MIDLAND PARK PUBLIC SCHOOLS
Midland Park, New Jersey
CURRICULUM

Science
Grade 4

Prepared by:
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CCCS born on 9/2012
NJSLS born on 8/2017

Grade 4 Science Curriculum Overview

Grade 4 science is taught in eight units throughout the school year. The science curriculum is a hands-on, open-ended and sequential process of investigating the biological and physical world. As part of the spiraling curriculum, aspects of physical science, life science, earth & space science, and engineering; technology & applications of science are taught throughout the year. A guided inquiry program gives students the opportunity to explore topics and concepts though investigations. Participating in this hands-on program helps students:

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

Suggested Course Sequence*:

Unit 1: Weathering and Erosion: 10 days
Unit 2: Earth Processes: 10 days
Unit 3: Structures and Functions: 10 days
Unit 4: How Organisms Process Information: 10 days
Unit 5: Transfer and Energy: 15 days
Unit 6: Force and Motion: 15 days
Unit 7: Using Engineering Design with Force and Motion Systems: 15 days
Unit 8: Waves and Information: 15 days

Pre-Requisite: Grade 3 Science

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

Content Area: Science

Unit Title: Weathering and Erosion

Grade Level: 4th

Unit Summary:

In this unit of study, students develop understandings of the effects of weathering and the rate of erosion by water, ice, wind, or vegetation. The crosscutting concepts of *patterns* and *cause and effect* are called out as organizing concepts. Students demonstrate grade-appropriate proficiency in *planning and carrying out investigations* and *constructing explanations*. Students are also expected to use these practices to demonstrate understanding of the core ideas.

Interdisciplinary Connections:

English Language Arts/Literacy

To support integration of the language arts standards in this unit, students can read content-specific texts to deepen their understanding of the cause-and-effect relationships within earth systems. As they read, students should take notes, which can be used to help them understand and explain how earth processes affect the world around them. They should ask questions, such as,

- What types of soil erode faster?
- Why do some rocks weather more easily or more quickly than others?
- What patterns of change can be observed using models?

As they attempt to answer these questions, students can cite evidence from observations and from texts to support their thinking. In addition, students can conduct short research projects that will help them gather additional evidence to support explanations. Throughout this unit, students should collect and record data in science journals and analyze the data to identify patterns of change.

Mathematics

To support integration of the Mathematics standards into this unit, students are expected to use mathematics when analyzing quantitative data to identify patterns, explain cause-and-effect relationships, and make predictions. Students need opportunities to measure earth materials using tools, such as balances and graduated cylinders, and to measure distances and heights using rulers or tape measures. Students should also be required to solve problems involving measurement and data.

21st Century Themes and Skills:

CRP2. Apply appropriate academic and technical skills.
CRP4. Communicate clearly and effectively and with reason.
CRP6. Demonstrate creativity and innovation.
CRP7. Employ valid and reliable research strategies.
CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.
CRP11. Use technology to enhance productivity.

Standards (Content and Technology)**:**

CPI#:	Statement:
NJSLS 4-ESS2-1	Make observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation.
NJSLS 4-ESS1-1	Identify evidence from patterns in rock formations and fossils in rock layers to support an explanation for changes in a landscape over time.
8.1.5.A.1	Select and use the appropriate digital tools and resources to accomplish a variety of tasks including solving problems.

8.2.5.C.4	Collaborate and brainstorm with peers to solve a problem evaluating all solutions to provide the best results with supporting sketches or models.

Unit Essential Question(s):

- **How can evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation be observed or measured?**
- **What can rock formations tell us about the past?**

Unit Enduring Understandings:

- Cause-and-effect relationships are routinely identified, tested, and used to explain change.
- Water, ice, wind, living organisms, and gravity break rocks, soils, and sediments into smaller particles and move them around.
- Rainfall helps to shape the land and affects the types of living things found in a region.
- Living things affect the physical characteristics of their regions.
- Science assumes consistent patterns in natural systems.
- Patterns can be used as evidence to support an explanation.
- Local, regional, and global patterns of rock formations reveal changes over time due to earth forces, such as earthquakes.
- The presence and location of certain fossil types indicate the order in which rock layers were formed.

Unit Learning Targets/Objectives:

Students will…

- Make observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation.
- Identify evidence from patterns in rock formations and fossils in rock layers to support an explanation for changes in a landscape over time.

Formative Assessments:

- **Identify, test, and use cause-and-effect relationships in order to explain change.**
- **Make observations and/or measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon.**
- **Make observations and/or measurements to produce evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation. (Note: Assessment is limited to a single form of weathering or erosion.) Examples of variables to test could include:**
  - **Angle of slope in the downhill movement of water**
  - **Amount of vegetation**
  - **Speed of the wind**
  - **Relative rate of deposition**
  - **Cycles of freezing and thawing of water**
  - **Cycles of heating and cooling**
  - **Volume of water flow**
- **Support explanations using patterns as evidence.**
- **Identify the evidence that supports particular points in an explanation.**

- **Identify evidence from patterns in rock formations and fossils in rock layers to support an explanation for changes in a landscape over time. (Note: Assessment does not include specific knowledge of the mechanism of rock formation or memorization of specific rock formations and layers. Assessment is limited to relative time.) Examples of evidence from patterns could include**
  - **Rock layers with marine shell fossils above rock layers with plant fossils and no shells, indicating a change from land to water over time.**
  - **A canyon with different rock layers in the walls and a river in the bottom, indicating that over time a river cut through the rock.**

Summative/Benchmark Assessment(s):

- Make observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation.
- Identify evidence from patterns in rock formations and fossils in rock layers to support an explanation for changes in a landscape over time.

