Englewood Public School District
Science
Biology
Second Marking Period

Unit 2: Matter and Energy Transformations in Living Systems

Overview: In this unit of study, students construct explanations for the role of energy in the cycling of matter in organisms. They apply mathematical concepts to develop evidence to support explanations of the interactions of photosynthesis and cellular respiration and develop models to communicate these explanations. The crosscutting concept of *matter and energy* provides students with insights into the structures and processes of organisms. Students are expected to *develop and use models, plan and conduct investigations, use mathematical thinking*, and *construct explanations and design solutions* as they demonstrate proficiency with the disciplinary core ideas.

Time Frame: 20 to 25 Days

Enduring Understandings:
Energy cannot be created or destroyed—it only moves between one place and another place, between objects and/or fields, or between systems.
The process of photosynthesis converts light energy to stored energy by converting carbon dioxide plus water into sugars plus released oxygen.
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.
As matter and energy flow through different organizational levels of living systems, chemical elements are recombined in different ways to form different products.

Essential Questions:
How do organisms obtain and use the energy they need to live and grow?
How does photosynthesis transform light energy into stored chemical energy?
How does cellular respiration result in a net transfer of energy?
How do matter and energy cycle through ecosystems?
How can the process of photosynthesis and respiration in a cell impact ALL of Earth's systems?

Standards	Topics and Objectives	Activities	Resources	Assessments
(HS-LS1-5) **Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy.**	**Topics** Photosynthesis Respiration Fermentation	Students will complete the investigations, labs, and activities: 1. Watch Untamed Science Chapters 8 and 9 video introduction via https://www.pearsonrealiz	**Text:** Miller & Levine Biology **Materials:** *See investigations, labs and activities material lists*	**Formative Assessments:** • Journals • Learning/Response Logs • Discussions • Student portfolios

(HS-LS1-7)
Use a model to illustrate that cellular respiration is a chemical process whereby the bonds of food molecules and oxygen molecules are broken and the bonds in new compounds are formed resulting in a net transfer of energy.

(HS-LS1-6)
Construct and revise an explanation based on evidence for how carbon, hydrogen, and oxygen from sugar molecules may combine with other elements to form amino acids and/or other large carbon-based molecules.

(HS-LS2-3)
Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions.

(HS-LS2-5)
Develop a model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere.

Twenty-First Century Themes and Skills include:

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

Objectives

Students will:

Provide a mechanistic explanation for how photosynthesis transforms light energy into stored chemical energy.

Use their understanding of energy flow and conservation of energy to illustrate the inputs and outputs of matter and the transformation of energy in photosynthesis.

Construct an evidence-based model, to illustrate that cellular respiration is a chemical process whereby the bonds of food molecules and oxygen molecules are broken and the bonds in new compounds are formed, resulting in a net transfer of energy.

Use their understanding of energy flow and conservation of energy to illustrate the inputs and outputs of the process of cellular

e.com

2. Lab - Do Plants Release or Consume CO2
3. Lab - Effects of a Closed Environment on Living Things
4. Lab - Investigating photosynthesis- "Floating Leaf Disk Assay"
5. Lab - "The Small But Mighty Mitochondria
6. Making a mitochondrial model
7. Lab - Cellular respiration in Yeast lab
8. Mitochondria Research Report- Students research in detail cellular respiration using enzymes, chemiosmotic gradients, and mitochondrial evolution
9. Act out cellular respiration in the classroom
10. Experiment in calorimetry- Energy in a peanut
11. Lab - "The Heat is On"- Energy in different foods

(HS-LS1-5, CRP11, 8.2.12.C.4)

Students will investigate the chemical and energy inputs and outputs of photosynthesis through the interactive Leaf Photosynthesis Model.
(HS-LS1-7, HS-LS2-5, N-Q.A.1)

Students will explore how the body converts the chemical

Websites:

- Leaf Photosynthesis Model
- Cellular Respiration
- https://www.pearsonrealize.com

Videos:

- Nature's smallest factory: The Calvin cycle
- The Beneficial Bacteria that Make Delicious Food

