Barrington School District	Haddon Heights School District	Lawnside School District	Merchantville School District

*All curriculum is aligned with the NJSLS in accordance with the Department's curriculum implementation timeline and includes all required components (NJ.A.C.6A:8).
**Resource and activity lists are compiled from all four districts and may not necessarily be reflected in each district or school.

UNIT 1 SUMMARY: 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.

This unit is based on MS-LS1-4 and MS-LS1-5.

Unit 1: Growth, Development and Reproduction of Organisms

ESTABLISHED GOALS (INDICATOR #)	**TRANSFER (How will this apply to their lives?)**
★ MS-LS1-4: Use argument based on empirical evidence and scientific	*Students will be able to independently use their knowledge to…* ★ Describe and explain characteristic animal behaviors that affect the probability of successful

<table>
<tr>
<td rowspan="3">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.
★ MS-LS1-5: Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.</td>
<td colspan="2">reproduction
★ Describe and explain specialized plant structures that affect the probability of successful reproduction
★ Argue and support the explanation for how environmental and genetic factors influence growth of organisms</td>
</tr>
<tr>
<td colspan="2">MEANING</td>
</tr>
<tr>
<td>UNDERSTANDINGS
Students will understand...
Part A
★ 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
Part B
★ 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</td>
<td>ESSENTIAL QUESTIONS
Part A
★ How do characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants, respectively?
Part B
★ How do environmental and genetic factors influence the growth of organisms?</td>
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	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.	

Unit 1: Grade 6 - Lessons

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.

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.

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Engaging in Argument from Evidence ● Use an oral and written argument supported by empirical evidence and scientific	**LS1.B: Growth and Development of Organisms**	**Cause and Effect**

reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem. (MS-LS1-4) **Constructing Explanations and Designing Solutions** ● Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students' own experiments) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (MS-LS1-5)	● 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)	● Cause and effect relationships may be used to predict phenomena in natural systems. (MS-LS1-4),(MS-LS1-5) ● Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability. (MS-LS1-4),(MS-LS1-5) **Structure and Function** ● Complex and microscopic structures and systems can be visualized, modeled, and used to describe how their function depends on the relationships among its parts; therefore complex natural structures/systems can be analyzed to determine how they function. (MS-LS1-4), (MS-LS1-5)
District/School Formative Assessment Plan		**District/School Summative Assessment Plan**
Part A ★ Collect empirical evidence about animal behaviors that affect the animals' 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. **Part B** ★ 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.		Teacher created tests Individual/Group Presentations Unit projects End of the Unit Writing Project with a rubric End of Unit Test
Alternative Assessments		
Evaluative Criteria	**Assessment Evidence**	

Suggested Performance Rubric: Use the following or similar rubric to evaluate students' performance on lesson assessments: Marzano Proficiency Scale **4 - Innovating:** Advanced understanding and application of the standard **3 - Applying:** Consistently applies skills independently **2 - Developing:** Progressing towards independent application of skills **1 - Beginning:** Early stages of development, need assistance OR **4 - Innovating:** In addition to score 3.0 performance, the student demonstrates in-depth inferences and applications that go beyond what is expected from the 3.0 goal. **3 - Applying:** *Students will be able to:* - 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. (MS-LS1-4) - Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms. (MS-LS1-5) **2 - Developing:** *Students will* ***recognize*** *and* ***recall*** *specific vocabulary, including:* - Animal, animal behavior, attract, breed, characteristic, mate, nectar, plant, plant structure, pollen, probability, reproduction, reproductive capacity,	*Suggested performance tasks include but are not limited to:* **Part A** Flower Dissection Lab: https://betterlesson.com/lesson/633272/the-beauty-of-a-flower-structure-and-function?from=cc_lesson **Part B** Effect of Environment on Plant Growth: https://www.apsnet.org/EDCENTER/K-12/TEACHERSGUIDE/PLANTBIOTECHNOLOGY/Pages/Activity7.aspx https://drive.google.com/drive/folders/1uf9I8yGNC281T9YsaVD4HBSzAPIKHzgk

reproductive system, specialized (MS-LS1-4) - Characteristics of life, drought, environmental, factor, fertilizer, genetic, growth, organism, soil fertility (MS-LS1-5) *Students will be able to:* - Describe animal behaviors that affect the probability of successful reproduction (MS-LS1-4) - Describe plant structures that affect the probability of successful reproduction - Describe environmental and genetic factors that influence the growth of organisms (MS-LS1-5) **1 - Beginning:** With help, partial success at score 2.0 and 3.0 content.	

District/School Texts	**District/School Supplementary Resources**
Haddon Heights: ***Unit Kits for Science Labs and References*** **Barrington: N/A** **Lawnside: Science Fusion (Houghton Mifflin Harcourt - 2017)** **Merchantville: N/A**	NEWSELA Mosa Mack BrainPop Youtube Quizlet Kahoot Readworks PHET Simulations

Interdisciplinary Connections

ELA	**Math**	**Social Studies**
RST.6-8.1: Cite specific textual evidence to support analysis of science and technical texts RST.6-8.2: Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions RI.6.8: Trace and evaluate the argument and specific claims in a text, distinguishing claims that are supported by reasons and evidence from claims that are not. WHST.6-8.1: Write arguments focused on discipline content.	6.SP.A.2: Understand that a set of data collected to answer a statistical question has a distribution which can be described by its center, spread, and overall shape. 6.SP.B.4: Summarize numerical data sets in relation to their context.	6.1.8.C.1.a: Evaluate the impact of science, religion and technological innovations on European explorations

WHST.6-8.2: Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content. WHST.6-8.9: Draw evidence from informational texts to support analysis, reflection, and research.		
<u>21st Century Skills/Career Education</u> CRP4. Communicate clearly and effectively and with reason. CRP6. Demonstrate creativity and innovation. CRP7. Employ valid and reliable research strategies. CRP8. Utilize critical thinking to make sense of problems and persevere in solving them. CRP12. Work productively in teams while using cultural global competence. 9.3.12.ED.2 Demonstrate effective oral, written and multimedia communication in multiple formats and contexts. 9.3.12.ED.5 Demonstrate group collaboration skills to enhance professional education and training practice.	**<u>Technology</u>** 8.1.8.A.1 Demonstrate knowledge of a real world problem using digital tools. 8.1.8.A.3 Use and/or develop a simulation that provides an environment to solve a real world problem or theory.	
Modifications and Accommodations		
Special Education Students Small group Direct instruction Restate/rephrase Graphic organizers Modified assignments Chunking Leveled text Intentional grouping Read text Extended time Breaks Teacher records/ student dictates	**English Language Learners** Labels Word banks Visuals Student friendly definitions Extended time Chunking Intentional grouping	**Students at Risk of School Failure** Leveled text Graphic organizers Modified assignments Kinesthetic activities Restate/rephrase Chunking Intentional grouping

Gifted and Talented	Students with 504 Plans	
Extension project Leveled text Leadership roles Intentional grouping Targeted learning from assessment	Breaks Chunking Preferential seating Visual reminders Restate/rephrase Check-in/check-out system Visual time Teacher records/ student dictates	
Unit Duration: Instructional Days		
25 days		

Unit 2 Summary

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.

This unit is based on MS-LS2-1, MS-LS2-2, and MS-LS2-3.

Unit 2: Matter and Energy in Organisms and Ecosystems	
ESTABLISHED GOALS- Standards Students who demonstrate understanding can:	**TRANSFER**
★ MS-LS2-1. Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem	*Students will be able to independently use their knowledge to…* ● I can provide evidence for the effects of resource availability on populations of organisms by analyzing and interpreting data. ● I can construct an explanation that predicts patterns of interactions among organisms across ecosystems. ● I can develop a model that shows the flow of energy among parts of an ecosystem.

★ MS-LS2-2. Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems. ★ MS-LS2-3. Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.	**MEANING**

	UNDERSTANDINGS	Essential Questions	
	Students will understand that… **Part A:** • 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 nonliving 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. **Part B:** • 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. **Part C:** • 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.	**Part A:** How do changes in the availability of matter and energy affect populations in an ecosystem? **Part B:** How do relationships among organisms, in an ecosystem, effect populations? **Part C:** How can you explain the stability of an ecosystem by tracing the flow of matter and energy?	

	• 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.		

Unit 2: Grade 6 - Lessons

Suggested Activities:

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.

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.