Resources/Materials (copy hyperlinks for digital resources)**:**
http://ngss.nsta.org/Resource.aspx?ResourceID=35
http://ngss.nsta.org/Resource.aspx?ResourceID=44
http://ngss.nsta.org/Resource.aspx?ResourceID=45
http://ngss.nsta.org/Resource.aspx?ResourceID=92
http://ngss.nsta.org/Resource.aspx?ResourceID=106

Modifications:

Special Education Students:

- Allow errors
- Rephrase questions, directions, and explanations
- Allow extended time to answer questions, and permit drawing, as an explanation
- Accept participation at any level, even one word
- Consult with Case Managers and follow IEP accommodations/modifications

At-Risk Students:

- Provide extended time to complete tasks
- Consult with Guidance Counselors and follow I&RS procedures/action plans
- Consult with classroom teacher(s) for specific behavior interventions
- Provide rewards as necessary

English Language Learners:

- Assign a buddy, same language or English speaking
- Allow errors in speaking
- Rephrase questions, directions, and explanations
- Allow extended time to answer questions
- Accept participation at any level, even one word

Gifted and Talented Students:

- Provide extension activities
- Build on students' intrinsic motivations
- Consult with parents to accommodate students' interests in completing tasks at their level of engagement

Lesson Name/Topic	Lesson Objective(s)	Time frame (day(s) to complete) Entire Unit: 10 Days
1	**Make observations and/or measurements to provide evidence**	5 Days

2	**Identify evidence from patterns to support an explanation**	5 Days

Teacher Notes:

Additional Resources

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

Content Area: Science

Unit Title: Earth Processes

Grade Level: 4th

Unit Summary:

In this unit of study, students apply their knowledge of natural Earth processes to generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans. In order to describe patterns of Earth's features, students analyze and interpret data from maps. The crosscutting concepts of *patterns*, *cause and effect*, and the influence of engineering, technology, and science on society and the natural world are called out as organizing concepts for these disciplinary core ideas. Students are expected to demonstrate grade-appropriate proficiency in planning and carrying out investigations, analyzing and interpreting data, and constructing explanations and designing solutions. Students are also expected to use these practices to demonstrate understanding of the core ideas.

Interdisciplinary Connections:

English Language Arts

To support integration of the CCSS for English Language Arts in this unit, students should have access to multiple sources of information about Earth's features and earth processes. Students should have opportunities to read, analyze, and interpret information from nonfiction text, charts, graphs, diagrams, timelines, and interactive elements on the Internet. Students use this information, along with data they collect during investigations, to help explain, both orally and in writing, the patterns they observe in the features of the Earth and in the natural hazards that occur on the Earth. As students engage in the engineering design process, they need opportunities to conduct research to build their understanding of how earth processes affect humans and to find examples of ways in which engineers reduce the effect of volcanic eruptions, earthquakes, floods, and tsunamis. Students should take notes as they read and summarize or paraphrase their notes to support their work throughout the engineering design process. In addition, students should provide a list of sources when using this type of information.

Mathematics

- Use measurements to determine how far earthquakes and volcanoes tend to occur from continental boundaries.
- Analyze data to determine patterns of change that occur in areas where volcanoes erupt, earthquakes occur, and in flood zones.
- Reason abstractly and quantitatively to draw diagrams to build scale models.
- Analyze timelines, charts, and graphs to determine patterns in Earth's features and patterns of change caused by earth processes.
- Reason abstractly and quantitatively when discussing the effects of an earth process on humans. For example, on average, 3,000 lives are lost every year due to tsunamis. When early warning systems are in place, fewer than 1,000 lives are lost annually.
- Analyze constraints on materials, time, or cost to in order to determine criteria for design solutions.

21st Century Themes and Skills:

CRP2. Apply appropriate academic and technical skills.
CRP4. Communicate clearly and effectively and with reason.
CRP6. Demonstrate creativity and innovation.
CRP7. Employ valid and reliable research strategies.
CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.
CRP11. Use technology to enhance productivity.

Standards (Content and Technology)**:**

CPI#:	**Statement:**

NJSLS 4-ESS2-2	Analyze and interpret data from maps to describe patterns of Earth's features.
NJSLS 4-ESS3-2	Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans.
NJSLS 3-5-ETS1-2	Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.
NJSLS 3-5-ETS1-3	Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.
8.1.5.A.1	Select and use the appropriate digital tools and resources to accomplish a variety of tasks including solving problems.
8.2.5.C.4	Collaborate and brainstorm with peers to solve a problem evaluating all solutions to provide the best results with supporting sketches or models.

Unit Essential Question(s):

- **What can maps tell us about the features of the world?**
- **In what ways can the impacts of natural Earth processes on humans be reduced?**

Unit Enduring Understandings:

- Patterns can be used as evidence to support an explanation.
- Maps can help locate the different land and water features of Earth.
- The locations of mountain ranges, deep ocean trenches, ocean floor structures, earthquakes, and volcanoes occur in patterns.
- Most earthquakes and volcanoes occur in bands that are often along the boundaries between continents and oceans.
- Major mountain chains form inside continents or near their edges.
- Cause-and-effect relationships are routinely identified, tested, and used to explain change.
- Engineers improve existing technologies or develop new ones to increase benefits, decrease known risks, and meet societal demands.
- A variety of hazards result from natural processes (e.g., earthquakes, floods, tsunamis, volcanic eruptions).
- Humans cannot eliminate the hazards, but they can take steps to reduce their impacts.
- Research on a problem should be carried out before beginning to design a solution.
- Testing a solution involves investigating how well it performs under a range of likely conditions.
- At whatever stage, communicating with peers about proposed solutions to a problem is an important part of the design process, and shared ideas can lead to improved designs.
- Tests are often designed to identify failure points or difficulties, which suggest the elements of the design that need to be improved.

	• Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints.

Unit Learning Targets/Objectives:

Students will...

