



SCIENCE CURRICULUM

Grade 6

New Jersey Student Learning Standards

**Science: Grade 6
Pacing Guide**

SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	JANUARY
Unit 1 Scientific and Engineering Practices <u>NJSLS- Earth & Space Sciences</u> Scientific and Engineering Practices 1-8	Unit 2 Growth, Development and Reproduction of Organisms <u>NJSLS- Life Sciences</u> MS-LS1-4 MS-LS1-5	Unit 3 Matter and Energy in Organisms and Ecosystems <u>NJSLS- Life Sciences</u> MS-LS2-1 MS-LS2-2 MS-LS2-3	Unit 4 Interdependent Relationships in Ecosystems <u>NJSLS- Life Sciences</u> MS-LS2-4 MS-LS2-5 <u>NJSLS- Engineering Design</u> MS-ETS1-1 MS-ETS1-3	Unit 5 Force and Motion <u>NJSLS- Physical Sciences</u> MS-PS2-1 MS-PS2-2 <u>NJSLS- Engineering Design</u> MS-ETS1-1 MS-ETS1-2 MS-ETS1-3 MS-ETS1-4

FEBRUARY	MARCH	APRIL	MAY/JUNE
Unit 6 Types of Interactions <u>NJSLS- Physical Sciences</u> MS-PS2-3 MS-PS2-4 MS-PS2-5	Unit 5 & 6 Review <u>NJSLS- Physical Sciences</u> MS-PS2-1 MS-PS2-2 MS-PS2-3 MS-PS2-4 MS-PS2-5	Unit 7 Astronomy <u>NJSLS- Earth & Space Sciences</u> MS-ESS1-1 MS-ESS1-2 MS-ESS1-3	Unit 8 Weather & Climate End of Year Review <u>NJSLS- Earth & Space Sciences</u> MS-ESS2-4 MS-ESS2-5 MS-ESS2-6

Science: Grade 6
Alternative Curriculum

Unit	Textbooks and Other Resources	Interactive Learning Centers & Related Activities
Unit 1 Scientific Practices	HSP Science Chapter 1 Mastering the Scientific Method Grades 4-8	Interpreting Graphs, Creating Graphs from Data, Application of the Scientific Method (experiments)
Unit 2 Growth, Development and Reproduction of Organisms	HSP Science Chapters 1-3 Steck-Vaughn: The Human Body Chapter 1 Steck-Vaughn: Land Animals Chapter 1 Steck- Vaughn: Plant Life Chapters 1 & 6	BrainPOP : Cells, Cell Structures, Genetics, DNA, Heredity, Mitosis, Natural Selection, Plant Growth Photosynthesis Centers : Plant and Animal Cell Vocabulary, Living & Nonliving Sort, What Plants and Animals Need, Life Cycles, Parts of a Plant, Animal Babies, Live Birth vs. Laying Eggs Sorting, Animal Adaptation Sort, Venn-Diagram Comparing and Contrasting Plant and Animal Cells and Reproduction
Unit 3 Matter and Energy in Organisms and Ecosystems	HSP Science Chapters 4 & 5	BrainPOP : Food Chains, Energy Pyramids, Natural Selection, Population Growth, Symbiosis, Ecosystems, Land Biomes, Human Evolution, Charles Darwin, Extinction, Behavior, Camouflage Centers : Animal Adaptation Sort, Ecosystem Sort, Food Chain, Food Pyramid, Carbon Cycle Center, Food Chains for Various Ecosystems, Nonliving and Living Parts of an Ecosystems
Unit 4 Interdependent Relationships in Ecosystems	HSP Science Chapters 4 & 5 Steck-Vaughn: Land Animals Chapter 7 Steck Vaughn: Plant Life: Chapter 8	BrainPOP : Food Chains, Energy Pyramids, Natural Selection, Population Growth, Symbiosis, Ecosystems, Land Biomes, Human Evolution, Charles Darwin, Extinction, Behavior, Camouflage Centers : Animal Adaptation Sort, Ecosystem Sort, Food Chain, Food Pyramid, Food Chains for Various Ecosystems, Identifying Environmental Solutions
Unit 5 Force and Motion	HSP Science Chapter 16 Steck-Vaughn: Matter, Motions, and Machines Chapter 6	BrainPOP : Isaac Newton, Acceleration, Distance, Rate and Time, Force, Gravity, Inclined Plane, Kinetic Energy, Newton's Laws of Motion, Potential Energy Centers : Potential and Kinetic Energy, Push or Pull, Force & Motion, Hot Wheels Tracks, Marble Maze
Unit 6 Types of Interactions	HSP Science Chapters 14 & 15 Steck Vaughn: Matter, Motions, and Machines Chapter 5	BrainPOP : Electricity, Magnetism, Albert Einstein

		<u>Centers:</u> Forms of Energy, Magnetism, Electricity, Snap Circuits, Gravitational Force of Objects
Unit 7 Astronomy	HSP Science Chapter 11 Steck-Vaughn: The Earth and Beyond Chapter 1	<u>BrainPOP:</u> Eclipse, Solar System, Galaxies, Milky Way, Outer Solar System, Moon, Moon Phases, Sun, Seasons, Tides, Star Life Cycles, Constellations <u>Centers:</u> Solar System, Moon Phases, Constellations, Seasons, Earth-Sun-Moon Diagram
Unit 8 Weather and Climate	HSP Science Chapters 9 & 10 Steck-Vaughn: The Earth & Beyond Chapter 2	<u>BrainPOP:</u> Climate Change, Climate Type, Clouds, Drought, Earth's Atmosphere, Floods, Greenhouse Effect, Humidity, Hurricanes, Natural Disaster, Seasons, Solstice and Equinox, Temperature, Thunderstorms, Tornadoes, Water Cycle, Weather, Wind <u>Centers:</u> Weather Vocabulary, Water Cycle, Dressing for the Weather, Seasons, Atmosphere layers, Climate Zones, Air Masses, Cloud Types

Science: Grade 6 Grade Level Curriculum

Unit 1: Scientific Practices

Unit Summary: The practices describe behaviors that scientists engage in as they investigate and build models and theories about the natural world and the key set of engineering practices that engineers use as they design and build models and systems. In this unit, students will learn the steps of the scientific method and how to use the steps to solve scientific problems. Students will use data to construct graphs and will interpret data on a graph. Students will develop and use models, construct explanations, and engage in argument from evidence.

Scientific and Engineering Practices

[Practice 1: Asking questions \(for science\) and defining problems \(for engineering\)](#)

[Practice 2: Developing and using models](#)

[Practice 3: Planning and carrying out investigations](#)

[Practice 4: Analyzing and interpreting data](#)

[Practice 5: Using mathematics and computational thinking](#)

[Practice 6: Constructing explanations \(for science\) and designing solutions \(for engineering\)](#)

[Practice 7: Engaging in argument from evidence](#)

[Practice 8: Obtaining, evaluating, and communicating information](#)

Description

The practices describe behaviors that scientists engage in as they investigate and build models and theories about the natural world and the key set of engineering practices that engineers use as they design and build models and systems. The NRC uses the term practices instead of a term like “skills” to emphasize that engaging in scientific investigation requires not only skill but also knowledge that is specific to each practice. Part of the NRC’s intent is to better explain and extend what is meant by “inquiry” in science and the range of cognitive, social, and physical practices that it requires.

Although engineering design is similar to scientific inquiry, there are significant differences. For example, scientific inquiry involves the formulation of a question that can be answered through investigation, while engineering design involves the formulation of a problem that can be solved through design. Strengthening the engineering aspects of the Next Generation Science Standards will clarify for students the relevance of science, technology, engineering and mathematics (the four STEM fields) to everyday life.

Unit 2: Growth, Development and Reproduction of Organisms

Grade: 6

Content Area: Life Science

Pacing: 25 Instructional Days

Essential Question

What influences the growth and development of an organism?

Student Learning Objectives (Performance Expectations)

[MS-LS1-4 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-LS1-5. Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.](#)

Unit 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.

Technical Terms

Reproduction, nest building, herding, breeding, predators, germination, phenomena, organisms

Formative Assessment Measures

Part A: How do characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants, respectively?

Students who understand the concepts are able to:

Collect empirical evidence about animal behaviors that affect the animal's probability of successful reproduction and also affect the probability of plant reproduction.

Collect empirical evidence about plant structures that are specialized for reproductive success.

Use empirical evidence from experiments and other scientific reasoning to support oral and written arguments that explain the relationship among plant structure, animal behavior, and the reproductive success of plants.

Identify and describe possible cause-and effect relationships affecting the reproductive success of plants and animals using probability.

Support or refute an explanation of how characteristic animal behaviors and specialized plant structures affect the probability of successful plant reproduction using oral and written arguments.

Part B: How do environmental and genetic factors influence the growth of organisms?

Students who understand the concepts are able to:

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.

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.			
Interdisciplinary Connections			
NJSLS- ELA		NJSLS- Mathematics	
Cite specific textual evidence to support analysis of science and technical texts. (MS-LS1-4),(MS-LS1-5) RST.6-8.1		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.	
Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions. (MS-LS1-5) RST.6-8.2		(MS-LS1-4),(MS-LS1-5) 6.SP.A.2	
Trace and evaluate the argument and specific claims in a text, distinguishing claims that are supported by reasons and evidence from claims that are not. (MS-LS1-4) RI.6.8		Summarize numerical data sets in relation to their context. (MS-LS1-4),(MS-LS1-5) 6.SP.B.4	
Write arguments focused on discipline content. (MS-LS1-4) WHST.6-8.1			
Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content. (MS-LS1-5) WHST.6-8.2			
Draw evidence from informational texts to support analysis, reflection, and research. (MS-LS1-5) WHST.6-8.9			
Core Instructional Materials	Can include: Textbooks Series, Lab Materials, etc.		
21st Century Life and Careers	CRP2, CRP4, CRP5, CRP 6, CRP7, CRP8 ,CRP11,CRP12		
Technology Standards	8.1.8.A.1, 8.1.8.A.2, 8.1.8.A.3, 8.1.8.A.4, 8.1.8.A.5, 8.1.8.D.4, 8.1.8.D.5, 8.1.8.E.1, 8.2.8.A.2, 8.2.8.3, 8.2.8.B.1,		
Modifications			
English Language Learners	Special Education	At-Risk	Gifted and Talented
Scaffolding	Word walls	Teacher tutoring	Curriculum compacting
Word walls	Visual aides	Peer tutoring	Challenge assignments
Sentence/paragraph frames	Graphic organizers	Study guides	Enrichment activities
Bilingual dictionaries/translation	Multimedia	Graphic organizers	Tiered activities
Think alouds	Leveled readers	Extended time	Independent research/inquiry
Read alouds	Assistive technology	Parent communication	Collaborative teamwork
Highlight key vocabulary	Notes/summaries	Modified assignments	Higher level questioning
Annotation guides	Extended time	Counseling	Critical/Analytical thinking tasks
Think-pair- share	Answer masking		Self-directed activities
Visual aides	Answer eliminator		
Modeling	Highlighter		
Cognates	Color contrast		

LIFE SCIENCE

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

MS-LS1-4 Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively.

Clarification Statement: Examples of behaviors that affect the probability of animal reproduction could include nest building to protect young from cold, herding of animals to protect young from predators, and vocalization of animals and colorful plumage to attract mates for breeding. Examples of animal behaviors that affect the probability of plant reproduction could include transferring pollen or seeds, and creating conditions for seed germination and growth. Examples of plant structures could include bright flowers attracting butterflies that transfer pollen, flower nectar and odors that attract insects that transfer pollen, and hard shells on nuts that squirrels bury.

Assessment Boundary: N/A

Evidence Statements: MS-LS1-4

Science & Engineering Practices	Disciplinary Core Ideas	Cross-Cutting Concepts
<u>Engaging in Argument from Evidence</u> <u>Engaging in argument from evidence in 6–8 builds on K–5 experiences and progresses to constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed world(s).</u> <u>Use an oral and written argument supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem.</u>	<u>LS1.B: Growth and Development of Organisms</u> <u>Animals engage in characteristic behaviors that increase the odds of reproduction.</u> <u>Plants reproduce in a variety of ways, sometimes depending on animal behavior and specialized features for reproduction.</u>	<u>Cause and Effect</u> <u>Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability.</u>

Connections to other DCIs in this grade-band: MS.LS2.A

Articulation of DCIs across grade-bands: 3.LS1.B ; HS.LS2.A ; HS.LS2.D

NJSLS- ELA: RST.6-8., WHST.6-8.1

NJSLS- Math: 6.SP.A.2, 6.SP.B.4

5E Model

MS-LS1-4 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.

