Pascack Valley Regional High School District

Pascack Hills High School, Montvale, New Jersey
Pascack Valley High School, Hillsdale, New Jersey

Course Name: Elements of Biological Science

Born On: August, 2015
Revised On: August, 2020
Current Revision: August, 2023
Board Approval: 8/28/2023

New Jersey Curricular Mandates for Science Instruction

Disabled & LGBT:
18A:35-4.35 - History of disabled and LGBT persons included in middle and high school curriculum. A board of education shall include instruction on the political, economic, and social contributions of persons with disabilities and lesbian, gay, bisexual, and transgender people, in an appropriate place in the curriculum of middle school and high school students as part of the district's implementation of the New Jersey Student Learning Standards.

Diversity, Equity, and Inclusion (DEI):
C.18A:35-4.36a - Curriculum to include instruction on diversity and inclusion. 1. a. Beginning in the 2021-2022 school year, each school district shall incorporate instruction on diversity and inclusion in an appropriate place in the curriculum of students in grades kindergarten through 12 as part of the district's implementation of the New Jersey Student Learning Standards. b. The instruction shall: (1) highlight and promote diversity, including economic diversity, equity, inclusion, tolerance, and belonging in connection with gender and sexual orientation, race and ethnicity, disabilities, and religious tolerance; (2) examine the impact that unconscious bias and economic disparities have at both an individual level and on society as a whole; and (3) encourage safe, welcoming, and inclusive environments for all students regardless of race or ethnicity, sexual and gender identities, mental and physical disabilities, and religious beliefs. c. The Commissioner of Education shall provide school districts with sample learning activities and resources designed to promote diversity and inclusion.

Amistad Law:
N.J.S.A. 18A 52:16A-88 Every board of education shall incorporate the information regarding the contributions of African Americans to our country in an appropriate place in the curriculum of elementary and secondary school students.

Climate Change:
2020 NJSLS-Science: Earth's climate is now changing faster than at any point in the history of modern civilization, primarily as a result of human activities. Global climate change has already resulted in a wide range of impacts across New Jersey and in many sectors of its economy. The addition of academic standards that focus on climate change is important so that all students will have a basic understanding of the climate system, including the natural and human-caused factors that affect it. The underpinnings of climate change span across physical, life, as well as Earth and space sciences. The goal is for students to understand climate science as a way to inform decisions that improve quality of life for themselves, their community, and globally and to know how engineering solutions can allow us to mitigate impacts, adapt practices, and build resilient systems.

Dissection Law
N.J.S.A. 18A:35-4.25 and N.J.S.A. 18A:35-4.24 authorizes parents or guardians to assert the right of their children to refuse to dissect, vivisect, incubate, capture or otherwise harm or destroy animals or any parts thereof as part of a course of instruction.

Elements of Biological Science
Introduction: Scientific Method and Measurements
Time Allotted: Approximately 4- 6 Weeks
New Jersey Student Learning Standards (NJSLS)
Science and Engineering Practices 1-8

Science & Engineering Practices

- **Constructing Explanations and Designing Solutions**
- **Asking Questions and Defining Problems**
- **Developing and Using Models**
- **Planning and Carrying Out Investigations**
- **Analyzing and Interpreting Data**
- **Using Mathematical and Computational Thinking**
- **Engaging in Argument from Evidence**
- **Obtaining, Evaluating, and Communicating Information**

Essential Questions	Student Learning Objectives	Suggested Tasks/Activities	Evidence of Learning (Assessment)
● What are the safety rules that must be followed when conducting experiments? ● How can you solve a problem or answer a question using the Scientific Method? ● How is data generated, displayed, and analyzed? ● What are the basic units of measurements in the SI System? ● How do we use technology in science?	Students will be able to: ● Understand and apply information, skills, and procedures developed from the district safety program as it directly relates to the student of science. ● Solve a problem using the Scientific Method. ● Demonstrate how to create and interpret graphs using a line, pie and bar graphs using sample data. ● Define length, weight, volume and temperature and their units.	● Read aloud the district- wide safety rules. ● Show lab safety equipment in the classroom: fire extinguisher, fume hood, safety shower, eyewash, and fire blanket and demonstrate how to use them. ● Provide the students with illustrations of safety procedures not being followed. Students then circle and verbally explain what is wrong and what would be the correct procedure. ● Role play the safety procedures correctly. ● Group Activity: Organize students in groups to solve a problem using the scientific	● Provide a lab that will demonstrate the use of appropriate equipment, techniques, and safety. ● Observe students during the actual lab and review their procedures in regards to techniques and safety. ● Students must sign and have parental signature of the safety contract. ● Students must pass a safety quiz. ● Students present the group activity and have a discussion. ● Verbal quiz on Scientific

