MOORESTOWN TOWNSHIP PUBLIC SCHOOLS
MOORESTOWN, NEW JERSEY

Moorestown High School
Science Department

Honors Biology
Grade: 9

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Course Description and Fundamental Concepts

Students investigate a wide variety of phenomena exhibited by living things in this activity-based, inquiry-approach to biology. Based on their data, students infer unifying principles and concepts in biology. Student experimentation in the laboratory develops research skills and problem-solving abilities. Furthermore, this course acquaints students with numerous specific topics in biology. These topics address how "structure and function help students formulate an answer to the question: "How do the structures of organisms enable life's functions?" "Inheritance and Variation of Traits help students in pursuing an answer to the question: How are the characteristics from one generation related to the previous generation?" "Matter and Energy in Organisms and Ecosystems help students answer the questions: How do organisms obtain and use energy they need to live and grow?" "Interdependent Relationships in Ecosystems help students answer the question, How do organisms interact with the living and nonliving environment to obtain matter and energy?" "Natural Selection and Evolution help students answer the questions: How can there be so many similarities among organisms yet so many different plants, animals, and microorganisms? How does biodiversity affect humans?"[1] Above all, classroom work, labs, lectures, and discussions foster critical thinking and the development of scientifically literate citizens. Students who wish to take this course should have demonstrated consistent, above-average achievement in science and mathematics.

New Jersey Student Learning Standards (NJSLS)

Subject/Content Standards
Include grade appropriate subject/content standards that will be addressed

Standard #	Standard Description
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.]**
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 in ecosystems of different scales. [Clarification Statement: Examples of mathematical representations include finding the average, determining trends, and using graphical 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.]**
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.]**
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 testing solutions for a proposed problem related to threatened or endangered species, or to genetic variation of organisms for multiple species.]**

English Companion Standards

List grade-level appropriate companion standards for History, Social Studies, Science and Technical Subjects (CTE/Arts) 6-12. English Companion Standards are required in these subject/content areas.

Unit Addressed	Standard #	Standard Description
1,2,4,5,6,7,8A,8B,9	**NJSLSA.R1**	Read closely to determine what the text says explicitly and to make logical inferences and relevant connections from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.
1,2,3,4,5,6,7,8A,8B,9	**NJSLSA.R7**	Integrate and evaluate content presented in diverse media and formats, including visually and quantitatively, as well as in words.
1,2,3,4,5,6,7,8A,8B,9	**RI.9-10.1**	Accurately cite strong and thorough textual evidence, (e.g., via discussion, written response, etc.) and make relevant connections, to support analysis of what the text says explicitly as well as inferentially, including determining where the text leaves matters uncertain.

1,2,3,4,5,6,7,8A, 8B,9	**RI.9-10.8**	Describe and evaluate the argument and specific claims in a text, assessing whether the reasoning is valid and the evidence is relevant and sufficient; identify false statements and reasoning.
1,2,3,4,5,6,7,8A, 8B,9	**NJSLSA.W 1**	Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.
1,2,3,4,5,6,7,8A, 8B,9	**NJSLSA.W 2**	Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content.
1,2,3,4,5,6,7,8A, 8B,9	**NJSLSA.W 6**	Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others.
1,2,3,4,5,6,7,8A, 8B,9	**NJSLSA.W 4**	Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
1,3,4,5,6,7,8A,8 B,9	**WHST.9-10. 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.
1,2,5,6,7,8A,8B, 9	**WHST.9-10. 8**	Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation (MLA or APA Style Manuals).
1,2,3,4,5,6,7,8A, 8B,9	**WHST.9-10. 9**	Draw evidence from literary or nonfiction informational texts to support analysis, reflection, and research.

