Science- Grade 6

Unit # 1	Title: Growth, Development, and Reproduction of Organisms // Matter and Energy in Organisms and Ecosystems	Pacing: 50 days

Stage 1- Desired Results

Established Goals/NJSLS Standards

Next Generation Science Standards/NJSLS:

MS-LS1-4 From Molecules to Organisms: Structures and Processes

- 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.] (MS-LS1-4)*

MS-LS1-5 From Molecules to Organisms: Structures and Processes

- 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.] (MS-LS1-5)*

MS-LS2-1 Ecosystems: Interactions, Energy, and Dynamics

- 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.] (MS-LS2-1)*

MS-LS2-2 Ecosystems: Interactions, Energy, and Dynamics

- 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.] (MS-LS2-2)*

MS-LS2-3 Ecosystems: Interactions, Energy, and Dynamics

- 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.] (MS-LS2-3)*

English Language Arts

- Cite specific textual evidence to support analysis of science and technical texts. (MS-LS1-4),(MS-LS1-5) RST.6-8.1
- 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- 8.2
- 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. (MSLS1-4) RI.6.8
- Write arguments focused on discipline content. (MS-LS1-4) WHST.6-8.1

English Language Arts Continued

- 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.6-8.2
- Draw evidence from informational texts to support analysis, reflection, and research. (MS-LS1-5) WHST.6-8.9
- Cite specific textual evidence to support analysis of science and technical texts. (MS-LS2-1),(MS-LS2-2) RST.6-8.1
- 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) RST.6-8.7
- 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.6-8.2
- Draw evidence from literary or informational texts to support analysis, reflection, and research. (MS-LS2-2) WHST.6-8.9
- 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.8.1

Mathematics

- 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.A.2
- Summarize numerical data sets in relation to their context. (MS-LS1-4),(MS-LS1- 5) 6.SP.B.4
- 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-LS2-3) 6.EE.C.9
- Summarize numerical data sets in relation to their context. (MS-LS2-2) 6.SP.B.5

Enduring Understandings (DCI) ***Students will understand...***	**Essential Questions** ***Students will consider...***
LS1.B: Growth and Development of Organisms ● 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) **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) ● 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.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)	● How do characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants, respectively? ● How do environmental and genetic factors influence the growth of organisms? ● How do changes in the availability of matter and energy affect populations in an ecosystem? ● How do relationships among organisms, in an ecosystem, affect populations? ● How can you explain the stability of an ecosystem by tracing the flow of matter and energy?

Knowledge (Concepts) ***Students will know…***	**Academic Vocabulary**
• Plants reproduce in a variety of ways, sometimes depending on animal behavior and specialized features for reproduction. There are a variety of ways that plants reproduce. • Specialized structures for plants affect their probability of successful reproduction. • Some characteristic animal behaviors affect the probability of successful reproduction in plants. • Animals engage in characteristic behaviors that affect the probability of successful reproduction. • There are a variety of characteristic animal behaviors that affect their probability of successful reproduction. • There are a variety of animal behaviors that attract a mate. • Successful reproduction of animals and plants may have more than one cause, and some cause-and-effect relationships in systems can only be described using probability. • Genetic factors as well as local conditions affect the growth of organisms. A variety of local environmental conditions affect the growth of organisms. • Genetic factors affect the growth of organisms (plant and animal). • The factors that influence the growth of organisms may have more than one cause. • Some cause-and-effect relationships in plant and animal systems can only be described using probability. • Organisms and populations of organisms are dependent on their environmental interactions with other living things. • Organisms and populations of organisms are dependent on their environmental interactions with non living factors. • In any ecosystem, organisms and populations with similar requirements for food, water, oxygen, or other resources may compete with others for limited resources. • Access to food, water, oxygen, or other resources constrain organisms' growth and reproduction. • Predatory interactions may reduce the number of organisms or eliminate whole populations of organisms. • Mutually beneficial interactions may become so interdependent that each organism requires the other for survival. • The patterns of interactions of organisms with their environment, both its living and nonliving components, are shared. • Interactions within ecosystems have patterns that can be used to identify cause-and-effect relationships. • Patterns of interactions among organisms across multiple ecosystems can be predicted. • Patterns of interactions can be used to make predictions about the relationships among and between organisms and abiotic components of ecosystems.	• organisms • reproduction • characteristics • behavior • genetic • ecosystem • food web • decomposers • producers • consumers • pattern • transfer • recycle • population • dependent • independent • interdependent • resources • oxygen • interaction • atoms • plants • animals • growth • interdependent • species • environment • biotic factors • abiotic factors • matter • energy

Knowledge Continued (Concepts)

Students will know…

- Food webs are models that demonstrate how matter and energy are transferred among 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.
- Decomposers recycle nutrients from dead plant or animal matter back 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.
- The transfer of energy can be tracked as energy flows through an ecosystem.
- Science assumes that objects and events in ecosystems occur in consistent patterns that are understandable through measurement and observation.

Skills

Students will be able to…

- Collect empirical evidence about animal behaviors that affect the animal's probability of successful reproduction and also affect the probability of plant reproduction.
- Collect empirical evidence about plant structures that are specialized for reproductive success.
- Use empirical evidence from experiments and other scientific reasoning to support oral and written arguments that explain the relationship among plant structure, animal behavior, and the reproductive success of plants.
- Identify and describe possible cause-and effect relationships affecting the reproductive success of plants and animals using probability.
- Support or refute an explanation of how characteristic animal behaviors and specialized plant structures affect the probability of successful plant reproduction using oral and written arguments.

Skills Continued

- Conduct experiments, collect evidence, and analyze empirical data.
- Use evidence from experiments and other scientific reasoning to support oral and written explanations of how environmental and genetic factors influence the growth of organisms.
- Identify and describe possible causes and effects of local environmental conditions on the growth of organisms.
- Identify and describe possible causes and effects of genetic conditions on the growth of organisms.
- Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.
- Use cause-and-effect relationships to predict the effect of resource availability on organisms and populations in natural systems.
- Construct an explanation about interactions within ecosystems.
- Include qualitative or quantitative relationships between variables as part of explanations about interactions within ecosystems.
- Make predictions about the impact within and across ecosystems of competitive, predatory, or mutually beneficial relationships as abiotic (e.g., floods, habitat loss) or biotic (e.g., predation) components change.
- Develop a model to describe the cycling of matter among living and nonliving parts of an ecosystem.
- Develop a model to describe the flow of energy among living and nonliving parts of ecosystem. Track the transfer of energy as energy flows through an ecosystem.
- Observe and measure patterns of objects and events in ecosystems.

21ST Century/ Interdisciplinary Themes	21st Century Skills
Global Awareness Financial, Business, & Entrepreneurial Literacy Civic Literacy Environmental Literacy **Health Literacy**	**Creativity & Innovation** **Communication & Collaboration** **Media Literacy** **Critical Thinking & Problem Solving** **Information Literacy** **Information, Communication, & Technology** **Life & Career Skills**

Stage 2- Assessment Evidence
from the NJ Model Curriculum:

What influences the growth and development of an organism?
Students use data and conceptual models to understand how the environment and genetic factors determine the growth of an individual organism. They connect this idea to the role of animal behaviors in animal reproduction and to the dependence of some plants on animal behaviors for their reproduction. Students provide evidence to support their understanding of the structures and behaviors that increase the likelihood of successful reproduction by organisms. The crosscutting concepts of cause and effect and structure and function provide a framework for understanding the disciplinary core ideas. Students demonstrate grade-appropriate proficiency in analyzing and interpreting data, using models, conducting investigations, and communicating information. Students are also expected to use these practices to demonstrate understanding of the core ideas.

How and why do organisms interact with their environment and what are the effects of these interactions?
Students analyze and interpret data, develop models, construct arguments, and demonstrate a deeper understanding of the cycling of matter, the flow of energy, and resources in ecosystems. They are able to study patterns of interactions among organisms within an ecosystem. They consider biotic and abiotic factors in an ecosystem and the effects these factors have on populations. They also understand that the limits of resources influence the growth of organisms and populations, which may result in competition for those limited resources. The crosscutting concepts of matter and energy, systems and system models, patterns, and cause and effect provide a framework for understanding the disciplinary core ideas. Students demonstrate grade-appropriate proficiency in analyzing and interpret data, developing models, and constructing arguments. Students are also expected to use these practices to demonstrate understanding of the core ideas.

Summative Assessment 1
- ***Standard:*** MS-LS1-4, MS-LS1-5
- ***Type:*** Essay
- ***Overview:*** Develop a written argument to explain how bees influence the probability of successful plant reproduction.
- ***Rubric:***https://docs.google.com/a/linwoodschools.org/document/d/1d4XriF8jjkQrKbaOSSc-eFOUyM3l1nzzpjYVLrAiIiE/edit?usp=sharing
- ***Resources:*** https://betterlesson.com/lesson/633283/pollination-the-story-behind-bees-and-flowers
  https://betterlesson.com/lesson/640362/busy-bees?from=search_lesson_title
  https://betterlesson.com/lesson/617285/monster-plants?from=search_lesson_title

Summative Assessment 2
- ***Standard:*** MS-LS2-1, MS-LS2-2, MS-LS2-3
- ***Type:*** PBL (project-based assessment)
- ***Overview:*** Students will create a baby animal nursery habitat brochure (similar to hotel advertisement ie airbnb or expedia) for a single species of animal.
  - Students must identify environmental factors (e.g. availability of light, space, food, water, size of habitat) that can influence growth. Genetic factors (e.g. specific breeds of animals and they typical sizes) that can influence growth
- ***Rubric:*** https://docs.google.com/a/linwoodschools.org/document/d/1qn7xDuwqZuDhpVnaWNi9xPYDFKh1YdHPzLUhY0UukkY/edit?usp=sharing

- ***Resources:*** https://betterlesson.com/lesson/639336/relationships-between-organisms

Formative Assessments	*Student Self-Assessment*	*Common Assessments*
• Pre-assessments • Labs • Quizzes • Project and problem-based learning activities • Graphic organizers • Short research projects • Collaborative learning projects • Formative checks (whiteboards, T/F, vote with your feet, thumbs up or thumbs down) • Summary Diagrams • Open ended responses • Short responses • Conferencing • Unit tests • Checklists	• Reflection activities (on the learning scale, on the daily target, on labs, on summative assessments, on collaborative work, on projects) • Responses to inquiry-based questions • Think-pair-share activities • Student revising knowledge throughout the unit	• Summative Assessments

Stage 3- Learning Plan

Suggested Learning Activities from the NJ DOE Model Curriculum

Growth, Development and Reproduction of Organisms / Matter and Energy in Organisms and Ecosystems

Instruction should result in students being able to use arguments based on empirical evidence and scientific reasoning to support an explanation of how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants. Students may observe examples of plant structures that could affect the probability of plant reproduction, including bright flowers attracting butterflies that transfer pollen, flower nectar and odors that attract pollen-transferring insects, and hard shells on nuts that squirrels bury. Possible activities could include plant experiments (e.g., students could count the number of butterflies on brightly colored plants vs. the number of butterflies on other types of plants and record the data they collect in a table), using microscopes/magnifiers to view plant structures (e.g., dissecting a lily), going on field trips, both virtual and actual (e.g., butterfly garden/botanical garden).