- **Analyze and interpret data from maps to describe patterns of Earth's features.**
- **Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans.**
- **Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.**
- **Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.**

Formative Assessments:

- **Support an explanation using patterns as evidence.**
- **Analyze and interpret data to make sense of phenomena using logical reasoning.**
- **Analyze and interpret data from maps to describe patterns of Earth's features. Maps can include: Topographic maps of Earth's land Topographic maps of Earth's ocean floor Locations of mountains Locations of continental boundaries Locations of volcanoes and earthquakes**
- **Identify and test cause-and-effect relationships in order to explain change.**
- **Generate multiple solutions to a problem and compare them based on how well they meet the criteria and constraints of the design solution.**
- **Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans (Assessment is limited to earthquakes, floods, tsunamis, and volcanic eruptions.) Examples of solutions could include: Designing an earthquake-resistant building Improving monitoring of volcanic activity.**
- **Generate multiple possible solutions to a problem and compare them based on how well each is likely to meet the criteria and constraints of the problem.**
- **Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered.**
- **Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.**

Summative/Benchmark Assessment(s):

- **Analyze and interpret data from maps to describe patterns of Earth's features.**
- **Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans.**
- **Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.**
- **Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.**

Resources/Materials (copy hyperlinks for digital resources)**:**

http://ngss.nsta.org/Resource.aspx?ResourceID=26
http://ngss.nsta.org/Resource.aspx?ResourceID=68
http://ngss.nsta.org/Resource.aspx?ResourceID=77
http://ngss.nsta.org/Resource.aspx?ResourceID=352
http://www.dlese.org/library/literacy_maps/

Modifications:

Special Education Students:

- Allow errors
- Rephrase questions, directions, and explanations
- Allow extended time to answer questions, and permit drawing, as an explanation
- Accept participation at any level, even one word
- Consult with Case Managers and follow IEP accommodations/modifications

At-Risk Students:

- Provide extended time to complete tasks
- Consult with Guidance Counselors and follow I&RS procedures/action plans
- Consult with classroom teacher(s) for specific behavior interventions
- Provide rewards as necessary

English Language Learners:

- Assign a buddy, same language or English speaking
- Allow errors in speaking
- Rephrase questions, directions, and explanations
- Allow extended time to answer questions
- Accept participation at any level, even one word

Gifted and Talented Students:

- Provide extension activities
- Build on students' intrinsic motivations
- Consult with parents to accommodate students' interests in completing tasks at their level of engagement

Lesson Name/Topic	Lesson Objective(s)	Time frame (day(s) to complete) Entire Unit: 10 Days
1	**Analyze and interpret data from maps**	2 Days
2	**Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans.**	3 Days
3	**Generate and compare multiple possible solutions to a problem**	2 Days
4	**Plan and carry out fair tests**	3 Days

Teacher Notes:

Additional Resources

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

Content Area: Science

Unit Title: Structures and Functions

Grade Level: 4th

Unit Summary:

In this unit of study, students develop an understanding that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction. The crosscutting concepts of *systems and system models* are called out as organizing concepts for this disciplinary core idea. Students are expected to demonstrate grade-appropriate proficiency *in engaging in argument from evidence*. Students are also expected to use this practice to demonstrate understanding of the core idea.

Interdisciplinary Connections:

English Language Arts

Students use the evidence from their observations of plants and animals to support the claim that all organisms are systems with structures that function in growth, survival, behavior, and/or reproduction. Students need opportunities to observe plants and animals closely, taking notes and drawing pictures, so that they can describe various structures and their functions.

Mathematics

Students describe the symmetry that can be observed in an organism's structures. For example, the leaves of many plants and the bodies of many animals display bilateral symmetry. Students should be encouraged to draw each organism that they observe, pointing out any structures that are symmetrical. Students should also trace lines of symmetry in their drawings to support their thinking. In addition, students can conduct research to determine whether the symmetry serves a function in the growth, reproduction, or survival of the organism.

21st Century Themes and Skills:

CRP2. Apply appropriate academic and technical skills.
CRP4. Communicate clearly and effectively and with reason.
CRP6. Demonstrate creativity and innovation.
CRP7. Employ valid and reliable research strategies.
CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.
CRP11. Use technology to enhance productivity.

Standards (Content and Technology):

CPI#:	Statement:
NJSLS 4-LS1-1	Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.
8.1.5.A.1	Select and use the appropriate digital tools and resources to accomplish a variety of tasks including solving problems.
8.2.5.C.4	Collaborate and brainstorm with peers to solve a problem evaluating all solutions to provide the best results with supporting sketches or models.

Unit Essential Question(s):

- **How do internal and external parts of plants and animals help them to survive, grow, behave, and reproduce?**

Unit Enduring Understandings:

- A system can be described in terms of its components and their interactions.
- Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction.

Unit Learning Targets/Objectives:

Students will...

- **Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.**

Formative Assessments:

- Describe a system in terms of its components and their interactions.
- Construct an argument with evidence, data, and/or a model.
- Construct an argument to support the claim that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction. (Assessment is limited to macroscopic structures within plant and animal systems.) Examples of structures could include:
  - Thorns
  - Stems
  - Roots
  - Colored petals
  - Heart
  - Stomach
  - Lung
  - Brain
  - Skin

Summative/Benchmark Assessment(s):

- **Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.**

Resources/Materials (copy hyperlinks for digital resources)**:**

http://www.pbslearningmedia.org/resource/tdc02.sci.life.colt.lp_mouths/animal-mouth-structures/

Modifications:

Special Education Students:

- Allow errors
- Rephrase questions, directions, and explanations
- Allow extended time to answer questions, and permit drawing, as an explanation
- Accept participation at any level, even one word
- Consult with Case Managers and follow IEP accommodations/modifications

English Language Learners:

- Assign a buddy, same language or English speaking
- Allow errors in speaking
- Rephrase questions, directions, and explanations

At-Risk Students:

- Provide extended time to complete tasks
- Consult with Guidance Counselors and follow I&RS procedures/action plans
- Consult with classroom teacher(s) for specific behavior interventions
- Provide rewards as necessary

Gifted and Talented Students:

- Provide extension activities
- Build on students' intrinsic motivations

- 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

Lesson Name/Topic	Lesson Objective(s)	Time frame (day(s) to complete)	Entire Unit: 10 Days
1	**Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.**	10 Days	

Teacher Notes:

Additional Resources

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

Content Area: Science

Unit Title: How Organisms Process Information

Grade Level: 4th

Unit Summary:

In this unit of study, students are expected to develop an understanding that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction. By developing a model, they describe that an object can be seen when light reflected from its surface enters the eye. The crosscutting concepts of *cause and effect, systems and system models,* and *structure and function* are called out as organizing concepts for these disciplinary core ideas. Students are expected to demonstrate grade-appropriate proficiency in *developing and using models*. Students are expected to use these practices to demonstrate understanding of the core ideas.