Engage	Bald Eagle- Reproduction Pairs Maine
Anticipatory Set	http://participatoryscience.org/standard/ms-ls1-4
Exploration	

Video & Lesson Series

Born on August 24, 2016 by the South Bergen Jointure Commission Board of Education

Student Inquiry	http://www.pbslearningmedia.org/resource/tdc02.sci.life.repro.lp_reproduce/reproduction/ Lead students through series of videos and related discussion questions. <u>Construct an Argument</u> Have students select one plant or animal. Students will research the characteristics and structures to answer the following questions: How do organisms (plants and animals) reproduce? What environmental factors/characteristics would help to make plants and animals reproduce successfully? What factors/characteristics would inhibit reproduction? What are some of the causes/effects of reproduction that plants and animals might experience within their habitat/ecosystem?
Explanation Concepts and Practices	<u>In these lessons</u> Teachers Should: Introduce formal labels, definitions, and explanations for concepts, practices, skills or abilities. Students Should: Verbalize conceptual understandings and demonstrate scientific and engineering practices. <u>Topics to Be Discussed in Teacher Directed Lessons (Disciplinary Core Ideas):</u> LS1.B: Growth and Development of Organisms Animals engage in characteristic behaviors that increase the odds of reproduction. Plants reproduce in a variety of ways, sometimes depending on animal behavior and specialized features for reproduction.
Elaboration Extension Activity	<u>Related Activities</u> Better Lessons: MS-LS1-4
Evaluation Assessment Tasks	<u>Assessment Task A: Construct an Argument</u> Use an oral and written argument supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem. Evaluation Criteria- Argument should include: Key terms Information regarding the reproduction characteristics of plant/animal Factors that contribute to or inhibit reproduction Research-based evidence

LIFE SCIENCE

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

MS-LS1-5. Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.

Clarification Statement: Examples of local environmental conditions could include availability of food, light, space, and water. Examples of genetic factors could include large breed cattle and species of grass affecting growth of organisms. Examples of evidence could include drought decreasing plant growth, fertilizer increasing plant growth, different varieties of plant seeds growing at different rates in different conditions, and fish growing larger in large ponds than they do in small ponds.

Assessment Boundary: Assessment does not include genetic mechanisms, gene regulation, or biochemical processes.

Evidence Statements: MS-LS1-5

Science & Engineering Practices	Disciplinary Core Ideas	Cross-Cutting Concepts
<u>Constructing Explanations and Designing Solutions</u> Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific knowledge, principles, and theories. Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students’ own experiments) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.	<u>LS1.B: Growth and Development of Organisms</u> Genetic factors as well as local conditions affect the growth of the adult plant.	<u>Cause and Effect</u> Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability.

Connections to other DCIs in this grade-band: MS.LS2.A

Articulation of DCIs across grade-bands: 3.LS1.B ; 3.LS3.A ; HS.LS2.A

NJSLS- ELA: RST.6-8.1, RST.6-8.2, WHST.6-8.2, WHST.6-8.9

NJSLS- Math: 6.SP.A.2, 6.SP.B.4

5E Model

MS-LS1-5. Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.

Engage Anticipatory Set	Population Growth Patterns: http://www.ck12.org/life-science/Population-Growth-Patterns-in-Life-Science/lesson/Population-Growth-Patterns-Basic/?referrer=concept_details Limiting Factors: https://www.tracy.k12.ca.us/sites/mitrajuarez/Shared%20Documents/chapter05_section02.htm
Exploration Student Inquiry	Limiting Factors to Population Growth: http://www.ck12.org/life-science/Limiting-Factors-to-Population-Growth-in-Life-Science/ Lead students in exploration of articles, videos and related discussion questions. Carousel Activity

	Develop a set of questions that will provide students with situations and data about how specific factors will affect an organism, its habitat and its growth potential. These questions will be hung on the walls around the room. Students will pair up and like a Carousel move from station to station sharing their ideas of how to answer the question. Students will also provide feedback to other answers (students) and whether they agree (Check Mark) or disagree (X) with what was presented before them. Questions should include an organism, a genetic or environmental factor being discussed and how that factor may/may not affect the growth potential of that organism. <u>Example Questions:</u> What basic environmental factors do organisms need to survive (water, air, habitat and food)? What environmental factors would affect how an organism grows within its environment? How would an abundance of or lack of water, food, air and habitat affect an organism's growth potential? Are there any environmental hazards that would contribute to the growth of an organism within its habitat (drought, size of habitat vs. size of organism, human influence - fertilizer, etc.)?
Explanation Concepts and Practices	<u>In these lessons</u> Teachers Should: Introduce formal labels, definitions, and explanations for concepts, practices, skills or abilities. Students Should: Verbalize conceptual understandings and demonstrate scientific and engineering practices. <u>Topics to Be Discussed in Teacher Directed Lessons (Disciplinary Core Ideas):</u> LS1.B: Growth and Development of Organisms Genetic factors as well as local conditions affect the growth of the adult plant.
Elaboration Extension Activity	Related Activities Better Lessons: MS-LS1-5
Evaluation Assessment Tasks	<u>Assessment Task A: Carousel Evaluation</u> 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.

Unit 3: Matter and Energy in Organisms and Ecosystems	
Grade: 6	
Content Area: Life Science	
Pacing: 25 Instructional Days	
Essential Question	
How and why do organisms interact with their environment and what are the effects of these interactions?	
Student Learning Objectives (Performance Expectations)	
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.	
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.	
Unit Summary	
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.	
Technical Terms	
Cycling of Matter, flow of energy, ecosystems, biome, biotic, abiotic, producers, consumers, decomposers, symbiosis, carbon cycle	
Formative Assessment Measures	
<i>Part A: How do changes in the availability of matter and energy affect populations in an ecosystem?</i>	
Students who understand the concepts are able to:	
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.	
<i>Part B: How do relationships among organisms, in an ecosystem, affect populations?</i>	
Students who understand the concepts are able to:	
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.	
Interdisciplinary Connections	
NJSLS- ELA	NJSLS- Mathematics

Cite specific textual evidence to support analysis of science and technical texts.(MS-LS2-1),(MS-LS2-2) RST.6-8.1 Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).(MS-LS2-1) RST.6-8.7 Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content.(MS-LS2-2) WHST.6-8.2 Draw evidence from literary or informational texts to support analysis, reflection, and research.(MS-LS2-2) WHST.6-8.9 Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 8 topics, texts, and issues, building on others’ ideas and expressing their own clearly.(MS-LS2-2) SL.8.1 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.8.4 Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest.(MS-LS2-3) SL.8.5		Use variables to represent two quantities in a real-world problem that change in relationship to one another; write an equation to express one quantity, thought of as the dependent variable, in terms of the other quantity, thought of as the independent variable. Analyze the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation.(MS-LS2-3) 6.EE.C.9 Summarize numerical data sets in relation to their context.(MS-LS2-2) 6.SP.B.5	
Core Instructional Materials	Can include: Textbooks Series, Lab Materials, etc.		
21st Century Life and Careers	CRP2, CRP4, CRP5, CRP 6, CRP7, CRP8 ,CRP11,CRP12		
Technology Standards	8.1.8.A.1, 8.1.8.A.2, 8.1.8.A.3, 8.1.8.A.4, 8.1.8.A.5, 8.1.8.D.4, 8.1.8.D.5, 8.1.8.E.1, 8.1.8.F.1, 8.2.8.A.2, 8.2.8.A.3, 8.2.8.B.1, 8.2.8.D.1		
Modifications			
English Language Learners	Special Education	At-Risk	Gifted and Talented
Scaffolding	Word walls	Teacher tutoring	Curriculum compacting
Word walls	Visual aides	Peer tutoring	Challenge assignments
Sentence/paragraph frames	Graphic organizers	Study guides	Enrichment activities
Bilingual	Multimedia	Graphic organizers	Tiered activities
dictionaries/translation	Leveled readers	Extended time	Independent research/inquiry
Think alouds	Assistive technology	Parent communication	Collaborative teamwork
Read alouds	Notes/summaries	Modified assignments	Higher level questioning
Highlight key vocabulary	Extended time	Counseling	Critical/Analytical thinking tasks
Annotation guides	Answer masking		Self-directed activities
Think-pair- share	Answer eliminator		
Visual aides	Highlighter		
Modeling	Color contrast		
Cognates			

LIFE SCIENCE

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

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.

Clarification Statement: Emphasis is on cause and effect relationships between resources and growth of individual organisms and the numbers of organisms in ecosystems during periods of abundant and scarce resources.

Assessment Boundary: N/A

Evidence Statements: [MS-LS2-1](#)

Science & Engineering Practices	Disciplinary Core Ideas	Cross-Cutting 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.	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.	Cause and Effect Cause and effect relationships may be used to predict phenomena in natural or designed systems.

Connections to other DCIs in this grade-band: MS.ESS3.A ; MS.ESS3.C

Articulation of DCIs across grade-bands: 3.LS2.C ; 3.LS4.D ; 5.LS2.A ; HS.LS2.A ; HS.LS4.C ; HS.LS4.D ; HS.ESS3.A

NJSLS- ELA: RST.6-8.1, RST.6-8.7

NJSLS- Math: N/A

5E Model

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.

Engage	http://www.ck12.org/ngss/middle-school-life-sciences/ecosystems:-interactions,-energy,-and-dynamics
Anticipatory Set	Open Limiting Factors to Population Growth Tab Click Video: Populations' Biotic Potential
Exploration	Rat Attack- Interactive Population Activity
Student Inquiry	In this lesson, students will - understand that an ecosystem encompasses both biotic (organisms) and abiotic components (such as light, nutrients, and moisture).

	- describe the interactions among the components of one forest ecosystem. - predict how a forest ecosystem might change when a resource pulse occurs. http://www.pbs.org/wgbh/nova/education/activities/3603_rats.html <u>Exploring Resource Availability and Population Size</u> In this lesson, students will analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem. http://betterlesson.com/lesson/639457/exploring-resource-availability-and-population-size
Explanation Concepts and Practices	In these lessons: Teachers Should: Introduce formal labels, definitions, and explanations for concepts, practices, skills or abilities. Students Should: Verbalize conceptual understandings and demonstrate scientific and engineering practices. <u>Topics to Be Discussed in Teacher Directed Lessons (Disciplinary Core Ideas):</u> <u>LS2.A: Interdependent Relationships in Ecosystems</u> <u>Organisms, and populations of organisms, are dependent on their environmental interactions both with other living things and with nonliving factors.</u> <u>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.</u> <u>Growth of organisms and population increases are limited by access to resources.</u>
Elaboration Extension Activity	RiverVenture: Population Study Game http://www.riverventure.org/charleston/resources/pdf/population%20study%20game.pdf
Evaluation Assessment Tasks	<u>Assessment Task A: Narrative (Rat Attack Activity)</u> Have the new teams combine organism stories and put together a comprehensive narrative of what happened with the entire forest ecosystem over the two years, including the outcome of each organism at the end of each year. <u>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.</u> <u>Assessment Task B: Collaborative Group Discussion Questions (Exploring Resources Activity)</u> Student responses will indicate their ability to analyze and interpret given data. <u>Analyze and interpret data to provide evidence for phenomena.</u> <u>Assessment Task C: Exit Slips (Exploring Resources Activity)</u> Students will complete an Exit Slip which requires them to construct a scientific explanation addressing the relationship between resource availability and population dynamics.

LIFE SCIENCE

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

MS-LS2-2. Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.

Clarification Statement: Emphasis is on predicting consistent patterns of interactions in different ecosystems in terms of the relationships among and between organisms and abiotic components of ecosystems. Examples of types of interactions could include competitive, predatory, and mutually beneficial.

Assessment Boundary: N/A

Evidence Statements: MS-LS2-2

Science & Engineering Practices	Disciplinary Core Ideas	Cross-Cutting Concepts
<u>Constructing Explanations and Designing Solutions</u> 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.	<u>LS2.A: Interdependent Relationships in Ecosystems</u> Similarly, predatory interactions may reduce the number of organisms or eliminate whole populations of organisms. Mutually beneficial interactions, in contrast, may become so interdependent that each organism requires the other for survival. Although the species involved in these competitive, predatory, and mutually beneficial interactions vary across ecosystems, the patterns of interactions of organisms with their environments, both living and nonliving, are shared.	<u>Patterns</u> Patterns can be used to identify cause and effect relationships.

Connections to other DCIs in this grade-band: MS.LS1.B

Articulation of DCIs across grade-bands: 1.LS1.B ; HS.LS2.A ; HS.LS2.B ; HS.LS2.D

CCSS- ELA: RST.6-8.1, WHST.6-8.2, WHST.6-8.9, SL.8.1, SL.8.4

CCSS- Math: 6.SP.B.5

5E Model

MS-LS2-2. Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.