Students may observe examples of animal behaviors that affect the probability of plant reproduction, which could include observing how animals can transfer pollen or seeds and how animals can create conditions for seed germination and growth (e.g., students may conduct an experiment using rapid cycling Brassica rapa [Fast Plant] and collect data on how many plants produce seeds with and without the aid of a pollinator.

Students could then observe examples of animal behaviors (using videos, Internet resources, books, etc.) that could affect the probability of successful animal reproduction. These behaviors could include nest building to protect young from cold, herding of animals to protect young from predators, and colorful plumage and vocalizations to attract mates for breeding. Students may be able to identify and describe possible cause-and-effect relationships in factors that contribute to the reproductive success of plants and animals by using probability data from the rapid-cycling Brassica rapa (Fast Plant) experiments and drawing conclusions about one relationship between animals and plants.

At this point, students can present an oral and/or written argument supported by evidence and scientific reasoning that characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants, respectively. Students may use evidence from experiments or other sources to identify the role of pollinators in plant reproduction.

Suggested Learning Activities from the NJ DOE Model Curriculum Continued

Instruction that results in students being able to construct an evidence-based scientific explanation for how environmental and genetic factors influence the growth of organisms could begin with students conducting experiments and collecting data on the environmental conditions that effect the growth of organisms (e.g., the effect of variables such as food, light, space, and water on plant growth).

Students could then examine genetic factors (inherited traits) that influence the growth of organisms, including parental traits and selective breeding. It is important to note that at this grade level, Mendelian genetics are not a part of student learning. Mendelian genetics will be covered in future grades. This unit of study could end with students using an oral and/or written argument, supported by evidence and scientific reasoning from their experiments, to explain how environmental conditions and genetic factors affect the growth of an organism.

Resources/Instructional Materials

(articles, novels, websites, books, magazines, art, media)

- NJ DOE Model Curriculum - http://www.nj.gov/education/modelcurriculum/sci/6u1.pdf
- American Association for the Advancement of Science: http://www.aaas.org/programs
- American Association of Physics Teachers: http://www.aapt.org/resources/
- American Chemical Society: http://www.acs.org/content/acs/en/education.html
- Concord Consortium: Virtual Simulations: http://concord.org/
- International Technology and Engineering Educators Association: http://www.iteaconnect.org/
- National Earth Science Teachers Association: http://www.nestanet.org/php/index.php
- National Science Digital Library: https://nsdl.oercommons.org/
- National Science Teachers Association: http://ngss.nsta.org/Classroom-Resources.aspx
- North American Association for Environmental Education: http://www.naaee.net/
- Phet: Interactive Simulations https://phet.colorado.edu/
- Physics Union Mathematics (PUM): http://pum.rutgers.edu/
- http://ngss.nsta.org/Resource.aspx?ResourceID=516
- http://ngss.nsta.org/Resource.aspx?ResourceID=298
- http://ngss.nsta.org/Resource.aspx?ResourceID=21
- http://ngss.nsta.org/Resource.aspx?ResourceID=158
- Abetterlesson.com

Technology Resources

- Google Classroom
- Kahoot!
- Socrative
- BrainPop
- Mystery Science
- Youtube
- Nasa website
- Discovery
- Quizlet
- Google Apps
- PowerPoint
- Nova
- Science World Scholastic

Accommodations & Modifications
for Spec. Ed., ELL, GT, & At Risk Students

- Allow oral responses
- Allow verbalization before writing
- Use audio materials when necessary
- Modify homework assignments
- Read tests aloud
- Provide math manipulatives as necessary
- Restate, reword, clarify directions
- Re-teach concepts using small groups
- Provide educational "breaks" as necessary
- Expanding time for free reading
- Chunking Content
- Calculator
- Use mnemonic devices
- Provide a cueing system
- Untimed and/or extended test taking time
- Shorten assignments to focus on mastery concept
- Leveled Reading Materials
- Acronyms
- Graphic Organizers
- Notes Provided
- Check agenda book for parent(s) communication
- Read directions aloud
- Assignment, Project, and Assessment Modification Based on Individual Student Needs
- Speech to Text/Text to Speech Features in Google Apps
- Technology assisted instruction
- Preferential seating utilized
- Redirect student(s) as necessary
- Student choice for project or approach to assignment
- Inquiry-Based Learning
- Genius Hour

Adapted from: Wiggins, Grant and J. McTighe. (1998). *Understanding by Design*, Association for Supervision and Curriculum Development and 5E NGSS Lesson Plan from www.lewiscenter.org and NJ Science Model Curriculum at http://www.nj.gov/education/modelcurriculum/sci/

Science- Grade 6

Unit #2	**Title:** Interdependent Relationships in Ecosystems	**Pacing**: 25 days

Stage 1- Desired Results

Established Goals/NJSLS Standards

Next Generation Science Standards/NJSLS:

MS-LS2-4 Ecosystems: Interactions, Energy, and Dynamics

- 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.] (MS-LS2-4)*

MS-LS2-5 Ecosystems: Interactions, Energy, and Dynamics

- 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.] (MS-LS2-5)*

MS-ETS1-1 Engineering Design

- Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions. (MS-ETS1-1)

MS-ETS1-3 Engineering Design

- Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success. (MS-ETS1-3)

English Language Arts Standards

- Cite specific textual evidence to support analysis of science and technical texts. (MS-LS2-4) RST.6-8.1
- Distinguish among facts, reasoned judgment based on research findings, and speculation in a text. (MS-LS2-5) RST.6-8.8
- 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) RI.8.8
- Write arguments to support claims with clear reasons and relevant evidence. (MS-LS2-4),(MS-ETS1-1),(MS-ETS1-3) WHST.6-8.1
- 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.6-8.2
- 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-ETS1-3) RST.6-8.7
- 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-ETS1-1) WHST.6-8.8
- Draw evidence from literary or informational texts to support analysis, reflection, and research. (MS-LS2-2),(MS-LS2-4),(MS-ETS1-3), (MS-ETS1-2) WHST.6-8.9
- Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest. (MS-ETS1-4) SL.8.5

Mathematics Standards

- Reason abstractly and quantitatively. (MS-ETS1-1),(MS-ETS1-3) MP.2
- Model with mathematics. (MS-LS2-5) MP.4
- Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies. (MS-ETS1-1),(MS-ETS1-3) 7.EE.3
- Use ratio and rate reasoning to solve real-world and mathematical problems. (MS-LS2-5) 6.RP.A.3

<table>
<tr><th>Enduring Understandings (DCI)
Students will understand…</th><th>Essential Questions
Students will consider...</th></tr>
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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)
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)

ETS1.A: Defining and Delimiting Engineering Problems

The more precisely a design task’s criteria and constraints can be defined, the more likely it is that the designed solution will be successful. Specification of constraints includes consideration of scientific principles and other relevant knowledge that are likely to limit possible solutions. (MS-ETS1-1)

ETS1.B: Developing Possible Solutions

A solution needs to be tested, and then modified on the basis of the test results, in order to improve it. (MS-ETS1-4)
There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem. (MS-ETS1- 2), (MS-ETS1-3)
Sometimes parts of different solutions can be combined to create a solution that is better than any of its predecessors. (MS-ETS1-3)
Models of all kinds are important for testing solutions. (MS-ETS1-4)

ETS1.C: Optimizing the Design Solution

Although one design may not perform the best across all tests, identifying the characteristics of the design that performed the best in each test can provide useful information for the redesign process—that is, some of those characteristics may be incorporated into the new design. (MS-ETS1-3)

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How can a single change to an ecosystem disrupt the whole system?
What limits the number and variety of living things in an ecosystem?

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Knowledge (Concepts) ***Students will know…***	**Academic Vocabulary**
● Ecosystems are dynamic in nature. ● The characteristics of ecosystems can vary over time. ● Disruptions to any physical or biological component of an ecosystem can lead to shifts in all the ecosystem's populations. ● Small changes in one part of an ecosystem might cause large changes in another part. ● Patterns in data about ecosystems can be recognized and used to make warranted inferences about changes in populations. ● Evaluating empirical evidence can be used to support arguments about changes to ecosystems. ● 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. ● Changes in biodiversity can influence humans' resources, such as food, energy, and medicines. ● Changes in biodiversity can influence ecosystem services that humans rely on. ● There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem. ● A solution needs to be tested and then modified on the basis of the test results, in order to improve it. ● Models of all kinds are important for testing solutions. ● The iterative process of testing the most promising solutions and modifying what is proposed on the basis of the test results leads to greater refinement and ultimately to an optimal solution. ● Small changes in one part of a system might cause large changes in another part. ● Scientific knowledge can describe the consequences of actions but does not necessarily prescribe the decisions that society takes.	● ecosystems ● biodiversity ● population ● human resources ● matter ● energy ● species ● recycling ● abiotic ● biotic

Skills ***Students will be able to…***
● Construct an argument to support or refute an explanation for the changes to populations in an ecosystem caused by disruptions to a physical or biological component of that ecosystem. Empirical evidence and scientific reasoning must support the argument. ● Use scientific rules for obtaining and evaluating empirical evidence. ● Recognize patterns in data and make warranted inferences about changes in populations. ● Evaluate empirical evidence supporting arguments about changes to ecosystems. ● Construct a convincing argument that supports or refutes claims for solutions about the natural and designed world(s). ● Develop a model to generate data to test ideas about designed systems, including those representing inputs and outputs. ● Create design criteria for design solutions for maintaining biodiversity and ecosystem services. ● Evaluate competing design solutions based on jointly developed and agreed upon design criteria.

21[ST] Century/ Interdisciplinary Themes	21[st] Century Skills
Global Awareness Financial, Business, & Entrepreneurial Literacy Civic Literacy **Environmental Literacy** Health Literacy	**Creativity & Innovation** **Communication & Collaboration** **Media Literacy** **Critical Thinking & Problem Solving** **Information Literacy** **Information, Communication, & Technology** **Life & Career Skills**

Stage 2- Assessment Evidence
from the NJ Model Curriculum:

What happens to ecosystems when the environment changes?

