MIDLAND PARK PUBLIC SCHOOLS
Midland Park, New Jersey
CURRICULUM

Science
Grade 8

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CCCS born on 9/2012
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Grade 8 Science Curriculum Overview

Grade 8 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: Evidence of a Common Ancestry: 20 days
Unit 2: Selection and Adaptation: 20 days
Unit 3: Human Impact: 20 days
Unit 4: Human Impacts on Earth Systems and Global Climate Change: 20 days
Unit 5: Relationships among Forms of Energy: 20 days
Unit 6: Thermal Energy: 20 days
Unit 7: The Electromagnetic Spectrum: 20 days

Pre-Requisite: Grade 7 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: Evidence of a Common Ancestry

Grade Level: 8th

Unit Summary: In this unit of study, students analyze graphical displays and gather evidence from multiple sources in order to develop an understanding of how fossil records and anatomical similarities of the relationships among organisms and species describe biological evolution. Students search for patterns in the evidence to support their understanding of the fossil record and how those patterns show relationships between modern organisms and their common ancestors. The crosscutting concepts of cause and effect, patterns, and structure and function are called out as organizing concepts for these disciplinary core ideas. Students use the practices of analyzing graphical displays and gathering, reading, and communicating information. Students are also expected to use these practices to demonstrate understanding of the core ideas.

Interdisciplinary Connections:

- Cite specific textual evidence to support the analysis of patterns found in the fossil record to document the existence, diversity, extinction, and change of life forms throughout the history of life on Earth.
- Use scientific, precise details in the explanations.
- Integrate quantitative or technical information about the fossil record that is expressed in words into a version of that information expressed visually in the form of a flowchart, diagram, model, graph, or table.
- Attending to the precise details of explanations or descriptions, cite specific textual evidence to support analysis of science texts' information on the relationships between the anatomical similarities and differences among modern organisms and between modern and fossil organisms and their fossil relationships.
- Write informative/explanatory text examining anatomical similarities and differences among modern organisms and between modern and fossil organisms and their fossil relationships. The text should convey ideas, concepts, and information through the selection, organization, and analysis of relevant content.
- Draw evidence from informational texts to support an analysis of, reflection on, and research about anatomical similarities and differences among modern organisms and between modern and fossil organisms used to infer evolutionary relationships.
- Engage in a range of collaborative discussions about the anatomical similarities and differences among modern organisms and between modern and fossil organisms used to infer evolutionary relationships. Discussions must provide opportunities for students to clearly express their own ideas and exchange ideas with others. The discussions may be one on one, in groups, or led by the teacher.
- Present claims and findings to explain the anatomical similarities and differences among modern organisms and between modern and fossil organisms to infer evolutionary relationships. Emphasize the important points in a focused, coherent manner with relevant evidence, valid reasoning, and well-chosen details. During the presentation, students must use appropriate eye contact, adequate volume, and clear pronunciation.
- Cite specific textual evidence to support the analysis of pictorial data comparing patterns of similarities in embryological development across multiple species to identify relationships not evident in the fully formed anatomy. Attention must be paid to the precise details of explanation or descriptions.
- Integrate quantitative or technical information about general patterns of relatedness among embryos of different organisms expressed in words in a text with a version expressed in a flowchart, diagram, model, graph, or table.
- Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with the information gained from reading a text about embryological development across multiple species in order to identify relationships not evident in the fully formed anatomy.

Mathematics

- Use variables to represent numbers and write expressions to represent patterns of changes in the level of complexity of anatomical structures in organisms and the chronological order of fossil appearances in the rock record to document the existence, diversity, extinction, and change of life forms throughout the history of life on Earth, under the assumption that natural laws operate today as in the past. Understand that a variable can represent an unknown number or, depending on the purpose at hand, any number in a specified set.

