Hillside Township School District

Biology CP/Honors

Grade 11

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Hillside Township School District Biology Curriculum

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District Mission Statement

The mission of the Hillside Public Schools is to ensure that all students at all grade levels achieve the Next Generation Science Standards and make connections to real-world success. We are committed to strong parent-community school partnerships, providing a safe, engaging, and effective learning environment, and supporting a comprehensive system of academic and developmental support that meets the unique needs of each individual.

Academic Area Overview

The Hillside Township School District is committed to excellence. We believe that all children are entitled to an education that will equip them to become productive citizens of the twenty-first century. We believe that an education grounded in the fundamental principles of science will provide students with the skills and content necessary to become our future leaders.

A sound science education is grounded in the principles of inquiry and rigor. Children are actively engaged in learning as they model real-world scientific behaviors to construct knowledge. They have ample opportunities to manipulate materials in ways that are developmentally appropriate to their age. They work in an environment that encourages them to take risks, think critically, and make models, note patterns and anomalies in those patterns. Children are encouraged to ask questions, not just the "how" and the "what" of observed phenomena, but also the "why".

Our program provides teachers with cost-effective science materials that are aligned to state and national standards, incorporate instructional strategies that are research-based, and provides teachers with a deep understanding of science and the pedagogical underpinnings of science. Our teachers receive quality professional development through a partnership with nearby districts. Our K-8 kit based program encourages "hands-on science" and is endorsed by the National Science Foundation.

Equality and Equity in Curriculum

The Hillside Township School District ensures that the district's curriculum and instruction are aligned to the Next Generation Science Standards and addresses the elimination of discrimination and the achievement gap, as identified by underperforming school-level AYP reports for State assessment, by providing equity in educational programs and by providing opportunities for students to interact positively with others regardless of race, creed, color, national origin, ancestry, age, marital status, affectional or sexual orientation, gender, religion, disability or socioeconomic status.

N.J.A.C. 6A:7-1.7(b): Section 504, Rehabilitation Act of 1973; N.J.S.A. 10:5; Title IX, Education Amendments of 1972

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Honors Curriculum

The content of an Honors course is organized to include more elaborate, complex, in-depth study of major ideas, problems and themes that integrate knowledge within a given academic subject. Emphasis is placed on higher-level thinking skills, creativity and excellence of performance. Students are selected for honors courses by state test data, previous course grades, and teacher recommendation. These students have been identified as being capable of above-average work. To maintain enrollment in Honor courses, students must maintain a marking period average of 'B' or above. In the event a marking period average falls under a 'B', a review process consisting of the student's counselor seeking input from the teacher regarding the placement of the student will take place. If removal from the Honor course is recommended, a parent conference with the student's counselor and teacher will be conducted.

All science department courses at Hillside High School prepare students with the knowledge and critical thinking skills necessary for study at the college level. The Honors Science courses are designed to support students seeking an additional challenge in their high school coursework, leading to the pursuit of STEM career paths. These honors courses stress the intellectual role of the student as they grapple with key concepts of science in increased depth. Emphasis will be on the analysis and application of data to make sense of major scientific concepts and principles. Students will learn by designing experiments, performing independent research, and working with models of systems at the nanoscopic, microscopic, and macroscopic levels.

To be successful in an Honors Science course, a student must be prepared to work both independently and cooperatively inside and outside of class. Students will also be required to apply more rigorous mathematical skills in Honors science, so it is recommended that students electing to take Honors Science courses have strong grades in their Math coursework. Students succeeding in Honors Science courses are prepared for success at the honors level the following year in the corresponding discipline.

- **In this document, the Honors Level components are indicated in bold purple text.**

Next Generation Science Standards Performance Expectations for High School Biology

HS-LS1 From Molecules to Organisms: Structures and Processes

Students who demonstrate understanding can:

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. [Assessment Boundary: Assessment does not include identification of specific cell or tissue types, whole body systems, specific protein structures and functions, or the biochemistry of protein synthesis.]

HS-LS1-2. Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms. [Clarification Statement: Emphasis is on functions at the organism system level such as nutrient uptake, water delivery, and organism movement in response to neural stimuli. An example of an interacting system could be an artery depending on the proper function of elastic tissue and smooth muscle to regulate and deliver the proper amount of blood within the circulatory system.] [Assessment Boundary: Assessment does not include interactions and functions at the molecular or chemical reaction level.]

HS-LS1-3. Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis. [Clarification Statement: Examples of investigations could include heart rate response to exercise, stomate response to moisture and temperature, and root development in response to water levels.] [Assessment Boundary: Assessment does not include the cellular processes involved in the feedback mechanism.]

HS-LS1-4. Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms. [Assessment Boundary: Assessment does not include specific gene control mechanisms or rote memorization of the steps of mitosis.]

HS-LS1-5. Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy. [Clarification Statement: Emphasis is on illustrating inputs and outputs of matter and the transfer and transformation of energy in photosynthesis by plants and other photosynthesizing organisms. Examples of models could include diagrams, chemical equations, and conceptual models.] [Assessment Boundary: Assessment does not include specific biochemical steps.]

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.]

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Science and Engineering Practices

Developing and Using Models

Modeling in 9–12 builds on K–8 experiences 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 and use a model based on evidence to illustrate the relationships between systems or between components of a system. (HS-LS1-2)
- § 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)

Planning and Carrying Out Investigations

Disciplinary Core Ideas

LS1.A: Structure and Function

- § Systems of specialized cells within organisms help them perform the essential functions of life. (HS-LS1-1)
- § All cells contain genetic information in the form of DNA molecules. Genes are regions in the DNA that contain the instructions that code for the formation of proteins, which carry out most of the work of cells. (HS-LS1-1) *(Note: This Disciplinary Core Idea is also addressed by HS-LS3- 1.)*
- § Multicellular organisms have a hierarchical structural organization, in which any one system is made up of

Crosscutting Concepts

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-LS1-2), (HS-LS1-4)

Energy and Matter

- § 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-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)

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-LS1-1)

Stability and Change

- § Feedback (negative or positive) can stabilize or destabilize a system. (HS- LS1-3)

Planning and carrying out 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-LS1-3)

Constructing Explanations and Designing Solutions

Constructing explanations and designing solutions in 9–12 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, 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-LS1-1)

§ 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-LS1-6)

numerous parts and is itself a component of the next level. (HS-LS1-2)

§ Feedback mechanisms maintain a living system's internal conditions within certain limits and mediate behaviors, allowing it to remain alive and functional even as external conditions change within some range. Feedback mechanisms can encourage (through positive feedback) or discourage (negative feedback) what is going on inside the living system. (HS-LS1-3)

LS1.B: Growth and Development of Organisms

§ In multicellular organisms individual cells grow and then divide via a process called mitosis, thereby allowing the organism to grow. The organism begins as a single cell (fertilized egg) that divides successively to produce many cells, with each parent cell passing identical genetic material (two variants of each chromosome pair) to both daughter cells. Cellular division and differentiation produce and maintain a complex organism, composed of systems of tissues and organs that work together to meet the needs of the whole organism. (HS-LS1-4)

