Hanover Township Public Schools

Science Curriculum

Grade 7

Philosophy

The Hanover Township School District's science curriculum encourages students to use inquiry based and problem solving approaches to understand science and engineering principles. By combining traditional science concepts (physical science, chemistry, biology, earth, space and environmental sciences) with the application of these concepts through engineering and technology, students will gain a greater understanding of the world around them. This curriculum is based on a coherent progression of concepts that allows students to continually build on and revise their knowledge.

Through the New Generation Science Standards, the "… students, over multiple years of school, actively engage in scientific and engineering practices and apply crosscutting concepts to deepen their understanding of the core ideas…". The intertwining of these three dimensions will allow a deeper understanding of science and engineering concepts and promote better problem solving skills.

Collaborative, student-centered lessons and cooperative learning is essential. Students will use evidence as a basis for analysis of data and arguments. Emphasis is on the integration of knowledge from a variety of resources and effective communication of an understanding of this knowledge to meet the performance expectations.

Adapted from

Framework for K-12 Science Education. Natl Academy Pr, 2011. Print.

Arrangement of Performance Expectations and Evidence Statements

	6th	7th	8th
Unit 1	History of the Earth **ESS1-4, ESS2-2, ESS2-3**	Structure, Function and Information Processing **LS1-1, LS1-2, LS1-3, LS1-8**	Chemical Reactions **PS1-2, PS1-5, PS1-6**
Unit 2	Weather and Climate **ESS2-5, ESS2-6, ESS3-5**	Natural Selection and Adaptations **LS4-1, LS4-2, LS4-3, LS4-4, LS4-6**	Force and Interactions **PS2-1, PS2-2, PS2-3, PS2-4, PS2-5**
Unit 3	Space Systems **ESS1-1, ESS1-2, ESS1-3**	Matter and Energy in Organisms and Ecosystems **LS1-6, LS1-7, LS2-1, LS2-3, LS2-4**	Energy **PS3-1, PS3-2, PS3-3, PS3-4, PS3-5**
Unit 4	Earth's Systems **ESS2-1, ESS3-1**	Interdependent Relationships in Ecosystems **LS2-5, LS2-2**	Waves and Electromagnetic Radiation **PS4-1, PS4-2, PS4-3**
Unit 5	Structures and Properties of Matter **PS1-1, PS1-3, PS1-4**	Growth, Development and Reproduction of Organisms **LS1-4, LS1-5, LS3-1, LS3-2, LS4-5**	Human Impacts **ESS3-2, ESS3-3, ESS3-4**

Scope and Sequence of 6-8 Spiral Curriculum

Physical Sciences

PS1: Matter and Its Interaction — 6th Grade
- A. Structure and Properties of Matter — 7th Grade
- B. Chemical Reactions — 8th Grade

PS2: Motion and Stability: Forces and Interactions
- A. Forces and Motion
- B. Types of Interactions

PS3: Energy
- A. Definitions of Energy (8th)
- B. Conservation of Energy and Energy Transfer
- C. Relationship Between Energy and Forces
- D. Energy in Chemical Processes and Everyday Life

PS4: Waves and Their Application in Technologies for Information Transfer
- A. Wave Properties
- B. Electromagnetic Radiation
- C. Information Technologies and Instrumentation

Life Sciences

LS1: From Molecules to Organisms: Structures and Processes
- A. Structure and Function
- B. Growth and Development
- C. Organization for Matter and Energy Flow in Organisms
- D. Information Processing

LS2: Ecosystems: Interactions, Energy, and Dynamics
- A. Interdependent Relationships in Ecosystems
- B. Cycle of Matter and Energy Transfer in Ecosystems
- C. Ecosystem Dynamics, Functioning, and Resilience

LS3: Heredity: Inheritance and Variation of Traits
- A. Inheritance of Traits
- B. Variations of Traits

LS4: Biological Evolution: Unity and Diversity
- A. Evidence of Common Ancestry and Diversity
- B. Natural Selection
- C. Adaptation
- D. Biodiversity and Humans

Earth and Space Sciences

ESS1: Earth's Place in the Universe

A. The Universe and Its Stars
B. Earth and the Solar System
C. The History of Planet Earth

ESS2: Earth's Systems
A. Earth's Materials and Systems (8th)
B. Plate Tectonics and Large-Scale System Interactions
C. The Roles of Water in Earth's Surface Processes (7th) (8th)
D. Weather and Climate

ESS3: Earth and Human Activity
A. Natural Resources
B. Natural Hazards
C. Human Impacts on Earth Systems
D. Global Climate Change

Engineering, Technology and Application of Science

ETS1: Engineering Design
A. Defining and Delimiting an Engineering Problem
B. Developing Possible Solutions
C. Optimizing the Design Solution

ETS2: Links Among Engineering Technology, Science and Society

Science Instructional Strategies

Strategy	Description	Application
Labs	Labs are a staple of K-12 science education. This teaching strategy encourages cooperation in small groups and participation in doing science.	● Students follow the Scientific Method to answer a question or solve a problem. (ie. What effect does sunlight have on the growth of plants?) ● Students can create a situation to test an idea or answer a question. (ie. How can I get more popped kernels in a bag of microwave popcorn?)
Process Oriented Guided Inquiry Learning	In this approach, groups of students work together to examine data and answer leading questions designed to guide them to formulate valid conclusions about a scientific concept.	● Presenting the students with a mystery to be solved – What Made the People Sick? Students are then given data showing bacteria levels in different places in town. ● Students work together to answer questions and arrive at a conclusion.
Documented Problem Solving	This process requires students to record their thought process as they solve a problem. Instead of simply presenting a solution, students must explain their reasoning for arriving at their solution.	● This can be integrated into each lab and demonstration. Students should keep careful notes and observations as well as reflections. ● This can also be applied when students are calculating velocity and accelerations by showing the mathematical process/formula and calculatio to arrive at the answer.
Flipped Learning	Videos and/or powerpoint presentations to introduce and /or reinforce concepts. These also serve as a resource for students to refer back to i order to review concepts.	● Students view a video on how punting a football illustrates the forces that act on any projectile. ● Preview a video on the parts of an atom prior to coming to class.
Graphic Organizers	Visual illustrations of verbal statements; they help the learner organize comprehend, summarize, and synthesize information. Examples includ the following: spider map, continuum/scale, series of events chain, problem/solution outline, network tree, fishbone map, cycle, pie chart, Venn diagram, mind map, web, ranking ladder, etc.	● After reading a selection, the learner classifies items based on common characteristics. (ie. living vs. non-living things, elements vs. compounds) ● Teacher starts a web with a key idea; learners brainstorm words/phrases to build a web of interrelated ideas from the reading, discussion or demonstration. ● A fishbone map to visualize cause and effect could be constructed by teachers and learners. ● The cycle graphic could be used to see how a series of events interacts. ● (ie. water cycle, rock cycle)
Structured Overview	Framework of ideas in the selection present before reading; it gives learners an overview of the content; a graphic organizer presented before the reading.	● A structured overview of key terms could be presented on the smartboard/whiteboard to clarify the main ideas before reading. ● A completed idea map could be used as an overview before learners read content area text to help organize learners' thoughts.
Strategy	**Description**	**Application**
K-W-L: Recalling what learners ***Know***; Determining what they ***Want*** to know: Identifying what they ***Learn*** as they read	Active thinking needed when reading expository text; the letters stand for the three activities the learner engages in when reading to learn. This can also be used prior to labs and/or demonstrations.	● Learners can create a 3-column K-W-L strategy sheet filling it in before, during, and after they read a selection or conduct an experiment. ● Learners can use the 3 column K-W-L strategy sheet before, during and after a research project. ● Learners record what they know, questions they need answered, and finall the information they have gained.
Debate	Formal argument conducted as a contest between opposing sides on a specific question.	The learners may debate the following: - The sides of a current news story causing controversy.

		- The issues presented in nonfiction literature they read.
Effective Questioning	Purposeful questions require students to use thinking skills; questions can be organized by increasing levels of complexity. Suggestions: • Know goal; select context • Plan questions • Phrase questions clearly • Allow flexibility • Avoid yes/no questions • Allow wait time (at least 3 seconds) • Avoid saying learner's name before the question • Select learners randomly • Use positive feeling tone • Respond positively to all answers • Use the probing techniques to elicit more thorough responses • Offer opportunities for learners to react to or rephrase another's response	Sample question: Level 1: Gathering/Recalling Information - What is an element? - List the noble gases? - What events led to the Cell Theory? Level 2: Analyzing/Making Sense of Gathered Information - Compare and contrast ionic and covalent bonds. - What information supports the Law of Conservation of Matter? - Classify the different species in an ecosystem. Level 3: Applying and Evaluating Information - Predict what will happen if one substance is mixed with another. - How could you create a paper airplane that flies the farthest? - How does the data support your hypothesis?
Carouseling	A round-robin brainstorming activity where learners travel from one station to another writing ideas.	Students travel to different stations writing down observations of an unknown object. Other students must infer what object is being described.
Modeling	The act of demonstrating the behavior or activity that is to be elicited from the learner.	● The teacher models the first few steps of note taking. ● A learner models appropriate use of a bar graph for a peer.
Mini-lessons	Lessons conducted to address the needs of one or a small group of learners in any subject area; they are usually of relatively short duratio (10-15 minutes).	● The teacher instructs five learners having difficulty with comparing one type of element with another. ● The teacher reviews calculating the speed of an object given the distance traveled and the time.
Strategy	**Description**	**Application**
Thematic Units	Units of study constructed around a central theme; they incorporate many skills and integrate curriculum areas.	● The teacher may form interest groups. ● The teacher may group learners in study groups according to topic.
Cross-ability Grouping	Grouping based upon factors other than ability; heterogeneous grouping; grouping based upon interest, topic studied, etc. This grouping method helps to avoid the stigma of "low" groups.	● The teacher may form interest groups. ● The teacher may group learners in study groups according to topic.
Peer Practice	A cooperative learning technique in which groups (pairs, triads, etc.) o learners practice the learning together, "Buddy Study."	● A small group of learners quizzes each other on the Periodic Table. ● A pair of learners sits beside each other, chairs touching, but facing in opposite directions to "buddy" read aloud to each other.
Conferencing	Meetings between teacher and learners as a follow-up to instruction; these meetings reinforce the learning and help the teacher check for understanding.	● The teacher meets with the learner to refine an lab conclusion written by the learner. ● The learner and teacher meet to check for understanding on a controversial news topic.
Changing, Rapping, Songs	Highly motivating methods to practice, reinforce, and provide	● The intermediate learner could write and perform a rap to remember