	• Use proper equipment to measure length, weight, volume and temperature. • Identify instruments of technology used in science including microscopes, computers, balances, etc. • Identify scientific discoveries made possible through invention of technology as well as the evolution of technology through the advancement of science.	method. • Students manipulate steps into the correct order. • Read and interpret graphs containing data to which students may relate. • Give students a topic and survey the class to obtain data and have them develop a graph. • Provide graphing exercise with given data. • Complete worksheet, board work, or graphic organizer on measurement, base unit, and equipment. • Give worksheets with practice problems, allow students to identify the information. • Students identify items in the home measured in metrics or used in metric quantities. • Measurement Lab • Students identify names and uses of different instruments of technology. • Allow students to use as many types of technology as possible. • Discuss microscope and MRI machines as tools to advance science and vice versa. *Scientist Spotlight:* • **Temple Grandin** – Animal Behaviorist with Autism Spectrum Disorder	Method. • Collect and grade graphs. • Quiz on graphing. • Written and oral responses to academic prompts. • Lab report • Quiz on Measurement • Quiz on technology instrument identification • Unit Test

Resources/Materials	-District Safety Rules -Scientific Method Sorting Activity -Graphing Worksheets -Object to measure length, weight, volume and temperature along with the equipment -Microscope and images of MRI machines
Interdisciplinary Connections	Connections to ELA Essential Elements: EE.SL.11-12.5: Use digital media strategically (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to support understanding and add interest.
Career Readiness, Life Literacies, and Key Skills	9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas. 9.4.12.CT.1: Identify problem-solving strategies used in the development of an innovative product or practice. 9.4.12.CT.2: Explain the potential benefits of collaborating to enhance critical thinking and problem solving. 9.2.12.CAP.8: Determine job entrance criteria (e.g., education credentials, math/writing/reading comprehension tests, drug tests) used by employers in various industry sectors.
Computer Science & Design Thinking	8.1.5.A.1 Select and use the appropriate digital tools and resources to accomplish a variety of tasks including solving problems 8.1.5.A.4 Graph data using a spreadsheet, analyze and produce a report that explains the analysis of the data.

Modifications

Multi-Lingual Learners	Special Education	At-Risk	Gifted and Talented
● Model steps ● Show examples vs.. non examples of student work ● Small group instruction (partner up) ● Lower reading level of text ● Use sentence starters to give student practice with academic language ● Pre- teach vocab using pictures	● Additional time for assignments and assessments ● Use of mnemonics ● Review of directions ● Have students restate directions or information back to you ● Concrete examples ● Support auditory presentations with visuals ● Review Sessions ● Access to completed notes ● Visual and verbal cues and prompts ● Graphic organizers	● Incorporate student choice ● Provide peer mentoring to improve understanding of the material.	● Ask higher level questions that require students to look into causes, experiences, and facts to draw a conclusion or make connections to other areas of learning ● Use of open-ended questions rather than multiple choice questions. ● Choice of an alternate assignment that can be projects related to the area of study that extended the curriculum or independent projects that are chosen

	• Hands on activities • Frequent Check-ins		based on students' individual interests.

Elements of Biological Science
Unit 1: Structure and Processes
Time Allotted: Approximately 10 Weeks
New Jersey Student Learning Standards (NJSLS)
EE.HS-LS1-1: Explain how different organs of the body carry out essential functions of life. *(HS-LS1-1)*
EE.HS-LS1-2: Use a model to illustrate the organization and interaction of major organs into systems (e.g., circulatory, respiratory, digestive, sensory) in the body to provide specific functions. *(HS-LS1-2)*
EE.HS-LS1-4: Use a model to illustrate how growth occurs when cells multiply. *(HS-LS1-4)*

Science & Engineering Practices	Disciplinary Core Ideas	Cross-Cutting Concepts
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. **Developing and Using Models** • Develop and use a model based on evidence to illustrate the relationships between systems or between components of a system.	**LS1.A: Structure and Function** • Systems of specialized cells within organisms help them perform the essential functions of life. • 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. **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.	**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. **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.

