|  |
| --- |
| **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** |
| 1. Identify an environmental issue.
 | Obtaining, evaluating and communicating information |  | SystemsStability and Change |
| 1. Develop and write research questions related to an environmental issue.
 | Planning and carrying out investigations |  |  |
| 1. Given a specific issue, communicate the issue, the stakeholders involved and the stakeholders’ beliefs and values.
 | Obtaining, evaluating and communicating information |  |  |
| 1. Design and conduct the research.
 | Planning and carrying out investigations |  |  |
| 1. Use data and references to interpret findings to form conclusions.
 | Analyzing and interpreting data |  |  |
| **Topic B: Action Component** |
| 1. Use recommendation(s) to develop and implement an environmental action plan.
 | Constructing explanations and designing solutions |  |  |
| 1. Communicate, evaluate and justify personal views on environmental issue and alternate ways to address them.
 | Obtaining, evaluating and communicating informationEngaging in argument from evidence |  |  |
| 1. Analyze the effectiveness of the action plan in terms of achieving the desired outcomes.
 | Analyzing and interpreting data |  |  |

|  |
| --- |
| **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** |
| 1. The student will analyze and explain the interactions of earth’s systems.
 | Obtaining, evaluating and communicating informationConstructing explanations and designing solutionsDeveloping & Using Models | 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. | Systems and system models |
| **Topic B: Systems Thinking** |
| 1. Analyze, explain and apply the properties of systems thinking to earth systems interactions.
 | Developing & Using Models | HS-LS1-2. Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms. | Systems and system models |
| 1. Use models and computer simulations to extend his/her understanding of scientific concepts.
 | Developing and using models | 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. | Systems and system models |

|  |
| --- |
| **STANDARD 3****FLOW OF MATTER & ENERGY****The student will analyze and explain the movement of matter and energy through interactions of earth’s systems (*biosphere, geosphere, hydrosphere, atmosphere, and cryosphere*) and the influence of this movement on weather patterns, climatic zones, and the distribution of life.**  |
| **Topic A:** **Conservation of Matter within Earth Systems** |
| 1. Demonstrate that matter cycles through and between living systems and the physical environment, constantly being recombined in different ways
 | Analyzing and interpreting dataConstructing explanations and designing solutionsDeveloping & Using Models | HS-LS1-1. Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells.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-LS2-3. Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions. | Systems and system modelsEnergy & Matter: Mechanisms and ExplanationPatternsStructure & Function |
| **Topic B: Energy Distribution through Earth Systems** |
| 1. Analyze how the position and movement of the Earth in space determine distribution of heat and light.
 | Analyzing and interpreting dataConstructing explanations and designing solutionsDeveloping & Using ModelsUsing Mathematics & Computational Thinking |  | Cause and effect: Mechanisms and ExplanationScale, Proportion & QuantityEnergy & Matter |
| 1. 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.
 | Constructing explanations and designing solutionsAnalyzing & Interpreting Data | . | Cause and effect: Mechanisms and ExplanationStability & ChangePatterns |
| 1. Explain that transfer of thermal energy between the atmosphere and the land or oceans influences climate patterns.
 | Constructing explanations and designing solutionsDeveloping & Using ModelsPlanning & Carrying Out Investigations |  | Cause and effect: Mechanisms and ExplanationEnergy & MatterSystems & System Models |
| **Topic C: Interaction of Physical Systems and the Biosphere** |
| 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.
 | Analyzing and interpreting dataConstructing explanations and designing solutionsDeveloping & Using Models | 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. | Systems and system modelsEnergy & Matter:  |

|  |
| --- |
| **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** |
| 1. Explain how organisms are linked by the transfer and transformation of matter and energy at the ecosystem level.
 | Constructing explanations and designing solutionsEngaging in Argument from EvidenceDeveloping & Using ModelsUsing Mathematics & Computational Thinking | 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-LS2-3. 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. | Systems and system modelsEnergy & Matter:  |
| **Topic B: Population Dynamics** |
| 1. Analyze the growth or decline of populations and identify a variety of responsible factors.
 | Analyzing and interpreting dataDeveloping and using models | HS-LS1-4. Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms. | Systems & System Models |
| **Topic C: Community and Ecosystem Dynamics** |
| 1. Explain how the interrelationships and interdependencies of organisms and populations contribute to the dynamics of communities and ecosystems.
 | Constructing explanations and designing solutionsUsing Mathematics & Computational ThinkingEngaging in Argument from Evidence | HS-LS2-1. Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales.HS-LS2-8. Evaluate the evidence for the role of group behavior on individual and species’ chances to survive and reproduce. | Systems and system modelsScale, Proportion & QuantityCause & Effect |
| **Topic D: Stability in Populations, Communities and Ecosystems** |
| 1. Use models and provide examples to show how the interaction and interdependence of populations contribute to the stability of populations, communities and ecosystems.
 | Developing and using modelsUsing Mathematics & Computational ThinkingEngaging in Argument from Evidence | HS-LS2-1. Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales.HS-LS2-4. Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem.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. | Systems and system modelsScale, proportion and quantityEnergy & MatterStability & Change |
| 1. Use models and provide examples to show how species’ interactions may generate ecosystems that are stable for hundreds or thousands of years.
 | Developing and using modelsEngaging in Argument from EvidenceAnalyzing & Interpreting Data | 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-LS4-3. 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. | Systems and system modelsScale, proportion and quantityStability & ChangePatterns |
| **Topic E: Diversity** |
| 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.
 | Constructing explanations and designing solutionsUsing Mathematics & Computational ThinkingAsking Questions & Defining ProblemsEngaging in Argument from Evidence | 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.HS-LS3-1. Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring.HS-LS3-2. Make and defend a claim based on evidence that inheritable genetic variations may result from: (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors.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-LS4-4. Construct an explanation based on evidence for how natural selection leads to adaptation of populations. | Scale, proportion and quantityCause & Effect |