Choral Response, etc.	opportunities for the learner to hear, see, say, sing, and move rhythmically with the learning; learning becomes more vivid, repetitious, and memorable.	Newton's Laws of Motion. ● The learners may write and perform a song about a historical scientist.
Learning Logs	The learners communicate how and what they have understood about a concept or unit of study. They may describe their learning process, define a term, or indicate what they have learned.	● The learner could summarize an activity. ● The learner may assess an objective. ● The learner could reflect upon an activity in the log. ● The learner may list 2 or 3 interesting ideas in response to teacher/peer questions.
The Prep	A type of "advanced organizer" or pre-reading plan where the learners brainstorm what they know about the topic, recognize relationships between their ideas, and finally reform their knowledge upon discussion/reading.	Before reading a selection, learners are asked what they know. The teacher lists ideas and then attempts to relate ideas. Students add to, eliminate, or enhance the knowledge determined after discussion/reading.
The Request	A questioning session first between teacher and learner to model, and then between learners; questioners alternate a variety of types/levels of questions.	● After reading a selection, paired group learners, paired in groups, alternate questioning about the selection. ● After reading a selection, paired learners attempt to incorporate higher leve questions in the Request activity.
Response Log	A journal for recording lab results, attaining knowledge, current issues	● May be used to do the following: ● Respond in writing to a question, impression, mood, or reaction ● Respond to open-ended questions, free-writing, vocabulary, or illustrations ● Stimulate group discussions ● Reflect on personal reactions while reading ● Record new vocabulary ● Write questions for discussion
Reading to Students	Reading aloud is seen as the single most influential factor in young children's success in learning. It has a positive impact on student's attitude toward reading. The teacher or a student may read to the class or a group of other students.	May be used to do the following: ● Improve listening skills ● Build vocabulary ● Aid reading comprehension ● Integrate literature with social studies ● Enjoy hearing a short story or excerpt ● Review current events/issues
Jigsawing	Each student in turn becomes the "expert" on one subject by working with members from other teams. Upon returning to their team, each on in turn, teaches the rest of the group.	May be used to do the following: ● Acquiring new material ● Review of information learned ● Having a debate
Mnemonic Schemes	A technique to assist in memorization by association.	May be used to do the following: ● Memorize the classification pyramid – King Phillip Came Over For Good Spaghetti
PMI Chart	A technique to assist individuals or groups in brainstorming the positive, negative (minus) and interesting characteristics about existing situations.	May be used to do the following: ● Determine plusses, minuses, and interesting facts about global warming.

Strategies for Modifying Instruction

. All students benefit from a variety of instructional delivery methods.

Organizational Difficulties	Prior to having a guest speaker or taking field trips, it may be helpful to structure the situation. Use of a checklist or a set of questions generated by the class will help students focus on relevant information. Accessibility for students with disabilities should be considered when field trips are arranged. When assigning long-term projects/reports, provide a timeline with benchmarks as indicators for completion of major project/report sections. Students who have difficulty with organizational skills and time sequence may need to see completion of sections to maintain the organization of a lengthy project report. Limit the number of directions presented. Write directions on the board, on smartboard, or on paper. Provide a quiet place for the child to work. Use earphones to block out noise when studying. Or, place the child near you and away from distracting noise.
Difficulties with Writing	The use of computer software may be appropriate for activities that require significant amounts of writing by students.
Conceptual Difficulties	Identify, define, and pre-teach key vocabulary. Many terms in this syllabus are specific and may need continuous reinforcement for some students with disabilities. It would also be helpful to provide a list of these key words to the special education teacher in order to provide additional reinforcement in the special educational setting. Check periodically to determine student understanding of lectures, discussion, demonstration, etc., and how this is related to the overall topic. Encourage students to express their understanding. It may be necessary to have small group discussions or work with a partner to determine this. Provide student and special education teachers with a tape of lectures that contain substantial new vocabulary content for further review within their special education class. Assign a partner for the duration of a unit to a student as an additional resource to facilitate clarification of daily assignment, timelines for assignments, and to access daily class notes. Use visuals and hands-on experiences. Create flashcards on which a single vocabulary word has been written using a different color for each syllable. The definition may be written on the back of the card.
Testing Difficulties	Students with disabilities may use alternative test techniques. The needed testing modifications must be identified in the student's Individualized Education Program (IEP). Both special and regular education teachers need to work in close cooperation so that the testing modifications can be used consistently throughout the student's program. In severe cases of auditory dysfunction, children will need even more assistance in order to be successful, such as: 1) Have another child take notes, 2) Dictate assignments on a tape recorder, and/or 3) Take oral tests instead of written ones.

Science – Accommodations and Modifications Strategies for Consideration

Special Education Students	English Language Learners	At-Risk Students	Gifted and Talented Students	Students with 504s
• Pair visual prompts with verbal presentations • Utilize use of lab or experiments to give visual representation of concept • Ask students to restate information, directions, and assignments. • Pre Teach vocabulary • Provide flashcards with key science terminology • Use manipulatives and visual representation to examine concepts • Utilize mnemonic tricks to improve memory • Use manipulatives to visualize concept • Highlight key vocabulary-chart or vocabulary bank • Note taker or lab assistant • Group lab	• Create a word wall • Utilize native language translation (peer, online assistive technology, translation device, bilingual dictionary) • Preteach vocabulary • Use graphic organizers or other visual model • Use manipulatives to visualize concept • Highlight key vocabulary-chart or vocabulary bank • Use nonverbal responses (thumbs up/down) • Use sentence frames • Design questions for different proficiency levels • Utilize partners and partner talk • Break down large assignments into smaller tasks • Utilize “Can Do” Descriptors	• Pair visual prompts with verbal presentations • Utilize use of lab or experiments to give visual representation of concept • Ask students to restate information, directions, and assignments. • Work within group or partners. Self-select partners ahead of time to choose positive role model. • Repeat and practice Model skills / techniques to be mastered. • Use metacognitive work • Extend time to complete class work • Provide copy of class notes • Utilize preferential seating to be mutually determined by the	• Structure the learning around explaining or solving a social or community-based issue. • Use project-based science learning to connect science with observable phenomena • Collaborate with after-school programs to extend learning opportunities. • Interdisciplinary and problem-based assignments with planned scope and sequence • Advance, accelerated, or compacted content • Abstract and advanced higher-level thinking • Allowance for individual student	• Pair visual prompts with verbal presentations • Utilize use of lab or experiments to give visual representation of concept • Ask students to restate information, directions, and assignments. • Preteach vocabulary • Use manipulatives and visual representation to examine concepts • Use mnemonic tricks to improve memory • Note taker or lab assistant • Group lab assignments • Additional time for lab assignments • Assignments in electronic format to facilitate communication, web-based materials & assignments

assignments • Use of scribe • Adaptive computer to type assignments • Adjustable lab tables and lab equipment within reach • Additional time for lab assignments • Assignments in electronic format to facilitate communication, web-based materials & assignments • Note takes, audio & video recorded class sessions • Captioned videos • Preferred seating • Tactile drawings, graphs, and three-dimensional models, • Large print handouts, lab signs, and equipment labels • Computer equipped to enlarge screen characters and images • LED projection microscopes • Audio, braille or electronic notes, handouts, and texts	https://wida.wisc.edu/teach/can-do/descriptors • Note taker or lab assistant • Group lab assignments • Additional time for lab assignments • Assignments in electronic format to facilitate communication, web-based materials & assignments • Note takes, audio & video recorded class sessions • Computer with optical character reader and voice output • Interpreter or real time captioning • Demonstration reviews • Computer with optical character reader and voice output • Interpreter or real time captioning • Demonstration reviews	student and teacher • Allow student to use a computer to complete assignments. • Use manipulatives to examine conceptS • Note taker or lab assistant • Group lab assignments • Additional time for lab assignments • Assignments in electronic format to facilitate communication, web-based materials & assignments • Note takes, audio & video recorded class sessions • Computer with optical character reader and voice output • Interpreter or real time captioning • Demonstration reviews	interests • Assignments geared to development in areas of affect, creativity, cognition, and research skills • Complex, in-depth assignments • Diverse enrichment that broadens learning • Variety in types of resources • Community involvement • Cultural diversity • Internship, mentorship, and other forms of apprenticeship	• Note takes, audio & video recorded class sessions • Computer with optical character reader and voice output • Interpreter or real time captioning • Demonstration reviews

• Braille signs & equipment labels • Raised-line drawings, clay models, 3-D triangles and spheres for geometric shapes • Verbal descriptions of visual aids • Auditory lab warning signs • Adaptive lab equipment • Computer with optical character reader and voice output • Interpreter or real time captioning • Demonstration reviews • Visual warning system for lab emergencies				

7th Grade Science Curriculum

Course Title: Science
Grade Level: 7

Unit 1
Structure, Function, and Information Processing

Unit 2
Natural Selection and Adaptation

Unit 3
Matter and Energy in Organisms and Ecosystems

Unit 4
Interdependent Relationships in Ecosystems

Unit 5
Growth, Development, and Reproduction of Organisms

Structure, Function, and Information Processing

Content Area: Science

Unit Title: Structure, Function, and Information Processing

Target Course/Grade Level: Seventh Grade

Unit Rationale

According to the **A Framework for K-12 Science** Education, there are central features of life. All living things are composed of cells and can range from unicellular organisms to complex multicellular organisms. Within each cell are structures that carry out specific functions. This unit is designed to help students distinguish between living and nonliving things and lead to an understanding that cells are the structural unit of life.

Unit Summary

Students plan and carry out investigations to develop evidence that living organisms are made of cells and to determine the relationship of organisms to the environment. Students use their understanding of cell theory to develop physical and conceptual models of cells. They construct explanations for the interactions of systems in cells and organisms and how organisms gather and use information from the environment. Students understand that all organisms are made of cells, that special structures are responsible for particular functions in organisms, and that for many organisms the body is a system of multiple interacting subsystems that form a hierarchy from cells to the body. Crosscutting concepts of cause and effect, structure and function, and matter and energy are called out as organizing concepts for these core ideas

Unit Essential Questions	**Unit Enduring Understandings**
● ***What is the smallest unit that can be said to be alive?*** ● ***What are the functions of the special structures found in cells?*** ● ***How do cells work together in a multicellular organism?*** ● ***How do our senses help us to react to the environment?***	**● All living things are made up of cells.** **● Within cells, special structures are responsible for particular functions. For example, the cell membrane controls what enters and exits a cell.** **● Cells work together to form tissues or organs that are specialized.** **● Sensory receptors respond to different stimuli/inputs. These signals are processed in the brain and stored as memories.**

STUDENT LEARNING OBJECTIVES (SLO)

Students will...