Essential Questions	Student Learning Objectives	Suggested Tasks/Activities	Evidence of Learning (Assessment)
• What are the characteristics of living things?	Students will be able to: • Discriminate between living	• Students work in pairs to create two lists containing	• Students make a collage of pictures of living things.

• How do living things obtain energy? • How are living things recorded and organized? • What is the structure and function of a cell? • What happens when you fall or cut yourself? • Why and how do cells divide? • Why is cell size important? • What are the major systems of the body?	and non-living things using criteria. • Explain that living things produce and expend energy. • Outline the system for classification of living things. • Describe the cell theory. • Identify basic parts of a cell and their functions. • Compare and contrast a plant cell from an animal cell. . • Understand that as we grow we need to make more cells. • The larger the organism the more cells/ complex it is. • Explain the need for mitosis • Understand that Cells make up tissues, tissues make up organs, and organs make up organ systems. • Use a model to illustrate the organization and interaction of major organs into systems (e.g., circulatory, respiratory, digestive, sensory) in the body to provide specific functions	living and non-living things. Then compile a list of the characteristics of living things. • Inform students that energy begins at the cellular level. • Explain that animal and plant cells both require food for energy. • List components of cell theory. • Students make an edible cell. Use jelly-like substance as cytoplasm. Insert objects to represent cell parts. • Students color illustrations of plant and animal cell same colors for similar parts and single colors for parts that are found in one cell type only. • Class discussion: Have students think about the following questions- What happens when you fall and scrape your knee? Do you look different than you did when you were five years old? What happens a month after cutting your nails? Have students turn and talk to a peer about their responses. Come back as a class, go over responses, and tell students all three of these scenarios	• Students work in pairs using a checklist of characteristics to determine if an object is living or non-living. • Students create a poster labeling plant and animal cell parts. • Allow students to role-play as a plant and an animal in terms of obtaining food for energy. • Poster or PowerPoint describing the goals of mitosis including the phases • Students can role play the phases in groups • Students create poster or PowerPoint Presentation of one organ system. Class discussion regarding interrelationships among systems.

		have one thing in common and that is mitosis (cell division). ● Students are given a series of pictures and they have to identify if cell division has taken place. Have an image of a seed and a grown plant, a baby and a toddler, etc.) ● BrainPop- Mitosis ● Mnemonic for helping students remember (PMAT) Have students sort steps using images only. ● Go over with students that we are more complex (larger organisms) than an ant. Ants cannot carry out as complex functions like we can. ● Students identify major organs in the body and how they work for a specific function ● Use student every day experiences to explain various components, e.g., ask students the meaning of "cardio" as it relates to their Physical Education class. Explain the relationship to the cardio-vascular (heart-lungs) system of the body. Ask what happens to food after students eat lunch. Tie in the digestive system and	

		relate to transfer of energy. *Scientist Spotlight*: • **Dr. Ben Barres** – Neuroscience Pioneer & Gender Champion. - **Stanford Medicine article**– Ben Barres & his work on glial cells • **Dr. Ruth Smith Lloyd** – First African American Woman in the US to earn her doctorate degree in Anatomy. Studied endocrinology/sex-hormones.	
Resources/Materials	- Internet - Video Clips (brain-pop, amoeba sisters) - PowerPoints - Worksheets from resource binder - Current Textbooks - Graphic organizers - Internet for viewing images of phases of mitosis		
ELA Companion Standards	WHST.9-12.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. RST.9-10.3 - Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text. RST.9-10.4 - Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9-10 texts and topics.		
Interdisciplinary Connections	Connections to ELA Essential Elements: EE.SL.11-12.5: Use digital media strategically (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to support understanding and add interest. Connections to Mathematics Essential Elements EE.F-BF.1: Select the appropriate graphical representation (first quadrant) given a situation involving constant		

	rate of change.
Career Readiness, Life Literacies, and Key Skills	9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas. 9.4.12.CT.1: Identify problem-solving strategies used in the development of an innovative product or practice. 9.4.12.CT.2: Explain the potential benefits of collaborating to enhance critical thinking and problem solving. 9.2.12.CAP.8: Determine job entrance criteria (e.g., education credentials, math/writing/reading comprehension tests, drug tests) used by employers in various industry sectors.
Computer Science & Design Thinking	8.1.5.A.2 Format a document using a word processing application to enhance text and include graphics, symbols and/ or pictures.

