Science

Grade 8

Prepared by:

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Superintendent of Schools:

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Born on **June 20, 2022**

Science 8

Course Description:

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.

Course Sequence:

Unit 1: Evidence of a Common Ancestry: 18 days (September - October)
Unit 2: Selection and Adaptation: 23 days (October - November) Unit 3: Stability and Change on Earth: 34 days (December)
Unit 4: Human Impacts: 27 days (January)
Unit 5: Relationships among Forms of Energy: 23 days (February - March)
Unit 6: Thermal Energy: 32 days (March - May)
Unit 7: The Electromagnetic Spectrum: 23 days (May - June)

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 48 minutes of seat time.*

Midland Park Public Schools

Content Area: Science
Unit Title: Evidence of a Common Ancestry
Grade Level: 8th

Core Ideas: Fossil Formation, Fossil Dating, Evidence of Evolution

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.

Standards (Content and Technology)**:**

CPI#:	**Statement:**
Performance Expectations (NJSLS)	
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.
Career Readiness, Life Literacies, and Key Skills	
9.3.ST-ET.2	Display and communicate STEM information.
9.3.ST-ET.3	Apply processes and concepts for the use of technological tools in STEM.
9.4.8.CI.3	Examine challenges that may exist in the adoption of new ideas (e.g., 2.1.8.SSH, 6.1.8.CivicsPD.2).
9.4.8.GCA.2	Demonstrate openness to diverse ideas and perspectives through active discussions to achieve a group goal.
9.4.8.IML.7	Use information from a variety of sources, contexts, disciplines, and cultures for a specific purpose

Computer Science and Design Thinking	
8.2.8.ED.2	Identify the steps in the design process that could be used to solve a problem.

8.2.8.ITH.2	Compare how technologies have influenced society over time.
Intercultural Statements (Amistad, Holocaust, LGBT, etc...)	
ELD Standard 4	English language learners communicate information, ideas, and concepts necessary for academic success in the content area of Science
ELD-SC 6-8 Explain Interpretive	Defining investigable questions or design problems based on observations, information, and/or data about a phenomenon ● Determining central ideas in complex evidence and information to help explain how or why a phenomenon occurs ● Evaluating scientific reasoning that shows why data or evidence adequately supports conclusions
ELD-SC 6-8 Explain Expressive	Describe valid and reliable evidence from sources about a phenomenon ● Establish neutral or objective stance in how results are communicated ● Develop reasoning to show relationships among independent and dependent variables in models and simple systems ● Summarize patterns in evidence, making trade-offs, revising, and retesting
ELD-SC 6-8 Argue Interpretive	Identifying convincing evidence from data, models, and/or information from investigations of phenomena or design solutions ● Comparing reasoning and claims based on evidence from two arguments on the same topic ● Evaluating whether they emphasize similar or different evidence and/or interpretations of facts
ELD-SC 6-8 Argue Expressive	Introduce and contextualize topic/ phenomenon in issues related to the natural and designed world(s) ● Support or refute a claim based on data and evidence ● Establish and maintain a neutral or objective stance ● Signal logical relationships among reasoning, evidence, data, and/or a model when making or defending a claim or counterclaim
Interdisciplinary Connection	
RST.6-8.1.	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.
RST.6-8.10.	By the end of grade 8, read and comprehend science/technical texts in the grades 6-8 text complexity band independently and proficiently.
RST.6-8.7.	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.
RST.6-8.1.	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.

NJSLSA.W2.	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.
NJSLSA.W9.	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.
WHST.6-8.1.	Write arguments focused on *discipline-specific content*. A.Introduce claim(s) about a topic or issue, acknowledge and distinguish the claim(s) from alternate or opposing claims, and organize the reasons and evidence logically. B. Support claim(s) with logical reasoning and relevant, accurate data and evidence that demonstrate an understanding of the topic or text, using credible sources.
Math	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.
Math	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.

Unit Essential Question(s):	**Unit Enduring Understandings:**
• How do we know when an organism (fossil) was alive? • How do we know that birds and dinosaurs are related? • Other than bones and structures being similar, what other evidence is there that birds and dinosaurs are related?	• The fossil record documents the existence, diversity, extinction, and change of many life forms throughout the history of life on Earth. • The collection of fossils and their placement in chronological order as identified through the location of sedimentary layers in which they are found or through radioactive dating is known as the fossil record. • Relative fossil dating is achieved by examining the fossil's relative position in sedimentary rock layers.

	• Objects and events in the fossil record occur in consistent patterns that are understandable through measurement and observation. • Patterns exist in the level of complexity of anatomical structures in organisms and the chronological order of fossil appearance in rock layers. • Patterns can occur within one species of organism or across many species. • Similarities and differences exist in the gross anatomical structures of modern organisms. • There are anatomical similarities and differences among modern organisms and between modern organisms and fossil organisms. • Similarities and differences exist in the gross anatomical structures of modern organisms and their fossil relatives. • Similarities and differences in the gross anatomical structures of modern organisms enable the reconstruction of evolutionary history and the inference of lines of evolutionary descent. • Patterns and anatomical similarities in the fossil record can be used to identify cause-and-effect relationships. • Science assumes that objects and events in evolutionary history occur in consistent patterns that are understandable through measurement and observation. • Relationships between embryos of different species show similarities in their development. • General patterns of relatedness among embryos of different organisms can be inferred by comparing the macroscopic appearance of diagrams or pictures. • Pictorial data can be used to identify patterns of similarities in embryological development across multiple species. • Similarities in embryological development across multiple species show relationships that are not evident in the fully formed organisms.

Formative Assessments:

· Use graphs, charts, and images to identify patterns within the fossil record.

· Analyze and interpret data within the fossil record to determine similarities and differences in findings. ·

Apply scientific ideas to construct explanations for evolutionary relationships.

· Apply the patterns in gross anatomical structures among modern organisms and between modern organisms and fossil organisms to construct explanations of evolutionary relationships.

· Use diagrams or pictures to identify patterns in embryological development across multiple species.

· Analyze displays of pictorial data to identify where the embryological development is related linearly and where that linear nature ends.

· Infer general patterns of relatedness among embryos of different organisms by comparing the macroscopic appearance of diagrams or pictures.

Summative/Benchmark Assessment(s):

· Make logical and conceptual connections between evidence in the fossil record and explanations about the existence, diversity, extinction, and change in many life forms throughout the history of life on Earth.

· Apply scientific ideas about evolutionary history to construct an explanation for evolutionary relationships evidenced by similarities or differences in the gross appearance of anatomical structures.

· Claim, Evidence, Reasoning writing pieces

Alternative Assessments:

· Write a how-to-guide on making a perfect fossil and animal remains preservation.

· Create an infographic on the evidences of evolution.

