in reaction rate and energy.
- Describe chemical equilibrium as a dynamic condition in which forward and reverse reactions continue while the overall system remains relatively stable.
- Predict how changes in conditions, such as concentration, temperature, or pressure, can influence the position of equilibrium and the relative amounts of reactants and products.
- Evaluate possible strategies for increasing product formation in an equilibrium system by considering scientific evidence, constraints, efficiency, and trade-offs.
- Develop, test, and refine an evidence-based solution for optimizing a chemical process while considering performance criteria, limitations, safety, and environmental or practical impacts.

Unit 3 Enduring Understandings	Unit 3 Essential Questions
<i>Students will know...</i> ● Chemical reactions involve the rearrangement of atoms, and the identity and properties of the elements involved can be used to predict reaction outcomes. ● Matter and energy are conserved within chemical systems, although they may be transferred or transformed. ● Changes in chemical systems can be	● How does energy change as atoms break apart, form bonds, and rearrange during a chemical reaction? ● What factors can be changed to increase or decrease the rate of a chemical reaction? ● How can the properties of reactants help us predict what products will form? ● How is matter conserved when substances undergo chemical change?

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understood by tracking the movement of matter and energy into, out of, and within a system. • Chemical bonds represent differences in energy; forming stable bonds generally results in a lower-energy arrangement than separated atoms. • Chemical reactions occur when particles collide and atoms are rearranged, resulting in changes to bond energy and the overall energy of the system. • Reaction rates depend on particle interactions and are influenced by conditions such as temperature and concentration. • Patterns in experimental data can reveal relationships between changing conditions and the behavior or rate of a chemical reaction. • Chemical systems can undergo change while also maintaining stability through dynamic processes. • At equilibrium, forward and reverse reactions continue simultaneously, with conditions determining the relative amounts of reactants and products. • Scientific models and evidence can be used to explain, predict, and evaluate changes in chemical systems. • Effective solutions to chemical and engineering problems require clearly defined criteria, prioritization of goals, and consideration of constraints and trade-offs. • Chemical processes can be optimized by evaluating conditions, testing solutions, and refining designs based on evidence.	• How do particle collisions influence whether a chemical reaction occurs and how quickly it proceeds? • How can chemical reactions transfer or release energy, as demonstrated by systems such as hot and cold packs? • What conditions can be adjusted to favor the formation of desired products in a chemical system? • How can a chemical system change while maintaining stability or reaching equilibrium?
Unit 3 Instructional Plan	
Suggested Activities/Use of Technology	Resources
• Chemical Compound Practice: Apply naming conventions and formula-writing	• Gizmos • Textbook • Lab materials

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skills through guided and independent practice. • Chemical Change Laboratory Investigations: Conduct hands-on experiments to observe, identify, and analyze physical and chemical changes. • Interactive Chemistry Media: Use TED-Ed and Bozeman Science videos to reinforce concepts related to chemical compounds, reactions, and molecular interactions. • Chemical Compounds Visual Project: Create informational posters that organize and communicate key concepts related to chemical compounds, including their properties, structures, and classifications. • Digital Learning and Review Activities: Incorporate interactive simulations, multimedia resources, and online practice tools to strengthen understanding of chemical compounds and reactions.	• YouTube
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Unit 3 Suggested Options for Differentiation: Content-specific Accommodations and Modifications for Subgroups

Multilingual Learners

- Speak slowly, distinctly, and write down key terms
- Closed Captioning
- Emphasize visual literacy
- Graphic Organizers
- Use charts, graphs and figures
- Group projects & cooperative learning
- Partner English learners with strong English speakers
- Consistent routines
- Outlines
- Language-based science games
- Picture glossary
- Root words

Students with 504 Plans

- At the beginning of a course, have a conversation about the value of understanding one's learning profile and/or let students take a learning style survey.
- Explicitly share with students your observations about their learning strengths and

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challenges as the course progresses.

- Build metacognitive reflection into assignments.
- Instead of relying on large unit tests or exams, build in more frequent forms of assessment.
- Use grade-keeping software and make updated grade reports accessible to students.
- Provide direct personalized feedback to students
- Provide (or assign) some form of study guide for students to review before any quiz or exam.
- Provide scoring rubrics that describe the qualities of excellent work for the various components of each assignment.
- Make a direct connection, orally and in writing, between each class task and its associated learning objective.
- Distribute all important assignment handouts in the same format and structure.
- Establish and rationalize a routine for how class operates
- Post and review daily agendas for all class activities and assignments.
- Consider making available, in the classroom or learning support center, emerging assistive technologies such as text-to-speech screen readers, which are designed to assist students with difficulties decoding or attending to written text.
- Teach students to use some form of course planner or calendar that shows assignment due dates in a clear, graphical format.

Special Education

- At the beginning of a course, have a conversation about the value of understanding one's learning profile and/or let students take a learning style survey.
- Explicitly share with students your observations about their learning strengths and challenges as the course progresses.
- Build metacognitive reflection into assignments.
- Instead of relying on large unit tests or exams, build in more frequent forms of assessment.
- Use grade-keeping software and make updated grade reports accessible to students.
- Provide direct personalized feedback to students
- Provide (or assign) some form of study guide for students to review before any quiz or exam.
- Provide scoring rubrics that describe the qualities of excellent work for the various components of each assignment.
- Make a direct connection, orally and in writing, between each class task and its associated learning objective.
- Distribute all important assignment handouts in the same format and structure.
- Establish and rationalize a routine for how class operates
- Post and review daily agendas for all class activities and assignments.
- Consider making available, in the classroom or learning support center, emerging assistive technologies such as text-to-speech screen readers, which are designed to assist students with difficulties decoding or attending to written text.
- Teach students to use some form of course planner or calendar that shows assignment due dates in a clear, graphical format.

Gifted and Talented

- Interdisciplinary and problem-based assignments with planned scope and sequence

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- Advance, accelerated, or compacted content
- Abstract and advanced higher-level thinking
- Allowance for individual student interests
- Assignments geared to development in areas of affect, creativity, cognition, and research skills
- Complex, in-depth assignments
- Diverse enrichment that broadens learning
- Variety in types of resources
- Open-ended questions for higher-level thinking
- Higher-level text

Students at Risk of School Failure

- Small group instruction
- Frequent breaks
- Increased parent communication
- Daily log

Diversity and Inclusion:

- Involve families in student learning
- Respect cultural traditions
- Provide students with necessary academic resources and materials
- Allow for alternative assignments
- Provide visuals
- Assign peer tutor
- Collaborate with language professionals and ESL teachers
- Encourage parents to help children maintain their native language at home, while the school helps the child attain proficiency in English.
- Establish a positive connection with parent
- Utilize closed captioning when available
- Provide road maps or outlines for difficult concepts
- Provide sufficient wait time before calling on any student to help keep students who may need more time engaged
- Speak clearly and slowly, avoid slang and idiomatic expressions
- Create a nurturing environment with structured routines

Core Instructional and Supplemental Materials and Resources

Instructional Materials

- Textbook
- Laboratory manuals and equipment

Supplemental Materials

Science Websites:

- American Chemical Society
- Ptable
- Chemical Portal

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- PBS Learning Media
- Chemistry library | Science | Khan Academy
- bozemanscience
- News from Science | AAAS
- nsf
- Newsela Science Text sets
- Next Generation Science Standards
- chemspider
- LGBTQ plus Resources
- Individuals with disabilities Resources
- School databases
- Multimedia Resources
- Printers and Computers
- Online Resources and videos
- [Amistad Commission](#)
- [Holocaust Commission](#)
- Interactive Projector
- Rubrics

Intervention Materials

- Guided notes
- Flipped videos
- Leveled Text

Social and Emotional Learning New Jersey SEL

Competencies and Sub-Competencies Social and emotional learning (SEL) involves the process through which children and adults acquire and apply the knowledge, attitudes and skills necessary to understand and manage emotions, set and achieve positive goals, feel and show empathy for others, establish and maintain positive relationships, and make responsible decisions. The purpose of the SEL competencies is to provide schools with guidelines for integrating SEL across grades and subject areas.

Self-Awareness

- Recognize one's feelings and thoughts
- Recognize the impact of one's feelings and thoughts on one's own behavior
- Recognize one's personal traits, strengths and limitations
- Recognize the importance of self-confidence in handling daily tasks and challenges

Self-Management

- Understand and practice strategies for managing one's own emotions, thoughts and behaviors
- Recognize the skills needed to establish and achieve personal and educational goals

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- Identify and apply ways to persevere or overcome barriers through alternative methods to achieve one's goals

Social Awareness

- Recognize and identify the thoughts, feelings and perspectives of others
- Demonstrate awareness of the differences among individuals, groups and others' cultural backgrounds
- Demonstrate an understanding of the need for mutual respect when viewpoints differ
- Demonstrate an awareness of the expectations for social interactions in a variety of settings

Responsible Decision-Making

- Develop, implement and model effective problem solving and critical thinking skills
- Identify the consequences associated with one's actions in order to make constructive choices
- Evaluate personal, ethical, safety and civic impact of decisions

Relationship Skills

- Establish and maintain healthy relationships
- Utilize positive communication and social skills to interact effectively with others
- Identify ways to resist inappropriate social pressure
- Demonstrate the ability to prevent and resolve interpersonal conflicts in constructive ways
- Identify who, when, where, or how to seek help for oneself or others when needed

NJDOE Website on Social and Emotional Learning

<http://www.nj.gov/education/students/safety/sandp/sel>

Teacher Notes:

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Unit 4 Overview

Content Area: Science

Unit 4: Matter and Energy in Living Systems

Target Course/Grade Levels: 10-11

Duration: 12 Days

Unit 4 Introduction:

In this unit, students investigate how matter and energy are involved in chemical processes and how changes at the molecular level can be connected to observable phenomena. Students use models and evidence to examine how atoms are rearranged during chemical reactions and how energy is transferred or transformed as substances undergo chemical and physical changes.

Students analyze the relationships among chemical reactions, energy transfer, and the properties of substances. They use mathematical representations, experimental data, and particle-level models to describe and predict how changes in a chemical system affect the movement of matter and energy. Through laboratory investigations, students collect and interpret quantitative and qualitative evidence to support explanations of chemical behavior.

Throughout the unit, students develop proficiency with scientific and engineering practices by constructing and revising models, planning and conducting investigations, analyzing data, applying mathematical reasoning, and communicating evidence-based explanations. Students also consider how chemistry can be used to address real-world challenges involving energy use, chemical processes, efficiency, and the design of practical solutions.

The crosscutting concepts of energy and matter, patterns, and cause and effect provide a framework for understanding how chemical systems function and change. By connecting observations at the macroscopic level to interactions among particles, students develop a deeper understanding of how matter and energy are conserved and how chemical processes can be explained, predicted, and optimized.

This unit is based on HS-LS1-6 and HS-LS1-7.

Standard 9.1 Personal Financial Literacy: This standard outlines the important fiscal knowledge, habits, and skills that must be mastered in order for students to make informed decisions about personal finance. Financial literacy is an integral component of a student's college and career readiness, enabling students to achieve fulfilling, financially-secure, and successful careers.

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Standard 9.2 Career Awareness, Exploration, Preparation and Training. This standard outlines the importance of being knowledgeable about one's interests and talents, and being well informed about postsecondary and career options, career planning, and career requirements.

Standard 9.4 Life Literacies and Key Skills. This standard outline key literacies and technical skills such as critical thinking, global and cultural awareness, and technology literacy* that are critical for students to develop to live and work in an interconnected global economy.

Standard 8.1 Computer Science

Computer Science outlines a comprehensive set of concepts and skills, such as data and analysis, algorithms and programming, and computing systems.

Standard 8.2 Design Thinking

Technology, outlines the technological design concepts and skills essential for technological and engineering literacy. The framework design includes Engineering Design, Ethics and Culture, and the Effects of Technology on the Natural world among the disciplinary concepts

Amistad Law: N.J.S.A. 18A 52:16A-88 Every board of education shall incorporate the information regarding the contributions of African-Americans to our country in an appropriate place in the curriculum of elementary and secondary school students.

Holocaust Law: N.J.S.A. 18A:35-28 Every board of education shall include instruction on the Holocaust and genocide in an appropriate place in the curriculum of all elementary and secondary school pupils. The instruction shall further emphasize the personal responsibility that each citizen bears to fight racism and hatred whenever and wherever it happens.

LGBT and Disabilities Law: N.J.S.A. 18A:35-4.35 A board of education shall include instruction on the political, economic, and social contributions of persons with disabilities and lesbian, gay, bisexual, and transgender people, in an appropriate place in the curriculum of middle school and high school students as part of the district's implementation of the New Jersey Student Learning Standards (N.J.S.A.18A:35-4.36) A board of education shall have policies and procedures in place pertaining to the selection of instructional materials to implement the requirements of N.J.S.A. 18A:35-4.35.

Diversity and Inclusion

C.18A:35-4.36a Curriculum to include instruction on diversity and inclusion.

1. The instruction shall:
 - (1) highlight and promote diversity, including economic diversity, equity, inclusion, tolerance, and belonging in connection with gender and sexual orientation, race and ethnicity, disabilities, and religious tolerance;
 - (2) examine the impact that unconscious bias and economic disparities have at both an individual level and on society as a whole; and

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(3) encourage safe, welcoming, and inclusive environments for all students regardless of race or ethnicity, sexual and gender identities, mental and physical disabilities, and religious beliefs.

Asian Americans and Pacific Islanders (AAPI)

Ensures that the contributions, history, and heritage of Asian Americans and Pacific Islanders (AAPI) are included in the New Jersey Student Learning Standards (NJSLS) for Social Studies in kindergarten through Grade 12 (P.L.2021, c.416).

21st Century Themes and Skills

“Twenty-first century themes and skills” means themes such as global awareness; financial, economic, business, and entrepreneurial literacy; civic literacy; health literacy; learning and innovation skills, including creativity and innovation, critical thinking and problem solving, and communication and collaboration; information, media, and technology skills; and life and career skills, including flexibility. Career readiness, life literacies, and key skills education provides students with the necessary skills to make informed career and financial decisions, engage as responsible community members in a digital society, and to successfully meet the challenges and opportunities in an interconnected global economy.”