Enrichment Lesson Plan:
See Eating and Exercise

Additional Resources:
https://www.thoughtco.com/cellular-respiration-process-373396

https://quizlet.com/10709249/matter-and-energy-transformations-flash-cards/

https://study.com/academy/practice/quiz-worksheet-types-of-energy-transformation.html

https://prezi.com/ck2ej_ny2uln/matter-and-energy-transformations/

Book:
Energy Transformations in Living Matter: A Survey Softcover reprint of the original 1st ed. 1957 Edition by Hans A. Krebs

will be used to monitor progress

Summative Assessments:
Student needs will be evaluated after completing the interactive Leaf Photosynthesis Model, the interactive Cellular Respiration simulation, and Nature's smallest factory: The Calvin cycle quiz
Models, Drawings, Interactive Learning Games

Students will receive a grade for the following lab activity conclusions: *Lab - Do Plants Release or Consume CO2, Lab - Effects of a Closed Environment on Living Things, Lab - Investigating photosynthesis- "Floating Leaf Disk Assay", Lab - "The Small But Mighty Mitochondria, Lab - Cellular respiration in Yeast lab*, and *Lab - "The Heat is On"- Energy in different foods.*

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:

	respiration. Use evidence from models and simulations to support explanations for how carbon, hydrogen, and oxygen from sugar molecules may combine with other elements to form amino acids and/or other large, carbon-based molecules.	energy of glucose into the chemical energy of ATP in the interactive Cellular Respiration simulation. (HS-LS2-3) Students will watch the video Nature's smallest factory: The Calvin cycle and participate in an online quiz and discussion. (N-Q.A.3) Students will observe the everyday uses of fermentation in the video The Beneficial Bacteria that Make Delicious Food. (SL.11-12.5) Students will make connections between photosynthesis, respiration, and the carbon cycle by participating the movement based activity Cruising Through the Carbon Cycle. (8.2.12.C.4, 6.1.12.D.16.b) **Enrichment Activity:** Student will look at energy input and output in the online simulation Eating and Exercise. (N-Q.A.2)	Students will develop a model, based on evidence, to illustrate the roles of photosynthesis and cellular respiration in the cycling of carbon. Model/Project, Drawings, Cycles Student will use a mathematical model of stored energy in biomass to describe the transfer of energy from one trophic level to another and to show how matter and energy are conserved as matter cycles and energy flows through ecosystems. Math Models, Projects, Peer Assessment, Discussion, Practice Presentation Students will use a mathematical model to describe the conservation of atoms and molecules as they move through an ecosystem. Model/Project, Drawings, Graphing, Checklist, Response Journals

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	● Chunk material into smaller parts ● 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.	● Chunk material into smaller parts ● 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,	● Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understandings. ● Inquiry-based instruction ● Independent study ● Higher order thinking skills ● Adjusting the pace of lessons ● Interest based content ● Real world scenarios ● Student Driven Instruction ● 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.

• Use graphic organizers	multisensory techniques- auditory/visual aids; pictures, illustrations, graphs, charts, data tables, multimedia, modeling).	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).	

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-LS2-3)

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-LS1-5)

Mathematics:
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-LS2-4)
N-Q.A.2: Define appropriate quantities for the purpose of descriptive modeling. (HS-LS2-4)
N-Q.A.3: Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (HSLS2-4)

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:
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 and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (HS-LS2-3)

Using Mathematics and Computational Thinking

- Use mathematical representations of phenomena or design solutions to support claims. (HS-LS2-4)

Developing and Using Models

- Develop a model based on evidence to illustrate the relationships between systems or components of a system. (HS-LS1-5),(HS-LS2-5)

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

- The process of photosynthesis converts light energy to stored chemical energy by converting carbon dioxide plus water into sugars plus released oxygen. (HS-LS1-1)

LS2.B: Cycles of Matter and Energy Transfer in Ecosystems

- Photosynthesis and cellular respiration (including anaerobic processes) provide most of the energy for life processes. (HS-LS2-3)
- Plants or algae form the lowest level of the food web. At each link upward in a food web, only a small fraction of the matter consumed at the lower level is transferred upward, to produce growth and release energy in cellular respiration at the higher level. Given this inefficiency, there are generally fewer organisms at higher levels of a food web. Some matter reacts to release energy for life functions, some matter is stored in newly made structures, and much is discarded. The chemical elements that make up the molecules of organisms pass through food webs and into and out of the atmosphere and soil, and they are combined and recombined in different ways. At each link in an ecosystem, matter and energy are conserved. (HS-LS2-4)
- Photosynthesis and cellular respiration are important components of the carbon cycle, in which carbon is exchanged among the biosphere, atmosphere, oceans, and geosphere through chemical, physical, geological, and biological processes. (HS-LS2-5)