Resources/Materials:	**Key Vocabulary: Fossil, Imprint, Preserve, Relative Dating, Radiometric Dating, Isotope, Half-life, Superposition, Index Fossils**
NOVA: Judgement Day: Intelligent Design on Trial: Human Chromosome 2: The Day the Mesozoic Died https://ny.pbslearningmedia.org/resource/tdc02.sci.life.e vo.recordoftime/ https://ny.pbslearningmedia.org/resource/tdc02.sci.life.d iv.lp_evid/evidence-for-evolution/	

Lesson Name/Topic	**Student Learning Objective(s)**	**Suggested Tasks/Activities:**	**Day(s) to Complete Entire Unit: 18 Days**

Change in the Fossil Record	• 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.	- Becoming a Fossil reading/video - Mystery Skull activity - Radiometric Dating reading/video - Record of time reading - Fossil Interview	6 Days
Evolutionary Relationships	• 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.	- Fish with Fingers - Early Tetrapod Fossil - Evolving Ideas - Whale Evolution Assignments	6 Days
Embryological Development	• 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.	- Evidence of Evolution organizer - Origin of Birds	6 Days

Teacher Notes:

Additional Resources:

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

Students with Disabilities	**English Language Learners**	**Gifted and Talented Students**	**Students at Risk**	**504Students**

• Consult with Guidance Counselors and follow plan procedures/action plans • Allow extended time to answer questions and	•Assign a buddy, same language or English speaking •Allow errors in speaking •Rephrase questions, directions,	•Provide extension activities •Build on students' intrinsic motivation •Consult with parents to accommodate	•Provide extended time to complete tasks •Consult with other members of the 8th grade team for specific behavior	•Allow errors •Rephrase questions, directions, and explanations •Allow extended time to answer

permit drawing as an explanation • Accept participation on any level, when necessary and appropriate	and explanations •Allow extended time to answer questions •Accept participation at any level, even one word	students' interests in completing tasks at their level of engagement	interventions •Provide rewards as necessary	questions and permit drawing as an explanation •Accept participation on any level, even one word •Consult with Case Managers and follow IEP accommodations/modifications

Content Area: Science
Unit Title: Selection and Adaptation

Grade Level: 8th

Core Ideas: Adaptation, Evolution, Natural Selection, Artificial Selection

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.

Standards (Content and Technology)**:**

CPI#:	**Statement:**
Performance Expectations (NJSLS)	
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.
Career Readiness, Life Literacies, and Key Skills	
9.3.12.AG-ANI.1	Analyze historic and current trends impacting the animal systems industry.
9.3.12.AG-ANI.4	Apply principles of animal reproduction to achieve desired outcomes for performance, development and/or economic production.
9.3.12.AG-ANI.6	Classify, evaluate and select animals based on anatomical and physiological characteristics.
9.4.8.CI.3	Examine challenges that may exist in the adoption of new ideas (e.g., 2.1.8.SSH, 6.1.8.CivicsPD.2).

9.4.8.CT.1	Evaluate diverse solutions proposed by a variety of individuals, organizations, and/or agencies to a local or global problem, such as climate change, and use critical thinking skills to predict which one(s) are likely to be effective (e.g., MS-ETS1-2).

9.4.8.CT.2	Develop multiple solutions to a problem and evaluate short- and long-term effects to determine the most plausible option (e.g., MS-ETS1-4, 6.1.8.CivicsDP.1).
9.4.8.CT.3	Compare past problem-solving solutions to local, national, or global issues and analyze the factors that led to a positive or negative outcome.
9.4.8.GCA.2	Demonstrate openness to diverse ideas and perspectives through active discussions to achieve a group goal.
Computer Science and Design Thinking	
8.2.8.ED.2	Identify the steps in the design process that could be used to solve a problem.
8.2.8.ED.3:	Develop a proposal for a solution to a real-world problem that includes a model (e.g., physical prototype, graphical/technical sketch).
8.2.8.ITH.2	Compare how technologies have influenced society over time.
8.2.8.ITH.3	Evaluate the impact of sustainability on the development of a designed product or system.
8.2.8.EC.1	Explain ethical issues that may arise from the use of new technologies.
Intercultural Statements (Amistad, Holocaust, LGBT, etc...)	
ELD Standard 4	English language learners communicate information, ideas, and concepts necessary for academic success in the content area of Science
ELD-SC 6-8 Explain Interpretive	Defining investigable questions or design problems based on observations, information, and/or data about a phenomenon ● Determining central ideas in complex evidence and information to help explain how or why a phenomenon occurs ● Evaluating scientific reasoning that shows why data or evidence adequately supports conclusions
ELD-SC 6-8 Explain Expressive	Describe valid and reliable evidence from sources about a phenomenon ● Establish neutral or objective stance in how results are communicated ● Develop reasoning to show relationships among independent and dependent variables in models and simple systems ● Summarize patterns in evidence, making trade-offs, revising, and retesting
ELD-SC 6-8 Argue Interpretive	Identifying convincing evidence from data, models, and/or information from investigations of phenomena or design solutions ● Comparing reasoning and claims based on evidence from two arguments on the same topic ● Evaluating whether they emphasize similar or different evidence and/or interpretations of facts
ELD-SC 6-8 Argue Expressive	Introduce and contextualize topic/ phenomenon in issues related to the natural and designed world(s) ● Support or refute a claim based on data and evidence ● Establish and maintain a neutral or objective stance ● Signal logical relationships among reasoning, evidence, data, and/or a model when making or defending a claim or counterclaim

Interdisciplinary Connection	
RST.6-8.1.	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.
NJSLSA.W2.	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.
NJSLSA.W9.	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.
NJSLSA.W8.	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.
Math	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.
Math	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.
Math	Recognize and represent proportional relationships in trends in changes to populations over time.
Math	Use mathematical models to support explanations of trends in changes to populations over time.

Unit Essential Question(s):	
· How can changes to the genetic code increase or decrease an individual's chances of survival? **· How can the environment effect natural selection? · Are Genetically Modified Organisms (GMO) safe to eat?**	· • Genetic variations of traits in a population increase or decrease some individuals' probability of surviving and reproducing in a specific environment. • Natural selection leads to the predominance of certain traits in a population and the suppression of others. • Natural selection may have more than one cause, and some cause-and-effect relationships within natural selection can only be described using probability.

	• • Natural selection, which over generations leads to adaptations, is one important process through which species change over time in response to changes in environmental conditions. • The distribution of traits in a population changes. • Traits that support successful survival and reproduction in the new environment become more common; those that do not become less common. • Natural selection may have more than one cause, and some cause-and-effect relationships in natural selection can only be described using probability. • Mathematical representations can be used to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time. • Gather, read, and synthesize information about technologies that have changed the way humans influence the inheritance of desired traits in organisms (artificial selection) from multiple appropriate sources. • Describe how information from publications about technologies and methods that have changed the way humans influence the inheritance of desired traits in organisms (artificial selection) used are supported or not supported by evidence. • • Assess the credibility, accuracy, and possible bias of publications and they methods they used when gathering information about technologies that have changed the way humans influence the inheritance of desired traits in organisms (artificial selection).

