MIDLAND PARK PUBLIC SCHOOLS
Midland Park, New Jersey
CURRICULUM

Science
Grade 6

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CCCS born on 9/2012
Revised 5/2013
NJSLS born on 9/2016

Grade 6 Science Curriculum Overview

Grade 6 science is taught in seven units throughout the school year. The science curriculum is a hands-on, open-ended and sequential process of investigating the biological and physical world. As part of the spiraling curriculum, aspects of physical science, life science, earth & space science, and engineering; technology & applications of science are taught throughout the year. A guided inquiry program gives students the opportunity to explore topics and concepts though investigations. Participating in this hands-on program helps students:

1. To foster a life-long enjoyment of learning science.
2. To observe science in the world around them.
3. To meet the science standards for New Jersey Public Schools.

Suggested Course Sequence*:

Unit 1: Growth, Development, and Reproduction of Organisms: 25 days
Unit 2: Matter and Energy in Organisms and Ecosystems: 25 days
Unit 3: Interdependent Relationships in Ecosystems: 25 days
Unit 4: Forces and Motion: 25 days
Unit 5: Types of Interactions: 25 days
Unit 6: Astronomy: 25 days
Unit 7: Weather and Climate: 25 days

Pre-Requisite: Grade 5 Science

**The number of instructional days is an estimate based on the information available at this time. 1 day equals approximately 42 minutes of seat time. Teachers are strongly encouraged to review the entire unit of study carefully and collaboratively to determine whether adjustments to this estimate need to be made.*

Content Area: Science

Unit Title: Growth, Development, and Reproduction of Organisms

Grade Level: 6

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.

Interdisciplinary Connections:

English Language Arts/Literacy

• Cite specific, empirical, textual evidence to support analysis of how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants, respectively.

• Trace and evaluate the argument and specific claims in a text about how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants, respectively. Distinguish claims that are supported by empirical evidence and scientific reasoning from claims that are not.

• Write an argument focused on how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants, respectively.

Mathematics

• Understand that a set of data collected to answer a statistical question about how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants, respectively, has a distribution which can be described by its center (mean), spread (range), and overall shape (shape of the distribution of data).

• Summarize numerical data sets, collected to answer a statistical question about how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants, respectively, that have a distribution that can be described by its center (mean), spread (range), and overall shape (shape of the distribution of data) in relation to their context.

21st Century Themes and Skills:

- CRP1. Act as a responsible and contributing citizen and employee.
- CRP2. Apply appropriate academic and technical skills.
- CRP4. Communicate clearly and effectively and with reason.
- CRP5. Consider the environmental, social and economic impacts of decisions.
- CRP6. Demonstrate creativity and innovation.
- CRP7. Employ valid and reliable research strategies.
- CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.

- CRP9. Model integrity, ethical leadership and effective management.
- CRP11. Use technology to enhance productivity.
- CRP12. Work productively in teams while using cultural global competence.

Standards (Content and Technology):

CPI#:	Statement:
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.
8.1.8.D.4	Assess the credibility and accuracy of digital content.
8.1.8.E.1	Effectively use a variety of search tools and filters in professional public databases to find information to solve a real world problem.
8.1.8.A.4	Graph and calculate data within a spreadsheet and present a summary of the results.

Unit Essential Question(s):

- **How do characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants, respectively?**
- **How do environmental and genetic factors influence the growth of organisms?**

Unit Enduring Understandings:

- Plants reproduce in a variety of ways, sometimes depending on animal behavior and specialized features for reproduction.
  There are a variety of ways that plants reproduce.
  • Specialized structures for plants affect their probability of successful reproduction.
  • Some characteristic animal behaviors affect the probability of successful reproduction in plants.
  • Animals engage in characteristic behaviors that affect the probability of successful reproduction.
  • There are a variety of characteristic animal behaviors that affect their probability of successful reproduction.
  • There are a variety of animal behaviors that attract a mate.
  • Successful reproduction of animals and plants may have more than one cause, and some cause-and-effect relationships in systems can only be described using probability.
- Genetic factors as well as local conditions affect the growth of organisms.
  A variety of local environmental conditions affect the growth of organisms.
  • Genetic factors affect the growth of organisms (plant and animal).
  • The factors that influence the growth of

	organisms may have more than one cause. • Some cause-and-effect relationships in plant and animal systems can only be described using probability.

Unit Learning Targets/Objectives:

Students will

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

Formative Assessments:

• Collect empirical evidence about animal behaviors that affect the animals' probability of successful reproduction and also affect the probability of plant reproduction.
• Collect empirical evidence about plant structures that are specialized for reproductive success.
• 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.
• Conduct experiments, collect evidence, and analyze empirical data.
• 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.

Summative/Benchmark Assessment(s):

• 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.
• 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.

Resources/Materials (copy hyperlinks for digital resources):

Modifications:

- Special Education Students
  - Allow errors
  - Rephrase questions, directions, and explanations
  - Allow extended time to answer questions and permit drawing as an explanation
  - Accept participation on any level, even one word
- At-Risk Students
  - Provide extended time to complete tasks
  - Consult with Guidance Counselors and follow I&RS procedures/action plans

- Consult with Case Managers and follow IEP accommodations/modifications
- English Language Learners
  - Assign a buddy, same language or English speaking
  - Allow errors in speaking
  - Rephrase questions, directions, and explanations
  - Allow extended time to answer questions
  - Accept participation at any level, even one work
  - Consult with other members of the 7th grade team for specific behavior interventions
  - Provide rewards as necessary
- Gifted and Talented Students
  - Provide extension activities
  - Build on students' intrinsic motivation
  - Consult with parents to accommodate students' interests in completing tasks at their level of engagement

Lesson Name/Topic	Lesson Objective(s)	Time frame (day(s) to complete) Entire Unit: 25 Days
1	**Animal and Plant Reproduction**	15 Days
2	**Growth of Organisms**	10 Days

Teacher Notes:

Additional Resources
Click links below to access additional resources used to design this unit:
http://www.state.nj.us/education/modelcurriculum/sci/8.shtml

Content Area: Science

Unit Title: Matter and Energy in Organisms and Ecosystems

Grade Level: 6

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.

Interdisciplinary Connections:

English Language Arts/Literacy

• Cite specific, empirical, textual evidence to support analysis of how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants, respectively.

• Trace and evaluate the argument and specific claims in a text about how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants, respectively. Distinguish claims that are supported by empirical evidence and scientific reasoning from claims that are not.

• Write an argument focused on how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants, respectively.

Mathematics

• Understand that a set of data collected to answer a statistical question about how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants, respectively, has a distribution which can be described by its center (mean), spread (range), and overall shape (shape of the distribution of data).

• Summarize numerical data sets, collected to answer a statistical question about how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants, respectively, that have a distribution that can be described by its center (mean), spread (range), and overall shape (shape of the distribution of data) in relation to their context.

21st Century Themes and Skills:

- CRP1. Act as a responsible and contributing citizen and employee.
- CRP2. Apply appropriate academic and technical skills.
- CRP4. Communicate clearly and effectively and with reason.
- CRP5. Consider the environmental, social and economic impacts of decisions.
- CRP6. Demonstrate creativity and innovation.
- CRP7. Employ valid and reliable research strategies.

- CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.
- CRP9. Model integrity, ethical leadership and effective management.
- CRP11. Use technology to enhance productivity.
- CRP12. Work productively in teams while using cultural global competence.

Standards (Content and Technology):

CPI#:	Statement:
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.
8.1.8.A.1	Demonstrate knowledge of a real world problem using digital tools. Select and use applications effectively and productively.
8.1.8.A.4	Graph and calculate data within a spreadsheet and present a summary of the results.
8.1.8.B.1	Synthesize and publish information about a local or global issue or event (ex. telecollaborative project, blog, school web).
8.1.8.D.4	Assess the credibility and accuracy of digital content.
8.1.8.E.1	Effectively use a variety of search tools and filters in professional public databases to find information to solve a real world problem.

Unit Essential Question(s):

- **How do changes in the availability of matter and energy effect populations in an ecosystem?**
- **How do relationships among organisms, in an ecosystem, effect populations?**
- **How can you explain the stability of an ecosystem by tracing the flow of matter and energy?**

Unit Enduring Understandings:

- Organisms and populations of organisms are dependent on their environmental interactions with other living things.
  - Organisms and populations of organisms are dependent on their environmental interactions with nonliving factors.
  - In any ecosystem, organisms and populations with similar requirements for food, water, oxygen, or other resources may compete with others for limited resources.
  - Access to food, water, oxygen, or other resources constrain organisms' growth and reproduction.
- Predatory interactions may reduce the number of organisms or eliminate whole populations of organisms.
  - Mutually beneficial interactions may become so interdependent that each organism requires the other for survival.
  - The patterns of interactions of organisms with their environment, both its living and nonliving components, are shared.
  - Interactions within ecosystems have patterns that can be used to identify

	cause-and-effect relationships. • Patterns of interactions among organisms across multiple ecosystems can be predicted. • Patterns of interactions can be used to make predictions about the relationships among and between organisms and abiotic components of Ecosystems. • Food webs are models that demonstrate how matter and energy are transferred among producers, consumers, and decomposers as the three groups interact within an ecosystem. • Transfers of matter into and out of the physical environment occur at every level. • Decomposers recycle nutrients from dead plant or animal matter back to the soil in terrestrial environments. • Decomposers recycle nutrients from dead plant or animal matter back to the water in aquatic environments. • The atoms that make up the organisms in an ecosystem are cycled repeatedly between the living and nonliving parts of the ecosystem. • The transfer of energy can be tracked as energy flows through an ecosystem. • Science assumes that objects and events in ecosystems occur in consistent patterns that are understandable through measurement and observation.

Unit Learning Targets/Objectives:

Students will

- **Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.**
- **Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.**
- **Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.**

Formative Assessments:
• 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.
• 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.
• Observe and measure patterns of objects and events in ecosystems.

Summative/Benchmark Assessment(s):
• Construct an explanation about interactions within ecosystems.
• Develop a model to describe the cycling of matter among living and nonliving parts of an ecosystem.
• Develop a model to describe the flow of energy among living and nonliving parts of ecosystem. Track the transfer of energy as energy flows through an ecosystem.

Resources/Materials (copy hyperlinks for digital resources):
Modeling Marine Food Webs and Human Impact
Interactive Interdependence
Florida's Everglades: The River of Grass

Modifications:
- Special Education Students
  - Allow errors
  - Rephrase questions, directions, and explanations
  - Allow extended time to answer questions and permit drawing as an explanation
  - Accept participation on any level, even one word
  - Consult with Case Managers and follow IEP accommodations/modifications
- English Language Learners
  - Assign a buddy, same language or English speaking
  - Allow errors in speaking
  - Rephrase questions, directions, and explanations
  - Allow extended time to answer questions
  - Accept participation at any level, even one work
- At-Risk Students
  - Provide extended time to complete tasks
  - Consult with Guidance Counselors and follow I&RS procedures/action plans
  - Consult with other members of the 7th grade team for specific behavior interventions
  - Provide rewards as necessary
- Gifted and Talented Students
  - Provide extension activities
  - Build on students' intrinsic motivation
  - Consult with parents to accommodate students' interests in completing tasks at their level of engagement

Lesson Name/Topic	Lesson Objective(s)	Time frame (day(s) to complete) Entire Unit: 25 Days
1	Resource Availability	8 Days
2	Organism Interactions	9 Days

3	**Flow of Energy**	8 Days

Teacher Notes:

Additional Resources

Click links below to access additional resources used to design this unit:

http://www.state.nj.us/education/modelcurriculum/sci/8.shtml

Content Area: Science

Unit Title: Interdependent Relationships in Ecosystems

Grade Level: 6

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.

Interdisciplinary Connections:

English Language Arts/Literacy

- Distinguish among facts, reasoned judgment based on research findings, and speculation when reading text about maintaining biodiversity and ecosystem services. Examples of ecosystem services could include water purification, nutrient recycling, and prevention of soil erosion.
- Trace and evaluate the argument and specific claims in a text *about maintaining biodiversity and ecosystem services*, distinguishing claims that are supported by reasons and evidence from claims that are not. Trace and evaluate the arguments about specific claims in a text and assess whether the reasoning is sound and the evidence is relevant and sufficient to support the claims.
- Include multimedia components and visual displays *as part of an argument about competing design solutions based on jointly developed and agreed-upon design criteria* to clarify information. Include multimedia components and visual displays. The multimedia component and visual displays should clarify claims and findings and emphasize salient points in the presentation.

Mathematics

- Model design solutions for maintaining biodiversity and ecosystem services with mathematics. Use ratio and rate reasoning to evaluate competing design solutions for maintaining biodiversity and ecosystem services.
- Develop a model that generates data for the iterative testing of competing design solutions involving a proposed object, tool, or process that maintains biodiversity and ecosystem services, reasoning quantitatively (with amounts, numbers, sizes) and abstractly (with variables).
- Develop a probability and use it to find the probability *that designed systems, including those representing inputs and outputs, will maintain biodiversity and ecosystem services*. Compare probabilities from the model to observe frequencies. If the agreement is not good, explain possible sources of the discrepancy.

21st Century Themes and Skills:

- CRP1. Act as a responsible and contributing citizen and employee.
- CRP2. Apply appropriate academic and technical skills.
- CRP4. Communicate clearly and effectively and with reason.
- CRP5. Consider the environmental, social and economic impacts of decisions.
- CRP6. Demonstrate creativity and innovation.
- CRP7. Employ valid and reliable research strategies.

- CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.
- CRP9. Model integrity, ethical leadership and effective management.
- CRP11. Use technology to enhance productivity.
- CRP12. Work productively in teams while using cultural global competence.

Standards (Content and Technology):

CPI#:	Statement:
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.
8.1.8.A.1	Demonstrate knowledge of a real world problem using digital tools. Select and use applications effectively and productively.
8.1.8.A.4	Graph and calculate data within a spreadsheet and present a summary of the results.
8.1.8.B.1	Synthesize and publish information about a local or global issue or event (ex. telecollaborative project, blog, school web).
8.1.8.D.4	Assess the credibility and accuracy of digital content.
8.1.8.E.1	Effectively use a variety of search tools and filters in professional public databases to find information to solve a real world problem.

Formative Assessments:

- **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.**
- **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.**

Summative/Benchmark Assessment(s):

- **Construct a convincing argument that supports or refutes claims for solutions about the natural and designed world(s).**
- **Create design criteria for design solutions for maintaining biodiversity and ecosystem services.**

Resources/Materials (copy hyperlinks for digital resources):

Exploring the "Systems" in Ecosystems

Flow of Matter and Energy in Ecosystems SciPack

Problem Based Learning Scenario

You are a cargo inspection agent working in Guam to prevent the introduction of non-native species to your island. People coming into your territory often do not understand why you must spend so much time checking their cargo. Working in small groups, develop a public service announcement and media campaign to explain to the public how devastating the introduction of non-native species can be to an island ecosystem. Research how the region has been affected by invasive species. Connect with experts in the field to further your understandings. Use video clips, podcasts,

and other authentic media to help explain the impact. Focus your message on how non-native species can become invasive and affect the biodiversity of the island.

Modifications:

- Special Education Students
  - Allow errors
  - Rephrase questions, directions, and explanations
  - Allow extended time to answer questions and permit drawing as an explanation
  - Accept participation on any level, even one word
  - Consult with Case Managers and follow IEP accommodations/modifications
- English Language Learners
  - Assign a buddy, same language or English speaking
  - Allow errors in speaking
  - Rephrase questions, directions, and explanations
  - Allow extended time to answer questions
  - Accept participation at any level, even one work
- At-Risk Students
  - Provide extended time to complete tasks
  - Consult with Guidance Counselors and follow I&RS procedures/action plans
  - Consult with other members of the 7th grade team for specific behavior interventions
  - Provide rewards as necessary
- Gifted and Talented Students
  - Provide extension activities
  - Build on students' intrinsic motivation
  - Consult with parents to accommodate students' interests in completing tasks at their level of engagement

Lesson Name/Topic	Lesson Objective(s)	Time frame (day(s) to complete) Entire Unit: 25 Days
1	**Changes to Ecosystems**	13 Days*
2	**Maintaining Biodiversity**	12 Days*
*	**Design Problem Solutions**	(Incorporated in above days)
*	**Testing Solutions**	(Incorporated in above days)

Teacher Notes:

Additional Resources

Click links below to access additional resources used to design this unit:

http://www.state.nj.us/education/modelcurriculum/sci/8.shtml

Content Area: Science

Unit Title: Forces and Motion

Grade Level: 6

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.

Interdisciplinary Connections:

English Language Arts/Literacy

- Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions of the application of Newton's third law involving the motion of two colliding objects.
- Follow precisely a multistep procedure when carrying out experiments to apply Newton's third law when designing a solution to a problem involving the motion of two colliding objects, taking measurements, or performing technical tasks.
- Follow precisely a multistep procedure when performing an investigation that provides 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, taking measurements or performing technical tasks.
- Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading texts about the application of Newton's third law to the motion of two colliding objects Conduct a short research project to answer a question about the application of Newton's third law when designing a solution to a problem involving the motion of two colliding objects, drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration.
- Conduct a short research project to answer a question about how the sum of the forces on the object and the mass of the object change an object's motion, drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration.
- Gather relevant information from multiple print and digital sources that provide information about the application of Newton's third law when designing a solution to a problem involving the motion of two colliding objects; assess the credibility of each source and quote or paraphrase the data and conclusions of others while avoiding plagiarism and providing basic bibliographic information for sources.
- Draw evidence from informational texts to support analysis, reflection, and research about the application of Newton's third law when designing a solution to a problem involving the motion of two colliding objects.

Mathematics

- Reason abstractly and quantitatively when collecting and analyzing data about the application of Newton's third law in the course of designing a solution to a problem involving the motion of two colliding objects.
- Analyze data in the form of numbers and symbols to draw conclusions about how the sum of the forces on an object and the mass of an object change the object's motion.
- 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 a design that applies Newton's third law to a problem involving the motion of two colliding objects.
- When collecting and analyzing data from investigations about how the sum of the forces on an object and the mass of the object changes the object's motion, write, read, and evaluate expressions in which letters stand for

numbers.

21st Century Themes and Skills:

- CRP1. Act as a responsible and contributing citizen and employee.
- CRP2. Apply appropriate academic and technical skills.
- CRP4. Communicate clearly and effectively and with reason.
- CRP5. Consider the environmental, social and economic impacts of decisions.
- CRP6. Demonstrate creativity and innovation.
- CRP7. Employ valid and reliable research strategies.
- CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.
- CRP9. Model integrity, ethical leadership and effective management.
- CRP11. Use technology to enhance productivity.
- CRP12. Work productively in teams while using cultural global competence.

Standards (Content and Technology):

CPI#:	Statement:
MS-PS2-1	Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects. *
MS-PS2-2	Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object.
MS-ETS1-1	Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.
MS-ETS1-2	Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
MS-ETS1-3	Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
MS-ETS1-4	Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.
8.1.8.A.1	Demonstrate knowledge of a real world problem using digital tools. Select and use applications effectively and productively.
8.1.8.A.4	Graph and calculate data within a spreadsheet and present a summary of the results.
8.1.8.B.1	Synthesize and publish information about a local or global issue or event (ex. telecollaborative project, blog, school web).
8.1.8.D.4	Assess the credibility and accuracy of digital content.
8.1.8.E.1	Effectively use a variety of search tools and filters in professional public databases to find information to solve a real world problem.

Modifications:

- Special Education Students
  - Allow errors
  - Rephrase questions, directions, and explanations
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- English Language Learners
  - Assign a buddy, same language or English speaking
  - Allow errors in speaking
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  - Accept participation at any level, even one work
  - Provide rewards as necessary
- Gifted and Talented Students
  - Provide extension activities
  - Build on students' intrinsic motivation
  - Consult with parents to accommodate students' interests in completing tasks at their level of engagement

Lesson Name/Topic	Lesson Objective(s)	Time frame (day(s) to complete)
1	**Newton's Third Law**	13 Days
2	**Change in an Object's Motion**	12 Days
*	**Design Problem Solutions**	(Incorporated in above days)
*	**Evaluate Solutions**	(Incorporated in above days)
*	**Testing Solutions**	(Incorporated in above days)
*	**Develop a Model**	(Incorporated in above days)

Teacher Notes:

Additional Resources
Click links below to access additional resources used to design this unit:

http://www.state.nj.us/education/modelcurriculum/sci/8.shtml

Content Area: Science

Unit Title: Types of Interactions

Grade Level: 6

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.

Interdisciplinary Connections:

English Language Arts/Literacy

- Cite specific textual evidence to support analysis of information about science and technical texts regarding the factors that affect the strength of electric and magnetic forces, attending to the precise details of explanations or descriptions.
- Write arguments focused on evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects.

Mathematics

- Reason abstractly and quantitatively while using data to determine the factors that affect the strength of electric and magnetic forces.

21st Century Themes and Skills:

- CRP1. Act as a responsible and contributing citizen and employee.
- CRP2. Apply appropriate academic and technical skills.
- CRP4. Communicate clearly and effectively and with reason.
- CRP5. Consider the environmental, social and economic impacts of decisions.
- CRP6. Demonstrate creativity and innovation.
- CRP7. Employ valid and reliable research strategies.
- CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.
- CRP9. Model integrity, ethical leadership and effective management.
- CRP11. Use technology to enhance productivity.
- CRP12. Work productively in teams while using cultural global competence.

Standards (Content and Technology):

CPI#:	Statement:
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.
8.1.8.A.1	Demonstrate knowledge of a real world problem using digital tools. Select and use applications effectively and productively.
8.1.8.A.4	Graph and calculate data within a spreadsheet and present a summary of the results.
8.1.8.B.1	Synthesize and publish information about a local or global issue or event (ex. telecollaborative project, blog, school web).
8.1.8.D.4	Assess the credibility and accuracy of digital content.
8.1.8.E.1	Effectively use a variety of search tools and filters in professional public databases to find information to solve a real world problem.

Modifications:

- Special Education Students
  - Allow errors
  - Rephrase questions, directions, and explanations
  - Allow extended time to answer questions and permit drawing as an explanation
  - Accept participation on any level, even one word
  - Consult with Case Managers and follow IEP accommodations/modifications
- English Language Learners
  - Assign a buddy, same language or English speaking
  - Allow errors in speaking
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  - Allow extended time to answer questions
  - Accept participation at any level, even one work
- At-Risk Students
  - Provide extended time to complete tasks
  - Consult with Guidance Counselors and follow I&RS procedures/action plans
  - Consult with other members of the 7th grade team for specific behavior interventions
  - Provide rewards as necessary
- Gifted and Talented Students
  - Provide extension activities
  - Build on students' intrinsic motivation
  - Consult with parents to accommodate students' interests in completing tasks at their level of engagement

Lesson Name/Topic	Lesson Objective(s)	Time frame (day(s) to complete) Entire Unit: 25 Days
1	**Electric and Magnetic Forces**	9 Days
2	**Gravitational Interactions**	8 Days
3	**Non-Contact Forces**	8 Days

Teacher Notes:

Additional Resources

Click links below to access additional resources used to design this unit:

http://www.state.nj.us/education/modelcurriculum/sci/8.shtml

Content Area: Science

Unit Title: Astronomy

Grade Level: 6

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.

Interdisciplinary Connections:

English Language Arts/Literacy

- Include multimedia components and visual displays in presentations to describe the cyclical patterns of lunar phases, eclipses of the sun and moon, seasons, and the role of gravity in the motions within galaxies and the solar system. The presentation needs to clarify claims and findings and emphasize salient points.
- Cite specific textual evidence to support analysis of science and technical text about scale properties of objects in the solar system.
- Integrate quantitative or technical information expressed in words in a text about scale properties of objects in the solar system with a version of that information expressed visually in a flowchart, diagram, model, graph, or table.

Mathematics

- Reason quantitatively and abstractly about the sizes of an object's layers, surface features, and orbital radius where appropriate.
- Use mathematics to model the motion of the sun, moon, and stars in the sky and the role of gravity in the motions within galaxies and the solar system.
- Understand the concept of a ratio and use ratio language to describe a ratio relationship between the measurements of the cyclical motion between at least two bodies in the solar system and the relative sizes of objects and/or distances between objects and the impact of gravity on the motion of these objects.
- Recognize and represent proportional relationships between the measurement of patterns in the cyclical motion of the sun, moon, and stars in the sky and mathematical proportions relative to the sizes of objects and the effect of gravity on the motion of these objects.
- Use variables to represent numbers and write expressions when solving a problem involving the role of gravity in the motions within galaxies and within the solar system. Understand that a variable can represent an unknown number, or depending on the problem, any number in a specified set.

21st Century Themes and Skills:

- CRP1. Act as a responsible and contributing citizen and employee.
- CRP2. Apply appropriate academic and technical skills.
- CRP4. Communicate clearly and effectively and with reason.
- CRP5. Consider the environmental, social and economic impacts of decisions.
- CRP6. Demonstrate creativity and innovation.

- CRP7. Employ valid and reliable research strategies.
- CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.
- CRP9. Model integrity, ethical leadership and effective management.
- CRP11. Use technology to enhance productivity.
- CRP12. Work productively in teams while using cultural global competence.

Standards (Content and Technology):

CPI#:	Statement:
ESS1.B	Generate and analyze evidence (through simulations or long term investigations) to explain why the Sun's apparent motion across the sky changes over the course of a year.
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.
ESS1.A	Develop and use a model that shows how gravity causes smaller objects to orbit around larger objects at increasing scales, including the gravitational force of the sun causes the planets and other bodies to orbit around it holding together the solar system.
MS-ESS1-2	Analyze and interpret data to determine scale properties of objects in the solar system.
MS-ESS1-3	Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system.
8.1.8.A.1	Demonstrate knowledge of a real world problem using digital tools. Select and use applications effectively and productively.
8.1.8.A.4	Graph and calculate data within a spreadsheet and present a summary of the results.
8.1.8.B.1	Synthesize and publish information about a local or global issue or event (ex. telecollaborative project, blog, school web).
8.1.8.D.4	Assess the credibility and accuracy of digital content.
8.1.8.E.1	Effectively use a variety of search tools and filters in professional public databases to find information to solve a real world problem.

Modifications:

- Special Education Students
  - Allow errors
  - Rephrase questions, directions, and explanations
  - Allow extended time to answer questions and permit drawing as an explanation
  - Accept participation on any level, even one word
  - Consult with Case Managers and follow IEP accommodations/modifications
- English Language Learners
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- At-Risk Students
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  - Consult with Guidance Counselors and follow I&RS procedures/action plans
  - Consult with other members of the 7th grade team for specific behavior interventions
  - Provide rewards as necessary
- Gifted and Talented Students
  - Provide extension activities
  - Build on students' intrinsic motivation
  - Consult with parents to accommodate students' interests in completing tasks at their level of engagement

Lesson Name/Topic	Lesson Objective(s)	Time frame (day(s) to complete) Entire Unit: 20 Days
1	**Sun's Motion**	4 Days

2	Cyclic Patterns	4 Days
3	Gravity in the Solar System	4 Days
4	Scale of the Solar System	4 Days
5	Motions of Galaxies	4 Days

Teacher Notes:

Additional Resources
Click links below to access additional resources used to design this unit:

http://www.state.nj.us/education/modelcurriculum/sci/8.shtml

Content Area: Science

Unit Title: Weather and Climate

Grade Level: 6

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 through the ocean and atmosphere. The crosscutting concepts of *cause and effect, systems and system models,* and *energy and matter* are called out as frameworks for understanding the disciplinary core ideas. In this unit, students are expected to demonstrate proficiency in *developing and using models* and *planning and carrying out investigations* as they make sense of the disciplinary core ideas. Students are also expected to use these practices to demonstrate understanding of the core ideas.

Interdisciplinary Connections:

English Language Arts/Literacy

- Support the analysis of science and technical texts by citing specific textual evidence for how the motions and complex interactions of air masses result in changes in weather conditions.
- Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with information that is gained from reading text about how the complex patterns of the changes and movement of water in the atmosphere, determined by winds, landforms, and ocean temperatures and currents are major determinants of local weather patterns.
- Gather relevant information from multiple print and digital sources about how the complex patterns of the changes and movement of water in the atmosphere, determined by winds, landforms, and ocean temperatures and currents, are major determinants of local weather patterns; assess the credibility of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and providing basic bibliographic information for sources.
- Include multimedia components and visual displays in presentations to clarify information about how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates.

Mathematics

- Reason abstractly and quantitatively by using data such as weather maps, diagrams, and visualizations or obtained through laboratory experiments to predict weather within probabilities ranges.
- Understand that positive and negative numbers are used together to describe quantities having opposite directions or values. Use positive and negative numbers to represent changes in atmospheric and oceanic temperatures, explaining the meaning of 0 in each situation.

21st Century Themes and Skills:

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- CRP11. Use technology to enhance productivity.
- CRP12. Work productively in teams while using cultural global competence.

Standards (Content and Technology):

CPI#:	Statement:
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
ESS2.C	Explain how variations in density result from variations in temperature and salinity drive a global pattern of interconnected ocean currents.
ESS2.D	Use a model to explain the mechanisms that cause varying daily temperature ranges in a coastal community and in a community located in the interior of the country.
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.
8.1.8.A.1	Demonstrate knowledge of a real world problem using digital tools. Select and use applications effectively and productively.
8.1.8.A.4	Graph and calculate data within a spreadsheet and present a summary of the results.
8.1.8.B.1	Synthesize and publish information about a local or global issue or event (ex. telecollaborative project, blog, school web).
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Lesson Name/Topic	Lesson Objective(s)	Time frame (day(s) to complete) Entire Unit: 20 Days
1	Water Cycle	4 Days
2	Weather Conditions	4 Days

3	**Ocean Currents**	4 Days
4	**Temperature Ranges**	4 Days
5	**Regional Climates**	4 Days

Teacher Notes:

Additional Resources
Click links below to access additional resources used to design this unit:
http://www.state.nj.us/education/modelcurriculum/sci/8.shtml