Englewood Public School District
Science
Biology
Third Marking Period

Unit 4: Human Activity and Biodiversity

Overview: 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.

Time Frame: 15 to 20 Days

Enduring Understandings:
The sustainability of human societies and the biodiversity that supports them require responsible management of natural resources.
Changes in the environment—including habitat destruction, pollution, introduction of invasive species, overexploitation, and climate change—can disrupt an ecosystem and threaten the survival of some species.
Sustaining biodiversity so that ecosystems' functioning and productivity are maintained is essential to supporting and enhancing life on Earth.

Essential Questions:
How might we change habits if we replaced the word "environment" with the word "life support system"?
Does reducing human impacts on our global life support system require social engineering or mechanical engineering?
Is the damage done to the global life support system permanent?

Standards	Topics and Objectives	Activities	Resources	Assessments
(HS-ESS3-3) **Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity.**	**Topics** Human Impact on the Environment Biodiversity Twenty-First Century Themes and Skills include:	Students will complete the investigations, labs, and activities: 1. Watch Untamed Science Chapter 6 video introduction via https://www.pearsonrealize.com 2. Global warming faucet,	**Text:** Miller & Levine Biology **Materials:** *See investigations, labs and activities material lists* For How Biodiversity Can Stop a Disease from Spreading	**Formative Assessments:** • Journals • Learning/Response Logs • Discussions • Student portfolios will be used to monitor progress

(HS-LS2-7)
Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.

(HS-LS4-6)
Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity.

(HS-ETS1-1)
Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.

(HS-ETS1-2)
Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

- The Four C's
- Life and Career Skills
- Information and Media literacy
- Environmental Literacy
- Global Awareness

Objectives

Students will:

Use empirical evidence to make claims about the impacts of human activity on biodiversity.

Analyze costs and benefits of a solution to mitigate adverse impacts of human activity on biodiversity.

hose, bucket, sink activity and associated critical thinking questions.

3. Global climate change graph research, creation, and analysis.
4. Clean technologies student project and rubric.
5. Human impact on the environment video/text debate.

(CRP5)

Students will complete the hands-on activity How Biodiversity Can Stop a Disease from Spreading.
(N-Q.A.2, HS-ESS3-3)

Students will watch a video Why is Biodiversity So Important? and participate in an online quiz and discussion.
(HS-ETS1-1, CRP11)

Students will watch a segment of a NASA video Earth: Planet of Altered States and discuss how the earth is constantly changing.
(HS-ETS1-2, MP2, 6.1.12.D.16.b)

Students will investigate how much land area it takes to support their lifestyle using the Ecological Footprint Calculator.
(HS-LS4-6, 8.2.12.C.4)

Students investigate how much energy they use at school and the financial and environmental

- Printed Biodiversity Tree Cards

Websites:

- Ecological Footprint Calculator
- National Climate Assessment
- Environmental Change Model
- Climate Reanalyzer
- https://www.pearsonrealize.com

Videos:

- Why is Biodiversity So Important?
- Earth: Planet of Altered States

Enrichment Lesson Plans:
See Carbon Stabilization Wedge Game

Additional Resources:
https://sciencing.com/humans-affected-planets-biodiversity-positive-negative-ways-2286.html

http://ete.cet.edu/gcc/?/bio_loss_of_diversity_humact/

http://www.fao.org/agriculture/crops/thematic-sitemap/theme/spi/soil-biodiversity/effect-of-human-activity-on-biodiversity/en/

Summative Assessments:
Student needs will be evaluated after completing the How Biodiversity Can Stop a Disease from Spreading activity.

Students will be evaluated using a rubric for the *Clean technologies student project*.