Habitable Planet Population Simulator: This ecosystem interactive will allow the user to determine the producers and consumers (primary and secondary) in a simulated ecosystem. The user can then see the outcome of including species with particular diets, including the result of how food resources can be depleted if consumers have similar diets. The accompanying lessons do have questions to guide the development of investigations, and there are data tables that are provided to gather information as it is collected.
Modeling Marine Food Webs and Human Impact: In this two-part lesson, students develop food webs and investigate human impacts on marine ecosystems. In Part I, students explore the ecological role of organisms in an ocean habitat and use information provided on Food Web Cards to develop food chains. In Part ll, students model the interconnected feeding relationships in the open ocean ecosystem by developing food webs and then using their food webs to explore the impact that different scenarios have on the ecosystem.
Interactive Interdependence: This article describes an interactive lesson in which the complexity of food webs and ecosystems is explored. Students generate a list of organisms in a Pacific aquatic ecosystem, assign each organism to a student, and then link the organisms together in a food web using string. Students tug on the string to identify the connections in the food web. In response to several potential changes the teacher describes, the students tug on their strings to predict patterns of interactions. Next, they investigate the limiting factors in an ecosystem. As a concluding activity, students respond to how organisms are affected with differing "Interdependence Scenarios."
Florida's Everglades: The River of Grass utilizes a video clip of a visit to the Everglades, short articles for students to read, a series of slides and a suggested project for students to complete. Students sign up for a pbsteacherline.org account (no email required) to save their notes. As they go through the lesson, they read, watch videos, and answer questions in order to investigate the Florida Everglades ecosystem. Students investigate the biodiversity in the varying ecosystems and the human impact on this biome. Students compare the Florida Everglades to their local ecosystem. An included writing prompt helps students explain patterns of interactions between organisms and ecosystems. An eight page teacher's guide is included in support materials under "For Teachers". This guide provides lesson goals, key literacy strategies, essential background information, questions for determining students' prior knowledge, suggestions for ways to support students as they complete the lesson and a variety of assessment ideas. This lesson is grade appropriate.

Science & Engineering Practices:	**Disciplinary Core Ideas:**	**Crosscutting Concepts:**
Analyzing and Interpreting Data Analyzing data in 6–8 builds on K–5 experiences and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis. • Analyze and interpret data to provide evidence for phenomena. Constructing Explanations and Designing Solutions Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories. Construct an explanation that includes qualitative or quantitative relationships between variables that predict phenomena.	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. 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. Growth of organisms and population increases are limited by access to resources. LS2.A: Interdependent Relationships in Ecosystems Similarly, predatory interactions may reduce the number of organisms or eliminate whole populations of organisms. Mutually beneficial interactions, in contrast, may become so interdependent that each organism requires the other for	Cause and effect Patterns Energy and Matter

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

District/School Formative Assessment Plan	District/School Summative Assessment Plan
Part A: ● 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. Part B ● 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. Part C ● 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.	<u>Suggested Assessments:</u> Teacher created tests Individual/Group Presentations Unit projects Project with a rubric End of Unit Test STEAM Labs

Alternative Assessments	
Evaluative Criteria	**Assessment Evidence**

Suggested Performance Rubric: Use the following or similar rubric to evaluate students' performance on lesson assessments: Marzano Proficiency Scale **4 - Innovating:** Advanced understanding and application of the standard **3 - Applying:** Consistently applies skills independently **2 - Developing:** Progressing towards independent application of skills **1 - Beginning:** Early stages of development, need assistance	**Suggested Performance Task:** Students with needs alternative assessments Through the ecosystems unit project, students will complete each component as outlined below. 1)Research a specific ecosystem (terrestrial or aquatic) to include at least 5 interesting facts, an example of a food chain with the labeling of producer, consumer, or decomposer, and 4 biotic and 2 abiotic factors in the ecosystem. 2) Informational powerpoint or google slide that includes every part as stated in number 1. 3) A model or display (with or without technology) that includes a food chain, 4 biotic **and 2** abiotic factors in the ecosystem labeled. Gifted or advanced students alternative assessment Through the ecosystems unit project, students will complete each component as outlined below. 1)Research a specific ecosystem (terrestrial or aquatic) to include at least 10 interesting facts, an example of a food chain with the labeling of producer, consumer, or decomposer, and 6 biotic and 4 abiotic factors in the ecosystem. 2) Informational writing that includes every part as stated in number 1. 3) A model or display (with or without technology) that includes a food chain, 6 biotic and 4 abiotic factors in the ecosystem labeled.

District/School Texts	District/School Supplementary Resources
Haddon Heights: *Unit Kits for Science Labs and References* **Barrington: N/A** **Lawnside: Science Fusion (Houghton Mifflin Harcourt - 2017)** **Merchantville: N/A**	Click for link to running resources doc.

Interdisciplinary Connections

ELA	**Math**	**Social Studies**
RST.6-8.1: Cite specific textual evidence to support analysis of science and technical texts. (MS-LS2-1),(MS-LS2-2) RST.6-8.7: Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table). (MS-LS2-1) WHST.6-8.2: Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content. (MS-LS2-2)	6.EE.C.9: Use variables to represent two quantities in a real-world problem that change in relationship to one another; write an equation to express one quantity, thought of as the dependent variable, in terms of the other quantity, thought of as the independent variable. Analyze the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation. 6.SP.B.5: Summarize numerical data sets in relation to their context.	6.1.8.C.1.a: Evaluate the impact of science, religion and technological innovations on European explorations

WHST.6-8.9: Draw evidence from literary or informational texts to support analysis, reflection, and research. (MS-LS2-2) SL.8.1: Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 8 topics, texts, and issues, building on others' ideas and expressing their own clearly. (MS-LS2-2) SL.8.4: Present claims and findings, emphasizing salient points in a focused, coherent manner with relevant evidence, sound valid reasoning, and well-chosen details; use appropriate eye contact, adequate volume, and clear pronunciation. (MS-LS2-2) SL.8.5: Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest. (MS-LS2-3)		
<u>21st Century Skills/Career Education</u> 9.2.4.A.1: Identify reasons why people work, different types of work, and how work can help a person achieve personal and professional goals. 9.2.4.A.2: Identify various life roles and civic and work-related activities in the school, home, and community. 9.2.8.B.3: Evaluate communication, collaboration, and leadership skills that can be developed through school, home, work, and extracurricular activities for use in a career. CRP1.: Act as a responsible and contributing citizen and employee.	**<u>Technology</u>** 8.1.8.A.3: Use and/or develop a simulation that provides an environment to solve a real world problem or theory. 8.1.8.A.1: Demonstrate knowledge of a real world problem using digital tools 8.1.8.A.4: Graph and calculate data within a spreadsheet and present a summary of the results 8.2.8.A.2: Examine a system, consider how each part relates to other parts, and discuss a part to redesign to improve the system.	

CRP2. Apply appropriate academic and technical skills. CRP4.: Communicate clearly and effectively and with reason. CRP5.: Consider the environmental, social and economic impacts of decisions. CRP6.: Demonstrate creativity and innovation. CRP7.: Employ valid and reliable research strategies. CRP8.: Utilize critical thinking to make sense of problems and persevere in solving them. CRP9.: Model integrity, ethical leadership and effective management. CRP11.: Use technology to enhance productivity. CRP12.: Work productively in teams while using cultural global competence.		
Modifications and Accommodations		
<u>Special Education Students</u> small group/intentional grouping preferred seating direct instruction provide background knowledge provide individual/small group assistance provide student friendly definitions for vocabulary modified assignments (reduce/revise) provide notes/study guides restate/rephrase graphic organizers, labels, word banks visuals chunking	**<u>English Language Learners</u>** small group/intentional grouping preferred seating direct instruction provide background knowledge provide individual/small group assistance provide student friendly definitions for vocabulary modified assignments (reduce/revise) provide notes/study guides restate/rephrase graphic organizers, labels, word banks visuals chunking leveled text	**<u>Students at Risk of School Failure</u>** small group/intentional grouping preferred seating direct instruction provide background knowledge provide individual/small group assistance provide student friendly definitions for vocabulary modified assignments (reduce/revise) provide notes/study guides

leveled text read text, use audio when available kinesthetic activities extended time breaks check-in/check-out system · Structure lessons around questions that are authentic, relate to students' interests, social/family background and knowledge of their community. · Provide students with multiple choices for how they can represent their understandings (e.g. multisensory techniques-auditory/visual aids; pictures, illustrations, graphs, charts, data tables, multimedia, modeling). · Provide opportunities for students to connect with people of similar backgrounds (e.g. conversations via digital tool such as SKYPE, experts from the community helping with a project, journal articles, and biographies). · Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures (e.g. multiple representation and multimodal experiences). · Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understandings. · Use project-based science learning to connect science with observable phenomena. · Structure the learning around explaining or solving a social or community-based issue. ·	read text, use audio when available kinesthetic activities extended time breaks check-in/check-out system Provide ELL students with multiple literacy strategies.	restate/rephrase graphic organizers, labels, word banks visuals chunking leveled text read text, use audio when available kinesthetic activities extended time breaks check-in/check-out system
Gifted and Talented extension project	**Students with 504 Plans** small group/intentional grouping	

leveled text leadership roles intentional grouping targeted learning from assessment DOK higher order questions Blooms - analyze, evaluate, create	preferred seating direct instruction provide background knowledge provide individual/small group assistance provide student friendly definitions for vocabulary modified assignments (reduce/revise) provide notes/study guides restate/rephrase graphic organizers, labels, word banks visuals chunking leveled text read text, use audio when available kinesthetic activities extended time breaks check-in/check-out system	
Unit Duration: Instructional Days		
25 days		