Unit 4 Focus Standards (Major Standards)

<https://www.nj.gov/education/cccs/2020/NJSLS-Science.pdf>

HS-LS1-6: Construct and revise an explanation based on evidence for how carbon, hydrogen, and oxygen from sugar molecules may combine with other elements to form amino acids and/or other large carbon-based molecules. **[Clarification Statement: Emphasis is on using evidence from models and simulations to support explanations.]** **[Assessment Boundary: Assessment does not include the details of the specific chemical reactions or identification of macromolecules.]**

HS-LS1-7: Use a model to illustrate that cellular respiration is a chemical process whereby the bonds of food molecules and oxygen molecules are broken and the bonds in new compounds are formed resulting in a net transfer of energy. **[Clarification Statement: Emphasis is on the conceptual understanding of the inputs and outputs of the process of cellular respiration.]** **[Assessment Boundary: Assessment should not include identification of the steps or specific processes involved in cellular respiration.]**

<https://www.nj.gov/education/aps/cccs/science/safety.htm>

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Developing and Using Models Modeling in 9-12 builds on K-8 and progresses to using,	LS1.C: Organization for Matter and Energy Flow in Organisms	Energy and Matter Changes of energy and matter in a system can be

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synthesizing, and developing models to predict and show relationships among variables between systems and their components in the natural and designed worlds. • Use a model based on evidence to illustrate the relationships between systems or between components of a system. (HS-LS1-4), (HS-LS1-5), (HS-LS1-7) Constructing Explanations and Designing Solutions Constructing explanations and designing solutions in 9-12 builds on K-8 builds on K-8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories. • 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.	• The sugar molecules thus formed contain carbon, hydrogen, and oxygen: their hydrocarbon backbones are used to make amino acids and other carbon-based molecules that can be assembled into larger molecules (such as proteins or DNA), used for example to form new cells. (HS-LS1-6) • As matter and energy flow through different organizational levels of living systems, chemical elements are recombined in different ways to form different products. (HS-LS1-6), (HS-LS1-7) • As a result of these chemical reactions, energy is transferred from one system of interacting molecules to another. Cellular respiration is a chemical process in which the bonds of food molecules and oxygen molecules are broken and new compounds are formed that can transport energy to muscles. Cellular respiration also releases the energy needed to maintain body temperature despite ongoing energy transfer to the surrounding environment. (HSL1-7)	described in terms of energy and matter flows into, out of, and within that system. (HS-LS1-5), (HS-LS1-6) • Energy cannot be created or destroyed—it only moves between one place and another place, between objects and/or fields, or between systems. (HS-LS1-7)
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(HS-LS1-6)

Interdisciplinary Connections Supporting and Additional Standards Unit 4

[New Jersey Student Learning Standards-Mathematics](#)

[New Jersey Student Learning Standards-ELA](#)

Connections to other DCIs in grades 9-12: • HS.PS1.B (HS-LS1-5), (HS-LS1-6), (HS-LS1-7) • HS.PS2.B (HS-LS1-7) • HS.PS3.B (HS-LS1-5), (HS-LS1-7)

Articulation of DCIs across grade levels: • MS.PS1.A (HS-LS1-6) • MS.PS1.B (HS-LS1-5), (HS-LS1-6), (HS-LS1-7) • MS.PS3.D (HS-LS1-5), (HS-LS1-6), (HS-LS1-7) • MS.LS1.C (HS-LS1-5), (HS-LS1-6), (HS-LS1-7) • MS.LS2.B (HS-LS1-5), (HS-LS1-7) • MS.ESS2.E (HS-LS1-6)

ELA/Literacy -

RI.CR.9-10.1. Cite a range and thorough textual evidence and make clear and relevant connections, to strongly support an analysis of multiple aspects of what an informational text says explicitly and inferentially, as well as interpretations of the text. (HS-LS1-1), (HS-LS1-6)

W.IW.9-10.2. Write informative/explanatory texts (including the narration of historical events, scientific procedures/ experiments, or technical processes) to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content.

- A. Introduce a topic; organize complex ideas, concepts, and information to make important connections and distinctions; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aid in comprehension.
- B. Develop the topic with well-chosen, relevant, and sufficient facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience's knowledge of the topic.
- C. Use appropriate and varied transitions to link the major sections of the text, create cohesion, and clarify the relationships among complex ideas and concepts.
- D. Use precise language and domain-specific vocabulary to manage the complexity of the topic.
- E. Establish and maintain a style and tone appropriate to the audience and purpose (e.g., formal and objective for academic writing) while attending to the norms and conventions of the discipline in which they are writing.
- F. Provide a concluding paragraph or section that supports the information or explanation presented (e.g., articulating implications or the significance of the topic).. (HS-LS1-1), (HS-LS1-6)

W.WP.9-10.4. Develop and strengthen writing as needed by planning, revising, editing, rewriting, trying a new approach; sustaining effort to complete complex writing tasks; seeking out feedback

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and reflecting on personal writing progress; consulting a style manual (such as MLA or APA Style), focusing on addressing what is most significant for a specific purpose and audience. (HS-LS1-6)

SL.UM.9-10.5. Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance findings, reasoning, and evidence and to add interest. (HS-LS1-2), (HS-LS1-4), (HS-LS1-5), (HS-LS1-7)

Unit 4 New Jersey Student Learning Standards Connections: Career Readiness, Life Literacies, and Key Skills

Disciplinary Concepts

Career Awareness and Planning (9.2)

Creativity and Innovations (9.4)

Critical Thinking and Problem-solving (9.4)

Digital Citizenship

Global and Cultural Awareness (9.4)

Information and Media Literacy (9.4)

Core Ideas

Performance Expectations

(Identified with Standard Number and Statement)

There are strategies to improve one's professional value and marketability.

- 9.2.12.CAP.2: Develop college and career readiness skills by participating in opportunities such as structured learning experiences, apprenticeships, and dual enrollment programs.
- 9.2.12.CAP.3: Investigate how continuing education contributes to one's career and personal growth.

Career planning requires purposeful planning based on research, self-knowledge, and informed choices.

- 9.2.12.CAP.4: Evaluate different careers and develop various plans (e.g., costs of public, private, training schools) and timetables for achieving them, including educational/training requirements, costs, loans, and debt repayment.
- 9.2.12.CAP.5: Assess and modify a personal plan to support current interests and postsecondary plans.
- 9.2.12.CAP.6: Identify transferable skills in career choices and design alternative career plans based on those skills.
- 9.2.12.CAP.8: Determine job entrance criteria (e.g., education credentials, math/writing/reading comprehension tests,

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	drug tests) used by employers in various industry sectors.
An individual's income and benefit needs and financial plan can change over time.	9.2.12.CAP.13: Analyze how the economic, social, and political conditions of a time period can affect the labor market.
With a growth mindset, failure is an important part of success	9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a).
Innovative ideas or innovation can lead to career opportunities.	9.4.12.CI.2: Identify career pathways that highlight personal talents, skills, and abilities (e.g., 1.4.12prof.CR2b, 2.2.12.LF.8) 9.4.12.CI.3: Investigate new challenges and opportunities for personal growth, advancement, and transition (e.g., 2.1.12.PGD.1).
Collaboration with individuals with diverse experiences can aid in the problem-solving process, particularly for global issues where diverse solutions are needed.	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.2: Explain the potential benefits of collaborating to enhance critical thinking and problem solving (e.g., 1.3E.12profCR3.a). 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). 9.4.12.CT.4: Participate in online strategy and planning sessions for course-based, school-based, or other projects and determine the strategies that contribute to effective outcomes.
Laws govern the use of intellectual property and there are legal consequences to utilizing or sharing another's original works without permission or appropriate credit.	9.4.12.DC.1: Explain the beneficial and harmful effects that intellectual property laws can have on the creation and sharing of content (e.g., 6.1.12.CivicsPR.16.a). 9.4.12.DC.2: Compare and contrast international differences in copyright laws and ethics.
Digital communities influence many aspects of society, especially the workforce. The	9.4.12.DC.7: Evaluate the influence of digital communities on the nature, content and

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increased connectivity between people in different cultures and different career fields have changed the nature, content, and responsibilities of many careers.	responsibilities of careers, and other aspects of society (e.g., 6.1.12.CivicsPD.16.a).
Network connectivity and computing capability extended to objects, sensors and everyday items not normally considered computers allows these devices to generate, exchange, and consume data with minimal human intervention. Technologies such as Artificial Intelligence (AI) and blockchain can help minimize the effect of climate change.	9.4.12.DC.8: Explain how increased network connectivity and computing capabilities of everyday objects allow for innovative technological approaches to climate protection.
Solutions to the problems faced by a global society require the contribution of individuals with different points of view and experiences.	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).
Advanced search techniques can be used with digital and media resources to locate information and to check the credibility and the expertise of sources to answer questions, solve problems, and inform the decision-making.	9.4.12.IML.2: Evaluate digital sources for timeliness, accuracy, perspective, credibility of the source, and relevance of information, in media, data, or other resources (e.g., NJSLA.W8, Social Studies Practice: Gathering and Evaluating Sources).
In order for members of our society to participate productively, information needs to be shared accurately and ethically	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.6: Use various types of media to produce and store information on climate change for different purposes and audiences with sensitivity to cultural, gender, and age diversity (e.g., NJSLA.SL5).
Unit 4 New Jersey Student Learning Standards: Computer Science and Design Thinking	
Disciplinary Concepts Impacts of Computing (8.1)	

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Data & Analysis (8.1) Engineering Design (8.2) Interaction of Technology and Humans (8.2) Effects of Technology on the Natural World (8.2)	
Core Ideas	
The design and use of computing technologies and artifacts can positively or negatively affect equitable access to information and opportunities.	8.1.12.IC.1: Evaluate the ways computing impacts personal, ethical, social, economic, and cultural practices. 8.1.12.IC.3: Predict the potential impacts and implications of emerging technologies on larger social, economic, and political structures, using evidence from credible sources.
Large data sets can be transformed, generalized, simplified, and presented in different ways to influence how individuals interpret and understand the underlying information.	8.1.12.DA.5: Create data visualizations from large data sets to summarize, communicate, and support different interpretations of real-world phenomena.
Engineering design is a complex process in which creativity, content knowledge, research, and analysis are used to address local and global problems.	8.2.12.ED.1: Use research to design and create a product or system that addresses a problem and make modifications based on input from potential consumers. 8.2.12.ED.4: Design a product or system that addresses a global problem and document decisions made based on research, constraints, trade-offs, and aesthetic and ethical considerations and share this information with an appropriate audience.
Engineering design evaluation, a process for determining how well a solution meets requirements, involves systematic comparisons between requirements, specifications, and constraints.	8.2.12.ED.5: Evaluate the effectiveness of a product or system based on factors that are related to its requirements, specifications, and constraints (e.g., safety, reliability, economic considerations, quality control, environmental concerns, manufacturability, maintenance and repair, ergonomics). 8.2.12.ED.6: Analyze the effects of changing resources when designing a specific product or system (e.g., materials, energy, tools, capital, labor).

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Changes caused by the introduction and use of a new technology can range from gradual to rapid and from subtle to obvious, and can change over time. These changes may vary from society to society as a result of differences in a society's economy, politics, and culture.	8.2.12.ITH.2: Propose an innovation to meet future demands supported by an analysis of the potential costs, benefits, trade-offs, and risks related to the use of the innovation. 8.2.12.ITH.3: Analyze the impact that globalization, social media, and access to open source technologies has had on innovation and on a society's economy, politics, and culture.
Development and modification of any technological system needs to take into account how the operation of the system will affect natural resources and ecosystems. Impacts of technological systems on the environment need to be monitored and must inform decision-making. Many technologies have been designed to have a positive impact on the environment and to monitor environmental change over time.	8.2.12.ETW.1: Evaluate ethical considerations regarding the sustainability of environmental resources that are used for the design, creation, and maintenance of a chosen product. 8.2.12.ETW.2: Synthesize and analyze data collected to monitor the effects of a technological product or system on the environment. 8.2.12.ETW.3: Identify a complex, global environmental or climate change issue, develop a systemic plan of investigation, and propose an innovative sustainable solution.

New Jersey Student Learning Standards: [Climate Change Mandate](#)

Core Ideas

Performance Expectations (Identified with Standard Number and Statement)

Unit 4 Evidence of Student Learning

Performance Tasks/Use of Technology:

- Acid-Base Investigation: Use laboratory activities and digital tools to explore acid-base behavior, neutralization, and changes in solution properties.
- Solubility Exploration: Investigate how different substances dissolve in water and examine factors that affect solubility.
- pH and Concentration Simulation: Use an interactive model to investigate relationships among pH, hydronium concentration, and dilution.
- Ionic and Molecular Solutions: Compare sugar and salt solutions to explore the

Other Assessments:

Formative

- Observation
- Homework
- Class participation
- Graphic Organizers
- Projects
- Student Response Systems (ex.Clickers)
- Do-Now/Exit Cards
- Laboratories/Lab Reports
- Notebook
- Writing Assignments
- Graphs, Models, and Tables

Summative

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behavior of ionic and molecular substances when dissolved in water. ● Reaction Rate Modeling: Use an interactive simulation to examine how concentration and other conditions influence the rate of chemical reactions. ● Molecular Polarity Simulation: Model molecular structure and electronegativity to determine how the distribution of charge influences molecular polarity. ● Data Analysis and Curve Fitting: Analyze experimental data, evaluate patterns and sources of error, and use mathematical models to determine relationships among variables.	● Chapter/Unit Test ● Writing Assignments ● Presentations ● Laboratory Reports/Practical ● Unit Projects Benchmark ● Quarterlies ● Mid-Term ● Final Exams ● Performance Assessment Alternative CER (claim, evidence, reasoning)
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Unit 4 Knowledge and Skills

Unit 4 Learning Targets

Students will be able to..

- Analyze how chemical reactions involve the transfer, transformation, and conservation of energy as atoms and molecules interact and rearrange.
- Use particle-level models to represent how matter and energy change during chemical processes and connect these changes to observable evidence.
- Explain how the structure and composition of molecules influence their ability to store, transfer, and release chemical energy.
- Develop and revise models that show how chemical bonds are broken and formed during reactions and how these changes affect the overall energy of a system.
- Apply the principles of conservation of matter and energy to identify and explain the inputs, outputs, and transformations occurring within chemical systems.
- Use mathematical relationships and experimental data to quantify changes in matter and energy during chemical reactions.
- Construct evidence-based explanations for how atoms from reactants can be rearranged and incorporated into new molecules and compounds.
- Evaluate evidence from laboratory investigations, simulations, models, and other scientific sources to explain how molecular structure and chemical interactions influence the formation of new substances.

Unit 4 Enduring Understandings

Unit 4 Essential Questions

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Students will know...