Student will demonstrate understanding of concepts by completing end of lesson quizzes via https://www.pearsonrealize.com.
Online Quiz

Benchmark Assessment:
Common Formative Assessment

Alternative Assessments:
Students will use empirical evidence to make claims about the impacts of human activity on biodiversity.
Charts, Note-taking, Research, Mini-lessons, Questioning, Discussion

Students will design a solution for a proposed problem related to threatened or endangered species.
Computer Research, Journals, Field Assignments, Peer Assessments, Visual Presentations

(HS-ETS1-3) **Evaluate a solution to a complex real-world problem based on prioritized criteria and tradeoffs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.** **(HS-ETS1-4)** **Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.**		cost in the activity Know Your Energy Costs. (N-Q.A.1, MP.4, HS-ETS1-3, RST.11-12.1) Students explore the National Climate Assessment to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity. (HS-ETS1-4, RST.11-12.7) Students use the Environmental Change Model of the Climate Reanalyzer to study the feedbacks in the climate system. (9.3.ST.2, RST.11-12.9) **Enrichment Activity:** Students play a Carbon Stabilization Wedge game in order to evaluate competing design solutions for developing, managing, and utilizing energy resources based on cost-benefit ratios. (N-Q.A.3, 9.3.ST.2, CRP5, RST.11-12.8)	http://www.greenfacts.org/en/biodiversity/ **Books:** https://www.goodreads.com/shelf/show/biodiversity https://www.questia.com/library/science-and-technology/environmental-and-earth-sciences/biodiversity https://books.google.com/books/about/Biodiversity.html?id=WM0flbmDrLsC https://www.goodreads.com/book/show/318225.Our_Ecological_Footprint https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1852758/	Students will analyze costs and benefits of a solution to mitigate adverse impacts of human activity on biodiversity. Conferencing/Reviews, Business Games, Practice Presentations Students will design, evaluate, and refine a solution for reducing the impacts of human activities on the environment. Response Log, Observation, Hold Mock Council Meeting, Questioning, Discussion

Accommodations and Modifications:

Students with special needs: Support staff will be available to aid students related to IEP specifications. 504 accommodations will also be attended to by all instructional leaders. Physical expectations and modifications, alternative assessments, and scaffolding strategies will be used to support this learning.
The use of Universal Design for Learning (UDL) will be considered for all students as teaching strategies are considered.

ELL/ESL students: Students will be supported according to the recommendations for "can do's" as outlined by WIDA –

https://www.wida.us/standards/CAN_DOs/

This particular unit has limited language barriers due to the physical nature of the curriculum.

Students at risk of school failure: Formative and summative data will be used to monitor student success at first signs of failure student work will be Reviewed to determine support. This may include parent consultation, basic skills review and differentiation strategies. With considerations to UDL, time may be a factor in overcoming developmental considerations. More time and will be made available with a certified instructor to aid students in reaching the standards.

Gifted and Talented Students: Students excelling in mastery of standards will be challenged with complex, high level challenges related to the complexity in planning and carrying out investigations and analyzing and interpreting data.

English Language Learners	**Special Education**	**At-Risk**	**Gifted and Talented**
● Pre-teach vocabulary ● Speak and display terminology ● Teacher modeling ● Peer modeling ● Provide ELL students with multiple literacy strategies. ● Word walls ● Use peer readers ● Give page numbers to help the students find answers ● Provide a computer for written work ● Provide two sets of textbooks, one for home and one for school ● Provide visual aides ● Provide additional time to complete a task ● Use graphic organizers	● Provide guided notes ● Utilize modifications & accommodations delineated in the student's IEP ● Work with paraprofessional ● Use multi-sensory teaching approaches. ● Work with a partner ● Provide concrete examples ● Restructure lesson using UDL principals (http://www.cast.org/our-work/about-udl.html#.VXmoXcfD_UA). ● Provide students with multiple choices for how they can represent their understandings (e.g. multisensory techniques-auditory/visual aids;	● Provide guided notes ● Using visual demonstrations, illustrations, and models ● Give directions/instructions verbally and in simple written format. Oral prompts can be given. ● Peer Support ● Increase one on one time ● Teachers may modify instructions by modeling what the student is expected to do ● Instructions may be printed out in large print and hung up for the student to see during the time of the lesson. ● Review behavior expectations and make adjustments for personal space or other behaviors as needed. ● Structure lessons around questions that are authentic, relate to students' interests, social/family background and knowledge of their community.	● Inquiry-based instruction ● Independent study ● Higher order thinking skills ● Adjusting the pace of lessons ● Interest based content ● Real world scenarios ● Student Driven Instruction ● Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understandings. ● Use project-based science learning to connect science with observable phenomena. ● Structure the learning around explaining or solving a social or community-based issue. ● Collaborate with after-school programs or clubs to extend learning opportunities.