Modifications			
Multi-Lingual Learners	**Special Education**	**At-Risk**	**Gifted and Talented**
● Model steps ● Show examples vs. non examples of student work ● Small group instruction (partner up) ● Lower reading level of text ● Use sentence starters to give student practice with academic language ● Pre- teach vocab using pictures	● Additional time for assignments and assessments ● Use of mnemonics ● Review of directions ● Have students restate directions or information back to you ● Concrete examples ● Support auditory presentations with visuals ● Review Sessions ● Access to completed notes ● Visual and verbal cues and prompts ● Graphic organizers ● Hands on activities ● Frequent Check-ins	● Incorporate student choice ● Provide peer mentoring to improve understanding of the material.	● Ask higher level questions that require students to look into causes, experiences, and facts to draw a conclusion or make connections to other areas of learning ● Use of open-ended questions rather than multiple choice questions. ● Choice of an alternate assignment that can be projects related to the area of study that extended the curriculum or independent projects that are chosen based on students' individual interests.

Elements of Biological Science
Unit 2: Genetics
Time Allotted: Approximately 10 Weeks
New Jersey Student Learning Standards (NJSLS)
EE.HS-LS3-2: Defend why reproduction may or may not result in offspring with different traits. *(HS-LS3-2)*

Science & Engineering Practices	Disciplinary Core Ideas	Cross-Cutting Concepts
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.	**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 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. • 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.	**Cause and Effect** • Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects.

Essential Questions	Student Learning Objectives	Suggested Tasks/Activities	Evidence of Learning (Assessment)
• What is heredity? • How can you determine the probability of traits passed on from parent to offspring? • What are the different types of genetic disorders and how are they inherited?	Students will be able to: • Define heredity and the role DNA plays in inheritance of traits. • Explain use of letters to symbolize traits and understand that dominant traits are expressed over recessive • Construct a model of the DNA molecule. • Use a punnett square to determine change of genetic outcomes.	• Define traits. Demonstrate of certain hereditary traits i.e. rolling the tongue, widows peak • Play a matching game of letters that symbolize traits. • Make a model of the double helix out of candy. • Look at pictures of family members to observe family traits. Divide paper in half and have students list their traits and traits of family members. • Use coins to depict traits. Ex.	• Written or Oral Assignments. • Project assessment • Observations of continued work • Present Genetic Disorder Presentation to the class

	• Recognize the contribution of Gregor Mendel to inheritance. • Research and present information about various types of human genetic disorders • Explore certain genetic disorders that are more common among certain groups of people.	Heads is blue eyes, and tails is brown. Students flip coins to determine inherited traits and draw them on an outline of an applicable organism (human, animal, etc.) to determine outcome. • Collect data regarding traits from classmate's color hair, color eyes, etc. Use information to make a bar graph. • Discuss life and contributions of Gregor Mendel. Show illustrations. • Complete a Punnett Square together. • Presentation on Genetic Disorder: Students research a human genetic disorder. *Scientist Spotlights*: *Scientist Spotlights*: • **Dr. Derek Braun** – Deaf scientist who teaches & performs genetic research. *Diversity, Equity, and Inclusion:* • **Dr. Rosalind Franklin** – How her stolen data led to the discovery of the structure of DNA.	
Resources/Materials	- Internet resources - Video clips (BrainPop) - Demonstrate Punnett Square		

