ALLIGNMENT BETWEEN THE MARYLAND ENVIRONMENTAL LITERACY STANDARDS AND THE NEXT GENERATION SCIENCE STANDARDS (NGSS) PERFORMANCE EXPECTATIONS

MD Environmental Literacy Standards	MD Environmental Literacy Standards Topics and Indicators	Performance Expectations	Students who demonstrate understanding of the performance expectations can:
STANDARD 1 **ENVIRONMENTAL ISSUES** The student will investigate and analyze environmental issues ranging from local to global perspectives and develop and implement a local action project that protects, sustains, or enhances the natural environment.	**Topic A: Environmental Issue Investigation**		
	Indicator 1: Identify an environmental issue. *Indicator 2:* Develop and write research questions related to an environmental issue. *Indicator 3:* Given a specific issue, communicate the issue, the stakeholders involved and the stakeholders' beliefs and values. *Indicator 4:* Design and conduct the research. *Indicator 5:* Use data and references to interpret findings to form conclusions.	3-5-ETS1-1.	Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.
		3-5-ETS1-2.	Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.
		3-5-ETS1-3.	Plan and carry our fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.
		MS-ESS3-3.	Apply principles to design a method for monitoring and minimizing a human impact on the environment.
		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.
		HS-LS4-6.	Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity.
		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.

	Topic B. Action Component		
	1: Use recommendation(s) to develop and implement an environmental action plan.		
	Indicator 2: Communicate, evaluate and **justify** personal views on environmental issue and alternate ways to address them.		
	Indicator 3: Analyze the effectiveness of the action plan in terms of achieving the desired outcomes.		
STANDARD 2 **INTERACTIONS OF EARTH'S SYSTEMS** The student will analyze and apply the properties of systems thinking and modeling to the study of Earth's systems.	**Topic A: Earth Systems**		
	Indicator 1: The student will analyze and explain the interactions of earth's systems.	5-ESS2-1.	Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.
		5-ESS3-1.	Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.
	Topic B: Systems Thinking		
	Indicator 1: Analyze, explain and apply the properties of systems thinking to earth systems interactions.		
	Indicator 2: Use models and computer simulations to extend his/her understanding of scientific concepts.		

STANDARD 3 **FLOW OF MATTER AND ENERGY** The student will analyze and apply the properties of systems thinking and modeling to the study of Earth's systems.	**Topic A: Conservation of Matter within Earth Systems**		
	Indicator 1: Demonstrate that matter cycles through and between living systems and the physical environment, constantly being recombined in different ways.	K-ESS2-1.	Use and share observations of local weather conditions to describe patterns over time.
		5-PS1-2.	Measure and graph quantities to provide evidence that regardless of the type of change that occurs when heating, cooling, or mixing substances, the total weight of matter is conserved.
		MS-ESS2-1.	Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process.
		MS-ESS2-4.	Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity.
		MS-LS2-3.	Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.
		HS-LS1-5.	Use a model to illustrate how photosynthesis transforms light into stored chemical energy.
		HS-LS2-2.	Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions.
	Topic B: Energy Distribution through Earth Systems		
	Indicator 1: Analyze how the position and movement of the Earth in space determine distribution of heat and light.	1-ESS1-2.	Make observations at different times of the year to relate the amount of daylight to the time of year.
		MS-ESS1-1.	Develop and use a model of the Earth-sun-moon system to describe the cyclic patterns of lunar phases, eclipses of the sun and moon, and seasons.
	Indicator 2: Explain that transfer of thermal energy between the atmosphere and the land or oceans produces temperature and density gradients in the atmosphere and the oceans.	MS-ESS3-5.	Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century

	Indicator 3: Explain that transfer of thermal energy between the atmosphere and the land or oceans influences climate patterns.	MS-ESS2-6.	Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates.
		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 results in changes in climate.
		HS-EES3-5.	Analyze geoscience data and the results from global climate models to make an evidence-based forecast of the current rate 0of global or regional climate change and associated future impacts to Earth's systems
	Topic C: Interaction of Physical Systems and the Biosphere		
	Indicator 1: Analyze and explain the movement of matter and energy through earth's systems and the influence of this movement on the distribution of life	5-ESS2-2.	Describe and graph the amounts and percentages of water and fresh water in various reservoirs to provide evidence about the distribution of water on Earth.
		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