Students build on their understandings of the transfer of matter and energy as they study patterns of interactions among organisms within an ecosystem. They consider biotic and abiotic factors in an ecosystem and the effects these factors have on a population. They construct explanations for the interactions in ecosystems and the scientific, economic, political, and social justifications used in making decisions about maintaining biodiversity in ecosystems. The crosscutting concept of stability and change provide a framework for understanding the disciplinary core ideas. This unit includes a two-stage engineering design process. Students first evaluate different engineering ideas that have been proposed using a systematic method, such as a tradeoff matrix, to determine which solutions are most promising. They then test different solutions, and combine the best ideas into a new solution that may be better than any of the preliminary ideas. Students demonstrate grade appropriate proficiency in asking questions, designing solutions, engaging in argument from evidence, developing and using models, and designing solutions. Students are also expected to use these practices to demonstrate understanding of the core ideas.

Summative Assessment 1

- ***Standard:*** MS-LS2-4, MS-LS2-5, MS-ETS1-1, MS-EST1-3
- ***Type:*** Lab
- ***Overview:*** Students will identify and differentiate between symbiotic relationships among animals in an ecosystem, including symbiosis, commensalism, mutualism, parasitism, competition and predatory relationships. As well as explain that living things in an ecosystem rely on a web of interdependence and show that relationships can take on many forms.
- ***Rubric:*** https://docs.google.com/a/linwoodschools.org/document/d/15ybWaljGXLgCVYR3OMNlegiydZb4xa8vdcSG1_d-_LA/edit?usp=sharing
- ***Resources:*** https://betterlesson.com/lesson/631889/the-feeling-is-mutual
  https://api.betterlesson.com/mtp/lesson/631889/print

Summative Assessment 2

- ***Standard:*** MS-LS2-4, MS-LS2-5, MS-ETS1-1, MS-EST1-3
- ***Type:*** Exam
- ***Overview:*** Students will synthesize information gather throughout the unit by completing the end of unit exam
- ***Resources:*** Student composition books

Formative Assessments	*Student Self-Assessment*	*Common Assessments*
• Pre-assessments • Labs • Quizzes • Project and problem-based learning activities • Graphic organizers • Short research projects • Collaborative learning projects • Formative checks (whiteboards, T/F, vote with your feet, thumbs up or thumbs down) • Summary Diagrams • Open ended responses • Short responses • Conferencing • Unit tests • Checklists	• Reflection activities (on the learning scale, on the daily target, on labs, on summative assessments, on collaborative work, on projects) • Responses to inquiry-based questions • Think-pair-share activities • Student revising knowledge throughout the unit	• Summative Assessments

Stage 3- Learning Plan

Suggested Learning Activities from the NJ DOE Model Curriculum

Interdependent Relationships in Ecosystems

At the beginning of this unit of study, students will begin to collect empirical evidence that will be used to argue that physical or biological components of an ecosystem affect populations. Students will evaluate existing solutions for maintaining biodiversity and ecosystem services to determine which solutions are most promising. As part of their evaluation, students will develop a probability and use it to determine the probability that designed systems, including those representing inputs and outputs, will maintain biodiversity and ecosystem services. They will develop mathematical model(s) to generate data to test the designed systems and compare probabilities from the models to observe frequencies. If the agreement is not good, they will explain possible sources of the discrepancy.

Distinguish among facts, reasoned judgment based on research findings, and speculation During this process, students will distinguish among facts reasoned judgment based on research findings, and speculation while reading text about maintaining biodiversity and ecosystem services. Examples of ecosystem services could include water purification, nutrient recycling, and prevention of soil erosion.

After determining that ecosystems are dynamic in nature, students may construct an argument to support an explanation for how shifts (large and/or small) in populations are caused by change to physical or biological components in ecosystems (e.g., gas explosions, tornadoes, mining, oil spills, clear cutting, hurricanes, volcanoes, etc.).

Students will study the variety of species found in terrestrial and oceanic ecosystems and use the data they gather to make decisions about the health of the ecosystem. Students may compare, through observations and data analysis, the biodiversity before and after events affecting a specific area—for examples, the Pinelands, that were lost due to the creation of the reservoir; the underground coal fires in Centralia, PA, that caused people to abandon the town; the volcanic eruption in Mt. St. Helen's, WA; the nuclear reactor meltdown in Chernobyl, Ukraine.

Students should recognize patterns in data about changes to components in ecosystems and make inferences about how these changes contribute to changes in the biodiversity of populations. Students should investigate and design investigations to test their ideas and develop possible solutions to problems caused when changes in the biodiversity of an ecosystem affect resources (food, energy, and medicine) as well as ecosystem services (water purification, nutrient recycling, soil erosion prevention) available to humans. Students can then construct arguments using evidence to support recognized patterns of change in factors such as global temperatures and their effect on populations and the environment. As part of their argument, students need to note how small changes in one part of an ecosystem might cause large changes in another part.

Suggested Learning Activities from the NJ DOE Model Curriculum Continued

While collecting evidence for their arguments about maintaining biodiversity, students will trace and evaluate specific claims in a text, distinguishing claims that are supported by reasons and evidence from claims that are not. Students will evaluate the argument and claims in text, assess whether the reasoning is sound and the evidence is relevant and sufficient to support the claims.

As a culmination of this unit of study, students will take the evidence they have collected and their understanding of how changes in the biodiversity of populations can impact ecosystem services and use that evidence and understanding to evaluate competing design solutions. Students will include multimedia components and visual displays as part of their argument about competing design solutions based on jointly developed and agreed-upon design criteria to clarify evidence used in their arguments. The multimedia component and visual displays should clarify claims and findings and emphasize salient points in their argument.

Students will use a systematic process for evaluating their design solutions with respect to how well they meet the criteria and constraints. Students may determine the systematic process they will use, or the teacher can determine a process for students to use to evaluate ecosystem services. Any process used should include mathematical models that generates data for the iterative testing of competing design solutions involving a proposed object, tool, or process maintaining biodiversity and ecosystem services and quantitative reasoning (with amounts, numbers, sizes) and abstract reasoning (with variables). Ecosystem services could include water purification, nutrient recycling, and prevention of soil erosion. For this unit of study, design solution constraints could include scientific, economic, and social considerations. After determining the process for evaluating the design solutions and establishing the criteria and constraints, students will compare competing design solutions to determine the optimal solution.

Resources/Instructional Materials

(articles, novels, websites, books, magazines, art, media)

- NJ DOE Model Curriculum - http://www.nj.gov/education/modelcurriculum/sci/6u3.pdf
- http://ri.pbslearningmedia.org/resource/lsps07.sci.life.eco.lpexpecosystems/exploring-the-systems-in-ecosystems/
- http://ngss.nsta.org/Resource.aspx?ResourceID=173
- http://www.learner.org/resources/series179.html
- http://www.invasivespeciesinfo.gov/

Technology Resources

- Google Classroom
- Kahoot!
- Socrative
- Youtube
- BrainPop
- Mystery Science
- Nasa website
- Discovery
- Google Apps
- PowerPoint
- Quizlet
- Nova
- Science World Scholastic

Accommodations & Modifications
for Spec. Ed., ELL, GT, & At Risk Students

- Allow oral responses
- Allow verbalization before writing
- Use audio materials when necessary
- Modify homework assignments
- Read tests aloud
- Provide math manipulatives as necessary
- Restate, reword, clarify directions
- Re-teach concepts using small groups
- Provide educational "breaks" as necessary
- Expanding time for free reading
- Chunking Content
- Calculator
- Use mnemonic devices
- Provide a cueing system
- Untimed and/or extended test taking time
- Shorten assignments to focus on mastery concept
- Leveled Reading Materials
- Acronyms
- Graphic Organizers
- Notes Provided
- Check agenda book for parent(s) communication
- Read directions aloud
- Assignment, Project, and Assessment Modification Based on Individual Student Needs
- Speech to Text/Text to Speech Features in Google Apps
- Technology assisted instruction
- Preferential seating utilized
- Redirect student(s) as necessary
- Student choice for project or approach to assignment
- Inquiry-Based Learning
- Genius Hour

Adapted from: Wiggins, Grant and J. McTighe. (1998). *Understanding by Design*, Association for Supervision and Curriculum Development and 5E NGSS Lesson Plan from www.lewiscenter.org and NJ Science Model Curriculum at http://www.nj.gov/education/modelcurriculum/sci/

Science- Grade 6		
Unit #3	**Title:** Forces and Motion// Types of Interactions	**Pacing**: 50 days

Stage 1- Desired Results

Established Goals/NJSLS Standards

Next Generation Science Standards/NJSLS:

MS-PS2-1 Motion and Stability: Forces and Interactions

- Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects. * *[Clarification Statement: Examples of practical problems could include the impact of collisions between two cars, between a car and stationary objects, and between a meteor and a space vehicle.] [Assessment Boundary: Assessment is limited to vertical or horizontal interactions in one dimension.] (MS-PS2-1)*

MS-PS2-2 Motion and Stability: Forces and Interactions

- Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object. *[Clarification Statement: Emphasis is on balanced (Newton's First Law) and unbalanced forces in a system, qualitative comparisons of forces, mass and changes in motion (Newton's Second Law), frame of reference, and specification of units.] [Assessment Boundary: Assessment is limited to forces and changes in motion in one dimension in an inertial reference frame and to change in one variable at a time. Assessment does not include the use of trigonometry.] (MS-PS2-2)*

MS-ETS1-1 Engineering Design

- Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions. (MS-ETS1-1)

MS-ETS1-2 Engineering Design

- Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem. (MS-ETS1-2)

MS-ETS1-3 Engineering Design

- Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success. (MS-ETS1-3)

MS-ETS1-4 Engineering Design

- Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved. (MS-ETS1-4)

MS-PS2-5 Motion and Stability: Forces and Interactions

- Conduct an investigation and evaluate the experimental design to provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contact. *[Clarification Statement: Examples of this phenomenon could include the interactions of magnets, electrically-charged strips of tape, and electrically-charged pith balls. Examples of investigations could include first-hand experiences or simulations.] [Assessment Boundary: Assessment is limited to electric and magnetic fields, and is limited to qualitative evidence for the existence of fields.] (MS-PS2-5)*

MS-PS2-3 Motion and Stability: Forces and Interactions

- Ask questions about data to determine the factors that affect the strength of electric and magnetic forces. *[Clarification Statement: Examples of devices that use electric and magnetic forces could include electromagnets, electric motors, or generators. Examples of data could include the effect of the number of turns of wire on the strength of an electromagnet, or the effect of increasing the number or strength of magnets on the speed of an electric motor.] [Assessment Boundary: Assessment about questions that require quantitative answers is limited to proportional reasoning and algebraic thinking.] (MS-PS2-3)*