- Use variables to represent numbers and write expressions showing patterns that can be used to identify cause-and-effect relationships among the anatomical similarities and differences among modern organisms and between modern and fossil organisms. This representation will be used to infer evolutionary relationships. Understand that a variable can represent an unknown number or, depending on the purpose at hand, 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.
- 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

Standards (Content and Technology):

CPI#:	Statement:
MS-LS4-1	Analyze and interpret data for patterns in the fossil record that document the existence, diversity, extinction, and change of life forms throughout the history of life on Earth under the assumption that natural laws operate today as in the past.
MS-LS4-2	Apply scientific ideas to construct an explanation for the anatomical similarities and differences among modern organisms and between modern and fossil organisms to infer evolutionary relationships.
MS-LS4-3	Analyze displays of pictorial data to compare patterns of similarities in the embryological development across multiple species to identify relationships not evident in the fully formed anatomy.
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
- 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: 15 Days
1	**Change in the Fossil Record**	5 Days
2	**Evolutionary Relationships**	5 Days
3	**Embryological Development**	5 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: Selection and adaptation

Grade Level: 8th

Unit Summary:

Students construct explanations based on evidence to support fundamental understandings of natural selection and evolution. They will use ideas of genetic variation in a population to make sense of how organisms survive and reproduce, thus passing on the traits of the species. The crosscutting concepts of patterns and structure and function are called out as organizing concepts that students use to describe biological evolution. Students use the practices of constructing explanations, obtaining, evaluating, and communicating information, and using mathematical and computational thinking. 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 scientific and technical texts about how genetic variations in a population increase some individuals' probability of surviving and reproducing in a specific environment. Attention must be paid to precise details of explanations or descriptions. Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with information gained from reading a text on how genetic variations of traits in a population increase some individuals' probability of surviving and reproducing in a specific environment.
- Write informative/explanatory texts examining how natural selection leads to the predominance of some traits in a population and the suppression of others. Convey ideas, concepts, and information through the selection, organization, and analysis of relevant content.
- Draw evidence from informational texts to support the analysis, reflection, and research used to construct an explanation of how genetic variation of traits in a population increase some individuals' probability of surviving and reproducing in a specific environment.
- Engage effectively in a range of collaborative discussions with diverse partners to discuss how natural selection leads to the predominance of certain traits in a population and the suppression of others. Discussions may be one-on-one, in groups, or teacher-led; in these discussions, students should build on others' ideas while expressing their own clearly.
- Present claims and findings about how natural selection leads to the predominance of certain traits in a population and the suppression of others. Claims must emphasize salient points in a focused, coherent manner with relevant evidence, sound valid reasoning, and well-chosen details. Students must use appropriate eye contact, adequate volume, and clear pronunciation.
- Cite specific textual evidence to support analysis of information about the technologies that have changed the way humans influence the inheritance of desired traits in organisms (artificial selection).
- Gather relevant information from multiple print and digital sources; assess the credibility of each source; and quote or paraphrase the data and conclusions of others about technologies that have changed the way humans influence the inheritance of desired traits. Avoid plagiarism and provide basic bibliographic information for sources.

Mathematics

- Understand the concept of a ratio and use ratio language to describe a ratio relationship between specific genetic variations in a population and the probability of some individuals in that populations surviving and reproducing in a specific environment.
- Summarize numerical data sets about a ratio relationship between genetic variations in a population and the probability of some individuals in that population surviving and reproducing in a specific environment.
- Recognize and represent proportional relationships in trends in changes to populations over time.
- Use mathematical models to support explanations of trends in changes to populations over time.
- Understand the concept of a ratio and use ratio language to describe a ratio relationship between natural selection

and decreases of specific traits in populations over time.
• Summarize numerical data sets to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time.