STANDARD 4 **POPULATIONS, COMMUNITIES AND ECOSYSTEMS** The student will use physical, chemical, biological, and ecological concepts to analyze and explain the interdependence of humans and organisms in populations, communities and ecosystems.			
	Topic A: Cycling of Matter and Energy		
	Indicator 1: Explain how organisms are linked by the transfer and transformation of matter and energy at the ecosystem level.	K-LS1-1.	Use observations to describe patterns of what plants and animals (including humans) need to survive.
		2-LS2-1.	Plan and conduct an investigation to determine if plants need sunlight and water to grow.
		5-LS1-1.	Support an argument that plants get the materials they need for growth chiefly from air and water.
		5-LS2-1.	Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.
		5-PS3-1.	Use models to describe that energy in animals' food (used for body repair, growth, and motion and to maintain body warmth) was once energy from the sun.
		MS-LS1-6.	Construct a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms.
		MS-LS1-7.	Develop a model to describe how food is rearranged through chemical reactions forming new molecules that support growth and/or release energy as this matter moves through an organism
		HS-LS2-4	Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem.
		HS-ESS2-6.	Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere.
	Topic B: Population Dynamics		
	Indicator 1: Analyze the growth or decline of populations and identify a variety of responsible factors.	MS-LS2-1.	Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.
		MS-LS2-4.	Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.
		HS-LS2-1.	Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales.

	Topic C: Community and Ecosystem Dynamics		
	Indicator 1: Explain how the interrelationships and interdependencies of organisms and populations contribute to the dynamics of communities and ecosystems.	MS-LS2-2.	Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.
		MS-LS2-3.	Develop a model to describe the cycling of matter and flow of energy among living and non-living parts of an ecosystem.
		MS-LS2-4.	Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affects populations.
		MS-LS2-5.	Evaluate competing design solutions for maintaining biodiversity and ecosystem services.
	Topic D: Stability in Populations, Communities and Ecosystems		
	Indicator 1: Use models and provide examples to show how the interaction and interdependence of populations contribute to the stability of populations, communities and ecosystems.	3-LS4-4.	Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change.
		MS-LS2-5.	Evaluate competing design solutions for maintaining biodiversity and ecosystem services
	Indicator 2: Use models and provide examples to show how species' interactions may generate ecosystems that are stable for hundreds or thousands of years.		
	Topic E: Diversity		
	Indicator 1: Provide examples and evidence to show that a greater diversity of genes, species and/or environments increases the chance that at least some living things will survive in the face of large changes in the environment.	1-LS1-2.	Use materials to design a solution to a human problem by mimicking how plants and/or animals use their external parts to help them survive, grow, and meet their needs.
		3-LS4-2.	Use evidence to construct an explanation for how the variations in characteristics among individuals of the same species may provide advantages in surviving, finding mates, and reproducing.
		3-LS4-3.	Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all.
		HS-LS2-2.	Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.

STANDARD 5 **HUMANS AND NATURAL RESOURCES** The student will use concepts from chemistry, physics, biology, and ecology to analyze and interpret both positive and negative impacts of human activities on earth's natural systems and resources.			
	Topic A: Human Impact on Natural Processes		
	Indicator 1: Analyze the effects of human activities on earth's natural processes.	HS-LS4-5.	Evaluate the evidence supporting claims that changes in environmental conditions may result in (1) increase in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.
		HS-ESS2-5.	Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.
		HS-ESS3-6.	Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity.
	Indicator 2: Analyze the effects of human activities that deliberately or inadvertently alter the equilibrium of natural processes.	K-ESS2-2.	Construct an argument supported by evidence for how plants and animals (including humans) can change the environment to meet their needs.
		MS-ESS3-1.	Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes.
	Topic B: Human Impact on Natural Resources		
	Indicator 1: Analyze from local to global levels, the relationship between human activities and the earth's resources.	K-ESS3-1.	Use a model to represent the relationship between the needs of different plants and animals (including humans) and the places they live.
		2-ESS2-1.	Compare multiple solutions designed to slow or prevent wind or water from changing the shape of the land.
		3-ESS3-1.	Make a claim about the merit of a design solution that reduces the impacts of a weather-related hazard.
		HS-ESS3-2.	Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.