MS-PS2-4 Motion and Stability: Forces and Interactions

- Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects. *[Clarification Statement: Examples of evidence for arguments could include data generated from simulations or digital tools; and charts displaying mass, strength of interaction, distance from the Sun, and orbital periods of objects within the solar system.] [Assessment Boundary: Assessment does not include Newton's Law of Gravitation or Kepler's Laws.] (MS-PS2-4)*

English Language Arts Standards

- Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions. (MS-PS2-1),(MS-ETS1-1),(MS-ETS1-2) RST.6-8.1
- Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks. (MS-PS2-1),(MS-PS2-2) RST.6-8.3
- 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-ETS1-1) WHST.6-8.8
- Draw evidence from informational texts to support analysis, reflection, and research. (MS-ETS1-2) WHST.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-ETS1-2),(MS-ETS1-3) RST.6-8.9
- 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-ETS1-2) WHST.6- 8.7

Mathematics Standards

- Reason abstractly and quantitatively. (MS-PS2-1),(MS-PS2-2),(MS-PS2-3),(MSETS1-1),(MS-ETS1-2) MP.2
- Understand that positive and negative numbers are used together to describe quantities having opposite directions or values; use positive and negative numbers to represent quantities in real-world contexts, explaining the meaning of 0 in each situation. (MS-PS2-1) 6.NS.C.5
- Write, read, and evaluate expressions in which letters stand for numbers. (MSPS2-1),(MS-PS2-2) 6.EE.A.2
- Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form, using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies. (MS-PS2-1),(MS-PS2-2) 7.EE.B.3
- Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities. (MS-PS2-1),(MS-PS2-2) 7.EE.B.4
- Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies. (MS-ETS1-1),(MS-ETS1-2) 7.EE.3

Enduring Understandings (DCI) ***Students will understand…***	**Essential Questions** ***Students will consider...***
PS2.A: Forces and Motion ● For any pair of interacting objects, the force exerted by the first object on the second object is equal in strength to the force that the second object exerts on the first, but in the opposite direction (Newton's third law). (MS-PS2-1) ● The motion of an object is determined by the sum of the forces acting on it; if the total force on the object is not zero, its motion will change. The greater the mass of the object, the greater the force needed to achieve the same change in motion. For any given object, a larger force causes a larger change in motion. (MS-PS2-2) ● All positions of objects and the directions of forces and motions must be described in an arbitrarily chosen reference frame and arbitrarily chosen units of size. In order to share information with other people, these choices must also be shared. (MS-PS2-2) **ETS1.A: Defining and Delimiting Engineering Problems** ● The more precisely a design task's criteria and constraints can be defined, the more likely it is that the designed solution will be successful. Specification of constraints includes consideration of scientific principles and other relevant knowledge that are likely to limit possible solutions. (MS-ETS1-1) **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. (MS-ETS1-2) ● A solution needs to be tested, and then modified on the basis of the test results, in order to improve it. (MS-ETS1-4) ● There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem. (MS-ETS1-2), (MS-ETS1-3) ● Sometimes parts of different solutions can be combined to create a solution that is better than any of its predecessors. (MS-ETS1-3) ● Models of all kinds are important for testing solutions. (MS-ETS1-4) **ETS1.C: Optimizing the Design Solution** ● Although one design may not perform the best across all tests, identifying the characteristics of the design that performed the best in each test can provide useful information for the redesign process—that is, some of those characteristics may be incorporated into the new design. (MS-ETS1-3) ● The iterative process of testing the most promising solutions and modifying what is proposed on the basis of the test results leads to greater refinement and ultimately to an optimal solution. (MS-ETS1-4)	● How does a sailboat work? ● Who can build the fastest sailboat? ● Can you apply a force on something without touching it? ● How does a Maglev train work? ● If I were able to eliminate air resistance and dropped a feather and a hammer at the same time, which would land first?

Enduring Understandings (DCI) Continued
Students will understand…

PS2.B: Types of Interactions

- Newton's law of universal gravitation and Coulomb's law provide the mathematical models to describe and predict the effects of gravitational and electrostatic forces between distant objects. (HS-PS2-4)
- Forces at a distance are explained by fields (gravitational, electric, and magnetic) permeating space that can transfer energy through space. Magnets or electric currents cause magnetic fields; electric charges or changing magnetic fields cause electric fields. (HS-PS2-4)

PS2.A: Forces and Motion

- If a system interacts with objects outside itself, the total momentum of the system can change; however, any such change is balanced by changes in the momentum of objects outside the system. (HS-PS2-3)

ETS1.A: Defining and Delimiting an Engineering Problem

- Criteria and constraints also include satisfying any requirements set by society, such as taking issues of risk mitigation into account, and they should be quantified to the extent possible and stated in such a way that one can tell if a given design meets them. (secondary) (HS-PS2-3)

ETS1.C: Optimizing the Design Solution

- Criteria may need to be broken down into simpler ones that can be approached systematically, and decisions about the priority of certain criteria over others (trade-offs) may be needed. (secondary HS-PS2-3)

PS2.B: Types of Interactions

- Newton's law of universal gravitation and Coulomb's law provide the mathematical models to describe and predict the effects of gravitational and electrostatic forces between distant objects. (HS-PS2-5)
- Forces at a distance are explained by fields (gravitational, electric, and magnetic) permeating space that can transfer energy through space. Magnets or electric currents cause magnetic fields; electric charges or changing magnetic fields cause electric fields. (HS-PS2-5)

PS3.A: Definitions of Energy

- "Electrical energy" may mean energy stored in a battery or energy transmitted by electric currents. (secondary HS-PS2-5)

Knowledge (Concepts) ***Students will know…***	**Academic Vocabulary**
• For any pair of interacting objects, the force exerted by the first object on the second object is equal in strength to the force that the second object exerts on the first, but in the opposite direction (Newton's third law). • Models can be used to represent the motion of objects in colliding systems and their interactions, such as inputs, processes, and outputs, as well as energy and matter flows within systems. • The uses 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. • The more precisely a design task's criteria and constraints can be defined, the more likely it is that the designed solution will be successful. • Specification of constraints includes consideration of scientific principles and other relevant knowledge, which are likely to limit possible solutions.	• force • net force • motion • gravity • magnetism • electricity • magnetic field • electrical field • energy

Knowledge (Concepts) Continued ***Students will know…***	Academic Vocabulary Continued
• The change in an object's motion depends on balanced (Newton's first law) and unbalanced forces in a system Evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object includes qualitative comparisons of forces, mass, and changes in motion (Newton's second law); frame of reference; and specification of units. • if the total force on the object is not zero, its motion will change. • The greater the mass of the object, the greater the force needed to achieve the same change in motion. • For any given object, a larger force causes a larger change in motion. • Explanations of stability and change in natural or designed systems can be constructed by examining the changes over time and forces at different scales. • Fields exist between objects that exert forces on each other even though the objects are not in contact. • The interactions of magnets, electrically charged strips of tape, and electrically charged pith balls are examples of fields that exist between objects exerting forces on each other, even though the objects are not in contact. • Forces that act at a distance (electric, magnetic, and gravitational) can be explained by fields that extend through space and can be mapped by their effect on a test object (a charged object or a ball, respectively). • Cause-and-effect relationships may be used to predict phenomena in natural or designed systems. • Factors affect the strength of electric and magnetic forces. • Devices that use electric and magnetic forces could include electromagnets, electric motors, and generators. • Electric and magnetic (electromagnetic) forces can be attractive or repulsive. • The size of an electric or magnetic (electromagnetic) force depends on the magnitudes of the charges, currents, or magnetic strengths involved and on the distances between the interacting objects. • Cause-and-effect relationships may be used to predict the factors that affect the strength of electrical and magnetic forces in natural or designed systems. • Gravitational interactions are always attractive and depend on the masses of interacting objects. • There is a gravitational force between any two masses, but it is very small except when one or both of the objects have large mass. • Evidence supporting the claim that gravitational interactions are attractive and depend on the masses of interacting objects could include data generated from simulations or digital tools and charts displaying mass, strength of interaction, distance from the sun, and orbital periods of objects within the solar system.	• charge • Newton's first law of motion • Newton's second law of motion • Newton's third law of motion • attract • repel • neutral

Skills

Students will be able to…

- Apply Newton's third law to design a solution to a problem involving the motion of two colliding objects.
- Define a design problem involving the motion of two colliding objects that can be solved through the development of an object, tool, process, or system and that includes multiple criteria and constraints, including scientific knowledge that may limit possible solutions.
- Evaluate competing design solutions involving the motion of two colliding objects based on jointly developed and agreed-upon design criteria.
- Develop a model to generate data to test ideas about designed systems, including those representing inputs and outputs.
- Analyze and interpret data to determine similarities and differences in findings.
- Plan an investigation individually and collaboratively to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object.
- Design an investigation and identify independent and dependent variables and controls, what tools are needed to do the gathering, how measurements will be recorded, and how many data are needed to support a claim.
- Make logical and conceptual connections between evidence and explanations.
- Examine the changes over time and forces at different scales to explain the stability and change in designed systems.
- Plan an investigation individually and collaboratively to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object.
- Design an investigation and identify independent and dependent variables and controls, what tools are needed to do the gathering, how measurements will be recorded, and how many data are needed to support a claim.
- Make logical and conceptual connections between evidence and explanations.
- Examine the changes over time and forces at different scales to explain the stability and change in designed systems.
- Students will conduct an investigation and evaluate an experimental design to produce data that can serve as the basis for evidence that fields exist between objects exerting forces on each other even though the objects are not in contact.
- Students will identify the cause-and-effect relationships between fields that exist between objects and the behavior of the objects
- Students will ask questions about data to determine the effect of the strength of electric and magnetic forces that can be investigated within the scope of the classroom, outdoor environment, and museums and other public facilities with available resources and, when appropriate, frame a hypothesis based on observations and scientific principles.
- Students will perform investigations using devices that use electromagnetic forces.
- Students will collect and analyze data that could include the effect of the number of turns of wire on the strength of an electromagnet or the effect of increasing the number or strength of magnets on the speed of an electric motor.
- Students construct and present oral and written arguments supported by empirical evidence and scientific reasoning to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects.
- Students use models to represent the gravitational interactions between two masses.

