Kingsway Regional School District

Committed to Excellence

Course Name: College Prep Biology	
Prerequisite(s): N/A	**Grade Level(s): Grade** 11-12
Department: Science	**Credits:** 1.0
BOE Adoption Date: October 2016	**Revision Dates:** September 2021; September 2022

Course Description and Outcomes

Student will explore college prep biology through a collaborative and lab/inquiry based environment, developing critical thinking and problem-solving skills essential to becoming informed productive contributors to society in the 21st century. High school students will engage in engineering practices and apply crosscutting concepts to deepen their understanding of the living things and their interdependence with the environment. Units that will be explored are: matter and energy transformations in ecosystems, interdependent relationships in ecosystems, cell specialization and homeostasis, DNA and inheritance, natural selection and evolution, and human impact on the environment. Through applications of each one of these units, students will gain understanding of how humans affect other lives and use this understanding to make informed data-based decisions.

Proficiencies and Pacing Guide:

Course Title: CP Biology

Unit Title:	Months & Number of Weeks	Relevant Content Standards	Learning Goals:	Learning Objectives (Identify the DOK Level):
Unit 1:. Matter and Energy Transformations in Ecosystems	12 weeks	NJSLS HS-LS2-4 NJSLS HS-LS1-6 NJSLS HS-LS1- 7 NJSLS HS-LS2-5 NJSLS HS-LS1-5 NJSLS HS-LS2-5 NJSLS HS-LS1-6 NJSLS HS-LS1-7 NJSLS HS-LS2-3 NJSLS ESS2.D NJSLS ESS3.D	• Students will understand that plants or algae form the lowest level of the energy pyramid. At each level up the pyramid, only a small fraction of energy is transferred because some of the energy is used by the organism or released into the environment. (2 weeks) • Students will understand that as matter and energy flow through different organizational levels of living systems, chemical elements are recombined in different ways to form different products. (1 weeks) • Students will understand that 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. (1 weeks) • Students will understand that the process of photosynthesis converts light energy from the sun to stored chemical energy by converting carbon dioxide plus water into sugars plus released oxygen. (2 weeks) • Students will understand that The sugar molecules can be broken down and rearranged to make	• Students will be able to identify the transfer of energy and matter between trophic levels; and identify the relative proportion of organisms at each trophic level by correctly identifying producers as the lowest trophic level having the greatest biomass and energy and consumers decreasing in numbers at higher trophic levels. • Students will be able to identify and describe the components of the model relevant for illustrating that photosynthesis transforms light energy into stored chemical energy by converting carbon dioxide plus water into sugars plus released oxygen. • Students will use the given model to illustrate the transfer of matter and flow of energy between the organism and its environment during photosynthesis and photosynthesis as resulting in the storage of energy in the difference between the energies of the chemical bonds of the inputs (carbon dioxide and water) and outputs (sugar and oxygen). • Students will use the given model to illustrate the transfer of matter and flow of energy between the

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			macromolecules needed for cell structure and function (1 week) • Students will understand that cellular respiration is a chemical process in which the bonds of food molecules and oxygen molecules are broken 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. (2 weeks) • Students will understand that photosynthesis and cellular respiration (including anaerobic processes) provide most of the energy for life processes. (3 weeks) • Climate Change and the effect of CO2 from the carbon cycle and utilize historical data to determine the causation for global climate change. (1 week)	organism and its environment during photosynthesis. • Students will construct an explanation that includes that energy from photosynthesis and respiration drives the cycling of matter and flow of energy under aerobic or anaerobic conditions within an ecosystem. • Students will be able to describe the following chain of reasoning used to construct their explanation: Energy inputs to cells occur either by photosynthesis or by taking in food; Since all cells engage in cellular respiration, they must all produce products of respiration. • Students will be able to describe the following chain of reasoning used to construct their explanation: The flow of matter into and out of cells must therefore be driven by the energy captured by photosynthesis or obtained by taking in food and released by respiration; the flow of matter and energy must occur whether respiration is aerobic or anaerobic. • Students will be able to describe the contribution of photosynthesis and cellular respiration to the exchange of carbon within and among the biosphere, atmosphere, hydrosphere, and geosphere in their model.

Unit Title:	Months & Number of Weeks	Relevant Content Standards	Learning Goals:	Learning Objectives (Identify the DOK Level):
Unit 2: Interdependent Relationships in Ecosystems	7weeks/ December-January	NJSLS-S.HS-LS2-1 NJSLS-S.HS-LS2-2 NJSLS-S.HS-LS2-6	• Students will understand that ecosystems have carrying capacities, which are limits to the numbers of organisms and populations they can support. (HS-LS2-1),(HS-LS2-2) (1 week) • Students will understand that organisms would have the capacity to produce populations of great size were it not for the fact that environments and resources are finite. (HS-LS2-1), (HS-LS2-2) (3 weeks) • Students will understand that 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. (HS-LS2-2), (HS-LS2-6) (1 week) • Students will understand that changes to the environment will affect the function of the ecosystem. (HS-LS2-2), (HS-LS2-6) (4 weeks)	• HS-LS2-1 (LS2.A). Students will use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales. • HS-LS2-2 (LS2.A). Students will use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales • HS-LS2-6(LS2.C). Students will 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.
Unit 3: Cell Specialization and Homeostasis	8 weeks / January-March	NJSLS-S.HS-LS1-1 NJSLS-S.HS-LS1-2 NJSLS-S.HS-LS1-3 NJSLS-S.HS-LS1-4 NJSLS-S.HS-LS3-1	• Students will understand that all cells contain genetic information in the form of DNA molecules. • Students will understand genes are regions in the DNA that contain the instructions that code for the formation of proteins. (HS-LS1-1) (Note: This Disciplinary Core Idea is also addressed by HS-LS3-1.) (3 weeks) • Students will understand that multicellular organisms have a	• HS-LS1-1 Students construct an explanation that includes the idea that regions of DNA called genes determine the structure of proteins, which carry out the essential functions of life through systems of specialized cells. • Students identify and describe the evidence that groups of specialized cells (tissues) use proteins to carry out functions that are essential to the organism.