Interdisciplinary Connections:

English Language Arts

Students should use text and online media resources when appropriate to help them understand how animals receive and process information they receive from the environment, and to develop a conceptual understanding of what happens when light reflects off objects and enters the eye. They should also use visual displays to enhance their observations and explanations of the concepts in this unit of study.

Mathematics

Students should model with mathematics as they draw points, lines, line segments, and angles to describe how light behaves when coming into contact with lenses, mirrors, and other objects. Students will also use points, lines, and angles when drawing pictures and diagrams that show how light reflects off objects and into the pinhole viewer or into the human eye.

21st Century Themes and Skills:

CRP2. Apply appropriate academic and technical skills.
CRP4. Communicate clearly and effectively and with reason.
CRP6. Demonstrate creativity and innovation.
CRP7. Employ valid and reliable research strategies.
CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.
CRP11. Use technology to enhance productivity.

Standards (Content and Technology)**:**

CPI#:	Statement:
NJSLS 4-LS1-2	Use a model to describe that animals receive different types of information through their senses, process the information in their brain, and respond to the information in different ways.
NJSLS 4-PS4-2	Develop a model to describe that light reflecting from objects and entering the eye allows objects to be seen.
8.1.5.A.1	Select and use the appropriate digital tools and resources to accomplish a variety of tasks including solving problems.
8.2.5.C.4	Collaborate and brainstorm with peers to solve a problem evaluating all solutions to provide the best results with supporting sketches or models.

Unit Essential Question(s):	Unit Enduring Understandings:
• **How do animals receive and process different types of information from their environment in order to respond appropriately?**	• A system can be described in terms of its components and its interactions.

• **What happens when light from an object enters the eye?**	• Different sense receptors are specialized for particular kinds of information, which may be then processed by the animal's brain. • Animals are able to use their perceptions and memories to guide their actions • Cause-and-effect relationships are routinely identified. • An object can be seen when light reflected from its surface enters the eyes.

Unit Learning Targets/Objectives:

Students will...

- **Use a model to describe that animals receive different types of information through their senses, process the information in their brain, and respond to the information in different ways.**
- **Develop a model to describe that light reflecting from objects and entering the eye allows objects to be seen.**

Formative Assessments:

- **Describe a system in terms of its components and their interactions.**
- **Use a model to test interactions concerning the functioning of a natural system.**
- **Use a model to describe that animals receive different types of information through their senses, process the information in their brain, and respond to the information in different ways.**
  - **Emphasis is on systems of information transfer.**
  - **Assessment does not include the mechanisms by which the brain stores and recalls information or the mechanisms of how sensory receptors function.**
- **Identify cause-and-effect relationships.**
- **Develop a model to describe phenomena.**
- **Develop a model to describe that light reflecting from objects and entering the eye allows objects to be seen.**
  - **(Assessment does not include knowledge of specific colors reflected and seen, the cellular mechanisms of vision, or how the retina works).**

Summative/Benchmark Assessment(s):

- **Use a model to describe that animals receive different types of information through their senses, process the information in their brain, and respond to the information in different ways.**
- **Develop a model to describe that light reflecting from objects and entering the eye allows objects to be seen.**

Resources/Materials (copy hyperlinks for digital resources)**:**

http://ngss.nsta.org/Resource.aspx?ResourceID=88
http://ngss.nsta.org/Resource.aspx?ResourceID=189
http://ngss.nsta.org/Resource.aspx?ResourceID=267
http://ngss.nsta.org/Resource.aspx?ResourceID=302

Modifications:

Special Education Students:

- Allow errors

At-Risk Students:

- Provide extended time to complete tasks

- Rephrase questions, directions, and explanations
- Allow extended time to answer questions, and permit drawing, as an explanation
- Accept participation at any level, even one word
- Consult with Case Managers and follow IEP accommodations/modifications

English Language Learners:

- Assign a buddy, same language or English speaking
- Allow errors in speaking
- Rephrase questions, directions, and explanations
- Allow extended time to answer questions
- Accept participation at any level, even one word
- Consult with Guidance Counselors and follow I&RS procedures/action plans
- Consult with classroom teacher(s) for specific behavior interventions
- Provide rewards as necessary

Gifted and Talented Students:

- Provide extension activities
- Build on students' intrinsic motivations
- Consult with parents to accommodate students' interests in completing tasks at their level of engagement

Lesson Name/Topic	Lesson Objective(s)	Time frame (day(s) to complete) Entire Unit: 10 Days
1	Use a model to describe that animals receive, process, and respond to information in different ways.	5 Days
2	Develop a model to describe that light reflecting from objects and entering the eye allows objects to be seen.	5 Days

Teacher Notes:

Additional Resources

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

Content Area: Science

Unit Title: Transfer of Energy

Grade Level: 4th

Unit Summary:

In this unit of study, fourth-grade students develop an understanding that energy can be transferred from place to place by sound, light, heat, and electrical currents. Students also obtain and combine information to describe that energy and fuels are derived from natural resources and that their uses affect the environment. The crosscutting *concepts of cause and effect, energy and matter,* and the *interdependence of science, engineering, and technology, and influence of science, engineering, and technology on society and the natural world* are called out as organizing concepts for these disciplinary core ideas. Students are expected to demonstrate grade-appropriate proficiency in *planning and carrying out investigations* and *obtaining, evaluating, and communicating information*. Students are also expected to use these practices to demonstrate understanding of the core ideas.