LS1.C: Organization for Matter and Energy Flow in Organisms

§ The process of photosynthesis converts light energy to stored chemical energy by converting carbon dioxide plus water into sugars plus released oxygen. (HS-LS1-5)

§ 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

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HS-LS2 Ecosystems: Interactions, Energy, and Dynamics

Students who demonstrate understanding can:

HS-LS2-1. Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales. [Clarification Statement: Emphasis is on quantitative analysis and comparison of the relationships among interdependent factors including boundaries, resources, climate, and competition. Examples of mathematical comparisons could include graphs, charts, histograms, and population changes gathered from simulations or historical data sets.] [*Assessment Boundary: Assessment does not include deriving mathematical equations to make comparisons.*]

HS-LS2-2. Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations ecosystems of different scales. [Clarification Statement: Examples of mathematical representations include finding the average, determining trends, and using gr comparisons of multiple sets of data.] [*Assessment Boundary: Assessment is limited to provided data.*]

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. [Clarification Statement: Emphasis is on conceptual understanding of the role of aerobic and anaerobic respiration in different environments.] [*Assessment Boundary: Assessment does not include the specific chemical processes of either aerobic or anaerobic respiration.*]

HS-LS2-4. Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem. [Clarification Statement: Emphasis is on using a mathematical model of stored energy in biomass to describe the transfer of energy from one trophic level to another and that matter and energy are conserved as matter cycles and energy flows through ecosystems. Emphasis is on atoms and molecules such as carbon, oxygen, hydrogen and nitrogen being conserved as they move through an ecosystem.] [*Assessment Boundary: Assessment is limited to proportional reasoning to describe the cycling of matter and flow of energy.*]

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. [Clarification Statement: Examples of models could include simulations and mathematical models.] [*Assessment Boundary: Assessment does not include the specific chemical steps of photosynthesis and respiration.*]

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. [Clarification Statement: Examples of changes in ecosystem conditions could include modest biological or physical changes, such as moderate hunting or a seasonal flood; and extreme changes, such as volcanic eruption or sea level rise.]

HS-LS2-7. Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.* [Clarification Statement: Examples of human activities can include urbanization, building dams, and dissemination of invasive species.]

HS-LS2-8. Evaluate the evidence for the role of group behavior on individual and species' chances to survive and reproduce. [Clarification Statement: Emphasis is on: (1) distinguishing between group and individual behavior, (2) identifying evidence supporting the outcomes of group behavior, and (3) developing logical and reasonable arguments based on evidence. Examples of group behaviors could include flocking, schooling, herding, and cooperative behaviors such as hunting, migrating, and swarming.]

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

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Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Developing and Using Models Modeling in 9–12 builds on K–8 experiences and progresses to using, synthesizing, and developing models to predict and show how 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 components of a system. (HS-LS2-5) **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 models of basic assumptions. • Use mathematical and/or computational representations of phenomena or design solutions to support explanations. (HS-LS2-1) • Use mathematical representations of phenomena or design solutions to support and revise explanations. (HS-LS2-2) • Use mathematical representations of phenomena or design solutions to support claims. (HS-LS2-4) **Constructing Explanations and Designing Solutions** Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent	**LS2.A: Interdependent Relationships in Ecosystems** • 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. 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. (HS-LS2-1),(HS-LS2-2) **LS2.B: Cycles of Matter and Energy Transfer in Ecosystems** • Photosynthesis and cellular respiration (including anaerobic processes) provide most of the energy for life processes. (HS-LS2-3) • 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. (HS-LS2-4) • 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. (HS-LS2-5) **LS2.C: Ecosystem Dynamics, Functioning, and Resilience** • 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. (HS-LS2-2),(HS-LS2-6) • 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. (HS-LS2-7)	**Cause and Effect** • Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. (HS-LS2-8) **Scale, Proportion, and Quantity** • The significance of a phenomenon is dependent on the scale, proportion, and quantity at which it occurs. (HS-LS2-1) • Using the concept of orders of magnitude allows one to understand how a model at one scale relates to a model at another scale. (HS-LS2-2) **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-LS2-5) **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. (HS-LS2-4) • Energy drives the cycling of matter within and between systems. (HS-LS2-3) **Stability and Change**

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-LS2-3) ● Design, evaluate, and refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. (HS-LS2-7) **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 the natural and designed world(s). Arguments may also come from current scientific or historical episodes in science. ● Evaluate the claims, evidence, and reasoning behind currently accepted explanations or solutions to determine the merits of arguments. (HS-LS2-6) ● Evaluate the evidence behind currently accepted explanations to determine the merits of arguments. (HS-LS2-8) - ***Connections to Nature of Science***	**LS2.D: Social Interactions and Group Behavior** ● Group behavior has evolved because membership can increase the chances of survival for individuals and their genetic relatives. (HS-LS2-8) **LS4.D: Biodiversity and Humans** ● Biodiversity is increased by the formation of new species (speciation) and decreased by the loss of species (extinction). *(secondary to HS-LS2-7)* ● Humans depend on the living world for the resources and other benefits provided by biodiversity. But human activity is also having adverse impacts on biodiversity through overpopulation, overexploitation, habitat destruction, pollution, introduction of invasive species, and climate change. Thus sustaining biodiversity so that ecosystem functioning and productivity are maintained is essential to supporting and enhancing life on Earth. Sustaining biodiversity also aids humanity by preserving landscapes of recreational or inspirational value.*(secondary to HS-LS2-7) (Note: This Disciplinary Core Idea is also addressed by HS-LS4-6.)* **PS3.D: Energy in Chemical Processes** ● The main way that solar energy is captured and stored on Earth is through the complex chemical process known as photosynthesis. *(secondary to HS-LS2-5)* **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.*(secondary to HS-LS2-7)*	● Much of science deals with constructing explanations of how things change and how they remain stable. (HS-LS2-6),(HS-LS2-7)

Scientific Knowledge is Open to Revision in Light of New Evidence

- Most scientific knowledge is quite durable, but is, in principle, subject to change based on new evidence and/or reinterpretation of existing evidence. (HS-LS2-2),(HS-LS2-3)
- Scientific argumentation is a mode of logical discourse used to clarify the strength of relationships between ideas and evidence that may result in revision of an explanation. (HS-LS2-6),(HS-LS2-8)

Connections to other DCIs in this grade-band:

HS.PS1.B (HS-LS2-3),(HS-LS2-5); **HS.PS3.B** (HS-LS2-3),(HS-LS2-4); **HS.PS3.D** (HS-LS2-3),(HS-LS2-4); **HS.ESS2.A** (HS-LS2-3); **HS.ESS2.D** (HS-LS2-5),(HS-LS2-7);**HS.ESS2.E** (HS-LS2-2),(HS-LS2-6),(HS-LS2-7); **HS.ESS3.A** (HS-LS2-2),(HS-LS2-7); **HS.ESS3.C** (HS-LS2-2),(HS-LS2-7); **HS.ESS3.D** (HS-LS2-2)

Articulation of DCIs across grade-bands:

MS.PS1.B (HS-LS2-3); **MS.PS3.D** (HS-LS2-3),(HS-LS2-4),(HS-LS2-5); **MS.LS1.B** (MS-LS2-8); **MS.LS1.C** (HS-LS2-3),(HS-LS2-4),(HS-LS2-5); **MS.LS2.A** (HS-LS2-1),(HS-LS2-2),(HS-LS2-6); **MS.LS2.B** (HS-LS2-3),(HS-LS2-4),(HS-LS2-5); **MS.LS2.C**(HS-LS2-1),(HS-LS2-2),(HS-LS2-6),(HS-LS2-7); **MS.ESS2.A** (HS-LS2-5); **MS.ESS3.A** (HS-LS2-1); **MS.ESS3.C** (HS-LS2-1),(HS-LS2-2),(HS-LS2-6),(HS-LS2-7); **MS.ESS3.D** (HS-LS2-7)

Common Core State Standards Connections:

ELA/Literacy -

RST.9-10.8 Assess the extent to which the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem.(HS-LS2-6),*(HS-LS2-7),(HS-LS2-8)*

RST.11-12.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies the account. *(HS-LS2-1),(HS-LS2-2),*(HS-LS2-3),(HS-LS2-6),(HS-LS2-8)

RST.11-12.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem. *(HS-LS2-6),(HS-LS2-7),(HS-LS2-8)*

RST.11-12.8 Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. (HS-LS2-6),(HS-LS2-7),(HS-LS2-8)

WHST.9-12.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. *(HS-LS2-1),(HS-LS2-2)*,(HS-LS2-3)

WHST.9-12.5 Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience. (HS-LS2-3)

WHST.9-12.7 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-LS2-7)

Mathematics -

MP.2 Reason abstractly and quantitatively. (HS-LS2-1),(HS-LS2-2),(HS-LS2-4),(HS-LS2-6),*(HS-LS2-7)*

MP.4 Model with mathematics. *(HS-LS2-1),(HS-LS2-2),(HS-LS2-4)*

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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-LS2-1),(HS-LS2-2),(HS-LS2-4),*(HS-LS2-7)*
HSN.Q.A.2 Define appropriate quantities for the purpose of descriptive modeling. *(HS-LS2-1),(HS-LS2-2),(HS-LS2-4),(HS-LS2-7)*
HSN.Q.A.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (HS-LS2-1),(HS-LS2-2),(HS-LS2-4),*(HS-LS2-7)*
HSS-ID.A.1 Represent data with plots on the real number line. *(HS-LS2-6)*
HSS-IC.A.1 Understand statistics as a process for making inferences about population parameters based on a random sample from that population. *(HS-LS2-6)*
HSS-IC.B.6 Evaluate reports based on data. (HS-LS2-6)

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HS-LS3 Heredity: Inheritance and Variation of Traits

Students who demonstrate understanding can:

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. [*Assessment Boundary: Assessment does not include the phases of meiosis or the biochemical mechanism of specific steps in the process.*]
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. [Clarification Statement: Emphasis is on using data to support arguments for the way variation occurs.] [Assessment Boundary: Assessment does not include the phases of meiosis or the biochemical mechanism of specific steps in the process.]
HS-LS3-3. Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population.[Clarification Statement: Emphasis is on the use of mathematics to describe the probability of traits as it relates to genetic and environmental factors in the expression of traits.] [*Assessment Boundary: Assessment does not include Hardy-Weinberg calculations.*]

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Science and Engineering Practices

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.

- Ask questions that arise from examining models or a theory to clarify relationships. (HS-LS3-1)

Analyzing and Interpreting Data

Analyzing data in 9-12 builds on K-8 experiences and progresses to introducing more detailed statistical analysis, the comparison of data sets for

Disciplinary Core Ideas

LS1.A: Structure and Function

- All cells contain genetic information in the form of DNA molecules. Genes are regions in the DNA that contain the instructions that code for the formation of proteins. *(secondary to HS-LS3-1) (Note: This Disciplinary Core Idea is also addressed by HS-LS1-1.)*

LS3.A: Inheritance of Traits

- Each chromosome consists of a single very long DNA molecule, and each gene on the chromosome is a particular segment of that DNA. The instructions for forming species' characteristics are carried in DNA. All cells in an organism have the same genetic content, but the genes used (expressed) by the cell may be regulated in different ways. Not all DNA codes for a protein; some segments of DNA are involved in regulatory or structural functions, and some have no as-yet known function. (HS-LS3-1)

LS3.B: Variation of Traits

- In sexual reproduction, chromosomes can sometimes swap sections during the process of meiosis (cell division), thereby creating new genetic combinations and thus more genetic variation. Although DNA replication is tightly regulated and remarkably accurate, errors do

Crosscutting Concepts

Cause and Effect

- Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. (HS-LS3-1),(HS-LS3-2)

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). (HS-LS3-3)

Connections to Nature of Science

Science is a Human Endeavor

consistency, and the use of models to generate and analyze data. ● Apply concepts of statistics and probability (including determining function fits to data, slope, intercept, and correlation coefficient for linear fits) to scientific and engineering questions and problems, using digital tools when feasible. (HS-LS3-3) **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 the natural and designed world(s). Arguments may also come from current scientific or historical episodes in science. ● Make and defend a claim based on evidence about the natural world that reflects scientific knowledge, and student-generated evidence. (HS-LS3-2)	occur and result in mutations, which are also a source of genetic variation. Environmental factors can also cause mutations in genes, and viable mutations are inherited. (HS-LS3-2) ● Environmental factors also affect expression of traits, and hence affect the probability of occurrences of traits in a population. Thus the variation and distribution of traits observed depends on both genetic and environmental factors. (HS-LS3-2),(HS-LS3-3)	● Technological advances have influenced the progress of science and science has influenced advances in technology. (HS-LS3-3) ● Science and engineering are influenced by society and society is influenced by science and engineering. (HS-LS3-3)
Connections to other DCIs in this grade-band: **HS.LS2.A** (HS-LS3-3); **HS.LS2.C** (HS-LS3-3); **HS.LS4.B** (HS-LS3-3); **HS.LS4.C** (HS-LS3-3)		
Articulation of DCIs across grade-bands: **MS.LS2.A** (HS-LS3-3); **MS.LS3.A** (HS-LS3-1),(HS-LS3-2); **MS.LS3.B** (HS-LS3-1),(HS-LS3-2),(HS-LS3-3); **MS.LS4.C** (HS-LS3-3)		
Common Core State Standards Connections: *ELA/Literacy -* **RST.11-12.1** Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. *(HS-LS3-1),(HS-LS3-2)* **RST.11-12.9** Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible. *(HS-LS3-1)* **WHST.9-12.1** Write arguments focused on *discipline-specific content.* (HS-LS3-2)		

Mathematics -
MP.2 Reason abstractly and quantitatively. (HS-LS3-2),(HS-LS3-3)

HS-LS4 Biological Evolution: Unity and Diversity

Students who demonstrate understanding can:

HS-LS4-1. Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence. [Clarification Statement: Emphasis is on a conceptual understanding of the role each line of evidence has relating to common ancestry and biological evolution. Examples of evidence could include similarities in DNA sequences, anatomical structures, and order of appearance of structures in embryological development.]
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. [Clarification Statement: Emphasis is on using evidence to explain the influence each of the four factors has on number of organisms, behaviors, morphology, or physiology in terms of ability to compete for limited resources and subsequent survival of individuals and adaptation of species. Examples of evidence could include mathematical models such as simple distribution graphs and proportional reasoning.] [*Assessment Boundary: Assessment does not include other mechanisms of evolution, such as genetic drift, gene flow through migration, and co-evolution.*]
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. [Clarification Statement: Emphasis is on analyzing shifts in numerical distribution of traits and using these shifts as evidence to support explanations.] [*Assessment Boundary: Assessment is limited to basic statistical and graphical analysis. Assessment does not include allele frequency calculations.*]
HS-LS4-4. Construct an explanation based on evidence for how natural selection leads to adaptation of populations. [Clarification Statement: Emphasis is on using data to provide evidence for how specific biotic and abiotic differences in ecosystems (such as ranges of seasonal temperature, long-term climate change, acidity, light, geographic barriers, or evolution of other organisms) contribute to a change in gene frequency over time, leading 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. [Clarification Statement: Emphasis is on determining cause and effect relationships for how changes to the environment such as deforestation, fishing, application of fertilizers, drought, flood, and the rate of change of the environment affect distribution or disappearance of traits in species.]
HS-LS4-6. Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity.* [Clarification Statement: Emphasis is on designing solutions for a proposed problem related to threatened or endangered species, or to genetic variation of organisms for multiple species.]

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Science and Engineering Practices

Analyzing and Interpreting Data

Analyzing data in 9–12 builds on K–8 experiences and progresses to introducing more detailed statistical analysis, the comparison of data sets for consistency, and the use of models to generate and analyze data.

- Apply concepts of statistics and probability (including determining function fits to data, slope, intercept, and correlation coefficient for linear fits) to scientific and engineering questions and problems, using digital tools when feasible. (HS-LS4-3)

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 models of basic assumptions.

- Create or revise a simulation of a phenomenon, designed device, process, or system. (HS-LS4-6)

Constructing Explanations and Designing Solutions

Constructing explanations and designing solutions in 9–12 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,

Disciplinary Core Ideas

LS4.A: Evidence of Common Ancestry and Diversity

- Genetic information, like the fossil record, provides evidence of evolution. DNA sequences vary among species, but there are many overlaps; in fact, the ongoing branching that produces 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. (HS-LS4-1)

LS4.B: 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. (HS-LS4-2),(HS-LS4-3)
- The traits that positively affect survival are more likely to be reproduced, and thus are more common in the population. (HS-LS4-3)

LS4.C: Adaptation

- Evolution is a consequence of the interaction of four factors: (1) the potential for a species to increase in number, (2) the genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for an environment's limited supply of the resources that individuals need in order to survive and reproduce, and (4) the ensuing proliferation of those organisms that are better able to survive and reproduce in that environment. (HS-LS4-2)
- Natural selection leads to adaptation, that is, to a population dominated by organisms that are anatomically, behaviorally, and physiologically well suited to survive and reproduce in a specific environment. That is, the differential survival and reproduction of organisms in a population that have an advantageous heritable trait leads to an increase in the proportion of individuals in future generations that have the trait and to a decrease in the proportion of individuals that do not. (HS-LS4-3),(HS-LS4-4)

Crosscutting Concepts

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-LS4-1),(HS-LS4-3)

Cause and Effect

- Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. (HS-LS4-2),(HS-LS4-4),(HS-LS4-5),(HS-LS4-6)

Connections to Nature of Science

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-LS4-1),(HS-LS4-4)

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-LS4-2),(HS-LS4-4)

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 the natural and designed world(s). Arguments may also come from current or historical episodes in science.

- Evaluate the evidence behind currently accepted explanations or solutions to determine the merits of arguments. (HS-LS4-5)

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 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). (HS-LS4-1)

- -

Connections to Nature of Science

Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena

- A scientific theory is a substantiated explanation of some aspect of the

- Adaptation also means that the distribution of traits in a population can change when conditions change. (HS-LS4-3)
- 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. (HS-LS4-5),(HS-LS4-6)
- Species become extinct because they can no longer survive and reproduce in their altered environment. If members cannot adjust to change that is too fast or drastic, the opportunity for the species' evolution is lost. (HS-LS4-5)

LS4.D: Biodiversity and Humans

- Humans depend on the living world for the resources and other benefits provided by biodiversity. But human activity is also having adverse impacts on biodiversity through overpopulation, overexploitation, habitat destruction, pollution, introduction of invasive species, and climate change. Thus sustaining biodiversity so that ecosystem functioning and productivity are maintained is essential to supporting and enhancing life on Earth. Sustaining biodiversity also aids humanity by preserving landscapes of recreational or inspirational value. (HS-LS4-6) *(Note: This Disciplinary Core Idea is also addressed by HS-LS2-7.)*

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. *(secondary to HS-LS4-6)*
- Both physical models and computers can be used in various ways to aid in the engineering design 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. *(secondary to HS-LS4-6)*

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-LS4-1)		

Connections to other DCIs in this grade-band:

HS.LS2.A (HS-LS4-2),(HS-LS3-4),(HS-LS4-4),(HS-LS4-5); **HS.LS2.D** (HS-LS4-2),(HS-LS4-3),(HS-LS4-4),(HS-LS4-5); **HS.LS3.A** (HS-LS4-1); **HS.LS3.B** (HS-LS4-1),(HS-LS4-2),(HS-LS4-3),(HS-LS4-5); **HS.ESS1.C** (HS-LS4-1); **HS.ESS2.D** (HS-LS4-6); **HS.ESS2.E** (HS-LS4-2),(HS-LS4-5),(HS-LS4-6); **HS.ESS3.A** (HS-LS4-2),(HS-LS4-5),(HS-LS4-6); **HS.ESS3.C** (HS-LS4-6); **HS.ESS3.D** (HS-LS4-6)

Articulation of DCIs across grade-bands:

MS.LS2.A (HS-LS4-2),(HS-LS4-3),(HS-LS4-5); **MS.LS2.C** (HS-LS4-5),(HS-LS4-6); **LS3.A** (HS-LS4-1); **LS3.B** (HS-LS4-1),(HS-LS4-2),(HS-LS4-3); **MS.LS4.A** (HS-LS4-1);**MS.LS4.B** (HS-LS4-2),(HS-LS4-3),(HS-LS4-4); **MS.LS4.C** (HS-LS4-2),(HS-LS4-3),(HS-LS4-4),(HS-LS4-5); **MS.ESS1.C** (HS-LS4-1); **HS.ESS3.C** (HS-LS4-5),(HS-LS4-6)

Common Core State Standards Connections:

ELA/Literacy -

RST-11.12.1	Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. *(HS-LS4-1)*,(HS-LS4-2),*(HS-LS4-3)*,(HS-LS4-4)
RST-11.12.8	Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. (HS-LS4-5)
WHST.9-12.2	Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. *(HS-LS4-1)*,(HS-LS4-2),*(HS-LS4-3)*,(HS-LS4-4)
WHST.9-12.5	Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience. *(HS-LS4-6)*
WHST.9-12.7	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-LS4-6)*
WHST.9-12.9	Draw evidence from informational texts to support analysis, reflection, and research. *(HS-LS4-1)*,(HS-LS4-2),*(HS-LS4-3)*,(HS-LS4-4),(HS-LS4-5)
SL.11-12.4	Present claims and findings, emphasizing salient points in a focused, coherent manner with relevant evidence, sound valid reasoning, and well-chosen details; use appropriate eye contact, adequate volume, and clear pronunciation. *(HS-LS4-1),(HS-LS4-2)*

Mathematics -

MP.2	Reason abstractly and quantitatively. *(HS-LS4-1)*,(HS-LS4-2),(HS-LS4-3),*(HS-LS4-4),(HS-LS4-5)*
MP.4	Model with mathematics. *(HS-LS4-2)*

Science Department Lesson Plan Template

Lesson Information

Lesson Name: _____
Unit: _____
Date: _____

Lesson Data

1. Essential Question:

2. NGSS:

3. DCI :

Students will know……

4. Practices:

Students will be able to…..

5. Crosscutting Concepts:

Students will apply…

6. Assessment:

Evidence of student learning:

7. Lesson Agenda:

Include in Lesson Outline:

- *Anticipated timing*
- *DO NOW*
- *Activities and Investigations*
- *Discussion prompts*
- *Journal writing prompts*
- *Student uses of technology*
- *Safety precautions*
- *Materials*

8. Homework:

UNIT 1: ENERGY

ENDURING UNDERSTANDINGS	ESSENTIAL QUESTIONS

✓ Living organisms convert the sun's energy into stored energy to be used within the organism or passed through the ecosystem. ✓ Matter cycles through the ecosystem while energy moves in one direction. ✓ Students understand organisms' interactions with each other and their physical environment, how organisms obtain resources, change the environment, and how these changes affect both organisms and ecosystems. ✓ Students utilize the crosscutting concepts of matter and energy and systems and system models to make sense of ecosystem dynamics.	✓ How do organisms obtain and use energy they need to live and grow? ✓ How do matter and energy move through ecosystems?

Student Learning Objective	**Disciplinary Core Ideas with Extended Knowledge Students will know:**	**Practices of Science & Engineering with Additional Skills Students will be able to:**	**Cross Cutting Concepts Students will apply:**

Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy.**HS-LS1-5** 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-LS1-6** 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-LS1-7** Develop a model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere,	Use visual representations to illustrate how interactions among living systems and with their environment result in the movement of matter and energy. **LS1.C** • The process of photosynthesis converts light energy to stored chemical energy by converting carbon dioxide plus water into sugars plus released oxygen. (**HS-LS1-5**) • 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 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 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	**Modeling** • Develop and use a model based on evidence to illustrate the relationships between systems or between components of a system. (**HS-LS1-2**) **Constructing explanations** • 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. **(HSLS1-1)** **Using Mathematics and Computational Thinking** • Use mathematical representations of phenomena or design solutions to support claims**. (HS-LS2-4)** **Critical Thinking, problem solving, and decision making** Evaluate the strengths and limitations of emerging technologies and their	**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. (**HSLS1-2**) **Energy and Matter** • 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-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),(HS-LS2-4**) • Energy drives the cycling of matter within and between systems. (**HS-LS2-3**)

hydrosphere, and geosphere. **HS-LS2- 5** Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions. **HS-LS2-3** Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem. **HS-LS2-4**	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. (**HS-LS1-7**) • Photosynthesis and cellular respiration (including anaerobic processes) provide most of the energy for life processes. (**HSLS2-3**) • 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 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. (**HS-LS2-4**) • 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. (**HS-LS2- 5**) • The main way that solar energy is captured and stored on Earth is through the complex chemical process known as photosynthesis. (**secondary to HS-LS2-5**)	impact on educational, career, personal and or social needs. (**Technology 8.1.12.F.1**)	

	BIOLOGY HONORS WILL INCLUDE THE FOLLOWING ASSESSMENT BOUNDARIES: HS-LS1-6: *The details of the specific chemical reactions or identification of macromolecules.* HS-LS1-7: *The identification of the steps or specific processes involved in cellular respiration.* HS-LS2-3: *The specific chemical processes of either aerobic or anaerobic respiration.* HS-LS2-5:*The specific chemical steps of photosynthesis and respiration.*		

Biology Pacing Energy:

Hillside Township School District Biology Curriculum

TIME FRAME	UNIT	PERFORMANCE TASKS ACTIVITIES/PROJECTS ASSESSMENTS	RESOURCES/INTERDISCIPLINARY CONNECTIONS
SEPT/MID OCT	**ENERGY**	**The Race, p278** Releasing energy p288 Energy in matter p289 Keep on running p294 **Lab Report** Using light to build matter p299 Building living systems p303 Virtual Lab - Carbon Transfer Through Snails and Elodea **Lab Report** Tracing Matter and Energy p306 Spinning the web of life p316 What have I learned about energy and matter in communities? p323 **Energy Drink Debate** Unit Assessment and Quiz(zes) Assessment Boundaries for Biology CP classes: HS-LS1-5:*Assessment Boundary: Assessment does not include specific biochemical steps.* HS-LS1-6:*Assessment Boundary: Assessment does not include the details of the specific chemical reactions or identification of macromolecules.* HS-LS1-7:*Assessment Boundary: Assessment should not include identification of the steps or specific processes involved in cellular respiration.*	BSCS Biology AHA Textbook Chapters 8 and 9 **Virtual Lab - Carbon Transfer Through Snails and Elodea**

		HS-LS2-3*Assessment Boundary: Assessment does not include the specific chemical processes of either aerobic or anaerobic respiration.* HS-LS2-4:*Assessment Boundary: Assessment is limited to proportional reasoning to describe the cycling of matter and flow of energy.* HS-LS2-5:*Assessment Boundary: Assessment does not include the specific chemical steps of photosynthesis and respiration.*	

Hillside Township School District Biology Curriculum

UNIT 2: STRUCTURES AND PROCESSES

ENDURING UNDERSTANDINGS	ESSENTIAL QUESTIONS
✓ Homeostasis is a dynamic balance between the internal and external environments of a cell or an organism. ✓ Cells work together in tissues, organs, and organ systems to maintain homeostasis	✓ How do the external conditions influence the internal processes of the human body? ✓ How do the structures of organisms enable life's functions?