Formative Assessments:

· Construct an explanation that includes probability statements regarding variables and proportional reasoning of how genetic variations of traits in a population increase some individuals' probability surviving and reproducing in a specific environment.

· Use probability to describe some cause-and-effect relationships that can be used to explain why some individuals survive and reproduce in a specific environment.

· Use mathematical representations to support conclusions about how natural selection may lead to increases and decreases of genetic traits in populations over time.

Summative/Benchmark Assessment(s):

· Explain some causes of natural selection and the effect it has on the increase or decrease of specific traits in populations over time.

Alternative Assessments:

· Present opposite points of view on genetically modified organisms.

· Create a concept map on the different types of selection, linking them when applicable.

Resources/Materials:	**Key Vocabulary:** Adaptation, Structural, Behavioral, Physiological, Evolution, Natural Selection, Directional, Stabilizing, Disruptive, Kin Selection, Sexual Selection, Sexual Dimorphism, Mating Rituals, Male-Male competition, Artificial Selection, Mutation
99.99% Antibacterial Products and Natural Selection An Origin of Species: Pollenpeepers Making Sense of Natural Selection Bug Hunt https://www.biointeractive.org/classroom resources/making-fittest-natural-selection-and adaptation	

Lesson Name/Topic	**Student Learning Objective(s)**	**Suggested Tasks/Activities:**	**Day(s) to Complete Entire Unit: 23 Days**

Genetic Variations	**· 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.**	- Making of the fittest activity - Bird Adaptations activity - Amazing Animal Adaptations project	8 Days
Inheritance of Desired Traits	**· Gather and synthesize information about the technologies that have changed the way humans influence the inheritance of desired traits in organisms.**	- Puppy Breeding - GMO problems and solution cards	7 Days
Natural Selection	**· Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in**	- Types of Natural Selection - Kin selection - Sexual Selection	8 Days

	populations over time.			
Teacher Notes:				
Additional Resources:				
Students with Disabilities	**English Language Learners**	**Gifted and Talented Students**	**Students at Risk**	**505Students**

• Consult with Guidance Counselors and follow plan procedures/action plans • Allow extended time to answer questions and permit drawing as an explanation • Accept participation on any level, when necessary and appropriate	•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 word	•Provide extension activities •Build on students' intrinsic motivation •Consult with parents to accommodate students' interests in completing tasks at their level of engagement	•Provide extended time to complete tasks •Consult with other members of the 8th grade team for specific behavior interventions •Provide rewards as necessary	•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 accommod

				ations/modifications

Content Area: Science
Unit Title: Stability and Change on Earth

Grade Level: 8th

Core Ideas: Natural Resource Distribution, Natural Resource Classification, Climate Change, Natural Disasters

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.

Standards (Content and Technology)**:**

CPI#:	**Statement:**
Performance Expectations (NJSLS)	
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.**
Career Readiness, Life Literacies, and Key Skills	
9.4.8.CI.1	Assess data gathered on varying perspectives on causes of climate change (e.g., crosscultural, gender specific, generational), and determine how the data can best be used to design multiple potential solutions (e.g., RI.7.9, 6.SP.B.5, 7.1.NH.IPERS.6, 8.2.8.ETW.4).
9.4.8.CI.3	Examine challenges that may exist in the adoption of new ideas (e.g., 2.1.8.SSH, 6.1.8.CivicsPD.2).

9.4.8.CT.1	Evaluate diverse solutions proposed by a variety of individuals, organizations, and/or agencies to a local or global problem, such as climate change, and use critical thinking skills to predict which one(s) are likely to be effective (e.g., MS-ETS1-2).

9.4.8.CT.2	Develop multiple solutions to a problem and evaluate short- and long-term effects to determine the most plausible option (e.g., MS-ETS1-4, 6.1.8.CivicsDP.1).
9.4.8.CT.3	Compare past problem-solving solutions to local, national, or global issues and analyze the factors that led to a positive or negative outcome.
Computer Science and Design Thinking	
8.1.8.DA.1	Organize and transform data collected using computational tools to make it usable for a specific purpose.
8.1.8.DA.5	Test, analyze, and refine computational models.
8.1.8.DA.6	Analyze climate change computational models and propose refinements.
8.2.8.ITH.1	Explain how the development and use of technology influences economic, political, social, and cultural issues.
8.2.8.ITH.2	Compare how technologies have influenced society over time.
8.2.8.ETW.3	Analyze the design of a product that negatively impacts the environment or society and develop possible solutions to lessen its impact.
8.2.8.ETW.4	Compare the environmental effects of two alternative technologies devised to address climate change issues and use data to justify which choice is best.
8.2.8.EC.1	Explain ethical issues that may arise from the use of new technologies.
Intercultural Statements (Amistad, Holocaust, LGBT, etc...)	
ELD Standard 4	English language learners communicate information, ideas, and concepts necessary for academic success in the content area of Science
ELD-SC 6-8 Explain Interpretive	Defining investigable questions or design problems based on observations, information, and/or data about a phenomenon ● Determining central ideas in complex evidence and information to help explain how or why a phenomenon occurs ● Evaluating scientific reasoning that shows why data or evidence adequately supports conclusions
ELD-SC 6-8 Explain Expressive	Describe valid and reliable evidence from sources about a phenomenon ● Establish neutral or objective stance in how results are communicated ● Develop reasoning to show relationships among independent and dependent variables in models and simple systems ● Summarize patterns in evidence, making trade-offs, revising, and retesting
ELD-SC 6-8 Argue Interpretive	Identifying convincing evidence from data, models, and/or information from investigations of phenomena or design solutions ● Comparing reasoning and claims based on evidence from two

	arguments on the same topic ● Evaluating whether they emphasize similar or different evidence and/or interpretations of facts
ELD-SC 6-8 Argue Expressive	Introduce and contextualize topic/ phenomenon in issues related to the natural and designed world(s) ● Support or refute a claim based on data and evidence ● Establish and maintain a neutral or objective stance ● Signal logical relationships among reasoning, evidence, data, and/or a model when making or defending a claim or counterclaim
Interdisciplinary Connection	
RST.6-8.1	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.
NJSLSA.W2.	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.
NJSLSA.W9.	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.
RST.6-8.1.	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.
RST.6-8.7.	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.
RST.6-8.1	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.
Math	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.
Math	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.
Math	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.

Math	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.