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			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) (1 week) • Students will understand that in multicellular organisms, individual cells grow and then divide via a process called mitosis, thereby allowing the organism to grow. (HS-LS1-4) (1 week) • Students will understand that organisms begin as a single cell that divides successively to produce many cells, with each parent cell passing identical genetic material to both daughter cells. (HS-LS3-1) (1 week) • Students will understand that 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. (HS-LS1-4) (1 week) • Students will understand that all cells in an organism have the same genetic content, but the genes used (expressed) by the cell may be regulated in different ways. (HS-LS1-4) (1 week) • Students will understand that systems of specialized cells within organisms help them perform the essential functions of life. (HS-LS1-1)	• HS-LS1-2 Students develop a model in which they identify and describe the relevant parts (e.g., organ system, organs, and their component tissues) and processes (e.g., transport of fluids, motion) of body systems in multicellular organisms. • HS-LS1-3 Students design an investigation and describe the phenomenon, which includes the following idea: that feedback mechanisms maintain homeostasis. • Students describe why the data will provide information relevant to the purpose of the investigation. • Students will assess the accuracy and precision of the data, as well as limitations of the investigation, make suggestions for refinement, assess the ability of the data to provide the evidence required, and refine the investigation plan to produce more generalizable data. • HS-LS1-4 Students identify and describe the components of the model relevant for illustrating the role of mitosis and differentiation in producing and maintaining complex organisms. • Students use the given model to illustrate that mitotic cell division results in more cells that: • Allow growth of the organism, can then differentiate to create different cell types, and can replace

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			(1 week) • Students will understand that complex organisms are made of cells, tissues, organs, and organ systems to function. (HS-LS1-4) (2 weeks) • Students will understand that 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. (HS-LS1-3) (2 weeks)	dead cells to maintain a complex organism.
Unit 4: DNA and Inheritance	**7 weeks / February - April**	NJSLS-S.HS-LS3-2 NJSLS-S.HS-LS3-3	• Students will understand that organisms begin as a single cell that divides successively to produce many cells, with each parent cell passing identical genetic material to both daughter cells. (1 week) • Students will understand that 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. (1 week) • Students will understand that all cells in an organism have the same genetic content, but the genes used (expressed) by the cell may be regulated in different ways. (1 week) • Students will understand that in sexual reproduction, chromosomes can sometimes swap sections during	• HS-LS1-4 Students use a given model to illustrate meiotic cell division results in four genetically different daughter cells. • HS-LS3-2 Students make a claim that includes the idea that inheritable genetic variations may result from: new genetic combinations through meiosis, viable errors occurring during replication; and mutations caused by environmental factors. • Students use reasoning and valid evidence to describe that new combinations of DNA can arise from several sources, including meiosis, errors during replication, and mutations caused by environmental factors. • Students calculate gene frequency and probability by using Punnett squares.

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			the process of meiosis, thereby creating new genetic combinations and thus more genetic variation. (1 week) • Students will understand that 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. (1 week) • Students will know that 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. (1 week)	
Unit 5: Natural Selection and Evolution	6 weeks May-June	NJSLS-S.HS-LS2-8 NJSLS-S.HS-LS4-4 NJSLS-S.HS-LS4-3 NJSLS-S.HS-LS4-5 NJSLS-S.HS-LS4-2 NJSLS-S.HS-LS4-1 NJSLS-S.HS-ESS1-5 NJSLS-S.HS-ESS1-6 NJSLS-S.HS-ESS1-7	• Students will communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence. (HS-LS4-1) (1 week) • Students will know that natural selection leads to adaptation. Students will know that 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. (HS-LS4-4) (1 week)	• Students construct an explanation that identifies the cause and effect relationship between natural selection and adaptation. • Students identify and describe the evidence to construct their explanation, including: changes in a population when some feature of the environment changes, relative survival rates of organisms with different traits in a specific environment, the fact that individuals in a species have genetic variation that is passed on to their

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			• Students will understand that traits that positively affect survival are more likely to be reproduced, and thus are more common in the population and that the distribution of traits in a population can change when conditions change. (HS-LS4-3) • Students will understand that 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) • Students will understand that 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) • Students will understand that group behavior has evolved because membership can increase the chances of survival for individuals and their genetic relatives. (HS-LS2-8) (1 week) • Students will understand that evolution is a consequence of the interaction of four factors: (1) the	offspring, and the fact that individuals can have specific traits that give them a competitive advantage relative to other individuals in the species. • Students use reasoning to construct the explanation about how natural selection provides a mechanism for • species to adapt to changes in their environment, including the following elements: • Biotic and abiotic differences in ecosystems contribute to changes in gene frequency overtime through natural selection. • Increasing gene frequency in a population results in an increasing fraction of the population in each successive generation that carries a particular gene and expresses a particular trait. • Over time, this process leads to a population that is adapted to a particular environment by the widespread expression of a trait that confers a competitive advantage in that environment. • Students organize data by the distribution of genetic traits over time, describe what each dataset represents and use appropriate statistical analyses of data to determine patterns of change in numerical distribution of traits over various time and population scales.

Unit Title:	Months & Number of Weeks	Relevant Content Standards	Learning Goals:	Learning Objectives (Identify the DOK Level):
			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). (1 week)	• Students use the data analyses as evidence to support explanations that natural selection is the cause of increases and decreases in heritable traits over time in a population, but only if it affects reproductive success; and the changes in distribution of adaptations of anatomical, behavioral, and physiological • traits in a population. • Students identify the given claims, which include the idea that changes in environmental conditions may result in: ○ Increases in the number of individuals of some species; ○ The emergence of new species over time; and ○ The extinction of other species. • Students identify the given explanation that is supported by the evidence to be evaluated, and which includes the following idea: Group behavior can increase the chances for an individual and a species to survive and reproduce. • Students construct an explanation that includes a description that evolution is caused primarily by • one or more of the four factors: (1) the potential for a species to increase in number, (2) the • heritable genetic variation of

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				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.
Unit 6: Human Impact on the Environment	3 weeks / June	NJSLS-S.HS-ESS3-1 NJSLS-S.HS-ESS3-6 NJSLS-S.HS-ESS3-5 NJSLS-S.HS-ESS3-4 NJSLS-S.HS-ESS3-3 NJSLS-S.HS-LS4-6 NJSLS-S.HS-LS2-7 NJSLS-S.HS-ETS1-1 NJSLS-S.HS-ETS1-2 NJSLS-S.HS-ETS1-3 NJSLS-S.HS-ETS1-4	• ETS1.A&C: Defining and Delimiting Engineering Problems & Optimizing the Design Solution. Students will understand that scientists and engineers must approach criteria and constraints systematically while also satisfying any requirements set by society, such as taking issues of risk mitigation into account, and they should be quantified to the extent possible and stated in such a way that one can tell if a given design meets them. (1 week) • ESS2.D: Weather and Climate Students will be able to understand that current models predict that, although future regional climate changes will be complex and varied, average global temperatures will continue to rise. The outcomes predicted by global climate models strongly depend on the amounts of human-generated greenhouse gases added to the atmosphere each year and by the ways in which these gases are absorbed by the ocean and biosphere. (secondary) • ESS3.D: Global Climate Change	• Students construct an explanation that includes: ○ Specific cause and effect relationships between environmental factors (natural hazards, changes in climate, and the availability of natural resources) and features of human societies including population size and migration patterns; and ○ That technology in modern civilization has mitigated some of the effects of natural hazards, climate, and the availability of natural resources on human activity. • Students identify and describe the relevant components of each of the Earth systems modeled in the given computational representation, including system boundaries, initial conditions, inputs and outputs, and relationships that determine the interaction • Students organize data (e.g., with graphs) from global climate models (e.g., computational simulations)