Student Learning Objective	Disciplinary Core Ideas with Extended Knowledge Students will know:	Practices of Science & Engineering with Additional Skills Students will be able to:	Cross Cutting Concepts Students will apply:
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-LS1-1** Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms. **HS-LS1-2**	• Systems of specialized cells within organisms help them perform the essential functions of life. **(HS-LS1-1)** • All cells contain genetic information in the form of DNA molecules. Genes are regions in the DNA that contain the instructions that code for the formation of proteins, which carry out most of the work of cells. **(HS-LS1- 1)** • Multicellular organisms have a hierarchical structural organization, in which any one system is made up of numerous parts and is itself a component of the next level. **(HS-LS1- 2**) • Feedback mechanisms maintain a living system's internal conditions within certain limits and mediate	Developing and Using Models • Develop and use a model based on evidence to illustrate the relationships between systems or between components of a system. (**HS-LS1-2**)	**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. **(HSLS1-2)**

Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis. **HS-LS1-3**	behaviors, allowing it to remain alive and functional even as external conditions change within some range. Feedback mechanisms can encourage (through positive feedback) or discourage (negative feedback) what is going on inside the living system. (**HS-LS1-3**) **BIOLOGY HONORS WILL INCLUDE THE FOLLOWING ASSESSMENT BOUNDARIES:** HS-LS1-2: *Interactions and functions at the molecular or chemical reaction level.* HS-LS1-3: *The cellular processes involved in the feedback mechanism.*	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. (**HS-LS1-3**) 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. (**HSLS1-1**) **Technology Operations and Concepts** • Explore a real world problem using digital tools to develop an understanding of the issues.	**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-LS1-1)** **Stability and Change** • Feedback (negative or positive) can stabilize or destabilize a system. **(HS-LS1-3)** **Connections to Nature of Science** Scientific Investigations Use a Variety of Methods Scientific inquiry is characterized by a common set of values that include: logical thinking, precision, open-mindedness, objectivity, skepticism, replicability of results, and honest and ethical reporting of findings. **(HS-LS1-3)**

		Create or use a digital simulation to explore a real world problem and possible alternative solutions. (**Technology 8.1.12.A.3**)	

Hillside Township School District Biology Curriculum

Biology Pacing Structures and Processes

TIME FRAME	UNIT	PERFORMANCE TASKS ACTIVITIES/PROJECTS ASSESSMENTS	RESOURCES/INTERDISCIPLINARY CONNECTIONS
MID OCT/MID DECEMBER	**STRUCTURE AND PROCESSES**	Can you stand the heat? p150 Cells in action p150 A Cell Model p161 **Poster Session or Lab Report** Regulating the Internal Environment p164 Can you stand the heat – again? p166 The Body responds p172 Stepping up the pace p177 On a scale of 0-14 p182 **Lab Report - Regulating pH p184** **Pushing the Limits p194** **Hospital Triage p196** **Organelle Group Project** Unit Assessment and Quiz(zes) Assessment Boundaries for Biology CP classes: HS-LS1-1:*Assessment Boundary: Assessment does not include identification of specific cell or tissue types, whole body systems, specific protein structures and functions, or the biochemistry of protein synthesis.* HS-LS1-2:*Assessment Boundary: Assessment does not include interactions and functions at the molecular or chemical reaction level.*	BSCS Biology AHA Textbook Chapters 4 and 5 Planet Earth: Deserts

		HS-LS1-3:*Assessment Boundary: Assessment does not include the cellular processes involved in the feedback mechanism.*	

Hillside Township School District Biology Curriculum

UNIT 3: REPRODUCTION AND DEVELOPMENT; INHERITANCE AND GENETICS

ENDURING UNDERSTANDINGS	ESSENTIAL QUESTIONS
✓ There are predictable patterns of inheritance. ✓ Genes located on chromosomes encode instructions for proteins that result in the characteristics of an organism. ✓ Students demonstrate understanding of the relationship of DNA and chromosomes in the processes of cellular division that pass traits from one generation to the next. ✓ Students will use structure and function, patterns, and cause and effect to develop a generalized understanding of inheritance of traits to other applications in science ✓ As an organism grows from a single cell to an adult, cells divide and differentiate in a predictable pattern.	✓ How is genetic information passed through generations? ✓ How does a change in DNA affect not only an organism but offspring produced by that organism? ✓ How are the characteristics from one generation related to the previous generation? ✓ How do organisms develop from fertilization to adulthood?

Hillside Township School District Biology Curriculum

Student Learning Objective	Disciplinary Core Ideas with Extended Knowledge Students will know:	Practices of Science & Engineering with Additional Skills Students will be able to:	Cross Cutting Concepts Students will apply:
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-LS3-1** 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-LS1-1** 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-LS3-2** Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population. **HS-LS3-3**	**LS1.A: Structure and Function** • All cells contain genetic information in the form of DNA molecules. Genes are regions in the DNA that contain the instructions that code for the formation of proteins. (**HS-LS3-1**) **LS3.A**: **Inheritance of Traits** • Each chromosome consists of a single very long DNA molecule, and each gene on the chromosome is a particular segment of that DNA. The instructions for forming species' characteristics are carried in DNA. All cells in an organism have the same genetic content, but the genes used (expressed) by the cell may be regulated in different ways. Not all DNA codes for a protein; some segments of DNA are involved in regulatory or structural functions, and some have no as-yet known function. (**HS-LS3-1**) **LS3.B: Variation of Traits** • In sexual reproduction, chromosomes can sometimes swap sections during the process of meiosis (cell division), thereby creating new genetic combinations and thus more genetic variation. Although DNA replication is	**Asking Questions and Defining Problems** • Ask questions that arise from examining models or a theory to clarify relationships. (**HS-LS3-1**) **Developing and Using Models** • Use a model based on evidence to illustrate the relationships between systems or between components of a system. (**HS-LS1- 4**) **Analyzing and Interpreting Data** • Apply concepts of statistics and probability (including determining function fits to data, slope, intercept, and correlation coefficient for linear fits) to scientific and engineering questions and problems, using digital tools when feasible. (**HS-LS3-3**) **Engaging in Argument from Evidence** • Make and defend a claim based on evidence about the natural world that reflects scientific knowledge, and student-generated evidence. (**HS-LS3-2**)	**Cause and Effect** • Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. **(HS-LS3-1),(HS-LS3-2)** **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). **(HSLS3-3)** **Systems and System Models** IN• 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. **(HSLS1-4)** **Connections to Nature of Science** **Science is a Human Endeavor**

Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms. **HS-LS1-4**	tightly regulated and remarkably accurate, errors do occur and result in mutations, which are also a source of genetic variation. Environmental factors can also cause mutations in genes, and viable mutations are inherited. (**HS-LS3-2**) • Environmental factors also affect expression of traits, and hence affect the probability of occurrences of traits in a population. Thus the variation and distribution of traits observed depends on both genetic and environmental factors. (**HS-LS3-2),(HS-LS3-3**) **LS1.B**: **Growth and Development of Organisms** • In multicellular organisms individual cells grow and then divide via a process called mitosis, thereby allowing the organism to grow. The organism begins as a single cell (fertilized egg) that divides successively to produce many cells, with each parent cell passing identical genetic material (two variants of each chromosome pair) to both daughter cells. Cellular division and differentiation produce and maintain a complex organism, composed of systems of tissues and organs that work together to	**Technology Operations and Concepts** • Explore a real world problem using digital tools to develop an understanding of the issues. Create or use a digital simulation to explore a real world problem and possible alternative solutions. (**Technology 8.1.12.A.3**) **Critical Thinking, problem solving, and decision making** Evaluate the strengths and limitations of emerging technologies and their impact on educational, career, personal and or social needs. (**Technology 8.1.12.F.1**) **Educational Technology** Develop an innovative solution to a real world problem or issue in collaboration with peers and experts, and present ideas for feedback through social media or in an online community (**Technology 8.1.12.C.1**)	• Technological advances have influenced the progress of science and science has influenced advances in technology. **(HS-LS3-3)** • Science and engineering are influenced by society and society is influenced by science and engineering. **(HS-LS3-3)**

	meet the needs of the whole organism. (**HS-LS1-4**) **BIOLOGY HONORS WILL INCLUDE THE FOLLOWING ASSESSMENT BOUNDARIES:** HS-LS3-1: *The phases of meiosis or the biochemical mechanism of specific steps in the process.* HS-LS1-1: *Identification of specific cell or tissue types, whole body systems, specific protein structures and functions, or the biochemistry of protein synthesis.* HS-LS3-2: *The phases of meiosis or the biochemical mechanism of specific steps in the process.* HS-LS1-4: *Specific gene control mechanisms or rote memorization of the steps of mitosis.*		