Unit Essential Question(s):	Unit Enduring Understandings:
· **Why aren't minerals and groundwater distributed evenly across the world?** · **How can we predict and prepare for natural disasters?** · **How might we treat resources if we thought about the Earth as a spaceship on an extended survey of the solar system? (How would astronauts manage their resources?)** · **How can basic chemistry be used to explain the mechanisms that control the global temperature the atmosphere?**	· • Humans depend on Earth's land, ocean, atmosphere, and biosphere for many different resources. • All human activities draw on Earth's land, ocean, atmosphere, and biosphere resources and have both short and long-term consequences, positive as well as negative, for the health of people and the natural environment. • Minerals, fresh water, and biosphere resources are distributed unevenly around the planet as a result of past geologic processes. • Cause-and-effect relationships may be used to explain how uneven distributions of Earth's mineral, energy, and groundwater resources have resulted from past and current geosciences processes. • Resources that are unevenly distributed as a result of past processes include but are not limited to petroleum, metal ores, and soil. • Mineral, fresh water, ocean, biosphere, and atmosphere resources are limited, and many are not renewable or replaceable over human lifetimes. • The distribution of some of Earth's land, ocean, atmosphere, and biosphere resources are changing significantly due to removal by humans. · • Natural hazards can be the result of interior processes, surface processes, or severe weather events. • Some natural hazards, such as volcanic eruptions and severe weather, are preceded by phenomena that allow for reliable predictions, but others, such as earthquakes, occur suddenly and with no notice, and thus are not yet predictable. • Mapping the history of natural hazards in a region, combined with an understanding of related geologic forces, can help forecast the locations and likelihoods of future events. • Data on natural hazards can be used to forecast future catastrophic events and inform the development of technologies to mitigate their effects. • Data on natural hazards can include the locations, magnitudes, and frequencies of the natural hazards. • Graphs, charts, and images can be used to identify patterns of natural hazards in a

	region. • Graphs, charts, and images can be used to

	understand patterns of geologic forces that can help forecast the locations and likelihoods of future events. • Technologies that can be used to mitigate the effects of natural hazards can be global or local. • Technologies used to mitigate the effects of natural hazards vary from region to region and over time. • • All human activity draws on natural resources and has both short and long-term consequences, positive as well as negative, for the health of people and the natural environment. • Increases in human population and per-capita consumption of natural resources impact Earth's systems. • Typically as human populations and per-capita consumption of natural resources increase, so do the negative impacts on Earth unless the activities and technologies involved are engineered otherwise. • Cause and effect relationships may be used to predict how increases in human population and per capita consumption of natural resources impact Earth's systems. • The consequences of increases in human populations and consumption of natural resources are described by science. • Science does not make the decisions for the actions society takes. • Scientific knowledge can describe the consequences of human population and per-capita consumption of natural resources impact Earth's systems but does not necessarily prescribe the decisions that society takes. • Stability in Earth's surface temperature might be disturbed either by sudden events or gradual changes that accumulate over time. • Human activities and natural processes are examples of factors that have caused the rise in global temperatures over the past century. • Human activities play a major role in causing the rise in global temperatures. • Human activities, such as the release of greenhouse gases from burning fossil fuels, are major factors in the current rise in Earth's

	mean

	surface temperature (global warming). • Reducing the level of climate change and reducing human vulnerability to whatever climate changes do occur depend on understanding of climate science, engineering capabilities, and other kinds of knowledge, such as understanding of human behavior, and on applying that knowledge wisely in decisions and activities. • Evidence that some factors have caused the rise in global temperature over the last century can include 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.

Formative Assessments:

• Construct a scientific explanation based on valid and reliable evidence of how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geosciences processes. • Obtain evidence from sources, which must include the student's own experiments.

• Analyze and interpret data on natural hazards to determine similarities and differences and to distinguish between correlation and causation.

• Ask questions to identify and clarify a variety of evidence for an argument about the factors that have caused the rise in global temperatures over the past century.

• Ask questions to clarify human activities and natural processes that are major factors in the current rise in Earth's mean surface temperature.

Summative/Benchmark Assessment(s):

• Construct a scientific explanation based on the assumption that theories and laws that describe the current geosciences process operates today as they did in the past and will continue to do so in the future.

• Construct an oral and written argument supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem.

Alternative Assessments:

• Present Opposite points of view on the causes of climate change.

• Compete in a STEM challenge on earthquake proof structures.

Resources/Materials: USGS Educational Resources for Secondary Grades (7–12): NOAA Education Resources: https://www.footprintnetwork.org/	**Key Vocabulary:** Closed System, Open System, Input, Output, Heat Transfer, Conduction, Convection, Radiation, Insulator, Conductor, Renewable Resource, Non-renewable Resource, Earth Overshoot Day, Ecological Footprint,

https://www.overshootday.org/ https://www.census.gov/popclock/ https://ny.pbslearningmedia.org/resource/lsps07-sci-phys thermalenergy/thermal-energy-transfer/	Biocapacity, Ecological Reserve, Ecological Deficit, Natural Disaster

Lesson Name/Topic	Student Learning Objective(s)	Suggested Tasks/Activities:	Day(s) to Complete Entire Unit: 34 Days
Geoscience Processes	**· 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.**	- Earth's Resources video - Renewable vs. Non-renewable popcorn lab - Natural Resource Investigation -	8 Days
Catastrophic Events	**· Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.**	- Natural Disaster Project - Save the City activity	8 Days
Impact on Earth's Systems	**· Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems.**	- Shared resource vs. Private resource lab - Population Clock - Earth Overshoot day Webquest - Ecological Footprint Webquest	9 Days

Global Temperature	**• Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century.**	- Weather vs climate - Us Regions project - Thermal Energy transfer - Layers of the Atmosphere - Formation of a Hurricane activity - Sources of Climate Change Webquest	9 Days

Teacher Notes:				
Additional Resources: http://www.state.nj.us/education/modelcurriculum/sci/8.shtml				
Students with Disabilities	**English Language Learners**	**Gifted and Talented Students**	**Students at Risk**	**506Students**

• Consult with Guidance Counselors and follow plan procedures/action plans • Allow extended time to answer questions and permit drawing as an explanation • Accept participation on any level, when necessary and appropriate	•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 word	•Provide extension activities •Build on students' intrinsic motivation •Consult with parents to accommodate students' interests in completing tasks at their level of engagement	•Provide extended time to complete tasks •Consult with other members of the 8th grade team for specific behavior interventions •Provide rewards as necessary	•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

Midland Park Public Schools

Content Area: Science
Unit Title: Human Impacts
Grade Level: 8th

Core Ideas: Earth Systems, Pollution, Engineering Design Process, Human Impacts on the Environment

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.