	- Coins for trait flipping activity - Student worksheet for writing results down - Materials to make DNA model - Textbook and resource binder
ELA Companion Standards	WHST.9-12.1 Write arguments focused on discipline-specific content. WHST.9-12.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. RST.9-10.3 - Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text. RST.9-10.4 - Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9-10 texts and topics.
Interdisciplinary Connections	Connections to ELA Essential Elements: EE.SL.11-12.5: Use digital media strategically (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to support understanding and add interest. Connections to Mathematics Essential Elements EE.F-BF.1: Select the appropriate graphical representation (first quadrant) given a situation involving constant rate of change.
Career Readiness, Life Literacies, and Key Skills	9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas. 9.4.12.CT.1: Identify problem-solving strategies used in the development of an innovative product or practice. 9.4.12.CT.2: Explain the potential benefits of collaborating to enhance critical thinking and problem solving. 9.2.12.CAP.8: Determine job entrance criteria (e.g., education credentials, math/writing/reading comprehension tests, drug tests) used by employers in various industry sectors.
Computer Science & Design Thinking	8.1.5.A.2 Format a document using a word processing application to enhance text and include graphics, symbols and/ or pictures. 8.1.5.A.4 Graph data using a spreadsheet, analyze and produce a report that explains the analysis of the data.

Modifications			
Multi-Lingual Learners	**Special Education**	**At-Risk**	**Gifted and Talented**
● Model steps ● Show examples vs. non examples of student work ● Small group instruction (partner up) ● Lower reading level of text ● Use sentence starters to give	● Additional time for assignments and assessments ● Use of mnemonics ● Review of directions ● Have students restate directions or information	● Incorporate student choice ● Provide peer mentoring to improve understanding of the material.	● Ask higher level questions that require students to look into causes, experiences, and facts to draw a conclusion or make connections to other areas of learning

student practice with academic language ● Pre- teach vocab using pictures	back to you ● Concrete examples ● Support auditory presentations with visuals ● Review Sessions ● Access to completed notes ● Visual and verbal cues and prompts ● Graphic organizers ● Hands on activities ● Frequent Check-ins		● Use of open-ended questions rather than multiple choice questions. ● Choice of an alternate assignment that can be projects related to the area of study that extended the curriculum or independent projects that are chosen based on students' individual interests.

Elements of Biological Science		
Unit 3: Evolution		
Time Allotted: Approximately 10 Weeks		
New Jersey Student Learning Standards (NJSLS)		
EE.HS-LS4-2: Explain how the traits of particular species allow them to survive in their specific environments. *(HS-LS4-2)*		
EE.HS-LS4-3: Interpret data sets to identify an advantageous heritable trait. *(HS-LS4-3)*		
EE.HS-LS4-6: Evaluate a strategy to protect a species. *(HS-LS4-6)*		
Science & Engineering Practices	**Disciplinary Core Ideas**	**Cross-Cutting Concepts**
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. **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. **Using Mathematics and Computational Thinking** • Create or revise a simulation of a phenomenon, designed device, process, or system.	**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. **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. • 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. • Adaptation also means that the distribution of traits in a population can change when conditions change. **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	**Cause and Effect** • Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. **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.

	enhancing life on Earth. Sustaining biodiversity also aids humanity by preserving landscapes of recreational or inspirational value. *(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)* • 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)*	

Essential Questions	Student Learning Objectives	Suggested Tasks/Activities	Evidence of Learning (Assessment)
• What is evolution? • What evidence supports evolution? • How can survival of the fittest lead to changes in species? • How does human activity impact species? • What is an endangered species? • How does a species become extinct?	Students will be able to: • Clarify any misconceptions they may have about evolution. • Discuss Charles Darwin and his impact on Evolution, specifically his theory on natural selection. • Recognize that favorable traits will pass down from generation to generation. • Explain the impact human actions have had on biodiversity and possible ways of reversing this impact.	• Complete a Charles Darwin Webquest to learn about the Father of Genetics. • Discuss with students why evolution matters -using this article questions embedded. • Peppered Moth- Natural Selection Activity (teachers pay teachers) • Students watch TedEd Video: Disappearing Frogs to get them engaged in loss of biodiversity. • Explain: Students read and answer questions about causes and effects of extinction, and ways to prevent. Students read a	• Observe ongoing classwork • Quiz on Evolution • Present projects to the class.