Energy and Matter

- Changes of energy and matter in a system can be described in terms of energy and matter flows into, out of, and within that system. (HS-LS1-1)
- Energy drives the cycling of matter within and between systems. (HS-LS2-3)
- Energy cannot be created or destroyed—it only moves between one place and another place, between objects and/or fields, or between systems. (HS-LS2-4)

Systems and System Models

- Models (e.g., physical, mathematical, computer models) can be used to simulate systems and interactions—including energy, matter, and information flows—within and between systems at different scales. (HS-LS2-5)

Connections to Nature of Science

Scientific Knowledge is Open to Revision in Light of New Evidence

- Most scientific knowledge is quite durable, but is, in principle, subject to change based on new evidence and/or reinterpretation of existing evidence. (HS-LS2-3)

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Unit 3: Interdependent Relationships in Ecosystems

Overview: 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.

Time Frame: 20 -25 Days

Enduring Understandings:
Ecosystems have carrying capacities, which are limits to the number of organisms and populations they can support.
A complex set of interactions within an ecosystem can keep its numbers and types of organisms relatively constant over long periods of time under stable conditions.
If a modest biological or physical disturbance to an ecosystem occurs, it may return to its more or less original status (i.e., the ecosystem) as opposed to becoming a very different ecosystem.
Extreme fluctuations in conditions or the size of any population, however, can challenge the functioning of ecosystems in terms of resources and habitat availability.

Essential Questions:
How do organisms interact with the living and nonliving environments to obtain matter and energy?
When they relocate bears, wolves, or other predators, how do they know that they will survive?
What limits the number and types of different organisms that live in one place?
How can a small change in the environment devastate an ecosystem?

Standards	Topics and Objectives	Activities	Resources	Assessments
(HS-LS2-4) **Use mathematical representations to support claims for the cycling of**	**Topics** Food Webs	Students will complete the investigations, labs, and activities: 1. Watch Untamed Science	**Text:** Miller & Levine Biology **Materials:**	**Formative Assessments:** • Journals • Learning/Response Logs

matter and flow of energy among organisms in an ecosystem. **(HS-LS2-1)** **Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales.** **(HS-LS2-2)** **Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.** **(HS-LS2-6)** **Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem.**	Energy Flow in Ecosystems Community Interactions Populations Changes Twenty-First Century Themes and Skills include: • The Four C's • Environmental Literacy • Life and Career Skills • Information and Media literacy • Environmental Literacy **Objectives** Students will: Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales. Use the concept of orders of magnitude to represent how factors affecting biodiversity and populations in ecosystems at one scale relate to those factors at another scale. Construct explanations of how modest biological or physical changes versus extreme changes affect stability and change in ecosystems.	Chapters 3-5 video introduction via https://www.pearsonrealize.com 2. Create a food web that incorporates and explains the characteristics of producers, consumers and decomposers and illustrates the flow of energy and the cycling of matter in an ecosystem. 3. Use a mathematical formula to evaluate the energy efficiency of feeding at various trophic levels. 4. Trophic Level Activity - Energy (water) Bucket Brigade 5. Predator-Prey card game. 6. Symbiosis Math Symbol Jigsaw activity 7. Predator Prey Population Graph- Canadian Lynx and Snowshoe Hare 8. Research and write about the symbiotic relationship computer activity given 15 pairs of organisms 9. Lab - Carrying Capacity - space, resources, competition, disease. (HS-LS2-4, HS-LS2-1) Students will be introduced to Food Chains, Food Webs, and Energy Pyramids and play a Food Chain Hollywood Squares review game. (8.2.12.C.4, CRP11)	*See investigations, labs and activities material lists* For Trophic Levels Lab • Zip top bags • Popcorn **Websites:** • Population Explosion • African Lions Activity • https://www.pearsonrealize.com **Videos:** • Feedback loops: How nature gets its rhythms **Enrichment Lesson Plan:** See Of Microbes and Men **Additional Resources:** https://study.com/academy/exam/topic/interdependent-relationships-in-ecosystems.html Habitat Symbaloo Plants Grow Ecosystems San Diego Zoo San Francisco Zoo NatGeo for Kids Seaworld Animals https://quizlet.com/15594268/interdependent-relationships-ecosystems-flash-cards/	• Discussions • Student portfolios will be used to monitor progress **Summative Assessments:** Student needs will be evaluated after completing the Food Chain Hollywood Squares, Population Explosion, and African Lions Activity. Written Questions/Exercises Students will receive a grade for the *Lab - Carrying Capacity - space, resources, competition, disease* and *Trophic Levels Lab* conclusions. Labs, Writing Conclusions, Discussion, Journals Student will demonstrate understanding of concepts by completing end of lesson quizzes via https://www.pearsonrealize.com. Online quiz **Benchmark Assessment:** See Unit 2 for quarterly assessment **Alternative Assessments:** Students will use the concept of orders of magnitude to represent how factors affecting biodiversity and populations in ecosystems at