- | | |
|--|---|
| <ul style="list-style-type: none">• Matter is conserved during chemical reactions; the properties of the elements and the arrangement of their atoms can be used to explain and predict how substances interact.• Chemical reactions involve the rearrangement of atoms and the breaking and formation of chemical bonds, resulting in new substances with different properties.• Energy is conserved in chemical systems and can be transferred or transformed as bonds are broken, bonds form, and particles interact.• The movement of matter and energy through a system can be represented by tracking inputs, outputs, transfers, and transformations at both the macroscopic and molecular levels.• The chemical energy stored in molecules can be converted into other forms of energy through chemical reactions and transferred between interacting systems.• Molecular structure influences how substances participate in chemical reactions and how atoms can be reorganized into new compounds.• Carbon-based molecules can be assembled and rearranged into increasingly complex substances, with atoms such as carbon, hydrogen, oxygen, and other elements serving as the building blocks for larger molecules.• Photosynthesis demonstrates how chemical reactions can use energy from light to drive the formation of energy-rich molecules from simpler substances.• Cellular respiration illustrates how chemical energy stored in food molecules can be released through a series of reactions and transferred to support biological processes.• Scientific models, mathematical | <ul style="list-style-type: none">• How are atoms rearranged during chemical reactions to create new substances and compounds?• How is energy transferred and transformed as chemical reactions occur?• How can chemical reactions convert one form of energy into another and contribute to the storage or release of energy?• How does the molecular composition and structure of a substance influence the ways in which it can participate in chemical reactions?• How can models, mathematical representations, and experimental evidence be used to explain the movement of matter and energy within a chemical system? |
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representations, experimental evidence, and simulations can be used together to explain and predict the movement of matter and energy within chemical systems.	
Unit 4 Instructional Plan	
Suggested Activities	Resources
• Photosynthesis and Cellular Respiration Visual Project: Create detailed posters or digital infographics that compare photosynthesis and cellular respiration, highlighting reactants, products, energy transformations, and the relationship between the two processes. • Photosynthesis Simulation Investigation: Use an interactive simulation to examine how variables such as light intensity, carbon dioxide availability, and water affect the rate of photosynthesis. Students collect data, identify patterns, and use evidence to explain their observations. • Chemistry of the Human Body Project: Research the chemical processes that support human life, including the roles of carbohydrates, proteins, lipids, nucleic acids, water, enzymes, and energy-transfer reactions. Students present their findings through a multimedia presentation, digital project, or other technology-based format. • Cellular Energy Laboratory: Conduct investigations that model or demonstrate energy transfer and chemical changes associated with photosynthesis and cellular respiration. Students analyze experimental observations and connect macroscopic evidence to molecular-level processes. • Interactive Science Media: Use TED-Ed and Bozeman Science videos to	• Gizmos • Textbook • Lab materials • YouTube

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introduce, reinforce, and review concepts related to energy transformations, photosynthesis, cellular respiration, chemical reactions, and biological molecules.

- Chemical Energy and Matter Analysis: Analyze diagrams, reaction equations, data sets, and models to trace the movement of matter and energy through photosynthesis and cellular respiration.
- Photosynthesis and Respiration Modeling Activity: Develop and revise molecular models or diagrams showing how atoms are rearranged and how energy is stored or released during photosynthesis and cellular respiration.
- Real-World Chemistry Research: Investigate how chemical processes in the human body, agriculture, food production, medicine, or environmental systems depend on energy transformations and the movement of matter.

Unit 4 Suggested Options for Differentiation: Content-specific Accommodations and Modifications for Subgroups

Multilingual Learners

- Speak slowly, distinctly, and write down key terms
- Closed Captioning
- Emphasize visual literacy
- Graphic Organizers
- Use charts, graphs and figures
- Group projects & cooperative learning
- Partner English learners with strong English speakers
- Consistent routines
- Outlines
- Language-based science games
- Picture glossary
- Root words

Students with 504 Plans

- At the beginning of a course, have a conversation about the value of understanding one's learning profile and/or let students take a learning style survey.

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- Explicitly share with students your observations about their learning strengths and challenges as the course progresses.
- Build metacognitive reflection into assignments.
- Instead of relying on large unit tests or exams, build in more frequent forms of assessment.
- Use grade-keeping software and make updated grade reports accessible to students.
- Provide direct personalized feedback to students
- Provide (or assign) some form of study guide for students to review before any quiz or exam.
- Provide scoring rubrics that describe the qualities of excellent work for the various components of each assignment.
- Make a direct connection, orally and in writing, between each class task and its associated learning objective.
- Distribute all important assignment handouts in the same format and structure.
- Establish and rationalize a routine for how class operates
- Post and review daily agendas for all class activities and assignments.
- Consider making available, in the classroom or learning support center, emerging assistive technologies such as text-to-speech screen readers, which are designed to assist students with difficulties decoding or attending to written text.
- Teach students to use some form of course planner or calendar that shows assignment due dates in a clear, graphical format.

Special Education

- At the beginning of a course, have a conversation about the value of understanding one's learning profile and/or let students take a learning style survey.
- Explicitly share with students your observations about their learning strengths and challenges as the course progresses.
- Build metacognitive reflection into assignments.
- Instead of relying on large unit tests or exams, build in more frequent forms of assessment.
- Use grade-keeping software and make updated grade reports accessible to students.
- Provide direct personalized feedback to students
- Provide (or assign) some form of study guide for students to review before any quiz or exam.
- Provide scoring rubrics that describe the qualities of excellent work for the various components of each assignment.
- Make a direct connection, orally and in writing, between each class task and its associated learning objective.
- Distribute all important assignment handouts in the same format and structure.
- Establish and rationalize a routine for how class operates
- Post and review daily agendas for all class activities and assignments.
- Consider making available, in the classroom or learning support center, emerging assistive technologies such as text-to-speech screen readers, which are designed to assist students with difficulties decoding or attending to written text.
- Teach students to use some form of course planner or calendar that shows assignment due dates in a clear, graphical format.

Gifted and Talented

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- Interdisciplinary and problem-based assignments with planned scope and sequence
- Advance, accelerated, or compacted content
- Abstract and advanced higher-level thinking
- Allowance for individual student interests
- Assignments geared to development in areas of affect, creativity, cognition, and research skills
- Complex, in-depth assignments
- Diverse enrichment that broadens learning
- Variety in types of resources
- Open-ended questions for higher-level thinking
- Higher-level text

Students at Risk of School Failure

- Small group instruction
- Frequent breaks
- Increased parent communication
- Daily log

Diversity and Inclusion:

- Involve families in student learning
- Respect cultural traditions
- Provided students with necessary academic resources and materials
- Allow for alternative assignments
- Provide visuals
- Assign peer tutor
- Collaborate with language professionals and ESL teachers
- Encourage parents to help children maintain their native language at home, while the school helps the child attain proficiency in English.
- Establish a positive connection with parent
- Utilize closed captioning when available
- Provide road maps or outlines for difficult concepts
- Provide sufficient wait time before calling on any student to help keep students who may need more time engaged
- Speak clearly and slowly, avoid slang and idiomatic expressions
- Create a nurturing environment with structured routines

Core Instructional and Supplemental Materials and Resources

Instructional Materials

- Textbook
- Laboratory manuals and equipment

Supplemental Materials

Science Websites:

- American Chemical Society
- Ptable

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- Chemical Portal
- PBS Learning Media
- Chemistry library | Science | Khan Academy
- bozemanscience
- News from Science | AAAS
- nsf
- Newsela Science Text sets
- Next Generation Science Standards
- chemspider
- LGBTQ plus Resources
- Individuals with disabilities Resources
- School databases
- Multimedia Resources
- Printers and Computers
- Online Resources and videos
- [Amistad Commission](#)
- [Holocaust Commission](#)
- Interactive Projector
- Rubrics

Intervention Materials

- Guided notes
- Flipped videos
- Leveled Text

Social and Emotional Learning New Jersey SEL

Competencies and Sub-Competencies Social and emotional learning (SEL) involves the process through which children and adults acquire and apply the knowledge, attitudes and skills necessary to understand and manage emotions, set and achieve positive goals, feel and show empathy for others, establish and maintain positive relationships, and make responsible decisions. The purpose of the SEL competencies is to provide schools with guidelines for integrating SEL across grades and subject areas.

Self-Awareness

- Recognize one's feelings and thoughts
- Recognize the impact of one's feelings and thoughts on one's own behavior
- Recognize one's personal traits, strengths and limitations
- Recognize the importance of self-confidence in handling daily tasks and challenges

Self-Management

- Understand and practice strategies for managing one's own emotions, thoughts and behaviors

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- Recognize the skills needed to establish and achieve personal and educational goals
- Identify and apply ways to persevere or overcome barriers through alternative methods to achieve one's goals

Social Awareness

- Recognize and identify the thoughts, feelings and perspectives of others
- Demonstrate awareness of the differences among individuals, groups and others' cultural backgrounds
- Demonstrate an understanding of the need for mutual respect when viewpoints differ
- Demonstrate an awareness of the expectations for social interactions in a variety of settings

Responsible Decision-Making

- Develop, implement and model effective problem solving and critical thinking skills
- Identify the consequences associated with one's actions in order to make constructive choices
- Evaluate personal, ethical, safety and civic impact of decisions

Relationship Skills

- Establish and maintain healthy relationships
- Utilize positive communication and social skills to interact effectively with others
- Identify ways to resist inappropriate social pressure
- Demonstrate the ability to prevent and resolve interpersonal conflicts in constructive ways
- Identify who, when, where, or how to seek help for oneself or others when needed

NJDOE Website on Social and Emotional Learning

<http://www.nj.gov/education/students/safety/sandp/sel>

Teacher Notes:

Ocean Academy Charter High School Unit 5 Overview	
Content Area: Science	Unit 5: Nuclear Energy
Target Course/Grade Levels: 10-11	Duration: 15 Days
Unit 5 Introduction:	

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In this unit, students investigate how changes within the atomic nucleus are connected to energy, matter, and the formation of elements. They explore the structure and stability of atomic nuclei and examine how nuclear processes differ from ordinary chemical reactions. Through the study of isotopes, radioactive decay, nuclear fission, and nuclear fusion, students develop models that explain how matter and energy change at the nuclear level.

Students examine the origins and transformations of matter throughout the universe, considering how elements were formed during the early development of the universe and through nuclear processes occurring within stars. They use concepts of scale, proportion, and quantity to compare nuclear phenomena across extremely small and large scales and to recognize the relationship between atomic structure, nuclear energy, and the evolution of stars and other astronomical systems.

The unit also emphasizes radioactive decay as a tool for understanding the age and history of materials. Students use mathematical and computational reasoning to analyze decay data and apply radiometric dating methods to determine absolute ages. They evaluate evidence from incomplete or changing records and consider how scientists use patterns in available data to reconstruct events that occurred deep in Earth's history.

Students engage in scientific and engineering practices by developing and revising models, analyzing mathematical representations and data, constructing evidence-based explanations, and evaluating scientific information. They investigate how nuclear reactions can be used to produce energy and consider the benefits, limitations, risks, and real-world applications associated with nuclear technologies.

The organizing concepts for this unit are energy and matter, scale, proportion, and quantity, and stability and change. Students apply these concepts to explain nuclear processes, radioactive decay, the formation of elements, and changes in Earth's and the universe's history. By the end of the unit, students will use models, mathematical reasoning, experimental and observational evidence, and scientific communication to explain nuclear phenomena and their significance in chemistry and the world around them.

This unit is based on HS-PS1-8, HS-ESS1-1, HS-ESS1-2, HS-ESS1-3, and HS-ESS1-6

Standard 9.1 Personal Financial Literacy: This standard outlines the important fiscal knowledge, habits, and skills that must be mastered in order for students to make informed decisions about personal finance. Financial literacy is an integral component of a student's college and career readiness, enabling students to achieve fulfilling, financially-secure, and successful careers.

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Standard 9.2 Career Awareness, Exploration, Preparation and Training. This standard outlines the importance of being knowledgeable about one's interests and talents, and being well informed about postsecondary and career options, career planning, and career requirements.

Standard 9.4 Life Literacies and Key Skills. This standard outline key literacies and technical skills such as critical thinking, global and cultural awareness, and technology literacy* that are critical for students to develop to live and work in an interconnected global economy.

Standard 8.1 Computer Science

Computer Science outlines a comprehensive set of concepts and skills, such as data and analysis, algorithms and programming, and computing systems.

Standard 8.2 Design Thinking

Technology, outlines the technological design concepts and skills essential for technological and engineering literacy. The framework design includes Engineering Design, Ethics and Culture, and the Effects of Technology on the Natural world among the disciplinary concepts

Amistad Law: N.J.S.A. 18A 52:16A-88 Every board of education shall incorporate the information regarding the contributions of African-Americans to our country in an appropriate place in the curriculum of elementary and secondary school students.

Holocaust Law: N.J.S.A. 18A:35-28 Every board of education shall include instruction on the Holocaust and genocide in an appropriate place in the curriculum of all elementary and secondary school pupils. The instruction shall further emphasize the personal responsibility that each citizen bears to fight racism and hatred whenever and wherever it happens.

LGBT and Disabilities Law: N.J.S.A. 18A:35-4.35 A board of education shall include instruction on the political, economic, and social contributions of persons with disabilities and lesbian, gay, bisexual, and transgender people, in an appropriate place in the curriculum of middle school and high school students as part of the district's implementation of the New Jersey Student Learning Standards (N.J.S.A.18A:35-4.36) A board of education shall have policies and procedures in place pertaining to the selection of instructional materials to implement the requirements of N.J.S.A. 18A:35-4.35.

Diversity and Inclusion

C.18A:35-4.36a Curriculum to include instruction on diversity and inclusion.

1. The instruction shall:

- (1) highlight and promote diversity, including economic diversity, equity, inclusion, tolerance, and belonging in connection with gender and sexual orientation, race and ethnicity, disabilities, and religious tolerance;
- (2) examine the impact that unconscious bias and economic disparities have at both an

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individual level and on society as a whole; and

(3) encourage safe, welcoming, and inclusive environments for all students regardless of race or ethnicity, sexual and gender identities, mental and physical disabilities, and religious beliefs.

Asian Americans and Pacific Islanders (AAPI)

Ensures that the contributions, history, and heritage of Asian Americans and Pacific Islanders (AAPI) are included in the New Jersey Student Learning Standards (NJSLs) for Social Studies in kindergarten through Grade 12 (P.L.2021, c.416).

21st Century Themes and Skills

“Twenty-first century themes and skills” means themes such as global awareness; financial, economic, business, and entrepreneurial literacy; civic literacy; health literacy; learning and innovation skills, including creativity and innovation, critical thinking and problem solving, and communication and collaboration; information, media, and technology skills; and life and career skills, including flexibility. Career readiness, life literacies, and key skills education provides students with the necessary skills to make informed career and financial decisions, engage as responsible community members in a digital society, and to successfully meet the challenges and opportunities in an interconnected global economy.”

