CITY OF BURLINGTON PUBLIC SCHOOL DISTRICT CURRICULUM

4th Grade Science

Revision Date: July 10, 2017

Submitted by: Laura M Capriotti
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Course Overview

The New Jersey Student Learning Standards provide a consistent, clear understanding of what students are expected to learn, so teachers and parents know what they need to do to help them. The standards are designed to be robust and relevant to the real world, reflecting the knowledge and skills that our young people need for success in college and careers. With American students fully prepared for the future, our communities will be best positioned to compete successfully in the global economy.

The Burlington City Science department has adopted and implemented the Next Generation Science Standards as the cornerstone of the curriculum. Areas of study within the Science department are designed to be rigorous, college-preparatory courses in which students will be exposed to a variety of nonfiction texts, science processing, laboratory skills along with communication and presentation skills. The NJ Department of Education, in developing a Model Curriculum for middle school and high school science courses, has published the following:

Mission: Scientifically literate individuals possess the knowledge and understanding of scientific concepts and processes required for personal decision-making, participation in civic and cultural affairs, and economic productivity. Vision: The science standards are designed to help realize a vision for education in the sciences and engineering in which students, over multiple years of school, actively engage in scientific and engineering practices and apply crosscutting concepts to deepen their understanding of the core ideas in these fields. The learning experiences provided for students should engage them with fundamental questions about the world and with how scientists have investigated and found answers to those questions. Throughout grades K-12, students should have the opportunity to carry out scientific investigations and engineering design projects related to the disciplinary core ideas (pp. 8-9, NRC, 2012). The curriculum guide has been generated to not only help students achieve the Next Generation Science Standards, but to ensure that students will be prepared for college and career opportunities following high school graduation. It represents opportunities from cross-curricular collaboration and creative thinking skills. The diagram shown below illustrates the thought process to be employed for problem solving in all science classes. This model is an integral component of STEM education.

There are many standards included in this curriculum. The Next Generation Science Standards encourage multi-discipline approach to topics that encompass many standards in mathematics and English language arts. Standards overview for all these areas is provided in this document. As the curriculum is implemented, many of the activities and resources will be reviewed and revised as more information becomes available. Activities in science classes may include, but not be limited to the following: Journal writing, science notebook, lab experiments, independent research, supplemental reading, projects, technology applications, assessments, performance tasks, presentations, and group activities.

Primary Resource(s)
Textbook/s
Title: Discovery Works
Publisher: Houghton Mifflin Science
Copyright: 2003 Series

Supplemental Materials (including various level of texts at each grade level)
Delta Science Module kits include:
Food Chains
Webs Water Cycle Classroom
Plants
Solar System
<table>
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<th>Unit # &amp; Title</th>
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<td>Unit 6: Using Engineering Design with Force and Motion Systems</td>
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<tr>
<td>Unit 7: Waves and Information</td>
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</table>
Unit 1 Overview At-a-Glance

Unit #1 – Title: Weathering and Erosion

Unit Description:
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.

Essential Skills:
- 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.

Standards Addressed within this Unit

Central Unit Standards- This unit will focus primarily on learning goals aligned with the following standards:
NJSLS 4-ESS2-1
NJSLS 4-ESS1-1

Supporting Unit Standards- This unit will also include activities aligned with the following standards:
ELA/Literacy
RI.4.7 I
W.4.7 C
W.4.8
Mathematics
MP.2
MP.4
MP.5
4.MD.A.1
4.MD.A.2
### Modifications for Special Education Students, English Language Learners, Students at Risk of Failure, and Gifted Students

Modify instructional approach and/or assignments and evaluations as needed based for students with IEPs, 504s, ELLs and gifted and talented students including but not limited to:

- Structure lessons around questions that are authentic, relate to students' interests, social/family background and knowledge of their community.
- Provide students with multiple choices for how they can represent their understandings (e.g. multisensory techniques—auditory/visual aids; pictures, illustrations, graphs, charts, data tables, multimedia, modeling).
- Provide opportunities for students to connect with people of similar backgrounds (e.g. conversations via digital tool such as SKYPE, experts from the community helping with a project, journal articles, and biographies).
- Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures (e.g. multiple representation and multimodal experiences).
- Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understandings.

### Integration of 21st century skills through NJSLS 9 and Career Education:

- 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.
- CRP12. Work productively in teams while using cultural global competence.
- Use project-based science learning to connect science with observable phenomena.

- Structure the learning around explaining or solving a social or community-based issue.

- Provide ELL students with multiple literacy strategies.

- Collaborate with after-school programs or clubs to extend learning opportunities.

- Restructure lesson using UDL principles ([http://www.cast.org/our-work/about-udl.html#.VXmoXcfD_UA](http://www.cast.org/our-work/about-udl.html#.VXmoXcfD_UA)).