	pictures, illustrations, graphs, charts, data tables, multimedia, modeling).	• Provide opportunities for students to connect with people of similar backgrounds (e.g. conversations via digital tool such as SKYPE, experts from the community helping with a project, journal articles, and biographies).	

Interdisciplinary Connections:

ELA-NJSLS/ELA:

RST.11-12.1: Accurately cite strong and thorough evidence from the text to support analysis of science and technical texts, attending to precise details for explanations or descriptions. (HS-ETS1-3)

RST.11-12.7 : Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem. (HS-ETS1-3)

RST.11-12.8: Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. (HS-ETS1-3)
RST.11-12.9: Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible. (HS-ETS1-3).

Mathematics:
MP.2: Reason abstractly and quantitatively. (HS-LS2-7), (HS-ETS1-3)
MP.4: Model with mathematics. (HS-ETS1-3)
N-Q.A.1: Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. (HS-LS2-7)
N-Q.A.2: Define appropriate quantities for the purpose of descriptive modeling. (HS-ETS1-3)
N-Q.A.3: Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (HS-ETS1-3)

Social Studies:
6.1.12.D.16.b: Explain how and why technology is transforming access to education and educational practices worldwide.

Career Ready Practices:
CRP5: Consider the environmental, social and economic impacts of decisions.
CRP11: Use technology to enhance productivity**.**

Integration of Technology Standards NJSLS 8:
8.2.12.C.4: Explain and identify interdependent systems and their functions.

Integration of 21st Century Standards NJSLS 9:
9.3.ST-ET.2: Display and communicate STEM information.
9.3.ST.2: Use technology to acquire, manipulate, analyze and report data.

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting 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. (HS-ESS3-1) • Design or refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations. (HS-ESS3-4) **Analyzing and Interpreting Data** • Analyze data using computational models in order to make valid and reliable scientific claims. (HS-ESS3-5) **Using Mathematics and Computational Thinking** • Use a computational representation of phenomena or design solutions to describe and/or support claims and/or explanations. (HS-ESS3-6)	**ESS3.A: Natural Resources** • Resource availability has guided the development of human society. (HS-ESS3-1) **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. (HS-ESS3-1) **ESS2.D: Weather and Climate** • 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 to HS-ESS3-6) **ESS3.D: Global Climate Change** • Through computer simulations and other studies, important discoveries are still being made about how the ocean, the atmosphere, and the biosphere interact and are modified in response to human activities. (HS-ESS3-6)	**Cause and Effect** • Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. (HS-ESS3-1) **Systems and System Models** • When investigating or describing a system, the boundaries and initial conditions of the system need to be defined and their inputs and outputs analyzed and described using models. (HS-ESS3-6) **Stability and Change** • Feedback (negative or positive) can stabilize or destabilize a system. (HSESS3-4) ---------- ***Connections to Engineering, Technology, and Applications of Science*** **Influence of Science, Engineering, and Technology on Society and the Natural World** • New technologies can have deep impacts on society and the environment, including some that were not anticipated. Analysis of costs and benefits is a critical aspect of decisions about technology. (HS-ETS1-1) (HS-ETS1-3)

		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. (HS-ETS1-3)		

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Unit 5: DNA and Inheritance

Overview: 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.