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-LS4-4	**Construct an explanation based on evidence that describes how genetic variations of traits in a population increase some individuals' probability of surviving and reproducing in a specific environment.**
MS-LS4-5	**Gather and synthesize information about the technologies that have changed the way humans influence the inheritance of desired traits in organisms.**
MS-LS4-6	**Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time.**
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**
- **Rephrase questions, directions, and explanations**

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

- **Allow extended time to answer questions**
- **Accept participation at any level, even one work**
- 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	**Genetic Variations**	7 Days
2	**Inheritance of Desired Traits**	6 Days
3	**Natural Selection**	7 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: Stability and change on Earth

Grade Level: 8th

Unit Summary:

Students construct an understanding of the ways that human activities affect Earth's systems. Students use practices to understand the significant and complex issues surrounding human uses of land, energy, mineral, and water resources and the resulting impacts on the development of these resources. Students also understand that the distribution of these resources is uneven due to past and current geosciences processes or removal by humans. The crosscutting concepts of patterns, cause and effect, and stability and change are called out as organizing concepts for these disciplinary core ideas. In this unit of study students are expected to demonstrate proficiency in asking questions, analyzing and interpreting data, 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 how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geosciences processes.
- Write informative/explanatory texts examining how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geosciences processes. Convey ideas, concepts, and information through the selection, organization, and analysis of relevant content.
- Draw evidence from informational texts to support analysis, reflection, and research on how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geosciences processes.
- Cite specific textual evidence in data used to support the analysis of natural hazards and to forecast future catastrophic events and inform the development of technologies to mitigate their effects.
- Integrate quantitative or technical information about natural hazards and forecasting future catastrophic events that is expressed visually (e.g., in a flowchart, diagram, model, graph, or table). Use the integrated text and visual displays to analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.
- Cite specific textual evidence to support an argument about the role of human activity and natural processes in the gradual increase in global temperatures over the past century.

Mathematics

- Use variables to represent numbers and write expressions for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geosciences processes. Convey ideas, concepts, and information through the selection, organization, and analysis of relevant content.
- Use variables to represent quantities for how the distribution of Earth's mineral, energy, and groundwater resources are significantly changing as a result of removal by humans. Construct simple equations and inequalities to solve problems by reasoning about the quantities.
- Analyze and interpret data on natural hazards by reasoning abstractly (manipulating symbols abstractly) and quantitatively (while attending to the meaning of those symbols) to forecast future catastrophic events and inform the development of technologies to mitigate their effects.
- Use variables to represent numbers and write expressions for the locations, magnitudes, and frequencies of natural hazards and how these data can be used to forecast future catastrophic events and inform the development of technologies to mitigate their effects. The variable can represent an unknown number or, depending on the purpose at hand, any number in a specified set.
- Use variables to represent quantities for the location, magnitudes, and frequencies of natural hazards and how these data can be used to forecast future catastrophic events and inform the development of technologies to mitigate their

effects. Construct simple equations and inequalities to solve problems by reasoning about the quantities.
- Students will clarify evidence of the factors that have caused the rise in global temperatures over the past century, reasoning abstractly (manipulating symbols abstractly) and quantitatively (while attending to the meaning of those symbols).
- Use variables to represent numbers and write expressions for data found in tables, graphs, and maps of global and regional temperatures; atmospheric levels of gases such as carbon dioxide and methane' and the rates of human activities. The variable can represent an unknown number or, depending on the purpose at hand, any number in a specified set.
- Use variables to represent quantities found in tables, graphs, and maps of global and regional temperatures, atmospheric levels of gases such as carbon dioxide and methane, and the rates of human activities. Construct simple equations and inequalities to solve problems by reasoning about the quantities.

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-ESS3-1	**Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes.**
MS-ESS3-2	**Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.**
MS-ESS3-4	**Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems.**
MS-ESS3-5	**Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century.**
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**

At-Risk Students
- Provide extended time to complete tasks

- **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**

- 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: 30 Days
1	**Geoscience Processes**	7 Days
2	**Catastrophic Events**	7 Days
3	**Impact on Earth's Systems**	8 Days
4	**Global Temperature**	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: Human Impacts

Grade Level: 8th

Unit Summary:

In this unit of study, students analyze and interpret data and design solutions to build on their understanding of the ways that human activities affect Earth's systems. The emphasis of this unit is the significant and complex issues surrounding human uses of land, energy, mineral, and water resources and the resulting impacts of these uses. The crosscutting concepts of cause and effect and the influence of science, engineering, and technology on society and the natural world are called out as organizing concepts for these disciplinary core ideas.