Unit 3: Interdependent Relationships in Ecosystems **UNIT SUMMARY: 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 trade-off 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.**		
Unit 3: Interdependent Relationships in Ecosystems		
ESTABLISHED GOALS (INDICATOR #)	**TRANSFER (How will this apply to their lives?)**	
★ MS-LS2-4- Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.	*Students will be able to independently use their knowledge to…* ★ **Explain how the physical or biological components of an ecosystem affect populations.** ★ **Design, compare and contrast solutions for maintaining biodiversity and ecosystem services.** ★ **Identify limiting factors that may possible environmental solutions solutions.**	
	MEANING	
	UNDERSTANDINGS	ESSENTIAL QUESTIONS

★ MS-LS2-5- Evaluate competing design solutions for maintaining biodiversity and ecosystem services. ★ MS-ETS1-1- 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-ETS1-3- 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.	*Students will understand…* ★ 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 populations of an ecosystem. ★ 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.	★ How can a single change to an ecosystem disrupt the whole system? ★ What limits the number and variety of living things in an ecosystem?
Unit 3: Grade 6 - Lessons		
Lesson topics may include, but are not limited to: 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, tornados, 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. 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.

Science and Engineering Practices	**Disciplinary Core Ideas**	**Crosscutting Concepts**
Engaging in Argument from Evidence **• Construct an oral and written argument**	**LS2.C: Ecosystem Dynamics, Functioning, and Resilience**	**Stability and Change** **• Small changes in one part of a system might**

	supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem. (MS-LS2-4) **• Evaluate competing design solutions based on jointly developed and agreed-upon design criteria. (MS-LS2-5)** **Asking Questions and Defining Problems** **• Define a design problem that can be solved through the development of an object, tool, process or system and includes multiple criteria and constraints, including scientific knowledge that may limit possible solutions. (MS-ETS1-1)** **Developing and Using Models • Develop a model to generate data to test ideas about designed systems, including those representing inputs and outputs. (MS-ETS1-4) Analyzing and Interpreting Data • Analyze and interpret data to determine similarities and differences in findings. (MS-ETS1-3)**	**• 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**	**cause large changes in another part. (MS-LS2- 4), (MS-LS2-5)** **- -** **Connections to Engineering, Technology, and Applications of Science Influence of Science, Engineering, and Technology on Society and the Natural World • The use of technologies and any limitations on their use are driven by individual or societal needs, desires, and values; by the findings of scientific research; and by differences in such factors as climate, natural resources, and economic conditions. Thus technology use varies from region to region and over time. (MS-LS2-5)** **- -** **Connections to Nature of Science** **Scientific Knowledge Assumes an Order and Consistency in Natural Systems** **• Science assumes that objects and events in natural systems occur in consistent patterns that are understandable through measurement and observation. (MS-LS2-3)** **Scientific Knowledge is Based on Empirical Evidence** **• Science disciplines share common rules of obtaining and evaluating empirical evidence. (MS-LS2-4)** **Science Addresses Questions About the Natural and Material World** **• Scientific knowledge can describe the consequences of actions but does not necessarily prescribe the decisions that society takes (MS-LS2-5).**

		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**	

District/School Formative Assessment Plan	District/School Summative Assessment Plan
Formative assessment informs instruction and is ongoing throughout a unit to determine how students are progressing against the standards. Discussions with Peers in Small Groups/Pairs, Turn and talk Practice/Homework Strategic, H.O.T. (Higher Order Thinking) Questioning Graphic Organizers Journal Entry/Double Journal Entry Sentence/Paragraph Summaries Anecdotal Notes Self Evaluation Rubrics Comprehension Quizzes, Assessments Vocabulary Assessments/Quizzes Teacher/Student Conferencing Open Ended Questions Oral Assessments Exit tickets	*Summative assessment is an opportunity for students to demonstrate mastery of the skills taught during a particular unit.* Teacher created tests Individual/Group Presentations Unit projects End of the Unit Writing Project with a rubric End of Unit Test .

Alternative Assessments	
Evaluative Criteria	**Assessment Evidence**

Suggested Performance Rubric: Use the following or similar rubric to evaluate students' performance on lesson assessments: Marzano Proficiency Scale **4 - Innovating:** Advanced understanding and application of the standard **3 - Applying:** Consistently applies skills independently **2 - Developing:** Progressing towards independent application of skills **1 - Beginning:** Early stages of development, need assistance	**Suggested Performance Tasks:** In Exploring the "Systems" in Ecosystems, students are introduced to the concept of an ecosystem, and explore how to analyze ecosystems using a systems thinking approach. A class discussion brings out students' ideas about ecosystems and introduces basic information about the components and processes of ecosystems. Next, students encounter a hypothetical ecosystem and gain experience analyzing it the way scientists do. Students then select a local ecosystem and apply what they have learned to analyze it. Finally, students extend their understanding by characterizing three different types of ecosystems and describing their components and processes. The Flow of Matter and Energy in Ecosystems SciPack explores the systemic interplay and flow of matter and energy throughout ecosystems, populations and organisms. Energy from the sun is the direct or indirect source of energy for nearly all organisms, it can flow only in one direction through ecosystems: from the sun to producers, to consumers, and finally to decomposers. Unlike the unidirectional transformation of energy, matter cycles among ecosystem components. One key ecosystem function, the cycling of carbon from non-living to living components and back, serves as a primary example in this SciPack for how all nutrients cycle on Earth. Webs and pyramids are used to model and communicate about the transfer of energy and cycling of matter within an ecosystem, representing how the total living biomass stays roughly constant—cycling materials from old to new life—accompanied by an irreversible flow of energy from captured sunlight into dissipated heat. Annenberg Media's Teachers' Resources offer short video courses covering essential science content for teachers. http://www.learner.org/resources/series179.html

District/School Texts	District/School Supplementary Resources
Haddon Heights: *Unit Kits for Science Labs and References* **Barrington: N/A** **Lawnside: Science Fusion (Houghton Mifflin Harcourt - 2017)** **Merchantville: N/A**	*Supplementary text and online resources, for example:* NewsELA BrainPop Scholastic News YouTube Quizlet Kahoot Quizizz Khan Academy Readworks USGS Educational Resources for Secondary Grades (7–12): This web site contains selected USGS educational resources that may be useful to educators in secondary school grades. Many of these resources can be used directly in the classroom or will be useful in classroom lessons or demonstration activities preparation, or as resources for teacher education and curriculum development.

	NOAA Education Resources: This website contains access to curriculum resources, professional development opportunities, student opportunities, and outreach.