|  |
| --- |
| **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** |
| Analyze the effects of human activities on earth’s natural processes. | Analyzing and interpreting dataConstructing explanations and designing solutions | HS-LS2-7. Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity. | Cause and effectStability and changeSystems & System Models |
| Analyze the effects of human activities that deliberately or inadvertently alter the equilibrium of natural processes. | Using Mathematics & Computational Thinking | HS-LS4-6. Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity. | Cause and effect |
| **Topic B: Human Impact on Natural Resources** |
| Analyze, from local to global levels, the relationship between human activities and the earth’s resources. | Analyzing and interpreting dataConstructing explanations and designing solutionsUsing Mathematics & Computational Thinking |  | PatternsScale, proportion & quantityEnergy & matter: flows, cycles and conservationStability & changeSystems & System Models |

|  |
| --- |
| **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** |
| Identify and describe natural changes in the environment that may affect the health of human populations and individuals. | Analyzing and interpreting dataDeveloping & Using ModelsPlanning & Carrying Out Investigations | HS-LS1-2. Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.HS-LS1-3. Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis. | Cause and effectSystems & System ModelsStability & Change |
| **Topic B: Human-Induced Changes and Human Health** |
| Describe and explain that many changes in the environment designed by humans bring benefits to society as well as cause risks. | Obtaining, evaluating and communicating informationEngaging in Argument from Evidence | HS-LS3-2. Make and defend a claim based on evidence that inheritable genetic variations may result from: (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors. | Cause and effectStability and change |
| **Topic C: Hazards and Risk Analysis**  |
| Analyze and explain that human activities, products, processes, technologies and inventions can involve some level of risk to human health. | Obtaining, evaluating and communicating informationEngaging in Argument from Evidence | HS-LS3-2. Make and defend a claim based on evidence that inheritable genetic variations may result from: (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors. | Cause and effectStability and change |

|  |
| --- |
| **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** |
| Investigate factors that influence environmental quality. | Analyzing and interpreting dataConstructing Explanations & Designing Solutions | HS-LS2-7. Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity. | Cause and effectStability & Change |
| **Topic B:** **Individual and Group Actions and the Environment** |
| Examine the influence of individual and group actions on the environment and explain how groups and individuals can work to promote and balance interests. | Obtaining, evaluating and communicating information |  | Cause and effect: Mechanisms and explanation |
| **Topic C: Cultural Perspectives and the Environment** |
| Investigate cultural perspectives and dynamics and apply their understanding in context. | Obtaining, evaluating and communicating information |  | Scale, proportion and quantity |
| **Topic D: Political Systems and the Environment** |
| Understand how different political systems account for, manage, and affect natural resources and environmental quality. | Analyzing and interpreting dataObtaining, evaluating and communicating information |  | Systems and system models |
| **Topic E: Economics and Environment** |
| Analyze and explain global economic and environmental connections. | Obtaining, evaluating and communicating informationEngaging in Argument from Evidence |  | Systems and system modelsConnect to ETS-Influence of Science, Engineering & Technology and the Natural World |
| **Topic F:Technology and Environment** |
| Investigate and examine the social and environmental impacts of various technologies and technological systems on the environment. | Analyzing and interpreting dataPlanning & Carrying Out Investigations |  | Cause and effect: Mechanisms and explanationSystems & System Models |
| 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. | Obtaining, evaluating and communicating information |  | Cause and effect: Mechanisms and explanation |

|  |
| --- |
| **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** |
| Understand and apply the basic concept of sustainability to natural and human communities. | Obtaining, evaluating and communicating information |  | Stability and change |
| **Topic B: Interconnectedness of Systems**  |
| 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. | Engaging in Argument from Evidence | HS-LS2-8. Evaluate the evidence for the role of group behavior on individual and species’ chances to survive and reproduce. | Cause and effect: mechanisms and explanation  |
| **Topic C: Influence of Economic Systems on Sustainability** |
| Investigate and make decisions that demonstrate understanding of how the dynamics of economic systems affect the sustainability of ecological and social systems. | Obtaining, evaluating and communicating information |  | Systems and system modelsStability and change |
| **Topic D: Influence of Social and Cultural Systems on Sustainability** |
| Investigate and make decisions that demonstrate understanding of how the dynamics of social and cultural systems affect the sustainability of ecological and economic systems. | Obtaining, evaluating and communicating informationEngaging in argument from evidenceUsing Mathematics & Computational Thinking |  | Systems and system modelsStability and changeStructure and function |
| **Topic E: Limits of Ecological Systems** |
| Investigate and make decisions that demonstrate understanding of how the dynamics of ecological systems affect the sustainability of social, cultural, and economic systems. | Obtaining, evaluating and communicating informationEngaging in argument from evidence Constructing explanations and designing solutions | HS-LS2-7. Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.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. | Systems and system modelsStability and changeStructure and functionCause & Effect |
| **Topic F: Action Component**  |
| 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. | Planning and carrying out investigations Constructing explanations and designing solutions |  | Systems and system modelsStability and changeStructure and function |