Building on Unit 3, students define a problem by precisely specifying criteria and constraints for solutions as well as potential impacts on society and the natural environment; systematically evaluate alternative solutions; analyze data from tests of different solutions; combining the best ideas into an improved solution; and develop and iteratively test and improve their model to reach an optimal solution. In this unit of study students are expected to demonstrate proficiency in analyzing and interpreting data and designing solutions. Students are also expected to use these practices to demonstrate understanding of the core ideas.

Interdisciplinary Connections:

English Language Arts/Literacy

- Conduct short research projects to determine a method for monitoring and minimizing a human impact on the environment, drawing on several sources and generating additional, related, focused questions that allow multiple avenues of exploration.
- Gather relevant information from multiple print and digital sources about a method for monitoring and minimizing a human impact on the environment, 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 about minimizing a human impact on the environment to support analysis, reflection, and research.
- Cite specific textual evidence about a method for monitoring and minimizing a human impact on the environment to support analysis of science and technical texts.
- Compare and contrast the information gained from experiments, simulations, videos, or multimedia sources with that gained from reading a text on a method for monitoring and minimizing a human impact on the environment.
- Integrate quantitative or technical information about a method for monitoring and minimizing a human impact on the environment expressed in words with a version of that information expressed visually.

Mathematics

- Use abstract and quantitative reasoning to analyze and interpret data in order to determine similarities and differences in findings of how well designed methods meet the criteria and constraints of solutions that could reduce a human impact on the environment.
- Understand the concept of a ratio and use ratio language to describe a ratio relationship between human impacts on environments and the impact of methods to minimize these impacts.
- Use variables to represent quantities when analyzing and interpreting data to determine how well designed methods meet the criteria and constraints of solutions that could reduce a human impact on the environment and construct simple equations and inequalities to solve problems by reasoning about the quantities.
- While analyzing data to determine how well designed methods meet the criteria and constraints of solutions that could reduce a human impact on the environment, solve multi step 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.

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.
- 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-ESS3-3	Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.
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.
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.
8.2.8.B.3	Research and analyze the ethical issues of a product or system on the environment and report findings for review by peers and /or experts.
8.2.8.B.4	Research examples of how humans can devise technologies to reduce the negative consequences of other technologies and present your findings.

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

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

- 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
- 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	**Human Impact on the Environment**	25 Days
*	**Design Problem Solutions**	(Incorporated in above days)
*	**Evaluate 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: Relationships among forms of energy

Grade Level: 8th

Unit Summary:

In this unit, students use the practices of analyzing and interpreting data, developing and using models, and engaging in argument from evidence to make sense of relationship between energy and forces. Students develop their understanding of important qualitative ideas about the conservation of energy. Students understand that objects that are moving have kinetic energy and that objects may also contain stored (potential) energy, depending on their relative positions. Students also understand the difference between energy and temperature, and the relationship between forces and energy. The crosscutting concepts of scale, proportion, and quantity, systems and system models, and energy and matter are called out as organizing concepts for these disciplinary core ideas. Students use the practices of analyzing and interpreting data, developing and using models, and engaging in argument from evidence. 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 that describe the relationships of kinetic energy to the mass of an object and to the speed of an object, attending to the precise details of explanations or descriptions.
- Integrate quantitative or technical information that describes the relationship of kinetic energy to the mass of an object and to the speed of object that is expressed in words with a version of that information expressed visually in a flowchart, diagram, model, graph, or table.
- Integrate multimedia and visual displays into presentations that describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system to clarify information, strengthen claims and evidence, and add interest.
- Cite specific textual evidence to support analysis of science and technical texts to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object, attending to the precise details of explanations or descriptions.
- Write arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object.