Time Frame: 25 to 30 Days

Enduring Understandings:
Each chromosome consists of a single, very long DNA molecule, and each gene on the chromosome is a particular segment of that DNA.
Not all DNA codes for a protein; some segments of DNA are involved in regulatory or structural functions, and some have, as yet, no known function.
All cells in an organism have the same genetic content, but the genes used (expressed) by the cell may be regulated in different ways.
Environmental factors can affect the expression of traits and also cause mutations in genes.

Essential Questions:
How are characteristics from one generation related to the previous generation?
How does inheritable genetic variation occur?
Can the distribution of expressed traits in a population be predicted?

Standards	Topics and Objectives	Activities	Resources	Assessments
(HS-LS3-1) **Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring.** **(HS-LS3-2)** **Make and defend a claim based on evidence that inheritable genetic variations may result from: (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors.**	**Topics** Meiosis Chromosomes Mutations Punnett Squares/Probability Patterns of Inheritance Pedigrees Genetic Engineering Twenty-First Century Themes and Skills include: • The Four C's • Life and Career Skills • Information and Media literacy **Objectives** Students will:	Students will complete the investigations, labs, and activities: 1. Watch Untamed Science Chapters 11, 14, and 15 video introduction via https://www.pearsonrealize.com 2. Somatic cell vs. gamete investigation- Shuffling genes through crossing over. 3. Karyotype hands on activity and related disorders- probability of such disorders and whether amniocentesis or chorionic villus sampling is warranted. 4. Cancer research investigation benign vs. malignant tumors. - DNA mutation group work activity, additions, deletions, frameshift mutations. 5. Pedigree analysis and	**Text:** Miller & Levine Biology **Materials:** *See investigations, labs and activities material lists* For Inheritance of Genetic Disorders • Index cards of two different colors (one of each color card per student) **Websites:** • What is Meiosis? • Geniverse • Genetics Web Labs • Gene Expression - The Basics • Mutations • Nutrition and the Epigenome • https://www.pearsonrealize.com **Videos:**	**Formative Assessments:** • Journals • Learning/Response Logs • Discussions • Student portfolios will be used to monitor progress **Summative Assessments:** Student needs will be evaluated after completing the What is Meiosis? online activity and A Recipe for Traits activity. Response Journals Students will receive a grade for the *Lab - Probability and Statistics conclusions.* Student will demonstrate understanding of concepts by completing end of lesson quizzes via https://www.pearsonrealize.c

(HS-LS3-3) **Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population.**	Make claims about the role of DNA and chromosomes in coding the instructions for characteristics passed from parents to offspring. Use data to support arguments for the ways inheritable genetic variation occurs. Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population.	probability that recessive disorders pass down through generations. 6. Punnett square analysis- chances of passing on traits to offspring. 7. Lab - Probability and Statistics. 8. Human genetics group activity with student traits- analyzation of class distribution and comparison to law of dominance. 9. Genetic Engineering pros and cons literature reading. 10. Genetically Modified Organisms Ethical Debate. (HS-LS3-3) Students will simulate meiosis and fertilization in dragons in the What is Meiosis? online activity. (HS-LS3-1) Students will create and decode a "DNA recipe" to observe how variations in DNA lead to the inheritance of different traits during the A Recipe for Traits activity. (HS-LS3-1, WHST.9-10.7) Students investigate dragon phenotypes and genotypes, run breeding experiments and solve genetic problems in the virtual lab Geniverse. Students will explore interactive Genetics Web Labs to model Mendel's	• Building a Dinosaur From A Chicken • Epigentic: Why Inheritance is Weirder Than We Thought **Enrichment Lesson Plans:** See Nutrition and the Epigenome and Structure and Function: Stem Cell **Additional Resources:** http://dnaftb.org/5/ https://www.yourgenome.org/facts/what-is-inheritance https://www.ncbi.nlm.nih.gov/books/NBK9944/ https://ghr.nlm.nih.gov/primer https://geneed.nlm.nih.gov/topic_subtopic.php?tid=5 https://isogg.org/wiki/Beginners%27_guides_to_genetic_genealogy	om. **Benchmark Assessment:** See Unit 4 for quarterly assessment **Alternative Assessment:** Student will apply genetics concepts to research and present information about the Inheritance of Genetic Disorders. Computer Research, Simulation, Self-Assessments