Engage Anticipatory Set	Videos: http://www.ck12.org/ngss/middle-school-life-sciences/ecosystems:-interactions,-energy,-and-dynamics Competition, Predation, and Symbiosis (separate videos as part of explanation) Symbiosis: A Surprising Tale of Species Cooperation
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Exploration Student Inquiry	In groups, students will create a digital presentation (PPT, Google Slides etc.) for an assigned biome. Each student will be responsible to contributing to the presentation by creating at least one slide on one of the following factors of their biome: abiotic and biotic factors, food chain and web, land features, organisms, cycles, etc. The following websites can be used for student research: http://kids.nceas.ucsb.edu/biomes/ http://www.blueplanetbiomes.org/world_biomes.htm http://earthobservatory.nasa.gov/Experiments/Biome/ The following are short video clips: http://www.pbslearningmedia.org/resource/tdc02.sci.life.eco.arctic/arctic-tundra/ http://www.pbslearningmedia.org/resource/tdc02.sci.life.eco.desert/desert-biome/ http://www.pbslearningmedia.org/resource/tdc02.sci.life.oate.rainforest/amazon-rainforest/ Following the group presentations, guide students in predicting the patterns of interaction that were presented in each biome by asking the following questions: 1. What competitive interactions did you see? 2. What predatory interactions did you see? 3. What symbiotic interactions did you see? 4. Which interactions were mutually beneficial to more than one organism?
Explanation Concepts and Practices	<u>In these lessons:</u> Teachers Should: Introduce formal labels, definitions, and explanations for concepts, practices, skills or abilities. Students Should: Verbalize conceptual understandings and demonstrate scientific and engineering practices. <u>Topics to Be Discussed in Teacher Directed Lessons (Disciplinary Core Ideas):</u> LS2.A: Interdependent Relationships in Ecosystems Similarly, predatory interactions may reduce the number of organisms or eliminate whole populations of organisms. Mutually beneficial interactions, in contrast, may become so interdependent that each organism requires the other for survival. Although the species involved in these competitive, predatory, and mutually beneficial interactions vary across ecosystems, the patterns of interactions of organisms with their environments, both living and nonliving, are shared.
Elaboration Extension Activity	<u>Related Activities</u> http://www.ck12.org/ngss/middle-school-life-sciences/ecosystems:-interactions,-energy,-and-dynamics
Evaluation Assessment Tasks	<u>Assessment Task A: Group Presentation Response Questions</u> 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.

LIFE SCIENCE

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

MS-LS2-3. Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.

Clarification Statement: Emphasis is on describing the conservation of matter and flow of energy into and out of various ecosystems, and on defining the boundaries of the system.

Assessment Boundary: Assessment does not include the use of chemical reactions to describe the processes.

Evidence Statements: MS-LS2-3

Science & Engineering Practices	Disciplinary Core Ideas	Cross-Cutting Concepts
Developing and Using Models Modeling in 6–8 builds on K–5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems. Develop a model to describe phenomena.	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.	Energy and Matter The transfer of energy can be tracked as energy flows through a natural system. 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.

Connections to other DCIs in this grade-band: MS.PS1.B

Articulation of DCIs across grade-bands: 5.LS2.A ; 5.LS2.B ; HS.PS3.B ; HS.LS1.C ; HS.LS2.B ; HS.ESS2.A

NJSLS- ELA: SL.8.5

NJSLS- Math: 6.EE.C.9

5E Model

MS-LS2-3. Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.

Engage	Video and Activities
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Anticipatory Set	http://betterlesson.com/lesson/639248/biotic-and-abiotic-factors
Exploration Student Inquiry	Carbon Cycle Role Play https://www.calacademy.org/educators/lesson-plans/carbon-cycle-role-play Role Play Cards: http://www.calacademy.org:8080/sites/default/files/assets/docs/pdf/048s1_carboncycledemocards.pdf Lesson Plan: http://www.calacademy.org:8080/sites/default/files/assets/docs/pdf/048_carboncycleroleplayredesign10nov2014mks.pdf
Explanation Concepts and Practices	In these lessons: Teachers Should: Introduce formal labels, definitions, and explanations for concepts, practices, skills or abilities. Students Should: Verbalize conceptual understandings and demonstrate scientific and engineering practices. Topics to Be Discussed in Teacher Directed Lessons (Disciplinary Core Ideas): 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.
Elaboration Extension Activity	Meadowlands Environmental Center http://mec.rst2.edu/environment/
Evaluation Assessment Tasks	Assessment Task A: Discussion- Human Impacts on the Carbon Cycle (Part of Carbon Cycle Role Play lesson plan) Lead a class discussion to assess student understanding of human impact on the carbon cycle. Assessment Task B: Carbon Cycle Poster https://www.calacademy.org/educators/lesson-plans/carbon-cycle-poster 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.

Unit 4: Interdependent Relationships in Ecosystems	
Grade: 6	
Content Area: Life Science	
Pacing: 25 Instructional Days	
Essential Question	
What happens to ecosystems when the environment changes?	
Student Learning Objectives (Performance Expectations)	
MS-LS2-4. Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.	
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.	
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 tradeoff matrix, to determine which solutions are most promising. They then test different solutions, and combine the best ideas into a new solution that may be better than any of the preliminary ideas. Students demonstrate grade appropriate proficiency in asking questions, designing solutions, engaging in argument from evidence, developing and using models, and designing solutions. Students are also expected to use these practices to demonstrate understanding of the core ideas.	
Technical Terms	

Biodiversity, scientific justification ,habitat, niches, herbivore, carnivore, omnivore, energy pyramid, food chain	
Formative Assessment Measures	
<i>Part A: How can a single change to an ecosystem disrupt the whole system?</i>	
<u>Students who understand the concepts are able to:</u> Construct an argument to support or refute an explanation for the changes to populations in an ecosystem caused by disruptions to a physical or biological component of that ecosystem. Empirical evidence and scientific reasoning must support the argument. Use scientific rules for obtaining and evaluating empirical evidence. Recognize patterns in data and make warranted inferences about changes in populations. Evaluate empirical evidence supporting arguments about changes to ecosystems.	
<i>Part B: What limits the number and variety of living things in an ecosystem?</i>	
<u>Students who understand the concepts are able to:</u> Construct a convincing argument that supports or refutes claims for solutions about the natural and designed world(s). Develop a model to generate data to test ideas about designed systems, including those representing inputs and outputs. Create design criteria for design solutions for maintaining biodiversity and ecosystem services. Evaluate competing design solutions based on jointly developed and agreed-upon design criteria.	
Interdisciplinary Connections	
NJSLS- ELA	NJSLS- Mathematics
Cite specific textual evidence to support analysis of science and technical texts. (MS-LS2-4) RST.6-8.1 Distinguish among facts, reasoned judgment based on research findings, and speculation in a text. (MS-LS2-5) RST.6-8.8 Trace and evaluate the argument and specific claims in a text, assessing whether the reasoning is sound and the evidence is relevant and sufficient to support the claims. (MS-LS2-5) RI.8.8 Write arguments to support claims with clear reasons and relevant evidence. (MS-LS2-4),(MS-ETS1-1),(MS-ETS1-3) WHST.6-8.1 Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content. (MS-LS2-2) WHST.6-8.2 Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table). (MS-ETS1-3) RST.6-8.7 Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source;	Reason abstractly and quantitatively. (MS-ETS1-1),(MS-ETS1-3) MP.2 Model with mathematics. (MS-LS2-5) MP.4 Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies. (MS-ETS1-1),(MS-ETS1-3) 7.EE.3 Use ratio and rate reasoning to solve real-world and mathematical problems. (MS-LS2-5) 6.RP.A.3

and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation. (MS-ETS1-1) WHST.6-8.8 Draw evidence from literary or informational texts to support analysis, reflection, and research. (MS-LS2-2),(MS-LS2-4),(MS-ETS1-3), (MS-ETS1-2) WHST.6-8.9 Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest. (MS-ETS1-4) SL.8.5			
Core Instructional Materials	Can include: Textbooks Series, Lab Materials, etc.		
21st Century Life and Careers	CRP2, CRP4, CRP5, CRP 6, CRP7, CRP8 ,CRP11,CRP12		
Technology Standards	8.1.8.A.1, 8.1.8.A.2, 8.1.8.A.3, 8.1.8.A.4, 8.1.8.A.5, 8.1.8.D.4, 8.1.8.D.5, 8.1.8.E.1, 8.1.8.F.1, 8.2.8.A.2, 8.2.8.A.3, 8.2.8.B.1, 8.2.8.D.1		
Modifications			
English Language Learners	Special Education	At-Risk	Gifted and Talented
Scaffolding	Word walls	Teacher tutoring	Curriculum compacting
Word walls	Visual aides	Peer tutoring	Challenge assignments
Sentence/paragraph frames	Graphic organizers	Study guides	Enrichment activities
Bilingual	Multimedia	Graphic organizers	Tiered activities
dictionaries/translation	Leveled readers	Extended time	Independent research/inquiry
Think alouds	Assistive technology	Parent communication	Collaborative teamwork
Read alouds	Notes/summaries	Modified assignments	Higher level questioning
Highlight key vocabulary	Extended time	Counseling	Critical/Analytical thinking tasks
Annotation guides	Answer masking		Self-directed activities
Think-pair- share	Answer eliminator		
Visual aides	Highlighter		
Modeling	Color contrast		
Cognates			

LIFE SCIENCE

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

MS-LS2-4. Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.

Clarification Statement: Emphasis is on recognizing patterns in data and making warranted inferences about changes in populations, and on evaluating empirical evidence supporting arguments about changes to ecosystems.

Assessment Boundary: N/A

Evidence Statements: MS-LS2-4

Science & Engineering Practices	Disciplinary Core Ideas	Cross-Cutting Concepts
Engaging in Argument from Evidence Engaging in argument from evidence in 6–8 builds on K–5 experiences and progresses to constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed world(s). Construct an oral and written argument supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem. Connections to Nature of Science Scientific Knowledge is Based on Empirical Evidence Science disciplines share common rules of obtaining and evaluating empirical evidence.	LS2.C: Ecosystem Dynamics, Functioning, and Resilience Ecosystems are dynamic in nature; their characteristics can vary over time. Disruptions to any physical or biological component of an ecosystem can lead to shifts in all its populations.	Stability and Change Small changes in one part of a system might cause large changes in another part.

Connections to other DCIs in this grade-band: MS.LS4.C ; MS.LS4.D ; MS.ESS2.A ; MS.ESS3.A ; MS.ESS3.C

Articulation of DCIs across grade-bands: 3.LS2.C ; 3.LS4.D ; HS.LS2.C ; HS.LS4.C ; HS.LS4.D ; HS.ESS2.E ; HS.ESS3.B ; HS.ESS3.C

NJSLS- ELA: RST.6-8.1, RI.8.8, WHST.6-8.1, WHST.6-8.9

NJSLS- Math: N/A

5E Model

MS-LS2-4. Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.

Engage Anticipatory Set	Endangered Species Introductory Video- Here Today, Gone Tomorrow http://mariana68.wix.com/biodiversityproject
Exploration	Endangered Species- A Multi Day Project

Student Inquiry	http://betterlesson.com/lesson/639346/endangered-species-a-multiday-project
Explanation Concepts and Practices	In these lessons: Teachers Should: Introduce formal labels, definitions, and explanations for concepts, practices, skills or abilities. Students Should: Verbalize conceptual understandings and demonstrate scientific and engineering practices. <u>Topics to Be Discussed in Teacher Directed Lessons (Disciplinary Core Ideas):</u> LS2.C: Ecosystem Dynamics, Functioning, and Resilience Ecosystems are dynamic in nature; their characteristics can vary over time. Disruptions to any physical or biological component of an ecosystem can lead to shifts in all its populations.
Elaboration Extension Activity	<u>Mini-Lessons</u> http://participatoryscience.org/standard/ms-ls2-4
Evaluation Assessment Tasks	<u>Assessment Task A: Endangered Species- Recovery Plan Presentation</u> Construct an oral and written argument supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem. Students will work in teams to develop a plan to bring their chosen species back from the brink of extinction. Students will develop and share a brief presentation of their recovery plan. Recovery plans must address specific questions and are aimed at convincing listeners that their species deserves special attention. Persuasive Plan Rubric Infographic Rubric

LIFE SCIENCE

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

MS-LS2-5. Evaluate competing design solutions for maintaining biodiversity and ecosystem services.

Clarification Statement: Examples of ecosystem services could include water purification, nutrient recycling, and prevention of soil erosion. Examples of design solution constraints could include scientific, economic, and social considerations.