21ST Century/ Interdisciplinary Themes	21st Century Skills
Global Awareness **Financial, Business, & Entrepreneurial Literacy** Civic Literacy Environmental Literacy Health Literacy	**Creativity & Innovation** **Communication & Collaboration** **Media Literacy** **Critical Thinking & Problem Solving** **Information Literacy** **Information, Communication, & Technology** **Life & Career Skills**

Stage 2- Assessment Evidence
from the NJ Model Curriculum:

How can we predict the motion of an object?

Students use system and system models and stability and change to understanding ideas related to why some objects will keep moving and why objects fall to the ground. Students apply Newton's third law of motion to related forces to explain the motion of objects. Students also apply an engineering practice and concept to solve a problem caused when objects collide. The crosscutting concepts of system and system models and stability and change provide a framework for understanding the disciplinary core ideas. Students demonstrate proficiency in asking questions, planning and carrying out investigations, designing solutions, engaging in argument from evidence, developing and using models, and constructing explanations and designing solutions. Students are also expected to use these practices to demonstrate understanding of the core ideas.

Is it possible to exert on an object without touching it?

Students use cause and effect; system and system models; and stability and change to understand ideas that explain why some materials are attracted to each other while others are not. Students apply ideas about gravitational, electrical, and magnetic forces to explain a variety of phenomena including beginning ideas about why some materials attract each other while others repel. In particular, students develop understandings that gravitational interactions are always attractive but that electrical and magnetic forces can be both attractive and negative. Students also develop ideas that objects can exert forces on each other even though the objects are not in contact, through fields. Students are expected to consider the influence of science, engineering, and technology on society and the natural world. Students are expected to demonstrate proficiency in asking questions, planning and carrying out investigations, designing solutions, and engaging in argument. Students are also expected to use these practices to demonstrate understanding of the core ideas.

Summative Assessment 1

- ***Standard:*** MS-PS2-1, MS-PS2-2, MS-PS2-3, MS-PS2-4, MS-PS2-5
- ***Type:*** Lab
- ***Overview:*** Students will carry out an investigation exploring how to measure invisible forces.
- ***Rubric:*** https://docs.google.com/a/linwoodschools.org/document/d/15ybWaljGXLgCVYR3OMNlegiydZb4xa8vdcSG1_d-_LA/edit?usp=sharing
- ***Resources:*** https://api.betterlesson.com/mtp/lesson/637564/print
  https://betterlesson.com/lesson/637564/measurement-forces

Summative Assessment 2

- ***Standard:*** MS-PS2-1, MS-PS2-2
- ***Type:*** Lab
- ***Overview:*** Students will conduct a lab simulation to understand that the motion of the object depends on the sum of the forces on the object and the mass of the object.
- ***Rubric:*** https://docs.google.com/a/linwoodschools.org/document/d/15ybWaljGXLgCVYR3OMNlegiydZb4xa8vdcSG1_d-_LA/edit?usp=sharing
- ***Resources:*** https://api.betterlesson.com/mtp/lesson/637564/print
  https://betterlesson.com/lesson/637564/measurement-forces

Summative Assessment 3

- ***Standard:*** MS-PS2-1, MS-PS2-2, MS-PS2-3, MS-PS2-4, MS-PS2-5, MS-ETS1-1, MS-ETS1-2, MS-ETS1-3, MS-ETS1-4
- ***Type:*** Exam
- ***Overview:*** Students will synthesize information gather throughout the unit by completing the end of unit exam

- ***Resources:*** Student composition books

Formative Assessments	*Student Self-Assessment*	*Common Assessments*
• Pre-assessments • Labs • Quizzes • Project and problem-based learning activities • Graphic organizers • Short research projects • Collaborative learning projects • Formative checks (whiteboards, T/F, vote with your feet, thumbs up or thumbs down) • Summary Diagrams • Open ended responses • Short responses • Conferencing • Unit tests • Checklists	• Reflection activities (on the learning scale, on the daily target, on labs, on summative assessments, on collaborative work, on projects) • Responses to inquiry-based questions • Think-pair-share activities • Student revising knowledge throughout the unit	• Summative Assessments

Stage 3- Learning Plan

Suggested Learning Activities from the NJ DOE Model Curriculum

Forces and Motion

Throughout this unit of study, students will be examining and interacting with objects in motion. They will begin this unit by investigating Newton's third law of motion by observing the action/reaction forces involved during a collision. Students will expand their idea of collisions beyond the narrow view of collisions as being an accident in which two or more objects crash into each other. They will learn that scientists' use of the word collision does not refer to the size of the force; instead it describes any interaction between two objects. We want students to understand that a collision can be as small as an ant walking on a blade of grass—that is, that a collision is any touch between two objects, no matter how small or how large the force.

Some possible observations may include the action/reaction forces involved in roller skating, skateboarding, moving boxes of different masses, etc. Students will then apply Newton's third law to possible problems and solutions. Some possible investigations could include designing and launching rockets or protecting eggs in a collision.

Students then investigate Newton's first and second laws of motion through hands-on activities in which they observe the result of balanced and unbalanced forces on an object's motion. Some examples may include using a seesaw or kicking a ball. In addition, students will observe how an object's motion will change depending upon the mass of the object and the amount of force applied. Activities could include pushing objects of different masses and comparing the forces needed to accelerate the objects.

Students will continue their investigation of Newton's third law by participating in an engineering and design problem that will require them to design a solution to a problem involving the motion of two colliding objects.

Students could begin by observing collisions. An example of a collision could be an egg in a cart rolling down an incline and colliding with a barrier. Based on their observations of collisions, students will jointly develop and agree upon the design problem that they will focus on. Students will begin by making a clear statement of the problem they are going to attempt to solve. Once students have a clearly stated problem, the teacher will need to provide them with time and opportunity to participate in a short research project where they will gather background information that will help them come up with possible design solutions. Students will need to document their findings, making sure that they cite the resources they use.

After students have collected evidence, they can then begin to brainstorm possible solutions. To begin this process, students will need to identify the constraints and criteria for a successful design solution. This would involve them identifying the limits of the design. For example, time, materials, and resources could be some constraints. Students will next identify the criteria for a successful design. For example, one criterion could be that the egg in the collision does not break at all, or that it may crack as long as the contents do not spill out.

Suggested Learning Activities from the NJ DOE Model Curriculum Continued

After the constraints and criteria have been identified, students can them generate possible solutions. Multiple solutions could be generated. Using the evidence collected during their research, as well as information they have learned as a part of their classroom experience, students can eliminate the solutions that seem least likely to be successful and focus on those that are more likely to be successful.

After students have identified the solutions that are most likely to be successful, they will evaluate their competing design solutions using a rubric, checklist, or decision tree to assist them in selecting the design solution they will take into the next phase of the process.

Students have reached the stage where they will need to create a model that can be tested. The model could be physical, graphical, mathematical, or it could be a scale model. Students will use the model to collect evidence that will help them determine which of the possible design solutions will be taken into the prototype phase. During the prototype phase, students will create their actual model. Once students have constructed their devices, they should gather necessary data from tests performed on their design solutions. They will analyze and interpret these data to determine which design best minimizes the force acting upon the egg. For example, the materials of a particular design may be superior and/or the structure of another design may be more successful. Once students have evaluated competing solutions and analyzed and interpreted data, they may then begin to modify their original designs. It is important that students consider the benefits of each design solution. This is when they are deciding whether different parts of their solutions can be combined to maximize efficiency. The final goal is for students to identify the parts of each design solution that best fit their criteria and combine these parts into a design solution that is better than any of its predecessors. Students will then translate this activity to a real world-example in which they see the influence of science, engineering, and technology on society and the natural world.

Types of Interactions

Students will conduct investigations of fields that exist between objects exerting forces on each other, even though the objects are not in contact. Through first-hand experiences or simulations, students will observe and evaluate the behavior of objects and record evidence of fields that exist and are responsible for the observed behavior of the objects. Students can investigate the interactions between magnets, electrically charged strips of tape, and/or electrically charged pith balls. Through hands-on investigations or simulations, students will be able to observe how the motion or behavior of objects change when they are exposed to electric or magnetic fields. For example, a pith ball could be suspended from a lightweight string and students can apply a charge to a balloon, comb, or plastic rod and make observations about the motion of the pith ball when these objects are placed in close proximity to the ball. The same type of investigation could be conducted with magnets or strips of electric tape. If instruction starts with students making these observations, students could then generate questions that they could use to ask questions about the cause-and-effect relationships that could explain their observations. A short research project could be conducted to provide data that students would use to help them answer their self-generated questions.

Students will investigate magnetic and electric forces to determine the nature of the force (repulsive, attractive, or both), and factors that affect the strength of the forces. Before beginning the investigations, students will generate questions that will be used to guide their investigations. Depending on the nature of their questions, students may need to cite specific textual evidence to support the generation of a hypothesis. During the investigation, students will identify cause-and effect relationships and use their understanding of these relationships to make predictions about what would happen if a variable in the investigation were changed. They will also determine the impact of distance on the strength of a force. Investigations may include the use of electromagnets, electric motors, or generators. During these investigations, students will collect data that they will use to answer their self-generated questions.

Students will investigate magnetic and electric forces to determine the nature of the force (repulsive, attractive, or both), and factors that affect the strength of the forces. Before beginning the investigations, students will generate questions that will be used to guide their investigations. Depending on the nature of their questions, students may need to cite specific textual evidence to support the generation of a hypothesis. During the investigation, students will identify cause-and effect relationships and use their understanding of these relationships to make predictions about what would happen if a variable in the investigation were changed.

Suggested Learning Activities from the NJ DOE Model Curriculum Continued

They will also determine the impact of distance on the strength of a force. Investigations may include the use of electromagnets, electric motors, or generators. During these investigations, students will collect data that they will use to answer their self-generated questions. Investigations can take place in the classroom, outdoor environment, or museums and other public facilities with available resources and when appropriate. Students will frame a hypothesis based on observations and scientific principles about the behavior of electromagnetic forces and carry out investigations to collect data about the factors that affect the strength of electric and magnetic forces. Examples of investigations could include the effect of the number of turns of wire on the strength of an electromagnet or the effect of increasing the number or strength of magnets on the speed of an electric motor. Students will analyze both numerical and symbolic data and use these data to determine the factors that affect the strength of electric and magnetic fields. Students will conclude this portion of the unit by citing specific textual evidence to support the analysis of information they access while reading science and technical texts or online sources about electric and magnetic forces, attending to the precise details of explanations or descriptions.

The next portion of this unit will focus on gravitational forces. Students will construct and present oral and written arguments using evidence to support the claim that gravitational interactions are always attractive and depend on the masses of interacting objects. Students will also understand that there is gravitational force between any two masses, but it is very small except when one or both of the objects have large mass. Because of this, gravitational fields will only be observed through the observation of simulations, the use of models, or the analysis of data. These could include simulations or digital tools and charts displaying mass, strength of interactions, distance from the sun, and orbital periods of objects within the solar system. Models used need to represent gravitational interactions between two masses within and between systems.