Interdisciplinary Connections		
ELA	**Math**	**Social Studies**
RST.6-8.1: Cite specific textual evidence to support analysis of science and technical texts. (MS-LS2-4) RST.6-8.8: Distinguish among facts, reasoned judgment based on research findings, and speculation in a text. (MS-LS2-5) RI.8.8: Trace and evaluate the argument and specific claims in a text, assessing whether the reasoning is sound and the evidence is relevant and sufficient to support the claims. (MS-LS2-5) WHST.6-8.1: Write arguments to support claims with clear reasons and relevant evidence. (MS-LS2-4),(MS-ETS1-1),(MS-ETS1-3) WHST.6-8.2: Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content. (MS-LS2-2) RST.6-8.7: Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table). (MS-ETS1-3) WHST.6-8.8: Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation. (MS-ETS1-1)	MP.2: Reason abstractly and quantitatively. (MS-ETS1-1),(MS-ETS1-3) MP.4: Model with mathematics. (MS-LS2-5) 7.EE.3: 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) 6.RP.A.3: Use ratio and rate reasoning to solve real-world and mathematical problems. (MS-LS2-5)	6.1.8.C.1.a: Evaluate the impact of science, religion and technological innovations on European explorations

WHST.6-8.9: 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) SL.8.5: Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest. (MS-ETS1-4)		
21st Century Skills/Career Education CRP1.: Act as a responsible and contributing citizen and employee. CRP2. Apply appropriate academic and technical skills. CRP4.: Communicate clearly and effectively and with reason. CRP5.: Consider the environmental, social and economic impacts of decisions. CRP6.: Demonstrate creativity and innovation. CRP7.: Employ valid and reliable research strategies. CRP8.: Utilize critical thinking to make sense of problems and persevere in solving them. CRP9.: Model integrity, ethical leadership and effective management. CRP11.: Use technology to enhance productivity. CRP12.: Work productively in teams while using cultural global competence.	**Technology** 8.1.8.A.3: Use and/or develop a simulation that provides an environment to solve a real world problem or theory. 8.1.8.A.1: Demonstrate knowledge of a real world problem using digital tools 8.1.8.A.4: Graph and calculate data within a spreadsheet and present a summary of the results 8.2.8.A.2: Examine a system, consider how each part relates to other parts, and discuss a part to redesign to improve the system.	

9.2.4.A.1: Identify reasons why people work, different types of work, and how work can help a person achieve personal and professional goals. 9.2.4.A.2: Identify various life roles and civic and work-related activities in the school, home, and community. 9.2.8.B.3: Evaluate communication, collaboration, and leadership skills that can be developed through school, home, work, and extracurricular activities for use in a career.		
Modifications and Accommodations		
Special Education Students Small group Direct instruction restate/rephrase graphic organizers modified assignments chunking leveled text intentional grouping read text extended time breaks Teacher records/ student dictates	**English Language Learners** Labels word banks visuals student friendly definitions extended time chunking intentional grouping	**Students at Risk of School Failure** leveled text graphic organizers modified assignments kinesthetic activities restate/rephrase chunking intentional grouping
Gifted and Talented extension project leveled text leadership roles intentional grouping Targeted learning from assessment	**Students with 504 Plans** breaks chunking preferential seating visual reminders restate/rephrase check-in/check-out system visual time Teacher records/ student dictates	
Unit Duration: Instructional Days		
25 Instructional days		

<table>
<tr><td colspan="3">Unit 4 Summary: Unbalanced Forces cause changes in the motion of objects, and these changes can be predicted and described.</td></tr>
<tr><td colspan="3">Unit 4: Forces and Motion</td></tr>
<tr><td>ESTABLISHED GOALS (INDICATOR #)</td><td colspan="2">TRANSFER (How will this apply to their lives?)</td></tr>
<tr><td rowspan="3">MS-PS2-1. Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects.
MS-PS2-2. 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.
MS-PS2-3. Ask questions about data to determine the factors that affect the strength of electric and magnetic forces.
MS-PS2-4. Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects.
MS-PS2-5. 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.
MS-ETS1-1. 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-ETS1-2. Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
MS-ETS1-3. 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-ETS1-4. Develop a model to generate data for iterative testing and modification of a</td><td colspan="2">Students will be able to independently use their knowledge to…
★ Investigate and apply Newton's Third Law of Motion by examining and interacting with objects in motion.</td></tr>
<tr><td colspan="2">MEANING</td></tr>
<tr><td>UNDERSTANDINGS

Students will …
Students will …
★ Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects.
★ 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.

★ 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.

★ Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.

★ 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.</td><td>ESSENTIAL QUESTIONS

★ How does motion change?
★ How do forces affect motion?
★ How are distance, time, and speed related?
★ How do objects move under the influence of gravity?
★ What happens when fluids exert pressure?</td></tr>
</table>

proposed object, tool, or process such that an optimal design can be achieved.	★ 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.	

Unit 4: Grade 6 - Lessons

★ Some possible activities may include the action/reaction forces involved in roller skating, skateboarding, moving boxes of different masses, etc. Students applying 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. An example of a collision could be an egg in a cart rolling down an incline and colliding with a barrier.

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Planning and Carrying Out Investigations · Plan an investigation individually and collaboratively, and in the design: 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. (MS-PS2-2) **Constructing Explanations and Designing Solutions** · Apply scientific ideas or principles to design an object, tool, process or system. (MS-PS2-1) **Asking Questions and Defining Problems** · Define a design problem that can be solved through the development of an object, tool, process or system and includes multiple criteria and constraints, including scientific knowledge that may limit possible solutions. (MS-ETS1-1) **Engaging in Argument from Evidence** Evaluate competing design solutions based on jointly developed and agreed-upon design criteria. (MS-ETS1-2)	**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**	**Systems and System Models** · Models can be used to represent systems and their interactions—such as inputs, processes and outputs—and energy and matter flows within systems. (MS-PS2-1) **Stability and Change** · Explanations of stability and change in natural or designed systems can be constructed by examining the changes over time and forces at different scales. (MS-PS2-2) - ***Connections to Engineering, Technology, and Applications of Science*** **Influence of Science, Engineering, and Technology on Society and the Natural World** · 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

	<u>Problems</u> · 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) **<u>ETS1.B: Developing Possible Solutions</u>** · 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) **<u>ETS1.C: Optimizing the Design Solution</u>** · 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)	in such factors as climate, natural resources, and economic conditions. (MS-PS2-1) · All human activity draws on natural resources and has both short and long-term consequences, positive as well as negative, for the health of people and the natural environment. (MS-ETS1-1) · The uses of technologies and 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. (MS-ETS1-1)

District/School Formative Assessment Plan		District/School Summative Assessment Plan
Formative assessment informs instruction and is ongoing throughout a unit to determine how students are progressing against the standards. ★ Discussion with peers in Small Groups/Pairs, Turn and talk ★ Practice/Homework ★ Strategic, H.O.T. (Higher Order Thinking) Questioning ★ Graphic Organizers ★ Lab Books ★ Sentence/Paragraph Summaries ★ Science Rubrics ★ Comprehensive Quizzes, Assessments ★ Vocabulary Assessments/Quizzes ★ Teacher/Student Conferencing ★ Open-Ended Questions ★ Oral Assessments ★ Exit Tickets ★ Hands On Labs ★ Digital Lessons and Virtual Labs ★ Project-Based Assignments		***Summative assessment is an opportunity for students to demonstrate mastery of the skills taught during a particular unit.*** ★ Teacher created tests ★ Individual/Group Presentations ★ Unit projects ★ End of the Unit Writing Project with a rubric ★ End of Unit Test

Alternative Assessments	
Evaluative Criteria	**Assessment Evidence**
Suggested Performance Rubric: Use the following or similar rubric to evaluate students' performance on lesson assessments: ***Marzano Proficiency Scale*** 4 - Innovating: Apply scientific ideas or principles to design an object, tool, process or system. 3 - Applying: Planning and Carrying out Investigations. 2 - Developing: Make inferences from scientific data. 1 - Beginning: Identify how motion and forces affect our daily lives.	Suggested Performance Tasks: **<u>Students with needs alternative assessments</u>** ● Students will develop a visual illustration that shows the interaction of forces and motion. ● After reading the definitions for Newton's Laws of Motion, Students will write a short description of each Law with an illustration and explain how it is a part of our daily lives. **<u>Gifted or advanced students alternative assessment</u>** ● Students will research a recent scientific discovery and report on it to the class. Students will discuss what impact this discovery may have on society. Students should also identify the possible negative effects this discovery may have on today's world. (eg, cost, environmental impact, waste by product availability)

District/School Texts	District/School Supplementary Resources
Haddon Heights: Life Science Prentice Hall	Science News

Barrington: N/A **Lawnside:** SCIENCE FUSION (2017) Houghton, Mifflin, Harcourt Online Textbook, audiovisual aids, and lab simulation - Harcourt Think Central **Merchantville:** N/A		Scholastic News Phet Simulations YouTube Quizlet Mosa Mack Science Arkive Nova Zooniverse Smithsonian Science Ed. Center California Academy of Sciences Nasa Laptops