		Experiments, Crossing Over, Meiosis, and Patterns of Inheritance. (HS-LS3-2, WHST.11-12.8) Students will simulate the creation of proteins in Gene Expression - The Basics. Students explore how changes in DNA cause Mutations in an interactive simulation. (HS-LS3-3, MP.2, SL.11-12.5) Student will model and research the Inheritance of Genetic Disorders. (HS-LS3-2, 8.2.12.C.4, MP.4) Students will watch the video Building a Dinosaur From A Chicken and participate in an online quiz and discussion. **Enrichment Activities:** Students will discover how diet effect gene expression by visiting the website Nutrition and the Epigenome. (N-Q.A.1, CRP11) Student will watch the video Epigentic: Why Inheritance is Weirder Than We Thought. Students will investigate how stem cells become specialized in the hands on simulation Structure and Function: Stem Cell. (9.3.ST.2, 6.1.12.D.16.b, CRP5)

Accommodations and Modifications:

Students with special needs: Support staff will be available to aid students related to IEP specifications. 504 accommodations will also be attended to by all instructional leaders. Physical expectations and modifications, alternative assessments, and scaffolding strategies will be used to support this learning. The use of Universal Design for Learning (UDL) will be considered for all students as teaching strategies are considered.

ELL/ESL students: Students will be supported according to the recommendations for "can do's" as outlined by WIDA – https://www.wida.us/standards/CAN_DOs/
This particular unit has limited language barriers due to the physical nature of the curriculum.

Students at risk of school failure: Formative and summative data will be used to monitor student success at first signs of failure student work will be Reviewed to determine support. This may include parent consultation, basic skills review and differentiation strategies. With considerations to UDL, time may be a factor in overcoming developmental considerations. More time and will be made available with a certified instructor to aid students in reaching the standards.

Gifted and Talented Students: Students excelling in mastery of standards will be challenged with complex, high level challenges related to the complexity in planning and carrying out investigations and analyzing and interpreting data.

English Language Learners	**Special Education**	**At-Risk**	**Gifted and Talented**
● Use project-based science learning to connect science with observable phenomena. ● Speak and display terminology ● Teacher modeling ● Peer modeling ● Provide ELL students with multiple literacy strategies. ● Word walls ● Use peer readers ● Give page numbers to help the students find	● Pre-teach vocabulary ● Utilize modifications & accommodations delineated in the student's IEP ● Work with paraprofessional ● Use multi-sensory teaching approaches. ● Work with a partner ● Provide concrete examples ● Restructure lesson using UDL principals (http://www.cast.org/our-work/about-udl.html#.VXmoXcfD_	● Pre-teach vocabulary ● Using visual demonstrations, illustrations, and models ● Give directions/instructions verbally and in simple written format. Oral prompts can be given. ● Peer Support ● Increase one on one time ● Teachers may modify instructions by modeling what the student is expected to do ● Instructions may be printed out in large print and hung up for the student to see during the time of the lesson. ● Review behavior	● Use project-based science learning to connect science with observable phenomena. ● Curriculum compacting ● Inquiry-based instruction ● Independent study ● Higher order thinking skills ● Adjusting the pace of lessons ● Interest based content ● Real world scenarios ● Student Driven Instruction ● Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understandings. ● Structure the learning around