Standards (Content and Technology)**:**

CPI#:	**Statement:**
Performance Expectations (NJSLS)	
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.
Career Readiness, Life Literacies, and Key Skills	
9.4.8.CI.1	Assess data gathered on varying perspectives on causes of climate change (e.g., crosscultural, gender specific, generational), and determine how the data can best be used to design multiple potential solutions (e.g., RI.7.9, 6.SP.B.5, 7.1.NH.IPERS.6, 8.2.8.ETW.4).

9.4.8.CI.3	Examine challenges that may exist in the adoption of new ideas (e.g., 2.1.8.SSH, 6.1.8.CivicsPD.2).
9.4.8.CT.1	Evaluate diverse solutions proposed by a variety of individuals, organizations, and/or agencies to a local or global problem, such as climate change, and use critical thinking skills to predict which one(s) are likely to be effective (e.g., MS-ETS1-2).

9.4.8.CT.2	Develop multiple solutions to a problem and evaluate short- and long-term effects to determine the most plausible option (e.g., MS-ETS1-4, 6.1.8.CivicsDP.1).
9.4.8.CT.3	Compare past problem-solving solutions to local, national, or global issues and analyze the factors that led to a positive or negative outcome.
9.4.8.GCA.2	Demonstrate openness to diverse ideas and perspectives through active discussions to achieve a group goal.
9.4.8.IML.12	Use relevant tools to produce, publish, and deliver information supported with evidence for an authentic audience.
9.4.8.TL.2	Gather data and digitally represent information to communicate a real-world problem
Computer Science and Design Thinking	
8.2.8.ED.2	Identify the steps in the design process that could be used to solve a problem.
8.2.8.ED.3:	Develop a proposal for a solution to a real-world problem that includes a model (e.g., physical prototype, graphical/technical sketch).
8.2.8.ED.5	Explain the need for optimization in a design process.
8.2.8.ED.6	Analyze how trade-offs can impact the design of a product.
8.2.8.ED.7	Design a product to address a real-world problem and document the iterative design process, including decisions made as a result of specific constraints and trade-offs (e.g., annotated sketches).
8.2.8.ITH.1	Explain how the development and use of technology influences economic, political, social, and cultural issues.
8.2.8.ITH.2	Compare how technologies have influenced society over time.
8.2.8.ITH.3	Evaluate the impact of sustainability on the development of a designed product or system.
Intercultural Statements (Amistad, Holocaust, LGBT, etc...)	
ELD Standard 4	English language learners communicate information, ideas, and concepts necessary for academic success in the content area of Science
ELD-SC 6-8 Explain Interpretive	Defining investigable questions or design problems based on observations, information, and/or data about a phenomenon ● Determining central ideas in complex evidence and information to help explain how or why a phenomenon occurs ● Evaluating scientific reasoning that shows why data or evidence adequately supports conclusions

ELD-SC 6-8 Explain Expressive	Describe valid and reliable evidence from sources about a phenomenon ● Establish neutral or objective stance in how results are communicated ● Develop reasoning to show relationships among independent and dependent variables in models and simple systems ● Summarize patterns in evidence, making trade-offs, revising, and retesting
ELD-SC 6-8 Argue Interpretive	Identifying convincing evidence from data, models, and/or information from investigations of phenomena or design solutions ● Comparing reasoning and claims based on evidence from two arguments on the same topic ● Evaluating whether they emphasize similar or different evidence and/or interpretations of facts
ELD-SC 6-8 Argue Expressive	Introduce and contextualize topic/ phenomenon in issues related to the natural and designed world(s) ● Support or refute a claim based on data and evidence ● Establish and maintain a neutral or objective stance ● Signal logical relationships among reasoning, evidence, data, and/or a model when making or defending a claim or counterclaim
Interdisciplinary Connection	
WHST.6-8.7.	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.
WHST.6-8.8.	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.
NJSLSA.W9.	Draw evidence from informational texts about minimizing a human impact on the environment to support analysis, reflection, and research.
RST.6-8.1	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.
RST.6-8.9	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.
RST.6-8.7	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.
Math	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.
Math	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.
Math	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.
Math	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.

Unit Essential Question(s):	**Unit Enduring Understandings:**
· **How do we monitor the health of the environment (our life support system)?** · **Is it possible to predict and protect ourselves from natural hazards?**	· • Human activities have significantly altered the biosphere, sometimes damaging or destroying natural habitats and causing the extinction of other species. • Changes to Earth's environments can have different impacts (negative and positive) for different living things. • Typically as human populations and per capita consumption of natural resources increase, so do the negative impacts on Earth, unless the activities and technologies involved are engineered otherwise. • Relationships can be classified as causal or correlational, and correlation does not necessarily imply causation. • The uses of technologies and any limitations on their use are driven by individual or societal needs, desires, and values; by the findings of scientific research; and by differences in such factors as climate, natural resources, and economic conditions. Thus technology use varies from region to region and over time.

Formative Assessments: **Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment. Summative/Benchmark Assessment(s):** **Design a possible solution for one form of human impact on the environment using scientific principles and research. Alternative Assessments:** **Create a pamphlet showing a human impact on the environment and possible solutions.**

Resources/Materials: **http://education.usgs.gov/secondary.html**	**Key Vocabulary: Engineering, Prototype, Pollutant, Point source pollution, Non-point source pollution.**

http://www.education.noaa.gov/			
Lesson Name/Topic	**Student Learning Objective(s)**	**Suggested Tasks/Activities:**	**Day(s) to Complete Entire Unit: 27 Days**
Human Impact on the Environment	**· Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.**	- Garbage timeline - Earth Systems - Pollution Jigsaw - Human Impact Design Project	27 Days
Design Problem Solutions	**· 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.**	- Earthquake Simulation activity	(Incorporated in above days)

Evaluate Solutions	**· Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.**	- Human impact design project	(Incorporated in above days)
Testing Solutions	**· 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.**	- Human impact design project	(Incorporated in above days)

Teacher Notes:

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

Students with Disabilities	**English Language Learners**	**Gifted and Talented Students**	**Students at Risk**	**507Students**

• Consult with Guidance Counselors and follow plan procedures/action plans • Allow extended time to answer questions and permit drawing as an explanation • Accept participation on any level, when necessary and appropriate	•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 word	•Provide extension activities •Build on students' intrinsic motivation •Consult with parents to accommodate students' interests in completing tasks at their level of engagement	•Provide extended time to complete tasks •Consult with other members of the 8th grade team for specific behavior interventions •Provide rewards as necessary	•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

Midland Park Public Schools

Content Area: Science
Unit Title: Relationships among forms of energy
Grade Level: 8th

Core Ideas: Distance, Displacement, Speed, Velocity, Acceleration, Energy, Newton's Laws

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.