1. **Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells.** [Clarification Statement: Emphasis is on developing evidence that living things are made of cells, distinguishing between living and non-living things, and understanding that living things may be made of one cell or many and varied cells.] **(LS1-1)**
2. **Develop and use a model to describe the function of a cell as a whole and ways parts of cells contribute to the function.** [Clarification Statement: Emphasis is on the cell functioning as a whole system and the primary role of identified parts of the cell, specifically the nucleus, chloroplasts, mitochondria, cell membrane, and cell wall.] [*Assessment Boundary: Assessment of organelle structure/function relationships is limited to the cell wall and cell membrane. Assessment of the function of the other organelles is limited to their relationship to the whole cell. Assessment does not include the biochemical function of cells or cell parts.*] **(LS1-2)**
3. **Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells.** [Clarification Statement: Emphasis is on the conceptual understanding that cells form tissues and tissues form organs specialized for particular body functions. Examples could include the interaction of subsystems within a system and the normal functioning of those systems.] [*Assessment Boundary: Assessment does not include the mechanism of one body system independent of others. Assessment is limited to the circulatory, excretory, digestive, respiratory, muscular, and nervous systems.*] **(LS1-3)**
4. Develop a model to explain how senses change energy coming from the environment (light, sound waves, chemicals in gases or food, heat or touch/pressure) into electrical signals in the nerves that go into the brain and spinal cord. [*Assessment Boundary: Assessment does not include mechanisms for the transmission of this information.*] **(LS1.D)**
5. **Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories.** [*Assessment Boundary: Assessment does not include mechanisms for the transmission of this information.*] **(LS1-8)**

The SLOs above were developed using the following elements from the NRC document A Framework for K-12 Science Education:

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Developing and Using Models Modeling in 6–8 builds on K–5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems. ● Develop and use a model to describe phenomena. (MS-LS1-2) ● Develop a model to describe unobservable mechanisms. (MS-LS1-7) **Planning and Carrying Out Investigations** Planning and carrying out investigations in 6-8 builds on K-5 experiences and progresses to include investigations that use multiple variables and provide evidence to support explanations or solutions. ● Conduct an investigation to produce data to serve as the basis for evidence that meet the goals of an investigation. (MS-LS1-1) **Engaging in Argument from Evidence** Engaging in argument from evidence in 6–8 builds on K–5 experiences and progresses to constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed world(s). ● Use an oral and written argument supported by evidence to support or refute an explanation or a model for a phenomenon. (MS-LS1-3) **Obtaining, Evaluating, and Communicating Information** Obtaining, evaluating, and communicating information in 6-8 builds on K-5 experiences and progresses to evaluating the merit and validity of ideas and methods. ● Gather, read, and synthesize information	**LS1.A: Structure and Function** ● All living things are made up of cells, which is the smallest unit that can be said to be alive. An organism may consist of one single cell (unicellular) or many different numbers and types of cells (multicellular). (MS-LS1-1) ● Within cells, special structures are responsible for particular functions, and the cell membrane forms the boundary that controls what enters and leaves the cell. (MS-LS1-2) ● In multicellular organisms, the body is a system of multiple interacting subsystems. These subsystems are groups of cells that work together to form tissues and organs that are specialized for particular body functions. (MS-LS1-3) **LS1.D: Information Processing** ● Each sense receptor responds to different inputs (electromagnetic, mechanical, chemical), transmitting them as signals that travel along nerve cells to the brain. The signals are then processed in the brain, resulting in immediate behaviors or memories. (MS-LS1-8) (SLO 4)	**Cause and Effect** ● Cause and effect relationships may be used to predict phenomena in natural systems. (MS-LS1-8) **Scale, Proportion, and Quantity** ● Phenomena that can be observed at one scale may not be observable at another scale. (MS-LS1-1) **Systems and System Models** ● Systems may interact with other systems; they may have sub-systems and be a part of larger complex systems. (MS-LS1-3) **Structure and Function** ● Complex and microscopic structures and systems can be visualized, modeled, and used to describe how their function depends on the relationships among its parts, therefore complex natural structures/systems can be analyzed to determine how they function. (MS-LS1-2) ***Connections to Engineering, Technology and Applications of Science*** **Interdependence of Science, Engineering, and Technology** ● Engineering advances have led to important discoveries in virtually every field of science, and scientific discoveries have led to the development of entire industries and engineered systems. (MS-LS1-1) ***Connections to Nature of Science*** **Science is a Human Endeavor** ● Scientists and engineers are guided by habits of mind such as intellectual honesty, tolerance of ambiguity, skepticism, and openness to new ideas. (MS-LS1-3)

from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication and methods used, and describe how they are supported or not supported by evidence. (MS-LS1-8)		

Connections to Disciplinary Core Ideas and Common Core Math and ELA

Connections to other DCIs in this grade-band:
MS.LS3.A (MS-LS1-2)

Articulation of DCIs across grade-bands:
4.LS1.A (MS-LS1-2); **4.LS1.D** (MS-LS1-8); **HS.LS1.A** (MS-LS1-1),(MS-LS1-2),(MS-LS1-3),(MS-LS1-8)

Common Core State Standards Connections:

ELA/Literacy -

RST.6-8.1	Cite specific textual evidence to support analysis of science and technical texts. (MS-LS1-3)
RST.6-8.2	Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions. *(MS-LS1-5),(MS-LS1-6)*
RI.6.8	Trace and evaluate the argument and specific claims in a text, distinguishing claims that are supported by reasons and evidence from claims that are not. (MS-LS1-3)
WHST.6-8.1	Write arguments focused on discipline content. (MS-LS1-3)
WHST.6-8.7	Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration. (MS-LS1-1)
WHST.6-8.8	Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation. (MS-LS1-8)
SL.8.5	Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest. *(MS-LS1-2)*

Mathematics -

6.EE.C.9	Use variables to represent two quantities in a real-world problem that change in relationship to one another; write an equation to express one quantity, thought of as the dependent variable, in terms of the other quantity, thought of as the independent variable. Analyze the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation. *(MS-LS1-1),(MS-LS1-2),(MS-LS1-3)*

New Jersey Content Standards Technology and 21st Century

8.1 Educational Technology: All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.

8.2 Technology Education, Engineering, Design, and Computational Thinking - Programming: All students will develop an understanding of the nature and impact of technology, engineering, technological design, computational thinking and the designed world as they relate to the individual, global society, and the environment.

Resources and Activities

There are a number of different resources to assist in aligning activities to the NJSLS.

- Newsela: Nonfiction Literacy and Current Events
  https://newsela.com/

- NSTA Formative Assessment Probes: This book series will be used as a form of pre-assessment and Do Now activities for the topics covered in this unit.

- Discovery:
  http://www.discoveryeducation.com/

- Kahoot: Game-Based Learning Platform
  https://getkahoot.com/

Video Resources:

- Amoeba Sisters Youtube channel
- Crash Course Science Youtube channel
- Crash Course Kids Youtube channel
- TED-Ed Youtube channel
- AsapSCIENCE Youtube channel
- National Geographic Youtube channel
- Moomoomath and science Youtube channel
- Peekaboo Kidz Youtube channel

Specific to this unit, are the following activities:

Explore Learning Gizmo:

- Cell Energy Cycle
- Cell Structure
- Identifying Nutrients
- Diffusion

Mosa Mack: Science Detective:

- Cells
- Plant and Animal Structure
- Disease Spread

Generation Genius:

- Bacteria and Viruses
- Multicellular Organisms
- Plant and Animal Cells
- Classification of Living Things

Problem-Based Activity/ Engineering Design:

Problem-Based/Engineering Design Challenge: Outbreak Alert: Engineering a Pandemic Response

Viral PSA Research Project: Students will be researching epidemics and pandemics throughout history and discovering the longevity, severity, and prevention and treatment. Students will also be given the opportunity to create a PSA commercial video as part of this assignment.

Structure, Function, and Information Processing (NJSLS Standard: MS-LS1-1, MS-LS 3-1, MS-LS 4-4)

Engineering is Elementary- **Outbreak Alert: Engineering a Pandemic Response**: Students will be begin by exploring how diseases can spread from one person to another in order to introduce them to the problem of stopping the spread of viruses. They will then partake in a mock-outbreak scenario, where they will engineer an antiviral for a contagious virus, create public service announcements to inform the public, and consider what steps they should take to prevent the outbreak from becoming a pandemic.

Evidence of Learning

Summative Assessment

The final summative exam evaluates students' learning after they finish all the investigations. Test items may be presented in a variety of formats, including multiple-choice, short-answer, and narrative items. Some items require students to draw diagrams, solve problems, and explain their understanding. Each problem-based activity will be evaluated using a scaled rubric.

The summative exam should focus on the performance expectations as outlined in the NJSLS.

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Throughout the unit, formative assessments should be conducted to check understanding and student progress toward the end performance expectation. Formative assessments can be written or oral.

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In order to measure student growth and design curriculum to meet individual student learning needs, benchmark assessments will be administered throughout the unit.

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Differentiated Instruction:	**Special Needs** – Reinforcement, do now, and exit activities are designed with lower level learners in mind. The activities, both done in school and at home, allow the students to review the concepts learned in each lesson. Additional resources and study tools are available for students. Students will be grouped heterogeneously to allow for peer scaffolding. When available, the in-class support teacher will be utilized. **ELL** – refer to ELL Curriculum. **Gifted Learners** – End of unit "Problem Based Activities" are designed with higher-level learners in mind. These activities contain advanced questions and research opportunities. Students are encouraged to investigate more deeply into topics to gain a more complex understanding of the content. Students are asked to create and design solutions to problems, with little guidance from the instructor throughout the process. **Mainstream Learners** – Even within the mainstream learner groupings, there are a variety of individual learning styles and strengths. In order to reach all learners, teachers can make use of the interactive investigations, pictures, movies, websites, and Science extension activities.

NJSLS – Career Readiness, Life Literacies, and Key Skills (21st Century Themes and Skills)

Personal Finance Literacy 9.1	Career Awareness Exploration Preparedness and Training 9.2	Life Literacies and Key Skills 9.4
9.1.8.CR.1: Compare and contrast the role of philanthropy, volunteer service, and charities in community development and the quality of life in a variety of cultures. **9.1.8.CR.2**: Compare various ways to give back through strengths, passions, goals, and other personal factors. **9.1.8.CR.3**: Relate the importance of consumer, business, and government responsibility to the economy and personal finance. **9.1.8.CR.4**: Examine the implications of legal and ethical behaviors when making financial decisions**.**	**9.2.8.CAP.10:** Evaluate how careers have evolved regionally, nationally, and globally. **9.2.8.CAP.12:** Assess personal strengths, talents, values, and interests to appropriate jobs and careers to maximize career potential.	**9.4.8.CI.1**: Assess data gathered on varying perspectives on causes of climate change (e.g., cross cultural, gender-specific, generational), and determine how the data can best be used to design multiple potential solutions. **9.4.8.CI.2**: Repurpose an existing resource in an innovative way. **9.4.8.CI.3**: Examine challenges that may exist in the adoption of new ideas. **9.4.8.CI.4**: Explore the role of creativity and innovation in career pathways and industries. **9.4.8.CT.2:** Develop multiple solutions to a problem and evaluate short- and long-term effects to determine the most plausible option **9.4.8.DC.8:** Explain how communities use data and technology to develop measures to respond to effects of climate change. **9.4.8.GCA.2**: Demonstrate openness to diverse ideas and perspectives through active discussions to achieve a group goal. **9.4.8.IML.4**: Ask insightful questions to organize different types of data and create meaningful visualizations. **9.4.8.IML.5**: Analyze and interpret local or public data sets to summarize and effectively communicate the data. **9.4.8.TL.1**: Construct a spreadsheet in order to analyze multiple data sets, identify relationships, and facilitate data-based decision-making. **9.4.8.TL.3:** Select appropriate tools to organize and present information digitally

Natural Selection and Adaptation

Content Area: Science

Unit Title: Natural Selection and Adaptation

Target Course/Grade Level: Seventh Grade

Unit Rationale

According to the **A Framework for K-12 Science** Education, biological evolution and natural selection is supported by evidence and can be used to explain both the similarity among species and the biodiversity found on Earth. This unit is designed to help students analyze and evaluate evidence (fossil records, embryology) to infer evolutionary relationships.