		second article about frogs at risk and how they've become endangered. • Evaluate: PowerPoint Presentation - Students can choose an endangered or extinct species and discuss how human activity has impacted their disappearance. Research ways to prevent. *Scientist Spotlights:* • **Dr. Geerat Vermeij** – how a blind paleontologist studies fossil evidence through touch.	
Resources/Materials	- Textbook (ck-12) - Evolution PowerPoint - Video clips (linked above) - Articles (linked above) - Internet resources		
ELA Companion Standards	WHST.9-12.1 Write arguments focused on discipline-specific content. WHST.9-12.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. RST.9-10.3 - Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text. RST.9-10.4 - Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9-10 texts and topics.		
Interdisciplinary Connections	Connections to ELA Essential Elements EE.SL.11-12.4: Present an argument on a topic using an organization appropriate to the purpose, audience, and task.		
Career Readiness, Life Literacies, and Key Skills	9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas. 9.4.12.CT.1: Identify problem-solving strategies used in the development of an innovative product or practice. 9.4.12.CT.2: Explain the potential benefits of collaborating to enhance critical thinking and problem solving.		

	9.2.12.CAP.8: Determine job entrance criteria (e.g., education credentials, math/writing/reading comprehension tests, drug tests) used by employers in various industry sectors.
Computer Science & Design Thinking	8.1.5.A.2 Format a document using a word processing application to enhance text and include graphics, symbols and/ or pictures.

Modifications			
Multi-Lingual Learners	**Special Education**	**At-Risk**	**Gifted and Talented**
● Model steps ● Show examples vs. non examples of student work ● Small group instruction (partner up) ● Lower reading level of text ● Use sentence starters to give student practice with academic language ● Pre- teach vocab using pictures	● Additional time for assignments and assessments ● Use of mnemonics ● Review of directions ● Have students restate directions or information back to you ● Concrete examples ● Support auditory presentations with visuals ● Review Sessions ● Access to completed notes ● Visual and verbal cues and prompts ● Graphic organizers ● Hands on activities ● Frequent Check-ins	● Incorporate student choice ● Provide peer mentoring to improve understanding of the material.	● Ask higher level questions that require students to look into causes, experiences, and facts to draw a conclusion or make connections to other areas of learning ● Use of open-ended questions rather than multiple choice questions. ● Choice of an alternate assignment that can be projects related to the area of study that extended the curriculum or independent projects that are chosen based on students' individual interests.

Elements of Biological Science

Unit 4: Ecosystems

Time Allotted: Approximately 8-10 Weeks

New Jersey Student Learning Standards (NJSLS)

EE.HS-LS2-1: Use a graphical representation to explain changes over time in the population size of an animal species (e.g., currently on the endangered list). (*HS-LS2-1)*

EE.HS-LS2-2: Use a graphical representation to explain the dependence of an animal population on other organisms for food and their environment for shelter. *(HS-LS2-2)*

Science & Engineering Practices	Disciplinary Core Ideas	Cross-Cutting Concepts
Using Mathematics and Computational ● Use mathematical and/or computational representations of phenomena or design solutions to support explanations. - ***Connections to Nature of Science*** **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.	**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. **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	**Scale, Proportion, and Quantity** ● The significance of a phenomenon is dependent on the scale, proportion, and quantity at which it occurs. ● Using the concept of orders of magnitude allows one to understand how a model at one scale relates to a model at another scale.

Essential Questions	Student Learning Objectives	Suggested Tasks/Activities	Evidence of Learning (Assessment)
● What are the different components to an ecosystem? ● What are autotroph and	Students will be able to: ● Define ecosystem. ● Discuss the different roles	● List all of the components to an ecosystem ● Sort pictures of autotrophs	● Assign students to an animal and have them identify where in a food web/chain

heterotrophs? ● How do food chains/ food webs work? ● Why don't populations grow and grow? ● What happens if a population exceeds its carrying capacity?	in a food chain. ● Give examples of autotrophs and heterotrophs. ● Label the trophic levels organisms occupy in a food web/ chain. ● Explore how environmental factors put limits on population sizes.	and heterotrophs ● Role play different animals in a food pyramid. ● Read from textbook about Population Size, can also be presented in a PowerPoint ● Have students answer questions once they've finished reading: 1. What causes a population to grow? 2. What is carrying capacity? 3. Discuss with students what limiting factors are- have students make a list. ● Interpret a population graph with students.	they'd be. Students can discuss what they may eat or predators that would eat them. ● Have students identify the carrying capacity on a graph.
Resources/Materials	- Pictures of autotrophs and heterotrophs - Pictures of food web/chain - Textbook - PowerPoint - Population Graph		
ELA Companion Standards	WHST.9-12.1 Write arguments focused on discipline-specific content. WHST.9-12.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. RST.9-10.3 - Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text. RST.9-10.4 - Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9-10 texts and topics.		
Interdisciplinary Connections	Connections to Mathematics Essential Elements EE.N.Q.1-3: Express quantities to the appropriate precision of measurement. EE.S-ID.1-2: Given data, construct a simple graph (line, pie, bar, or picture) or table, and interpret the data. EE.N-Q.1-3: Express quantities to the appropriate precision of measurement.		
Career Readiness, Life Literacies, and	9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas.		