Unit 5 Focus Standards (Major Standards)

<https://www.nj.gov/education/cccs/2020/NJSLs-Science.pdf>

HS-PS1-8: Develop models to illustrate the changes in the composition of the nucleus of the atom and the energy released during the processes of fission, fusion, and radioactive decay.

[Clarification Statement: Emphasis is on simple qualitative models, such as pictures or diagrams, and on the scale of energy released in nuclear processes relative to other kinds of transformations.] [Assessment Boundary: Assessment does not include quantitative calculation of energy released. Assessment is limited to alpha, beta, and gamma radioactive decays.]

HS-ESS1-1: Develop a model based on evidence to illustrate the life span of the sun and the role of nuclear fusion in the sun’s core to release energy that eventually reaches Earth in the form of radiation. [Clarification Statement: Emphasis is on the energy transfer mechanisms that allow energy from nuclear fusion in the sun’s core to reach Earth. Examples of evidence for the model include observations of the masses and lifetimes of other stars, as well as the ways that the sun’s radiation varies due to sudden solar flares (“space weather”), the 11-year sunspot cycle, and non-cyclic variations over centuries.] [Assessment Boundary: Assessment does not include details of the atomic and sub-atomic processes involved with the sun’s nuclear fusion.]

HS-ESS1-2: Construct an explanation of the Big Bang theory based on astronomical evidence of light spectra, motion of distant galaxies, and composition of matter in the universe. [Clarification Statement: Emphasis is on the astronomical evidence of the red shift of light from galaxies as an indication that the universe is currently expanding, the cosmic microwave background as the remnant radiation from the Big Bang, and the observed composition of ordinary matter of the

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universe, primarily found in stars and interstellar gases (from the spectra of electromagnetic radiation from stars), which matches that predicted by the Big Bang theory (3/4 hydrogen and 1/4 helium).]

HS-ESS1-3: Communicate scientific ideas about the way stars, over their life cycle, produce elements. [Clarification Statement: Emphasis is on the way nucleosynthesis, and therefore the different elements created, varies as a function of the mass of a star and the stage of its lifetime.] [Assessment Boundary: Details of the many different nucleosynthesis pathways for stars of differing masses are not assessed.]

HS-ESS1-6: Apply scientific reasoning and evidence from ancient Earth materials, meteorites, and other planetary surfaces to construct an account of Earth's formation and early history. [Clarification Statement: Emphasis is on using available evidence within the solar system to reconstruct the early history of Earth, which formed along with the rest of the solar system 4.6 billion years ago. Examples of evidence include the absolute ages of ancient materials (obtained by radiometric dating of meteorites, moon rocks, and Earth's oldest minerals), the sizes and compositions of solar system objects, and the impact cratering record of planetary surfaces.]

<https://www.nj.gov/education/aps/cccs/science/safety.htm>

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Developing and Using Models Modeling in 9-12 builds on K-8 and progresses to using, synthesizing, and developing models to predict and show relationships among variables between systems and their components in the natural and designed worlds. Develop a model based on evidence to illustrate the relationships between systems or between components of a system. (HS-PS1-4), (HS-PS1-8), (HS-ESS1-1) Constructing Explanations and Designing Solutions Constructing explanations and	PS1.C: Nuclear Processes - Nuclear processes, including fusion, fission, and radioactive decays of unstable nuclei, involve release or absorption of energy. The total number of neutrons plus protons does not change in any nuclear process. (HS-PS1-8) ESS1.A: The Universe and Its Stars - The star called the sun is changing and will burn out over a lifespan of approximately 10 billion years. (HS-ESS1-1) - The study of stars' light	Scale, Proportion, and Quantity - The significance of a phenomenon is dependent on the scale, proportion, and quantity at which it occurs. (HS-ESS1-1) Energy and Matter - Energy cannot be created or destroyed-only moved between one place and another place, between objects and/or fields, or between systems. (HS-ESS1-2) - In nuclear processes, atoms are not conserved, but the total number of protons plus neutrons is

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designing solutions in 9-12 builds on K-8 builds on K-8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories. - Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, 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-ESS1-2) - Apply scientific reasoning to link evidence to the claims to assess the extent to which the reasoning and data support the explanation or conclusion. (HS-ESS1-6) Obtaining, Evaluating, and Communicating Information Obtaining, evaluating, and communicating information in 9-12 builds on K-8 experiences and progresses to evaluating the validity and reliability of the claims, methods, and designs. - Communicate scientific	spectra and brightness is used to identify compositional elements of stars, their movements, and their distances from Earth. (HS-ESS1-2), (HS-ESS1-3) - The Big Bang theory is supported by observations of distant galaxies receding from our own, of the measured composition of stars and non-stellar gases, and of the maps of spectra of the primordial radiation (cosmic microwave background) that still fills the universe. (HS-ESS1-2) - Other than the hydrogen and helium formed at the time of the Big Bang, nuclear fusion within stars produces all atomic nuclei lighter than and including iron, and the process releases electromagnetic energy. Heavier elements are produced when certain massive stars achieve a supernova stage and explode. (HS-ESS1-2), (HS-ESS1-3) ESS1.C: The History of Planet Earth - Although active geologic processes, such as plate tectonics and erosion, have destroyed or altered most of the very early rock record on Earth, other objects in the solar	conserved. (HS-ESS1-3) Stability and Change - Much of science deals with constructing explanations of how things change and how they remain stable. (HS-ESS1-6) <i>Connections to Engineering, Technology, and Applications of Science</i> Interdependence of Science, Engineering, and Technology - Science and engineering complement each other in the cycle known as research and development (R&D). Many R&D projects may involve scientists, engineers, and others with wide ranges of expertise. (HS-ESS1-2), (HS-ESS1-4) <i>Connections to Nature of Science</i> Scientific Knowledge Assumes an Order and Consistency in Natural Systems - Scientific knowledge is based on the assumption that natural laws operate today as they did in the past and they will continue to do so in the future. (HS-ESS1-2)
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ideas (e.g. about phenomena and/or the process of development and the design and performance of a proposed process or system) in multiple formats (including orally, graphically, textually, and mathematically). (HS-ESS1-3)	system, such as lunar rocks, asteroids, and meteorites, have changed little over billions of years. Studying these objects can provide information about Earth's formation and early history. (HS-ESS1-6) PS1.C: Nuclear Processes - Spontaneous radioactive decays follow a characteristic exponential decay law. Nuclear lifetimes allow radiometric dating to be used to determine the ages of rocks and other materials. (secondary to HS-ESS1-5), (secondary to HS-ESS1-6) PS3.D: Energy in Chemical Processes and Everyday Life - Nuclear Fusion processes in the center of the sun release the energy that ultimately reaches Earth as radiation. (secondary to HS-ESS1-1) PS4.B Electromagnetic Radiation - Atoms of each element emit and absorb characteristic frequencies of light. These characteristics allow identification of the presence of an element, even in microscopic quantities. (secondary to	- Science assumes the universe is a vast single system in which basic laws are consistent. (HS-ESS1-2) Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena - A scientific theory is a substantiated explanation of some aspect of the natural world, based on a body of facts that have been repeatedly confirmed through observation and experiment and the science community validates each theory before it is accepted. If new evidence is discovered that the theory does not accommodate, the theory is generally modified in light of this new evidence. (HS-ESS1-2), (HS-ESS1-6) - Models, mechanisms, and explanations collectively serve as tools in the development of a scientific theory. (HS-ESS1-6)
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	HS-ESS1-2)	
Interdisciplinary Connections Supporting and Additional Standards Unit 5 New Jersey Student Learning Standards-Mathematics New Jersey Student Learning Standards-ELA <i>Connections to other DCIs in grades 9-12:</i> • HS.PS1.A (HS-ESS1-2), (HS-ESS1-3) • HS.PS1.C (HS-ESS1-1), (HS-ESS1-2), (HS-ESS1-3) • HS.PS2.A (HS-ESS1-6) • HS.PS2.B (HS-ESS1-4), (HS-ESS1-6) • HS.PS3.A (HS-PS1-4), (HS-PS1-5), (HSPS1-8), (HS-ESS1-1), (HS-ESS1-2) • HS.PS3.B (HS-PS1-4), (HS-PS1-6), (HSPS1-7), (HS-PS1-8), (HS-ESS1-2) • HS.PS3.C (HS-PS1-8) • HS.PS3.D (HS-PS1-4), (HS-PS1-8) • HS.PS4.A (HS-ESS1-2) • HS.ESS1.A (HS-PS1-8) • HS.ESS1.C (HS-PS1-8) <i>Articulation of DCIs across grade levels:</i> • MS.PS1.A (HS-PS1-1), (HS-PS1-2), (HSPS1-3), (HS-PS1-4), (HS-PS1- 5), (HS-PS1-7), (HS-PS1-8), (HS-ESS1-1), (HS-ESS1-2), (HS-ESS1-3) • MS.PS1.B (HS-PS1-1), (HS-PS1-2), (HS-PS1-4), (HS-PS1-5), (HS-PS1- 6), (HS-PS1-7), (HS-PS1-8) • MS.PS1.C (HS-PS1-8) • MS.PS2.B (HS-ESS1-4), (HS-ESS1-6); • MS.PS4.B (HS-ESS1-1), (HS-ESS1-2) • MS.ESS1.A (HS-ESS1-1), (HS-ESS1-2), (HS-ESS1-3), (HS-ESS1-4) • MS.ESS1.B (HS-ESS1-4), (HS-ESS1-6) • MS.ESS1.C (HS-ESS1-5), (HS-ESS1-6) • MS.ESS2.A (HS-PS1-7), (HS-PS1-8), (HS-ESS1-1), (HS-ESS1-5), (HS-ESS1-6) • MS.ESS2.B (HS-ESS1-5), (HS-ESS1-6) • MS.ESS2.D (HS-ESS1-1)		
ELA/Literacy - RI.CR.9-10.1. Cite a range and thorough textual evidence and make clear and relevant connections, to strongly support an analysis of multiple aspects of what an informational text says explicitly and inferentially, as well as interpretations of the text.. (HS-ESS1-1), (HS-ESS1-2), (HS-ESS1-5), (HS-ESS1-6) RI.AA.9-10.7. Describe and evaluate the argument and specific claims in an informational text, assessing whether the reasoning is valid and the evidence is relevant and sufficient; identify false statements and reasoning. (HS-ESS1-5), (HS-ESS1-6) W.AW.9-10.1. Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient textual and non-textual evidence. A. Introduce precise claim(s), distinguish the claim(s) from alternate or opposing claims, and create an organization that establishes clear relationships among claim(s), counterclaims, reasons, and evidence. B. Develop claim(s) and counterclaims using sound reasoning, supplying data and evidence for each while pointing out the strengths and limitations of both claim(s) and counterclaims in		

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a discipline-appropriate manner that anticipates the audience's knowledge level and concerns.

- C. Use transitions (e.g., words, phrases, clauses) to link the major sections of the text, create cohesion, and clarify the relationships between claim(s) and reasons, between reasons and evidence, and between claim(s) and counterclaims.
- D. Establish and maintain a style and tone appropriate to the audience and purpose (e.g., formal and objective for academic writing) while attending to the norms and conventions of the discipline in which they are writing.
- E. Provide a concluding paragraph or section that supports the argument presented..
(HS-ESS1-6)

W.IW.9-10.2. Write informative/explanatory texts (including the narration of historical events, scientific procedures/ experiments, or technical processes) to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content.

- A. Introduce a topic; organize complex ideas, concepts, and information to make important connections and distinctions; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aid in comprehension.
- B. Develop the topic with well-chosen, relevant, and sufficient facts, extended definitions, concrete details, quotations, or other information and examples appropriate to the audience's knowledge of the topic.
- C. Use appropriate and varied transitions to link the major sections of the text, create cohesion, and clarify the relationships among complex ideas and concepts.
- D. Use precise language and domain-specific vocabulary to manage the complexity of the topic.
- E. Establish and maintain a style and tone appropriate to the audience and purpose (e.g., formal and objective for academic writing) while attending to the norms and conventions of the discipline in which they are writing.
- F. Provide a concluding paragraph or section that supports the information or explanation presented (e.g., articulating implications or the significance of the topic).(HS-ESS1-2), (HS-ESS1-3), (HS-ESS1-5)

SL.PI.9-10.4. Present information, findings, and supporting evidence clearly, concisely, and logically. The content, organization, development, and style are appropriate to task, purpose, and audience. (HS-ESS1-3)

SL.II.9-10.2. Integrate multiple sources of information presented in diverse media or formats (e.g., visually, quantitatively, qualitatively, orally) evaluating the credibility and accuracy of each source.(MS-ESS2-1), (MS-ESS2-2), (MS-ESS2-6)

Mathematics -

- **MP.2:** Reason abstractly and quantitatively. (HS-ESS1-1), (HS-ESS1-2), (HS-ESS1-3), (HS-ESS1-4), (HS-ESS1-5), (HS-ESS1-6)
- **MP.4:** Model with mathematics. (HS-PS1-4), (HS-PS1-8), (HS-ESS1-1), (HS-ESS1-4)

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- **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-PS1-4), (HS-PS1-5), (HS-PS1-7), (HS-PS1-8), (HS-ESS1-1), (HS-ESS1-2), (HS-ESS1-4), (HS-ESS1-5), (HS-ESS1-6)
- **HSN-Q.A.2:** Define appropriate quantities for the purpose of descriptive modeling. (HS-PS1-4), (HS-PS1-7), (HS-PS1-8), (HS-ESS1-1), (HS-ESS1-2), (HS-ESS1-4), (HS-ESS1-5), (HS-ESS1-6)
- **HSN-Q.A.3:** Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (HS-PS1-2), (HS-PS1-3), (HS-PS1-4), (HS-PS1-5), (HS-PS1-7), (HS-PS1-8), (HS-ESS1-1), (HS-ESS1-2), (HS-ESS1-4), (HS-ESS1-5), (HS-ESS1-6)
- **HSA-SSE.A.1** Interpret expressions that represent a quantity in terms of its context. (HS-ESS1-1), (HS-ESS1-2), (HS-ESS1-4)
- **HSA-CED.A.2:** Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. (HS-ESS1-1), (HS-ESS1-2), (HS-ESS1-4)
- **HSA-CED.A.4:** Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. (HS-ESS1-1), (HS-ESS1-2), (HS-ESS1-4)
- **HSF-IF.B.5:** Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. (HS-ESS1-6)
- **HSS-ID.B.6:** Represent data on two quantitative variables on a scatter plot, and describe how those variables are related. (HS-ESS1-6)

Unit 5 New Jersey Student Learning Standards Connections: [Career Readiness](#), [Life Literacies](#), and [Key Skills](#)

Disciplinary Concepts

Career Awareness and Planning (9.2)

Creativity and Innovations (9.4)

Critical Thinking and Problem-solving (9.4)

Digital Citizenship

Global and Cultural Awareness (9.4)

Information and Media Literacy (9.4)

Core Ideas

There are strategies to improve one's professional value and marketability.