Unit Summary

Students analyze data from the fossil record to describe evidence of the history of life on Earth and construct explanations for similarities in organisms. They have a beginning understanding of the role of variation in natural selection and how this leads to speciation. They have a grade-appropriate understanding and use of the practices of analyzing graphical displays; using mathematical models; and gathering, reading, and communicating information. The crosscutting concept of cause and effect is central to this topic.

Unit Essential Questions

- ***What information can be gained through analyzing and interpreting fossil records?***
- ***How does genetic variation among organisms in a species affect survival and reproduction?***
- ***How does the environment influence genetic traits in populations over multiple generations?***

Unit Enduring Understandings

- **Fossil records show the existence, diversity, extinction and changes of life forms.**
- **Comparison of embryological development can show evolutionary relationships.**
- **Advantageous genetic variations within a population allow an individual to survive and reproduce. These traits will be passed on to future generations. This is natural selection.**
- **Over several generations, these advantageous traits will become more common.**

STUDENT LEARNING OBJECTIVES (SLO)

Students will...

1. **Analyze and interpret data for patterns in the fossil record that document the existence, diversity, extinction, and change of life forms throughout the history of life on Earth under the assumption that natural laws operate today as in the past.** [Clarification Statement: Emphasis is on finding patterns of changes in the level of complexity of anatomical structures in organisms and the chronological order of fossil appearance in the rock layers.] [Assessment Boundary: Assessment does not include the names of individual species or geological eras in the fossil record.] **(LS4-1)**
2. **Apply scientific ideas to construct an explanation for the anatomical similarities and differences among modern organisms and between modern and fossil organisms to infer evolutionary relationships.** [Clarification Statement: Emphasis is on explanations of the evolutionary relationships among organisms in terms of similarity or differences of the gross appearance of anatomical structures.] **(LS4-2)**
3. **Analyze displays of pictorial data to compare patterns of similarities in the embryological development across multiple species to identify relationships not evident in the fully formed anatomy.** [Clarification Statement: Emphasis is on inferring general patterns of relatedness among embryos of different organisms by comparing the macroscopic appearance of diagrams or pictures.] [Assessment Boundary: Assessment of comparisons is limited to gross appearance of anatomical structures in embryological development.] **(LS4-3)**
4. **Construct an explanation based on evidence that describes how genetic variations of traits in a population increase some individuals' probability of surviving and reproducing in a specific environment.** [Clarification Statement: Emphasis is on using simple probability statements and proportional reasoning to construct explanations.] **(LS4-4)**
5. **Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time.** [Clarification Statement: Emphasis is on using mathematical models, probability statements, and proportional reasoning to support explanations of trends in changes to populations over time.] [*Assessment Boundary: Assessment does not include Hardy Weinberg calculations.*] **(LS4-6)**

Science and Engineering Practices

Analyzing and Interpreting Data

Analyzing data in 6–8 builds on K–5 experiences and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis.

- Analyze displays of data to identify linear and nonlinear relationships. (MS-LS4-3)
- Analyze and interpret data to determine similarities and differences in findings. (MS-LS4-1)

Using Mathematics and Computational Thinking

Mathematical and computational thinking in 6–8 builds on K–5 experiences and progresses to identifying patterns in large data sets and using mathematical concepts to support explanations and arguments.

- Use mathematical representations to support scientific conclusions and design solutions. (MS-LS4-6)

Constructing Explanations and Designing Solutions

Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories.

- Apply scientific ideas to construct an explanation for real-world phenomena, examples, or events. (MS-LS4-2)
- Construct an explanation that includes qualitative or quantitative relationships between variables that describe phenomena. (MS-LS4-4)

Disciplinary Core Ideas

LS4.A: Evidence of Common Ancestry and Diversity

- The collection of fossils and their placement in chronological order (e.g., through the location of the sedimentary layers in which they are found or through radioactive dating) is known as the fossil record. It documents the existence, diversity, extinction, and change of many life forms throughout the history of life on Earth. (MS-LS4-1)
- Anatomical similarities and differences between various organisms living today and between them and organisms in the fossil record, enable the reconstruction of evolutionary history and the inference of lines of evolutionary descent. (MS-LS4-2)
- Comparison of the embryological development of different species also reveals similarities that show relationships not evident in the fully-formed anatomy. (MS-LS4-3)

LS4.B: Natural Selection

- Natural selection leads to the predominance of certain traits in a population, and the suppression of others. (MS-LS4-4)

LS4.C: Adaptation

- Adaptation by natural selection acting over generations is one important process by which species change over time in response to changes in environmental conditions. Traits that support successful survival and reproduction in the new environment become more common; those that do not become less common.

Crosscutting Concepts

Patterns

- Patterns can be used to identify cause and effect relationships. (MS-LS4-2)
- Graphs, charts, and images can be used to identify patterns in data. (MS-LS4-1),(MS-LS4-3)

Cause and Effect

- Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability. (MS-LS4-4),(MS-LS4-6)

Connections to Nature of Science

Scientific Knowledge Assumes an Order and Consistency in Natural Systems

- Science assumes that objects and events in natural systems occur in consistent patterns that are understandable through measurement and observation. (MS-LS4-1),(MS-LS4-2)

Connections to Nature of Science **Scientific Knowledge is Based on Empirical Evidence** ● Science knowledge is based upon logical and conceptual connections between evidence and explanations. (MS-LS4-1)	Thus, the distribution of traits in a population changes. (MS-LS4-6)	

Connections to Disciplinary Core Ideas and Common Core Math and ELA

Connections to other DCIs in this grade-band:
MS.LS2.A (MS-LS4-4),(MS-LS4-6); **MS.LS2.C** (MS-LS4-6); **MS.LS3.A** (MS-LS4-2),(MS-LS4-4); **MS.LS3.B** (MS-LS4-2),(MS-LS4-4),(MS-LS4-6); **MS.ESS1.C** (MS-LS4-1),(MS-LS4-2),(MS-LS4-6); **MS.ESS2.B** (MS-LS4-1)

Articulation of DCIs across grade-bands:
3.LS3.B (MS-LS4-4); **3.LS4.A** (MS-LS4-1),(MS-LS4-2); **3.LS4.B** (MS-LS4-4); **3.LS4.C** (MS-LS4-6); **HS.LS2.A** (MS-LS4-4),(MS-LS4-6); **HS.LS2.C** (MS-LS4-6); **HS.LS3.B** (MS-LS4-4),(MS-LS4-6); **HS.LS4.A** (MS-LS4-1),(MS-LS4-2),(MS-LS4-3); **HS.LS4.B** (MS-LS4-4),(MS-LS4-6); **HS.LS4.C** (MS-LS4-4),(MS-LS4-6); **HS.ESS1.C** (MS-LS4-1),(MS-LS4-2)

Common Core State Standards Connections:

ELA/Literacy -

RST.6-8.1	Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions. *(MS-LS4-1)*,(MS-LS4-2),*(MS-LS4-3)*,*(MS-LS4-4)*
RST.6-8.7	Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table). (MS-LS4-1),(MS-LS4-3)
RST.6-8.9	Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic. *(MS-LS4-3)*,*(MS-LS4-4)*
WHST.6-8.2	Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content. (MS-LS4-2),(MS-LS4-4)
WHST.6-8.9	Draw evidence from informational texts to support analysis, reflection, and research. (MS-LS4-2),(MS-LS4-4)
SL.8.1	Engage effectively in a range of collaborative discussions (one-on-one, in groups, teacher-led) with diverse partners on grade 6 topics, texts, and issues, building on others' ideas and expressing their own clearly. *(MS-LS4-2)*,*(MS-LS4-4)*
SL.8.4	Present claims and findings, emphasizing salient points in a focused, coherent manner with relevant evidence, sound valid reasoning, and well-chosen details; use appropriate eye contact, adequate volume, and clear pronunciation. *(MS-LS4-2)*,*(MS-LS4-4)*

Mathematics -

MP.4	Model with mathematics. (MS-LS4-6)
6.RP.A.1	Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. *(MS-LS4-4)*,*(MS-LS4-6)*
6.SP.B.5	Summarize numerical data sets in relation to their context. *(MS-LS4-4)*,*(MS-LS4-6)*
6.EE.B.6	Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set. *(MS-LS4-1)*,*(MS-LS4-2)*
7.RP.A.2	Recognize and represent proportional relationships between quantities. *(MS-LS4-4)*,*(MS-LS4-6)*

New Jersey Content Standards Technology and 21st Century

8.1 Educational Technology: All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.

8.2 **Technology Education, Engineering, Design, and Computational Thinking - Programming:** All students will develop an understanding of the nature and impact of technology, engineering, technological design, computational thinking and the designed world as they relate to the individual, global society, and the environment.

Resources and Activities

There are a number of different resources to assist in aligning activities to the NJSLS.

- Newsela: Nonfiction Literacy and Current Events
  https://newsela.com/

- NSTA Formative Assessment Probes: This book series will be used as a form of pre-assessment and Do Now activities for the topics covered in this unit.