Hillside Township School District Biology Curriculum

Biology Pacing Reproduction and Development, Inheritance and Genetics

TIME FRAME	UNIT	PERFORMANCE TASKS ACTIVITIES/PROJECTS ASSESSMENTS	RESOURCES/INTERDISCIPLINARY CONNECTIONS
MID DECEMBER/ MID-FEBRUARY	**REPRODUCTION DEVELOPMENT INHERITANCE GENETICS**	A start in development p549 Processes that generate complexity p552 Development gone awry p555 Quiz Chapter 13 A zillion ways to make more p402 Gifts from your parents p418 Game of Chance p420 (skip yeast protocol) Patterns of inheritance p427 Understanding Inherited Patterns p431 Can You Sort it Out? (Parts A and B) p434 **Can You Sort it Out? (Part C) p434** **Dihybrid Cross Problems** The stuff of life p446 Transferring Information p451 Modeling DNA p452 Gene Expression p458 A closer look at protein synthesis p464 **Genetic Disorder Group Project** **Genetic Screening Debate** Unit Assessment and Quiz(zes) Assessment Boundaries for Biology CP classes:	BSCS Biology AHA Textbook Chapters 10 - 13 Mitosis and Meiosis comparison interactive BrainPOP: Heredity GSLC: Heredity and Traits Meiosis animation DNA Replication animation GSLC: DNA to protein Protein Synthesis animation **Cell Biology and Cancer, NIH** **Stem Cells and Ethics: Case Study: One Parent's Dilemna** NOVA: Cracking the Genetic Code

		HS-LS3-1:*Assessment Boundary: Assessment does not include the phases of meiosis or the biochemical mechanism of specific steps in the process.* HS-LS1-1:*Assessment Boundary: Assessment does not include identification of specific cell or tissue types, whole body systems, specific protein structures and functions, or the biochemistry of protein synthesis.C* HS-LS3-2:*Assessment Boundary: Assessment does not include the phases of meiosis or the biochemical mechanism of specific steps in the process.* HS-LS3-3:*Assessment Boundary: Assessment does not include Hardy-Weinberg calculations.* HS-LS1-4:*Assessment Boundary: Assessment does not include specific gene control mechanisms or rote memorization of the steps of mitosis.*	

Hillside Township School District Biology Curriculum

UNIT4: NATURAL SELECTION AND EVOLUTION

ENDURING UNDERSTANDINGS	ESSENTIAL QUESTIONS
✓ Evolution provides a scientific explanation for the diversity of organisms found on the earth due to descent with modification from common ancestors. ✓ Students demonstrate understanding of the factors causing natural selection and the process of evolution of species over time. ✓ Students demonstrate understanding of how multiple lines of evidence contribute to the strength of scientific theories of natural selection and evolution. ✓ Students can demonstrate an understanding of the processes that change the distribution of traits in a population over time and describe scientific evidence ranging from the fossil record to genetic relationships among species that support the theory of biological evolution.	✓ How does evolution happen? ✓ What is the evidence for evolution? ✓ How can there be so many similarities among organisms yet so many different kinds of plants, animals, and microorganisms?

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Student Learning Objective	Disciplinary Core Ideas with Extended Knowledge Students will know:	Practices of Science & Engineering with Additional Skills Students will be able to:	Cross Cutting Concepts Students will apply:
Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence. **HS-LS4-1** 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-LS4-3** Construct an explanation based on evidence for how natural selection leads to adaptation of populations. **HS-LS4-4** Evaluate the evidence for the role of group behavior on individual and species' chances to survive and reproduce. **HS-LS2-8**	**LS4.A: Evidence of Common Ancestry and Diversity** • Genetic information, like the fossil record, provides evidence of evolution. DNA sequences vary among species, but there are many overlaps; in fact, the ongoing branching that produces 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. (**HS-LS4-1**) **LS4.B: 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. **(HS-LS4-2),(HS-LS4-3)** • The traits that positively affect survival are more likely to be reproduced, and thus are more common in the population. (**HS-LS4-3**) **LS4.C: Adaptation**	**Analyzing and Interpreting Data.** • Apply concepts of statistics and probability (including determining function fits to data, slope, intercept, and correlation coefficient for linear fits) to scientific and engineering questions and problems, using digital tools when feasible. (**HS-LS4-3**) **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. (**HS-LS4-2**),(**HS-LS4-4**) **Engaging in Argument from Evidence** • Evaluate the evidence behind currently accepted explanations or solutions to determine the merits of arguments. (**HS-LS4-5**)	**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-LS4-1),(HSLS4-3)** **Cause and Effect** • Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. **(HS-LS4-2),(HS-LS4-4),(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. **HS-LS4-5** 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-LS4-2**	• Evolution is a consequence of the interaction of four factors: (1) the potential for a species to increase in number, (2) the genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for an environment's limited supply of the resources that individuals need in order to survive and reproduce, and (4) the ensuing proliferation of those organisms that are better able to survive and reproduce in that environment. (**HS-LS4-2**) • Natural selection leads to adaptation, that is, to a population dominated by organisms that are anatomically, behaviorally, and physiologically well suited to survive and reproduce in a specific environment. That is, the differential survival and reproduction of organisms in a population that have an advantageous heritable trait leads to an increase in the proportion of individuals in future generations that have the trait and to a decrease in the proportion of individuals that do not. **(HS-LS4-3),(HS-LS4-4)** • Adaptation also means that the distribution of traits in a population can change when conditions change. (**HS-LS4-3**) • Changes in the physical environment, whether naturally occurring or human induced, have thus contributed to the	**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). (**HS-LS4-1**) **Critical Thinking, problem solving, and decision making** Evaluate the strengths and limitations of emerging technologies and their impact on educational, career, personal and or social needs. (**Technology 8.1.12.F.1**)	

	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. (**HS-LS4-5**) • Species become extinct because they can no longer survive and reproduce in their altered environment. If members cannot adjust to change that is too fast or drastic, the opportunity for the species' evolution is lost. (**HS-LS4-5**)		