Key Skills	9.4.12.CT.1: Identify problem-solving strategies used in the development of an innovative product or practice. 9.4.12.CT.2: Explain the potential benefits of collaborating to enhance critical thinking and problem solving. 9.2.12.CAP.8: Determine job entrance criteria (e.g., education credentials, math/writing/reading comprehension tests, drug tests) used by employers in various industry sectors.
Computer Science & Design Thinking	8.1.5.A.2 Format a document using a word processing application to enhance text and include graphics, symbols and/ or pictures. 8.1.5.A.4 Graph data using a spreadsheet, analyze and produce a report that explains the analysis of the data.

Modifications

Multi-Lingual Learners	Special Education	At-Risk	Gifted and Talented
● Model steps ● Show examples vs. non examples of student work ● Small group instruction (partner up) ● Lower reading level of text ● Use sentence starters to give student practice with academic language ● Pre- teach vocab using pictures	● Additional time for assignments and assessments ● Use of mnemonics ● Review of directions ● Have students restate directions or information back to you ● Concrete examples ● Support auditory presentations with visuals ● Review Sessions ● Access to completed notes ● Visual and verbal cues and prompts ● Graphic organizers ● Hands on activities ● Frequent Check-ins	● Incorporate student choice ● Provide peer mentoring to improve understanding of the material.	● Ask higher level questions that require students to look into causes, experiences, and facts to draw a conclusion or make connections to other areas of learning ● Use of open-ended questions rather than multiple choice questions. ● Choice of an alternate assignment that can be projects related to the area of study that extended the curriculum or independent projects that are chosen based on students' individual interests.

Elements of Biological Science
Unit 5: Environmental Studies
Time Allotted: Approximately 10 Weeks
New Jersey Student Learning Standards (NJSLS)
EE.HS-ESS3-1: Construct an explanation based on evidence for how natural hazards have influenced human activity. *(HS-ESS3-1)*
EE.HS-ESS3-2: Construct an argument for a strategy to conserve, recycle, or reuse resources. *(HS-ESS3-2)*
EE.HS-ESS3-3: Analyze data to determine the effects of a conservation strategy on the level of a natural resource. *(HS-ESS3-3)*

Science & Engineering Practices	Disciplinary Core Ideas	Cross-Cutting Concepts
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. **Engaging in Argument from Evidence** • Evaluate competing design solutions to a real-world problem based on scientific ideas and principles, empirical evidence, and logical arguments regarding relevant factors (e.g. economic, societal, environmental, ethical considerations). **Using Mathematics and Computational Thinking** • Create a computational model or simulation of a phenomenon, designed device, process, or system.	**ESS3.A: Natural Resources** • Resource availability has guided the development of human society. • All forms of energy production and other resource extraction have associated economic, social, environmental, and geopolitical costs and risks as well as benefits. New technologies and social regulations can change the balance of these factors. **ESS3.B: Natural Hazards** • Natural hazards and other geologic events have shaped the course of human history; [they] have significantly altered the sizes of human populations and have driven human migrations. **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)* **ESS3.C: Human Impacts on Earth Systems** • The sustainability of human societies and the biodiversity that supports them requires responsible management of natural resources.	**Cause and Effect** • Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. **Stability and Change** • Change and rates of change can be quantified and modeled over very short or very long periods of time. Some system changes are irreversible. ***Connections to Engineering, Technology, and Applications of Science*** **Influence of Science, Engineering, and Technology on Society and the Natural World** • Modern civilization depends on major technological systems. • Engineers continuously modify these technological systems by applying scientific knowledge and engineering design practices to increase benefits while decreasing costs and risks. • Analysis of costs and benefits is a critical aspect of decisions about technology. • New technologies can have deep impacts on society and the environment, including some that were not anticipated. ***Connections to Nature of Science***

		Science Addresses Questions About the Natural and Material World • Science and technology may raise ethical issues for which science, by itself, does not provide answers and solutions. • Science knowledge indicates what can happen in natural systems—not what should happen. The latter involves ethics, values, and human decisions about the use of knowledge. • Many decisions are not made using science alone, but rely on social and cultural contexts to resolve issues. • Science is a result of human endeavors, imagination, and creativity.