- Discovery:
  http://www.discoveryeducation.com/

- Kahoot: Game-Based Learning Platform
  https://getkahoot.com/

Video Resources:

- Amoeba Sisters Youtube channel
- Crash Course Science Youtube channel
- Crash Course Kids Youtube channel
- TED-Ed Youtube channel
- AsapSCIENCE Youtube channel
- National Geographic Youtube channel
- Moomoomath and science Youtube channel
- Peekaboo Kidz Youtube channel

Specific to this unit, are the following activities:

- Malaria and Sickle Cell Anemia Coevolution in Humans- Students will be reading chapter 8, A Sickle Cell Safari, from the book "Into the Jungle" by Sean B. Carroll. Students will learn about the link between sickle cell and malaria resistance in Africa. Lab activities to follow regarding sickle cell anemia. Video clip to follow:
  https://www.youtube.com/watch?v=Zsbhvl2nVNE

Activities:

- **Adaptation and Evolution Stations Activity**- Homologous Structures, Darwin's Finches, Now You See It- Now You Don't, The Perfect Animal and Its Adaptations, Fossils- The World's History Book, Are We Related? Comparative Anatomy, A Picture is Worth a Thousand Words
- **Geologic Time Scale**- calendar analogy of Earth's history
- **The Great Fossil Find!!!:** in this activity students will work with a partner and play the role of a paleontologist working in Montana. Students will be given evidence packets of fossil and a manual and try to figure out what organism was found. Students will be taking notes as they go along throughout "5 days". Students will also get the opportunity to look at their classmates' bones.
- **Chapter 1 of "Into the Jungle"**- students learned about Charles Darwin's early life, voyage on The Beagle, and post research struggles.
- **Evidence for Evolution Webquest-** students use multiple websites to expand their knowledge of evolution.
- **Human Evolution Mini Unit**- students apply their knowledge of evolution and natural selection to modern man. Student's learn about the origin of human life.

Explore Learning Gizmo:

- Human Evolution – Skull Analysis
- Natural Selection
- Evolution – Mutation and Selection
- Evolution – Natural and Artificial Selection

Mosa Mack: Science Detective:

- Selection and Adaptations
- Genetic Variation
- Mutations
- Evidence of Evolution

Generation Genius:

- Comparative Anatomy
- The Fossil Record
- Genes and Mutations
- Natural Selection

Evidence of Learning

Summative Assessment

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Matter and Energy in Organisms and Ecosystems

Content Area: Science

Unit Title: Matter and Energy in Organisms and Ecosystems

Target Course/Grade Level: Seventh Grade

Unit Rationale

According to the **A Framework for K-12 Science** Education, most energy needed for life is from the sun. Through the process of photosynthesis, plants use sunlight to create food. Through chemical reactions, matter and energy is transferred throughout individual organism and the ecosystem. This unit is designed to help students understand the energy cycle within an ecosystem and the effects of resources available on the growth of the population.

Unit Summary

Students use conceptual and physical models to explain the transfer of energy and cycling of matter as they construct explanations for the role of photosynthesis in cycling matter in ecosystems. They construct explanations for the cycling of matter in organisms and the interactions of organisms to obtain the matter and energy from the ecosystem to survive and grow. Students have a grade-appropriate understanding and use of the practices of investigations, constructing arguments based on evidence, and oral and written communication. They understand that sustaining life requires substantial energy and matter inputs and the structure and functions of organisms contribute to the capture, transformation, transport, release, and elimination of matter and energy. Adding to these crosscutting concepts is a deeper understanding of systems and system models that ties the performances expectations in this topic together.

Unit Essential Questions

- ***How do organisms obtain and use matter and energy?***
- ***How do matter and energy move through an ecosystem?***
- ***What affects do the abiotic features in an ecosystem have on living things?***

Unit Enduring Understandings

- **Plants use energy from light to make sugars through photosynthesis. Animals obtain food from eating plant and/or other animals. Within organisms, food is broken down through a series of chemical reactions to release energy.**
- **Organisms are dependent upon their environmental reactions with both living and non-living things.**
- **Interactions occur between biotic and abiotic parts of an ecosystem. These interactions can affect the population of organisms in the ecosystem.**

STUDENT LEARNING OBJECTIVES (SLO)

Students will...

1. Create a representation the process by which plants, algae and many microorganisms use the energy from light to make sugars (food) from carbon dioxide from the atmosphere and water. **(LS1.C)**
2. **Construct a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms.** [Clarification Statement: Emphasis is on tracing movement of matter and flow of energy.] [Assessment Boundary: Assessment does not include the biochemical mechanisms of photosynthesis.] **(LS1-6)**
3. **Develop a model to describe how food is rearranged through chemical reactions forming new molecules that support growth and/or release energy as this matter moves through an organism.** [Clarification Statement: Emphasis is on describing that molecules are broken apart and put back together and that in this process, energy is released.] [Assessment Boundary: Assessment does not include details of the chemical reactions for photosynthesis or respiration.] **(LS1-7)**

4. **Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.** [Clarification Statement: Emphasis is on cause and effect relationships between resources and growth of individual organisms and the numbers of organisms in ecosystems during periods of abundant and scarce resources.] **(LS2-1)**
5. **Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.** [Clarification Statement: Emphasis is on describing the conservation of matter and flow of energy into and out of various ecosystems, and on defining the boundaries of the system.] [Assessment Boundary: Assessment does not include the use of chemical reactions to describe the processes.] **(LS2-3)**
6. **Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.** [Clarification Statement: Emphasis is on recognizing patterns in data and making warranted inferences about changes in populations, and on evaluating empirical evidence supporting arguments about changes to ecosystems.] **(LS2-4)**

Science and Engineering Practices

Developing and Using Models

Modeling in 6–8 builds on K–5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems.

- Develop a model to describe phenomena. (MS-LS2-3)
- Develop a model to describe unobservable mechanisms. (MS-LS1-7)

Analyzing and Interpreting Data

Analyzing data in 6–8 builds on K–5 experiences and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis.

- Analyze and interpret data to provide evidence for phenomena. (MS-LS2-1)

Constructing Explanations and Designing Solutions

Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific knowledge, principles, and theories.

- Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students' own experiments) 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. (MS-LS1-6)

Disciplinary Core Ideas

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

- Plants, algae (including phytoplankton), and many microorganisms use the energy from light to make sugars (food) from carbon dioxide from the atmosphere and water through the process of photosynthesis, which also releases oxygen. These sugars can be used immediately or stored for growth or later use. (MS-LS1-6)
- Within individual organisms, food moves through a series of chemical reactions in which it is broken down and rearranged to form new molecules, to support growth, or to release energy. (MS-LS1-7)

LS2.A: Interdependent Relationships in Ecosystems

- Organisms, and populations of organisms, are dependent on their environmental interactions both with other living things and with nonliving factors. (MS-LS2-1)
- In any ecosystem, organisms and populations with similar requirements for food, water, oxygen, or other resources may compete with each other for limited resources, access to which consequently constrains their growth and reproduction. (MS-LS2-1)
- Growth of organisms and population increases are limited by access to resources. (MS-LS2-1)

Crosscutting Concepts

Cause and Effect

- Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-LS2-1)

Energy and Matter

- Matter is conserved because atoms are conserved in physical and chemical processes. (MS-LS1-7)
- Within a natural system, the transfer of energy drives the motion and/or cycling of matter. (MS-LS1-6)
- The transfer of energy can be tracked as energy flows through a natural system. (MS-LS2-3)

Stability and Change

- Small changes in one part of a system might cause large changes in another part. (MS-LS2-4)

Connections to Nature of Science

Scientific Knowledge Assumes an Order and Consistency in Natural Systems

- Science assumes that objects and events in natural systems occur in consistent patterns that are understandable through measurement and observation. (MS-LS2-3)

Engaging in Argument from Evidence Engaging in argument from evidence in 6–8 builds on K–5 experiences and progresses to constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed world(s). ● Construct 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-LS2-4) - ***Connections to Nature of Science*** **Scientific Knowledge is Based on Empirical Evidence** ● Science knowledge is based upon logical connections between evidence and explanations. (MS-LS1-6) ● Science disciplines share common rules of obtaining and evaluating empirical evidence. (MS-LS2-4)	**LS2.B: Cycle of Matter and Energy Transfer in Ecosystems** ● Food webs are models that demonstrate how matter and energy is transferred between producers, consumers, and decomposers as the three groups interact within an ecosystem. Transfers of matter into and out of the physical environment occur at every level. Decomposers recycle nutrients from dead plant or animal matter back to the soil in terrestrial environments or to the water in aquatic environments. The atoms that make up the organisms in an ecosystem are cycled repeatedly between the living and nonliving parts of the ecosystem. (MS-LS2-3) **LS2.C: Ecosystem Dynamics, Functioning, and Resilience** ● Ecosystems are dynamic in nature; their characteristics can vary over time. Disruptions to any physical or biological component of an ecosystem can lead to shifts in all its populations. (MS-LS2-4) **PS3.D: Energy in Chemical Processes and Everyday Life** ● The chemical reaction by which plants produce complex food molecules (sugars) requires an energy input (i.e., from sunlight) to occur. In this reaction, carbon dioxide and water combine to form carbon-based organic molecules and release oxygen. *(secondary to MS-LS1-6)* ● Cellular respiration in plants and animals involve chemical reactions with oxygen that release stored energy. In these processes, complex molecules containing carbon react with oxygen to produce carbon dioxide and other materials. *(secondary to MS-LS1-7)*	

Connections to Disciplinary Core Ideas and Common Core Math and ELA

Connections to other DCIs in this grade-band:

MS.PS1.B (MS-LS1-6),(MS-LS1-7),(MS-LS2-3); **MS.LS4.C** (MS-LS2-4); **MS.LS4.D** (MS-LS2-4); **MS.ESS2.A** (MS-LS1-6),(MS-LS2-3),(MS-LS2-4); **MS.ESS3.A** (MS-LS2-1),(MS-LS2-4); **MS.ESS3.C** (MS-LS2-1),(MS-LS2-4)

Articulation of DCIs across grade-bands:

3.LS2.C (MS-LS2-1),(MS-LS2-4); **3.LS4.D** (MS-LS2-1),(MS-LS2-4); **5.PS3.D** (MS-LS1-6),(MS-LS1-7); **5.LS1.C** (MS-LS1-6),(MS-LS1-7); **5.LS2.A** (MS-LS1-6),(MS-LS2-1),(MS-LS2-3); **5.LS2.B** (MS-LS1-6),(MS-LS1-7);(MS-LS2-3); **HS.PS1.B** (MS-LS1-6),(MS-LS1-7); **HS.PS3.B** (MS-LS2-3); **HS.LS1.C** (MS-LS1-6),(HS-LS1-7),(MS-LS2-3); **HS.LS2.A** (MS-LS2-1); **HS.LS2.B** (MS-LS1-6),(MS-LS1-7),(MS-LS2-3); **HS.LS2.C** (MS-LS2-4),**HS.LS4.C** (MS-LS2-1),(MS-LS2-4); **HS.LS4.D** (MS-LS2-1),(MS-LS2-4); **HS.ESS2.A** (MS-LS2-3); **HS.ESS2.D** (MS-LS1-6); **HS.ESS2.E** (MS-LS2-4); **HS.ESS3.A** (MS-LS2-1); **HS.ESS3.B** (MS-LS2-4); **HS.ESS3.C** (MS-LS2-4)

Common Core State Standards Connections:

ELA/Literacy -

RST.6-8.1 Cite specific textual evidence to support analysis of science and technical texts. ,(MS-LS1-6),(MS-LS2-1),(MS-LS2-4)

RST.6-8.2 Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions. *(MS-LS1-6)*

RST.6-8.7 Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table). (MS-LS2-1)

RI.8.8 Trace and evaluate the argument and specific claims in a text, assessing whether the reasoning is sound and the evidence is relevant and sufficient to support the claims. (MS-LS2-4)

WHST.6-8.1 Write arguments focused on discipline content. (MS-LS2-4)

WHST.6-8.2 Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content. (MS-LS1-6)

WHST.6-8.9 Draw evidence from informational texts to support analysis, reflection, and research. (MS-LS1-6)

SL.8.5 Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest. *(MS-LS1-7),(MS-LS2-3)*

Mathematics -

6.EE.C.9 Use variables to represent two quantities in a real-world problem that change in relationship to one another; write an equation to express one quantity, thought of as the dependent variable, in terms of the other quantity, thought of as the independent variable. Analyze the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation. *(MS-LS1-6),(MS-LS2-3)*

New Jersey Content Standards Technology and 21st Century

8.1 Educational Technology: All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.

8.2 Technology Education, Engineering, Design, and Computational Thinking - Programming: All students will develop an understanding of the nature and impact of technology, engineering, technological design, computational thinking and the designed world as they relate to the individual, global society, and the environment.