Mathematics

- Reason abstractly and quantitatively by interpreting numerical, graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object.
- Describe a ratio relationship between kinetic energy and mass separately from kinetic energy and speed.
- Understand the concept of a unit rate a/b associated with a ratio a:b with b≠, and use rate language in the context of a ratio relationship between kinetic energy and mass separately from kinetic energy and speed.
- Recognize and represent proportional relationships between kinetic energy and mass separately from kinetic energy and speed.
- Know and apply the properties of integer exponents to generate equivalent numerical expressions when describing the relationships between kinetic energy and mass separately from kinetic energy and speed.
- When constructing and interpreting graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object, use square root and cube root symbols to represent solutions to equations of the form x2=p and x3=p, where p is a positive rational number. Evaluate square roots of small perfect squares and cube roots of small perfect cubes. Know that $\sqrt{2}$ is irrational.
- When constructing and interpreting graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object, interpret the equation y = mx + b as defining a linear function whose graph is a straight line; give examples of functions that are not linear.

• Reason abstractly and quantitatively when analyzing data to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object.
• Understand the concept of ratio and use ratio language to describe the ratio relationships between the change in the kinetic energy of an object and the energy transferred to or from the object.
• Recognize and represent proportional relationships between the change in the kinetic energy of an object and the energy transferred to or from the object.
• Interpret the equation y = mx + b as defining a linear function whose graph is a straight line; give examples of functions that are not linear when describing the change in the kinetic energy of an object and the energy transferred to or from the object.

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-PS3-1	Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object.
MS-PS3-2	Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system.
MS-PS3-5	Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object.
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 Learning Targets/Objectives:
Students will

- **Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object.**
- **Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system.**
- **Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object.**

Formative Assessments:

- **Construct and interpret graphical displays of data to identify linear and nonlinear relationships of kinetic energy to the mass of an object and to the speed of an object.**
- **Develop a model to describe what happens to the amount of potential energy stored in the system when the arrangement of objects interacting at a distance changes**
- **Use models to represent systems and their interactions, such as inputs, processes, and outputs, and energy and matter flows within systems. Models could include representations, diagrams, pictures, and written descriptions.**
- **Conduct an inventory or other representation of the energy before and after the transfer in the form of temperature changes or motion of an object. Do not include calculations of energy.**

Summative/Benchmark Assessment(s):

- **Construct, use, and present oral and written arguments supported by empirical evidence and scientific reasoning to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object.**

Resources/Materials (copy hyperlinks for digital resources):

Soccer - Kick it
It's All Downhill: Forces and Sports Lesson Plan
Energy Skate Park: Basics
Energy: Different Kinds of Energy

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: 20 Days
1	**Kinetic Energy**	6 Days
	Potential Energy	7 Days

2		
3	**Energy Transfer**	7 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: Thermal Energy

Grade Level: 8th

Unit Summary:

In this unit, students ask questions, plan and carry out investigations, engage in argument from evidence, analyze and interpret data, construct explanations, define problems and design solutions as they make sense of the difference between energy and temperature. They use the practices to make sense of how the total change of energy in any system is always equal to the total energy transferred into or out of the system. The crosscutting concepts of energy and matter, scale, proportion, and quantity, and influence of science, engineering, and technology on society and the natural world are the organizing concepts for these disciplinary core ideas. Students ask questions, plan and carry out investigations, engage in argument from evidence, analyze and interpret data, construct explanations, define problems and design solutions. Students are also expected to use these practices to demonstrate understanding of the core ideas.

Interdisciplinary Connections:

English Language Arts/Literacy

- Follow precisely a multistep procedure for an investigation that has been planned individually and collaboratively to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample.
- Conduct short research projects to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of particles as measured by the temperature of the sample, drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration.
- Follow precisely a multistep process for the design, construction, and testing of a device that either minimizes or maximizes thermal energy transfer.
- Conduct short research projects to apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer, drawing on several sources and generating additional related, focused questions that allow for multiple avenue of exploration.
- Gather relevant information to inform the design, construction, and testing of a device that either minimizes or maximizes thermal energy transfer using multiple print and digital sources; 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 that informs the design, construction, and testing of a device that either minimizes or maximizes thermal energy transfer.
- Cite specific textual evidence to support analysis of science and technical texts that provide information about the application of scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer.
- Compare and contrast the information gained from experiments, simulations, or multimedia sources with that gained from reading text about devices that either minimize or maximize energy transfer.

