Environmental Science
Grades 11 - 12
Unit 1: Organization

New Jersey Student Learning Standards - Science

Established 2016-2017
Revised 2018-2019
Revised 2019-2020
Revised 2020-2021
Revised 2021-2022
Revised 2022-2023

Marking Period	Unit Title	Recommended Instructional Days
1	Organization	45 days

NJSLS - Science: *Title*	NJSLS - Science: *Performance Expectations*	**Recommended Activities, Investigations, Interdisciplinary Connections, and/or Student Experiences to Explore NJSLS-S within Unit**
HS-ESS2: Earth's Systems HS-LS1: From Molecules to Organisms: Structures and Processes HS-LS2: Ecosystems: Interactions, Energy and Dynamics HS-LS4: Biological Evolution: Unity and Diversity	HS-ESS2-1 Develop a model to illustrate how Earth's internal and surface processes operate at different spatial and temporal scales to form continental and ocean-floor features. HS-ESS2-2 Analyze geoscience data to make the claim that one change to Earth's surface can create feedbacks that cause changes to other Earth systems. HS-ESS2-4 Use a model to describe how variations in the flow of energy into and out of Earth's systems result in changes in climate. HS-ESS2-5 Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes. HS-ESS2-6 Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere.	

	HS-ESS2-7 Construct an argument based on evidence about the simultaneous coevolution of Earth's systems and life on Earth. HS-LS1-5 Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy. 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. 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. HS-LS2-1 Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales HS-LS2-3 Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions HS-LS2-4 Use mathematical representations to support claims for	

	the cycling of matter and flow of energy among organisms in an ecosystem. HS-LS2-5 Develop a model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere HS-LS2-6 Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem. HS-LS4-1 Communicates scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence. HS-LS4-2 Construct an explanation based on evidence that the process of evolution primarily results from four factors: (1) the potential for a species to increase in number, (2) the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for limited resources, and (4) the proliferation of those organisms that are better able to	

	survive and reproduce in the environment. HS-LS4-3 Apply concepts of statistics and probability to support explanations that organisms with an advantageous heritable trait tend to increase in proportion to organisms lacking this trait. HS-LS4-4 Construct an explanation based on evidence for how natural selection leads to adaptation of populations. HS-LS4-5 Evaluate the evidence supporting claims that changes in environmental conditions may result in: (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.	
FOUNDATION Disciplinary: ***Core Idea***	**FOUNDATION Disciplinary:** ***Statement***	
ESS2A – Earth Materials and Systems ESS2B – Plate Tectonics and Large-Scale Systems	Earth's systems, being dynamic and interacting, cause feedback effects that can increase or decrease the original changes. Plate tectonics is the unifying theory that explains the past and current movements of the rocks at Earth's surface and provides a framework for understanding its geologic history. Plate movements are responsible for most continental and ocean-floor	**Essential Question/s:** How are the systems of Earth and its organisms dependent upon each other? **Activity Description:**"The Captain and Lake Wilmar" (Three sequential performance tasks) Students examine the ecosystem of Lake Wilmar through three coordinated performance tasks. In the first task, Decline in Freshwater Animal Populations, students use pH paper and water samples to investigate the effects of pH on freshwater animals. For the second task, Hot Rocks and Water, students use limestone samples and hot water baths to investigate the

ESS2C – The Role of Water in Earth's Surface Processes	features and for the distribution of most rocks and minerals within Earth's crust. 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.	concepts of heat and temperature. In the last task, Rock Erosion, students investigate the effects of polluted vs. non-polluted water on rocks. The task assesses students' abilities to make simple observations, interpret and produce graphical data, use simple tools, determine and design additional experiments, apply their understanding and observations to form explanations and predictions. **Activity Description:** Lab safety Procedure activity. Students will discuss lab safety procedures and take a short practical exam.
ESS2D – Weather and Climate	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.	**Activity Description:** Students will design a plan to see the impact of different food sources on yeast. The concept of fermentation as part of the carbon cycle will be demonstrated. **Activity Description:** "Relating Natural Selection and Frequency of Traits" Students will create a natural habitat and use different colored pinto beans to represent adaptations for survival. Students will then show how the colors will change over time. **Activity Description:** "Beaches" Students will investigate the impact of waves on the erosion of beaches, and engineer a breakwater to reduce the impact. Differentiate by either drawing or building their model.
ESS2E - Biogeology	The foundation for Earth's global climate systems is the electromagnetic radiation from the sun, as well as its reflection, absorption, storage, and redistribution among the atmosphere,	**Activity Description:** "Pond Water Ecosystem" Students will care for pond water samples over a period of several weeks. As time and resources change the types of organisms in the pond water will change. Students will make observations and change resources throughout. Students will need to write a proposal about how to keep the pond ecosystem