Standards (Content and Technology)**:**

CPI#:	**Statement:**
Performance Expectations (NJSLS)	
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.
Career Readiness, Life Literacies, and Key Skills	
9.4.8.IML.3	Create a digital visualization that effectively communicates a data set using formatting techniques such as form, position, size, color, movement, and spatial grouping (e.g., 6.SP.B.4, 7.SP.B.8b).
9.4.8.IML.12	Use relevant tools to produce, publish, and deliver information supported with evidence for an authentic audience.
9.4.8.TL.2	Gather data and digitally represent information to communicate a real-world problem
Computer Science and Design Thinking	

8.1.8.DA.1	Organize and transform data collected using computational tools to make it usable for a specific purpose.
8.1.8.DA.4	Transform data to remove errors and improve the accuracy of the data for analysis.
8.1.8.DA.5	Test, analyze, and refine computational models.

Intercultural Statements (Amistad, Holocaust, LGBT, etc...)	
ELD Standard 4	English language learners communicate information, ideas, and concepts necessary for academic success in the content area of Science
ELD-SC 6-8 Explain Interpretive	Defining investigable questions or design problems based on observations, information, and/or data about a phenomenon ● Determining central ideas in complex evidence and information to help explain how or why a phenomenon occurs ● Evaluating scientific reasoning that shows why data or evidence adequately supports conclusions
ELD-SC 6-8 Explain Expressive	Describe valid and reliable evidence from sources about a phenomenon ● Establish neutral or objective stance in how results are communicated ● Develop reasoning to show relationships among independent and dependent variables in models and simple systems ● Summarize patterns in evidence, making trade-offs, revising, and retesting
ELD-SC 6-8 Argue Interpretive	Identifying convincing evidence from data, models, and/or information from investigations of phenomena or design solutions ● Comparing reasoning and claims based on evidence from two arguments on the same topic ● Evaluating whether they emphasize similar or different evidence and/or interpretations of facts
ELD-SC 6-8 Argue Expressive	Introduce and contextualize topic/ phenomenon in issues related to the natural and designed world(s) ● Support or refute a claim based on data and evidence ● Establish and maintain a neutral or objective stance ● Signal logical relationships among reasoning, evidence, data, and/or a model when making or defending a claim or counterclaim
Interdisciplinary Connection	
RST.6-8.1.	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.
RST.6-8.7.	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.
RST.6-8.7.	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.
RST.6-8.1.	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.

NJSLSA.W1.	Write arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object.

Math	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.
Math	Describe a ratio relationship between kinetic energy and mass separately from kinetic energy and speed.
Math	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.
Math	Recognize and represent proportional relationships between kinetic energy and mass separately from kinetic energy and speed.
Math	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.
Math	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 √2 is irrational.
Math	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.

Unit Essential Question(s):

- **Is it better to have an aluminum (baseball/softball) bat or a wooden bat?**
- **What would give you a better chance of winning a bowling match, using a basketball that you can roll really fast, or a bowling ball that you can only roll slowly?**
- **Who can design the best roller coaster?**

Unit Enduring Understandings:

- • Kinetic energy is related to the mass of an object and to the speed of an object.
  • Kinetic energy has a relationship to mass separate from its relationship to speed.
  • Motion energy is properly called kinetic energy; it is proportional to the mass of the moving object and grows with the square of the object's speed. • Proportional relationships among different types of quantities provide information about the magnitude of properties and processes.

- • When the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system.
  • A system of objects may contain stored (potential) energy, depending on the objects' relative positions.
  • When two objects interact, each one exerts a

	force on the other that can cause energy to be transferred to or from the objects. • Models that could include representations, diagrams, pictures, and written descriptions of systems can be used to represent systems and their interactions, such as inputs, processes, and outputs, and energy and matter flows within systems. • When the kinetic energy of an object changes, energy is transferred to or from the object. • When the motion energy of an object changes, there is inevitably some other change in energy at the same time. • Kinetic energy may take different forms (e.g., energy in fields, thermal energy, energy of motion).

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.

Alternative Assessments:

· Create a Rube Goldberg as a STEM challenge describing the forms and transformations of energy.

Resources/Materials:	Key Vocabulary: Reference point, position, motion, distance, displacement, Speed, Constant speed, Instantaneous speed, Average speed, velocity, Acceleration, Work
Soccer - Kick it It's All Downhill: Forces and Sports Lesson Plan Energy Skate Park: Basics Energy: Different Kinds of Energy	

Lesson Name/Topic	Student Learning Objective(s)	Suggested Tasks/Activities:	Day(s) to Complete Entire Unit: 23 Days
Kinetic Energy	• 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.	- Where are you? - Car Perspective - Distance vs. Displacement - Speed/Velocity/Acceleration calculations	7 Days
Potential Energy	• 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.	- Rollercoaster Video - Types of Energy Charades	8 Days
Energy Transfer	• 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.	- Energy Transformation riddles - Rube Goldberg Machines - Newton's Laws	8 Days
Teacher Notes:			
Additional Resources: http://www.state.nj.us/education/modelcurriculum/sci/8.shtml			

Students with Disabilities	English Language Learners	Gifted and Talented Students	Students at Risk	508Students
• Consult with Guidance Counselors and follow plan procedures/action plans • Allow extended	•Assign a buddy, same language or English speaking •Allow errors in speaking	•Provide extension activities •Build on students' intrinsic motivation	•Provide extended time to complete tasks •Consult with other members of the 8th	•Allow errors •Rephrase questions, directions, and explanations

time to answer questions and permit drawing as an explanation Accept participation on any level, when necessary and appropriate	•Rephrase questions, directions, and explanations •Allow extended time to answer questions •Accept participation at any level, even one word	•Consult with parents to accommodate students' interests in completing tasks at their level of engagement	grade team for specific behavior interventions •Provide rewards as necessary	•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

Content Area: Science

Unit Title: Thermal Energy

Grade Level: 8th

Core Ideas: Thermal Energy Transfer, Insulators Vs. Conductors, Engineering Design Process

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.