Resources and Activities

There are a number of different resources to assist in aligning activities to the NJSLS.

- Newsela: Nonfiction Literacy and Current Events
  https://newsela.com/

- NSTA Formative Assessment Probes: This book series will be used as a form of pre-assessment and Do Now activities for the topics covered in this unit.

- Discovery:
  http://www.discoveryeducation.com/

- Kahoot: Game-Based Learning Platform
  https://getkahoot.com/

Video Resources:

- Amoeba Sisters Youtube channel
- Crash Course Science Youtube channel
- Crash Course Kids Youtube channel
- TED-Ed Youtube channel
- AsapSCIENCE Youtube channel
- National Geographic Youtube channel
- Moomoomath and science Youtube channel
- Peekaboo Kidz Youtube channel

Specific to this unit, are the following activities:

Explore Learning Gizmo:

- Cell Energy Cycle
- Food Chain
- Photosynthesis
- Pond Ecosystem
- Forest Ecosystem
- Prairie Ecosystem

Mosa Mack: Science Detective:

- Interaction of Organisms
- Food Webs
- Biodiversity

Generation Genius:

- Food Webs: Cycling of Matter and Flow of Energy
- Competition in Ecosystems

Problem-Based Activity/ Engineering Design:

"Survivor" Challenge… students worked in groups of 4 researching, planning, and creating their Survivor powerpoint in order to convince the Producers that the next season of Survivor should be filmed in their biome. Each individual student also made a separate poster on a specific plant or animal in that biome.

Land Biomes Project Lesson Plan - UGA Extension

extension.uga.edu/k12/science-behind-our-food/lesson-plans/landbiomes.pdf

Problem-Based/Engineering Design Challenge: Growing Up- Engineering Vertical Farms

Matter and Energy in Organisms and Ecosystems (NJSLS Standard: MS-LS1-6)

Engineering is Elementary- Growing Up- Engineering Vertical Farms: Students will be able to explore food production problems related to population growth. They will then engineer a model vertical farm as a potential solution to current food production limitations in a fictional location.
https://www.eie.org/engineering-everywhere/curriculum-units/verticalfarms

Evidence of Learning

Summative Assessment

The final summative exam evaluates students' learning after they finish all the investigations. Test items may be presented in a variety of formats, including multiple-choice, short-answer, and narrative items. Some items require students to draw diagrams, solve problems, and explain their understanding. Each problem-based activity will be evaluated using a scaled rubric.

The summative exam should focus on the performance expectations as outlined in the NJSLS.

Formative Assessment

Throughout the unit, formative assessments should be conducted to check understanding and student progress toward the end performance expectation. Formative assessments can be written or oral.

Benchmark Assessment

In order to measure student growth and design curriculum to meet individual student learning needs, benchmark assessments will be administered throughout the unit.

The following activities and experiences for students are examples of the integration of specific skills and strategies which support student achievement for the unit.

Interdisciplinary Connections:	**Language Arts-** Through the use of Newsela, students will read current event articles and be able to answer comprehension questions as well as be able to relay the main ideas and themes to their classmates. After several reading experiences, students will be leveled based on their comprehension skills and with more practice, they can improve their reading level. In addition, students will write four laboratory reports throughout the year. Their progress will be tracked and monitored for growth. **Mathematics-** Each student will be required to graph their data when applicable. When calculations and conversions are necessary, students will pull from their prior mathematics knowledge to accurately complete the task. Laboratory data will be analyzed. **Social Studies-** Major scientific advancements will be incorporated and the specific time period they occurred will be discussed. Class discussions will take place regarding its impact at that time and how it challenged the thinking and norms of that time.
Integration of Technology:	Students will be using chromebooks throughout the unit to explore these ideas and concepts virtually. They will be asked to complete virtual modules along with investigating these topics independently using designated internet resources. These resources include Mosa Mack: Science Detective, Explore Learning Gizmos, Generation Genius, and IXL programs.Students also will be viewing educational videos to further enhance their learning. Students will be informally assessed using the Kahoot online quiz and the teacher created Google Form exit tickets.
Differentiated Instruction:	**Special Needs** – Reinforcement, do now, and exit activities are designed with lower level learners in mind. The activities, both done in school and at home, allow the students to review the concepts learned in each lesson. Additional resources and study tools are available for students. Students will be grouped heterogeneously to allow for peer scaffolding. When available, the in-class support teacher will be utilized. **ELL** – refer to ELL Curriculum. **Gifted Learners** – End of unit "Problem Based Activities" are designed with higher-level learners in mind. These activities contain advanced questions and research opportunities. Students are encouraged to investigate more deeply into topics to gain a more complex understanding of the content. Students are asked to create and design solutions to problems, with little guidance from the instructor throughout the process. **Mainstream Learners** – Even within the mainstream learner groupings, there are a variety of individual learning styles and strengths. In order to reach all learners, teachers can make use of the interactive investigations, pictures, movies, websites, and Science extension activities.

NJSLS – Career Readiness, Life Literacies, and Key Skills (21st Century Themes and Skills)

Personal Finance Literacy 9.1	Career Awareness Exploration Preparedness and Training 9.2	Life Literacies and Key Skills 9.4
9.1.8.CR.1: Compare and contrast the role of philanthropy, volunteer service, and charities in community development and the quality of life in a variety of cultures. **9.1.8.CR.2**: Compare various ways to give back through strengths, passions, goals, and other personal factors. **9.1.8.CR.3**: Relate the importance of consumer, business, and government responsibility to the economy and personal finance. **9.1.8.CR.4**: Examine the implications of legal and ethical behaviors when making financial decisions**.**	**9.2.8.CAP.10:** Evaluate how careers have evolved regionally, nationally, and globally. **9.2.8.CAP.12:** Assess personal strengths, talents, values, and interests to appropriate jobs and careers to maximize career potential.	**9.4.8.CI.1**: Assess data gathered on varying perspectives on causes of climate change (e.g., cross cultural, gender-specific, generational), and determine how the data can best be used to design multiple potential solutions. **9.4.8.CI.2**: Repurpose an existing resource in an innovative way. **9.4.8.CI.3**: Examine challenges that may exist in the adoption of new ideas. **9.4.8.CI.4**: Explore the role of creativity and innovation in career pathways and industries. **9.4.8.CT.2:** Develop multiple solutions to a problem and evaluate short- and long-term effects to determine the most plausible option **9.4.8.DC.8:** Explain how communities use data and technology to develop measures to respond to effects of climate change. **9.4.8.GCA.2**: Demonstrate openness to diverse ideas and perspectives through active discussions to achieve a group goal. **9.4.8.IML.4**: Ask insightful questions to organize different types of data and create meaningful visualizations. **9.4.8.IML.5**: Analyze and interpret local or public data sets to summarize and effectively communicate the data. **9.4.8.TL.1**: Construct a spreadsheet in order to analyze multiple data sets, identify relationships, and facilitate data-based decision-making. **9.4.8.TL.3:** Select appropriate tools to organize and present information digitally

Interdependent Relationships in Ecosystems

Content Area: Science

Unit Title: Interdependent Relationships in Ecosystems

Target Course/Grade Level: Seventh Grade

Unit Rationale

According to the **A Framework for K-12 Science** Education, ecosystems are constantly changing. The changes in both population of organisms and the physical environment affect the stability of the entire system. This unit is designed to help students identify biotic and abiotic factors in an ecosystem and predict the affect of these changes on the population of organisms.

Unit Summary

Students construct explanations for the interactions in ecosystems and the scientific, economic, political, and social justifications used in making decisions about maintaining biodiversity in ecosystems. Students use models, construct evidence-based explanations, and use argumentation from evidence. Students understand that organisms and populations of organisms are dependent on their environmental interactions both with other organisms and with nonliving factors. They also understand the limits of resources influence the growth of organisms and populations, which may result in competition for those limited resources. Crosscutting concepts of matter and energy, systems and system models, and cause and effect are used by students to support understanding the phenomena they study.

Unit Essential Questions

- ***How do organisms react with other organisms to obtain energy?***
- ***What effect does the physical environment of an ecosystem have on the organisms?***
- ***Why is biodiversity important?***

Unit Enduring Understandings

- **Ecosystems are constantly changing. Changes in the physical and biological parts of an ecosystem will affect all of its populations.**
- **Types of interactions among organisms within an ecosystem include competitive, predatory, and mutually beneficial.**
- **Biodiversity within an ecosystem is a measure of its success.**

STUDENT LEARNING OBJECTIVES (SLO)

Students will...