Interdisciplinary Connections:

English Language Arts

Students will conduct research to build their understanding of energy, transfer of energy, and natural sources of energy. Students will recall relevant information from in-class investigations and experiences and gather relevant information from print and digital sources. They should take notes and categorize information and provide a list of sources. Students also draw evidence from literary and informational texts in order to analyze and reflect on their findings. Students can also read, take notes, and construct responses using text and digital resources such as Scholastic News, Nat Geo Kids, Study Jams (Scholastic), Reading A–Z.com, NREL.com, switchenergyproject.com, and NOVA Labs by PBS.

Mathematics

Students reason abstractly and quantitatively as they gather and analyze data during investigations and while conducting research about transfer of energy and energy sources. Students model with mathematics as they represent and/or solve word problems. As students research the environmental effects of obtaining fossil fuels, they might be asked to represent a verbal statement of multiplicative comparison as a multiplication equation. For example, students might find information about a spill that was 5 million gallons of oil and was 40 times larger that a previous oil spill in the same location. They can be asked to represent this mathematically using an equation to determine the number of gallons of oils that were spilled in the previous event.

21st Century Themes and Skills:

CRP2. Apply appropriate academic and technical skills.
CRP4. Communicate clearly and effectively and with reason.
CRP6. Demonstrate creativity and innovation.
CRP7. Employ valid and reliable research strategies.
CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.
CRP11. Use technology to enhance productivity.

Standards (Content and Technology):

CPI#:	Statement:
NJSLS 4-PS3-2	Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.
NJSLS 4-ESS3-1	Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment.
8.1.5.A.1	Select and use the appropriate digital tools and resources to accomplish a variety of tasks including solving problems.

8.2.5.C.4	Collaborate and brainstorm with peers to solve a problem evaluating all solutions to provide the best results with supporting sketches or models.

Unit Essential Question(s):

- **How does energy move?**
- **From what natural resources are energy and fuels derived? In what ways does the human use of natural resources affect the environment?**

Unit Enduring Understandings:

- Energy can be transferred in various ways and between objects.
- Energy can be moved from place to place through sound, light, or electric currents.
- Energy is present whenever there is sound, light, or heat.
- Light also transfers energy from place to place.
- Energy can also be transferred from place to place by electric currents; the currents may have been produced to begin with by transforming the energy of motion into electrical energy.
- Cause-and-effect relationships are routinely identified and used to explain change.
- Knowledge of relevant scientific concepts and research findings is important in engineering.
- Over time, people's needs and wants change, as do their demands for new and improved technologies.
- Energy and fuels that humans use are derived from natural sources.
- The use of energy and fuels from natural sources affects the environment in multiple ways.
- Some resources are renewable over time, and others are not

Unit Learning Targets/Objectives:

Students will...

- **Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.**
- **Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment.**

Formative Assessments:

- **Make observations to produce data that can serve as the basis for evidence for an explanation of a phenomenon or for a test of a design solution.**
- **Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.**
- **Identify cause-and-effect relationships in order to explain change.**
- **Obtain and combine information from books and other reliable media to explain phenomena.**
- **Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment. Examples of renewable energy resources could include:**
  - **Wind energy,**
  - **Water behind dams,**

- Sunlight.
- Examples of nonrenewable energy resources are:
  - Fossil fuels,
  - Fissile materials
- Examples of environmental effects could include:
  - Loss of habitat due to dams
  - Loss of habitat due to surface mining
  - Air pollution from burning of fossil fuels

Summative/Benchmark Assessment(s):

- **Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.**
- **Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment.**

Resources/Materials (copy hyperlinks for digital resources):
http://switchenergyproject.com/education/
http://concord.org/stem-resources/wind-generator
http://www.pbslearningmedia.org/resource/lsps07-sci-phys-thermalenergy/thermal-energy-transfer/

Modifications:

Special Education Students:

- Allow errors
- Rephrase questions, directions, and explanations
- Allow extended time to answer questions, and permit drawing, as an explanation
- Accept participation at any level, even one word
- Consult with Case Managers and follow IEP accommodations/modifications

At-Risk Students:

- Provide extended time to complete tasks
- Consult with Guidance Counselors and follow I&RS procedures/action plans
- Consult with classroom teacher(s) for specific behavior interventions
- Provide rewards as necessary

English Language Learners:

- Assign a buddy, same language or English speaking
- Allow errors in speaking
- Rephrase questions, directions, and explanations
- Allow extended time to answer questions
- Accept participation at any level, even one word

Gifted and Talented Students:

- Provide extension activities
- Build on students' intrinsic motivations
- Consult with parents to accommodate students' interests in completing tasks at their level of engagement

Lesson Name/Topic	Lesson Objective(s)	Time frame (day(s) to complete) Entire Unit: 15 Days
1	**Make observations to provide evidence**	8 Days
2	**Obtain and combine information**	7 Days

Teacher Notes:

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

Content Area: Science

Unit Title: Force and Motion

Grade Level: 4th

Unit Summary:

In this unit of study, students are able to use evidence to construct an explanation of the relationship between the speed of an object and the energy of that object, and are expected to develop an understanding that energy can be transferred from object to object through collisions. The crosscutting concept of *energy and matter* is called out as an organizing concept. Students are expected to demonstrate grade-appropriate proficiency in *asking questions, defining problems,* and *constructing explanations, and designing solutions.* Students are also expected to use these practices to demonstrate understanding of the core ideas.