Resources/Instructional Materials
(articles, novels, websites, books, magazines, art, media)

- NJ DOE Model Curriculum -http://www.nj.gov/education/modelcurriculum/sci/6u4.pdf
- http://ngss.nsta.org/Resource.aspx?ResourceID=104
- http://concord.org/stem-resources/seeing-motion
- NJ DOE Model Curriculum - http://www.nj.gov/education/modelcurriculum/sci/6u5.pdf
- http://ngss.nsta.org/Resource.aspx?ResourceID=105
- http://ngss.nsta.org/Resource.aspx?ResourceID=246

Technology Resources

- Google Classroom
- Kahoot!
- Socrative
- Youtube
- BrainPop
- Mystery Science
- Nasa website
- Discovery
- Google Apps
- PowerPoint
- Quizlet
- Nova
- Science World Scholastic

Accommodations & Modifications
for Spec. Ed., ELL, GT, & At Risk Students

- Allow oral responses
- Allow verbalization before writing
- Use audio materials when necessary
- Modify homework assignments
- Read tests aloud
- Provide math manipulatives as necessary
- Restate, reword, clarify directions
- Re-teach concepts using small groups
- Provide educational "breaks" as necessary
- Expanding time for free reading
- Chunking Content
- Use mnemonic devices
- Provide a cueing system
- Untimed and/or extended test taking time
- Shorten assignments to focus on mastery concept
- Leveled Reading Materials
- Acronyms
- Graphic Organizers
- Notes Provided
- Check agenda book for parent(s) communication
- Read directions aloud
- Calculator
- Assignment, Project, and Assessment Modification Based on Individual Student Needs
- Speech to Text/Text to Speech Features in Google Apps
- Technology assisted instruction
- Preferential seating utilized
- Redirect student(s) as necessary
- Student choice for project or approach to assignment
- Inquiry-Based Learning
- Genius Hour

Science- Grade 6		
Unit # 4	**Title:** Astronomy	**Pacing**: 20 days

Stage 1- Desired Results

Established Goals/NJSLS Standards

Next Generation Science Standards/NJSLS:

MS-ESS1-1 Earth's Place in the Universe

- Develop and use a model of the Earth-sun-moon system to describe the cyclic patterns of lunar phases, eclipses of the sun and moon, and seasons. *[Clarification Statement: Examples of models can be physical, graphical, or conceptual.] (MS-ESS1-1)*
- Generate and analyze evidence (through simulations or long term investigations) to explain why the Sun's apparent motion across the sky changes over the course of a year. (ESS1.B) *[Clarification Statement: This SLO is based on a disciplinary core idea found in the Framework. It is included as a scaffold to the following SLO.]*
- Develop and use a model that shows how gravity causes smaller objects to orbit around larger objects at increasing scales, including the gravitational force of the sun causes the planets and other bodies to orbit around it holding together the solar system. (ESS1.A; ESS1.B) *[Clarification Statement: This SLO is based on disciplinary core ideas found in the Framework. It is included as a scaffold to the following SLO.]*

MS-ESS1-3 Earth's Place in the Universe

- Analyze and interpret data to determine scale properties of objects in the solar system. *[Clarification Statement: Emphasis is on the analysis of data from Earth-based instruments, space-based telescopes, and spacecraft to determine similarities and differences among solar system objects. Examples of scale properties include the sizes of an object's layers (such as crust and atmosphere), surface features (such as volcanoes), and orbital radius. Examples of data include statistical information, drawings and photographs, and models.] [Assessment Boundary: Assessment does not include recalling facts about properties of the planets and other solar system bodies.] (MS-ESS1-3)*

MS-ESS1-2 Earth's Place in the Universe

- Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system. *[Clarification Statement: Emphasis for the model is on gravity as the force that holds together the solar system and Milky Way galaxy and controls orbital motions within them. Examples of models can be physical (such as the analogy of distance along a football field or computer visualizations of elliptical orbits) or conceptual (such as mathematical proportions relative to the size of familiar objects such as students' school or state).] [Assessment Boundary: Assessment does not include Kepler's Laws of orbital motion or the apparent retrograde motion of the planets as viewed from Earth.] (MS-ESS1-2)*

English Language Arts Standards

- Cite specific textual evidence to support analysis of science and technical texts. (MS-ESS1-3) RST.6-8.1
- 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-ESS1-3) RST.6-8.7
- Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest. (MS-ESS1-1),(MS-ESS1-2) SL.8.5

Mathematics Standards

- Reason abstractly and quantitatively. (MS-ESS1-3) MP.2
- Model with mathematics. (MS-ESS1-1),(MS-ESS1-2) MP.4
- Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. (MS-ESS1-1),(MS-ESS1-2),(MS-ESS1-3) 6.RP.A.1
- Recognize and represent proportional relationships between quantities. (MS-ESS1-1),(MS-ESS1-2),(MS-ESS1-3) 7.RP.A.2
- 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-ESS1-2) 6.EE.B.6
- Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities. (MS-ESS1-2) 7.EE.B.6

Enduring Understandings (DCI) ***Students will understand…***	**Essential Questions** ***Students will consider...***
ESS1.A: The Universe and Its Stars ● Patterns of the apparent motion of the sun, the moon, and stars in the sky can be observed, described, predicted, and explained with models. (MS-ESS1-1) ● Earth and its solar system are part of the Milky Way galaxy, which is one of many galaxies in the universe. (MS-ESS1-2) **B: Earth and the Solar System** ● The solar system consists of the sun and a collection of objects, including planets, their moons, and asteroids that are held in orbit around the sun by its gravitational pull on them. (MS-ESS1-2),(MS-ESS1-3) ● This model of the solar system can explain eclipses of the sun and the moon. Earth's spin axis is fixed in direction over the short-term but tilted relative to its orbit around the sun. The seasons are a result of that tilt and are caused by the differential intensity of sunlight on different areas of Earth across the year. (MS-ESS1-1) ● The solar system appears to have formed from a disk of dust and gas, drawn together by gravity. (MS-ESS1-2)	● What pattern in the Earth–sun–moon system can be used to explain lunar phases, eclipses of the sun and moon, and seasons? ● What is the role of gravity in the motions within galaxies and the solar system? ● What are the scale properties of objects in the solar system?

Knowledge (Concepts) ***Students will know…***	**Academic Vocabulary**
● Patterns in the apparent motion of the sun, moon, and stars in the sky can be observed, described, predicted, and explained with models. ● The Earth and solar system model of the solar system can explain eclipses of the sun and the moon. ● Earth's spin axis is fixed in direction over the short term but tilted relative to its orbit around the sun. ● The seasons are a result of that tilt and are caused by the differential intensity of sunlight on different areas of Earth across the year. ● Patterns can be used to identify cause-and-effect relationships that exist in the apparent motion of the sun, moon, and stars in the sky. ● Science assumes that objects and events in the solar system systems occur in consistent patterns that are understandable through measurement and observation. ● Gravity plays a role in the motions within galaxies and the solar system. ● Gravity is the force that holds together the solar system and Milky Way galaxy and controls orbital motions within them. ● Earth and its solar system are part of the Milky Way galaxy, which is one of many galaxies in the universe. ● The solar system consists of the sun and a collection of objects, including planets, their moons, and asteroids, that are held in orbit around the sun by its gravitational pull on them. ● The solar system appears to have formed from a disk of dust and gas, drawn together by gravity.	● gravity ● lunar phases ● eclipses ● earth's axis ● seasons ● orbit ● galaxy ● planet ● orbit ● rotation ● revolution

Knowledge (Concepts) Continued
Students will know...

- Models can be used to represent the role of gravity in the motions and interactions within galaxies and the solar system.
- Science assumes that objects and events in the solar systems occur in consistent patterns that are understandable through measurement and observation.
- Objects in the solar system have scale properties.
- Data from Earth-based instruments, space-based telescopes, and spacecraft can be used to determine similarities and differences among solar system objects.
- The solar system consists of the sun and a collection of objects, including planets, their moons, and asteroids that are held in orbit around the sun by its gravitational pull on them.
- Time, space, and energy phenomena in the solar system can be observed at various scales, using models to study systems that are too large.
- Engineering advances have led to important discoveries in space science, and scientific discoveries have led to the development of entire industries and engineered systems.

Skills
Students will be able to…

- Students will develop and use a physical, graphical, or conceptual model to describe patterns in the apparent motion of the sun, moon, and stars in the sky.
- Students develop and use models to explain the relationship between the tilt of Earth's axis and seasons.
- Analyze and interpret data to determine similarities and differences among objects in the solar system.

21ST Century/ Interdisciplinary Themes	21st Century Skills
Global Awareness Financial, Business, & Entrepreneurial Literacy Civic Literacy **Environmental Literacy** Health Literacy	**Creativity & Innovation** **Communication & Collaboration** **Media Literacy** **Critical Thinking & Problem Solving** **Information Literacy** **Information, Communication, & Technology** **Life & Career Skills**

Stage 2- Assessment Evidence
from the NJ Model Curriculum:

What pattern in the Earth–sun–moon system can be used to explain lunar phases, eclipses of the sun and moon, and seasons? What is the role of gravity in the motions within galaxies and the solar system? What are the scale properties of objects in the solar system?

This unit is broken down into three sub-ideas: the universe and its stars, Earth and the solar system, and the history of planet Earth. Students examine the Earth's place in relation to the solar system, the Milky Way galaxy, and the universe. There is a strong emphasis on a systems approach and using models of the solar system to explain the cyclical patterns of eclipses, tides, and seasons. There is also a strong connection to engineering through the instruments and technologies that have allowed us to explore the objects in our solar system and obtain the data that support the theories explaining the formation and evolution of the universe. Students examine geosciences data in order to understand the processes and events in Earth's history. The crosscutting concepts of patterns, scale, proportion, and quantity and systems and systems models provide a framework for understanding the disciplinary core ideas. Students are expected to demonstrate proficiency in developing and using models and analyzing and interpreting data. Students are also expected to use these practices to demonstrate understanding of the core ideas.