STANDARD 6 **ENVIRONMENT AND HEALTH** The student will use concepts from science, social studies and health to analyze and interpret both positive and negative impacts of natural events and human activities on human health	**Topic A: Natural Changes and Human Health**		
	Indicator 1: Identify and describe natural changes in the environment that may affect the health of human populations and individuals.	K-ESS3-2	Ask questions to obtain information about the purpose of weather forecasting to prepare for, and respond to, severe weather.
		2-ESS1-1.	Use information from several sources to provide evidence that Earth events can occur quickly and slowly.
		MS-ESS3-2.	Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.
	Topic B: Human-Induced Changes and Human Health		
	Indicator 1: Describe and explain that many changes in the environment designed by humans bring benefits to society as well as cause risks.		
	Topic C: Hazards and Risk Analysis		
	Indicator 1: Analyze and explain that human activities, products, processes, technologies and inventions can involve some level of risk to human health.		

STANDARD 7 **ENVIRONMENT & SOCIETY** The student will analyze how the interactions of heredity, experience, learning and culture influence social decisions and social change.	**Topic A: Environmental Quality**		
	Indicator 1: Investigate factors that influence environmental quality.	MS-ESS3-4.	Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems.
	Topic B: Individual and Group Actions and the Environment		
	Indicator 1: Examine the influence of individual and group actions on the environment and explain how groups and individuals can work to promote and balance interests through:	5-ESS3-1.	Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.
	Topic C: Cultural Perspectives and the Environment		
	Indicator 1: Investigate cultural perspectives and dynamics and apply their understanding in context to:		
	Topic D: Political Systems and the Environment		
	Indicator 1: Understand how different political systems account for, manage, and affect natural resources and environmental quality.		
	Topic E: Economics and Environment		
	Indicator 1: Analyze and explain global economic and environmental connections.		
	Topic F: Technology and Environment		
	Indicator 1: Investigate and examine the social and environmental impacts of various technologies and technological systems on the environment including how:		
	Indicator 2: Investigate a decision involving the implementation of a new technology and present an assessment of risks, costs and benefits, identification of those who suffer, those who pay, those who gain, what the risks are, and who bears them.	HS-ESS3-4.	Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.

STANDARD 8

SUSTAINABILITY

The student will make decisions that demonstrate understanding of natural communities and the ecological, economic, political, and social systems of human communities, and examine how their personal and collective actions affect the sustainability of these interrelated systems.

Topic A: Intergenerational Responsibility		
Indicator 1: Understand and apply the basic concept of sustainability to natural and human communities.	K-ESS3-3.	Communicate solutions that will reduce the impact of humans on the land, water, air, and/or other living things in the local environment.
Topic B: Interconnectedness of Systems		
Indicator 1: Recognize the concept of sustainability as a dynamic condition characterized by the interdependency among ecological, economic, and social systems and how these interconnected systems affect individual and societal well-being.	4—ESS3-1.	Obtain and combine information to describe that energy and fuels are derived from natural resources and that their uses affect the environment.
	HS-PS3-3.	Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy.
	HS-ESS3-1.	Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.
Topic C: Influence of Economic Systems on Sustainability		
Indicator 1: Investigate and make decisions that demonstrate understanding of how the dynamics of economic systems affect the sustainability of ecological and social systems.	HS-ESS3-2.	Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.
	HS-ESS3-3.	Create a computational simulation to illustrate the relationships among the management of natural resources, the sustainability of human populations, and biodiversity.
Topic D: Influence of Social and Cultural Systems on Sustainability		
Indicator 1: Investigate and make decisions that demonstrate understanding of how the dynamics of social and cultural systems affect the sustainability of ecological and economic systems.		
Topic E: Limits of Ecological Systems		
Indicator 1: Investigate and make decisions that demonstrate understanding of how the dynamics of ecological systems affect the sustainability of social, cultural systems and economic systems.		
Topic F: Action Component		
Indicator 1: Apply knowledge and skills to investigate and implement personal and collective decisions and actions on an individual, local community, national, and global levels in order to achieve sustainability.	HS-LS2-7.	Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.