Interdisciplinary Connections:

English Language Arts

Students will conduct a short research project to build their understanding of the transfer of energy (motion, heat, and sound) in force and motion systems. They will need access to a variety of texts and should use information from their class experiences and from print and digital sources to write informative/explanatory texts. As students gather information, they should take notes and categorize information. In their writing, students should detail what they observed as they investigated simple force and motion systems, describe procedures they followed as they conducted investigations, and use information from their observations and research to explain the patterns of change that occur when objects move and collide. As students participate in discussions and write explanations, they should refer specifically to text, when appropriate.

Mathematics

N/A

21st Century Themes and Skills:

CRP2. Apply appropriate academic and technical skills.
CRP4. Communicate clearly and effectively and with reason.
CRP6. Demonstrate creativity and innovation.
CRP7. Employ valid and reliable research strategies.
CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.
CRP11. Use technology to enhance productivity.

Standards (Content and Technology):

CPI#:	Statement:
NJSLS 4-PS3-1	Use evidence to construct an explanation relating the speed of an object to the energy of that object.
NJSLS 4-PS3-3	Ask questions and predict outcomes about the changes in energy that occur when objects collide.
8.1.5.A.1	Select and use the appropriate digital tools and resources to accomplish a variety of tasks including solving problems.
8.2.5.C.4	Collaborate and brainstorm with peers to solve a problem evaluating all solutions to provide the best results with supporting sketches or models.

Unit Essential Question(s):

- **What is the relationship between the speed of an object and its energy?**
- **In what ways does energy change when objects collide?**

Unit Enduring Understandings:

- Energy can be transferred in various ways and between objects.
- The faster a given object is moving, the more energy it possesses

	• Energy can be transferred in various ways and between objects. • Energy can be moved from place to place by moving objects or through sound, light, or electric currents. • Energy is present whenever there are moving objects, sound, light, or heat. • When objects collide, energy can be transferred from one object to another, thereby changing their motion. In such collisions, some energy is typically also transferred to the surrounding air; as a result, the air gets heated and sound is produced. • When objects collide, the contact forces transfer energy so as to change the objects' motions

Unit Learning Targets/Objectives:

Students will...

- **Use evidence to construct an explanation relating the speed of an object to the energy of that object.**
- **Ask questions and predict outcomes about the changes in energy that occur when objects collide.**

Formative Assessments:

- **Describe various ways that energy can be transferred between objects.**
- **Use evidence (e.g., measurements, observations, patterns) to construct an explanation.**
- **Use evidence to construct an explanation relating the speed of an object to the energy of that object. (Assessment does not include quantitative measures of changes in the speed of an object or on any precise or quantitative definition of energy.)**
- **Describe the various ways that energy can be transferred between objects.**
- **Ask questions that can be investigated and predict reasonable outcomes based on patterns such as cause and effect relationships.**
- **Ask questions and predict outcomes about the changes in energy that occur when objects collide. Emphasis is on the change in the energy due to the change in speed, not on the forces, as objects interact. (Assessment does not include quantitative measurements of energy.)**

Summative/Benchmark Assessment(s):

- **Use evidence to construct an explanation relating the speed of an object to the energy of that object.**
- **Ask questions and predict outcomes about the changes in energy that occur when objects collide.**

Resources/Materials (copy hyperlinks for digital resources):

http://ngss.nsta.org/Resource.aspx?ResourceID=22

- http://www.scienceworld.ca/resources/activities/popcan-porsche
- http://pbskids.org/designsquad/build/rubber-band-car/

http://www.pbslearningmedia.org/resource/idptv11.sci.phys.maf.d4kfom/force-and-motion/

http://www.nasa.gov/audience/foreducators/topnav/materials/listbytype/Advanced_High_Power_Paper_Rockets.html#.VsxeJPkrJD8

Modifications:

Special Education Students:

- Allow errors
- Rephrase questions, directions, and explanations
- Allow extended time to answer questions, and permit drawing, as an explanation
- Accept participation at any level, even one word
- Consult with Case Managers and follow IEP accommodations/modifications

At-Risk Students:

- Provide extended time to complete tasks
- Consult with Guidance Counselors and follow I&RS procedures/action plans
- Consult with classroom teacher(s) for specific behavior interventions
- Provide rewards as necessary

English Language Learners:

- Assign a buddy, same language or English speaking
- Allow errors in speaking
- Rephrase questions, directions, and explanations
- Allow extended time to answer questions
- Accept participation at any level, even one word

Gifted and Talented Students:

- Provide extension activities
- Build on students' intrinsic motivations
- Consult with parents to accommodate students' interests in completing tasks at their level of engagement

Lesson Name/Topic	Lesson Objective(s)	Time frame (day(s) to complete) Entire Unit: 15 Days
1	**Use evidence to construct an explanation**	8 Days
2	**Ask questions and predict outcomes**	7 Days

Teacher Notes:

Additional Resources

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

Content Area: Science

Unit Title: Using Engineering Design with Force and Motion Systems

Grade Level: 4th

Unit Summary:

In this unit of study, students use evidence to construct an explanation of the relationship between the speed of an object and the energy of that object. Students develop an understanding that energy can be transferred from place to place by sound, light, heat, and electrical currents or from objects through collisions. They apply their understanding of energy to design, test, and refine a device that converts energy from one form to another. The crosscutting concepts of *energy and matter* and the *influence of engineering, technology, and science on society and the natural world* are called out as organizing concepts for these disciplinary core ideas. Students are expected to demonstrate grade-appropriate proficiency in *asking questions and defining problems*, *planning and carrying out investigations*, *constructing explanations*, and *designing solutions*. Students are also expected to use these practices to demonstrate their understanding of the core ideas.

Interdisciplinary Connections:

English Language Arts

Students conduct research that builds their understanding of energy transfers. They will gather relevant information from their investigations and from multiple print or digital sources, take notes, and categorize their findings. They should use this information to construct explanations and support their thinking.