1. Describe how one population of organisms may affect other plants and/or animals in an ecosystem. **(LS2.A)**
2. Predict the impact of humans altering biotic and abiotic factors has on an ecosystem. **(LS2.C)**
3. Model the effect of positive and negative changes in population size on a symbiotic pairing. **(LS2.A)**
4. **Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.** [Clarification Statement: Emphasis is on predicting consistent patterns of interactions in different ecosystems in terms of the relationships among and between organisms and abiotic components of ecosystems. Examples of types of interactions could include competitive, predatory, and mutually beneficial.] **(LS2-5)**
5. **Evaluate competing design solutions for maintaining biodiversity and ecosystem services.*** [Clarification Statement: Examples of ecosystem services could include water purification, nutrient recycling, and prevention of soil erosion. Examples of design solution constraints could include scientific, economic, and social considerations.] **(LS2-2)**

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Constructing Explanations and Designing Solutions Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories. ● Construct an explanation that includes qualitative or quantitative relationships between variables that predict phenomena. (MS-LS2-2) Engaging in Argument from Evidence Engaging in argument from evidence in 6–8 builds on K–5 experiences and progresses to constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed world(s). ● Evaluate competing design solutions based on jointly developed and agreed-upon design criteria. (MS-LS2-5)	**LS2.A: Interdependent Relationships in Ecosystems** ● Similarly, predatory interactions may reduce the number of organisms or eliminate whole populations of organisms. Mutually beneficial interactions, in contrast, may become so interdependent that each organism requires the other for survival. Although the species involved in these competitive, predatory, and mutually beneficial interactions vary across ecosystems, the patterns of interactions of organisms with their environments, both living and nonliving, are shared. (MS-LS2-2) **LS2.C: Ecosystem Dynamics, Functioning, and Resilience** ● Biodiversity describes the variety of species found in Earth's terrestrial and oceanic ecosystems. The completeness or integrity of an ecosystem's biodiversity is often used as a measure of its health. (MS-LS2-5) **LS4.D: Biodiversity and Humans** ● Changes in biodiversity can influence humans' resources, such as food, energy, and medicines, as well as ecosystem services that humans rely on—for example, water purification and recycling. *(secondary to MS-LS2-5)* **ETS1.B: Developing Possible Solutions** ● There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem. *(secondary to MS-LS2-5)*	**Patterns** ● Patterns can be used to identify cause and effect relationships. (MS-LS2-2) **Stability and Change** ● Small changes in one part of a system might cause large changes in another part. (MS-LS2-5) - ***Connections to Engineering, Technology, and Applications of Science*** **Influence of Science, Engineering, and Technology on Society and the Natural World** ● The use of technologies and any limitations on their use are driven by individual or societal needs, desires, and values; by the findings of scientific research; and by differences in such factors as climate, natural resources, and economic conditions. Thus technology use varies from region to region and over time. (MS-LS2-5) - ***Connections to Nature of Science*** **Science Addresses Questions About the Natural and Material World** ● Scientific knowledge can describe the consequences of actions but does not necessarily prescribe the decisions that society takes. (MS-LS2-5)

Connections to Disciplinary Core Ideas and Common Core Math and ELA

Connections to other DCIs in this grade-band:
MS.LS1.B (MS-LS2-2); **MS.ESS3.C** (MS-LS2-5)

Articulation of DCIs across grade-bands:
1.LS1.B (MS-LS2-2); **HS.LS2.A** (MS-LS2-2),(MS-LS2-5); **HS.LS2.B** (MS-LS2-2); **HS.LS2.C** (MS-LS2-5); **HS.LS2.D** (MS-LS2-2); **HS.LS4.D** (MS-LS2-5); **HS.ESS3.A** (MS-LS2-5); **HS.ESS3.C** (MS-LS2-5); **HS.ESS3.D** (MS-LS2-5)

Common Core State Standards Connections:

ELA/Literacy -

RST.6-8.1	Cite specific textual evidence to support analysis of science and technical texts. (MS-LS2-2)
RST.6-8.8	Distinguish among facts, reasoned judgment based on research findings, and speculation in a text. (MS-LS2-5)
RI.8.8	Trace and evaluate the argument and specific claims in a text, assessing whether the reasoning is sound and the evidence is relevant and sufficient to support the claims. (MS-LS2-5)
WHST.6-8.2	Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content. (MS-LS2-2)
WHST.6-8.9	Draw evidence from literary or informational texts to support analysis, reflection, and research. (MS-LS2-2)
SL.8.1	Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 8 topics, texts, and issues, building on others' ideas and expressing their own clearly. *(MS-LS2-2)*
SL.8.4	Present claims and findings, emphasizing salient points in a focused, coherent manner with relevant evidence, sound valid reasoning, and well-chosen details; use appropriate eye contact, adequate volume, and clear pronunciation. *(MS-LS2-2)*

Mathematics -

MP.4	Model with mathematics. *(MS-LS2-5)*
6.RP.A.3	Use ratio and rate reasoning to solve real-world and mathematical problems. *(MS-LS2-5)*
6.SP.B.5	Summarize numerical data sets in relation to their context. *(MS-LS2-2)*

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- Coral Reefs 1 – Abiotic Factors
- Coral Reefs 2 – Biotic Factors
- Rabbit Population by Season
- Forest Ecosystem
- Pond Ecosystem
- Prairie Ecosystem

Mosa Mack: Science Detective:

- Biodiversity

Generation Genius:

- Maintaining Biodiversity

Evidence of Learning

Summative Assessment

The final summative exam evaluates students' learning after they finish all the investigations. Test items may be presented in a variety of formats, including multiple-choice, short-answer, and narrative items. Some items require students to draw diagrams, solve problems, and explain their understanding. Each problem-based activity will be evaluated using a scaled rubric.

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Growth, Development, and Reproduction of Organisms

Content Area: Science

Unit Title: Growth, Development, and Reproduction of Organisms

Target Course/Grade Level: Seventh Grade

Unit Rationale

According to the **A Framework for K-12 Science** Education, there are predictable changes in the structures, functions and behaviors of organisms as they age. These changes can be due to genetic predisposition as well as environmental conditions. This unit is designed to help students understand the behaviors and characteristics that lead to successful reproduction and the factors that affect the transfer of genetic information from parent to offspring.

Unit Summary

Students understand how the environment and genetic factors determine the growth of an individual organism. They also demonstrate understanding of the genetic implications for sexual and asexual reproduction. Students develop evidence to support their understanding of the structures and behaviors that increase the likelihood of successful reproduction by organisms. They have a beginning understanding of the ways humans can select for specific traits, the role of technology, genetic modification, and the nature of ethical responsibilities related to selective breeding. At the end of the unit, students can explain how selected structures, functions, and behaviors of organisms change in predictable ways as they progress from birth to old age.

Unit Essential Questions

- ***How do characteristics in both plants and animals affect their reproduction?***
- ***What are some environmental and genetic factors that influence an organisms' growth?***
- ***How do changes in genetic material affect protein synthesis?***
- ***What can you predict about the offspring formed through asexual reproduction? Sexual reproduction?***
- ***How has technology affected genetics?***

Unit Enduring Understandings

- **There are certain behaviors and characteristics that increase the odds of successful reproduction.**
- **The growth of an organism is dependent on its genetic factors as well as environmental conditions.**
- **Each gene controls the production of a specific protein that affects the traits of an organism; changes in the protein will result in changes in the trait.**
- **Asexual reproduction will yield offspring with identical genetic material; sexual reproduction will yield a wide variety of genetic combinations.**
- **Genetic modifications, animal husbandry, gene therapy are all ways that technology has influenced genetic outcomes.**

STUDENT LEARNING OBJECTIVES (SLO)

Students will...

1. **Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively.** [Clarification Statement: Examples of behaviors that affect the probability of animal reproduction could include nest building to protect young from cold, herding of animals to protect young from predators, and vocalization of animals and colorful plumage to attract mates for breeding. Examples of animal behaviors that affect the probability of plant reproduction could include transferring pollen or seeds, and creating conditions for seed germination and growth. Examples of plant structures could include bright flowers attracting butterflies that transfer pollen, flower nectar and odors that attract insects that transfer pollen, and hard shells on nuts that squirrels bury.] **(LS1-4)**
2. **Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.** [Clarification Statement: Examples of local environmental conditions could include availability of food, light, space, and water. Examples of genetic factors could include large breed cattle and species of grass affecting growth of organisms. Examples of evidence could include drought decreasing plant growth, fertilizer increasing plant growth, different varieties of plant seeds growing at different rates in different conditions, and fish growing larger in large ponds than they do in small ponds.] [*Assessment Boundary: Assessment does not include genetic mechanisms, gene regulation, or biochemical processes.*] **(LS1-5)**
3. **Develop and use a model to describe why structural changes to genes (mutations) located on chromosomes may affect proteins and may result in harmful, beneficial, or neutral effects to the structure and function of the organism.** [Clarification Statement: Emphasis is on conceptual understanding that changes in genetic material may result in making different proteins.] [*Assessment Boundary: Assessment does not include specific changes at the molecular level, mechanisms for protein synthesis, or specific types of mutations*.] **(LS3-1)**
4. **Develop and use a model to describe why asexual reproduction results in offspring with identical genetic information and sexual reproduction results in offspring with genetic variation.** [Clarification Statement: Emphasis is on using models such as Punnett squares, diagrams, and simulations to describe the cause and effect relationship of gene transmission from parent(s) to offspring and resulting genetic variation.] **(LS3-2)**
5. **Gather and synthesize information about the technologies that have changed the way humans influence the inheritance of desired traits in organisms.** [Clarification Statement: Emphasis is on synthesizing information from reliable sources about the influence of humans on genetic outcomes in artificial selection (such as genetic modification, animal husbandry, gene therapy); and, on the impacts these technologies have on society as well as the technologies leading to these scientific discoveries.] **(LS4-5)**

Science and Engineering Practices

Developing and Using Models

Modeling in 6–8 builds on K–5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems.

- Develop and use a model to describe phenomena. (MS-LS3-1),(MS-LS3-2)

Constructing Explanations and Designing Solutions

Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific knowledge, principles, and theories.

- Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students' own experiments) 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. (MS-LS1-5)

Engaging in Argument from Evidence

Engaging in argument from evidence in 6–8 builds on K–5 experiences and progresses to constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed world(s).