		Students will play the role of predators and prey in the Trophic Levels Lab. Students will complete the Population Explosion simulation to study how populations stay in balance with their environment and respond to various factors such as food supply and predators. (RST.11-12.8, RST.11-12.1) Students will use the data from the African Lions Activity to make a prediction regarding the zebra population during the periods of increase rainfall and explore the concept of carrying capacity. (HS-LS2-2, HS-LS2-6, N-Q.A.1, S-ID.A.1) Students will watch a video Feedback loops: How nature gets its rhythms and participate in an online quiz and discussion. (HS-LS2.6, RST.11-12.7, WHST.9-12.2) **Enrichment Activity:** Students will develop a model in the **Of Microbes and Men** activity to explanation of the effects of the environmental and human factors on the nitrogen cycle. (N-Q.A.2, N-Q.A.3, 9.4.12.B.3)	one scale relate to those factors at another scale. Graphic Organizers, Response Logs, Simulations

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**
● 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	● Provide one-on-one as needed ● 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-	● Chunk material into smaller parts ● 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	● Students will act as peer support ● 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. ● Use project-based science learning to connect science with observable phenomena.

and one for school ● Provide visual aides ● Provide additional time to complete a task ● Use graphic organizers	udl.html#.VXmoXcfD_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).	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).	● Structure the learning around 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:

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

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-LS2-6)

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

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

Mathematics:

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

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

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.

Career Ready Practices:
CRP11: Use technology to enhance productivity.

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Using Mathematics and Computational Thinking • Use mathematical and/or computational representations of phenomena or design solutions to support explanations. (HS-LS2-1) • Use mathematical representations of phenomena or design solutions to support and revise explanations. (HS-LS2-2) **Engaging in Argument from Evidence** • Evaluate the claims, evidence, and reasoning behind currently accepted explanations or solutions to determine the merits of arguments. (HS-LS2-6)	**LS2.A: Interdependent Relationships in Ecosystems** • Ecosystems have carrying capacities, which are limits to the numbers of organisms and populations they can support. These limits result from such factors as the availability of living and nonliving resources and from such challenges such as predation, competition, and disease. Organisms would have the capacity to produce populations of great size were it not for the fact that environments and resources are finite. This fundamental tension affects the abundance (number of individuals) of species in any given ecosystem. (HS-LS2-1),(HS-LS2-2) **LS2.C: Ecosystem Dynamics, Functioning, and Resilience** • A complex set of interactions within an ecosystem can keep its numbers and types of organisms relatively constant over long periods of time under stable conditions. If a modest biological or physical disturbance to an ecosystem occurs, it may return to its more or less original status (i.e., the ecosystem is resilient), as opposed to	**Scale, Proportion, and Quantity** • The significance of a phenomenon is dependent on the scale, proportion, and quantity at which it occurs. (HS-LS2-1) • Using the concept of orders of magnitude allows one to understand how a model at one scale relates to a model at another scale. (HS-LS2-2) **Stability and Change** • Much of science deals with constructing explanations of how things change and how they remain stable. (HS-LS2-6)

		becoming a very different ecosystem. Extreme fluctuations in conditions or the size of any population, however, can challenge the functioning of ecosystems in terms of resources and habitat availability. (HS-LS2-2),(HS-LS2-6)		