Mathematics

Students can:

- Solve multistep word problems, using the four operations.
- Represent these problems using equations with a letter standing for the unknown quantity.
- Assess the reasonableness of answers using mental computation and estimating strategies, including rounding. For example, "The class has 144 rubber bands with which to make rubber band cars. If each car uses 6 rubber bands, how many cars can be made? If there are 28 students in the class, how many rubber bands can each car have (if every car has the same number of rubber bands)?"

Students can also analyze constraints on materials, time, or cost to determine what implications the constraints have for design solutions. For example, if a design calls for 20 screws and screws are sold in boxes of 150, how many copies of the design can be made?

21st Century Themes and Skills:

CRP2. Apply appropriate academic and technical skills.
CRP4. Communicate clearly and effectively and with reason.
CRP6. Demonstrate creativity and innovation.
CRP7. Employ valid and reliable research strategies.
CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.
CRP11. Use technology to enhance productivity.

Standards (Content and Technology):

CPI#:	Statement:
NJSLS 4-PS3-4	Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.
NJSLS 3-5-ETS1-1	Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.
NJSLS 3-5-ETS1-2	Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.

NJSLS 3-5-ETS1-3	Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.
8.1.5.A.1	Select and use the appropriate digital tools and resources to accomplish a variety of tasks including solving problems.
8.2.5.C.4	Collaborate and brainstorm with peers to solve a problem evaluating all solutions to provide the best results with supporting sketches or models.

Unit Essential Question(s):

- **How can scientific ideas be applied to design, test, and refine a device that converts energy from one form to another?**

Unit Enduring Understandings:

- Science affects everyday life.
- Most scientists and engineers work in teams.
- Engineers improve existing technologies or develop new ones.
- People's needs and wants change over time, as do their demands for new and improved technologies.
- Engineers improve existing technologies or develop new ones to increase their benefits, decrease known risks, and meet societal demands.
- Energy can be transferred in various ways and between objects.
- Energy can also be transferred from place to place by electric currents, which can then be used locally to produce motion, sound, heat, or light. The currents may have been produced to begin with by transforming the energy of motion into electrical energy.
- The expression "produce energy" typically refers to the conversion of stored energy into a desired form for practical use.
- Possible solutions to a problem are limited by available materials and resources (constraints).
- The success of a designed solution is determined by considering the desired features of a solution (criteria).
- Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account.
- Research on a problem should be carried out before beginning to design a solution.
- Testing a solution involves investigating how well it performs under a range of likely conditions.
- At whatever stage, communicating with peers about proposed solutions is an important part of the design process, and shared ideas can lead to improved designs.
- Tests are often designed to identify failure points or difficulties, which suggest the elements of the design that need to be improved.

	• Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints.

Unit Learning Targets/Objectives:

Students will...

- **Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.**
- **Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.**
- **Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.**
- **Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.**

Formative Assessments:

- **Describe the various ways that energy can be transferred between objects.**
- **Apply scientific ideas to solve design problems.**
- **Apply scientific ideas to design, test, and refine a device that converts energy from one form to another. (Devices should be limited to those that convert motion energy to electric energy or use stored energy to cause motion or produce light or sound.)**
- **Examples of devices could include electric circuits that convert electrical energy into motion energy of a vehicle, light, or sound or passive solar heater that converts light into heat. Examples of constraints could include the materials, cost, or time to design the device.**
- **Define a simple design problem that can be solved through the development of an object, tool, process, or system and includes several criteria for success and constraints on materials, time, or cost.**
- **Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.**
- **Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design problem.**
- **Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.**
- **Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered.**
- **Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.**

Summative/Benchmark Assessment(s):

- **Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.**
- **Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.**
- **Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.**
- **Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.**

Resources/Materials (copy hyperlinks for digital resources)**:**

http://ngss.nsta.org/Resource.aspx?ResourceID=191
http://ngss.nsta.org/Resource.aspx?ResourceID=253
http://ngss.nsta.org/Resource.aspx?ResourceID=262
http://www.childrensengineering.org/technology/designbriefs.php

Modifications:

Special Education Students:

- Allow errors
- Rephrase questions, directions, and explanations
- Allow extended time to answer questions, and permit drawing, as an explanation
- Accept participation at any level, even one word
- Consult with Case Managers and follow IEP accommodations/modifications

At-Risk Students:

- Provide extended time to complete tasks
- Consult with Guidance Counselors and follow I&RS procedures/action plans
- Consult with classroom teacher(s) for specific behavior interventions
- Provide rewards as necessary

English Language Learners:

- Assign a buddy, same language or English speaking
- Allow errors in speaking
- Rephrase questions, directions, and explanations
- Allow extended time to answer questions
- Accept participation at any level, even one word

Gifted and Talented Students:

- Provide extension activities
- Build on students' intrinsic motivations
- Consult with parents to accommodate students' interests in completing tasks at their level of engagement

Lesson Name/Topic	Lesson Objective(s)	Time frame (day(s) to complete) Entire Unit: 15 Days
1	**Apply scientific ideas to design, test, and refine a device**	4 Days
2	**Define a simple design problem**	3 Days
3	**Generate and compare multiple possible solutions to a problem**	4 Days
4	**Plan and carry out fair tests**	4 Days

Teacher Notes:

Additional Resources

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

Content Area: Science

Unit Title: Waves and Information

Grade Level: 4th

Unit Summary:

In this unit of study, students use a model of waves to describe patterns of waves in terms of amplitude and wavelength and to show that waves can cause objects to move. The crosscutting concepts of *patterns;interdependence of science, engineering, and technology; and influence of engineering, technology, and science on society and the natural world* are called out as organizing concepts for these disciplinary core ideas. Students demonstrate grade-appropriate proficiency in developing and *using models*, *planning and carrying out investigations*, and *constructing explanations*, *and designing solutions*. Students are also expected to use these practices to demonstrate their understanding of the core ideas.