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			Students will understand that through computer simulations of human impact we are able to model, predict and manage our current and future impact on the ocean, the atmosphere, and the biosphere. (1week) • ESS3.A&B: Natural Resources Students will understand that resource availability, natural hazards, and other geologic events have shaped the course of human history and guided the development of human society. (1 week) • ESS3.C: Human Impacts on Earth Systems Students will understand that while scientists and engineers developing technologies that curb negative human impact on the earth, they must also take into account a variety of constraints, including cost, safety, reliability, and aesthetics, and to consider social, cultural, and environmental impacts. (secondary) (1 week) • LS4.D: Biodiversity and Humans Students will understand that 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. In order to mitigate	and climate observations over time that relate to the effect of climate change on the atmosphere, geosphere, hydrosphere, or cryosphere. • Students use scientific information to investigate a number of possible refinements to a given technological solution to a problem caused my human activities. • Students describe simplified realistic relationships between computer simulation resources to indicate an understanding of the factors (e.g., costs, availability of • technologies) that affect the management of natural resources, human sustainability, and biodiversity. • Students create or revise a simulation that: ○ Models effects of human activity (e.g., overpopulation, overexploitation, adverse habitat alterations, pollution, invasive species, changes in climate) on a threatened or endangered species or to the genetic variation within a species ○ Provides quantitative information about the effect of the solutions on threatened or endangered species. • Students design, evaluate, and refine a solution for reducing

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			the problem, humans need to manage natural resources. (1 week)	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.] • Students analyze a major global problem. In their analysis, students: ○ Describe the challenge with a rationale for why it is a major global challenge; ○ Describe, qualitatively and quantitatively, the extent and depth of the problem and its major consequences to society and/or the natural world on both global and local scales if it remains unsolved; and ○ Document background research on the problem from two or more sources, including ○ research journals. • Students practice defining the problem by creating sub-problems and proposing solutions based on research and criteria. • Students refining and/or optimize the design solution • and in their evaluation, students describe which parts of the complex real-world problem may remain • even if the proposed solution is implemented. • Students identify the constraints

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				and implications of computer simulations used to study the relationships between environmental factors and human activity.

Unit 1: Matter and Energy Transformations in Ecosystems	Unit Length Months/Weeks: 14 weeks September – December
Unit Description: In this unit of study, students construct explanations for the role of energy in the cycling of matter in organisms and ecosystems. They apply mathematical concepts to develop evidence to support explanations of the interactions of photosynthesis and cellular respiration, and they will develop models to communicate these explanations. Students also understand organisms' interactions with each other and their physical environment and how organisms obtain resources. Students utilize the crosscutting concepts of matter and energy and systems, and system models to make sense of ecosystem dynamics. Students are expected to use students construct explanations for the role of energy in the cycling of matter in organisms and ecosystems. They apply mathematical concepts to develop evidence to support explanations as they demonstrate their understanding of the disciplinary core ideas.	

Essential Questions: (higher level questions that need to be considered/answers; are open and broad)	**Enduring Understandings:** (general/transferable ideas to other contexts)
• How do organisms obtain and use energy they need to live and grow? • How do matter and energy move through ecosystems?	Students will understanding that… • Energy plays a vital role in the cycling of matter in organisms and ecosystems. • Organisms interact with each other and their physical environment, these organisms obtain resources, change the environment, and these changes affect both organisms and ecosystems.

Learning Goals & (Primary Content Standards):	Learning Objectives (Identify the DOK Level):
• Students will understand that plants or algae form the lowest level of the energy pyramid. At each level up the pyramid, only a small fraction of energy is transferred because some of the energy is used by the organism or released into the environment. (1 week) • Students will understand that as matter and energy flow through different organizational levels of living systems, chemical elements are recombined in different ways to form different products. (1 week) • Students will understand that 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. (1 week) • Students will understand that the process of photosynthesis converts light energy to stored chemical energy by converting carbon dioxide plus water into sugars plus released oxygen. (1 week) • Students will understand that the main way that solar energy is captured and stored on Earth is through the complex chemical process known as photosynthesis. (1 week) • Students will understand that The sugar molecules can be broken down and rearranged to make macromolecules needed for cell structure and function (1 week) • Students will understand that cellular respiration is a chemical process in which the bonds of food molecules and oxygen molecules are broken 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. (1 week) • Students will understand that photosynthesis and cellular respiration (including anaerobic processes) provide most of the energy for life processes. (1 week) • Students will understand the Greenhouse effect and Historical Climate change records (1 week) • Students will understand Global Climate Change and the effect of CO2 from the carbon cycle. (1 week)	• Students will be able to identify the transfer of energy and matter between trophic levels; and identify the relative proportion of organisms at each trophic level by correctly identifying producers as the lowest trophic level having the greatest biomass and energy and consumers decreasing in numbers at higher trophic levels. • Students will be able to identify and describe the components of the model relevant for illustrating that photosynthesis transforms light energy into stored chemical energy by converting carbon dioxide plus water into sugars plus released oxygen. • Students will use the given model to illustrate the transfer of matter and flow of energy between the organism and its environment during photosynthesis and photosynthesis as resulting in the storage of energy in the difference between the energies of the chemical bonds of the inputs (carbon dioxide and water) and outputs (sugar and oxygen). • Students will use the given model to illustrate the transfer of matter and flow of energy between the organism and its environment during photosynthesis. • Students will construct an explanation that includes that energy from photosynthesis and respiration drives the cycling of matter and flow of energy under aerobic or anaerobic conditions within an ecosystem. • Students will be able to describe the following chain of reasoning used to construct their explanation: Energy inputs to cells occur either by photosynthesis or by taking in food; Since all cells engage in cellular respiration, they must all produce products of respiration. • Students will be able to describe the following chain of reasoning used to construct their explanation: The flow of matter into and out of cells must therefore be driven by the energy captured by photosynthesis or obtained by taking in food and released by respiration; the flow of matter and energy must occur whether respiration is aerobic or anaerobic. • Students will be able to describe the contribution of photosynthesis and cellular respiration to the exchange of carbon within and among the biosphere, atmosphere, hydrosphere, and geosphere in their model.

To ensure the needs of all learners (including, but not limited to, special education, 504, ELL, & advanced learners) are met when **delivering instruction and assessing students**, please refer to the District approved **Instructional & Assessment Supports: Accommodations/Modifications Reference Sheet.** These must be used in the planning and delivery of instruction. Specific student learning activities, differentiated instructional techniques, and accommodations/modifications are noted in Schoology.