Standards (Content and Technology)**:**

CPI#:	**Statement:**
Performance Expectations (NJSLS)	
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.
Career Readiness, Life Literacies, and Key Skills	

9.2.8.CAP.10	Evaluate how careers have evolved regionally, nationally, and globally.
9.4.8.CT.2	Develop multiple solutions to a problem and evaluate short- and long-term effects to determine the most plausible option (e.g., MS-ETS1-4, 6.1.8.CivicsDP.1).
9.4.8.IML.3	Create a digital visualization that effectively communicates a data set using formatting techniques such as form, position, size, color, movement, and spatial grouping (e.g., 6.SP.B.4, 7.SP.B.8b).
9.4.8.TL.2	Gather data and digitally represent information to communicate a real-world problem
Computer Science and Design Thinking	
8.1.8.DA.1	Organize and transform data collected using computational tools to make it usable for a specific purpose.
8.2.8.ED.2	Identify the steps in the design process that could be used to solve a problem.
8.2.8.ED.3:	Develop a proposal for a solution to a real-world problem that includes a model (e.g., physical prototype, graphical/technical sketch).
8.2.8.ED.5	Explain the need for optimization in a design process.
8.2.8.ED.6	Analyze how trade-offs can impact the design of a product.
8.2.8.ED.7	Design a product to address a real-world problem and document the iterative design process, including decisions made as a result of specific constraints and trade-offs (e.g., annotated sketches).
8.2.8.ITH.3	Evaluate the impact of sustainability on the development of a designed product or system.
Intercultural Statements (Amistad, Holocaust, LGBT, etc...)	
ELD Standard 4	English language learners communicate information, ideas, and concepts necessary for academic success in the content area of Science
ELD-SC 6-8 Explain Interpretive	Defining investigable questions or design problems based on observations, information, and/or data about a phenomenon ● Determining central ideas in complex evidence and information to help explain how or why a phenomenon occurs ● Evaluating scientific reasoning that shows why data or evidence adequately supports conclusions
ELD-SC 6-8 Explain Expressive	Describe valid and reliable evidence from sources about a phenomenon ● Establish neutral or objective stance in how results are communicated ● Develop reasoning to show relationships among independent and dependent variables in models and simple systems ● Summarize patterns in evidence, making trade-offs, revising, and retesting
ELD-SC 6-8 Argue Interpretive	Identifying convincing evidence from data, models, and/or information from investigations of phenomena or design solutions ● Comparing reasoning and claims based on evidence from two arguments on the same topic ● Evaluating whether they emphasize similar or different evidence and/or interpretations of facts

ELD-SC 6-8 Argue Expressive	Introduce and contextualize topic/ phenomenon in issues related to the natural and designed world(s) ● Support or refute a claim based on data and evidence ● Establish and maintain a neutral or objective stance ● Signal logical relationships among reasoning, evidence, data, and/or a model when making or defending a claim or counterclaim
Interdisciplinary Connection	
RST.6-8.3.	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.
WHST.6-8.7.	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.
RST.6-8.3.	Follow precisely a multistep process for the design, construction, and testing of a device that either minimizes or maximizes thermal energy transfer.
WHST.6-8.7.	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.
NJSLSA.W8.	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.
WHST.6-8.9.	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.
RST.6-8.1.	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.
RST.6-8.9.	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.
Math	Reason abstractly and quantitatively while collecting and analyzing numerical and symbolic data as part of an investigation that has been planned individually and collaboratively.

Math	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.
Math	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.

Unit Essential Question(s):	Unit Enduring Understandings:
· **How can a standard thermometer be used to tell you how particles are behaving?** · **You are an engineer working for NASA. In preparation for a manned space mission to the Moon, you are tasked with designing, constructing, and testing a device that will keep a hot beverage hot for the longest period of time. It costs approximately $10,000 per pound to take payload into orbit so the devise must be lightweight and compact. The lack of atmosphere on the Moon produces temperature extremes that range from -157 degrees C in the dark to +121 degrees C in the light. Your devise must operate on either side of the Moon**	· • There are 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. • Temperature is a measure of the average kinetic energy of particles of matter. • The relationship between the temperature and the total energy of a system depends on the types, states, and amounts of matter present. • The amount of energy transfer needed to change the temperature of a matter sample by a given amount depends on the nature of the matter, the size of the sample, and the environment. • Proportional relationships among the amount of energy transferred, the mass, and the change in the average kinetic energy of particles as measured by temperature of the sample provide information about the magnitude of properties and processes. • Temperature is a measure of the average kinetic energy of particles of matter. • The relationship between the temperature and the total energy of a system depends on the types, states, and amounts of matter present. • Energy is spontaneously transferred out of hotter regions or objects and into colder ones. • The transfer of energy can be tracked as energy flows through a designed or natural system. • The more precisely a design task's criteria and constraints can be defined, the more likely it is that the designed solution will be successful. • Specification of constraints includes consideration of scientific principles and other relevant knowledge that is likely to limit possible solutions. • A solution needs to be tested and then modified on the basis of the test results in order to improve it. • There are systematic processes for evaluating solutions with respect to how well they meet criteria and constraints of a problem.

Formative Assessments:

• Individually and collaboratively 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 particles as measured by the temperature of the sample.

• As part of a planned investigation, identify independent and dependent variables and controls, what tools are needed to do the gathering, how measurements will be recorded, and how many data are needed to support a claim.

• Make logical and conceptual connections between evidence and explanations.

• Determine design criteria and constraints for a device that either minimizes or maximizes thermal energy transfer. • Test design solutions and modify them on the basis of the test results in order to improve them. • Use a systematic process for evaluating solutions with respect to how well they meet criteria and constraints.

Summative/Benchmark Assessment(s):

• Apply scientific ideas or principles to design, construct, and test a design of a device that either minimizes or maximizes thermal energy transfer.

Alternative Assessments:

• Write a how-to-guide on using evidence and explanations to support a claim.

Resources/Materials:	**Key Vocabulary: Radiation, Conduction, Convection, Insulator, Conductor, Engineering Design Process**
https://spaceflightsystems.grc.nasa.gov/education/rocket/moon.html Energy Forms and Changes States of Matter	

Lesson Name/Topic	**Student Learning Objective(s)**	**Suggested Tasks/Activities:**	**Day(s) to Complete Entire Unit: 32 Days**

Thermal Energy Transfer	**• Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer.**	- Thermal heat transfer learning module - Conductor vs. Insulator - Thermal energy design challenge	16 Days

Relationships of Energy, Matter, Mass, and Temperature	**• 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.**	- Thermal energy design challenge	16 Days
Design Problem Solutions	**• 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.**	- Engineering design process	(Incorporated in above days)
Evaluate Solutions	**• Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.**	- Engineering design process	(Incorporated in above days)

Testing Solutions	**• 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.**	- Engineering design process	(Incorporated in above days)
Develop a Model	**• 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.**	- Engineering design process	(Incorporated in above days)
Teacher Notes:			
Additional Resources: http://www.state.nj.us/education/modelcurriculum/sci/8.shtml			

Students with Disabilities	**English Language Learners**	**Gifted and Talented Students**	**Students at Risk**	**509Students**

• Consult with Guidance Counselors and follow plan procedures/action plans • Allow extended time to answer questions and permit drawing as an explanation Accept participation on any level, when necessary and appropriate	•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 word	•Provide extension activities •Build on students' intrinsic motivation •Consult with parents to accommodate students' interests in completing tasks at their level of engagement	•Provide extended time to complete tasks •Consult with other members of the 8th grade team for specific behavior interventions •Provide rewards as necessary	•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

Midland Park Public Schools

Content Area: Science
Unit Title: The Electromagnetic Spectrum
Grade Level: 8th

Core Ideas: Waves, Electromagnetic Spectrum, Transmission

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.