Interdisciplinary Connections

ELA	**Math**	**Social Studies**
CCSS.ELA-Literacy.RST.6-8.1 Cite specific textual evidence to support analysis of science and technical texts. CCSS.ELA-Literacy.RST.6-8.2 Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions. CCSS.ELA-Literacy.RST.6-8.3 Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks. Craft and Structure: CCSS.ELA-Literacy.RST.6-8.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 6-8 texts and topics*. CCSS.ELA-Literacy.RST.6-8.5 Analyze the structure an author uses to organize a text, including how the major sections contribute to the	Reason abstractly and quantitatively. (MS-PS2-1),(MS-PS2-2),(MS-PS2-3),(MS-ETS1-1),(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. (MS-PS2-1),(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.	6.1.8.C.1.a: Evaluate the impact of science, religion and technological innovations on European explorations

whole and to an understanding of the topic. CCSS.ELA-Literacy.RST.6-8.6 Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text. Integration of Knowledge and Ideas: CCSS.ELA-Literacy.RST.6-8.7 Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table). CCSS.ELA-Literacy.RST.6-8.8 Distinguish among facts, reasoned judgment based on research findings, and speculation in a text. CCSS.ELA-Literacy.RST.6-8.9 Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic. Range of Reading and Level of Text Complexity: CCSS.ELA-Literacy.RST.6-8.10 By the end of grade 8, read and comprehend science/technical texts in the grades 6-8 text complexity band independently and proficiently.	(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	
21st Century Skills/Career Education CRP2.: Apply appropriate academic and technical skills. CRP4.: Communicate clearly and effectively and with reason. CRP5.: Consider the environmental, social and economic impacts of decisions. CRP6.: Demonstrate creativity and innovation. CRP 7.: Employ valid and reliable research strategies. CRP8.: Utilize critical thinking to make sense of	**Technology** 8.1.8.A.1: Demonstrate knowledge of a real world problem using digital tools. 8.1.8.A.2: Create a document (e.g. newsletter, reports, personalized learning plan, business letters or flyers) using one or more digital applications to be critiqued by professionals for usability. 8.1.8.A.3: Use and/or develop a simulation that provides an environment to solve a real world problem or theory.	

problems and persevere in solving them. CRP11.: Use technology to enhance productivity. CRP12.: Work productively in teams while using cultural global competence.	8.1.8.A.4: Create a simple spreadsheet, enter data, and interpret the information. 8.1.8.A.5: Determine the benefits of a wide range of digital tools by using them to solve problems.	

Modifications and Accommodations		
Special Education Students Small group Direct instruction restate/rephrase graphic organizers modified assignments chunking leveled text intentional grouping read text extended time breaks Teacher records/ student dictates	**English Language Learners** Labels word banks visuals student friendly definitions extended time chunking intentional grouping	**Students at Risk of School Failure** leveled text graphic organizers modified assignments kinesthetic activities restate/rephrase chunking intentional grouping
Gifted and Talented extension project leveled text leadership roles intentional grouping Targeted learning from assessment	**Students with 504 Plans** breaks chunking preferential seating visual reminders restate/rephrase check-in/check-out system visual time Teacher records/ student dictates	
Unit Duration: 25 Instructional Days		

UNIT 5 SUMMARY: 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.
This unit is based on MS-PS2-3, MS-PS2-4, and MS-PS2-5.

Unit 5: Types of Interactions

<table>
<tr><th>ESTABLISHED GOALS (INDICATOR #)</th><th colspan="2">TRANSFER (How will this apply to their lives?)</th></tr>
<tr><td rowspan="3">★ MS-PS2-3: Ask questions about data to determine the factors that affect the strength of electric and magnetic forces.
★ MS-PS2-4: Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects
★ MS-PS2-5: 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.</td><td colspan="2">Students will be able to independently use their knowledge to…
★ Determine factors that affect the strength of electric and magnetic forces
★ Conduct arguments about gravitational interactions
★ Identify that fields exist between objects that are not in conduct</td></tr>
<tr><th colspan="2">MEANING</th></tr>
<tr><td>UNDERSTANDINGS
Students will understand...
Part A
★ 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.
Part B
★ 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</td><td>ESSENTIAL QUESTIONS
Part A
★ Can you apply a force on something without touching it?
Part B
★ How does a Maglev train work?

Part C
★ If I were able to eliminate air resistance and dropped a feather and a hammer at the same time, which would land first?</td></tr>
</table>

	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 **Part C** ★ 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.	

Unit 5: Grade 6 - Lessons

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.

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.

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Using Mathematics and Computational Thinking ● Use mathematical representations of phenomena to describe explanations. (HS-PS2-4) **Constructing Explanations and Designing Solutions** ● Apply scientific ideas to solve a design problem, taking into account possible unanticipated effects. (HS-PS2-3) **Planning and Carrying Out Investigations** ● Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision	**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	**Patterns** ● Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena. (HS-PS2-4) **Cause and Effect** ● Systems can be designed to cause a desired effect. (HS-PS2-3) ● Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. (HS-PS2-5) *Connections to Nature of Science* **Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena**

of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly. (HS-PS2-5)	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)	● Theories and laws provide explanations in science. (HS-PS2-4) • Laws are statements or descriptions of the relationships among observable phenomena. (HS-PS2-4)

District/School Formative Assessment Plan	**District/School Summative Assessment Plan**
Part A	Teacher created tests

<table>
<tr><td colspan="2">

★ 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.

Part B

★ 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.

Part C

★ 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.

</td>
<td>Individual/Group Presentations
Unit projects
End of the Unit Writing Project with a rubric
End of Unit Test</td></tr>
<tr><th colspan="3">Alternative Assessments</th></tr>
<tr><th>Evaluative Criteria</th><th colspan="2">Assessment Evidence</th></tr>
<tr><td>Suggested Performance Rubric: Use the following or similar rubric to evaluate students' performance on lesson assessments:
<u>Marzano Proficiency Scale</u>
4 - Innovating: Advanced understanding and application of the standard
3 - Applying: Consistently applies skills independently
2 - Developing: Progressing towards independent application of skills
1 - Beginning: Early stages of development, need assistance
OR
4 - Innovating: In addition to score 3.0 performance, the student demonstrates in-depth inferences and applications that go beyond what is expected from the 3.0 goal.
3 - Applying:
Students will be able to:</td>
<td colspan="2">Suggested Performance Tasks:
<u>MS-PS2-3/MS-PS2-5</u>
Performance Task: <u>Advocacy Campaign</u> (Mosa Mack Resource)
In this task, students will create an advocacy campaign informing residents of the negative impacts to living near electric powerlines.

<u>MS-PS2-4/MS-PS2-5</u>
Performance Task: <u>Creating an AirDrop</u>
In this task, students will create an "Airdrop" using what they know about forces and motion, structure and function, and models to design. They will carry out an investigation to determine how parachute surface area affects the force due to air resistance. The guiding question of this investigation is, How does the surface area of a parachute affect the force due to air resistance as an object falls toward the ground?</td></tr>
</table>

- Ask questions about data to determine the factors that affect the strength of electric and magnetic forces. (MS-PS2-3) - Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects. (MS-PS2-4) - 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. (MS-PS2-5) **2 - Developing:** *Students will **recognize** and **recall** specific vocabulary, including:* - Effect, electric force, electric motor, electromagnet, factor, generator, magnetic force, speed, strength. (MS-PS2-3) - Attractive, direction of force, direction of motion, distance, gravitational force, gravitational interaction, interact, mass, orbital period, strength. (MS-PS2-4) - Contact, electric field, electrically charged, exert, field, force, interaction, magnet, magnetic field. (MS-PS2-5) *Students will be able to:* - Describe the effects of electric and magnetic forces and how certain devices use electric and magnetic forces. (MS-PS2-3) - Describe the effects of gravitational interactions and the role of mass in gravitational interactions. (MS-PS2-4) - Describe the effects of electric and magnetic fields on the forces of objects. (MS-PS2-5) **1 - Beginning:** With help, partial success at score 2.0 and 3.0 content.	

District/School Texts	District/School Supplementary Resources
Haddon Heights: ***Unit Kits for Science Labs and References***	NEWSELA

Barrington: N/A **Lawnside: Science Fusion (Houghton Mifflin Harcourt - 2017)** **Merchantville: N/A**	Mosa Mack BrainPop Youtube Quizlet Kahoot Readworks PHET Simulations

Interdisciplinary Connections

ELA	**Math**	**Social Studies**
WHST.11-12.7: Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. WHST.11-12.8: Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation. WHST.11-12.9:Draw evidence from informational texts to support analysis, reflection, and research.	HSN.Q.A.1: Use units as a way to understand problems and to guide the solution of multi step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. HSN.Q.A.2 : Define appropriate quantities for the purpose of descriptive modeling. HSN.Q.A.3: Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. MP.2: Reason abstractly and quantitatively. MP.4: Model with mathematics. HSA.SSE.A.1: Interpret expressions that represent a quantity in terms of its context. HSA.SSE.B.3: Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.	6.1.8.C.1.a: Evaluate the impact of science, religion and technological innovations on European explorations
21st Century Skills/Career Education	**Technology**	
CRP2. Apply appropriate academic and technical skills. CRP4. Communicate clearly and effectively and with reason. CRP6. Demonstrate creativity and innovation. CRP7. Employ valid and reliable research strategies.	8.1.8.A.1 Demonstrate knowledge of a real world problem using digital tools. 8.1.8.A.2 Create a document (e.g. newsletter, reports, personalized learning plan, business letters or flyers) using one or more digital applications to be critiqued by professionals for usability.	