Performance Expectations

(Identified with Standard Number and Statement)

- 9.2.12.CAP.2: Develop college and career readiness skills by participating in opportunities such as structured learning

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	experiences, apprenticeships, and dual enrollment programs. ● 9.2.12.CAP.3: Investigate how continuing education contributes to one's career and personal growth.
Career planning requires purposeful planning based on research, self-knowledge, and informed choices.	● 9.2.12.CAP.4: Evaluate different careers and develop various plans (e.g., costs of public, private, training schools) and timetables for achieving them, including educational/training requirements, costs, loans, and debt repayment. ● 9.2.12.CAP.5: Assess and modify a personal plan to support current interests and postsecondary plans. ● 9.2.12.CAP.6: Identify transferable skills in career choices and design alternative career plans based on those skills. ● 9.2.12.CAP.8: Determine job entrance criteria (e.g., education credentials, math/writing/reading comprehension tests, drug tests) used by employers in various industry sectors.
An individual's income and benefit needs and financial plan can change over time.	● 9.2.12.CAP.13: Analyze how the economic, social, and political conditions of a time period can affect the labor market.
With a growth mindset, failure is an important part of success	● 9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a).
Innovative ideas or innovation can lead to career opportunities.	● 9.4.12.CI.2: Identify career pathways that highlight personal talents, skills, and abilities (e.g., 1.4.12prof.CR2b, 2.2.12.LF.8) ● 9.4.12.CI.3: Investigate new challenges and opportunities for personal growth, advancement, and transition (e.g., 2.1.12.PGD.1).
Collaboration with individuals with diverse experiences can aid in the problem-solving process, particularly for global issues where diverse solutions are needed.	● 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).

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	9.4.12.CT.2: Explain the potential benefits of collaborating to enhance critical thinking and problem solving (e.g., 1.3E.12profCR3.a). 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). 9.4.12.CT.4: Participate in online strategy and planning sessions for course-based, school-based, or other projects and determine the strategies that contribute to effective outcomes.
Laws govern the use of intellectual property and there are legal consequences to utilizing or sharing another's original works without permission or appropriate credit.	9.4.12.DC.1: Explain the beneficial and harmful effects that intellectual property laws can have on the creation and sharing of content (e.g., 6.1.12.CivicsPR.16.a). 9.4.12.DC.2: Compare and contrast international differences in copyright laws and ethics.
Digital communities influence many aspects of society, especially the workforce. The increased connectivity between people in different cultures and different career fields have changed the nature, content, and responsibilities of many careers.	9.4.12.DC.7: Evaluate the influence of digital communities on the nature, content and responsibilities of careers, and other aspects of society (e.g., 6.1.12.CivicsPD.16.a).
Network connectivity and computing capability extended to objects, sensors and everyday items not normally considered computers allows these devices to generate, exchange, and consume data with minimal human intervention. Technologies such as Artificial Intelligence (AI) and blockchain can help minimize the effect of climate change.	9.4.12.DC.8: Explain how increased network connectivity and computing capabilities of everyday objects allow for innovative technological approaches to climate protection.
Solutions to the problems faced by a global society require the contribution of individuals with different points of view and experiences.	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,

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	HS-ETS1-4, 6.3.12.GeoGI.1, 7.1.IH.IPERS.6, 7.1.IL.IPERS.7, 8.2.12.ETW.3).
Advanced search techniques can be used with digital and media resources to locate information and to check the credibility and the expertise of sources to answer questions, solve problems, and inform the decision-making.	9.4.12.IML.2: Evaluate digital sources for timeliness, accuracy, perspective, credibility of the source, and relevance of information, in media, data, or other resources (e.g., NJSLSA.W8, Social Studies Practice: Gathering and Evaluating Sources.
In order for members of our society to participate productively, information needs to be shared accurately and ethically	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.6: Use various types of media to produce and store information on climate change for different purposes and audiences with sensitivity to cultural, gender, and age diversity (e.g., NJSLSA.SL5).
Unit 5 New Jersey Student Learning Standards: Computer Science and Design Thinking	
Disciplinary Concepts Impacts of Computing (8.1) Data & Analysis (8.1) Engineering Design (8.2) Interaction of Technology and Humans (8.2) Effects of Technology on the Natural World (8.2)	
Core Ideas	
The design and use of computing technologies and artifacts can positively or negatively affect equitable access to information and opportunities.	8.1.12.IC.1: Evaluate the ways computing impacts personal, ethical, social, economic, and cultural practices. 8.1.12.IC.3: Predict the potential impacts and implications of emerging technologies on larger social, economic, and political structures, using evidence from credible sources.
Large data sets can be transformed, generalized, simplified, and presented in different ways to influence how individuals	8.1.12.DA.5: Create data visualizations from large data sets to summarize, communicate, and support different interpretations of real-world phenomena.

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interpret and understand the underlying information.	
Engineering design is a complex process in which creativity, content knowledge, research, and analysis are used to address local and global problems.	• 8.2.12.ED.1: Use research to design and create a product or system that addresses a problem and make modifications based on input from potential consumers. • 8.2.12.ED.4: Design a product or system that addresses a global problem and document decisions made based on research, constraints, trade-offs, and aesthetic and ethical considerations and share this information with an appropriate audience.
Engineering design evaluation, a process for determining how well a solution meets requirements, involves systematic comparisons between requirements, specifications, and constraints.	• 8.2.12.ED.5: Evaluate the effectiveness of a product or system based on factors that are related to its requirements, specifications, and constraints (e.g., safety, reliability, economic considerations, quality control, environmental concerns, manufacturability, maintenance and repair, ergonomics). • 8.2.12.ED.6: Analyze the effects of changing resources when designing a specific product or system (e.g., materials, energy, tools, capital, labor).
Changes caused by the introduction and use of a new technology can range from gradual to rapid and from subtle to obvious, and can change over time. These changes may vary from society to society as a result of differences in a society's economy, politics, and culture.	• 8.2.12.ITH.2: Propose an innovation to meet future demands supported by an analysis of the potential costs, benefits, trade-offs, and risks related to the use of the innovation. • 8.2.12.ITH.3: Analyze the impact that globalization, social media, and access to open source technologies has had on innovation and on a society's economy, politics, and culture.
Development and modification of any technological system needs to take into account how the operation of the system will affect natural resources and ecosystems. Impacts of technological systems on the environment need to be monitored and must inform decision-making. Many technologies have been designed to have a positive impact on the environment and to monitor environmental change over time.	• 8.2.12.ETW.1: Evaluate ethical considerations regarding the sustainability of environmental resources that are used for the design, creation, and maintenance of a chosen product. • 8.2.12.ETW.2: Synthesize and analyze data collected to monitor the effects of a technological product or system on the environment.

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	8.2.12.ETW.3: Identify a complex, global environmental or climate change issue, develop a systemic plan of investigation, and propose an innovative sustainable solution.
New Jersey Student Learning Standards: Climate Change Mandate	
Core Ideas	Performance Expectations (Identified with Standard Number and Statement)
Unit 5 Evidence of Student Learning	
Performance Tasks/Use of Technology: - Radioactive Decay and Half-Life Laboratory: Conduct an investigation using data and models to examine radioactive decay patterns, calculate half-life, and interpret the relationship between remaining radioactive material and elapsed time. - Alpha and Beta Decay Simulations: Use interactive nuclear physics simulations to model alpha and beta decay and investigate how radioactive atoms change as particles are emitted from the nucleus. - Radiometric Dating Investigation: Use an interactive simulation to explore radioactive dating, isotope decay, and half-life calculations while applying mathematical reasoning to estimate the age of materials. - Nuclear Fission and Chain Reaction Simulation: Model nuclear fission and investigate how a chain reaction develops. Students examine how energy is released and consider the conditions necessary to sustain or control a nuclear reaction. - Nuclear Energy and Technology Research: Investigate practical applications of nuclear fission, including electricity generation, medical technologies, and other uses of radioactive materials. Students evaluate benefits, risks, and environmental	Other Assessments: Formative - Observation - Homework - Class participation - Graphic Organizers - Projects - Student Response Systems (ex.Clickers) - Do-Now/Exit Cards - Laboratories/Lab Reports - Notebook - Writing Assignments - Graphs, Models, and Tables Summative - Chapter/Unit Test - Writing Assignments - Presentations - Laboratory Reports/Practical - Unit Projects Benchmark - Quarterlies - Mid-Term - Final Exams - Performance Assessment Alternative CER (claim, evidence, reasoning)

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considerations. • Absolute Zero and Extreme Temperatures Exploration: Use NOVA resources to investigate the behavior of matter and energy at extremely low temperatures and connect these phenomena to particle motion and energy. • Exploring Gamma Rays and Dark Matter: Analyze multimedia resources to investigate how scientists use gamma-ray observations and other forms of evidence to study unexplained phenomena in the universe. • Dark Matter Research Activity: Explore current scientific methods used to search for evidence of dark matter and evaluate how scientists gather and interpret indirect evidence to develop models of the universe. • Black Holes and Stellar Systems Investigation: Use PBS LearningMedia resources to examine black holes and stellar systems, including how scientists use observations and mathematical relationships to estimate properties such as mass and distance. • Nuclear Chemistry Media Analysis: Use NOVA and PBS resources to connect nuclear chemistry concepts to current scientific research involving radiation, stars, extreme environments, and the structure of the universe.	
Unit 5 Knowledge and Skills	
Unit 5 Learning Targets	
<i>Students will be able to..</i> • Explain how nuclear reactions differ from chemical reactions in terms of changes to the nucleus and the conservation of particles and energy. • Develop and use models to represent changes within atomic nuclei during alpha decay, beta decay, gamma emission, nuclear fission, and nuclear fusion. • Analyze how the numbers of protons and neutrons change during different types of radioactive decay and nuclear reactions.	

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- Use evidence-based models to explain how nuclear processes release, absorb, or transfer extremely large amounts of energy compared with typical chemical transformations.
- Apply the principle of conservation of energy to nuclear processes and explain how energy is transferred or transformed within nuclear systems.
- Develop models showing how nuclear fusion in the Sun's core produces energy and how that energy is ultimately transferred to Earth through electromagnetic radiation.
- Explain how the mass and stage of development of a star influence the types of nuclear reactions that occur and the elements produced through nucleosynthesis.
- Communicate scientific explanations using diagrams, mathematical representations, written descriptions, and oral presentations to describe how stars create and distribute elements throughout the universe.
- Use astronomical evidence, including light spectra, redshift, and observations of distant galaxies, to construct an evidence-based explanation for the expansion and evolution of the universe.
- Analyze evidence such as cosmic microwave background radiation and the composition of matter in stars and interstellar space to support explanations of the Big Bang theory.
- Use evidence from meteorites, ancient Earth materials, and other planetary bodies to develop explanations for the formation and early development of Earth and the solar system.
- Apply scientific reasoning to evaluate how well available geological and astronomical evidence supports explanations about Earth's early history.
- Use patterns in evidence to explain how Earth has undergone significant changes over time while maintaining stability within larger Earth and solar system systems.
- Integrate data, mathematical reasoning, models, and scientific evidence to explain relationships among nuclear processes, the formation of elements, stellar evolution, and the development of Earth and the universe.

Unit 5 Enduring Understandings	Unit 5 Essential Questions
<i>Students will know...</i> ● Nuclear processes such as fusion, fission, and radioactive decay involve changes within the atomic nucleus and can release or absorb tremendous amounts of energy. ● Unlike chemical reactions, nuclear processes can change one element into another; however, the total number of protons and neutrons remains conserved. ● Radioactive isotopes decay according to predictable patterns, allowing half-life measurements and radiometric dating to be used to determine the ages of rocks and other materials. ● Energy is conserved throughout the	● How do scientists use evidence from stars and other celestial objects to understand how the universe has changed over time? ● What processes allow stars to create and distribute the elements that make up matter throughout the universe? ● How can radioactive decay and other chemical evidence help scientists reconstruct events that occurred long before humans existed? ● What factors influence the life cycle of a star, and how predictable are the stages of stellar evolution? ● How can nuclear fusion provide energy, and what challenges must scientists overcome to make fusion a practical source of electricity?

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universe and can be transferred or transformed between objects, systems, and forms, but it cannot be created or destroyed.

- The characteristic light emitted or absorbed by elements provides evidence that can be used to determine the composition, motion, and other properties of stars and distant objects.
- Nuclear fusion within stars produces energy and creates many of the elements found throughout the universe, while more massive stellar events contribute to the formation of heavier elements.
- A star's mass and stage of development influence the nuclear reactions it undergoes, the elements it produces, and the way it changes over its lifetime.
- The Sun is an evolving star in which nuclear fusion produces the energy that is ultimately transferred to Earth as electromagnetic radiation.
- The enormous scale of stellar systems and nuclear processes demonstrates the importance of scale, proportion, and quantity when interpreting energy, matter, and change.
- Evidence such as galaxy redshift, cosmic microwave background radiation, and the composition of matter throughout the universe provides support for the Big Bang theory and our understanding of an expanding universe.
- Scientific explanations and theories are developed from evidence and are revised when new observations provide information that existing explanations cannot adequately account for.
- Scientists use evidence from ancient rocks, meteorites, lunar materials, and other planetary bodies to reconstruct Earth's formation and early history, particularly where Earth's original geological record has been altered or destroyed.

- How do different types of radiation interact with matter and living organisms, and why are some forms more harmful than others?

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• Scientific knowledge is based on the assumption that consistent natural laws operate across space and time, allowing scientists to use present-day evidence to investigate events from Earth's distant past. • Understanding how systems change and maintain stability is central to science and allows scientists to explain processes ranging from radioactive decay and stellar evolution to changes in Earth's history. • Scientific research and engineering work together to develop technologies and solutions, with complex investigations often requiring collaboration among scientists, engineers, and specialists from multiple fields.	
Unit 5 Instructional Plan	
Suggested Activities	Resources
• Radioactive Decay Simulation: Use a hands-on simulation with M&M candies or another model to represent radioactive decay, collect data over multiple trials, calculate half-life, and analyze the resulting decay pattern. • Nuclear Chemistry Media Exploration: View selected TED-Ed, Bozeman Science, and other instructional videos to reinforce concepts such as radioactive decay, nuclear reactions, radiation, fission, fusion, and nuclear energy. • Radioactivity Data Analysis: Examine tables, graphs, and simulated radioactive decay data to identify patterns, interpret half-life, and make predictions about the amount of radioactive material remaining over time. • Radiation Investigation Laboratory: Conduct a laboratory activity that	• Gizmos • Textbook • Lab materials • YouTube

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models or measures aspects of radioactive decay and radiation, emphasizing safe procedures, data collection, evidence-based conclusions, and applications of nuclear chemistry.