Essential Questions	Student Learning Objectives	Suggested Tasks/Activities	Evidence of Learning (Assessment)
• What are the different types of natural hazards? • How do those natural hazards influence human activity? • What are the different ways to manage waste? • How does our school/community manage waste?	Students will be able to: • Recognize characteristics of natural hazards (e.g., floods, earthquakes, tornadoes) • Recognize how natural hazards (e.g., floods, earthquakes, tornadoes) influence human activity. • Describe strategies to manage objects (e.g., dispose, repurpose, or recycle). • Gather data on the effects of a local (e.g., class or school-wide) conservation strategy	• Students identify the major types of natural hazards • Watch videos to visual the characteristics of each. • Students fill out a graphic organizer as reference material. • Students choose an area around the world that typically experiences natural hazards and make a presentation about. (Example: Volcano in Italy) Research should include how it's impacted human activity. • Students come up with ways to protect the earth • Discuss items that should be recycled, reused, reduced • Come up with ways to do the	• Classwork/homework • Class Discussions • Present Natural Disasters Research Project • Managing Waste Project

		three R's in their everyday lives • Look up how the town and/or our school manages waste. Collect data on how often waste is collected, how it is collected, and ways to improve. *Scientist Spotlights* • **Rachel Carson** – How one scientist took on the chemical industry.	
Resources/Materials	-Internet Clips on different natural hazards -Pictures -PowerPoint for explicit instruction -Graphic organizer for students to take notes -Town site for management of waste information		
ELA Companion Standards	WHST.9-12.1 Write arguments focused on discipline-specific content. WHST.9-12.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. RST.9-10.3 - Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text. RST.9-10.4 - Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9-10 texts and topics.		
Interdisciplinary Connections	Connections to Mathematics Essential Elements EE.N-Q.1-3: Express quantities to the appropriate precision of measurement.		
Career Readiness, Life Literacies, and Key Skills	9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas. 9.4.12.CT.1: Identify problem-solving strategies used in the development of an innovative product or practice. 9.4.12.CT.2: Explain the potential benefits of collaborating to enhance critical thinking and problem solving. 9.2.12.CAP.8: Determine job entrance criteria (e.g., education credentials, math/writing/reading comprehension tests, drug tests) used by employers in various industry sectors.		
Computer Science & Design Thinking	8.1.5.A.2 Format a document using a word processing application to enhance text and include graphics, symbols and/ or pictures.		

	8.1.5.A.4 Graph data using a spreadsheet, analyze and produce a report that explains the analysis of the data.		
Modifications			
Multi-Lingual Learners	**Special Education**	**At-Risk**	**Gifted and Talented**
• Model steps • Show examples vs. non examples of student work • Small group instruction (partner up) • Lower reading level of text • Use sentence starters to give student practice with academic language • Pre- teach vocab using pictures	• Additional time for assignments and assessments • Use of mnemonics • Review of directions • Have students restate directions or information back to you • Concrete examples • Support auditory presentations with visuals • Review Sessions • Access to completed notes • Visual and verbal cues and prompts • Graphic organizers • Hands on activities • Frequent Check-ins	• Incorporate student choice • Provide peer mentoring to improve understanding of the material.	• Ask higher level questions that require students to look into causes, experiences, and facts to draw a conclusion or make connections to other areas of learning • Use of open-ended questions rather than multiple choice questions. • Choice of an alternate assignment that can be projects related to the area of study that extended the curriculum or independent projects that are chosen based on students' individual interests.

Additional Resources to promote DEI:

- Structure Matters: Twenty-One Teaching Strategies to Promote Student Engagement and Cultivate Classroom Equity
- Race Matters
- Inclusive Teaching