CRP8. Utilize critical thinking to make sense of problems and persevere in solving them. 9.3.12.AC.6 Read, interpret and use technical drawings, documents and specifications to plan a project. 9.3.12.ED.2 Demonstrate effective oral, written and multimedia communication in multiple formats and contexts. 9.3.12.ED.5 Demonstrate group collaboration skills to enhance professional education and training practice. 9.3.ST.1 Apply engineering skills in a project that requires project management, process control and quality assurance. 9.3.ST.2 Use technology to acquire, manipulate, analyze and report data.	8.1.8.A.3 Use and/or develop a simulation that provides an environment to solve a real world problem or theory. 8.1.8.A.4 Graph and calculate data within a spreadsheet and present a summary of the results	
Modifications and Accommodations		
Special Education Students Small group Direct instruction Restate/rephrase Graphic organizers Modified assignments Chunking Leveled text Intentional grouping Read text Extended time Breaks Teacher records/ student dictates	**English Language Learners** Labels Word banks Visuals Student friendly definitions Extended time Chunking Intentional grouping	**Students at Risk of School Failure** Leveled text Graphic organizers Modified assignments Kinesthetic activities Restate/rephrase Chunking Intentional grouping
Gifted and Talented Extension project Leveled text Leadership roles Intentional grouping Targeted learning from assessment	**Students with 504 Plans** Breaks Chunking Preferential seating Visual reminders Restate/rephrase Check-in/check-out system Visual time Teacher records/ student dictates	

Unit Duration: Instructional Days
25 days

UNIT 6 SUMMARY: 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.

<table>
<tr><th colspan="3">Unit 6: Astronomy</th></tr>
<tr><th>ESTABLISHED GOALS (Indicator #)</th><th colspan="2">TRANSFER (How will this apply to their lives?)</th></tr>
<tr><td rowspan="4">★ ESS1.B 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. [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.]
★ (MS-ESS1-1) 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.]
★ ESS1.A;(ESS1.B) 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. [Clarification Statement: This SLO is based on disciplinary core ideas found in</td><td colspan="2">Students will be able to independently use their knowledge to…
★ 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
★ 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.</td></tr>
<tr><th colspan="2">MEANING</th></tr>
<tr><th><u>UNDERSTANDINGS</u></th><th><u>ESSENTIAL QUESTIONS</u></th></tr>
<tr><td>Students will understand that…
★ 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</td><td>★ What makes up the universe?
★ What are some properties of stars?
★ How do stars change over time?
★ How have people modeled the solar system?
★ Why is gravity important in the solar system?
★ What are some properties of the sun?
★ What is known about the terrestrial planets?
★ What is known about the gas giant planets?
★ What is found in the solar system besides the sun, planets, and moons?
★ How are the Earth's days, years, and seasons related to the way Earth moves in space?
★ How do Earth, the moon, and the sun affect each other?
★ What causes tides?
★ What can we learn from space images?
★ How do we explore space?
★ What are some milestones of space exploration?</td></tr>
</table>

the Framework. It is included as a scaffold to the following SLO.] ★ **MS-ESS1-3 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-ESS1-2** Relate the development of language and forms of writing to the expression of ideas, creation of cultural identity, and development of more complex social structures.	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. ★ 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.	

Unit 6: Grade 6 - Lessons

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.

Science & Engineering Practices:	Disciplinary Core Ideas:	Crosscutting Concepts:
Developing and Using Models Develop and use a model to describe phenomena. (MS-ESS1-1),(MS-ESS1-2) **Analyzing and Interpreting Data** Analyze and interpret data to determine similarities and differences in findings(MS-ESS1-3)	**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) **ESS1.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) but tilted relative to its orbit around the sun. 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 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)	**Patterns** · Patterns can be used to identify cause-and-effect relationships. (MS-ESS1-1) **Scale, Proportion, and Quantity** · Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small. (MS-ESS1-3) **Systems and System Models** · Models can be used to represent systems and their interactions. (MS-ESS1-2) - ***Connections to Engineering, Technology, and Applications of Science*** **Interdependence of Science, Engineering, and Technology** · Engineering advances have led to important discoveries in virtually every field of science and scientific discoveries have led to the development of entire industries and engineered systems. (MS-ESS1-3) - ***Connections to Nature of Science*** Scientific Knowledge Assumes an Order and Consistency in Natural Systems Science assumes that objects and events in natural systems occur in consistent patterns that are understandable through measurement and

		observation. (MS-ESS1-1),(MS-ESS1-2)

District/School Formative Assessment Plan	District/School Summative Assessment Plan
Discussions with Peers in Small Groups/Pairs, Turn and talk Practice/Homework Strategic, H.O.T. (Higher Order Thinking) Questioning Graphic Organizers Journal Entry/Double Journal Entry Sentence/Paragraph Summaries Anecdotal Notes Self Evaluation Rubrics Comprehension Quizzes, Assessments Vocabulary Assessments/Quizzes Teacher/Student Conferencing Open Ended Questions Oral Assessments Exit tickets	Teacher created tests Individual/Group Presentations Unit projects End of the Unit Writing Project with a rubric End of Unit Test

Alternative Assessments	
Evaluative Criteria	**Assessment Evidence**
Suggested Performance Rubric: Use the following or similar rubric to evaluate students' performance on lesson assessments: Marzano Proficiency Scale **4 - Innovating:** Advanced understanding and application of the standard **3 - Applying:** Consistently applies skills independently **2 - Developing:** Progressing towards independent application of skills **1 - Beginning:** Early stages of development, need assistance **OR** 4 - **Innovating**: Apply scientific ideas or principles to design an object, tool, process or system. 3 - **Applying**: Planning and carrying out investigations.	**Suggested Performance Task:** **Nasa Solar System Exploration**: This link will connect you to Nasa's Solar system exploration website. The website offers a wide variety of student activities. **Seasons Interactive**: provides students with the opportunity to investigate how Earth's angle of inclination affects three factors:the angle of incoming sunlight, average daily temperatures and the Sun's ecliptic path. Three preset values for the angle of inclination are available (corresponding to the values of Earth, Venus and Uranus). Additionally, users may select an angle value from a sliding scale. Users can control the speed of the simulation or may pause it when needed. Students are able to compare the heights of the ecliptic paths during the course of the year by checking the "Trace Sun's Path" box. From this information, students will be able to construct an explanation for the occurrence of seasons. Exercises with solutions are included, as well as a self-assessment located below the simulation. Teachers should be aware of several weaknesses in the simulation. First, the model allows students to reverse the motion of the Earth around the Sun which could lead to misconceptions. Secondly, the model overemphasizes the elliptical path of the Earth which often leads to the misconception that seasons are caused by distance from the Sun. _Lastly, while the Sun is shown moving across the sky during the day (from Earth's view), the stars are left static during the night. In **Eclipse Interactive**, students investigate both lunar and solar eclipses by manipulating up to three independent variables: Moon's tilt from orbit, Earth-Moon distance and size of the Moon. . By viewing the

2 - **Developing-** Make inferences from scientific data. 1 - **Beginning-** The sun is one of billions of stars in one of billions of galaxies in the universe.	effects of changes to these variables, students will be able to construct explanations for solar and lunar eclipses. The model includes both top and side views of the Earth-Moon system during the Moon's revolution. In addition, students can toggle to show outlines of the Earth and Moon. Teachers should note that the simulation has been designed as a single screen model that automatically moves between solar and lunar eclipses without any indication of time. As a result, younger students may become confused and will need to be reminded about the duration of lunar months. The simulation includes bare-bones introductory content, how to instructions, the interactive model itself, related exercises, and solutions to the exercises. One minor inconvenience is the lack of a reset button. The **Pull of the Planets** is part of a thematic series of lessons highlighting the Juno mission to Jupiter. It is a traditional hands-on activity that models how gravitational forces can keep planets and asteroids in orbit within the Solar System. Using a stretchable fabric held in place with an embroidery hoop, students work with spheres of various materials to explore how mass and sizes affect the strength of gravitational forces. Background materials, including materials sheet, aid teachers in organizing this activity.