- 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)

Disciplinary Core Ideas

LS1.B: Growth and Development of Organisms

- Organisms reproduce, either sexually or asexually, and transfer their genetic information to their offspring. *(secondary to MS-LS3-2)*
- Animals engage in characteristic behaviors that increase the odds of reproduction. (MS-LS1-4)
- Plants reproduce in a variety of ways, sometimes depending on animal behavior and specialized features for reproduction. (MS-LS1-4)
- Genetic factors as well as local conditions affect the growth of the adult plant. (MS-LS1-5)

LS3.A: Inheritance of Traits

- Genes are located in the chromosomes of cells, with each chromosome pair containing two variants of each of many distinct genes. Each distinct gene chiefly controls the production of specific proteins, which in turn affects the traits of the individual. Changes (mutations) to genes can result in changes to proteins, which can affect the structures and functions of the organism and thereby change traits. (MS-LS3-1)
- Variations of inherited traits between parent and offspring arise from genetic differences that result from the subset of chromosomes (and therefore genes) inherited. (MS-LS3-2)

LS3.B: Variation of Traits

- In sexually reproducing organisms, each parent contributes half of the genes acquired (at random) by the offspring. Individuals have two of each chromosome and hence

Crosscutting Concepts

Cause and Effect

- Cause and effect relationships may be used to predict phenomena in natural systems. (MS-LS3-2)
- Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability. (MS-LS1-4),(MS-LS1-5),(MS-LS4-5)

Structure and Function

- Complex and microscopic structures and systems can be visualized, modeled, and used to describe how their function depends on the shapes, composition, and relationships among its parts, therefore complex natural structures/systems can be analyzed to determine how they function. (MS-LS3-1)

Connections to Engineering, Technology, and Applications of Science

Interdependence of Science, Engineering, and Technology

- Engineering advances have led to important discoveries in virtually every field of science, and scientific discoveries have led to the development of entire industries and engineered systems. (MS-LS4-5)

Connections to Nature of Science

Scientific Knowledge Assumes an Order and Consistency in Natural Systems

- Science assumes that objects and events in natural systems occur in consistent patterns that are understandable through measurement and observation. (MS-LS4-1),(MS-LS4-2)

Science Addresses Questions About the Natural and Material World

- Scientific knowledge can describe the consequences of actions but does not necessarily prescribe the decisions that society takes. (MS-LS4-5)

Obtaining, Evaluating, and Communicating Information Obtaining, evaluating, and communicating information in 6–8 builds on K–5 experiences and progresses to evaluating the merit and validity of ideas and methods. ● Gather, read, and synthesize information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication and methods used, and describe how they are supported or not supported by evidence. (MS-LS4-5)	two alleles of each gene, one acquired from each parent. These versions may be identical or may differ from each other. (MS-LS3-2) ● In addition to variations that arise from sexual reproduction, genetic information can be altered because of mutations. Though rare, mutations may result in changes to the structure and function of proteins. Some changes are beneficial, others harmful, and some neutral to the organism. (MS-LS3-1) **LS4.B: Natural Selection** ● In *artificial* selection, humans have the capacity to influence certain characteristics of organisms by selective breeding. One can choose desired parental traits determined by genes, which are then passed to offspring. (MS-LS4-5)	

Connections to Disciplinary Core Ideas and Common Core Math and ELA

Connections to other DCIs in this grade-band:
MS.LS1.A (MS-LS3-1); **MS.LS2.A** (MS-LS1-4),(MS-LS1-5); **MS.LS4.A** (MS-LS3-1)

Articulation of DCIs across grade-bands:
3.LS1.B (MS-LS1-4),(MS-LS1-5); **3.LS3.A** (MS-LS1-5),(MS-LS3-1),(MS-LS3-2); **3.LS3.B** (MS-LS3-1),(MS-LS3-2); **HS.LS1.A** (MS-LS3-1); **HS.LS1.B** (MS-LS3-1),(MS-LS3-2); **HS.LS2.A** (MS-LS1-4),(MS-LS1-5); **HS.LS2.D** (MS-LS1-4); **HS.LS3.A** (MS-LS3-1),(MS-LS3-2); **HS.LS3.B** (MS-LS3-1),(MS-LS3-2),(MS-LS4-5); **HS.LS4.C** (MS-LS4-5)

Common Core State Standards Connections:

ELA/Literacy -

RST.6-8.1	Cite specific textual evidence to support analysis of science and technical texts. (MS-LS1-4),(MS-LS1-5),*((MS-LS3-1),(MS-LS3-2)*,(MS-LS4-5)
RST.6-8.2	Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions. *(MS-LS1-5)*
RST.6-8.4	Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 6-8 texts and topics. *(MS-LS3-1),(MS-LS3-2)*
RST.6-8.7	Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table). (MS-LS3-1),(MS-LS3-2)
RI.6.8	Trace and evaluate the argument and specific claims in a text, distinguishing claims that are supported by reasons and evidence from claims that are not. (MS-LS1-4)
WHST.6-8.1	Write arguments focused on discipline content. (MS-LS1-4)
WHST.6-8.2	Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content. *(MS-LS1-5)*
WHST.6-8.8	Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation.*(MS-LS4-5)*
WHST.6-8.9	Draw evidence from informational texts to support analysis, reflection, and research. (MS-LS1-5)
SL.8.5	Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest. *(MS-LS3-1),(MS-LS3-2)*

Mathematics -

MP.4 Model with mathematics. *(MS-LS3-2)*

6.SP.A.2 Understand that a set of data collected to answer a statistical question has a distribution which can be described by its center, spread, and overall shape. *(MS-LS1-4),(MS-LS1-5)*

6.SP.B.4 Summarize numerical data sets in relation to their context. *(MS-LS1-4),(MS-LS1-5)*

6.SP.B.5 Summarize numerical data sets in relation to their context. *(MS-LS3-5)*

New Jersey Content Standards Technology and 21st Century

8.1 Educational Technology: All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.

8.2 Technology Education, Engineering, Design, and Computational Thinking - Programming: All students will develop an understanding of the nature and impact of technology, engineering, technological design, computational thinking and the designed world as they relate to the individual, global society, and the environment.

Resources and Activities

There are a number of different resources to assist in aligning activities to the NJSLS.

- Newsela: Nonfiction Literacy and Current Events
  https://newsela.com/

- NSTA Formative Assessment Probes: This book series will be used as a form of pre-assessment and Do Now activities for the topics covered in this unit.

- Discovery Techbook: Digital Textbook Resource
  http://www.discoveryeducation.com/

- Kahoot: Game-Based Learning Platform
  https://getkahoot.com/

Video Resources:

- Amoeba Sisters Youtube channel
- Crash Course Science Youtube channel
- Crash Course Kids Youtube channel
- TED-Ed Youtube channel
- AsapSCIENCE Youtube channel
- National Geographic Youtube channel
- Moomoomath and science Youtube channel
- Peekaboo Kidz Youtube channel

Specific to this unit, are the following activities:

Explore Learning Gizmo:

- Flower Pollination
- Inheritance
- Building DNA
- Mouse Genetics

Mosa Mack: Science Detective:

- Photosynthesis

Generation Genius:

- Reproduction of Living Things

Problem-Based Activity/ Engineering Design:

Genetics Egg Unit: students worked with plastic eggs and their "alleles" to expand their knowledge of genetics: DNA, genes, alleles, homozygous, heterozygous, punnett squares, dominant, recessive, incomplete and codominance.

Evidence of Learning

Summative Assessment

The final summative exam evaluates students' learning after they finish all the investigations. Test items may be presented in a variety of formats, including multiple-choice, short-answer, and narrative items. Some items require students to draw diagrams, solve problems, and explain their understanding. Each problem-based activity will be evaluated using a scaled rubric.

The summative exam should focus on the performance expectations as outlined in the NJSLS.

Formative Assessment

Throughout the unit, formative assessments should be conducted to check understanding and student progress toward the end performance expectation. Formative assessments can be written or oral.

Benchmark Assessment

In order to measure student growth and design curriculum to meet individual student learning needs, benchmark assessments will be administered throughout the unit.

The following activities and experiences for students are examples of the integration of specific skills and strategies which support student achievement for the unit.

Interdisciplinary Connections:	**Language Arts-** Through the use of Newsela, students will read current event articles and be able to answer comprehension questions as well as be able to relay the main ideas and themes to their classmates. After several reading experiences, students will be leveled based on their comprehension skills and with more practice, they can improve their reading level. In addition, students will write four laboratory reports throughout the year. Their progress will be tracked and monitored for growth. **Mathematics-** Each student will be required to graph their data when applicable. When calculations and conversions are necessary, students will pull from their prior mathematics knowledge to accurately complete the task. Laboratory data will be analyzed. **Social Studies-** Major scientific advancements will be incorporated and the specific time period they occurred will be discussed. Class discussions will take place regarding its impact at that time and how it challenged the thinking and norms of that time.
Integration of Technology:	Students will be using chromebooks throughout the unit to explore these ideas and concepts virtually. They will be asked to complete virtual modules along with investigating these topics independently using designated internet resources. These resources include Mosa Mack: Science Detective, Explore Learning Gizmos, Generation Genius, and IXL programs.Students also will be viewing educational videos to further enhance their learning. Students will be informally assessed using the Kahoot online quiz and the teacher created Google Form exit tickets.
Differentiated Instruction:	**Special Needs** – Reinforcement, do now, and exit activities are designed with lower level learners in mind. The activities, both done in school and at home, allow the students to review the concepts learned in each lesson. Additional resources and study tools are available for students. Students will be grouped heterogeneously to allow for peer scaffolding. When available, the in-class support teacher will be utilized. **ELL** – refer to ELL Curriculum. **Gifted Learners** – End of unit "Problem Based Activities" are designed with higher-level learners in mind. These activities contain advanced questions and research opportunities. Students are encouraged to investigate more deeply into topics to gain a more complex understanding of the content. Students are asked to create and design solutions to problems, with little guidance from the instructor throughout the process. **Mainstream Learners** – Even within the mainstream learner groupings, there are a variety of individual learning styles and strengths. In order to reach all learners, teachers can make use of the interactive investigations, pictures, movies, websites, and Science extension activities.

NJSLS – Career Readiness, Life Literacies, and Key Skills (21st Century Themes and Skills)

Personal Finance Literacy 9.1	Career Awareness Exploration Preparedness and Training 9.2	Life Literacies and Key Skills 9.4
9.1.8.CR.1: Compare and contrast the role of philanthropy, volunteer service, and charities in community development and the quality of life in a variety of cultures. **9.1.8.CR.2**: Compare various ways to give back through strengths, passions, goals, and other personal factors. **9.1.8.CR.3**: Relate the importance of consumer, business, and government responsibility to the economy and personal finance. **9.1.8.CR.4**: Examine the implications of legal and ethical behaviors when making financial decisions**.**	**9.2.8.CAP.10:** Evaluate how careers have evolved regionally, nationally, and globally. **9.2.8.CAP.12:** Assess personal strengths, talents, values, and interests to appropriate jobs and careers to maximize career potential.	**9.4.8.CI.1**: Assess data gathered on varying perspectives on causes of climate change (e.g., cross cultural, gender-specific, generational), and determine how the data can best be used to design multiple potential solutions. **9.4.8.CI.2**: Repurpose an existing resource in an innovative way. **9.4.8.CI.3**: Examine challenges that may exist in the adoption of new ideas. **9.4.8.CI.4**: Explore the role of creativity and innovation in career pathways and industries. **9.4.8.CT.2:** Develop multiple solutions to a problem and evaluate short- and long-term effects to determine the most plausible option **9.4.8.DC.8:** Explain how communities use data and technology to develop measures to respond to effects of climate change. **9.4.8.GCA.2**: Demonstrate openness to diverse ideas and perspectives through active discussions to achieve a group goal. **9.4.8.IML.4**: Ask insightful questions to organize different types of data and create meaningful visualizations. **9.4.8.IML.5**: Analyze and interpret local or public data sets to summarize and effectively communicate the data. **9.4.8.TL.1**: Construct a spreadsheet in order to analyze multiple data sets, identify relationships, and facilitate data-based decision-making. **9.4.8.TL.3:** Select appropriate tools to organize and present information digitally