Secondary Assessments (Formative)	Primary Assessments (Summative)
Transfer of Energy Assessment/CER Cycles of Matter Assessment Photosynthesis CER	Energy Pyramid Simulation Lab: Photosynthesis Photosynthesis Assessment, Unit 1 Assessment

Interdisciplinary Connections: CORE AREA CONNECTIONS

Literacy
NJSLS.RST.11-12.1
NJSLS.SL.11-12.5
NJSLS.WHST .9-12.2
NJSLS.WHST .9-12.7
NJSLS.WHST .11-12.8
NJSLS.WHST .9-12.9

Mathematics
NJSLS.MATH.PRACTICE.MP.2
NJSLS.MATH.PRACTICE.MP.4
NJSLS.HSN-Q.A.1
NJSLS.HSN-Q.A.2
NJSLS.HSN-Q.A.3

Financial Literacy
NJSLS.9.1.12.FP.7

Equity Integration (Using James Banks' Levels of Multicultural Integration):

- Classroom Supplies: Students will have access to all needed classroom supplies regardless of socioeconomic background. (Level 2)
- #Scientistswhoselfie activity: Students will investigate and explore multiple scientists from backgrounds unlike their own (differing cultures, races, ethnicities, genders) (Level 2-3)
- Posters of minority scientist contributors are posted around the classroom, and the contributions of minority members are emphasized when presenting information.(Level 1)

- Energy Transfer Class Simulation: Students roleplay a marine organism and their energy role in the ecosystem. This creates a shared experience for students who may not have much background knowledge of marine organisms. (Level 2)
- Peardeck: Students of various backgrounds are represented in the visuals of the Peardeck slides. SEL survey at the beginning of each Peardeck informs teacher instruction for the day. (Level 2)
- Climate Change impact on certain groups (socio-economic or cultural):
- Photosynthesis: food deserts in different global areas
- Cell Respiration: Tibetan high altitude leads to more mitochondria. Sports altitude affects (football/running)

Career Ready Practices: Note applicable CRPs used within the unit.

CLKS.1
CRP2
CRP4
CRP7
CLKS.6
CLKS.8
CLKS.9

Career Readiness, Life Literacies, & Key Skills (21st Century Themes & Skills): Note applicable 2020 NJ standards 9.1, 9.2, 9.3, or 9.4 within the unit.

Career Exploration
NJSLS.9.3.12.ST-ET.1
NJSLS.9.3.12.ST-ET.2
NJSLS.9.3.12.ST-ET.3
NJSLS.9.3.12.ST-SM.1

Integration of Technology: Note applicable 2020 standards 8.1 & 8.2 used within the unit.

NJSLS.9.4.12.TL.1
NJSLS.8.1.12.CS.1

Course/Unit Resources:

Texts/Materials:
Postlethwait, John H. Modern Biology. Student Ed. Place of Publication Not Identified: Holt, Rinehart and Winston, 2009. Print.
Optional Leveled Reading:

- Chloroplast read & Color
- Beer Belly and Fish Articles

Unit 2: Interdependent Relationships in Ecosystems	**Unit Length Months/Weeks:** 7 weeks/ December- January
Unit Description: In this unit of study, students formulate answers to the question "how and why do organisms interact with each other (biotic factors) and their environment (abiotic factors), and what affects these interactions?" Secondary ideas include the interdependent relationships in ecosystems; dynamics of ecosystems; and functioning, resilience, and social interactions, including group behavior. Students use mathematical reasoning and models to make sense of carrying capacity, factors affecting biodiversity and populations, the cycling of matter and flow of energy through systems. The crosscutting concepts of scale, proportion, and quantity and stability and change are called out as organizing concepts for the disciplinary core ideas. Students are expected to use mathematical reasoning and models to demonstrate proficiency with the disciplinary core ideas.	

Essential Questions: (higher level questions that need to be considered/answers; are open and broad)	**Enduring Understandings:** (general/transferable ideas to other contexts)
• How do organisms interact with the living and nonliving environments to obtain matter and energy? • What limits the number and types of different organisms that live in one place?	Students will understanding that… • Ecosystems have carrying capacities, which are limits to the number 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, completion, 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 (the number of individuals) of species in any given ecosystem. • 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. Even 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) as opposed to becoming a very different ecosystem. However, extreme fluctuations in conditions or the size of any population, however, can challenge the functioning of ecosystems in terms of resources and habitat availability.

Learning Goals & (<u>Primary Content Standards</u>):	**Learning Objectives (<u>Identify the DOK Level</u>):**
• Students will understand that ecosystems have carrying capacities, which are limits to the numbers of organisms and populations they can support. (HS-LS2-1),(HS-LS2-2) (2 weeks) • Students will understand that organisms would have the capacity to produce populations of great size were it not for the fact that environments and resources are finite. (HS-LS2-1), (HS-LS2-2)(3 weeks)	• HS-LS2-1 (LS2.A). Students will use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales. • HS-LS2-2 (LS2.A). Students will use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales

Learning Goals & (Primary Content Standards):	**Learning Objectives (Identify the DOK Level):**
• Students will understand that 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. (HS-LS2-2), (HS-LS2-6) (2 weeks) • Students will understand that changes to the environment will affect the function of the ecosystem. (HS-LS2-2), (HS-LS2-6) (2 weeks)	• HS-LS2-6(LS2.C). Students will 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.

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Secondary Assessments (Formative)	**Primary Assessments (Summative)**
Understanding Check: Kaibab Case Study & Prairie Gizmo CER Predator or Starvation Case Study Understanding Check: Populations and Symbiosis	Biome Project

Interdisciplinary Connections: CORE AREA CONNECTIONS

Interdisciplinary:
NJSLS:
Literacy
NJSLS.RST.9-10.8
NJSLS.RST.11-12.1
NJSLS.RST.11-12.7
NJSLS.RST.11-12.8
NJSLS.WHST.9-12.2
NJSLS.WHST.9-12.5
NJSLS.WHST.9-12.7

Mathematics
NJSLS.MATH.PRACTICE.MP.2
NJSLS.MATH.PRACTICE.MP.4
NJSLS.HSN.Q.A.1
NJSLS.HSN.Q.A.2

NJSLS.HSN.Q.A.3
NJSLS.HSS-ID.A.1
NJSLS.HSS-IC.A.1
NJSLS.HSS-IC.B.6

Equity Integration (Using James Banks' Levels of Multicultural Integration):

- Human impact on ecosystems and relationship to environment from various cultural perspectives. (Biome Project)
- Kaibab Lesson (Land management impact on indigenous people/socio economic impact)
- Human Population (how to solve human population issue?) China 1 child act, Indian culture, unequal access to medicine & nutritious food
- Tiered CER Assessment design based on student readiness

Career Ready Practices: Note applicable CRPs used within the unit.