- Nuclear Radiation Awareness Brochure: Create an informational brochure or digital resource explaining types of radiation, sources of exposure, potential risks, safety precautions, and beneficial applications of radiation in medicine, industry, and science.
- Nuclear Chemistry Concept Portfolio: Complete a series of guided activities, problem-solving exercises, diagrams, and short written responses addressing isotopes, radioactive decay, nuclear equations, half-life, fission, fusion, and nuclear energy.
- Half-Life Mathematical Modeling: Use mathematical models and graphical representations to investigate exponential decay, calculate half-life, and predict the behavior of radioactive isotopes.
- Nuclear Energy Research Project: Investigate the use of nuclear fission and fusion as energy sources and evaluate their advantages, limitations, environmental impacts, safety considerations, and potential future applications.
- Radiation in Everyday Life Investigation: Research common sources and uses of radiation and distinguish between naturally occurring and human-made radiation, including applications in medical imaging, cancer treatment, food preservation, and scientific research.
- Nuclear Chemistry CER Activity: Analyze evidence related to radiation, nuclear energy, or radioactive decay and develop a Claim-Evidence-Reasoning

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response explaining the scientific principles involved.

Unit 5 Suggested Options for Differentiation: Content-specific Accommodations and Modifications for Subgroups

Multilingual Learners

- Speak slowly, distinctly, and write down key terms
- Closed Captioning
- Emphasize visual literacy
- Graphic Organizers
- Use charts, graphs and figures
- Group projects & cooperative learning
- Partner English learners with strong English speakers
- Consistent routines
- Outlines
- Language-based science games
- Picture glossary
- Root words

Students with 504 Plans

- At the beginning of a course, have a conversation about the value of understanding one's learning profile and/or let students take a learning style survey.
- Explicitly share with students your observations about their learning strengths and challenges as the course progresses.
- Build metacognitive reflection into assignments.
- Instead of relying on large unit tests or exams, build in more frequent forms of assessment.
- Use grade-keeping software and make updated grade reports accessible to students.
- Provide direct personalized feedback to students
- Provide (or assign) some form of study guide for students to review before any quiz or exam.
- Provide scoring rubrics that describe the qualities of excellent work for the various components of each assignment.
- Make a direct connection, orally and in writing, between each class task and its associated learning objective.
- Distribute all important assignment handouts in the same format and structure.
- Establish and rationalize a routine for how class operates
- Post and review daily agendas for all class activities and assignments.
- Consider making available, in the classroom or learning support center, emerging assistive technologies such as text-to-speech screen readers, which are designed to assist students with difficulties decoding or attending to written text.
- Teach students to use some form of course planner or calendar that shows assignment due dates in a clear, graphical format.

Special Education

- At the beginning of a course, have a conversation about the value of understanding one's

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learning profile and/or let students take a learning style survey.

- Explicitly share with students your observations about their learning strengths and challenges as the course progresses.
- Build metacognitive reflection into assignments.
- Instead of relying on large unit tests or exams, build in more frequent forms of assessment.
- Use grade-keeping software and make updated grade reports accessible to students.
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- Provide (or assign) some form of study guide for students to review before any quiz or exam.
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- Consider making available, in the classroom or learning support center, emerging assistive technologies such as text-to-speech screen readers, which are designed to assist students with difficulties decoding or attending to written text.
- Teach students to use some form of course planner or calendar that shows assignment due dates in a clear, graphical format.

Gifted and Talented

- Interdisciplinary and problem-based assignments with planned scope and sequence
- Advance, accelerated, or compacted content
- Abstract and advanced higher-level thinking
- Allowance for individual student interests
- Assignments geared to development in areas of affect, creativity, cognition, and research skills
- Complex, in-depth assignments
- Diverse enrichment that broadens learning
- Variety in types of resources
- Open-ended questions for higher-level thinking
- Higher-level text

Students at Risk of School Failure

- Small group instruction
- Frequent breaks
- Increased parent communication
- Daily log

Diversity and Inclusion:

- Involve families in student learning
- Respect cultural traditions
- Provided students with necessary academic resources and materials
- Allow for alternative assignments

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- Provide visuals
- Assign peer tutor
- Collaborate with language professionals and ESL teachers
- Encourage parents to help children maintain their native language at home, while the school helps the child attain proficiency in English.
- Establish a positive connection with parent
- Utilize closed captioning when available
- Provide road maps or outlines for difficult concepts
- Provide sufficient wait time before calling on any student to help keep students who may need more time engaged
- Speak clearly and slowly, avoid slang and idiomatic expressions
- Create a nurturing environment with structured routines

Core Instructional and Supplemental Materials and Resources

Instructional Materials

- Textbook
- Laboratory manuals and equipment

Supplemental Materials

Science Websites:

- American Chemical Society
- Ptable
- Chemical Portal
- PBS Learning Media
- Chemistry library | Science | Khan Academy
- bozemanscience
- News from Science | AAAS
- nsf
- Newsela Science Text sets
- Next Generation Science Standards
- chemspider
- LGBTQ plus Resources
- Individuals with disabilities Resources
- School databases
- Multimedia Resources
- Printers and Computers
- Online Resources and videos
- [Amistad Commission](#)
- [Holocaust Commission](#)
- Interactive Projector
- Rubrics

Intervention Materials

- Guided notes
- Flipped videos
- Leveled Text

Social and Emotional Learning New Jersey SEL

Competencies and Sub-Competencies Social and emotional learning (SEL) involves the process through which children and adults acquire and apply the knowledge, attitudes and skills necessary to understand and manage emotions, set and achieve positive goals, feel and show empathy for others, establish and maintain positive relationships, and make responsible decisions. The purpose of the SEL competencies is to provide schools with guidelines for integrating SEL across grades and subject areas.

Self-Awareness

- Recognize one's feelings and thoughts
- Recognize the impact of one's feelings and thoughts on one's own behavior
- Recognize one's personal traits, strengths and limitations
- Recognize the importance of self-confidence in handling daily tasks and challenges

Self-Management

- Understand and practice strategies for managing one's own emotions, thoughts and behaviors
- Recognize the skills needed to establish and achieve personal and educational goals
- Identify and apply ways to persevere or overcome barriers through alternative methods to achieve one's goals

Social Awareness

- Recognize and identify the thoughts, feelings and perspectives of others
- Demonstrate awareness of the differences among individuals, groups and others' cultural backgrounds
- Demonstrate an understanding of the need for mutual respect when viewpoints differ
- Demonstrate an awareness of the expectations for social interactions in a variety of settings

Responsible Decision-Making

- Develop, implement and model effective problem solving and critical thinking skills
- Identify the consequences associated with one's actions in order to make constructive choices
- Evaluate personal, ethical, safety and civic impact of decisions

Relationship Skills

- Establish and maintain healthy relationships
- Utilize positive communication and social skills to interact effectively with others
- Identify ways to resist inappropriate social pressure
- Demonstrate the ability to prevent and resolve interpersonal conflicts in constructive ways

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- Identify who, when, where, or how to seek help for oneself or others when needed

NJDOE Website on Social and Emotional Learning

<http://www.nj.gov/education/students/safety/sandp/sel>

Teacher Notes:

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Unit 6 Overview

Content Area: Science

Unit 6:
Human Impact - The Chemistry of Sustainability

Target Course/Grade Levels: 10-11

Duration: 15 Days

Unit 6 Introduction:

In this unit, students investigate the dynamic interactions among Earth's systems and examine how these interactions shape the planet's surface, atmosphere, oceans, and climate. Students use models, data, and evidence to explore how energy and matter move through interconnected Earth systems and how these processes produce both short-term changes and long-term patterns.

Students examine the balance between processes that build and reshape Earth's surface, such as volcanism, mountain building, and tectonic activity, and surface processes driven largely by solar energy, including weathering, erosion, and sediment transport. Through the study of cause-and-effect relationships and system interactions, students develop explanations for how Earth's surface changes over time.

A major focus of the unit is weather and climate, including the mechanisms that influence climate patterns and the evidence supporting climate change. Students investigate how atmospheric, oceanic, geological, and biological systems interact and how changes within one component of the Earth system can produce feedbacks and responses in others. They analyze the movement of energy and matter through these systems and examine connections to important cycles, including the carbon cycle.

Students also consider the influence of human activities on Earth's systems and evaluate how changes in resource use, land use, atmospheric composition, and other human-driven factors can affect environmental stability and long-term sustainability. Using geoscience data, mathematical

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reasoning, models, and technology, students analyze evidence for environmental change and consider potential solutions to challenges facing human societies.

Students use evidence from multiple timescales to investigate climate and Earth-system changes, ranging from years to millions of years. These include short-term influences such as major volcanic eruptions and changes in ocean circulation; changes occurring over decades to centuries related to human activity, ocean circulation, and solar output; longer-term variations associated with Earth's orbit and axial orientation; and geological-scale changes in atmospheric composition and other Earth-system processes. Through these investigations, students recognize that Earth is a complex, interconnected system in which changes at one scale or within one component can influence conditions throughout the planet.

This unit is based on HS-ESS2-4, HS-ESS2-6, HS-ETS1-1, HS-ETS1-2, HS-ETS1-3, and HS-ETS1-4.

Standard 9.1 Personal Financial Literacy: This standard outlines the important fiscal knowledge, habits, and skills that must be mastered in order for students to make informed decisions about personal finance. Financial literacy is an integral component of a student's college and career readiness, enabling students to achieve fulfilling, financially-secure, and successful careers.

Standard 9.2 Career Awareness, Exploration, Preparation and Training. This standard outlines the importance of being knowledgeable about one's interests and talents, and being well informed about postsecondary and career options, career planning, and career requirements.

Standard 9.4 Life Literacies and Key Skills. This standard outline key literacies and technical skills such as critical thinking, global and cultural awareness, and technology literacy* that are critical for students to develop to live and work in an interconnected global economy.

Standard 8.1 Computer Science

Computer Science outlines a comprehensive set of concepts and skills, such as data and analysis, algorithms and programming, and computing systems.

Standard 8.2 Design Thinking

Technology, outlines the technological design concepts and skills essential for technological and engineering literacy. The framework design includes Engineering Design, Ethics and Culture, and the Effects of Technology on the Natural world among the disciplinary concepts

Amistad Law: N.J.S.A. 18A 52:16A-88 Every board of education shall incorporate the information regarding the contributions of African-Americans to our country in an appropriate place in the curriculum of elementary and secondary school students.

Holocaust Law: N.J.S.A. 18A:35-28 Every board of education shall include instruction on the Holocaust and genocide in an appropriate place in the curriculum of all elementary and secondary school pupils. The instruction shall further emphasize the personal responsibility that each citizen bears to fight racism and hatred whenever and wherever it happens.

LGBT and Disabilities Law: N.J.S.A. 18A:35-4.35 A board of education shall include instruction on the political, economic, and social contributions of persons with disabilities and lesbian, gay, bisexual, and transgender people, in an appropriate place in the curriculum of middle school and high school students as part of the district's implementation of the New Jersey Student Learning Standards (N.J.S.A.18A:35-4.36) A board of education shall have policies and procedures in place pertaining to the selection of instructional materials to implement the requirements of N.J.S.A. 18A:35-4.35.

Diversity and Inclusion

C.18A:35-4.36a Curriculum to include instruction on diversity and inclusion.

1. The instruction shall:
 - (1) highlight and promote diversity, including economic diversity, equity, inclusion, tolerance, and belonging in connection with gender and sexual orientation, race and ethnicity, disabilities, and religious tolerance;
 - (2) examine the impact that unconscious bias and economic disparities have at both an individual level and on society as a whole; and
 - (3) encourage safe, welcoming, and inclusive environments for all students regardless of race or ethnicity, sexual and gender identities, mental and physical disabilities, and religious beliefs.

Asian Americans and Pacific Islanders (AAPI)

Ensures that the contributions, history, and heritage of Asian Americans and Pacific Islanders (AAPI) are included in the New Jersey Student Learning Standards (NJSLs) for Social Studies in kindergarten through Grade 12 (P.L.2021, c.416).

21st Century Themes and Skills

“Twenty-first century themes and skills” means themes such as global awareness; financial, economic, business, and entrepreneurial literacy; civic literacy; health literacy; learning and innovation skills, including creativity and innovation, critical thinking and problem solving, and communication and collaboration; information, media, and technology skills; and life and career skills, including flexibility. Career readiness, life literacies, and key skills education provides students with the necessary skills to make informed career and financial decisions, engage as responsible community members in a digital society, and to successfully meet the challenges and opportunities in an interconnected global economy.”

Unit 6 Focus Standards <https://www.nj.gov/education/cccs/2020/NJSLs-Science.pdf>

HS-ESS2-4: Use a model to describe how variations in the flow of energy into and out of Earth's

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systems result in changes in climate. [Clarification Statement: Examples of the causes of climate change differ by timescale, over 1-10 years: large volcanic eruption, ocean circulation; 10-100s of years: changes in human activity, ocean circulation, solar output; 10-100s of thousands of years: changes to Earth's orbit and the orientation of its axis; and 10-100s of millions of years: long-term changes in atmospheric composition.] [Assessment Boundary: Assessment of the results of changes in climate is limited to changes in surface temperatures, precipitation patterns, glacial ice volumes, sea levels, and biosphere distribution.]

HS-ESS2-6: Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere. [Clarification Statement: Emphasis is on modeling biogeochemical cycles that include the cycling of carbon through the ocean, atmosphere, soil, and biosphere (including humans), providing the foundation for living organisms.]

HS-ETS1-1: Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.

HS-ETS1-2: Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

HS-ETS1-3: Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.

HS-ETS1-4: Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.