LS1C – Organization for Matter and Energy Flow in Organisms LS2A – Interdependent Relationships in Ecosystems LS2B – Cycles of Matter and Energy Transfer in Ecosystems LS2C – Ecosystems Dynamics, Functioning and Resilience	ocean, and land systems, and this energy's re- radiation into space. Changes in the atmosphere due to human activity have increased carbon dioxide concentrations and thus affect climate. The many dynamic and delicate feedbacks between the biosphere and other Earth systems cause a continual co-evolution of Earth's surface and the life that exists on it. The process of photosynthesis converts light energy to stored chemical energy by converting carbon dioxide plus water into sugars plus released oxygen. Photosynthesis and cellular respiration (including anaerobic processes) provide most of the energy for life processes. Photosynthesis and cellular respiration are important components of the carbon cycle, in which carbon is exchanged among the biosphere, atmosphere, oceans, and geosphere through chemical, physical, geological, and biological processes Ecosystems have carrying capacities, which are limits to the numbers of organisms and populations they can support. These limits result from such factors as the availability of living and nonliving resources and from such challenges such as predation, competition, and disease.	healthy. The lesson can be differentiated by adding/removing the essay portion **Activity Description:** "Recognizing Seismic Patterns" Students will locate, plot and analyze seismic activities in the world for a period of 2 months. The intention is to have them understand the patterns created by tectonic plates. Students will create either an artistic visual representation of the data, or write up an essay to account for different modalities of learning. **Amistad Law Activity Description:** Spotlight on Rufus Catchings and his accomplishments. Diversity in Science profile on Rufus Catchings, USGS Chief Researcher Students will read about Dr. Catchings and profile his career and explore some of his research. **LGBTQ Law Activity Description:** Spotlight on Alan Turing and his accomplishments. **Interdisciplinary Connections:** Content: ELA NJSLS#: RST.11-12.8/WHST.9-12.1/WHST.9-12.2/WHST.9-12.7 SL.11-12.4/SL.8.5 Content: Math NJSLS#: MP.2/MP.4/ HSN-Q.A.1/HSN-Q.A.2/ HSS-ID.B.6

	Organisms would have the capacity to produce populations of great size were it not for the fact that environments and resources are finite. This fundamental tension affects the abundance (number of individuals) of species in any given ecosystem A complex set of interactions within an ecosystem can keep its numbers and types of organisms relatively constant over long periods of time under stable conditions. If a modest biological or physical disturbance to an ecosystem occurs, it may return to its more or less original status (i.e., the ecosystem is resilient), as opposed to becoming a very different ecosystem. Extreme fluctuations in conditions or the size of any population, however, can challenge the functioning of ecosystems in terms of resources and habitat availability. Moreover, anthropogenic changes (induced by human activity) in the environment—including habitat destruction, pollution, introduction of invasive species, overexploitation, and climate change—can disrupt an ecosystem and threaten the survival of some species. Genetic information provides evidence of evolution. DNA sequences vary among species, but there are many overlaps; in fact, the ongoing branching that produces	

LS4A – Evidence of Common Ancestry and Diversity	multiple lines of descent can be inferred by comparing the DNA sequences of different organisms. Such information is also derivable from the similarities and differences in amino acid sequences and from anatomical and embryological evidence.	
LS4B – Natural Selection	Natural selection occurs only if there is both (1) variation in the genetic information between organisms in a population and (2) variation in the expression of that genetic information—that is, trait variation—that leads to differences in performance among individuals. The traits that positively affect survival are more likely to be reproduced, and thus are more common in the population	
LS4C - Adaptation	Changes in the physical environment, whether naturally occurring or human induced, have thus contributed to the expansion of some species, the emergence of new distinct species as populations diverge under different conditions, and the decline–and sometimes the extinction–of some species. Although energy cannot be destroyed, it can be converted to less useful forms—for example, to thermal energy in the surrounding environment.	

PS3D – Energy in Chemical Processes and Everyday Life		
FOUNDATION **Science and Engineering Practices:** ***Core Idea***		**FOUNDATION** **Science and Engineering Practices:** ***Statement***
Developing and Using Models		Develop a model based on evidence to illustrate the relationships between systems or between components of a system. Use a model to provide mechanistic accounts of phenomena. Analyze data using tools, technologies, and/or models (e.g., computational, mathematical) in order to make valid and reliable scientific claims or determine an optimal design solution.
Engaging in Argument from Evidence		Construct an oral and written argument or counter-arguments based on data and evidence.
Planning and Carrying out Investigations		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.	
Analyzing and Interpreting Data		Design or refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.	
Constructing Explanations and Designing Solutions		Construct 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.	
Using Mathematical and Computational Thinking		Create a computational model or simulation of a phenomenon, designed device, process, or system.	
Obtaining, Evaluating and Communicating Information		Communicate scientific information (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).	

FOUNDATION Crosscutting Concepts: ***Core Idea***	**FOUNDATION Crosscutting Concepts:** ***Statement***	
Stability and Change	Systems can be designed for greater or lesser stability.	
Influence of Engineering, Technology, and Science on Society and the Natural World	Modern civilization depends on major technological systems.	
Cause and Effect	Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects.	
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.	
Energy and Matter	Energy cannot be created or destroyed—it only moves between one place and another place, between objects and/or fields, or between systems. Energy drives the cycling of matter within and between systems.	
Scale, Proportion and Quantity	Algebraic thinking is used to examine scientific data and predict the effect of a change in one	

	variable on another (e.g., linear growth vs. exponential growth).	
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.	
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.	
Social and Emotional Learning: ***Competencies***	**Social and Emotional Learning:** ***Sub-Competencies***	
Self-awareness	Recognize one's feelings and thoughts and how they impact one's own behavior.	
Self-Management	Identify and apply ways to persevere. Recognize and identify the thoughts, feelings, and perspectives of others. Demonstrate an awareness of the differences among individuals, groups, and others' cultural backgrounds.	
Social Awareness	Demonstrate an understanding of the need for mutual respect when viewpoints differ.	

Responsible Decision Making	Demonstrate an awareness of the expectations for social interactions in a variety of settings. 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. Establish and maintain healthy relationships.	
NJSLS CAREER READINESS, LIFE LITERACIES & KEY SKILLS		
Disciplinary Concept		• Career Awareness and Planning • Creativity and Innovation • Critical Thinking and Problem Solving • Digital Citizenship • Global and Cultural Awareness • Information and Media Literacy • Technology Literacy
Core Ideas		• With a growth mindset, failure is an important part of success. • Innovative ideas or innovation can lead to career opportunities. • Collaboration with individuals with diverse experiences can aid in the problem-solving process, particularly for global issues where diverse solutions are needed. • 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. 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. • Solutions to the problems faced by a global society require the contribution

	of individuals with different points of view and experiences. • 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 decision-making. • Digital tools such as artificial intelligence, image enhancement and analysis, and sophisticated computer modeling and simulation create new types of information that may have profound effects on society. These new types of information must be evaluated carefully. • In order for members of our society to participate productively, information needs to be shared accurately and ethically. • Media have embedded values and points of view. • Digital tools differ in features, capacities, and styles. Knowledge of different digital tools is helpful in selecting the best tool for a given task. • Collaborative digital tools can be used to access, record and share different viewpoints and to collect and tabulate the views of groups of people.
Performance Expectation(s)	9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas (e.g., 1.1.12prof.CR3a). • 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). • 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. • 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. 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) 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). • 9.4.12.IML.1: Compare search browsers and recognize features that allow for filtering of information. • 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. • 9.4.12.IML.3: Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions (e.g., S-ID.B.6a., 8.1.12.DA.5, 7.1.IH.IPRET.8) • 9.4.12.IML.4: Assess and critique the appropriateness and impact of existing data visualizations for an intended audience (e.g., S-ID.B.6b, HS-LS2-4). • 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). • 9.4.12.IML.7: Develop an argument to support a claim regarding a current workplace or societal/ethical issue such as climate change (e.g., NJSLSA.W1, 7.1.AL.PRSNT.4). • 9.4.12.IML.8: Evaluate media sources for point of view, bias, and motivations (e.g., NJSLSA.R6, 7.1.AL.IPRET.6). • 9.4.12.IML.9: Analyze the decisions creators make to reveal explicit and implicit messages within information and media (e.g., 1.5.12acc.C2a, 7.1.IL.IPRET.4). • 9.4.12.TL.1: Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specified task (e.g., W.11-12.6.). • 9.4.12.TL.2: Generate data using formula-based calculations in a spreadsheet and draw conclusions about the data. . • 9.4.12.TL.3: Analyze the effectiveness of the process and quality of collaborative environments.

	• 9.4.12.TL.4: Collaborate in online learning communities or social networks or virtual worlds to analyze and propose a resolution to a real-world problem (e.g., 7.1.AL.IPERS.6).
Career Readiness, Life Literacies and Key Skills Practices	**Consider the environmental, social and economic impacts of decisions**. Students understand the interrelated nature of their actions and regularly make decisions that positively impact and/or mitigate negative impact on other people, organization, and the environment. They are aware of and utilize new technologies, understandings, procedures, materials, and regulations affecting the nature of their work as it relates to the impact on the social condition, the environment and the profitability of the organization. **Demonstrate creativity and innovation.** Students regularly think of ideas that solve problems in new and different ways, and they contribute those ideas in a useful and productive manner to improve their organization. They can consider unconventional ideas and suggestions as solutions to issues, tasks or problems, and they discern which ideas and suggestions will add greatest value. They seek new methods, practices, and ideas from a variety of sources and seek to apply those ideas to their own workplace. They take action on their ideas and understand how to bring innovation to an organization. **Utilize critical thinking to make sense of problems and persevere in solving them.** Students readily recognize problems in the workplace, understand the nature of the problem, and devise effective plans to solve the problem. They are aware of problems when they occur and take action quickly to address the problem; they thoughtfully investigate the root cause of the problem prior to introducing solutions. They carefully consider the options to solve the problem. Once a solution is agreed upon, they follow through to ensure the problem is solved, whether through their own actions or the actions of others.
Assessments (Formative) ***To show evidence of meeting the standard/s, students will successfully engage within:***	**Assessments (Summative)** ***To show evidence of meeting the standard/s, students will successfully complete:***
Formative Assessments: ● Do Now questions ● Exit Polls ● Kahoot ● Current Event Essays	**Benchmarks:** ● District generated diagnostic test and four district assessments. **Summative Assessments:** ● Exams based on multiple choice, true/false, short answer responses ● Summative essays based on performance tasks

		• Summative presentations	
Differentiated Student Access to Content: Teaching and Learning *Resources/Materials*			
Core Resources	**Alternate Core Resources *IEP/504/At-Risk/ESL***	**ELL Core Resources**	**Gifted & Talented Core Resources**
• Holt Environmental • Chromebooks • biointeractive.org • nasa.gov • Crash Course video series • Kahoot	• modified tests • supplemental study guides	• modified tests • supplemental study guides • multilingual assignments • multilingual dictionary	• modified assignments • supplemental assignments
Supplemental Resources			
Technology: • Chromebooks • Smartboard Other: • NA			
Differentiated Student Access to Content: Recommended *Strategies & Techniques*			
Core Resources	**Alternate Core Resources *IEP/504/At-Risk/ESL***	**ELL Core Resources**	**Gifted & Talented Core**
• Holt Environmental Science • Basic Lab Equipment • Chromebooks • Smartboard • biointeractive.org • nasa.gov • Crash Course video series	• Utilize a multi-sensory (VAKT) approach during instruction, provide alternate presentations of skills by varying the method (repetition, simple explanations, additional examples, modeling, etc.), modify test content and/or	• Extend time requirements, preferred seating, positive reinforcement, check often for understanding/review, oral/visual directions/prompts when necessary, supplemental materials including use of an online bilingual dictionary,	• Create an enhanced set of introductory activities, integrate active teaching/learning opportunities, incorporate authentic components, propose interest-based extension activities, and connect students to related

	format, allow students to retake tests for additional credit, provide additional times and preferential seating as needed, review, restate and repeat directions, provide study guides, and/or break assignments into segments of shorter tasks	and modified assessment and/or rubric.	talent development opportunities.

New Jersey Legislative Statutes and Administrative Code (place an "X" before each law/statute if/when present within the curriculum map)									
x	Amistad Law: *N.J.S.A. 18A 52:16A-88*		Holocaust Law: *N.J.S.A. 18A:35-28*	x	LGBT and Disabilities Law: *N.J.S.A. 18A:35-4.35*		Standards in Action: *Climate Change*	X	Diversity and Inclusion *N.J.S.A. 18A:35-4.36a*