Career Ready Practices
CLKS.1
CRP2
CRP4
CLKS.4
CRP7
CLKS.6
CLKS.8
CLKS.9

Career Readiness, Life Literacies, & Key Skills (21st Century Themes & Skills): Note applicable 2020 NJ standards 9.1, 9.2, 9.3, or 9.4 within the unit.

Career Exploration
NJSLS.9.3.12.ST-ET.1
NJSLS.9.3.12.ST-ET.2
NJSLS.9.3.12.ST-ET.3
NJSLS.9.3.12.ST-SM.1

Integration of Technology: Note applicable 2020 standards 8.1 & 8.2 used within the unit.

Technology
NJSLS.9.4.12.TL.1
NJSLS.9.4.12.DC.2
NJSLS.8.1.12.DA.1

Course/Unit Resources:

Texts/Materials:
Postlethwait, John H. Modern Biology. Student Ed. Place of Publication Not Identified: Holt, Rinehart and Winston, 2009. Print.

Unit 3: Cell Specialization and Homeostasis	**Unit Length Months/Weeks:** 8 weeks / January-March
Unit Description: Students formulate an answer to the question "How do the structures of organisms enable life's functions?" Students investigate explanations for the structure and functions of cells as the basic unit of life, of hierarchical organization of interacting organ systems, and of the role of specialized cells for maintenance and growth. The crosscutting concepts of structure and function, matter and energy, and systems and system models are called out as organizing concepts for the disciplinary core ideas. Students use critical reading, modeling, and conducting investigations. Students also use the science and engineering practices to demonstrate understanding of the disciplinary core ideas.	

Essential Questions: (higher level questions that need to be considered/answers; are open and broad)	**Enduring Understandings:** (general/transferable ideas to other contexts)
• How do the structures of organisms enable life's functions? • What do you mean they say that people are made of a system of systems?	Students will understanding that… • In multicellular organisms, individual cells grow and then divide via a process called mitosis, thereby allowing the organism to grow. Cellular division and differentiation produce and maintain a complex organism, composed of systems of tissues and organs made of specialized cells that work together to meet the needs of the whole organism. • Feedback mechanisms maintain a living system's internal conditions within certain limits, and they mediate behaviors, allowing the system 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.

Learning Goals & (Primary Content Standards):	**Learning Objectives (Identify the DOK Level):**
NJSLS-S.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. NJSLS-S.HS-LS1-2: Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms. NJSLS-S.HS-LS1-3: Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis NJSLS-S.HS-LS1-4: Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms.	• HS-LS1-1 Students construct an explanation that includes the idea that regions of DNA called genes determine the structure of proteins, which carry out the essential functions of life through systems of specialized cells. • Students identify and describe the evidence that groups of specialized cells (tissues) use proteins to carry out functions that are essential to the organism. • HS-LS1-2 Students develop a model in which they identify and describe the relevant parts (e.g., organ system, organs, and their component tissues) and processes (e.g., transport of fluids, motion) of body systems in multicellular organisms. • HS-LS1-3 Students design an investigation and describe the phenomenon, which includes the following idea: that feedback mechanisms maintain

Learning Goals & (Primary Content Standards):	**Learning Objectives (Identify the DOK Level):**
NJSLS-S.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.	homeostasis. • Students describe why the data will provide information relevant to the purpose of the investigation. • Students will assess the accuracy and precision of the data, as well as limitations of the investigation, make suggestions for refinement, assess the ability of the data to provide the evidence required, and refine the investigation plan to produce more generalizable data. • HS-LS1-4 Students identify and describe the components of the model relevant for illustrating the role of mitosis and differentiation in producing and maintaining complex organisms. • Students use the given model to illustrate that mitotic cell division results in more cells that: o Allow growth of the organism, o Can then differentiate to create different cell types o Can replace dead cells to maintain a complex organism.

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Secondary Assessments (Formative)	**Primary Assessments (Summative)**
DNA & Protein Synthesis Assessment (Multiple Choice) Protein Synthesis CER Cell Cycle Assessment (Multiple Choice) Homeostasis Assessment (Multiple Choice)	DNA Model Lab Cell Specialization Project Unit 3 Assessment

Interdisciplinary Connections: CORE AREA CONNECTIONS
NJSLS: Literacy NJSLS.RST.11-12.1 NJSLS.WHST.9-12.2 NJSLS.WHST.9-12.7 NJSLS.WHST.11-12.8 NJSLS.WHST.9-12.9

NJSLS.SL.11-12.5

Mathematics
NJSLS.MATH.PRACTICE.MP.4
NJSLS.HSF-IF.C.7
NJSLS.HSF-BF.A.1

Equity Integration (Using James Banks' Levels of Multicultural Integration):

- Henrietta Lacks – historical reference to discrimination of the black community
- Black History Month – door contest with past Kingsway students in science fields highlighted
- SEL survey – student experiences with cancer
- Cell Specialization – visual included diversity of babies
- Stem Cell Scientists – female, minority
- Homeostasis – sharing student experience stories about diabetes or other hormone-based disease
- Highlighting various disabilities as a result of an unbalance of homeostasis (ie. Diabetes)

Career Ready Practices: Note applicable CRPs used within the unit.

CLKS.1
CRP2
CLKS.2
CRP4
CRP7
CLKS.6
CLKS.8
CLKS.9

Career Readiness, Life Literacies, & Key Skills (21st Century Themes & Skills): Note applicable 2020 NJ standards 9.1, 9.2, 9.3, or 9.4 within the unit.

NJSLS.9.3.12.ST-ET.1
NJSLS.9.3.12.ST-ET.2
NJSLS.9.3.12.ST-ET.3
NJSLS.9.3.12.ST-SM.1

Integration of Technology: Note applicable 2020 standards 8.1 & 8.2 used within the unit.

Technology
NJSLS.9.4.12.TL.1
NJSLS.9.4.12.DC.2
NJSLS.8.1.12.AP.7

Course/Unit Resources:

Texts/Materials:
Postlethwait, John H. Modern Biology. Student Ed. Place of Publication Not Identified: Holt, Rinehart and Winston, 2009. Print.

Unit 4 Title: DNA and Inheritance	**Unit Length Months/Weeks:** 6 weeks / April-May
Unit Description: Students analyze data develop models to make sense of the relationship between DNA and chromosomes in the process of cellular division, which passes traits from one generation to the next. Students determine why individuals of the same species vary in how they look, function, and behave. Students develop conceptual models of the role of DNA in the unity of life on Earth and use statistical models to explain the importance of variation within populations for the survival and evolution of species. Ethical issues related to genetic modification of organisms and the nature of science are described. Students explain the mechanisms of genetic inheritance and describe the environmental and genetic causes of gene mutation and the alteration of gene expressions. The crosscutting concepts of structure and function, patterns, and cause and effect are used as organizing concepts for the disciplinary core ideas. Students also use the science and engineering practices to demonstrate understanding of the disciplinary core ideas.	