<https://www.nj.gov/education/aps/cccs/science/safety.htm>

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Asking Questions and Defining Problems Asking questions and defining problems in 9-12 builds on K-8 experiences and progresses to formulating, refining, and evaluating empirically testable questions and design problems using models and simulations. Analyze complex real-world problems by	ESS1.B: Earth and the Solar System Cyclical changes in the shape of Earth's orbit around the sun, together with changes in the tilt of the planet's axis of rotation, both occurring over hundreds of thousands of years, have altered the intensity and distribution of sunlight	Cause and Effect - Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. (HS-ESS2-4) Energy and Matter - The total amount of energy and matter in

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specifying criteria and constraints for successful solutions. (HS-ETS1-1) Developing and Using Models Modeling in 9-12 builds on K-8 and progresses to using, synthesizing, and developing models to predict and show relationships among variables between systems and their components in the natural and designed worlds. • Develop a model based on evidence to illustrate the relationships between systems or between components of a system. (HS-ESS2-1), (HS-ESS2-3), (HS-ESS2-6) • Use a model to provide mechanistic accounts of phenomena. (HS-ESS2-4) Using Mathematics and Computational Thinking Mathematical and computational thinking in 9-12 builds on K-8 experiences and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions including trigonometric functions, exponentials and logarithms, and computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical	falling on the earth. These phenomena cause a cycle of ice ages and other gradual climate changes. (secondary to HS-ESS2-4) ESS2.A: Earth Materials and Systems • The geological record shows that changes to global and regional climate can be caused by interactions among changes in the sun's energy output or Earth's orbit, tectonic events, ocean circulation, volcanic activity, glaciers, vegetation, and human activities. These changes can occur on a variety of time scales from sudden (e.g., volcanic ash clouds) to intermediate (ice ages) to very long-term tectonic cycles. (HS-ESS2-4) ESS2.D: Weather and Climate • Gradual atmospheric changes were due to plants and other organisms that captured carbon dioxide and released oxygen. (HS-ESS2-6), (HS-ESS2-7) • Changes in the atmosphere due to human activity have increased carbon dioxide concentrations and thus affect climate. (HS-ESS2-6), (HS-ESS2-4) Delimiting Engineering	closed systems is conserved. (HS-ESS2-6) • Systems and System Models • Models (e.g., physical, mathematical, computer models) can be used to simulate systems and interactions—including energy, matter, and information flows— within and between systems at different scales. (HS-ETS1-4) <i>Connections to Engineering, Technology, and Applications of Science</i> Influence of Science, Engineering, and Technology on Society and the Natural World • New technologies can have deep impacts on society and the environment, including some that were not anticipated. Analysis of costs and benefits is a critical aspect of decisions about technology. (HS-ETS1-1), (HS-ETS1-3)
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models of basic assumptions. • Use mathematical models and/or computer simulations to predict the effects of a design solution on systems and/or the interactions between systems. (HS-ETS1-4) Constructing Explanations and Designing Solutions Constructing explanations and designing solutions in 9-12 builds on K-8 builds on K-8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories. • Design a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. (HS-ETS1-2) • Evaluate a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. (HS-ETS1-3)	Problems • Criteria and constraints also include satisfying any requirements set by society, such as taking issues of risk mitigation into account, and they should be quantified to the extent possible and stated in such a way that one can tell if a given design meets them. (HS-ETS1-1) • Humanity faces major global challenges today, such as the need for supplies of clean water and food or for energy sources that minimize pollution, which can be addressed through engineering. These global challenges also may have manifestations in local communities. (HS-ETS1-1) ETS1.B: Developing Possible Solutions • When evaluating solutions, it is important to take into account a range of constraints, including cost, safety, reliability, and aesthetics, and to consider social, cultural, and environmental impacts. (HS-ETS1-3) • Both physical models and computers can be used in various ways to aid in the engineering design process. Computers are	
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	useful for a variety of purposes, such as running simulations to test different ways of solving a problem or to see which one is most efficient or economical; and in making a persuasive presentation to a client about how a given design will meet his or her needs. (HS-ETS1-4) ETS1.C: Optimizing the Design Solution Criteria may need to be broken down into simpler ones that can be approached systematically, and decisions about the priority of certain criteria over others (tradeoffs) may be needed. (HS-ETS1-2)	
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Interdisciplinary Connections/ Supporting and Additional Standards Unit 6

[New Jersey Student Learning Standards-Mathematics](#)

[New Jersey Student Learning Standards-ELA](#)

Connections to HS-ETS1.A: Defining and Delimiting Engineering Problems • Physical Science: HS-PS2-3, HS-PS3-3

Connections to HS-ETS1.B: Designing Solutions to Engineering Problems: • Earth and Space Science: HS-ESS3-2, HS-ESS3-4 • Life Science: HS-LS2-7, HS-LS4-6

Connections to HS-ETS1.C: Optimizing the Design Solution: • Physical Science: HS-PS1-6, HS-PS2-3

Connections to other DCIs in grades 9-12: • HS.PS1.A (HS-ESS2-5), (HS-ESS2-6) • HS.PS1.B (HS-ESS2-5), (HS-ESS2-6) • HS.PS3.A (HS-ESS2-4) • HS.PS3.B (HS-ESS2-2), (HS-ESS2-3), (HS-ESS2-4), (HS-ESS2-5) • HS.PS3.D (HS-ESS2-3), (HS-ESS2-6) • HS.LS1.C (HS-ESS2-6) • HS.LS2.B (HS-ESS2-2), (HS-ESS2-6) • HS.LS2.C (HS-ESS2-2), (HS-ESS2-4), (HS-ESS2-7) • HS.ESS1.C (HS-ESS2-4) • HS.ESS3.C (HS-ESS2-2), (HS-ESS2-4), (HS-ESS2-5), (HS-ESS2-6) • HS.ESS3.D (HS-ESS2-2), (HS-ESS2-4), (HS-ESS2-6)

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Articulation of DCIs across grade levels: • MS.PS1.A (HS-ESS2-3), (HS-ESS2-5), (HS-ESS2-6) • MS.PS2.B (HS-ESS2-1), (HS-ESS2-3) • MS.PS3.A (HS-ESS2-3), (HS-ESS2-4) • MS.PS3.B (HS-ESS2-3), (HS-ESS2-4) • MS.PS3.D (HS-ESS2-2), (HS-ESS2-4), (HS-ESS2-6) • MS.PS4.B (HS-ESS2-2), (HS-ESS2-4), (HS-ESS2-5), (HS-ESS2-6) • MS.LS1.C (HS-ESS2-4) • MS.LS2.A (HS-ESS2-7) • MS.LS2.B (HS-ESS2-1), (HS-ESS2-2), (HS-ESS2-4), (HS-ESS2-6) • MS.LS2.C (HS-ESS2-2), (HS-ESS2-4), (HS-ESS2-7) • MS.ESS2.A (HS-ESS2-1), (HS-ESS2-2), (HS-ESS2-3), (HS-ESS2-4), (HS-ESS2-5), (HS-ESS2-6), (HS-ESS2-7) • MS.ESS2.B (HS-ESS2-1), (HS-ESS2-2), (HS-ESS2-3), (HS-ESS2-4), (HS-ESS2-6) • MS.ESS2.C (HS-ESS2-1), (HS-ESS2-2), (HS-ESS2-4), (HS-ESS2-5), (HS-ESS2-6), (HS-ESS2-7) • MS.ESS2.D (HS-ESS2-1), (HS-ESS2-2), (HS-ESS2-4), (HS-ESS2-5) • MS.ESS3.C (HS-ESS2-2), (HS-ESS2-4), (HS-ESS2-6), (HS-ESS2-7) • MS.ESS3.D (HS-ESS2-2), (HS-ESS2-4), (HS-ESS2-6) , • MS.ETS1.A (HS-ETS1-1), (HS-ETS1-2), (HS-ETS1-3), (HS-ETS1-4) • MS.ETS1.B (HS-ETS1-2), (HS-ETS1-3), (HS-ETS1-4) • MS.ETS1.C (HS-ETS1-2), (HS-ETS1-4)

ELA/Literacy -

RI.MF.9-10.6. Analyze, integrate, and evaluate multiple interpretations (e.g., charts, graphs, diagrams, videos) of a single text or text/s presented in different formats (visually, quantitatively) as well as in words in order to address a question or solve a problem.. (HS-ETS1-1), (HS-ETS1-3)

RI.AA.9-10.7. Describe and evaluate the argument and specific claims in an informational text, assessing whether the reasoning is valid and the evidence is relevant and sufficient; identify false statements and reasoning. (HS-ETS1-1), (HS-ETS1-3)

SL.UM.9-10.5. Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance findings, reasoning, and evidence and to add interest. (HS-ESS2-1), (HS-ESS2-3), (HS-ESS2-4)

Mathematics -

• MP.2 Reason abstractly and quantitatively. (HS-ESS2-1), (HS-ESS2-2), (HS-ESS2-3), (HS-ESS2-4), (HS-ESS2-6), (HS-ETS1-1), (HS-ETS1-3), (HS-ETS1-4)

• MP.4 Model with mathematics. (HS-ESS2-1), (HS-ESS2-3), (HS-ESS2-4), (HS-ESS2-6), (HS-ETS1-1), (HS-ETS1-2), (HS-ETS1-3), (HS-ETS1-4)

• 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-ESS2-1), (HS-ESS2-2), (HS-ESS2-3), (HS-ESS2-4), (HS-ESS2-6)

• HSN-Q.A.2 Define appropriate quantities for the purpose of descriptive modeling. (HS-ESS2-1), (HS-ESS2-3), (HS-ESS2-4), (HS-ESS2-6)

• HSN-Q.A.3 Choose a level of accuracy appropriate to limitations on measurement when

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reporting quantities. (HS-ESS2-1), (HS-ESS2-2), (HS-ESS2-3), (HS-ESS2-4), (HS-ESS2-5), (HS-ESS2-6)

Unit 6 New Jersey Student Learning Standards Connections: [Career Readiness](#), [Life Literacies](#), and [Key Skills](#)

Disciplinary Concepts

Career Awareness and Planning (9.2)

Creativity and Innovations (9.4)

Critical Thinking and Problem-solving (9.4)

Digital Citizenship

Global and Cultural Awareness (9.4)

Information and Media Literacy (9.4)

Core Ideas

Performance Expectations (Identified with Standard Number and Statement)

There are strategies to improve one's professional value and marketability.

- 9.2.12.CAP.2: Develop college and career readiness skills by participating in opportunities such as structured learning experiences, apprenticeships, and dual enrollment programs.
- 9.2.12.CAP.3: Investigate how continuing education contributes to one's career and personal growth.

Career planning requires purposeful planning based on research, self-knowledge, and informed choices.

- 9.2.12.CAP.4: Evaluate different careers and develop various plans (e.g., costs of public, private, training schools) and timetables for achieving them, including educational/training requirements, costs, loans, and debt repayment.
- 9.2.12.CAP.5: Assess and modify a personal plan to support current interests and postsecondary plans.
- 9.2.12.CAP.6: Identify transferable skills in career choices and design alternative career plans based on those skills.
- 9.2.12.CAP.8: Determine job entrance criteria (e.g., education credentials, math/writing/reading comprehension tests, drug tests) used by employers in various industry sectors.

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An individual's income and benefit needs and financial plan can change over time.	9.2.12.CAP.13: Analyze how the economic, social, and political conditions of a time period can affect the labor market.
With a growth mindset, failure is an important part of success	9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a).
Innovative ideas or innovation can lead to career opportunities.	9.4.12.CI.2: Identify career pathways that highlight personal talents, skills, and abilities (e.g., 1.4.12prof.CR2b, 2.2.12.LF.8) 9.4.12.CI.3: Investigate new challenges and opportunities for personal growth, advancement, and transition (e.g., 2.1.12.PGD.1).
Collaboration with individuals with diverse experiences can aid in the problem-solving process, particularly for global issues where diverse solutions are needed.	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.2: Explain the potential benefits of collaborating to enhance critical thinking and problem solving (e.g., 1.3E.12profCR3.a). 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). 9.4.12.CT.4: Participate in online strategy and planning sessions for course-based, school-based, or other projects and determine the strategies that contribute to effective outcomes.
Laws govern the use of intellectual property and there are legal consequences to utilizing or sharing another's original works without permission or appropriate credit.	9.4.12.DC.1: Explain the beneficial and harmful effects that intellectual property laws can have on the creation and sharing of content (e.g., 6.1.12.CivicsPR.16.a). 9.4.12.DC.2: Compare and contrast international differences in copyright laws and ethics.
Digital communities influence many aspects of society, especially the workforce. The increased connectivity between people in different cultures and different career fields	9.4.12.DC.7: Evaluate the influence of digital communities on the nature, content and responsibilities of careers, and other aspects of society (e.g., 6.1.12.CivicsPD.16.a).

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have changed the nature, content, and responsibilities of many careers.	
Network connectivity and computing capability extended to objects, sensors and everyday items not normally considered computers allows these devices to generate, exchange, and consume data with minimal human intervention. Technologies such as Artificial Intelligence (AI) and blockchain can help minimize the effect of climate change.	9.4.12.DC.8: Explain how increased network connectivity and computing capabilities of everyday objects allow for innovative technological approaches to climate protection.
Solutions to the problems faced by a global society require the contribution of individuals with different points of view and experiences.	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).
Advanced search techniques can be used with digital and media resources to locate information and to check the credibility and the expertise of sources to answer questions, solve problems, and inform the decision-making.	9.4.12.IML.2: Evaluate digital sources for timeliness, accuracy, perspective, credibility of the source, and relevance of information, in media, data, or other resources (e.g., NJSLA.W8, Social Studies Practice: Gathering and Evaluating Sources).
In order for members of our society to participate productively, information needs to be shared accurately and ethically	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.6: Use various types of media to produce and store information on climate change for different purposes and audiences with sensitivity to cultural, gender, and age diversity (e.g., NJSLA.SL5).