Mathematics

- Reason abstractly and quantitatively while collecting and analyzing numerical and symbolic data as part of an investigation that has been planned individually and collaboratively.
- Summarize numerical data sets in relation to the amount of energy transferred, the type of matter, the mass, and the change in the average kinetic energy of particles in the sample as measured by the temperature of the sample.
- Reason abstractly and quantitatively while collecting and analyzing numerical and symbolic data as part of a systematic process for evaluating solutions with respect to how well they meet criteria and constraints of a problem involving the design of a device that either minimizes or maximizes thermal energy transfer.

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-PS3-3	Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer.
MS-PS3-4	Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample.
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
- 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

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

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- Allow errors in speaking
- Rephrase questions, directions, and explanations
- Allow extended time to answer questions
- Accept participation at any level, even one work
- 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: 30 Days
1	**Thermal Energy Transfer**	15 Days
2	**Relationships of Energy, Matter, Mass, and Temperature**	15 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: The Electromagnetic Spectrum

Grade Level: 8th

Unit Summary:

In this unit of study, students develop and use models, use mathematical thinking, and obtain, evaluate, and communicate information in order to describe and predict characteristic properties and behaviors of waves. Students also apply their understanding of waves as a means of sending digital information. The crosscutting concepts of patterns and structure and function are used as organizing concepts for these disciplinary core ideas. Students develop and use models, use mathematical thinking, and obtain, evaluate, and communicate information. Students are also expected to use these practices to demonstrate understanding of the core ideas

Interdisciplinary Connections:

English Language Arts/Literacy

- Integrate multimedia and visual displays into presentations that describe a simple model for waves that includes how the amplitude of a wave is related to the energy in a wave, to clarify information.
- Integrate multimedia and visual displays into presentations of a model that describes that waves are reflected, absorbed, or transmitted through various materials to clarify information.
- Cite specific textual evidence to support the claim that digitized signals are a more reliable way to encode and transmit information than analog signals.
- Determine the central ideas or conclusions of a text; provide an accurate summary of the text to support the claim that digitized signals are a more reliable way to encode and transmit information than analog signals, distinct from prior knowledge or opinions.
- Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text to support the claim that digitized signals are a more reliable way to encode and transmit information than analog signals.
- Draw evidence from informational texts to support the analysis of digitized signals as a more reliable way to encode and transmit information than analog signals.
- Integrate multimedia and visual displays into presentations to strengthen claims and evidence showing that digitized signals as a more reliable way to encode and transmit information than analog signals.

Mathematics

- Include mathematical representations to describe a simple model for waves.
- Use mathematical representations to describe and/or support scientific conclusions about how the amplitude of a wave is related to the energy in a wave.
- Understand the concept of a ratio and use ratio language to describe the relationship between the amplitude of a wave and the energy in the wave.
- Use ratio and rate reasoning to solve problems showing the relationship between the amplitude of a wave and the energy of the wave.
- Recognize and represent proportional relationships when using mathematical representations to describe a simple model.
- When using mathematical representations to describe a simple model, interpret the equation $y = mx + b$ as defining a linear function whose graph is a straight line and give examples of functions that are not linear.

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-PS4-1	Use mathematical representations to describe a simple model for waves that includes how the amplitude of a wave is related to the energy in a wave.
MS-PS4-2	Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials.
MS-PS4-3	Integrate qualitative scientific and technical information to support the claim that digitized signals are a more reliable way to encode and transmit information than analog signals.
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.

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Gifted and Talented Students

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- Build on students' intrinsic motivation
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Lesson Name/Topic	Lesson Objective(s)	Time frame (day(s) to complete) Entire Unit: 20 Days
1	**Amplitude and Energy of a Wave**	7 Days

2	**Reflection, Absorption, and Transmission of Waves**	7 Days
3	**Digitized vs. Analog Signals**	6 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