Essential Questions: (higher level questions that need to be considered/answers; are open and broad)	**Enduring Understandings:** (general/transferable ideas to other contexts)
• How are characteristics from one generation related to the previous generation? • How does inheritable genetic variation occur?	Students will understanding that… • All cells contain genetic information containing genes, which are regions in the DNA that contain the instructions that code for the formation of proteins. The instructions for forming species' characteristics are carried in the DNA and all cells in an organism have the same genetic content, but the genes used (expressed) by the cell may be regulated in different ways. • The instructions for forming species' characteristics are carried in the DNA and there are several causes of genetic variation: In sexual reproduction, chromosomes can sometimes swap sections, natural errors occur during DNA replication, environmental factors cause mutations, and gene expression can be affected by the environment.

Learning Goals & (Primary Content Standards):	**Learning Objectives (Identify the DOK Level):**
NJSLS-S.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. NJSLS-S.HS-LS3-3 Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population.	• Students will be able to : demonstrate understanding of meiosis, DNA replication, mutations and apply the understanding through completion of CER

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Secondary Assessments (Formative)	Primary Assessments (Summative)
Project: Genetic Disease Presentation CER – Written explanation • Meiosis v Mitosis Comparative essay • Cause/effect of gene mutation in DNA to genetic disease (sickle cell) Skill practice: Punnett Squares/Pedigrees	Unit 4 - CER

Interdisciplinary Connections: CORE AREA CONNECTIONS

NJSLS:
Literacy
NJSLS.RST.11-12.1
NJSLS.RST.11-12.9
NJSLS.WHST.9-12.1
NJSLS.SL.11-12.5

Mathematics
NJSLS.MATH.PRACTICE.MP.2
NJSLS.MATH.PRACTICE.MP.4
NJSLS.HSF-IF.C.7
NJSLS.HSF-BF.A.1

Equity Integration (Using James Banks' Levels of Multicultural Integration):

- Videos: perspective of people with genetic disorders
- Student stories of family with genetic disorders

Ethnic groups with high frequency of certain genetic disorders

Career Ready Practices: Note applicable CRPs used within the unit.

CLKS.1
CRP2
CRP4
CRP7

CLKS.6 CLKS.8 CLKS.9
Career Readiness, Life Literacies, & Key Skills (21st Century Themes & Skills): Note applicable 2020 NJ standards 9.1, 9.2, 9.3, or 9.4 within the unit.
NJSLS.9.3.12.ST-ET.1 NJSLS.9.3.12.ST-ET.2 NJSLS.9.3.12.ST-ET.3 NJSLS.9.3.12.ST-SM.1
Integration of Technology: Note applicable 2020 standards 8.1 & 8.2 used within the unit.
Technology NJSLS.9.4.12.TL.1 NJSLS.9.4.12.DC.2
Course/Unit Resources:
Texts/Materials: Postlethwait, John H. Modern Biology. Student Ed. Place of Publication Not Identified: Holt, Rinehart and Winston, 2009. Print.

Unit 5 Title: Natural Selection and Evolution	**Unit Length Months/Weeks: 4 weeks / May-June**
Unit Description: Students constructing explanations and designing solutions, analyzing and interpreting data, and engaging in argument from evidence investigate to make sense of the relationship between the environment and natural selection. Students also develop an understanding of the factors causing natural selection of species over time. They also demonstrate and understandings of how multiple lines of evidence contribute to the strength of scientific theories of natural selection. The crosscutting concepts of patterns and cause and effect serve as organizing concepts for the disciplinary core ideas. Students also use the science and engineering practices to demonstrate understanding of the disciplinary core ideas. Students construct explanations for the processes of natural selection and evolution and then communicate how multiple lines of evidence support these explanations. Students evaluate evidence of the conditions that may result in new species and understand the role of genetic variation in natural selection. Additionally, students can apply concepts of probability to explain trends in population as those trends relate to advantageous heritable traits in a specific environment. Students demonstrate an understanding of these concepts by obtaining, evaluating, and communicating information and constructing explanations and designing solutions. The crosscutting concepts of patterns and cause and effect support the development of a deeper understanding.	

Learning Goals & (Primary Content Standards):	**Learning Objectives (Identify the DOK Level):**
• NJSLS-S-HS-LS4-1 Students identify and communicate connections between each line of evidence and the claim of common ancestry and biological evolution. • NJSLS-S-HS-LS4-3 Apply concepts of statistics and probability to support explanations that organisms with an advantageous heritable	• HS-LS4-4 Students construct an explanation that identifies the cause and effect relationship between natural selection and adaptation. • Students identify and describe the evidence to construct their explanation, including: changes in a population when some feature of the environment changes, relative survival rates of organisms with different traits in a specific

Learning Goals & (Primary Content Standards):	Learning Objectives (Identify the DOK Level):
trait tend to increase in proportion to organisms lacking this trait. • NJSLS-S-HS-LS4-4 Construct an explanation based on evidence for how natural selection leads to adaptation of populations. • NJSLS-S-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. • NJSLS-S-HS-LS2-8 . Evaluate the evidence for the role of group behavior on individual and species' chances to survive and reproduce. • NJSLS-S-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.	environment, the fact that individuals in a species have genetic variation that is passed on to their offspring, and the fact that individuals can have specific traits that give them a competitive advantage relative to other individuals in the species. • Students use reasoning to construct the explanation about how natural selection provides a mechanism for • species to adapt to changes in their environment, including the following elements: - Biotic and abiotic differences in ecosystems contribute to changes in gene frequency overtime through natural selection. - Increasing gene frequency in a population results in an increasing fraction of the population in each successive generation that carries a particular gene and expresses a particular trait. - Over time, this process leads to a population that is adapted to a particular environment by the widespread expression of a trait that confers a competitive advantage in that environment. • HS-LS4-3 Students organize data by the distribution of genetic traits over time, describe what each dataset represents and use appropriate statistical analyses of data to determine patterns of change in numerical distribution of traits over various time and population scales. • Students use the data analyses as evidence to support explanations that natural selection is the cause of increases and decreases in heritable traits over time in a population, but only if it affects reproductive success; and the changes in distribution of adaptations of anatomical, behavioral, and physiological traits in a population. • HS-LS4-5 Students identify the given claims, which include the idea that changes in environmental conditions may result in: Increases in the number of individuals of some species; The emergence of new species over time; and the extinction of other species. • HS-LS2-8 Students identify the given explanation that is supported by the evidence to be evaluated, and which includes the following idea: Group behavior can increase the chances for an individual and a species to survive and reproduce. • HS-LS4-2 Students construct an explanation that includes a description that evolution is caused primarily by one or more of the four factors: (1) the potential for a species to increase in number, (2) the heritable genetic

Learning Goals & (Primary Content Standards):	Learning Objectives (Identify the DOK Level):
	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.