Unit 6 New Jersey Student Learning Standards: [Computer Science and Design Thinking](#)

Disciplinary Concepts

Impacts of Computing (8.1)

Data & Analysis (8.1)

Engineering Design (8.2)

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Interaction of Technology and Humans (8.2) Effects of Technology on the Natural World (8.2)	
Core Ideas	
The design and use of computing technologies and artifacts can positively or negatively affect equitable access to information and opportunities.	8.1.12.IC.1: Evaluate the ways computing impacts personal, ethical, social, economic, and cultural practices. 8.1.12.IC.3: Predict the potential impacts and implications of emerging technologies on larger social, economic, and political structures, using evidence from credible sources.
Large data sets can be transformed, generalized, simplified, and presented in different ways to influence how individuals interpret and understand the underlying information.	8.1.12.DA.5: Create data visualizations from large data sets to summarize, communicate, and support different interpretations of real-world phenomena.
Engineering design is a complex process in which creativity, content knowledge, research, and analysis are used to address local and global problems.	8.2.12.ED.1: Use research to design and create a product or system that addresses a problem and make modifications based on input from potential consumers. 8.2.12.ED.4: Design a product or system that addresses a global problem and document decisions made based on research, constraints, trade-offs, and aesthetic and ethical considerations and share this information with an appropriate audience.
Engineering design evaluation, a process for determining how well a solution meets requirements, involves systematic comparisons between requirements, specifications, and constraints.	8.2.12.ED.5: Evaluate the effectiveness of a product or system based on factors that are related to its requirements, specifications, and constraints (e.g., safety, reliability, economic considerations, quality control, environmental concerns, manufacturability, maintenance and repair, ergonomics). 8.2.12.ED.6: Analyze the effects of changing resources when designing a specific product or system (e.g., materials, energy, tools, capital, labor).
Changes caused by the introduction and use of a new technology can range from gradual to rapid and from subtle to obvious, and can	8.2.12.ITH.2: Propose an innovation to meet future demands supported by an analysis of

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change over time. These changes may vary from society to society as a result of differences in a society's economy, politics, and culture.	the potential costs, benefits, trade-offs, and risks related to the use of the innovation. 8.2.12.ITH.3: Analyze the impact that globalization, social media, and access to open source technologies has had on innovation and on a society's economy, politics, and culture.
Development and modification of any technological system needs to take into account how the operation of the system will affect natural resources and ecosystems. Impacts of technological systems on the environment need to be monitored and must inform decision-making. Many technologies have been designed to have a positive impact on the environment and to monitor environmental change over time.	8.2.12.ETW.1: Evaluate ethical considerations regarding the sustainability of environmental resources that are used for the design, creation, and maintenance of a chosen product. 8.2.12.ETW.2: Synthesize and analyze data collected to monitor the effects of a technological product or system on the environment. 8.2.12.ETW.3: Identify a complex, global environmental or climate change issue, develop a systemic plan of investigation, and propose an innovative sustainable solution.

New Jersey Student Learning Standards: [Climate Change Mandate](#)

Core Ideas

Performance Expectations

(Identified with Standard Number and Statement)

Unit 6 Evidence of Student Learning

Performance Tasks/Use of Technology:	Other Assessments:
- Greenhouse Effect Investigation: Use models, demonstrations, and digital resources to investigate how solar radiation interacts with Earth's atmosphere and how greenhouse gases influence the movement and retention of thermal energy. - Molecules and Light Interactive Simulation: Explore how different molecules interact with various forms of electromagnetic radiation and connect molecular structure to the absorption and transmission of energy. - Solar Energy Design Challenge: Design, construct, and test a solar cooker while investigating how surface materials,	Formative - Observation - Homework - Class participation - Graphic Organizers - Projects - Student Response Systems (ex.Clickers) - Do-Now/Exit Cards - Laboratories/Lab Reports - Notebook - Writing Assignments - Graphs, Models, and Tables Summative - Chapter/Unit Test

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color, insulation, angle, and exposure to sunlight influence energy absorption and temperature change. • Tropical Storm Data Analysis: Analyze air pressure, wind speed, and storm data to create graphs, identify patterns, and investigate the relationships among atmospheric pressure, wind, and the development or intensity of tropical storms. • Vantablack and Light Absorption Media Analysis: Examine how ultra-dark materials absorb and interact with light and use evidence from videos and other resources to connect material properties to energy transfer and electromagnetic radiation. • Invisible Car Technology Investigation: Explore how engineers use visual effects, reflective materials, cameras, and technology to create the appearance of an “invisible” vehicle. Evaluate how the design demonstrates concepts related to light, reflection, materials, and energy. • Growing Appetites, Limited Resources: Use the PBS LearningMedia resource to investigate population growth, resource availability, environmental pressures, and the challenges associated with sustaining human populations. • Sustainable Resource Management Activity: Analyze data and scenarios involving Earth’s limited resources and evaluate possible strategies for balancing human needs, environmental impacts, and long-term sustainability. • Search for the Super Battery Exploration: Investigate emerging battery technologies and evaluate how advances in energy storage could address challenges associated with renewable energy, transportation, resource use, and sustainability. • Energy and Climate Data Investigation: Analyze real-world environmental and	• Writing Assignments • Presentations • Laboratory Reports/Practical • Unit Projects Benchmark • Linkit assessment • Quarterlies • Mid-Term • Final Exams • Performance Assessment Alternative CER (claim, evidence, reasoning)
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climate datasets to identify trends, interpret relationships among variables, and develop evidence-based explanations for changes occurring within Earth systems.	
Unit 6 Knowledge and Skills	
Unit 6 Learning Targets	
<i>Students will be able to..</i> • Develop and use models to explain how carbon moves among the atmosphere, hydrosphere, geosphere, and biosphere. • Analyze how carbon is transferred and stored within Earth's major systems and explain how these processes support living organisms and influence Earth's environment. • Interpret scientific data and observations to identify evidence that changes in the movement of energy into and out of Earth's systems can contribute to changes in climate. • Construct evidence-based explanations for how differences in Earth's energy balance influence climate patterns and changes over time. • Compare multiple sources of empirical evidence to evaluate how changes in incoming and outgoing energy affect Earth's climate. • Use climate data, models, and scientific evidence to explain relationships among energy flow, atmospheric conditions, and long-term climate change.	
Unit 6 Enduring Understandings	Unit 6 Essential Questions
<i>Students will know...</i> • Earth's climate is influenced by the balance and movement of energy throughout the atmosphere, oceans, land, and other components of the Earth system. • The Sun provides the primary energy driving Earth's climate system, with incoming radiation being absorbed, reflected, stored, transferred, and eventually released back into space. • Earth's climate has changed throughout its history as a result of interactions among solar energy, orbital patterns, volcanic activity, ocean circulation, glaciers, vegetation, tectonic processes, and human activities. • Changes in Earth's orbit and the tilt of its axis occur over very long periods of	• How can changes in the composition of Earth's atmosphere influence weather, climate, and conditions for life? • What processes move carbon between Earth's atmosphere, oceans, land, and living organisms, and how are these reservoirs interconnected? • How do human activities alter the natural movement of carbon and other materials through Earth's systems? • In what ways can changes to one part of the carbon cycle affect other components of the Earth system? • How does the balance between carbon storage and carbon release influence Earth's climate over different timescales? • What evidence can scientists use to determine how changes in atmospheric composition have affected Earth's

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time and can alter the amount and distribution of solar energy received at Earth's surface, contributing to long-term climate patterns such as glacial and interglacial periods. • Human activities can alter the composition of the atmosphere, including increasing concentrations of carbon dioxide, which can influence Earth's energy balance and climate. • Carbon continually moves among the atmosphere, hydrosphere, geosphere, and biosphere through interconnected processes, while the overall amount of carbon within the Earth system remains conserved. • Matter and energy are conserved within closed systems, although they may be transferred between components or transformed into different forms. • Atmospheric composition has changed naturally over geologic time as organisms have removed carbon dioxide and released oxygen through biological processes, demonstrating the connection between life and Earth's atmosphere. • Climate changes can occur across a wide range of timescales, from rapid events such as volcanic eruptions to gradual changes occurring over thousands, millions, or hundreds of millions of years. • Scientific claims about climate change and its causes must be supported by empirical evidence that helps distinguish true cause-and-effect relationships from simple correlations. • Strong scientific explanations are supported by multiple, independent lines of evidence that converge on the same conclusion. • Understanding interactions among Earth's systems requires scientists to consider feedbacks, interconnected processes, and changes occurring at	climate in the past and present?
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different spatial and temporal scales.	
Unit 6 Instructional Plan	
Suggested Activities	Resources
• Digital Media and Scientific Video Analysis: Use educational videos and multimedia resources to introduce and reinforce concepts related to climate change, atmospheric processes, energy flow, and human impacts on Earth systems. • Ecological Footprint Investigation: Students calculate and analyze their individual or household ecological footprint and evaluate how everyday choices influence resource consumption, energy use, and environmental sustainability. • Earth Systems and Carbon Cycle Modeling: Create physical or digital models to demonstrate how carbon and other materials move among the atmosphere, hydrosphere, geosphere, and biosphere. • Climate and Environmental Data Labs: Conduct hands-on investigations in which students collect, analyze, graph, and interpret data related to atmospheric conditions, energy transfer, carbon dioxide levels, or other indicators of environmental change. • Human Impact Research Project: Investigate a specific human activity and its effects on Earth's systems. Students research scientific evidence, evaluate environmental consequences, and develop or propose strategies for reducing negative impacts. • Sustainability and Resource Management Activity: Examine real-world scenarios involving population growth, resource availability, energy use, and	• Gizmos • Textbook • Lab materials • YouTube

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environmental change, and evaluate possible solutions for promoting long-term sustainability.

Unit 6 Suggested Options for Differentiation:
Content-specific Accommodations and Modifications for Subgroups

Multilingual Learners

- Speak slowly, distinctly, and write down key terms
- Closed Captioning
- Emphasize visual literacy
- Graphic Organizers
- Use charts, graphs and figures
- Group projects & cooperative learning
- Partner English learners with strong English speakers
- Consistent routines
- Outlines
- Language-based science games
- Picture glossary
- Root words

Students with 504 Plans

- At the beginning of a course, have a conversation about the value of understanding one's learning profile and/or let students take a learning style survey.
- Explicitly share with students your observations about their learning strengths and challenges as the course progresses.
- Build metacognitive reflection into assignments.
- Instead of relying on large unit tests or exams, build in more frequent forms of assessment.
- Use grade-keeping software and make updated grade reports accessible to students.
- Provide direct personalized feedback to students
- Provide (or assign) some form of study guide for students to review before any quiz or exam.
- Provide scoring rubrics that describe the qualities of excellent work for the various components of each assignment.
- Make a direct connection, orally and in writing, between each class task and its associated learning objective.
- Distribute all important assignment handouts in the same format and structure.
- Establish and rationalize a routine for how class operates
- Post and review daily agendas for all class activities and assignments.
- Consider making available, in the classroom or learning support center, emerging assistive technologies such as text-to-speech screen readers, which are designed to assist students with difficulties decoding or attending to written text.
- Teach students to use some form of course planner or calendar that shows assignment due dates in a clear, graphical format.

Special Education

- At the beginning of a course, have a conversation about the value of understanding one's learning profile and/or let students take a learning style survey.
- Explicitly share with students your observations about their learning strengths and challenges as the course progresses.
- Build metacognitive reflection into assignments.
- Instead of relying on large unit tests or exams, build in more frequent forms of assessment.
- Use grade-keeping software and make updated grade reports accessible to students.
- Provide direct personalized feedback to students
- Provide (or assign) some form of study guide for students to review before any quiz or exam.
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- Distribute all important assignment handouts in the same format and structure.
- Establish and rationalize a routine for how class operates
- Post and review daily agendas for all class activities and assignments.
- Consider making available, in the classroom or learning support center, emerging assistive technologies such as text-to-speech screen readers, which are designed to assist students with difficulties decoding or attending to written text.
- Teach students to use some form of course planner or calendar that shows assignment due dates in a clear, graphical format.

Gifted and Talented

- Interdisciplinary and problem-based assignments with planned scope and sequence
- Advance, accelerated, or compacted content
- Abstract and advanced higher-level thinking
- Allowance for individual student interests
- Assignments geared to development in areas of affect, creativity, cognition, and research skills
- Complex, in-depth assignments
- Diverse enrichment that broadens learning
- Variety in types of resources
- Open-ended questions for higher-level thinking
- Higher-level text

Students at Risk of School Failure

- Small group instruction
- Frequent breaks
- Increased parent communication
- Daily log

Diversity and Inclusion:

- Involve families in student learning

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- Respect cultural traditions
- Provided students with necessary academic resources and materials
- Allow for alternative assignments
- Provide visuals
- Assign peer tutor
- Collaborate with language professionals and ESL teachers
- Encourage parents to help children maintain their native language at home, while the school helps the child attain proficiency in English.
- Establish a positive connection with parent
- Utilize closed captioning when available
- Provide road maps or outlines for difficult concepts
- Provide sufficient wait time before calling on any student to help keep students who may need more time engaged
- Speak clearly and slowly, avoid slang and idiomatic expressions
- Create a nurturing environment with structured routines

Core Instructional and Supplemental Materials and Resources

Instructional Materials

- Textbook
- Laboratory manuals and equipment

Supplemental Materials

Science Websites:

- American Chemical Society
- Ptable
- Chemical Portal
- PBS Learning Media
- Chemistry library | Science | Khan Academy
- bozemanscience
- News from Science | AAAS
- nsf
- Newsela Science Text sets
- Next Generation Science Standards
- chemspider
- LGBTQ plus Resources
- Individuals with disabilities Resources
- School databases
- Multimedia Resources
- Printers and Computers
- Online Resources and videos
- [Amistad Commission](#)
- [Holocaust Commission](#)
- Interactive Projector

- Rubrics

Intervention Materials

- Guided notes
- Flipped videos
- Leveled Text

Social and Emotional Learning New Jersey SEL

Competencies and Sub-Competencies Social and emotional learning (SEL) involves the process through which children and adults acquire and apply the knowledge, attitudes and skills necessary to understand and manage emotions, set and achieve positive goals, feel and show empathy for others, establish and maintain positive relationships, and make responsible decisions. The purpose of the SEL competencies is to provide schools with guidelines for integrating SEL across grades and subject areas.

Self-Awareness

- Recognize one's feelings and thoughts
- Recognize the impact of one's feelings and thoughts on one's own behavior
- Recognize one's personal traits, strengths and limitations
- Recognize the importance of self-confidence in handling daily tasks and challenges

Self-Management

- Understand and practice strategies for managing one's own emotions, thoughts and behaviors
- Recognize the skills needed to establish and achieve personal and educational goals
- Identify and apply ways to persevere or overcome barriers through alternative methods to achieve one's goals

Social Awareness

- Recognize and identify the thoughts, feelings and perspectives of others
- Demonstrate and awareness of the differences among individuals, groups and others' cultural backgrounds
- Demonstrate an understanding of the need for mutual respect when viewpoints differ
- Demonstrate an awareness of the expectations for social interactions in a variety of settings

Responsible Decision-Making

- Develop, implement and model effective problem solving and critical thinking skills
- Identify the consequences associated with one's actions in order to make constructive choices
- Evaluate personal, ethical, safety and civic impact of decisions

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Relationship Skills

- Establish and maintain healthy relationships
- Utilize positive communication and social skills to interact effectively with others
- Identify ways to resist inappropriate social pressure
- Demonstrate the ability to prevent and resolve interpersonal conflicts in constructive ways
- Identify who, when, where, or how to seek help for oneself or others when needed

NJDOE Website on Social and Emotional Learning

<http://www.nj.gov/education/students/safety/sandp/sel>

Teacher Notes: