

Environmental Science
Grades 11 - 12
Unit 3: Spheres and Impact

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
3	Spheres and Impact	45
NJSLS - Science: Title	NJSLS - Science: Performance Expectations	Recommended Activities, Investigations, Interdisciplinary Connections, and/or Student Experiences to Explore NJSL-S within Unit
HS-LS2: Ecosystems: Interactions, Energy and Dynamics HS-ESS2: Earth's Systems HS-ESS3: Earth and Human Activity HS-ETS1: Engineering Design	LS2-2 Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales. LS2-3 Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions 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. LS2-7 Design, evaluate and refine a solution for reducing the impacts of human activities on the environment and biodiversity. 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. ESS3-1 Construct an explanation based on evidence for how the availability of natural resources,	

	<p>occurrence of natural hazards, and changes in climate have influenced human activity.</p> <p>ESS3-2 Evaluate competing design solutions for developing, managing and utilizing energy and mineral resources based on cost-benefit ratio.</p> <p>ESS3-3 Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations and biodiversity.</p> <p>ESS3-4 Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.</p> <p>ESS3-6 Use a computational representation to illustrate the relationships among earth systems and how those relationships are being modified due to human activity.</p> <p>ETS1-1 Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.</p> <p>ETS1-3 Evaluate a solution to a complex real-world based on prioritized criteria and trade-offs that account for constraints, including cost, safety, reliability and aesthetics as well as possible social, cultural and environmental impacts</p>	
<p>FOUNDATION Disciplinary: <i>Core Idea</i></p>	<p>FOUNDATION Disciplinary: <i>Statement</i></p>	

<p>LS2A Interdependent Relationships in Ecosystems</p>	<p>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.</p>	<p><u>Essential Question/s:</u></p>
<p>LS2B Cycles of Matter and Energy Transfer in Ecosystems</p>	<p>Photosynthesis and cellular respiration (including anaerobic processes) provide most of the energy for life processes.</p>	<p>What are the key features of the geosphere, hydrosphere & atmosphere? How do human actions interrupt normal function?</p>
	<p>Plants or algae form the lowest level of the food web. At each link upward in a food web, only a small fraction of the matter consumed at the lower level is transferred upward, to produce growth and release energy in cellular respiration at the higher level. Given this inefficiency, there are generally fewer organisms at higher levels of a food web. Some matter reacts to release energy for life functions, some matter is stored in newly made structures, and much is discarded. The chemical elements that make up the molecules of organisms pass through food webs and into and out of the atmosphere and soil, and they are combined and recombined in different ways. At each link in an ecosystem, matter and energy are conserved.</p>	<p><u>Activity Description</u> Performance Task "Where Would You Live?" The distribution of human populations over time has been largely influenced by the Earth's geography and climate. As global climate changes, the impact on geography and climate will be profound, inevitably causing challenges to the quality of life and survival of human and animal populations, forcing migration. Where would you want to live in the future in order to ensure that you're comfortable and safe? Consider current geography and climate and how these might be impacted by climate change in the year 2100.</p>
	<p>Photosynthesis and cellular respiration are important components of the carbon cycle, in which carbon is exchanged among the biosphere,</p>	<p><u>Lab Activities</u> <u>Activity Description</u> "Ground Water Filters" Students will build soda bottle filters that mimic the activity in an aquifer. They will then test the effectiveness of the filters to discover what types of contaminants would be removed by an aquifer. Extension: Creation of an artesian well system. <u>Activity Description</u> "Operation Oil Spill Cleanup" Students will take on the role of engineers tasked with the responsibility of designing a device to clean up after an oil spill. Students will design, build and test their devices. "NASA Climate Change Inquiry Labs"</p>

<p>LS2C Ecosystem Dynamics, Functioning and Resilience</p>	<p>atmosphere, oceans, and geosphere through chemical, physical, geological, and biological processes. 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.</p> <p>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.</p>	<p>Projects <u>Activity Description</u> “Identifying Food Product Sources” Students will be asked to research all of the ingredients in a processed food item. Extension: research differences between common food safety laws in the US vs. Europe.</p> <p><u>Activity Description</u> “Identifying Sources of Pollution” Students will identify products in their homes that contain hazardous materials that can lead to air pollution. Each product will be evaluated for ingredients, hazards, uses and possible air pollution links. Extension: Students will write a persuasive essay to a consumer trying to convince them to use a less harmful product.</p> <p><u>LGBT and Disabilities Law Activity</u> “Profile Rachel Carson”</p> <p><u>Diversity and Inclusion Activity</u> “Outlining Problems with Access to Potable Water” Students will investigate several well known potable water problems in the United States, with a focus on the disparities among people of color and their access to clean, potable water.</p>
<p>ESS2A Earth Materials and Systems</p>	<p>Earth’s systems, being dynamic and interacting, cause feedback effects that can increase or decrease the original changes.</p> <p>Evidence from deep probes and seismic waves, reconstructions of</p>	<p><u>Long-term Projects</u> <u>Activity Description</u> “Analyzing Particulate Pollution” This assignment is a combination of data collection and research on local air quality. Students will design and utilize particulate matter collection devices, as well as use local air quality reports to map out the best and worst air quality in Bayonne.</p>

<p>ESS2D Weather and Climate</p>	<p>historical changes in Earth’s surface and its magnetic field, and an understanding of physical and chemical processes lead to a model of Earth with a hot but solid inner core, a liquid outer core, a solid mantle and crust. Motions of the mantle and its plates occur primarily through thermal convection, which involves the cycling of matter due to the outward flow of energy from Earth’s interior and gravitational movement of denser materials toward the interior.</p> <p>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.</p> <p>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, ocean, and land systems, and this energy’s re-radiation into space.</p>	<p><u>Activity Description</u> “Evaluating Trends in Mineral Resources and World Events” The price of minerals will be judged based on the occurrence of certain world events. The fluctuations will be monitored and assigned to different categories in conjunction with current events.</p> <p><u>Interdisciplinary Connections:</u> Content: ELA NJSL#: RST.9-10.8/RST.11-12.1/12.2/12.7/12.8 /12.9 WHST.9-12.2/12.5/12.7 Content: Math NJSL#: MP.2/MP.4/ HSN-Q.A.1/HSN-Q.A.2/HSN-Q.A.3/ HSS-ID.A.1/HSS-IC.A.1/B.6</p>
----------------------------------	---	--

<p>ESS3A Natural Resources</p> <p>ESS3B Natural Hazards</p> <p>ESS3C Human Impacts on Earth Systems</p>	<p>Gradual atmospheric changes were due to plants and other organisms that captured carbon dioxide and released oxygen.</p> <p>Changes in the atmosphere due to human activity have increased carbon dioxide concentrations and thus affect climate.</p> <p>Resource availability has guided the development of human society. 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.</p> <p>Natural hazards and other geologic events have shaped the course of human history; [they] have significantly altered the sizes of human populations and have driven human migrations.</p> <p>The sustainability of human societies and the biodiversity that supports them requires responsible management of natural resources.</p> <p>Scientists and engineers can make major contributions by developing technologies that produce less</p>	
---	---	--

<p>ESS3D Global Climate Change</p> <p>ETS1A Defining and Delimiting Engineering Problems</p>	<p>pollution and waste and that preclude ecosystem degradation.</p> <p>Though the magnitudes of human impacts are greater than they have ever been, so too are human abilities to model, predict, and manage current and future impacts.</p> <p>Through computer simulations and other studies, important discoveries are still being made about how the ocean, the atmosphere, and the biosphere interact and are modified in response to human activities.</p> <p>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.</p> <p>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.</p> <p>When evaluating solutions, it is important to take into account a range of constraints, including cost, safety,</p>	
--	--	--

<p>Energy and Matter</p>	<p>Using the concept of orders of magnitude allows one to understand how a model at one scale relates to a model at another scale.</p> <p>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.</p>	
<p>Stability and Change</p>	<p>Much of science deals with constructing explanations of how things change and how they remain stable.</p>	
<p>Cause and Effect</p>	<p>Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects.</p>	
<p>Influence of Science, Engineering and Technology on Society and the Natural World</p>	<p>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.</p>	
<p>Systems and System Models</p>		

	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.	
Social and Emotional Learning: <i>Competencies</i>	Social and Emotional Learning: <i>Sub-Competencies</i>	
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. 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. Establish and maintain healthy relationships.		
Assessments (Formative) <i>To show evidence of meeting the standard/s, students will successfully engage within:</i>		Assessments (Summative) <i>To show evidence of meeting the standard/s, students will successfully complete:</i>		
Formative Assessments: <ul style="list-style-type: none"> • Do Now questions • Exit Polls • Kahoot • Current Event Essays 		Benchmarks: <ul style="list-style-type: none"> • District generated diagnostic test and four district assessments. Summative Assessments: <ul style="list-style-type: none"> • 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	
<ul style="list-style-type: none"> • Holt Environmental Science • Basic Lab Equipment • Chromebooks • Newsela • Smartboard • biointeractive.org • Khan Academy 	<ul style="list-style-type: none"> • modified tests • supplemental study guides 	<ul style="list-style-type: none"> • modified tests • supplemental study guides • multilingual assignments • multilingual dictionary 	<ul style="list-style-type: none"> • modified assignments • supplemental assignments 	
Supplemental Resources				
Technology: <ul style="list-style-type: none"> • Chromebooks • Smartboard Other: <ul style="list-style-type: none"> • NA 				

Differentiated Student Access to Content: Recommended <i>Strategies & Techniques</i>			
Core Resources	Alternate Core Resources <i>IEP/504/At-Risk/ESL</i>	ELL Core Resources	Gifted & Talented Core
<ul style="list-style-type: none"> ● Holt Environmental Science ● Basic Lab Equipment ● Chromebooks ● Smartboard ● biointeractive.org ● nasa.gov ● Crash Course video series 	<ul style="list-style-type: none"> ● Utilize a multi-sensory (VAKT) approach during instruction, provide alternate presentations of skills by varying the method (repetition, simple explanations, additional examples, modeling, etc.), modify test content and/or format, allow students to retake test 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 	<ul style="list-style-type: none"> ● 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, and modified assessment and/or rubric. 	<ul style="list-style-type: none"> ● 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 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: <i>N.J.S.A. 18A 52:16A-88</i>		Holocaust Law: <i>N.J.S.A. 18A:35-28</i>	x	LGBT and Disabilities Law: <i>N.J.S.A. 18A:35-4.35</i>	x	Standards in Action: <i>Climate Change</i>	x	Diversity and Inclusion <i>N.J.S.A. 18A:35-4.36a</i>
---	---	--	---	---	---	---	---	---	---