Essential Questions: (higher level questions that need to be considered/answers; are open and broad)	**Enduring Understandings:** (general/transferable ideas to other contexts)
How can there be so many similarities among organisms yet so many different plants, animals, and microorganisms? What evidence shows that different species are related?	Students will understanding that… • Natural selection leads to adaptation, which results in a change in gene frequency over time of population. An adaptation in a population is 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. • 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. Group behavior has evolved because membership can increase the chances of survival for individuals and their genetic relatives. • Evidence for evolution includes: DNA sequencing, embryology, comparative anatomy, and the fossil record. • 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.

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Secondary Assessments (Formative)	Primary Assessments (Summative)
CER – Written explanation of how natural selection leads to adaptation and therefore evolution. Student choice: • Human Skin Color • Beaks of Finches • Peppered Moth Simulation analysis questions: Human Skin Color, Bird Beak Adaptations, AND/OR Peppered Moth	Unit 5 Test Writing Task – Written explanation of how natural selection leads to adaptation and therefore evolution. Student choice: • Human Skin Color • Beaks of Finches • Peppered Moth

Interdisciplinary Connections: CORE AREA CONNECTIONS

NJSLS:
Literacy
NJSLS.RST-11.12.1
NJSLS.RST-11.12.8
NJSLS.WHST.9-12.2
NJSLS.WHST.9-12.9
NJSLS.SL.11-12.4

Mathematics
NJSLS.MATH.PRACTICE.MP.2
NJSLS.MATH.PRACTICE.MP.4

Career Ready Practices: Note applicable CRPs used within the unit.

CLKS.1
CRP2
CRP4
CLKS.4
CRP7
CLKS.6
CLKS.8
CLKS.9

Career Readiness, Life Literacies, & Key Skills (21st Century Themes & Skills): Note applicable 2020 NJ standards 9.1, 9.2, 9.3, or 9.4 within the unit.
Financial Literacy NJSLS.9.1.12.A.11 NJSLS.9.1.12.F.1 Career Exploration NJSLS.9.3.12.ST-ET.1 NJSLS.9.3.12.ST-ET.2 NJSLS.9.3.12.ST-ET.3 NJSLS.9.3.12.ST-ET.6 NJSLS.9.3.12.ST-SM.1 NJSLS.9.3.12.ST-SM.2 NJSLS.9.3.12.ST-SM.3 NJSLS.9.3.12.ST-SM.4
Integration of Technology: Note applicable 2020 standards 8.1 & 8.2 used within the unit.
NJSLS.9.4.12.TL.1 NJSLS.9.4.12.DC.2 NJSLS.9.4.12.TL.4 NJSLS.8.1.12.D.3 NJSLS.8.1.12.E.1 NJSLS.8.1.12.F.1 NJSLS.8.2.12.B.2 NJSLS.8.2.12.ETW.4 NJSLS.8.2.12.C.7 NJSLS.8.2.12.D.4
Course/Unit Resources:
Texts/Materials: Postlethwait, John H. Modern Biology. Student Ed. Place of Publication Not Identified: Holt, Rinehart and Winston, 2009. Print.

Unit 6 Title: Human Impact on the Environment	**Unit Length Months/Weeks: June**
Unit Description: In this unit of study, students examine factors that have influenced the distribution and development of human society; these factors include climate, natural resource availability, and natural disasters. Students use computational representations to analyze how earth systems and their relationships are being modified by human activity. Students also develop an understanding of how human activities affect natural resources and of the interdependence between humans and Earth's systems, which affect the availability of natural resources. Students will apply their engineering capabilities to reduce human impacts on earth systems and improve social and environmental cost–benefit ratios. The crosscutting concepts of cause and effect, systems and systems models, stability and change, and the influence of engineering, technology, and science on society and the natural world are called	

Unit 6 Title: Human Impact on the Environment	Unit Length Months/Weeks: June
out as organizing concepts for the disciplinary core ideas. Students will analyze and interpret data, use mathematical and computational thinking, and construct explanations as they demonstrate understanding of the disciplinary core ideas. In this unit of study, mathematical models provide support for students' conceptual understanding of systems and students' ability to design, evaluate, and refine solutions for reducing the impact of human activities on the environment and maintaining biodiversity. Students create or revise a simulation to test solutions for mitigating adverse impacts of human activity on biodiversity. Crosscutting concepts of systems and system models play a central role in students' understanding of science and engineering practices and core ideas of ecosystems. Mathematical models also provide support for students' conceptual understanding of systems and their ability to develop design solutions for reducing the impact of human activities on the environment and maintaining biodiversity.	

Essential Questions: (higher level questions that need to be considered/answers; are open and broad)	**Enduring Understandings:** (general/transferable ideas to other contexts)
• How do humans depend on Earth's resources? • How and why do humans interact with their environment and what are the effects of these interactions?	Students will understanding that… • Natural hazards and other geologic events have significantly altered the sizes of human populations and have driven human migration and human activities. • Current science is studying how the ocean, the atmosphere, and the biosphere interact and are modified in response to human activities—including habitat destruction, pollution, introduction of invasive species, overexploitation, and climate change. Changes in climate can affect population or drive mass migration. Current models predict that, although future regional climate changes will be complex and will vary, average global temperatures will continue to rise. • New technologies developed by engineers can have deep impacts on society and the environment, including some that are not anticipated. • The sustainability of human societies and the biodiversity that supports them require responsible management of natural resources. Biodiversity is increased by the formation of new species (speciation) and decreased by the loss of species (extinction). Thus sustaining biodiversity so that ecosystems' 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. • New technologies can have deep impacts on society and the environment, including some that were not anticipated.