21st-Century Skills and Technology Integration (Standard 8)
List appropriate units below for which strands (A through F) will be addressed

Standard 8.1 (K-12)		**Educational Technology:** *All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.*
Unit Addressed	**Strand Letter**	**Standard Description**
1,2,3,4,5,6,7,8A, 8B,9	**Strand A**	**Technology Operations and Concepts:** *Students demonstrate a sound understanding of technology concepts, systems, and operations.*

1,3,4,6,7,8A,8B, 9	**Strand B**	**Creativity and Innovation:** *Students demonstrate creative thinking, construct knowledge and develop innovative products and process using technology.*
1,2,3,4,5,6,7,8A, 8B,9	**Strand C**	**Communication and Collaboration:** *Students use digital media and environments to communicate and work collaboratively, including at a distance, to support individual learning and contribute to the learning of others.*
1,2,3,4,5,6,7,8A, 8B,9	**Strand D**	**Digital Citizenship:** *Students understand human, cultural, and societal issues related to technology and practice legal and ethical behavior.*
1,2,3,4,5,6,7,8A, 8B,9	**Strand E**	**Research and Information Fluency:** *Students apply digital tools to gather, evaluate, and use information.*
1,2,3,4,5,6,7,8A, 8B,9	**Strand F**	**Critical thinking, problem-solving, and decision making:** *Students use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources.*
Standard 8.2 (K-5)		**Technology Education, Engineering, Design, and Computational Thinking - Programming:** *All students will develop an understanding of the nature and impact of technology, engineering, technological design, computational thinking and the designed world as they relate to the individual, global society, and the environment.*
	Strand A	**The Nature of Technology: Creativity and Innovation:** *Technology systems impact every aspect of the world in which we live.*
	Strand B	**Technology and Society:** *Knowledge and understanding of human, cultural and societal values are fundamental when designing technological systems and products in the global society.*
	Strand C	**Design:** *The design process is a systematic approach to solving problems.*
	Strand D	**Abilities for a Technological World:** *The designed world is the product of a design process that provides the means to convert resources into products and systems.*
	Strand E	**Computational Thinking: Programming:** *Computational thinking builds and enhances problem-solving, allowing students to move beyond using knowledge to creating knowledge.*

Career Ready Practices (Standard 9)
List appropriate units below for which CRPs will be addressed

Unit Addressed	Standard #	Standard Description
1,2,3,4,5,6,7,8A, 8B,9	**CRP1**	*Act as a responsible and contributing citizen and employee.*
1,2,3,4,5,6,7,8A, 8B,9	**CRP2**	*Apply appropriate academic and technical skills.*
1,2,3,4,5,6,7,8A, 8B,9	**CRP3**	*Attend to personal health and financial well-being.*
1,2,3,4,5,6,7,8A, 8B,9	**CRP4**	*Communicate clearly and effectively and with reason.*
1,2,3,4,5,6,7,8A, 8B,9	**CRP5**	*Consider the environmental, social and economic impacts of decisions.*
1,2,3,4,5,6,7,8A, 8B,9	**CRP6**	*Demonstrate creativity and innovation.*
1,2,3,4,5,6,7,8A, 8B,9	**CRP7**	*Employ valid and reliable research strategies.*
1,2,3,4,5,6,7,8A, 8B,9	**CRP8**	*Utilize critical thinking to make sense of problems and persevere in solving them.*
1,2,3,4,5,6,7,8A, 8B,9	**CRP9**	*Model integrity, ethical leadership, and effective management.*
1,2,3,4,5,6,7,8A, 8B,9	**CRP10**	*Plan education and career paths aligned to personal goals.*
1,2,3,4,5,6,7,8A, 8B,9	**CRP11**	*Use technology to enhance productivity.*
1,2,3,4,5,6,7,8A, 8B,9	**CRP12**	*Work productively in teams while using cultural global competence*

Interdisciplinary Connections
List any other content standards addressed as well as appropriate units

Visual & Performing Arts Integration (Standard 1)
List appropriate units below for which standards (1.1 through 1.4) may be addressed

Unit Addressed	Standard #	Standard Description
1,3,5,8A,8B	**Standard 1.1**	**The Creative Process:** *All students will demonstrate an understanding of the elements and principles that govern the creation of works of art in dance, music, theatre, and/or visual art.*
	Standard 1.2	**History of the Arts and Culture:** *All students will understand the role, development, and influence of the arts throughout history and across cultures.*
1,3,5,6,8A,8B,9	**Standard 1.3**	**Performing/Presenting/Producing:** *All students will synthesize those skills, media, methods, and technologies appropriate to creating, performing, and/or presenting works of art in dance, music, theatre, and/or visual art.*
	Standard 1.4	**Aesthetic Responses & Critique Methodologies:** *All students will demonstrate and apply an understanding of arts philosophies, judgment, and analysis to works of art in dance, music, theatre, and/or visual art.*