Assessment Boundary: N/A

Evidence Statements: MS-LS2-5

Science & Engineering Practices	Disciplinary Core Ideas	Cross-Cutting Concepts
<u>Engaging in Argument from Evidence</u> Engaging in argument from evidence in 6–8 builds on K–5 experiences and progresses to constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed world(s). <u>Evaluate competing design solutions based on jointly developed and agreed-upon design criteria.</u>	<u>LS2.C: Ecosystem Dynamics, Functioning, and Resilience</u> 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. <u>LS4.D: Biodiversity and Humans</u> 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) <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. (secondary)	<u>Stability and Change</u> Small changes in one part of a system might cause large changes in another part. Connections to Engineering, Technology, and Applications of Science <u>Influence of Science, Engineering, and Technology on Society and the Natural World</u> 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. Connections to Nature of Science Science Addresses Questions About the Natural and Material World Scientific knowledge can describe the consequences of actions but does not necessarily prescribe the decisions that society takes.

Connections to other DCIs in this grade-band: MS.ESS3.C

Articulation of DCIs across grade-bands: HS.LS2.A ; HS.LS2.C ; HS.LS4.D ; HS.ESS3.A ; HS.ESS3.C ; HS.ESS3.D

NJSLS- ELA: RST.6-8.8, RI.8.8

NJSLS- Math: MP.4, 6.RP.A.3

5E Model

MS-LS2-5. Evaluate competing design solutions for maintaining biodiversity and ecosystem services.

Engage Anticipatory Set	<u>Why Is Biodiversity So Important?</u> https://www.youtube.com/watch?v=GK_vRtHJZu4
Exploration Student Inquiry	<u>Saving the World- One Ecosystem at a Time</u> Elaborate: Each group takes their top-ranked idea from their chart and draws a “to scale” diagram depicting their idea. http://www.nsta.org/docs/DoingGoodScienceChapter15.pdf
Explanation Concepts and Practices	<u>In these lessons:</u> Teachers Should: Introduce formal labels, definitions, and explanations for concepts, practices, skills or abilities. Students Should: Verbalize conceptual understandings and demonstrate scientific and engineering practices. <u>Topics to Be Discussed in Teacher Directed Lessons (Disciplinary Core Ideas):</u> LS2.C: Ecosystem Dynamics, Functioning, and Resilience Biodiversity describes the variety of species found in Earth’s terrestrial and oceanic ecosystems. The completeness or integrity of an ecosystem’s biodiversity is often used as a measure of its health. 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) 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)
Elaboration Extension Activity	<u>Disturbances in Ecosystems</u> http://wyobio.org/files/3814/2971/8811/MiddleSchool_Lesson8.pdf http://wyobio.org/files/2914/1885/4938/MiddleSchool_Lesson8.2.pdf After identifying ecosystem disturbances, work to determine possible solutions. Evaluate the solutions of other groups based on criteria. Write criteria as a class.
Evaluation Assessment Tasks	<u>Assessment Task A: Solutions Presentation</u> Evaluate competing design solutions based on jointly developed and agreed-upon design criteria. After researching their ecosystem, students will develop design solutions for maintaining the ecosystem's health and biodiversity. Students will record solutions on a chart and rank them, with “1” being the most important solution to maintain the ecosystem services. Groups will present their solutions and explain the reasoning behind their rankings. (MS-ETS1-1) <u>Assessment Task B: Solutions Diagram</u> Each group takes their top-ranked idea from their chart and draws a “to scale” diagram depicting their idea.

	Assessment Task C: Designing a New Solution After determining the top solution for each group, students will work as a class to determine similarities and differences among the different design solutions. The students will identify the best characteristics of each to combine into a new solution that could potentially be applicable to maintaining biodiversity in all ecosystems. (MS-ETS-1-3)
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ENGINEERING DESIGN		
MS-ETS1-1 Engineering Design		
<u>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.</u>		
Evidence Statements: <u>MS-ETS1-1</u>		
Science & Engineering Practices	Disciplinary Core Ideas	Cross-Cutting Concepts
<u>Asking Questions and Defining Problems</u> <u>Asking questions and defining problems in grades 6–8 builds on grades K–5 experiences and progresses to specifying relationships between variables, and clarifying arguments and models.</u> <u>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.</u>	<u>ETS1.A: Defining and Delimiting Engineering Problems</u> <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.</u>	<u>Influence of Science, Engineering, and Technology on Society and the Natural World</u> <u>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. 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.</u>
Connections to MS-ETS1.A: Defining and Delimiting Engineering Problems include: Physical Science: MS-PS3-3		
Articulation of DCIs across grade-bands: 3-5.ETS1.A ; 3-5.ETS1.C ; HS.ETS1.A ; HS.ETS1.B		
NJSLS- ELA: RST.6-8.1, WHST.6-8.8		
NJSLS- Math: MP.2, 7.EE.3		

ENGINEERING DESIGN

MS-ETS1-3 Engineering Design

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.

Evidence Statements: MS-ETS1-3

Science & Engineering Practices	Disciplinary Core Ideas	Cross-Cutting Concepts
<u>Analyzing and Interpreting Data</u> 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 determine similarities and differences in findings.	<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. Sometimes parts of different solutions can be combined to create a solution that is better than any of its predecessors. <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.	

Connections to MS-ETS1.B: Developing Possible Solutions Problems include: Physical Science: MS-PS1-6, MS-PS3-3, Life Science: MS-LS2-5

Connections to MS-ETS1.C: Optimizing the Design Solution include: Physical Science: MS-PS1-6

Articulation of DCIs across grade-bands: 3-5.ETS1.A ; 3-5.ETS1.B ; 3-5.ETS1.C ; HS.ETS1.B ; HS.ETS1.C

NJSLS- ELA: RST.6-8.1, RST.6-8.7, RST.6-8.9

NJSLS- Math: MP.2, 7.EE.3

Unit 5: Force and Motion

Grade: 6

Content Area: Physical Science

Pacing: 25 Instructional Days

Essential Question

How can we predict the motion of an object?

Student Learning Objectives (Performance Expectations)

[MS-PS2-1. Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects.](#)

[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-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-ETS1-4. 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 Summary

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

Technical Terms

Newton's Third Law of Motion, friction, force, potential energy, kinetic energy, gravity, transfer, incline/decline, balanced/unbalanced forces, net force, momentum, velocity, weight, inertia

Formative Assessment Measures

Part A: How does a sailboat work?

Students who understand the concepts are able to:

Apply Newton's third law to design a solution to a problem involving the motion of two colliding objects.

Define a design problem involving the motion of two colliding objects that can be solved through the development of an object, tool, process, or system and that includes multiple criteria and constraints, including scientific knowledge that may limit possible solutions.

Evaluate competing design solutions involving the motion of two colliding objects based on jointly developed and agreed-upon design criteria.

Develop a model to generate data to test ideas about designed systems, including those representing inputs and outputs.

Analyze and interpret data to determine similarities and differences in findings.

Part B: Who can build the fastest sailboat?

Students who understand the concepts are able to:

Plan an investigation individually and collaboratively to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object.

Design an investigation and identify independent and dependent variables and controls, what tools are needed to do the gathering, how measurements will be recorded, and how many data are needed to support a claim.

Make logical and conceptual connections between evidence and explanations.

Examine the changes over time and forces at different scales to explain the stability and change in designed systems.

Interdisciplinary Connections

NJSLS- ELA	NJSLS- Mathematics
Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions. (MS-PS2-1),(MS-ETS1-1),(MS-ETS1-2) RST.6-8.1 Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks. (MS-PS2-1),(MS-PS2-2) RST.6-8.3 Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation. (MS-ETS1-1) WHST.6-8.8 Draw evidence from informational texts to support analysis, reflection, and research. (MS-ETS1-2) WHST.6-8.9 Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic. (MS-ETS1-2),(MS-ETS1-3) RST.6-8.9 Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating	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. (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

additional related, focused questions that allow for multiple avenues of exploration. (MS-ETS1-2) WHST.6-8.7		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	
Core Instructional Materials	Can include: Textbooks Series, Lab Materials, etc.		
21st Century Life and Careers	CRP2, CRP4, CRP5, CRP 6, CRP7, CRP8 ,CRP11,CRP12		
Technology Standards	8.1.8.A.1, 8.1.8.A.2, 8.1.8.A.3, 8.1.8.A.4, 8.1.8.A.5, 8.1.8.D.4, 8.1.8.D.5, 8.1.8.E.1, 8.2.8.D.1,		
Modifications			
English Language Learners	Special Education	At-Risk	Gifted and Talented
Scaffolding	Word walls	Teacher tutoring	Curriculum compacting
Word walls	Visual aides	Peer tutoring	Challenge assignments
Sentence/paragraph frames	Graphic organizers	Study guides	Enrichment activities
Bilingual	Multimedia	Graphic organizers	Tiered activities
dictionaries/translation	Leveled readers	Extended time	Independent research/inquiry
Think alouds	Assistive technology	Parent communication	Collaborative teamwork
Read alouds	Notes/summaries	Modified assignments	Higher level questioning
Highlight key vocabulary	Extended time	Counseling	Critical/Analytical thinking tasks
Annotation guides	Answer masking		Self-directed activities
Think-pair- share	Answer eliminator		
Visual aides	Highlighter		
Modeling	Color contrast		
Cognates			

PHYSICAL SCIENCE

MS. Motion and Stability: Forces and Interactions

MS-PS2-1. Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects.

Clarification Statement: Examples of practical problems could include the impact of collisions between two cars, between a car and stationary objects, and between a meteor and a space vehicle.

Assessment Boundary: Assessment is limited to vertical or horizontal interactions in one dimension.

Evidence Statements: [MS-PS2-1](#)

Science & Engineering Practices	Disciplinary Core Ideas	Cross-Cutting Concepts
Constructing Explanations and Designing Solutions Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories. Apply scientific ideas or principles to design an object, tool, process or system.	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).	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. 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 in such factors as climate, natural resources, and economic conditions.

Connections to other DCIs in this grade-band: MS.PS3.C

Articulation of DCIs across grade-bands: 3.PS2.A ; HS.PS2.A

NJSLS- ELA: RST.6-8.1, RST.6-8.3, WHST.6-8.7

NJSLS- Math: MP.2, 6.NS.C.5, 6.EE.A.2, 7.EE.B.3, 7.EE.B.4

5E Model

MS-PS2-1. Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects.

Engage	Go to link and click Newton's Third Law, then video.
Anticipatory Set	http://www.ck12.org/ngss/middle-school-physical-sciences/motion-and-stability:-forces-and-interactions

	Outline the action and reaction demonstrated by the astronauts in the video. Why does wearing the battery pack affect the motion of the astronaut named Alexander? Describe an example of Newton's cradle. How do space vehicles apply action and reaction forces to blast off? Lead class discuss: - State Newton's third law of motion. - Describe an example of an action and reaction. Identify the forces and their directions. - Explain why action and reaction forces are not balanced forces. <u>Collision Video</u> https://www.youtube.com/watch?v=xtxd27jIZ_g&feature=c4-overview-vl&list=PL983889014322C331 What are the engineers testing in these crash tests? How do you think we can predict the direction of the collisions? How does mass impact car collisions?
Exploration Student Inquiry	Newton's Third Law Lesson Plan The first two activities help students to review Newton's laws and forces acting on an object. In the culminating task, students are asked to design, test, and redesign a moon lander and rover. 1. Forces in Motion Activity 2. Describing Motion Activity The final project gives students design constraints and asks them to reflect and retest their design. Teachers should plan on the culminating activity as a 3-4 day project (unless students are working at home). Minimal teacher prep is required and most of the materials given to students can be basic household items and things you have around the classroom. 3. Moon Rover - Final Activity
Explanation Concepts and Practices	<u>In these lessons:</u> Teachers Should: Introduce formal labels, definitions, and explanations for concepts, practices, skills or abilities. Students Should: Verbalize conceptual understandings and demonstrate scientific and engineering practices. <u>Topics to Be Discussed in Teacher Directed Lessons (Disciplinary Core Ideas):</u> 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).
Elaboration Extension Activity	Balloon Rockets https://sciencebob.com/make-a-balloon-rocket/
Evaluation Assessment Tasks	<u>Assessment Task A: Moon Rover</u> Apply scientific ideas or principles to design an object, tool, process or system. Students will be able to apply Newton's 3rd Law of Motion to design a solution to landing a rover on the Moon. Use the attached rubric to assess students upon completion of design project.

ENGINEERING DESIGN

MS-ETS1-1 Engineering Design

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.

Evidence Statements: MS-ETS1-1

Science & Engineering Practices	Disciplinary Core Ideas	Cross-Cutting Concepts
<u>Asking Questions and Defining Problems</u> Asking questions and defining problems in grades 6–8 builds on grades K–5 experiences and progresses to specifying relationships between variables, and clarifying arguments and models. <u>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.</u>	<u>ETS1.A: Defining and Delimiting Engineering 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.	<u>Influence of Science, Engineering, and Technology on Society and the Natural World</u> 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. 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.

Connections to MS-ETS1.A: Defining and Delimiting Engineering Problems include: Physical Science: MS-PS3-3

Articulation of DCIs across grade-bands: 3-5.ETS1.A ; 3-5.ETS1.C ; HS.ETS1.A ; HS.ETS1.B

NJSLS- ELA: RST.6-8.1, WHST.6-8.8

NJSLS- Math: MP.2, 7.EE.3

ENGINEERING DESIGN

MS-ETS1-2 Engineering Design

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

Evidence Statements: [MS-ETS1-2](#)

Science & Engineering Practices	Disciplinary Core Ideas	Cross-Cutting Concepts
Engaging in Argument from Evidence Engaging in argument from evidence in 6–8 builds on K–5 experiences and progresses to constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed world. Evaluate competing design solutions based on jointly developed and agreed-upon design criteria.	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.	

Connections to MS-ETS1.B: Developing Possible Solutions Problems include: Physical Science: MS-PS1-6, MS-PS3-3, Life Science: MS-LS2-5

Articulation of DCIs across grade-bands: 3-5.ETS1.A ; 3-5.ETS1.B ; 3-5.ETS1.C ; HS.ETS1.A ; HS.ETS1.B

NJSLS ELA: RST.6-8.1, RST.6-8.9, WHST.6-8.7 , WHST.6-8.9

NJSLS- Math: MP.2, 7.EE.3

ENGINEERING DESIGN

MS-ETS1-3 Engineering Design

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.

Evidence Statements: MS-ETS1-3

Science & Engineering Practices	Disciplinary Core Ideas	Cross-Cutting Concepts
<u>Analyzing and Interpreting Data</u> 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 determine similarities and differences in findings.	<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. Sometimes parts of different solutions can be combined to create a solution that is better than any of its predecessors. <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.	

Connections to MS-ETS1.B: Developing Possible Solutions Problems include: Physical Science: MS-PS1-6, MS-PS3-3, Life Science: MS-LS2-5

Connections to MS-ETS1.C: Optimizing the Design Solution include: Physical Science: MS-PS1-6

Articulation of DCIs across grade-bands: 3-5.ETS1.A ; 3-5.ETS1.B ; 3-5.ETS1.C ; HS.ETS1.B ; HS.ETS1.C

NJSLS- ELA: RST.6-8.1, RST.6-8.7, RST.6-8.9

PHYSICAL SCIENCE

MS. Motion and Stability: Forces and Interactions

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.

Clarification Statement: Emphasis is on balanced (Newton's First Law) and unbalanced forces in a system, qualitative comparisons of forces, mass and changes in motion (Newton's Second Law), frame of reference, and specification of units.

Assessment Boundary: Assessment is limited to forces and changes in motion in one-dimension in an inertial reference frame and to change in one variable at a time. Assessment does not include the use of trigonometry.

Evidence Statements: MS-PS2-2

Science & Engineering Practices	Disciplinary Core Ideas	Cross-Cutting Concepts
<u>Planning and Carrying Out Investigations</u> <u>Planning and carrying out investigations to answer questions or test solutions to problems in 6–8 builds on K–5 experiences and progresses to include investigations that use multiple variables and provide evidence to support explanations or design solutions.</u> <u>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.</u>	<u>PS2.A: Forces and Motion</u> <u>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.</u> <u>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</u>	<u>Stability and Change</u> <u>Explanations of stability and change in natural or designed systems can be constructed by examining the changes over time and forces at different scales.</u>

Connections to Nature of Science Scientific Knowledge is Based on Empirical Evidence Science knowledge is based upon logical and conceptual connections between evidence and explanations.	order to share information with other people, these choices must also be shared.	
Connections to other DCIs in this grade-band: MS.PS3.A ; MS.PS3.B ; MS.ESS2.C		
Articulation of DCIs across grade-bands: 3.PS2.A ; HS.PS2.A ; HS.PS3.B ; HS.ESS1.B		
NJSLS- ELA: RST.6-8.3, WHST.6-8.7		
NJSLS- Math: MP.2, 6.EE.A.2, 7.EE.B.3, 7.EE.B.4		
5E Model		
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.		
Engage Anticipatory Set	Begin lesson by carrying out one of the Newton's Law Demonstrations from the following resource http://www.exo.net/~donr/activities/Newton's_Laws_Demonstrations.pdf Have students explore the following interactive site. This site will allow students to explore how gravity impacts the motion of objects. http://www.glencoe.com/sites/common_assets/science/virtual_labs/E25/E25.html	
Exploration Student Inquiry	Marble Roll- Let's Move It http://it.pinellas.k12.fl.us/Teachers3/gurianb/files/AD5483E493EE4299BDAF1BABAD473540.pdf Ask groups to set up their experiment. Provide the "Science Mini-boards" to record their data and have a notebook for them to record observations. During the actual experiments time, the teacher should be constantly assessing, looking for and correcting misconceptions. This is also where the teacher should be doing a lot of "playing dumb" and asking lots of "whys". Probing is essential to encourage scientific discussions. Student Procedures (See mini-board): 1. Decide on the number of books your group will use for this experiment. 2. Make your hypothesis about what you think will happen in your experiment. 3. Find the mass of the marbles. 4. Set up books and put the ruler on the edge. 5. Put the carton at the base of the ruler. 6. Use a pencil to hold the marble 2 inches from the top of the ruler. 7. Release the pencil so that no force is applied to the marble. 8. Measure the distance the carton was moved. 9. Repeat for a total of 10 trials. 10. The teacher will teach you how to use a calculator to find the average or mean. 11. Repeat procedures for the next marble.	
Explanation Concepts and Practices	<u>In these lessons:</u> Teachers Should: Introduce formal labels, definitions, and explanations for concepts, practices, skills or abilities. Students Should: Verbalize conceptual understandings and demonstrate scientific and engineering practices. <u>Topics to Be Discussed in Teacher Directed Lessons (Disciplinary Core Ideas):</u> PS2.A: Forces and Motion 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.	

	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.
Elaboration Extension Activity	Science of NFL Football: Newton's Second Law of Motion http://science360.gov/obj/video/58e62534-e38d-430b-bfb1-c505e628a2d4/science-nfl-football-newtons-second-law-motion
Evaluation Assessment Tasks	Assessment Task A: Marble Roll Experiment 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. Students will complete the Science Mini Board to provide evidence of mastery of the standard. Mini Board - pages 5 & 6

ENGINEERING DESIGN

MS-ETS1-4 Engineering Design

[MS-ETS1-4. 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.](#)

[Evidence Statements: MS-ETS1-4](#)

Science & Engineering Practices	Disciplinary Core Ideas	Cross-Cutting Concepts
Developing and Using Models Modeling in 6–8 builds on K–5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems. Develop a model to generate data to test ideas about designed systems, including those representing inputs and outputs.	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. Models of all kinds are important for testing solutions. ETS1.C: Optimizing the Design Solution 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.	

Connections to MS-ETS1.B: Developing Possible Solutions Problems include: Physical Science: MS-PS1-6, MS-PS3-3, Life Science: MS-LS2-5

Connections to MS-ETS1.C: Optimizing the Design Solution include: Physical Science: MS-PS1-6

Articulation of DCIs across grade-bands: 3-5.ETS1.B ; 3-5.ETS1.C ; HS.ETS1.B ; HS.ETS1.C

NJSLS- ELA: SL.8.5
NJSLS- Math: MP.2, 7.SP

Unit 6: Types of Interactions
Grade: 6
Content Area: Physical Science
Pacing: 25 Instructional Days
Essential Question
Is it possible to exert on an object without touching it?
Student Learning Objectives (Performance Expectations)
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.
Unit 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.

Technical Terms

Gravitational forces, electrical forces, magnetic forces, attract, repel, attractive, negative, air resistance, centripetal acceleration, centripetal force, joule, kinetic energy, mechanical energy, electrical conductors, electrical insulators, semiconductors, superconductors, induction, polarization

Formative Assessment Measures

Part A: Can you apply a force on something without touching it?

Students who understand the concepts are able to:

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: How does a Maglev train work?

Students who understand the concepts are able to:

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: If I were able to eliminate air resistance and dropped a feather and a hammer at the same time, which would land first?

Students who understand the concepts are able to:

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.

Interdisciplinary Connections

NJSLS- ELA

Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.(HS-PS2-5), (HS-PS2-3) WHST.11-12.7

NJSLS- Mathematics

Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. (HS-PS2-5),(HS-PS2-4) HSN.Q.A.1
Define appropriate quantities for the purpose of descriptive modeling. (HS-PS2-5),(HS-PS2-4) HSN.Q.A.2

Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation. (HS-PS2-5) WHST.11-12.8		Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (HS-PS2-5),(HS-PS2-4) HSN.Q.A.3	
Draw evidence from informational texts to support analysis, reflection, and research. (HS-PS2-5) WHST.11-12.9		Reason abstractly and quantitatively. (HS-PS2-4) MP.2	
		Model with mathematics. (HS-PS2-4) MP.4	
		Interpret expressions that represent a quantity in terms of its context. (HS-PS2-4) HSA.SSE.A.1	
		Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression. (HS-PS2-4) HSA.SSE.B.3	
Core Instructional Materials	Can include: Textbooks Series, Lab Materials, etc.		
21st Century Life and Careers	CRP2, CRP4, CRP5, CRP 6, CRP7, CRP8 ,CRP11,CRP12		
Technology Standards	8.1.8.A.1, 8.1.8.A.2, 8.1.8.A.3, 8.1.8.A.4, 8.1.8.A.5, 8.1.8.D.4, 8.1.8.D.5		
Modifications			
English Language Learners	Special Education	At-Risk	Gifted and Talented
Scaffolding	Word walls	Teacher tutoring	Curriculum compacting
Word walls	Visual aides	Peer tutoring	Challenge assignments
Sentence/paragraph frames	Graphic organizers	Study guides	Enrichment activities
Bilingual dictionaries/translation	Multimedia	Graphic organizers	Tiered activities
Think alouds	Leveled readers	Extended time	Independent research/inquiry
Read alouds	Assistive technology	Parent communication	Collaborative teamwork
Highlight key vocabulary	Notes/summaries	Modified assignments	Higher level questioning
Annotation guides	Extended time	Counseling	Critical/Analytical thinking tasks
Think-pair- share	Answer masking		Self-directed activities
Visual aides	Answer eliminator		
Modeling	Highlighter		
Cognates	Color contrast		

PHYSICAL SCIENCE

MS. Motion and Stability: Forces and Interactions

MS-PS2-3. Ask questions about data to determine the factors that affect the strength of electric and magnetic forces.

Clarification Statement: Examples of devices that use electric and magnetic forces could include electromagnets, electric motors, or generators. Examples of data could include the effect of the number of turns of wire on the strength of an electromagnet, or the effect of increasing the number or strength of magnets on the speed of an electric motor.

Assessment Boundary: Assessment about questions that require quantitative answers is limited to proportional reasoning and algebraic thinking.

Evidence Statements: MS-PS2-3

Science & Engineering Practices	Disciplinary Core Ideas	Cross-Cutting Concepts
<u>Asking Questions and Defining Problems</u> Asking questions and defining problems in grades 6–8 builds from grades K–5 experiences and progresses to specifying relationships between variables, and clarifying arguments and models. Ask questions 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.	<u>PS2.B: Types of Interactions</u> Electric and magnetic (electromagnetic) forces can be attractive or repulsive, and their sizes depend on the magnitudes of the charges, currents, or magnetic strengths involved and on the distances between the interacting objects.	<u>Cause and Effect</u> Cause and effect relationships may be used to predict phenomena in natural or designed systems.

Connections to other DCIs in this grade-band: N/A

Articulation of DCIs across grade-bands: 3.PS2.B ; HS.PS2.B

NJSLS- ELA: RST.6-8.1

NJSLS- Math: MP.2

5E MODEL

MS-PS2-3. Ask questions about data to determine the factors that affect the strength of electric and magnetic forces.

Engage Anticipatory Set	Use these short video clips to explain magnetism, magnetic forces, electric currents, and motors. <u>Magnetism</u> http://www.neok12.com/video/Magnetism/zX4752067171765e67545d45.htm Try the experiment to view the magnetic field lines seen on the video. You will need white paper, iron filings, and several different magnets for each group. Make sure to record your findings and to draw pictures of what you observe in your science notebooks! View the How does electricity create a magnet video clip (4:57 minutes) http://www.neok12.com/video/Magnetism/zX57555a4f5f0b606e625063.htm
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	Try to create your own electromagnet as described in the video. You will need 20-30 staples, a piece of paper, a length of fine copper wire, and several batteries for each group. Make sure to record your data and findings and to draw pictures of what you observe in your science notebooks! So, How do motors work? The transformation of electrical energy to mechanical energy is best seen in a short video such as NeoK12's 2:20 minute video about How to build a simple motor, and how it works: http://www.neok12.com/php/watch.php?v=zX5b4c696f007c5c7d525a6b&t=How-It-Works <u>Put the Charge in the Goal</u> To Explore electric fields and electric charges, students will utilize the following interactive. This interactive challenges students to put the electron into the goal using positive and negative charges. http://www.physicsclassroom.com/Physics-Interactives/Static-Electricity/Put-the-Charge-in-the-Goal
Exploration Student Inquiry	<u>Electromagnets</u> In this activity, students will make an electromagnet and evaluate how the strength of the electromagnet can be changed. http://betterlesson.com/lesson/637179/electromagnets
Explanation Concepts and Practices	<u>In these lessons:</u> Teachers Should: Introduce formal labels, definitions, and explanations for concepts, practices, skills or abilities. Students Should: Verbalize conceptual understandings and demonstrate scientific and engineering practices. <u>Topics to Be Discussed in Teacher Directed Lessons (Disciplinary Core Ideas):</u> PS2.B: Types of Interactions Electric and magnetic (electromagnetic) forces can be attractive or repulsive, and their sizes depend on the magnitudes of the charges, currents, or magnetic strengths involved and on the distances between the interacting objects.
Elaboration Extension Activity	Related Activities: MS-PS2-3 http://www.ck12.org/ngss/middle-school-physical-sciences/motion-and-stability:-forces-and-interactions
Evaluation Assessment Tasks	<u>Assessment Task A: Electromagnets, Students in Action (activity guide and summary).</u> Students should be assessed based upon the quality of their questions and ability for frame a hypothesis based on observations and scientific principles. Ask questions 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.

PHYSICAL SCIENCE

MS. Motion and Stability: Forces and Interactions

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.

Clarification Statement: Examples of evidence for arguments could include data generated from simulations or digital tools; and charts displaying mass, strength of interaction, distance from the Sun, and orbital periods of objects within the solar system.

Assessment Boundary: Assessment does not include Newton's Law of Gravitation and Kepler's Laws.

Evidence Statements: MS-PS2-4

Science & Engineering Practices	Disciplinary Core Ideas	Cross-Cutting Concepts
Engaging in Argument from Evidence Engaging in argument from evidence in 6–8 builds from K–5 experiences and progresses to constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed world. Construct and present oral and written arguments 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. Connections to Nature of Science Scientific Knowledge is Based on Empirical Evidence Science knowledge is based upon logical and conceptual connections between evidence and explanations.	PS2.B: Types of Interactions Gravitational forces are always attractive. 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—e.g., Earth and the sun.	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.

Connections to other DCIs in this grade-band: MS.ESS1.A ; MS.ESS1.B ; MS.ESS2.C

Articulation of DCIs across grade-bands: 5.PS2.B ; HS.PS2.B ; HS.ESS1.B

NJSLS- ELA: WHST.6-8.1

NJSLS- Math: N/A

5E MODEL

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.

Engage Anticipatory Set	Ask students “How would life be different without gravity?” Students should record their thoughts first in their notebooks. Class should then hold a discussion sharing ideas in how they lives would be different and what adjustments they would need to be make. All ideas should be recorded on a large piece of posterboard/paper
Exploration Student Inquiry	<u>Super Planet Crash</u> http://www.stefanom.org/spc/ To beat Planet Crash, students must create a planetary system that can survive for 500 years. Students will play 5 rounds. Students should observe that the closer the object is to the Sun the quicker the object moves and the larger the mass the more interference happens on the rest of the solar system. (Hint: Have your students at least in one of their rounds add the very massive Dwarf star.) <u>Gravity and Orbits Lab</u> https://phet.colorado.edu/en/simulation/gravity-and-orbits The two labs investigate how the force of gravity depends on mass as well as that the planets would continually move in a straight line due to inertia if the Sun suddenly disappeared. The labs also illustrate that the farther away the two planets are the longer (more time it takes to revolve around the Sun” <u>How Much Do I Weight on Different Planets?</u> http://www.exploratorium.edu/ronh/weight/ Have students calculate their weight on different planets. Once students have calculated their weight ask students to answer, “If your weight is different on different planets, does your mass differ on those same planets?” <u>Gravity Exploration</u> http://sciencespot.net/Media/gravlab.pdf
Explanation Concepts and Practices	In these lessons: Teachers Should: Introduce formal labels, definitions, and explanations for concepts, practices, skills or abilities. Students Should: Verbalize conceptual understandings and demonstrate scientific and engineering practices. <u>Topics to Be Discussed in Teacher Directed Lessons (Disciplinary Core Ideas):</u> <u>PS2.B: Types of Interactions</u> <u>Gravitational forces are always attractive. 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—e.g., Earth and the sun.</u>
Elaboration Extension Activity	<u>The Great Gravity Escape</u> https://www.teachengineering.org/view_activity.php?url=collection/cub_/activities/cub_mars/cub_mars_lesson04_activity1.xml
Evaluation Assessment Tasks	<u>Assessment Task A</u>

	Construct and present oral and written arguments 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. Based upon the various exploration activities, students will construct and present an oral and written argument supported by evidence and scientific reasoning. Distribute the quick guide to a well developed paragraph document to help students craft their written argument. https://docs.google.com/document/d/1QKaULOTkKr4z0F6PHvTR41E44noNdP2NupnibESg2ss/pub
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PHYSICAL SCIENCE		
MS. Motion and Stability: Forces and Interactions		
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.		
Clarification Statement: Examples of this phenomenon could include the interactions of magnets, electrically-charged strips of tape, and electrically-charged pith balls. Examples of investigations could include first-hand experiences or simulations.		
Assessment Boundary: Assessment is limited to electric and magnetic fields, and limited to qualitative evidence for the existence of fields.		
Evidence Statements: MS-PS2-5		
Science & Engineering Practices	Disciplinary Core Ideas	Cross-Cutting Concepts
Planning and Carrying Out Investigations Planning and carrying out investigations to answer questions or test solutions to problems in 6–8 builds on K–5 experiences and progresses to include investigations that use multiple variables and provide evidence to support explanations or design solutions. Conduct an investigation and evaluate the experimental design to produce data to serve as the basis for evidence that can meet the goals of the investigation.	PS2.B: Types of Interactions 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 Cause and effect relationships may be used to predict phenomena in natural or designed systems.
Connections to other DCIs in this grade-band: N/A		
Articulation of DCIs across grade-bands: 3.PS2.B ; HS.PS2.B ; HS.PS3.A ; HS.PS3.B ; HS.PS3.C		
NJSLS- ELA: RST.6-8.3, WHST.6-8.7		
NJSLS- Math: N/A		
5E MODEL		
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.		

Engage Anticipatory Set	Force: Definitions and Types- Video and Quiz http://study.com/academy/lesson/force-definition-and-types.html
Exploration Student Inquiry	<u>Measurement: Forces</u> In this lesson, students will explore the idea that forces happen every time objects interact and will learn how these invisible pushes and pulls can be measured. http://betterlesson.com/lesson/637564/measurement-forces
Explanation Concepts and Practices	<u>In these lessons:</u> Teachers Should: Introduce formal labels, definitions, and explanations for concepts, practices, skills or abilities. Students Should: Verbalize conceptual understandings and demonstrate scientific and engineering practices. <u>Topics to Be Discussed in Teacher Directed Lessons (Disciplinary Core Ideas):</u> PS2.B: Types of Interactions 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).
Elaboration Extension Activity	Measurement: Mass Relearn Activity
Evaluation Assessment Tasks	<u>Assessment Task A: Measurement Force Exploration Worksheet</u> Conduct an investigation and evaluate the experimental design to produce data to serve as the basis for evidence that can meet the goals of the investigation. Measurement Force Exploration As students collect data, make sure the data provides evidence that fields exist between objects exerting forces on each other even though the objects are not in contact

Unit 7: Astronomy

Grade: 6

Content Area: Earth and Space Science

Pacing: 20 Instructional Days

Student Learning Objectives (Performance Expectations)

[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.](#)

[MS-ESS1-2. Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system.](#)

[MS-ESS1-3. Analyze and interpret data to determine scale properties of objects in the solar system.](#)

Unit 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.

Technical Terms

Solar system, Milky Way galaxy, cyclical patterns, eclipses, tides, seasons, geosciences data, geocentric system, heliocentric system, inertia, gravity, nuclear fusion, photosphere, chromosphere, solar wind, prominence, retrograde rotation, geosynchronous orbit, apparent magnitude, barred galaxy, central bulge, cepheid variable, galactic center, globular clusters, halo, luminosity

Formative Assessment Measures

Part A: What pattern in the Earth–sun–moon system can be used to explain lunar phases, eclipses of the sun and moon, and seasons?

Students who understand the concepts are able to:

Students will develop and use a physical, graphical, or conceptual model to describe patterns in the apparent motion of the sun, moon, and stars in the sky.			
Part B: What is the role of gravity in the motions within galaxies and the solar system?			
Students who understand the concepts are able to:			
Students develop and use models to explain the relationship between the tilt of Earth’s axis and seasons.			
Part C: What are the scale properties of objects in the solar system?			
Students who understand the concepts are able to:			
Analyze and interpret data to determine similarities and differences among objects in the solar system.			
Interdisciplinary Connections			
NJSLS- ELA		NJSLS- Mathematics	
Cite specific textual evidence to support analysis of science and technical texts.(MS-ESS1-3) RST.6-8.1 Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).(MS-ESS1-3) RST.6-8.7 Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest.(MS-ESS1-1),(MS-ESS1-2) SL.8.5		Reason abstractly and quantitatively.(MS-ESS1-3) MP.2 Model with mathematics.(MS-ESS1-1),(MS-ESS1-2) MP.4 Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities.(MS-ESS1-1),(MS-ESS1-2),(MS-ESS1-3) 6.RP.A.1 Recognize and represent proportional relationships between quantities.(MS-ESS1-1),(MS-ESS1-2),(MS-ESS1-3) 7.RP.A.2 Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set.(MS-ESS1-2) 6.EE.B.6 Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities.(MS-ESS1-2) 7.EE.B.6	
Core Instructional Materials	Can include: Textbooks Series, Lab Materials, etc.		
21st Century Life and Careers	CRP2, CRP4, CRP5, CRP 6, CRP7, CRP8 ,CRP11,CRP12		
Technology Standards	8.1.8.A.1, 8.1.8.A.2, 8.1.8.A.3, 8.1.8.A.4, 8.1.8.A.5, 8.1.8.D.4, 8.1.8.D.5		
Modifications			
English Language Learners	Special Education	At-Risk	Gifted and Talented
Scaffolding	Word walls	Teacher tutoring	Curriculum compacting
Word walls	Visual aides	Peer tutoring	Challenge assignments
Sentence/paragraph frames	Graphic organizers	Study guides	Enrichment activities
Bilingual dictionaries/translation	Multimedia	Graphic organizers	Tiered activities
Think alouds	Leveled readers	Extended time	Independent research/inquiry
Read alouds	Assistive technology	Parent communication	Collaborative teamwork
Highlight key vocabulary	Notes/summaries	Modified assignments	Higher level questioning

Annotation guides Think-pair- share Visual aides Modeling Cognates	Extended time Answer masking Answer eliminator Highlighter Color contrast	Counseling	Critical/Analytical thinking tasks Self-directed activities
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EARTH AND SPACE SCIENCES		
MS-ESS1-1 Earth's Place in the Universe		
<u>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.</u>		
Clarification Statement: Examples of models can be physical, graphical, or conceptual.		
Assessment Boundary: N/A		
<u>Evidence Statements: MS-ESS1-1</u>		
Science & Engineering Practices	Disciplinary Core Ideas	Cross-Cutting Concepts
<u>Developing and Using Models</u> <u>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.</u> <u>Develop and use a model to describe phenomena.</u>	<u>ESS1.A: The Universe and Its Stars</u> <u>Patterns of the apparent motion of the sun, the moon, and stars in the sky can be observed, described, predicted, and explained with models.</u> <u>ESS1.B: Earth and the Solar System</u> <u>This model of the solar system can explain eclipses of the sun and the moon. Earth’s spin axis is fixed in direction over the short-term but tilted relative to its orbit around the sun. The seasons are a result of that tilt and are caused by the differential intensity of sunlight on different areas of Earth across the year.</u>	<u>Patterns</u> <u>Patterns can be used to identify cause-and-effect relationships.</u> 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.
Connections to other DCIs in this grade-band: MS.PS2.A ; MS.PS2.B		
Articulation of DCIs across grade-bands: 3.PS2.A ; 5.PS2.B ; 5.ESS1.B ; HS.PS2.A ; HS.PS2.B ; HS.ESS1.B		

NJSLS- ELA: SL.8.5	
NJSLS- Math: MP.4, 6.RP.A.1, 7.RP.A.2	
<u>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.</u>	
Engage Anticipatory Set	Begin by having students view the following video series: http://www.visuallearningsys.com/digital-science/preview. This series will provide students with an introduction to the Earth-sun-moon system by discussing the following topics: Planet Earth, Earth in Space, The Sun, Earth's Moon, Phases of the Moon, Eclipses and Tides. Provide students with the worksheet Video Review from the following learning guide to complete as they watch the video series (p. 18). http://s3.amazonaws.com/VLCmedia/Digital_Science_Preview/Guide/Exploring_Earth_Sun_and_Moon_Guide.pdf. Following the videos, review the post-video questions from the Video Review worksheet as a class.
Exploration Student Inquiry	To begin the lesson, have students view the following animations: These short animations provide visual representations of the following topics: Gravity, Lunar Eclipses, Phases of the Moon, Size of Earth to Sun, Size of Moon to Earth, Solar Eclipses and Tides. http://www.visuallearningsys.com/digital-science/preview <u>Lab Activity: Moon Phases and Eclipses</u> Use the following resources to guide students through a series of lab activities. http://www.myips.org/cms/lib8/IN01906626/Centricity/Domain/8123/Moon.pdf Lab Activity 1: What do You Think Causes the Phases of the Moon? Lab Activity 2: Modeling the Phases of the Moon Lab Activity 3: Determining which way the moon revolves around Earth Lab Activity 4: Synthesizing Your Understanding of the Phases of the Moon Lab Activity 5: Why Do We Always See the Same Side of the Moon? Lab Activity 6: What Causes Solar and Lunar Eclipses? Lab Activity 7: Why Don't We Have Solar and Lunar Eclipses Every Month?
Explanation Concepts and Practices	<u>In these lessons</u> Teachers Should: Introduce formal labels, definitions, and explanations for concepts, practices, skills or abilities. Students Should: Verbalize conceptual understandings and demonstrate scientific and engineering practices. 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. ESS1.B: Earth and the Solar System This model of the solar system can explain eclipses of the sun and the moon. Earth's spin axis is fixed in direction over the short-term but tilted relative to its orbit around the sun. The seasons are a result of that tilt and are caused by the differential intensity of sunlight on different areas of Earth across the year.

Elaboration Extension Activity	Phases of the Moon: In this activity, students will create a model to show how the regular motions of the Moon because Moon phases. http://betterlesson.com/lesson/636034/phases-of-the-moon
Evaluation Assessment Tasks	<u>Assessment Task A: Post-Lab Reflection Questions (Activities 1-7)</u> <u>Assessment Task B: Model Evaluation & Reflection</u> Develop and use a model to describe phenomena. Once students have made their models and reviewed them with the teacher, ask them to reflect on the accuracy of their model. Ask them to write a paragraph that compares the theory the developed in Lab Activity 1 to the actual arrangement of the sun, moon and Earth to create the phases of the moon, eclipses. and the seasons. What was similar? What was different? Were they surprised by the outcome? Did it bring up any questions? Ask students to hold a discussion with their partner before drafting the final paragraph.

EARTH AND SPACE SCIENCES

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

MS-ESS1-2. Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system.

Clarification Statement: Emphasis for the model is on gravity as the force that holds together the solar system and Milky Way galaxy and controls orbital motions within them. Examples of models can be physical (such as the analogy of distance along a football field or computer visualizations of elliptical orbits) or conceptual (such as mathematical proportions relative to the size of familiar objects such as students' school or state).

Assessment Boundary: Assessment does not include Kepler's Laws of orbital motion or the apparent retrograde motion of the planets as viewed from Earth.

Evidence Statements: MS-ESS1-2

Science & Engineering Practices	Disciplinary Core Ideas	Cross-Cutting Concepts
<u>Developing and Using Models</u> 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. <u>Develop and use a model to describe phenomena.</u>	<u>ESS1.A: The Universe and Its Stars</u> Earth and its solar system are part of the Milky Way galaxy, which is one of many galaxies in the universe. <u>ESS1.B: Earth and the Solar System</u> 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.	<u>Systems and System Models</u> Models can be used to represent systems and their interactions. 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.

Connections to other DCIs in this grade-band: MS.PS2.A ; MS.PS2.B

Articulation of DCIs across grade-bands: 3.PS2.A ; 5.PS2.B ; 5.ESS1.A ; 5.ESS1.B ; HS.PS2.A ; HS.PS2.B ; HS.ESS1.A ; HS.ESS1.B

NJSLS- ELA: SL.8.5

NJSLS- Math: MP.4, 6.RP.A.1, 7.RP.A.2, 6.EE.B.6, 7.EE.B.6

5E Model

MS-ESS1-2. Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system.

Engage Anticipatory Set	The following link provides introductory resources on the topic including videos and discussion questions. Gravity in the Solar System
Exploration Student Inquiry	Students will make a 3D model of gravity. The following website provides a full lesson plan and explanation of procedures. Group students into small groups. Have the following supplies for each group: hula hoop, approximately 1m2 (depends on size of hula hoop) of stretchy Lycra material (or a garbage bags), Bulldog clips, a rock and three or four balls (marble, golf ball, ping pong ball)

	The Pull of the Planets Following the activity, each group will be assigned a common misconception about gravity. Students will use research material to explain the misconceptions. When Gravity Gets You Down
Explanation Concepts and Practices	<u>In these lessons</u> Teachers Should: Introduce formal labels, definitions, and explanations for concepts, practices, skills or abilities. Students Should: Verbalize conceptual understandings and demonstrate scientific and engineering practices. ESS1.A: The Universe and Its Stars Earth and its solar system are part of the Milky Way galaxy, which is one of many galaxies in the universe. 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. The solar system appears to have formed from a disk of dust and gas, drawn together by gravity.
Elaboration Extension Activity	<u>Additional Activities: Better Lessons</u> MS-ESS1-2
Evaluation Assessment Tasks	Assessment Task A: Model Creation Develop and use a model to describe phenomena. Students will create models that conclude that based on the mass and distance of the object (planet, comet, asteroid, meteoroid, etc...), the object's gravitational force is proportional. Within the explanation of the model, students will conclude that the orbital motion is caused by gravity. Develop a rubric to assess the above criteria.

EARTH AND SPACE SCIENCES		
MS-ESS1-3 Earth's Place in the Universe		
<u>MS-ESS1-3. Analyze and interpret data to determine scale properties of objects in the solar system.</u>		
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.		
Evidence Statements: <u>MS-ESS1-3</u>		
Science & Engineering Practices	Disciplinary Core Ideas	Cross-Cutting Concepts
<u>Analyzing and Interpreting Data</u> 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 determine similarities and differences in findings.	<u>ESS1.B: Earth and the Solar System</u> 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.	<u>Scale, Proportion, and Quantity</u> Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small. Connections to Engineering, Technology, and Applications of Science <u>Interdependence of Science, Engineering, and Technology</u> 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.
Connections to other DCIs in this grade-band: MS.ESS2.A		
Articulation of DCIs across grade-bands: 5.ESS1.B ; HS.ESS1.B ; HS.ESS2.A		
NJSLS- ELA: RST.6-8.1, RST.6-8.7		
NJSLS- Math: MP.2, 6.RP.A.1, 7.RP.A.2		
5E Model		
<u>MS-ESS1-3. Analyze and interpret data to determine scale properties of objects in the solar system.</u>		
Engage Anticipatory Set	Begin lesson by asking students to draw a diagram of the solar system in and label all items. Remind students that they can use only one sheet of paper. Have students walk around the room and look at each other's diagrams. Have them discuss what they noticed about each other's diagrams. If you have access to a document camera you can use this to share the diagrams. Guide the discussion to focus on the size and distance of objects.	
Exploration Student Inquiry	Explain that all the images we know of the solar system are not to scale. In order to create a true model of the solar system, a much bigger is needed. Have students view the video: A Scale Model of the Solar System http://digg.com/video/scale-model-solar-system Distance Between Objects	

	http://joshworth.com/dev/pixelspace/pixelspace_solarsystem.html Create a worksheet or chart on which student will record the distance from the sun for each planet. After completing the worksheet, create questions which require the student to analyze and interpret the data they recorded on the distance between these solar system objects. <u>Size and Distance Comparison</u> http://education.nationalgeographic.com/activity/planetary-size-and-distance-comparison/ <u>Culminating Activity</u> After having viewed and analyzed the data presented in these resources, have students work independently to summarize, in writing, what they learned about our solar system, including: - locations of planets in relation to the sun and one another - relative sizes of planets, including Earth - relative distances of planets - any conclusions they can draw about the locations of the asteroid belt and Kuiper belt
Explanation Concepts and Practices	<u>In these lessons</u> Teachers Should: Introduce formal labels, definitions, and explanations for concepts, practices, skills or abilities. Students Should: Verbalize conceptual understandings and demonstrate scientific and engineering practices. <u>ESS1.B: Earth and the Solar System</u> 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.
Elaboration Extension Activity	Have student explore the following site: Build a Solar System Model. This website provides digital tools to determine accurate size and distance between the objects in our solar system, assisting students in creating an accurate model. http://www.exploratorium.edu/ronh/solar_system/
Evaluation Assessment Tasks	<u>Assessment Task A: Planetary Size Comparison Chart</u> http://media.education.nationalgeographic.com/assets/file/Planetary_Size_Comparison_Worksheet.pdf <u>Assessment Task B: Stepping Out in the Solar System</u> http://media.education.nationalgeographic.com/assets/file/Stepping_Out_the_Solar_System_Worksheet.pdf <u>Assessment Task C: Analysis & Interpretation of Data</u> Analyze and interpret data to determine similarities and differences in findings. Have students work independently to summarize, in writing, what they learned about our solar system, including: - locations of planets in relation to the sun and one another - relative sizes of planets, including Earth - relative distances of planets - any conclusions they can draw about the locations of the asteroid belt and Kuiper belt

Unit 8: Weather and Climate	
Grade: 6	
Content Area: Earth and Space Science	
Pacing: 20 Instructional Days	
Essential Question	
What factors interact and influence weather and climate?	
Student Learning Objectives (Performance Expectations)	
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.	
Unit 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 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 though the ocean and atmosphere. The crosscutting concepts of cause and effect, systems and system models, and energy and matter are called out as frameworks for understanding the disciplinary core ideas. In this unit, students are expected to demonstrate proficiency in developing and using models and planning and carrying out investigations as they make sense of the disciplinary core ideas. Students are also expected to use these practices to demonstrate understanding of the core ideas.	
Technical Terms	
Geosystems, cycling of matter, flow of energy, advection, radiation, conduction, convection, insulation, albedo, troposphere, stratosphere, thermosphere, ionosphere, trophism	
Formative Assessment Measures	
<i>Part A: What are the processes involved in the cycling of water through Earth's systems?</i>	
<u>Students who understand the concepts are able to:</u>	
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.	
<i>Part B: What is the relationship between the complex interactions of air masses and changes in weather conditions?</i>	
<u>Students who understand the concepts are able to:</u>	
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.	
<i>Part C: What are the major factors that determine regional climates?</i>	
<u>Students who understand the concepts are able to:</u>	
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.	

Interdisciplinary Connections			
NJSL- ELA		NJSL- Mathematics	
Cite specific textual evidence to support analysis of science and technical texts.(MS-ESS2-5),(MS-ESS3-5) RST.6-8.1 Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic.(MS-ESS2-5) RST.6-8.9 Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation.(MS-ESS2-5) WHST.6-8.8 Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest.(MS-ESS2-6) SL.8.5		Reason abstractly and quantitatively.(MS-ESS2-5),(MS-ESS3-5) MP.2 Understand that positive and negative numbers are used together to describe quantities having opposite directions or values (e.g., temperature above/below zero, elevation above/below sea level, credits/debits, positive/negative electric charge); use positive and negative numbers to represent quantities in real-world contexts, explaining the meaning of 0 in each situation.(MS-ESS2-5) 6.NS.C.5 Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set.(MS-ESS3-5) 6.EE.B.6	
Core Instructional Materials	Can include: Textbooks Series, Lab Materials, etc.		
21st Century Life and Careers	CRP2, CRP4, CRP5, CRP 6, CRP7, CRP8 ,CRP11,CRP12		
Technology Standards	8.1.8.A.1, 8.1.8.A.2, 8.1.8.A.3, 8.1.8.A.4, 8.1.8.A.5, 8.1.8.D.2, 8.1.8.D.3, 8.1.8.D.4, 8.1.8.D.5, 8.2.8.A.5		
Modifications			
English Language Learners	Special Education	At-Risk	Gifted and Talented
Scaffolding Word walls Sentence/paragraph frames Bilingual dictionaries/translation Think alouds Read alouds Highlight key vocabulary Annotation guides Think-pair- share Visual aides Modeling Cognates	Word walls Visual aides Graphic organizers Multimedia Leveled readers Assistive technology Notes/summaries Extended time Answer masking Answer eliminator Highlighter Color contrast	Teacher tutoring Peer tutoring Study guides Graphic organizers Extended time Parent communication Modified assignments Counseling	Curriculum compacting Challenge assignments Enrichment activities Tiered activities Independent research/inquiry Collaborative teamwork Higher level questioning Critical/Analytical thinking tasks Self-directed activities

EARTH AND SPACE SCIENCE

MS-ESS2-4 Earth's Systems

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.

Clarification Statement: Emphasis is on the ways water changes its state as it moves through the multiple pathways of the hydrologic cycle. Examples of models can be conceptual or physical.

Assessment Boundary: A quantitative understanding of the latent heats of vaporization and fusion is not assessed.

Evidence Statements: MS-ESS2-4

Science & Engineering Practices	Disciplinary Core Ideas	Cross-Cutting Concepts
<u>Developing and Using Models</u> <u>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.</u> <u>Develop a model to describe unobservable mechanisms.</u>	<u>ESS2.C: The Roles of Water in Earth's Surface Processes</u> <u>Water continually cycles among land, ocean, and atmosphere via transpiration, evaporation, condensation and crystallization, and precipitation, as well as downhill flows on land.</u> <u>Global movements of water and its changes in form are propelled by sunlight and gravity.</u>	<u>Energy and Matter</u> <u>Within a natural or designed system, the transfer of energy drives the motion and/or cycling of matter.</u>

Connections to other DCIs in this grade-band: MS.PS1.A ; MS.PS2.B ; MS.PS3.A ; MS.PS3.D

Articulation of DCIs across grade-bands: 3.PS2.A ; 4.PS3.B ; 5.PS2.B ; 5.ESS2.C ; HS.PS2.B ; HS.PS3.B ; HS.PS3.D ; HS.PS4.B ; HS.ESS2.A ; HS.ESS2.C ; HS.ESS2.D

NJSLS- ELA: N/A

NJSLS- Math: N/A

5E Model

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.

Engage Anticipatory Set	<u>Amazon Water Cycle Role Play</u> http://www.calacademy.org/educators/lesson-plans/amazon-water-cycle-role-play
Exploration Student Inquiry	<u>Modeling Watershed</u> In this activity, students use models to demonstrate how energy from the sun and the force of gravity impacts how groundwater moves. http://betterlesson.com/lesson/638308/modeling-watersheds
Explanation Concepts and Practices	<u>In these lessons</u> Teachers Should: Introduce formal labels, definitions, and explanations for concepts, practices, skills or abilities. Students Should: Verbalize conceptual understandings and demonstrate scientific and engineering practices. <u>ESS2.C: The Roles of Water in Earth's Surface Processes</u> <u>Water continually cycles among land, ocean, and atmosphere via transpiration, evaporation, condensation and crystallization, and precipitation, as well as downhill flows on land.</u>

	<u>Global movements of water and its changes in form are propelled by sunlight and gravity.</u>
Elaboration Extension Activity	Hands-on Activity: Natural and Urban "Stormwater" Water Cycle Models https://www.teachengineering.org/view_activity.php?url=collection/usf_/activities/usf_stormwater/usf_stormwater_lesson01_activity1.xml Monthly Climate Tables/Precipitation Charts http://climate.rutgers.edu/stateclim_v1/data/index.html Discussion Questions: How does duration and intensity of precipitation impact the water cycle? Compare the precipitation totals of different regions of NJ How would storms affect the movement of water through the water cycle? <u>Related Activities:</u> Earth Science Week http://www.earthsciweek.org/ngss-performance-expectations/ms-ess2-4
Evaluation Assessment Tasks	<u>Assessment Task A: Groundwater Simulator</u> Model Rubric

EARTH AND SPACE SCIENCE

MS-ESS2-5 Earth's Systems

MS-ESS2-5. Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions.

Clarification Statement: Emphasis is on how air masses flow from regions of high pressure to low pressure, causing weather (defined by temperature, pressure, humidity, precipitation, and wind) at a fixed location to change over time, and how sudden changes in weather can result when different air masses collide. Emphasis is on how weather can be predicted within probabilistic ranges. Examples of data can be provided to students (such as weather maps, diagrams, and visualizations) or obtained through laboratory experiments (such as with condensation).

Assessment Boundary: Assessment does not include recalling the names of cloud types or weather symbols used on weather maps or the reported diagrams from weather stations.

Evidence Statements: MS-ESS2-5

Science & Engineering Practices	Disciplinary Core Ideas	Cross-Cutting Concepts
<u>Planning and Carrying Out Investigations</u> <u>Planning and carrying out investigations in 6-8 builds on K-5 experiences and progresses to include investigations that use multiple variables and provide evidence to support explanations or solutions.</u> <u>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.</u>	<u>ESS2.C: The Roles of Water in Earth's Surface Processes</u> <u>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.</u> <u>ESS2.D: Weather and Climate</u> <u>Because these patterns are so complex, weather can only be predicted probabilistically.</u>	<u>Cause and Effect</u> <u>Cause and effect relationships may be used to predict phenomena in natural or designed systems.</u>

Connections to other DCIs in this grade-band: MS.PS1.A ; MS.PS2.A ; MS.PS3.A ; MS.PS3.B

Articulation of DCIs across grade-bands: 3.ESS2.D ; 5.ESS2.A ; HS.ESS2.C ; HS.ESS2.D

NJSLS- ELA: RST.6-8.1, RST.6-8.9, WHST.6-8.8

NJSLS- Math: MP.2, 6.NS.C.5

5E Model

MS-ESS2-5. Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions.

Engage Anticipatory Set	Begin lesson by showing a short video clip of a broadcast weather forecast by going to following website: Weather Channel Select the Forecast tab. Choose the national forecast and play this for the class. You can also try any of the major network station websites either in your area or nationally for their videos. After showing the video, ask the class how daily information is presented? What units are given? Where is evidence of fronts, high/low pressure, temperature, precipitation, cloud cover, humidity or wind speeds?
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	Much of what they will be studying is captured in a few minutes of video and now it's their turn to try their hand at predicting the weather.
Exploration Student Inquiry	<u>Weather Forecasting Online Activity</u> In this lesson, students will analyze weather maps as they develop their own understanding of the relationships between air pressure and clouds, factors that influence climate, weather fronts and the jet stream. http://betterlesson.com/lesson/638300/weather-forecasting-online-activity
Explanation Concepts and Practices	<u>In these lessons</u> Teachers Should: Introduce formal labels, definitions, and explanations for concepts, practices, skills or abilities. Students Should: Verbalize conceptual understandings and demonstrate scientific and engineering practices. ESS2.C: The Roles of Water in Earth's Surface Processes 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. ESS2.D: Weather and Climate Because these patterns are so complex, weather can only be predicted probabilistically.
Elaboration Extension Activity	Once students have made their predictions and reviewed them with the teacher, ask them to reflect on the accuracy of their model. Ask them to write a paragraph that compares their prediction to the actual forecast for day 4. What was similar? What was different? Were they surprised by the outcome? Did it bring up any questions? Ask students to hold a discussion with their partner before drafting the final paragraph.
Evaluation Assessment Tasks	<u>Assessment Task A: Weather Forecasting Packets</u> http://betterlesson.com/lesson/resource/3250148/weather-forecasting-internet-packet?from=resource_title 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. <u>Assessment Task B: Weather Forecasting Discussion Questions</u> http://betterlesson.com/lesson/resource/3250150/weather-forecasting-discussion-questions 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.

EARTH AND SPACE SCIENCE

MS-ESS2-6 Earth's Systems

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.

Clarification Statement: Emphasis is on how patterns vary by latitude, altitude, and geographic land distribution. Emphasis of atmospheric circulation is on the sunlight-driven latitudinal banding, the Coriolis effect, and resulting prevailing winds; emphasis of ocean circulation is on the transfer of heat by the global ocean convection cycle, which is constrained by the Coriolis effect and the outlines of continents. Examples of models can be diagrams, maps and globes, or digital representations.

Assessment Boundary: Assessment does not include the dynamics of the Coriolis effect.

Evidence Statements: [MS-ESS2-6](#)

Science & Engineering Practices	Disciplinary Core Ideas	Cross-Cutting Concepts
Developing and Using Models Modeling in 6–8 builds on K–5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems. Develop and use a model to describe phenomena.	ESS2.C: The Roles of Water in Earth's Surface Processes Variations in density due to variations in temperature and salinity drive a global pattern of interconnected ocean currents. 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. 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.	Systems and System Models Models can be used to represent systems and their interactions—such as inputs, processes and outputs—and energy, matter, and information flows within systems.

Connections to other DCIs in this grade-band: MS.PS2.A ; MS.PS3.B ; MS.PS4.B

Articulation of DCIs across grade-bands: 3.PS2.A ; 3.ESS2.D ; 5.ESS2.A ; HS.PS2.B ; HS.PS3.B ; HS.PS3.D ; HS.ESS1.B ; HS.ESS2.A ; HS.ESS2.D

NJSLS- ELA: SL.8.5

NJSLS- Math: N/A

5E Model

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.

Engage Anticipatory Set	Begin with a question-answer activity- Have you ever been to the beach on a hot day? Where is it cooler, on the water or on the sand? Demonstration- using two lamps. One lamp should be over a tray of water, one lamp should be over a tray of sand. Students will be able to touch the water and the sand and compare and contrast the difference in the temperature. Thermometers can also be used to determine the temperature of the sand and water. Ask students, If sand and water both absorb energy from the sun why do they feel so different?
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Exploration Student Inquiry	<u>Day 1:</u> Group students into pairs. Conduct the following experiment using these resources: Before conducting experiment have students make predictions about the rate of heating for each material. During experiment, students will collect data and make inferences based on their observations. Students will record information in data tables and later analyze their data. 1. Fill one cup with water. 2. Fill one cup with soil. 3. Stand one thermometer in the water and one in the soil. 4. Read and record the temperatures of each cup at room temperature. 5. Place both cups under the lamp. Wait several minutes for cups to absorb the lamp's heat. 6. Read and record the temperatures of each cup a second time. 7. Were there any changes in temperature? The temperature of the soil should rise (heat up) first, as the soil absorbs heat faster than water. 8. Remove the cans from under the lamp and leave at room temperature for several minutes. 9. Read and record the temperatures of each cup. <u>Day 2:</u> Students will create a graph based on the data they collected. They will graph the temperature increase and decrease over a period of minutes. Students will use the data collected to draw a model (line graph) of the land and water and predict how temperature will change during the course of 24 hours (the model should show that the land heats up and cools down faster than the water). Students will present their graphs and models. <u>Day 3:</u> <i>Exploration Questions</i> Hold a class discussion. Ask students to describe the heating and cooling rates of land and water in this investigation. Have students record their findings and answers to the following questions: Which material held its heat longer? What factors may have influenced your results? Why did the land change temperature the faster than the water? Next, students will observe animations of land and sea breezes. Animation of Land and Sea Breezes: http://www.classzone.com/books/earth_science/terc/content/visualizations/es1903/es1903page01.cfm They will compare the animation to their model and prediction. Students will have to explain their models. - Is the pattern in your model similar or different to those shown in the animation? Explain your findings.
Explanation	<u>In these lessons</u> Teachers Should: Introduce formal labels, definitions, and explanations for concepts, practices, skills or abilities.

Concepts and Practices	Students Should: Verbalize conceptual understandings and demonstrate scientific and engineering practices. ESS2.C: The Roles of Water in Earth's Surface Processes Variations in density due to variations in temperature and salinity drive a global pattern of interconnected ocean currents. 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. 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.
Elaboration Extension Activity	Students will work in groups to choose a geographical area (with teacher approval) and will develop and present a weather report for this region. Some presentation options include: posters, PowerPoint Presentations and videos. Teachers will identify the components which are to be included in the presentation through the use of a rubric. <u>Additional Resource:</u> http://www.nea.org/tools/lessons/hurricane-season-grades-6-8.html
Evaluation Assessment Tasks	<u>Assessment Task A: Line Graph Model</u> Develop and use a model to describe phenomena. Students will be assessed on accuracy of line graph and their ability to describe phenomena based upon data collected. Use the discussion questions as a guide. <u>Assessment Task B: Model Reflection Questions</u> Students will compare their models to the animation. Students must be able to answer the following question: Is the pattern in your model similar or different to those shown in the animation? Explain your findings.