Stage 2- Assessment Evidence Continued

Summative Assessment 1

- ***Standard:*** MS-ESS1-1
- ***Type:*** PBL (project-based assessment)
- ***Overview:*** Students create a model to show how the regular motions of the Moon cause Moon phases
- ***Rubric:*** https://docs.google.com/a/linwoodschools.org/document/d/1KZp5BH4wJBVHCP1DIAWCHpWyMrmSGpq4ZDOkMQlAACo/edit?usp=sharing
- ***Resources:*** https://api.betterlesson.com/mtp/lesson/636034/print
  https://betterlesson.com/lesson/636034/phases-of-the-moon

Summative Assessment 2

- ***Standard:*** MS-ESS1-2
- ***Type:*** Lab
- ***Overview:*** Student compare the concepts of mass and weight to understand how these properties of matter are similar and different
- ***Rubric:*** https://docs.google.com/a/linwoodschools.org/document/d/15ybWaljGXLgCVYR3OMNlegiydZb4xa8vdcSG1_d-_LA/edit?usp=sharing
- ***Resources:*** https://api.betterlesson.com/mtp/lesson/638056/print

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Summative Assessment 3

- ***Standard:*** MS-ESS1-3
- ***Type:*** Lab
- ***Overview:*** Students will create a model to explore the relative size of the sun and earth as well as the distance between them.
- ***Rubric:*** https://docs.google.com/a/linwoodschools.org/document/d/15ybWaljGXLgCVYR3OMNlegiydZb4xa8vdcSG1_d-_LA/edit?usp=sharing
- ***Resources:*** https://api.betterlesson.com/mtp/lesson/637645/print
  https://betterlesson.com/lesson/637645/scale-model-of-the-sun-earth

Formative Assessments	*Student Self-Assessment*	*Common Assessments*
• Pre-assessments • Labs • Quizzes • Project and problem-based learning activities • Graphic organizers • Short research projects • Collaborative learning projects • Formative checks (whiteboards, T/F, vote with your feet, thumbs up or thumbs down) • Summary Diagrams • Open ended responses • Short responses • Conferencing • Unit tests • Checklists	• Reflection activities (on the learning scale, on the daily target, on labs, on summative assessments, on collaborative work, on projects) • Responses to inquiry-based questions • Think-pair-share activities • Student revising knowledge throughout the unit	• Summative Assessments

Stage 3- Learning Plan

Suggested Learning Activities from the NJ DOE Model Curriculum

At the beginning of the unit, students will develop and use mathematical, physical, graphical or conceptual models to describe the cyclical patterns of lunar phases, eclipses of the sun and moon, and seasons. Students can use mathematics to create scale models of the solar system to investigate relative distances between the planets and their orbits around the sun or to represent the distance from the sun to the Earth during different Earth seasons. Students can also use physical models to examine the phases of the moon using a light source and a moon model to view the various shapes of the moon as it orbits the earth. Students may also keep a lunar calendar for one month and analyze the results by looking for differences and patterns. Using a model of the sun, Earth, and moon, students can view the positions of these planetary objects during a solar or lunar eclipse. To investigate seasons, students can simulate the position and tilt of the Earth as it revolves around the sun, using computer simulations, hands-on models, and videos.

Students will explore, through the development and use of models, the role of the force of gravity in explaining the motions within our solar system and the Milky Way Galaxy. As part of their study of the solar system and its components, including the sun, planets and their moons, and asteroids, they will use models and examine simulations to determine how gravity holds these systems together. To visualize how gravity pulls objects down towards its center, students can experiment with dropping spheres of different masses but of the same diameter as a way to determine that gravity acts on both objects and that they drop at the same rate. If technology is available, students can measure the acceleration of the objects as they fall from various heights. Students will be able to determine that the objects speed up as they fall, therefore proving that a force is acting on them. If motion detectors are not available for student use, they could observe these using simulations.

After students have had opportunities to participate in the investigations, they should prepare multimedia visual displays the present their findings. As part of their presentation, students will use mathematical models or simulations that show the relationship between relative sizes of objects in the solar system and the size of the gravitational force that is being exerted on the object. They should be able to compare and contrast the weight of an object if it were on the surface of different sized planets that have very different masses. Students will gather evidence that every object in the solar system is attracted to every other object in the solar system with a force that is related to the mass of the objects and the distance between the objects. They should extend this understanding of gravity to explain why objects in the solar system do not simply flow away from each other. Students should also make connections between their understanding of the force of gravity and the formation of the solar system from a cloud of dust and gas. As part of their mathematical model of the solar system, students will use variables to represent numbers and write expressions when solving a problem involving the role of gravity in the motions within galaxies and within the solar system. The variable can represent an unknown number or any number in a specified set.

Students will also analyze and interpret data from Earth-based instruments to determine the scale properties of objects within our solar system. Examples of models that students could use include physical (such as the analogy of distance along a football field or computer visualization of elliptical orbits), conceptual (such as mathematical proportions relative to the size of familiar objects such as students' school or state). Students can construct scale models of the solar system that will help them visualize relative sizes of objects in the system as well as distances between objects. Students can use graphs or tables to make comparisons between the size and gravitational pull of the planets and their moons.

Resources/Instructional Materials

(articles, novels, websites, books, magazines, art, media)

- NJ DOE Model Curriculum -http://www.nj.gov/education/modelcurriculum/sci/6u6.pdf
- http://solarsystem.nasa.gov/educ/
- http://ngss.nsta.org/Resource.aspx?ResourceID=6
- http://ngss.nsta.org/Resource.aspx?ResourceID=70
- http://ngss.nsta.org/Resource.aspx?ResourceID=290

Technology Resources

- Google Classroom
- Kahoot!
- Socrative
- Youtube
- BrainPop
- Mystery Science
- Nasa website
- Discovery
- Google Apps
- PowerPoint
- Quizlet
- Nova
- Science World Scholastic

Accommodations & Modifications

for Spec. Ed., ELL, GT, & At Risk Students

- Allow oral responses
- Allow verbalization before writing
- Use audio materials when necessary
- Modify homework assignments
- Read tests aloud
- Provide math manipulatives as necessary
- Restate, reword, clarify directions
- Re-teach concepts using small groups
- Provide educational "breaks" as necessary
- Expanding time for free reading
- Chunking Content
- Use mnemonic devices
- Provide a cueing system
- Untimed and/or extended test taking time
- Shorten assignments to focus on mastery concept
- Leveled Reading Materials
- Acronyms
- Graphic Organizers
- Notes Provided
- Check agenda book for parent(s) communication
- Read directions aloud
- Calculator
- Assignment, Project, and Assessment Modification Based on Individual Student Needs
- Speech to Text/Text to Speech Features in Google Apps
- Technology assisted instruction
- Preferential seating utilized
- Redirect student(s) as necessary
- Student choice for project or approach to assignment
- Inquiry-Based Learning
- Genius Hour

Adapted from: Wiggins, Grant and J. McTighe. (1998). *Understanding by Design*, Association for Supervision and Curriculum Development and 5E NGSS Lesson Plan from www.lewiscenter.org and NJ Science Model Curriculum at http://www.nj.gov/education/modelcurriculum/sci/

Science- Grade 6

Unit # 5	**Title:** Weather and Climate	Pacing: 20 days

Stage 1- Desired Results

Established Goals/NJSLS Standards

Next Generation Science Standards/NJSLS:

MS-ESS2-4 Earth's Systems

- Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity. *[Clarification Statement: Emphasis is on the ways water changes its state as it moves through the multiple pathways of the hydrologic cycle. Examples of models can be conceptual or physical.] [Assessment Boundary: A quantitative understanding of the latent heats of vaporization and fusion is not assessed.] (MS-ESS2-4)*

MS-ESS2-5 Earth's Systems

- Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions. *[Clarification Statement: Emphasis is on how air masses flow from regions of high pressure to low pressure, causing weather (defined by temperature, pressure, humidity, precipitation, and wind) at a fixed location to change over time, and how sudden changes in weather can result when different air masses collide. Emphasis is on how weather can be predicted within probabilistic ranges. Examples of data can be provided to students (such as weather maps, diagrams, and visualizations) or obtained through laboratory experiments (such as with condensation).] [Assessment Boundary: Assessment does not include recalling the names of cloud types or weather symbols used on weather maps or the reported diagrams from weather stations.] (MS-ESS2-5)*
- Explain how variations in density result from variations in temperature and salinity drive a global pattern of interconnected ocean currents. [Note: This SLO is based on a disciplinary core idea found in the Framework. It is included as a scaffold to the following SLO.] (ESS2.C)
- Use a model to explain the mechanisms that cause varying daily temperature ranges in a coastal community and in a community located in the interior of the country. [Note: This SLO is based disciplinary core ideas found in the Framework. It is included as a scaffold to the following SLO.] (ESS2.C; ESS2.D)

MS-ESS2-6 Earth's Systems

- Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates. *[Clarification Statement: Emphasis is on how patterns vary by latitude, altitude, and geographic land distribution. Emphasis of atmospheric circulation is on the sunlight-driven latitudinal banding, the Coriolis effect, and resulting prevailing winds; emphasis of ocean circulation is on the transfer of heat by the global ocean convection cycle, which is constrained by the Coriolis effect and the outlines of continents. Examples of models can be diagrams, maps and globes, or digital representations.] [Assessment Boundary: Assessment does not include the dynamics of the Coriolis effect.] (MS-ESS2-6)*

English Language Arts Standards

- Cite specific textual evidence to support analysis of science and technical texts. (MS-ESS2-5),(MS-ESS3-5) RST.6-8.1
- 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-ESS2-5) RST.6-8.9
- 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-ESS2-5) WHST.6-8.8
- Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest. (MS-ESS2-6) SL.8.5

Mathematics Standards

- Reason abstractly and quantitatively. (MS-ESS2-5),(MS-ESS3-5) MP.2
- Understand that positive and negative numbers are used together to describe quantities having opposite directions or values (e.g., temperature above/below zero, elevation above/below sea level, credits/debits, positive/negative electric charge); use positive and negative numbers to represent quantities in real-world contexts, explaining the meaning of 0 in each situation. (MS-ESS2-5) 6.NS.C.5
- 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-ESS3-5) 6.EE.B.6