Other Interdisciplinary Content Standards
List appropriate units below for any other content/standards that may be addressed

Unit Addressed	Content / Standard #	Standard Description
1,2,3,4,5,6,7,8A, 8B,9	**Math/ 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.*
1,2,3,4,5,6,7,8A, 8B,9	**Math/HSN-Q.A.3**	*Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.*
7,8A,8B	**Math/HSN-Q.C.7**	*Solve quadratic equations with real coefficients that have complex solutions*
2,5,6,7,8A,8B,9	**Math/HSA-CED.A.2**	*Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.*

1,2,3,4,5,6,7,8A, 8B,9	**Math/HSA-REI.A.1**	*Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.*
1,2,3,4,5,6,7,8A, 8B,9	**Math / MP.2**	*Reason abstractly and quantitatively.*
1,2,3,4,5,6,7,8A, 8B,9	**Math / MP.4**	*Model with mathematics.*

Pacing Guide (All Dates are approximate based on the school calendar)

Unit/ Topic	Month (w/Approx number of Teaching Days)
Introduction to Ecology year long project **Vocabulary for the entire ecology unit** **Identification of student ecosystems selected** **(LS2-3, LS2-4, LS2-5) (LS2-1, LS2-2, LS2-6, LS2-7)** **Unit 1 Organization, structure, and function** **Biochemistry and Elements of Life (LS1-6) (reduce focus on sub-groups and structure; basic carbon compounds and functions)**	**September** (~19 days)
Unit 1 Continued: Organization and Multicellularity (LS1-2) **(cells – tissues – organs, etc.)** **Unit 2 Cellular differentiation, Homeostasis, and communication** **Cell Differentiation and Mitosis (LS1-4) (decrease/remove focus on mitotic steps and cell parts)**	**October** (~19 days)
Unit 2 continued: Homeostasis, Feedback, and Transport (LS1-3) **Unit 3 Cellular processes, Feedback, and genetic variation** **(LS3-1, LS3-2)**	**November** (~16 days)
Unit 3 continued: Inheritable Genetic Variation **(Meiosis, Mutations, variation, and reproduction) (LS3-1, LS3-2)** **Unit 4 Central Dogma** **Protein synthesis, gene expression and DNA technology (LS1-1)**	**December** (~15 days)
Unit 4 Continued:Protein synthesis, gene expression and DNA technology (LS1-1) **-Review of semester topics** **-Midterm exam**	**January** (~18 days)
Unit 5 Inheritance and Variable traits **Human Genetics (LS3-3, LS3-1) - (reduce Mendel and combine chapters 9 and 12)** **Unit 6 Evolutionary Biology** **Evolution (LS4-1, LS4-2,LS4-3, LS4-4, LS4-5) (reduce history of Darwin, focus on process of natural selection and evidence for evolution)**	**February** (~18 days)
Continue Unit 6: Population Genetics (LS3-3, LS4-2, LS4-3) **(standards state no Hardy Weinberg)** **Unit 7 Cellular processes: Energy and Communication** **Photosynthesis and Respiration (LS1-5, LS1-7) (mostly focus on input and output; big picture importance and connection of processes)**	**March** (~15-20 days)
Unit 8 A Environmental Interactions within Ecosystems **Ecology (LS2-3, LS2-4, LS2-5) (cycling of materials, biomes)** **(cycling of materials, and acid rain)** **Natural science and Human Impacts (LS2-1, LS2-2, LS2-6, LS2-7)** **(relationships, ecosystem changes and factors)**	**April** (~15-20 days)

Unit 8B Environmental Interactions and Human Involvement **Natural science (cont. carrying capacity, human effects, etc.)** **(LS2-1, LS2-2, LS2-7, LS4-6)**	**May** **(~18 days)**
Unit 9 Advancements in Biomedical Science and Technology **Advances in Genome expression and modification (LS1-1)** **Modification and manipulation of cellular communication (LS1-3)** **Review of semester topics** **Final exam**	**June** **(~15 days)**

Units

Contact the Content Supervisor for unit details.