District/School Texts	District/School Supplementary Resources
Haddon Heights: ***Unit Kits for Science Labs and References*** **Barrington: N/A** **Lawnside: Science Fusion (Houghton Mifflin Harcourt - 2017)** **Merchantville: N/A**	Science News Scholastic News Phet Simulations YouTube Quizlet Mosa Mack Science Arkive Nova Zooniverse Smithsonian Science Ed. Center California Academy of Sciences Nasa Laptops

Interdisciplinary Connections

ELA	Math	Social Studies
SL.8.5: Include multimedia components and visual displays in presentations to describe the cyclical patterns of lunar phases, eclipses of the sun and moon, seasons, and the role of gravity in the motions within galaxies and the solar system. The presentation needs to clarify claims and findings and emphasize salient points. (MS-ESS1-1), (MS-ESS1-2) RST.6-8.1: Cite specific textual evidence to support analysis of science and technical text	MP.2: Reason abstractly and quantitatively. (MS-ESS1-3) MP.4: Model with mathematics. (MS-ESS1-1),(MS-ESS1-2) 6.RP.A.1: 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)	6.1.8.C.1.a: Evaluate the impact of science, religion and technological innovations on European exploration

about scale properties of objects in the solar system. (MS-ESS1-3) RST.6-8.7: Integrate quantitative or technical information expressed in words in a text about scale properties of objects in the solar system with a version of that information expressed visually in a flowchart, diagram, model, graph, or table. (MS-ESS1-3)	7.RP.A.2: Recognize and represent proportional relationships between quantities. (MS-ESS1-1),(MS-ESS1-2),(MS-ESS1-3) 6.EE.B.6: Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set. (MS-ESS1-2) 7.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)	
21st Century Skills/Career Education CRP2.: Apply appropriate academic and technical skills. CRP4.: Communicate clearly and effectively and with reason. CRP5. Consider the environmental, social and economic impacts of decisions. CRP6. Demonstrate creativity and innovation. CRP7. Employ valid and reliable research strategies. CRP8. Utilize critical thinking to make sense of problems and persevere in solving them. CRP11.Use technology to enhance productivity. CRP12. Work productively in teams while using cultural global competence. 9.2.4.A.1 Identify reasons why people work, different types of work, and how work can help a person achieve personal and professional goals. 9.2.8.B.3 Evaluate communication, collaboration, and leadership skills that can be developed through school, home, work, and extracurricular activities for use in a career. 9.3.12.AC.6 Read, interpret and use technical drawings, documents and specifications to plan a project.	**Technology** 8.1.8.A.3 Use and/or develop a simulation that provides an environment to solve a real world problem or theory. 8.1.8.A.4 Graph and calculate data within a spreadsheet and present a summary of the results 8.1.8.A.5 Create a database query, sort and create a report and describe the process, and explain the report results. 8.2.8.A.1: Research a product that was designed for a specific demand and identify how the product has changed to meet new demands (i.e. telephone for communication - smart phone for mobility needs). 8.2.8.A.2: Examine a system, consider how each part relates to other parts, and discuss a part to redesign to improve the system. 8.2.8.A.3: Investigate a malfunction in any part of a system and identify its impacts. The relationships among technologies and the connections between technology and other fields of study.	

9.3.12.ED.1 Apply communication skills with students, parents and other groups to enhance learning and a commitment to learning. 9.3.12.ED.2 Demonstrate effective oral, written and multimedia communication in multiple formats and contexts. 9.3.12.ED.5 Demonstrate group collaboration skills to enhance professional education and training practice. Cluster and the role of STEM in society and the economy. 9.3.ST.6 Demonstrate technical skills needed in a chosen STEM 9.3.ST.1 Apply engineering skills in a project that requires project management, process control and quality assurance. 9.3.ST.2 Use technology to acquire, manipulate, analyze and report data. 9.3.ST.4 Understand the nature and scope of the Science, Technology, Engineering & Mathematics career field. **Career Ready Practices** CRP1. Act as a responsible and contributing citizen and employee. CRP2. Apply appropriate academic and technical skills. CRP4. Communicate clearly and effectively and with reason. CRP5. Consider the environmental, social and economic impacts of decisions. CRP6. Demonstrate creativity and innovation. CRP7. Employ valid and reliable research strategies. CRP8. Utilize critical thinking to make sense of problems and persevere in solving them. CRP9. Model integrity, ethical leadership and effective management. CRP11. Use technology to enhance productivity. CRP12. Work productively in teams while using	8.2.8.A.4: Redesign an existing product that impacts the environment to lessen its impact(s) on the environment. 8.2.8.A.5: Describe how resources such as material, energy, information, time, tools, people, and capital contribute to a technological product or system.		

cultural global competence. CRP10. Plan education and career paths aligned to personal goals.		
Modifications and Accommodations		
Special Education Students small group/intentional grouping preferred seating direct instruction provide background knowledge provide individual/small group assistance provide student friendly definitions for vocabulary modified assignments (reduce/revise) provide notes/study guides restate/rephrase graphic organizers, labels, word banks visuals chunking leveled text read text, use audio when available kinesthetic activities extended time breaks check-in/check-out system	**English Language Learners** small group/intentional grouping preferred seating direct instruction provide background knowledge provide individual/small group assistance provide student friendly definitions for vocabulary modified assignments (reduce/revise) provide notes/study guides restate/rephrase graphic organizers, labels, word banks visuals chunking leveled text read text, use audio when available kinesthetic activities extended time breaks check-in/check-out system TPR Total Physical Response	**Students at Risk of School Failure** small group/intentional grouping preferred seating direct instruction provide background knowledge provide individual/small group assistance provide student friendly definitions for vocabulary modified assignments (reduce/revise) provide notes/study guides restate/rephrase graphic organizers, labels, word banks visuals chunking leveled text read text, use audio when available kinesthetic activities extended time breaks check-in/check-out system
Gifted and Talented extension project leveled text leadership roles intentional grouping targeted learning from assessment DOK higher order questions Blooms - analyze, evaluate, create	**Students with 504 Plans** small group/intentional grouping preferred seating direct instruction provide background knowledge provide individual/small group assistance provide student friendly definitions for vocabulary modified assignments (reduce/revise) provide notes/study guides restate/rephrase graphic organizers, labels, word banks visuals chunking leveled text read text, use audio when available kinesthetic activities extended time breaks	

	check-in/check-out system	
Unit Duration: Instructional Days		
20 days		

UNIT 7 Summary : 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 geosystems operate by modeling the flow of energy and the 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 an understanding of the core ideas.

<table>
<tr><th colspan="3">Unit 7: Weather and Climate</th></tr>
<tr><th>ESTABLISHED GOALS</th><th colspan="2">TRANSFER</th></tr>
<tr><td rowspan="3">★ MS-ESS2-4- Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity.
★ MS-ESS2-5- Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions.
★ MS-ESS2-6- 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.</td><td colspan="2">Students will be able to independently use their knowledge 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.
★ Collect data to provide evidence for how the motions and complex interactions of air masses results 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.</td></tr>
<tr><th colspan="2">MEANING</th></tr>
<tr><td><u>UNDERSTANDINGS</u>
Students will understand that…
<u>Part A</u>
★ 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
<u>Part B</u></td><td><u>ESSENTIAL QUESTIONS</u>
<u>Part A</u>
★ What are the processes involved in the cycling of water through Earth’s systems?
<u>Part B</u>
★ What is the relationship between the complex interactions of air masses and changes in weather conditions?
<u>Part C</u>
★ What are the major factors that determine regional climates?</td></tr>
</table>

	★ The motions and complex interactions of air masses result in changes in weather conditions. ★ 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. **<u>Part C</u>** ★ 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.	

Unit 7: Grade 6 - Lessons
Lesson topics may include, but are not limited to: 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.

Science & Engineering Practices:	Disciplinary Core Ideas	Crosscutting Concepts:
Developing and Using Models Develop and use a model to describe phenomena. (MS-ESS2-6) Develop a model to describe unobservable mechanisms. (MS-ESS2-4)	**SS2.C: The Roles of Water in Earth's Surface** **ESS2.C The role of Water in Earth's Surface Processes** Water continually cycles among land, oceans, and atmosphere via transpiration, evaporation,	**Cause and Effect** Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-ESS2-5) **Systems and System Models**

Planning and Carrying Out Investigations Collect data to produce data to serve as the basis for evidence to answer scientific questions or test design solutions under a range of conditions. (MS-ESS2-5)	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)	Models can be used to represent systems and their interactions—such as inputs, processes and outputs—and energy, matter, and information flows within systems. (MS-ESS2-6) **Energy and Matter** Within a natural or designed system, the transfer of energy drives the motion and/or cycling of matter. (MS-ESS2-4)

District/School Formative Assessment Plan	District/School Summative Assessment Plan
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.	Teacher created tests Individual/Group Presentations Unit projects End of the Unit Writing Project with a rubric End of Unit Test

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.	