Interdisciplinary Connections:

English Language Arts/Literacy

To support integration of English language arts into this unit, students conduct short research projects, using both print and digital sources, to build their understanding of wave properties and of the use of waves to communicate over a distance. Students should take notes, categorize information collected, and document a list of the sources used. Using the information they collect during research, as well as information from their experiences with waves, sound, and light, students integrate the information and use it to design a device or process that can be used to communicate over a distance using patterns. As students create presentations that detail how their design solutions can be used to communicate, they should use details and examples from both their research and experiences to explain how patterns are used in their design to communicate over a distance. They can include audio or video recordings and visual displays to enhance their presentations.

Mathematics

To support the integration of the CCSS for mathematics into this unit of study, students should have opportunities to draw points, lines, line segments, rays, angles, and perpendicular and parallel lines, and identify these in two-dimensional drawings as they identify rays and angles in drawings of the ways in which waves move. Students should also have opportunities to use the four operations to solve problems. Students can analyze constraints on materials, time, or cost to draw implications for design solutions. For example, if a design calls for 20 screws and screws are sold in boxes of 150, how many copies of the design could be made? As students represent and solve word problems, such as these, they reason abstractly and quantitatively and model with mathematics. As students create models of waves and engage in engineering design, they have opportunities to use tools strategically while measuring, drawing, and building.

21st Century Themes and Skills:

CRP2. Apply appropriate academic and technical skills.
CRP4. Communicate clearly and effectively and with reason.
CRP6. Demonstrate creativity and innovation.
CRP7. Employ valid and reliable research strategies.
CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.
CRP11. Use technology to enhance productivity.

Standards (Content and Technology):

CPI#:	Statement:
NJSLS 4-PS4-1	Develop a model of waves to describe patterns in terms of amplitude and wavelength and that waves can cause objects to move.
NJSLS 4-PS4-3	Generate and compare multiple solutions that use patterns to transfer information.

NJSLS 3-5-EST-1-2	Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.
NJSLS 3-5-ETS1-3	Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.
8.1.5.A.1	Select and use the appropriate digital tools and resources to accomplish a variety of tasks including solving problems.
8.2.5.C.4	Collaborate and brainstorm with peers to solve a problem evaluating all solutions to provide the best results with supporting sketches or models.

Unit Essential Question(s):

- **If a beach ball lands in the surf, beyond the breakers, what will happen to it?**
- **Which team can design a way to use patterns to communicate with someone across the room?**

Unit Enduring Understandings:

- Science findings are based on recognizing patterns.
- Similarities and differences in patterns can be used to sort and classify natural phenomena.
- Waves, which are regular patterns of motion, can be made in water by disturbing the surface.
- When waves move across the surface of deep water, the water goes up and down in place; there is no net motion in the direction of the wave except when the water meets a beach.
- Waves of the same type can differ in amplitude (height of the wave) and wavelength (spacing between wave peaks)
- Similarities and differences in patterns can be used to sort and classify designed products.
- Knowledge of relevant scientific concepts and research findings is important in engineering.
- Engineers improve existing technologies or develop new ones to increase their benefits, decrease known risks, and meet societal demands.
- Digitized information can be transmitted over long distances without significant degradation. High-tech devices, such as computers or cell phones, can receive and decode information—that is, convert it from digitized form to voice and vice versa.
- Different solutions need to be tested in order to determine which of them best solve the problem, given the criteria and the constraints.
- Research on a problem should be carried out before beginning to design a solution. Testing a solution involves investigating how well it performs under a range of likely conditions.
- At whatever stage, communicating with peers about proposed solutions is an important part of the design process, and shared ideas can lead to improved designs.

	• Tests are often designed to identify failure points or difficulties, which suggest the elements of the design that need to be improved.

Unit Learning Targets/Objectives:

Students will...

- **Develop a model of waves to describe patterns in terms of amplitude and wavelength and that waves can cause objects to move.**
- **Generate and compare multiple solutions that use patterns to transfer information.**
- **Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.**
- **Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.**

Formative Assessments:

- **Sort and classify designed products using similarities and differences in patterns.**
- **Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design solution.**
- **Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.**
- **Generate and compare multiple solutions that use patterns to transfer information. Examples of solutions could include:**
  - **Drums sending coded information through sound waves;**
  - **Using a grid of ones and zeroes representing black and white to send information about a picture;**
  - **Using Morse code to send text**
- **Plan and conduct an investigation collaboratively to produce data that can serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered.**
- **Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.**

Summative/Benchmark Assessment(s):

- **Develop a model of waves to describe patterns in terms of amplitude and wavelength and that waves can cause objects to move.**
- **Generate and compare multiple solutions that use patterns to transfer information.**
- **Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.**
- **Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.**

Resources/Materials (copy hyperlinks for digital resources):

http://www.uen.org/Lessonplan/LPview.cgi?grade=4

http://moodle.tbaisd.org/course/view.php?id=1021

Modifications:

Special Education Students:

- Allow errors
- Rephrase questions, directions, and explanations
- Allow extended time to answer questions, and permit drawing, as an explanation
- Accept participation at any level, even one word
- Consult with Case Managers and follow IEP accommodations/modifications

At-Risk Students:

- Provide extended time to complete tasks
- Consult with Guidance Counselors and follow I&RS procedures/action plans
- Consult with classroom teacher(s) for specific behavior interventions
- Provide rewards as necessary

English Language Learners:

- Assign a buddy, same language or English speaking
- Allow errors in speaking
- Rephrase questions, directions, and explanations
- Allow extended time to answer questions
- Accept participation at any level, even one word

Gifted and Talented Students:

- Provide extension activities
- Build on students' intrinsic motivations
- Consult with parents to accommodate students' interests in completing tasks at their level of engagement

Lesson Name/Topic	Lesson Objective(s)	Time frame (day(s) to complete) Entire Unit: 15 Days
1	**Develop a model of waves**	3 Days
2	**Generate and compare multiple solutions that use patterns to transfer information.**	4 Days
3	**Generate and compare multiple possible solutions to a problem**	4 Days
4	**Plan and carry out fair test**	4 Days

Teacher Notes:

Additional Resources

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