Standards (Content and Technology)**:**

CPI#:	**Statement:**
Performance Expectations (NJSLS)	
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.
Career Readiness, Life Literacies, and Key Skills	
9.4.8.IML.3	Create a digital visualization that effectively communicates a data set using formatting techniques such as form, position, size, color, movement, and spatial grouping (e.g., 6.SP.B.4, 7.SP.B.8b).
9.4.8.IML.12	Use relevant tools to produce, publish, and deliver information supported with evidence for an authentic audience.
9.4.8.TL.2	Gather data and digitally represent information to communicate a real-world problem
Computer Science and Design Thinking	
8.1.8.DA.1	Organize and transform data collected using computational tools to make it usable for a specific purpose.
8.1.8.DA.5	Test, analyze, and refine computational models.
8.2.8.ITH.2	Compare how technologies have influenced society over time.

Intercultural Statements (Amistad, Holocaust, LGBT, etc...)	
ELD Standard 4	English language learners communicate information, ideas, and concepts necessary for academic success in the content area of Science

ELD-SC 6-8 Explain Interpretive	Defining investigable questions or design problems based on observations, information, and/or data about a phenomenon ● Determining central ideas in complex evidence and information to help explain how or why a phenomenon occurs ● Evaluating scientific reasoning that shows why data or evidence adequately supports conclusions
ELD-SC 6-8 Explain Expressive	Describe valid and reliable evidence from sources about a phenomenon ● Establish neutral or objective stance in how results are communicated ● Develop reasoning to show relationships among independent and dependent variables in models and simple systems ● Summarize patterns in evidence, making trade-offs, revising, and retesting
ELD-SC 6-8 Argue Interpretive	Identifying convincing evidence from data, models, and/or information from investigations of phenomena or design solutions ● Comparing reasoning and claims based on evidence from two arguments on the same topic ● Evaluating whether they emphasize similar or different evidence and/or interpretations of facts
ELD-SC 6-8 Argue Expressive	Introduce and contextualize topic/ phenomenon in issues related to the natural and designed world(s) ● Support or refute a claim based on data and evidence ● Establish and maintain a neutral or objective stance ● Signal logical relationships among reasoning, evidence, data, and/or a model when making or defending a claim or counterclaim
Interdisciplinary Connection	
RST.6-8.7.	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.
RST.6-8.7.	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.
RST.6-8.1.	Cite specific textual evidence to support the claim that digitized signals are a more reliable way to encode and transmit information than analog signals.
RST.6-8.2.	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.
RST.6-8.9.	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.
WHST.6-8.9.	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.

RST.6-8.7.	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.

Math	Include mathematical representations to describe a simple model for waves.
Math	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.
Math	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.
Math	Use ratio and rate reasoning to solve problems showing the relationship between the amplitude of a wave and the energy of the wave.
Math	Recognize and represent proportional relationships when using mathematical representations to describe a simple model.
Math	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.

Unit Essential Question(s):

- **Why do surfers love physicists?**
- **How do the light and sound system in the auditorium work?**
- **If rotary phones worked for my grandparents, why did they invent cell phones?**

Unit Enduring Understandings:

- • A simple wave has a repeating pattern with a specific wavelength, frequency, and amplitude. • Describe a simple model for waves that includes how the amplitude of a wave is related to the energy in a wave.
  • Graphs and charts can be used to identify patterns in data.
  • Waves can be described with both qualitative and quantitative thinking.
- • When light shines on an object, it is reflected, absorbed, or transmitted through the object, depending on the object's material and the frequency (color) of the light.
  • The path that light travels can be traced as straight lines, except at surfaces between different transparent materials (e.g., air and water, air and glass) where the light path bends.
  • A wave model of light is useful for explaining brightness, color, and the frequency-dependent bending of light at a surface between media.
  • Waves are reflected, absorbed, or transmitted through various materials.
  • A sound wave needs a medium through which it is transmitted.
  • Because light can travel through space, it cannot

	be a matter wave, like sound or water waves. • The structure of a wave can be modified to serve particular functions by taking into account properties of different materials and how materials can be shaped and used. • Structures can be designed to use properties of waves to serve particular functions. • Waves can be used for communication purposes. • Digitized signals (sent as wave pulses) are a more reliable way to encode and transmit information than are analog signals. • Wave-related technologies extend the measurement, exploration, modeling, and computational capacity of scientific investigations.

Formative Assessments:

• 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.

• Use mathematical representations to describe a simple model.
• Develop and use models to describe the movement of waves in various materials.

Summative/Benchmark Assessment(s):

• Integrate qualitative scientific and technical information in written text with that contained in media and visual displays to clarify claims that digitized signals are a more reliable way to encode and transmit information than analog signals are.

Alternative Assessments:

• Create a pamphlet explaining how waves are reflected, absorbed, or transmitted through various materials.

• Design a concept map that links digitized signals to analog signals and compares their reliability to encode and transmit information.

Resources/Materials: Waves on a String Sound Waves Electromagnetic Math	**Key Vocabulary: Waves, Amplitude, Crest, Trough, Frequency, Electromagnetic Spectrum, Reflection, Absorption, Transmission, Analog**

Lesson Name/Topic	Student Learning Objective(s)	Suggested Tasks/Activities:	Day(s) to Complete Entire Unit: 23 Days
Amplitude and Energy of a Wave	**• 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.**	- Waves Webquest - Properties of Waves - Waves Simulation	8 Days
Reflection, Absorption, and Transmission of Waves	**• Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials.**	- Light/Optics lab - Mirror lab	8 Days
Digitized vs. Analog Signals	**• 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.**	- Signal research	7 Days

Teacher Notes:

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

Students with Disabilities	English Language Learners	Gifted and Talented Students	Students at Risk	510Students

• Consult with Guidance Counselors and follow plan procedures/action plans • Allow extended time to answer questions and	•Assign a buddy, same language or English speaking •Allow errors in speaking •Rephrase questions, directions,	•Provide extension activities •Build on students' intrinsic motivation •Consult with parents to accommodate	•Provide extended time to complete tasks •Consult with other members of the 8th grade team for specific behavior	•Allow errors •Rephrase questions, directions, and explanations •Allow extended time to answer

permit drawing as an explanation • Accept participation on any level, when necessary and appropriate	and explanations •Allow extended time to answer questions •Accept participation at any level, even one word	students' interests in completing tasks at their level of engagement	interventions •Provide rewards as necessary	questions and permit drawing as an explanation •Accept participation on any level, even one word •Consult with Case Managers and follow IEP accommodations/modifications