answers ● Provide a computer for written work ● Provide two sets of textbooks, one for home and one for school ● Provide visual aides ● Provide additional time to complete a task ● Use graphic organizers	UA). ● Provide students with multiple choices for how they can represent their understandings (e.g. multisensory techniques-auditory/visual aids; pictures, illustrations, graphs, charts, data tables, multimedia, modeling).	expectations and make adjustments for personal space or other behaviors as needed. ● Structure lessons around questions that are authentic, relate to students' interests, social/family background and knowledge of their community. ● Provide opportunities for students to connect with people of similar backgrounds (e.g. conversations via digital tool such as SKYPE, experts from the community helping with a project, journal articles, and biographies).	explaining or solving a social or community-based issue. ● Collaborate with after-school programs or clubs to extend learning opportunities.

Interdisciplinary Connections:

ELA-NJSLS/ELA:

WHST.9-10.7: Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. (HS-LS1-3)

WHST.11-12.8: Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation. (HS-LS1-3)

SL.11-12.5: Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest. (HS-LS1-2)

Social Studies:

6.1.12.D.16.b: Explain how and why technology is transforming access to education and educational practices worldwide.

Mathematics:
MP.2: Reason abstractly and quantitatively. (HS-LS2-7), (HS-ETS1-3)
MP.4: Model with mathematics. (HS-ETS1-3)
N-Q.A.1: Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. (HS-LS2-7)

Career Ready Practices:
CRP5: Consider the environmental, social and economic impacts of decisions.
CRP11: Use technology to enhance productivity**.**

Integration of Technology Standards NJSLS 8:
8.2.12.C.4: Explain and identify interdependent systems and their functions.

Integration of 21st Century Standards NJSLS 9:
9.3.ST-ET.2: Display and communicate STEM information.
9.3.ST.2: Use technology to acquire, manipulate, analyze and report data.

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Asking Questions and Defining Problems • Ask questions that arise from examining models or a theory to clarify relationships. (HS-LS3-1) **Constructing Explanations and Designing Solutions** • Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (HS-LS1-1) **Engaging in Argument from Evidence** • Make and defend a claim based on evidence	**LS1.A: Structure and Function** • All cells contain genetic information in the form of DNA molecules. Genes are regions in the DNA that contain the instructions that code for the formation of proteins. (secondary to HS-LS3-1) **LS3.A: Inheritance of Traits** • Each chromosome consists of a single very long DNA molecule, and each gene on the chromosome is a particular segment of that DNA. The instructions for forming species' characteristics are carried in DNA. All cells in an organism have the same genetic content, but the genes used (expressed) by the cell may be regulated in different ways. • Not all DNA codes for a protein; some segments of DNA are involved in regulatory	**Cause and Effect** • Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. (HSLS3-1; HSLS3-2) **Scale, Proportion, and Quantity** • Algebraic thinking is used to examine scientific data and predict the effect of a change in one variable on another (e.g., linear growth vs. exponential growth). (HS-LS3-3)

about the natural world that reflects scientific knowledge, and student-generated evidence. (HS-LS3-2) • Use an oral and written argument supported by evidence to support or refute an explanation or a model for a phenomenon. (MS-LS1-3) • Use an oral and written argument supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem. (MS-LS1-4)	or structural functions, and some have no as-yet known function. (HS-LS3-1) **LS3.B: Variation of Traits** • In sexual reproduction, chromosomes can sometimes swap sections during the process of meiosis (cell division), thereby creating new genetic combinations and thus more genetic variation. Although DNA replication is tightly regulated and remarkably accurate, errors do occur and result in mutations, which are also a source of genetic variation. Environmental factors can also cause mutations in genes, and viable mutations are inherited. (HS-LS3-2) • Environmental factors also affect expression of traits, and hence affect the probability of occurrences of traits in a population. Thus the variation and distribution of traits observed depends on both genetic and environmental factors. (HS-LS3-2; HS-LS3-3)	