Enduring Understandings (DCI) ***Students will understand…***	**Essential Questions** ***Students will consider...***
ESS2.C: The Roles of Water in Earth's Surface Processes • Water continually cycles among land, ocean, and atmosphere via transpiration, evaporation, condensation and crystallization, and precipitation, as well as downhill flows on land. (MS-ESS2-4) • The complex patterns of the changes and the movement of water in the atmosphere, determined by winds, landforms, and ocean temperatures and currents, are major determinants of local weather patterns. (MS-ESS2-5) • Global movements of water and its changes in form are propelled by sunlight and gravity. (MS-ESS2-4) • Variations in density due to variations in temperature and salinity drive a global pattern of interconnected ocean currents. (MS-ESS2-6) **ESS2.D: Weather and Climate** • Weather and climate are influenced by interactions involving sunlight, the ocean, the atmosphere, ice, landforms, and living things. These interactions vary with latitude, altitude, and local and regional geography, all of which can affect oceanic and atmospheric flow patterns. (MS-ESS2-6) • Because these patterns are so complex, weather can only be predicted probabilistically. (MS-ESS2-5) • The ocean exerts a major influence on weather and climate by absorbing energy from the sun, releasing it over time, and globally redistributing it through ocean currents. (MS-ESS2-6)	• What are the processes involved in the cycling of water through Earth's systems? • What is the relationship between the complex interactions of air masses and changes in weather conditions? • What are the major factors that determine regional climates?
Knowledge (Concepts) ***Students will know…***	**Academic Vocabulary**
• Water continually cycles among land, ocean, and atmosphere via transpiration, evaporation, condensation and crystallization, and precipitation, as well as downhill flows on land. • Global movements of water and its changes in form are propelled by sunlight and gravity. • The cycling of water through Earth's systems is driven by energy from the sun and the force of gravity. • Within Earth's systems, the transfer of energy drives the motion and/or cycling of water. • The motions and complex interactions of air masses result in changes in weather conditions.	• weather • climate • landforms • atmosphere • transpiration • evaporation • condensation • crystallization

Knowledge (Concepts) Continued ***Students will know…***	**Academic Vocabulary Continued**
● The complex patterns of the changes in and movement of water in the atmosphere, determined by winds, landforms, and ocean temperatures and currents, are major determinants of local weather patterns. ● Examples of data that can be used to provide evidence for how the motions and complex interactions of air masses result in changes in weather conditions include weather maps, diagrams, and visualizations; other examples can be obtained through laboratory experiments. ● Air masses flow from regions of high pressure to regions of low pressure, causing weather (defined by temperature, pressure, humidity, precipitation, and wind) at a fixed location to change over time. ● Because patterns of the changes and the movement of water in the atmosphere are so complex, weather can only be predicted probabilistically. ● Sudden changes in weather can result when different air masses collide. ● Weather can be predicted within probabilistic ranges. ● Cause-and effect-relationships may be used to predict changes in weather. ● Unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates. ● Patterns of atmospheric and oceanic circulation that determine regional climates vary by latitude, altitude, and geographic land distribution. ● Atmospheric circulation that, in part, determines regional climates is the result of sunlight-driven latitudinal banding, the Coriolis effect, and resulting prevailing winds. ● Ocean circulation that, in part, determines regional climates is the result of the transfer of heat by the global ocean convection cycle, which is constrained by the Coriolis effect and the outlines of continents. ● Models that can be used to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates can be diagrams, maps and globes, or digital representations.	● precipitation ● water cycle ● gravity ● air masses ● high pressure ● low pressure ● temperature ● pressure ● humidity ● Coriolis effect ● oceanic circulation ● atmospheric circulation

Skills

Students will be able to…

- Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity.
- Model the ways water changes its state as it moves through the multiple pathways of the hydrologic cycle.
- Collect data to serve as the basis for evidence for how the motions and complex interactions of air masses result in changes in weather conditions.
- Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates.

21ST Century/ Interdisciplinary Themes	**21st Century Skills**
Global Awareness Financial, Business, & Entrepreneurial Literacy Civic Literacy **Environmental Literacy** Health Literacy	**Creativity & Innovation** **Communication & Collaboration** **Media Literacy** **Critical Thinking & Problem Solving** **Information Literacy** **Information, Communication, & Technology** **Life & Career Skills**

Stage 2- Assessment Evidence
from the NJ DOE Model Curriculum

What factors interact and influence weather and climate?

This unit is broken down into three sub-ideas: Earth's large-scale systems interactions, the roles of water in Earth's surface processes, and weather and climate. Students make sense of how Earth's geo-systems operate by modeling the flow of energy and cycling of matter within and among different systems. A systems approach is also important here, examining the feedbacks between systems as energy from the Sun is transferred between systems and circulates through the ocean and atmosphere. The crosscutting concepts of cause and effect, systems and system models, and energy and matter are called out as frameworks for understanding the disciplinary core ideas. In this unit, students are expected to demonstrate proficiency in developing and using models and planning and carrying out investigations as they make sense of the disciplinary core ideas. Students are also expected to use these practices to demonstrate understanding of the core ideas.

Summative Assessment 1

- ***Standard:*** MS-ESS2-4, MS-ESS2-6
- ***Type:*** Essay
- ***Overview:*** Students evaluate the effectiveness of a model to represent global ocean and wind currents. Students combine information they gain from videos, demonstrations, and articles in order to find evidence to support their claim. In the essay, students will explain how the rotation and uneven heating of the earth cause patterns of oceanic and atmospheric circulation.
- ***Rubric:*** https://docs.google.com/a/linwoodschools.org/document/d/17JT_GMbHSIby2FHM1vgl3UU0cF9POkfSFDRbsIsL0cE/edit?usp=sharing
- ***Resources:*** https://api.betterlesson.com/mtp/lesson/638297/print
  https://betterlesson.com/lesson/638297/global-ocean-and-atmospheric-circulation-evaluating-models

Summative Assessment 2

- ***Standard:*** MS-ESS2-4, MS-ESS2-5, MS-ESS2-6
- ***Type:*** Exam
- ***Overview:*** Students will synthesize information gather throughout the unit by completing the end of unit exam
- ***Resources:*** Student composition books

Formative Assessments	*Student Self-Assessment*	*Common Assessments*
• Pre-assessments • Labs • Quizzes • Project and problem-based learning activities • Graphic organizers • Short research projects • Collaborative learning projects • Formative checks (whiteboards, T/F, vote with your feet, thumbs up or thumbs down) • Summary Diagrams • Open ended responses • Short responses • Conferencing • Unit tests • Checklists	• Reflection activities (on the learning scale, on the daily target, on labs, on summative assessments, on collaborative work, on projects) • Responses to inquiry-based questions • Think-pair-share activities • Student revising knowledge throughout the unit	• Summative Assessments

Stage 3- Learning Plan

Suggested Learning Activities from the NJ DOE Model Curriculum

Astronomy

During this unit, students will answer the question “What factors interact and influence weather and climate?” beginning with the cycling of water in Earth’s systems. Models will be created and emphasis will be on the ways water changes its state as it moves through the multiple pathways of the hydrologic cycle. Students will model the continuous movement of water from land, ocean, and atmosphere via transpiration, evaporation, condensation and crystallization, and precipitation. Students will focus on the global movement of water and its changes in form that are driven by sunlight as it heats the Earth’s surface water.

The motions and complex interactions of air masses result in changes in weather conditions. The patterns of the changes and the movement of water in the atmosphere, determined by winds, landforms, and ocean temperatures and currents, are major determinants of local weather patterns. Students will collect data from weather maps, diagrams, visualizations, and laboratory experiments to explain how the movements of air masses from regions of high pressure to regions of low pressure cause weather at a fixed location. For example, students can observe the movement of colored water that simulates the movement of hot and cold air masses. Students can observe the cooler water flowing in the direction of the warmer area and equate this with wind being created from the uneven heating of the Earth. Students will compare data collected from sources such as simulations, video, or experiments to identify the patterns of change in the movement of water in the atmosphere that are used to make weather predictions, understanding that any predictions are reported within probability ranges. Students will also make predictions about the conditions that result in sudden changes in weather.

Students will use models, diagrams, maps, and globes to understand atmospheric and ocean circulation patterns. Since the ocean exerts a major influence on weather and climate by absorbing energy from the sun, releasing it over time, and globally redistributing it through ocean currents, the ocean will be studied as a system with interactions such as inputs, outputs, processes, energy, and matter. Students will model how the unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates. They will describe how the unequal heating of the global ocean produces convection currents. By examining maps, globes and digital representations of the movement of ocean currents, students will model the patterns by latitude, altitude, and geographic distribution. They will show that these patterns vary as a result of sunlight-driven latitudinal banding, the Coriolis effect, and resulting prevailing wines.

Digital models like NOAA videos can be used to help students visualize how variations in density due to temperature and salinity drive a global pattern of interconnected ocean currents. This can be demonstrated in the classroom using models in which colored water with different temperatures or water with different densities is added to clear tubs of water. Students can observe that the warmer water is pushed upwards by the colder water. This same demonstration can be used with water that has different salinities. Using a turntable and drawing a straight line from the middle to the edge can model the Coriolis effect. If a turntable is not available, a Lazy Susan is a great substitute. The turntable or Lazy Susan can be painted with chalk paint, and the students can draw the line using chalk. Using chalk paint and chalk will enable the teacher to use them over and over. After the turntable is stopped, students will see that the motion of the turntable resulted in a curved line, and they will then be able to correlate how the rotation of Earth results in the movement of air.

Resources/Instructional Materials

(articles, novels, websites, books, magazines, art, media)

- NJ DOE Model Curriculum - http://www.nj.gov/education/modelcurriculum/sci/6u7.pdf
- http://ngss.nsta.org/Resource.aspx?ResourceID=23
- http://ngss.nsta.org/Resource.aspx?ResourceID=114
- http://ngss.nsta.org/Resource.aspx?ResourceID=251

Technology Resources

- Google Classroom
- Kahoot!
- Socrative
- Youtube
- BrainPop
- Mystery Science
- Nasa website
- Discovery
- Google Apps
- PowerPoint
- Quizlet
- Nova
- Science World Scholastic

Accommodations & Modifications
for Spec. Ed., ELL, GT, & At Risk Students

- Allow oral responses
- Allow verbalization before writing
- Use audio materials when necessary
- Modify homework assignments
- Read tests aloud
- Provide math manipulatives as necessary
- Restate, reword, clarify directions
- Re-teach concepts using small groups
- Provide educational "breaks" as necessary
- Expanding time for free reading
- Chunking Content
- Use mnemonic devices
- Provide a cueing system
- Untimed and/or extended test taking time
- Shorten assignments to focus on mastery concept
- Leveled Reading Materials
- Acronyms
- Graphic Organizers
- Notes Provided
- Check agenda book for parent(s) communication
- Read directions aloud
- Calculator
- Assignment, Project, and Assessment Modification Based on Individual Student Needs
- Speech to Text/Text to Speech Features in Google Apps
- Technology assisted instruction
- Preferential seating utilized
- Redirect student(s) as necessary
- Student choice for project or approach to assignment
- Inquiry-Based Learning
- Genius Hour

Adapted from: Wiggins, Grant and J. McTighe. (1998). ***Understanding by Design***, Association for Supervision and Curriculum Development and 5E NGSS Lesson Plan from www.lewiscenter.org and NJ Science Model Curriculum at http://www.nj.gov/education/modelcurriculum/sci/