Alternative Assessments	
Evaluative Criteria	**Assessment Evidence**
Suggested Performance Rubric: Use the following or similar rubric to evaluate students' performance on lesson assessments: <u>Marzano Proficiency Scale</u> **4 - Innovating:** Advanced understanding and application of the standard **3 - Applying:** Consistently applies skills independently **2 - Developing:** Progressing towards independent application of skills **1 - Beginning:** Early stages of development, need assistance	**Suggested Performance Task:** Air Masses of a set of Level 1 activities designed by the Science Center for Teaching, Outreach, and Research on Meteorology (STORM) Project. The authors suggest that previous activities in the unit be completed before Activity 12: Air Masses, including those that address pressure systems and dew point temperature. In Activity 12, the students learn about the four main types of air masses that affect weather in the United States, their characteristic temperatures, and humidity levels as it relates to dew point temperatures. The lesson plan follows the 5E format. Initially, students discuss local weather and then examine surface temperature and dew point data on maps to determine patterns and possible locations of air masses. They learn about the source regions of air masses and compare their maps to a forecast weather map with fronts and pressure systems drawn in. During the Extension phase, students access current maps with surface and dew point temperatures at http://www.uni.edu/storm/activities/level1 and try to identify locations of air masses. They sketch in fronts and compare their results to the fronts map. Evaluation consists of collection of student papers. Ocean Currents and Sea Surface Temperature allows students to gather data using My NASA Data microsets to investigate how differential heating of Earth results in circulation patterns in the oceans and the atmosphere that globally distribute the heat. They examine the relationship between the rotation of Earth and the circular motions of ocean currents and air. Students also make predictions based on the data to concerns about global climate change. They begin by examining the temperature of ocean's surface currents and ocean surface winds. These currents, driven by the wind, mark the movement of surface heating as monitored by satellites. Students explore the link between 1) ocean temperatures and currents, 2) uneven heating and rotation of Earth, 3) resulting climate and weather patterns, and 4) projected impacts of climate change (global warming). Using the Live Access Server, students can select data sets for various elements for different regions of the globe, at different times of the year, and for multiple years. The information is provided in maps or graphs which can be saved for future reference. Some of the data sets accessed for this lesson include Sea Surface Temperature, Cloud Coverage, and Sea Level Height for this lesson. The lesson provides directions for accessing the data as well as questions to guide discussion and learning. The estimated time for completing the activity is 50 minutes. Inclusion of the Extension activities could broaden the scope of the lesson to several days in length. Links to informative maps and text such as the deep ocean conveyor belt, upwelling, and coastal fog as needed to answer questions in the extension activities are included. Adopt a Drifter: Do Ocean Surface Currents Influence Climate? Students construct climographs showing both precipitation and temperature for 3 coastal cities and describe how ocean surface currents affect climate on nearby land. They are provided with the research question, "Do ocean currents influence climate?" and are asked to construct a hypothesis. The students are asked to read an introductory paragraph explaining the

	relationship between the temperature of the ocean current and temperature and precipitation on adjacent land and examine a map of major ocean currents. They construct 3 climographs using data provided. The labels on the graphs are not directly on the lines, so the teacher would need to instruct students on the placement of their data points. Conclusion and analysis questions are provided asking students to examine the direction of flow of ocean currents, temperature of the water, source regions of the current, and impact on both temperature and precipitation on coastal regions. Extension activities include researching additional information on vegetation, culture and physical geography of the 3 cities studied, plus comparing data for 2 additional cities. The activity should take 2 class periods.

District/School Texts	District/School Supplementary Resources
Haddon Heights: ***Unit Kits for Science Labs and References*** **Barrington: N/A** **Lawnside: Science Fusion (Houghton Mifflin Harcourt - 2017)** **Merchantville: N/A**	Science News PHET Simulations Youtube Quizlet Mosa Mack Science Arkive Nasa Nova Zooniverse Explore Learning Gizmos National Geographic Education Smithsonian Science Ed. Center California Academy of Sciences The Concord Consortium

Interdisciplinary Connections

ELA	Math	Social Studies
RST.6-8.1: Cite specific textual evidence to support analysis of science and technical texts. (MS-ESS2-5),(MS-ESS3-5) RST.6-8.9: Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic. (MS-ESS2-5) WHST.6-8.8: Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding	MP.2: Reason abstractly and quantitatively. (MS-ESS2-5),(MS-ESS3-5) 6.NS.C.5: 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)	6.1.8.C.1.a: Evaluate the impact of science, religion and technological innovations on European exploration

plagiarism and following a standard format for citation. (MS-ESS2-5) SL.8.5: Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest. (MS-ESS2-6)	6.EE.B.6: Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set. (MS-ESS3-5)	
<u>21st Century Skills/Career Education</u> CRP1.: Act as a responsible and contributing citizen and employee. CRP2. Apply appropriate academic and technical skills. CRP4.: Communicate clearly and effectively and with reason. CRP5.: Consider the environmental, social and economic impacts of decisions. CRP6.: Demonstrate creativity and innovation. CRP7.: Employ valid and reliable research strategies. CRP8.: Utilize critical thinking to make sense of problems and persevere in solving them. CRP9.: Model integrity, ethical leadership and effective management. CRP11.: Use technology to enhance productivity. CRP12.: Work productively in teams while using cultural global competence.	**<u>Technology</u>** 8.1.8.A.3 Use and/or develop a simulation that provides an environment to solve a real world problem or theory. 8.1.8.A.4 Graph and calculate data within a spreadsheet and present a summary of the results 8.1.8.A.5 Create a database query, sort and create a report and describe the process, and explain the report results. 8.2.8.A.1: Research a product that was designed for a specific demand and identify how the product has changed to meet new demands (i.e. telephone for communication - smart phone for mobility needs). 8.2.8.A.2: Examine a system, consider how each part relates to other parts, and discuss a part to redesign to improve the system. 8.2.8.A.3: Investigate a malfunction in any part of a system and identify its impacts. The relationships among technologies and the connections between technology and other fields of study.	

9.2.4.A.1: Identify reasons why people work, different types of work, and how work can help a person achieve personal and professional goals. 9.2.4.A.2: Identify various life roles and civic and work-related activities in the school, home, and community. 9.2.8.B.3: Evaluate communication, collaboration, and leadership skills that can be developed through school, home, work, and extracurricular activities for use in a career.	8.2.8.A.4: Redesign an existing product that impacts the environment to lessen its impact(s) on the environment . 8.2.8.A.5: Describe how resources such as material, energy, information, time, tools, people, and capital contribute to a technological product or system.	
Modifications and Accommodations		
Special Education Students small group/intentional grouping preferred seating direct instruction provide background knowledge provide individual/small group assistance provide student friendly definitions for vocabulary modified assignments (reduce/revise) provide notes/study guides restate/rephrase graphic organizers, labels, word banks visuals chunking leveled text read text, use audio when available kinesthetic activities extended time breaks check-in/check-out system	**English Language Learners** small group/intentional grouping preferred seating direct instruction provide background knowledge provide individual/small group assistance provide student friendly definitions for vocabulary modified assignments (reduce/revise) provide notes/study guides restate/rephrase graphic organizers, labels, word banks visuals chunking leveled text read text, use audio when available kinesthetic activities extended time breaks check-in/check-out system TPR Total Physical Response	**Students at Risk of School Failure** small group/intentional grouping preferred seating direct instruction provide background knowledge provide individual/small group assistance provide student friendly definitions for vocabulary modified assignments (reduce/revise) provide notes/study guides restate/rephrase graphic organizers, labels, word banks visuals chunking leveled text read text, use audio when available kinesthetic activities extended time breaks check-in/check-out system
Gifted and Talented extension project leveled text leadership roles intentional grouping targeted learning from assessment	**Students with 504 Plans** small group/intentional grouping preferred seating direct instruction provide background knowledge provide individual/small group assistance	

DOK higher order questions Blooms - analyze, evaluate, create	provide student friendly definitions for vocabulary modified assignments (reduce/revise) provide notes/study guides restate/rephrase graphic organizers, labels, word banks visuals chunking leveled text read text, use audio when available kinesthetic activities extended time breaks check-in/check-out system	
Unit Duration: Instructional Days		
20 days		