TIME FRAME	UNIT	PERFORMANCE TASKS ACTIVITIES/PROJECTS ASSESSMENTS	RESOURCES/INTERDISCIPLINARY CONNECTIONS
MID-FEBRUARY/ MID-APRIL	**NATURAL SELECTION EVOLUTION**	Lucy p37 Modeling the Earth's History p38 Evidence for Change Across Time p41 Explaining Evolution p50 Modeling Natural Selection p52 **Lab Report** Evolution in Action p58 **Fossil Find Analysis - BSCS Copymaster 4-37** Unit Assessment and Quiz(zes) Assessment Boundaries for Biology CP classes: HS-LS4-3:*Assessment Boundary: Assessment is limited to basic statistical and graphical analysis. Assessment does not include allele frequency calculations.* HS-LS4-2*Assessment Boundary: Assessment does not include other mechanisms of evolution, such as genetic drift, gene flow through migration, and co-evolution.*	BSCS Biology AHA Textbook Chapter 2 Interactive Timeline PBS: Adaptive radiation interactive PBS: Becoming a fossil PBS: Change over time PhET: Natural Selection Simulation Simulation: Evodots Simulation: Net Logo Bug Hunt NOVA ScienceNow: Where Did We Come From?

UNIT 5: ECOLOGY

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ENDURING UNDERSTANDINGS	ESSENTIAL QUESTIONS
✓ Each species in an ecosystem plays a unique role in its interactions with other species and the environment. ✓ Students will investigate the role of biodiversity in ecosystems and the role of animal behavior on survival of individuals and species. ✓ Students have increased understanding of interactions among organisms and how those interactions influence the dynamics of ecosystems. ✓ Students can generate mathematical comparisons, conduct investigations, use models, and apply scientific reasoning to link evidence to explanations about interactions and changes within ecosystems.	✓ How do humans affect the ecosystem? ✓ How do organisms interact with the living and non-living environment to obtain matter and energy? ✓ How does biodiversity affect humans?

Student Learning Objective			Cross Cutting Concepts

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	Disciplinary Core Ideas with Extended Knowledge **Students will know:**	**Practices of Science & Engineering with Additional Skills** **Students will be able to:**	**Students will apply:**
Evaluate the evidence for the role of group behavior on individual and species' chances to survive and reproduce. **HS-LS2-8** Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales. **HS-LS2-1** 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-LS2-6** Use mathematical representations to support and	**LS2.A: Interdependent Relationships in Ecosystems** • 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. 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. (**HS-LS2-1**),(**HS-LS2-2**) **LS2.C: Ecosystem Dynamics, Functioning, and Resilience** • 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. (**HS-LS2- 2**),(**HS-LS2-6**) • Moreover, anthropogenic changes (induced by human activity) in the environment— including	**Using Mathematics and Computational Thinking** • Use mathematical and/or computational representations of phenomena or design solutions to support explanations. (**HS-LS2-1**) • Use mathematical representations of phenomena or design solutions to support and revise explanations. (**HS-LS2-2**) • Create or revise a simulation of a phenomenon, designed device, process, or system. (**HS-LS4-6**) **Constructing Explanations and Designing Solutions** • Design, evaluate, and refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. (**HS-LS2-7**) **Engaging in Argument from Evidence**	**Cause and Effect** • Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. **(HS-LS2-8),(HS-LS4-6)** **Scale, Proportion, and Quantity** • The significance of a phenomenon is dependent on the scale, proportion, and quantity at which it occurs. (**HS-LS2-1**) • Using the concept of orders of magnitude allows one to understand how a model at one scale relates to a model at another scale. (**HS-LS2-2**) **Stability and Change** • Much of science deals with constructing explanations of how things change and how they remain stable. (**HS-LS2-6),(HS-LS2-7**)

revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales. **HS-LS2-2** Design, evaluate, and refine a solution or simulation for reducing the impacts of human activities on the environment and biodiversity. **HS-LS2-7; HS-LS4-6**	habitat destruction, pollution, introduction of invasive species, overexploitation, and climate change—can disrupt an ecosystem and threaten the survival of some species. (**HS-LS2-7**) **LS2.D: Social Interactions and Group Behavior** • Group behavior has evolved because membership can increase the chances of survival for individuals and their genetic relatives. **(HS-LS2-8**) **LS4.C: 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. (**HS-LS4-6**) **LS4.D: Biodiversity and Humans** • Biodiversity is increased by the formation of new species (speciation) and decreased by the loss of species (extinction). (**secondary to HS-LS2-7)** • Humans depend on the living world for the resources and other benefits provided by biodiversity. But human activity is also having adverse impacts on biodiversity through overpopulation, overexploitation, habitat destruction, pollution, introduction of invasive species, and climate change. Thus sustaining biodiversity so that ecosystem functioning and productivity are maintained is essential to	• Evaluate the claims, evidence, and reasoning behind currently accepted explanations or solutions to determine the merits of arguments. (**HS-LS2-6**) • Evaluate the evidence behind currently accepted explanations to determine the merits of arguments. (**HS-LS2-8**) **Critical Thinking, problem solving, and decision making** Evaluate the strengths and limitations of emerging technologies and their impact on educational, career, personal and or social needs. (**Technology 8.1.12.F.1**)	

	supporting and enhancing life on Earth. Sustaining biodiversity also aids humanity by preserving landscapes of recreational or inspirational value. (**secondary to HS-LS2-7),(HS-LS4-6.**) **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. (**secondary to HS-LS2-7),(secondary to HS-LS4-6)** • Both physical models and computers can be used in various ways to aid in the engineering design 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. (**secondary to HS-LS4-6**)		

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TIME FRAME	UNIT	PERFORMANCE TASKS ACTIVITIES/PROJECTS ASSESSMENTS	RESOURCES/INTERDISCIPLINARY CONNECTIONS
END APRIL-JUNE	**ECOLOGY**	Observing the world around us p622 Interactions in the world around us p623 Invasive Species Case Study **Endangered Species Project** Unit Assessment Assessment Boundaries HS-LS2-1: *Assessment Boundary: Assessment does not include deriving mathematical equations to make comparisons* HS-LS2-2: *Assessment Boundary: Assessment is limited to provided data.*	BSCS Biology AHA Textbook Chapter 15 Planet Earth: Jungles

Modifications

Teacher Note: Teachers identify the modifications that they will use in the unit.

- Restructure lesson using UDL principals (http://www.cast.org/our-work/about-udl.html#.VXmoXcfD_UA)
- Structure lessons around questions that are authentic, relate to students' interests, social/family background and knowledge of their community.
- Provide students with multiple choices for how they can represent their understandings (e.g. multisensory techniques-auditory/visual aids; pictures, illustrations, graphs, charts, data tables, multimedia, modeling).
- Provide opportunities for students to connect with people of similar backgrounds (e.g. conversations via digital tool such as SKYPE, experts from the community helping with a project, journal articles, and biographies).
- Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures (e.g. multiple representation and multimodal experiences).
- Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understandings.
- Use project-based science learning to connect science with observable phenomena.
- Structure the learning around explaining or solving a social or community-based issue.
- Provide ELL students with multiple literacy strategies.
- Collaborate with after-school programs or clubs to extend learning opportunities

NGSS Resources