Learning Goals & (Primary Content Standards):	Learning Objectives (Identify the DOK Level):
• ESS3.A&B: Natural Resources Students will understand that resource availability, natural hazards, and other geologic events have shaped the course of human history and guided the development of human society. • ESS2.D: Weather and Climate Students will be able to understand that current models predict that, although future regional climate changes will be complex and varied, average global temperatures will continue to rise. The outcomes predicted by global climate models strongly depend on the amounts of human-generated greenhouse gases added to the atmosphere each year and by the ways in which these gases are absorbed by the ocean and biosphere. (secondary) • ESS3.D: Global Climate Change Students will understand that through computer simulations of human impact we are able to model, predict and manage our current and future impact on the ocean, the atmosphere, and the biosphere. • LS4.D: Biodiversity and Humans Students will understand that 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. In order to mitigate the problem, humans need to manage natural resources. • ESS3.C: Human Impacts on Earth Systems Students will understand that while scientists and engineers developing technologies that curb negative human impact on the earth, they must also take into account a variety of constraints, including cost, safety, reliability, and aesthetics, and to consider social, cultural, and environmental impacts. (secondary) • ETS1.A&C: Defining and Delimiting Engineering Problems & Optimizing the Design Solution - Students will understand that scientists and engineers must approach criteria and constraints systematically while also satisfying any requirements set by society, such as taking issues of risk mitigation into account, and they should be quantified to the extent possible and stated in such a way that one can tell if a given design meets them. • ESS3.A&B: Natural Resources - Students will understand that resource	• HS-ESS3-1 Students construct an explanation that includes: • -Specific cause and effect relationships between environmental factors (natural hazards, changes in climate, and the availability of natural resources) and features of human societies including population size and migration patterns; and that technology in modern civilization has mitigated some of the effects of natural hazards, climate, and the availability of natural resources on human activity. • HS-ESS3-6 Students identify and describe the relevant components of each of the Earth systems modeled in the given computational representation, including system boundaries, initial conditions, inputs and outputs, and relationships that determine the interaction • HS-ESS3-5 Students organize data (e.g., with graphs) from global climate models (e.g., computational simulations) and climate observations over time that relate to the effect of climate change on the atmosphere, geosphere, hydrosphere, or cryosphere. • HS-ESS3-4 Students use scientific information to investigate a number of possible refinements to a given technological solution to a problem caused my human activities. • HS-ESS3-3 Students describe simplified realistic relationships between computer simulation resources to indicate an understanding of the factors (e.g., costs, availability of technologies) that affect the management of natural resources, human sustainability, and biodiversity. • HS-LS4-6 Students create or revise a simulation that: o Models effects of human activity (e.g., overpopulation, overexploitation, adverse habitat alterations, pollution, invasive species, changes in climate) on a threatened or endangered species or to the genetic variation within a species o Provides quantitative information about the effect of the solutions on threatened or endangered species. • HS-LS2-7 Students 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-ETS1-1 Students analyze a major global problem. In their analysis, students: o Describe the challenge with a rationale for why it is a major

Learning Goals & (Primary Content Standards):	Learning Objectives (Identify the DOK Level):
availability, natural hazards, and other geologic events have shaped the course of human history and guided the development of human society. • ESS2.D: Weather and Climate Students will be able to understand that current models predict that, although future regional climate changes will be complex and varied, average global temperatures will continue to rise. The outcomes predicted by global climate models strongly depend on the amounts of human-generated greenhouse gases added to the atmosphere each year and by the ways in which these gases are absorbed by the ocean and biosphere. (secondary) • ESS3.D: Global Climate Change Students will understand that through computer simulations of human impact we are able to model, predict and manage our current and future impact on the ocean, the atmosphere, and the biosphere. • LS4.D: Biodiversity and Humans - Students will understand that 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. In order to mitigate the problem, humans need to manage natural resources. • ESS3.C: Human Impacts on Earth Systems - Students will understand that while scientists and engineers developing technologies that curb negative human impact on the earth, they must also take into account a variety of constraints, including cost, safety, reliability, and aesthetics, and to consider social, cultural, and environmental impacts. (secondary) • ETS1.A&C: Defining and Delimiting Engineering Problems & Optimizing the Design Solution - Students will understand that scientists and engineers must approach criteria and constraints systematically while also satisfying any requirements set by society, such as taking issues of risk mitigation into account, and they should be quantified to the extent possible and stated in such a way that one can tell if a given design meets them.	global challenge; o Describe, qualitatively and quantitatively, the extent and depth of the problem and its major consequences to society and/or the natural world on both global and local scales if it remains unsolved; and -Document background research on the problem from two or more sources, including research journals. • HS-ETS1-2 - Students practice defining the problem by creating sub-problems and proposing solutions based on research and criteria. • HS-ETS1-3 - Students refining and/or optimize the design solution • and in their evaluation, students describe which parts of the complex real-world problem may remain even if the proposed solution is implemented. • HS-ETS1-4 - Students identify the constraints and implications of computer simulations used to study the relationships between environmental factors and human activity.

Secondary Assessments (Formative)	Primary Assessments (Summative)
Group Jigsaw/whiteboarding: greenhouse effect, climate change, and human impact on carbon cycle Google Timeline: Historical Context of climate change Human society based on availability of natural resources o Human Population growth analysis o Limiting factors for humans on earth articles Management of natural resources and biodiversity (technology) o Invasive Species Slide (Biome Project) – Extension for Advanced Students o Endangered Species Slide (biome Project) Case study on natural disasters that impacted human history/evolution/extinction o Optional Simulation analysis questions: Coral Reef (Gizmo) o Project: Reduce Human Impact- students research an environmental issue and develop a solution.	Project: Reduce Human Impact Writing Task (Student choice) – Written explanation of how human activities affect climate change OR biodiversity OR human evolution

Interdisciplinary Connections: CORE AREA CONNECTIONS
Literacy NJSLS.RST.9-10.8 NJSLS.RST.11-12.1 NJSLS.RST.11-12.7 NJSLS.RST.11-12.8 NJSLS.WHST.9-12.5 NJSLS.WHST.9-12.7 Mathematics NJSLS.MATH.PRACTICE.MP.2 NJSLS.MATH.PRACTICE.MP.4 NJSLS.HSN.Q.A.1 NJSLS.HSN.Q.A.2 NJSLS.HSN.Q.A.3
Career Ready Practices: Note applicable CRPs used within the unit.
Career Ready Practices CLKS.1. CRP2. CRP4.

CLKS.3.
CLKS.4.
CRP7.
CLKS.5.
CLKS.6.
CLKS.7.
CLKS.8.
CLKS.9

Career Readiness, Life Literacies, & Key Skills (21st Century Themes & Skills): Note applicable 2020 NJ standards 9.1, 9.2, 9.3, or 9.4 within the unit.

Career Exploration
NJSLS.9.2.12.CAP.6
NJSLS.9.2.12.PB.3
NJSLS.9.2.12.CAP.7

Financial Literacy
NJSLS.9.1.12.CI.2
NJSLS.9.2.12.CAP.1
NJSLS.9.2.12.FP.7
NJSLS.9.1.12.EGI.2
NJSLS.9.1.12.RMI.2
NJSLS.9.1.12.EGI.6
NJSLS.9.1.12.RMI.1
NJSLS.9.1.12.FP.5
NJSLS.9.1.12.EGI.4
NJSLS.9.1.12.EGI.5

Integration of Technology: Note applicable 2020 standards 8.1 & 8.2 used within the unit.

Technology
NJSLS.8.1.12.DA.1
NJSLS 9.3.ST.2
NJSLS 9.4.12.TL.1
NJSLS 8.1.12.C.1
NJSLS 8.1.12.E.1
NJSLS 8.2.12.ITH.2
NJSLS 8.2.12.ITH.1
NJSLS. 8.2.12.ETW.4
NJSLS 9.4.12.CT.1

Course/Unit Resources:

Texts/Materials:

Postlethwait, John H. Modern Biology. Student Ed. Place of Publication Not Identified: Holt, Rinehart and Winston, 2009. Print.