**Assessments - including benchmarks, formative, summative, and alternative 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. Examples of variables to test could include:
  - Angle of slope in the downhill movement of water

**Suggested Interdisciplinary Activities for this Unit**

- Career Education: Interview a weather person
- Health/PE: Investigate how weather affects health - write a report
- English Language Arts/Literacy: Read and explain how weather changes have affected
- Math: Create a pictograph of daily weather trends
- Social Studies: Research some of the damage caused by a hurricane and how it changes the environment.
- Technical Subjects: Measure an angle of slope using a protractor
- World Languages: Examine the Giants Causeway in Ireland and explain
<table>
<thead>
<tr>
<th>Factors</th>
<th>Evidence for Changes in Landscape Over Time</th>
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<tr>
<td>Amount of vegetation</td>
<td>- Rock layers with marine shell fossils above rock layers with plant fossils and no shells, indicating a change from land to water over time.</td>
</tr>
<tr>
<td>Speed of the wind</td>
<td>- 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.</td>
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<tr>
<td>Relative rate of deposition</td>
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<tr>
<td>Cycles of freezing and thawing of water</td>
<td></td>
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<tr>
<td>Cycles of heating and cooling</td>
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<td>Volume of water flow</td>
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<td>Support explanations using patterns as evidence.</td>
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<td>Identify the evidence that supports particular points in an explanation.</td>
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<tr>
<td>Identify evidence from patterns in rock formations and fossils in rock layers to support an explanation for changes in a landscape over time. Examples of evidence from patterns could include</td>
<td></td>
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Arts: Draw and create a 3-D model of the water cycle
Unit Resources

Teachers should utilize school resources available in our Media Center to infuse alternate sources, perspectives, and approaches. Resources should include textual support but also span multimedia options to engage multiple modalities. In addition, to support struggling readers and increase rigor for advanced readers, the coursework may also draw on additional developmentally appropriate resources to facilitate challenging levels of work for all students.

Leveled Supplemental Materials and Media/School Library Resources

- **Bill Nye Video-Erosion** Bill Nye Video- Erosion: Describes the effects of weathering.

- **Gary's Sand Journal**: This book allows students to observe illustrations of magnified sand particles with guided dialogue from an earth scientist who discusses sand origins. This book can be used to introduce students to types of sand, explain how earth processes were responsible for their creation, and discuss the work of earth scientists. After reading this book, students may use it as a resource when examining their own sand samples. They could list properties, discuss sand origins, and illustrate samples in a science journal.

- **Glacier, Water and Winds, Oh My!** This hands-on activity allows students to explore five earth forces that may cause erosion as they model, observe, and record the effects of erosion on earth surfaces. Stations include demonstrations of chemical, wind, water, ice and heat forces as they affect weathering. [Link](http://ngss.nsta.org/Resource.aspx?ResourceID=35)

Integration of the Technology Standard:

- 8.1.5.A.1
- 8.1.5.A.2
Explaining Glaciers, Accurately: Fourth grade lessons on glacial erosion demonstrate and explain the manner in which glaciers erode the earth. The mechanisms of plucking and abrasion are discussed. Activities (either whole-class or small group) include a teacher creation of a glacier model (using dirt and rocks to simulate a mountain, ice cubes and a small amount of water for glacier), then teacher demonstration of glacier "plucking" earth as it travels in a simulation activity. Students then experiment with rock samples, wood, sandpaper, and ice as they rub materials against each other to explore how glacial striations form and abrade other surfaces. In each simulation, students are asked to predict what would happen when glacial model water freezes, as they draw before and after pictures of the model. Students are also asked to predict how glacial striations were formed as they view photos, then record results of their abrasive materials activity. Students could benefit from the expertise of a mentoring geologist who shares illustrations and information with students and teachers.

Coastal Erosion: This engineering design lesson focuses on the effects of erosion on Florida’s coastline. It is one lesson offered within a larger weathering and erosion unit. Students groups
work to create and use a model able to slow erosion, without damaging the coastal ecosystem. Students are responsible for developing scale diagram of their coastline erosion solution before building and testing their models in a pan to simulate the coastline. Students then complete a redesign cycle. Similar lessons from the developer can be used in conjunction with this lesson to incorporate the effects of erosion on humans and wildlife.

<table>
<thead>
<tr>
<th>Central Unit Standard and Student Learning Objective</th>
<th>Suggested Instructional Activities</th>
<th>Suggested Student Output</th>
<th>Formative Assessments (Portfolios, Projects, Tasks, Evaluations, &amp; Rubrics)</th>
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<tbody>
<tr>
<td>NJSLS 4-ESS2-1 and NJSLS 4-ESS1-1 Students will be able to make observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind or vegetation and found in fossils. Essential Questions:</td>
<td>Teach using New Jersey Center for teaching and learning - <a href="https://njctl.org/courses/science/4th-grade-science/earths-systems/">https://njctl.org/courses/science/4th-grade-science/earths-systems/</a>  - Provide examples of pictures of: *landforms to show change over time (e.g. dunes, canyons, etc)</td>
<td>- Create a model of ice weathering a rock and relate it to weathering in nature  -Create a model of water weathering a rock and relate it to weathering in nature.  -Create a model of erosion and relate it to erosion in nature.  -Create a model of weathering and erosion and relate</td>
<td>- Student and teacher generated rubrics  -Round Robin Charts  - -PARCC/Common Core holistic rubrics  -Think-Pair-Share</td>
</tr>
</tbody>
</table>
| **What can rocks formations tell us about the past?** | *rock layers with fossils and no plants to show change from land to water*  
*canyon’s different rock layers in the walls and river to show over time how a river cut through the rock to form canyons*  
-Teach science associated terms as applied to informational text  
- Provide examples (print and/or electronic) of changes that students can observe firsthand and collect evidence for class or group discussions  
Engage in Practice and review work and Labs (see njctl site above for resources) | -Create a model of weathering and erosion and relate it to weathering and erosion in nature.  
-Identify the effects of weathering and erosion in the environment around their school.  
-Identify chemical versus mechanical weathering.  
-Distinguish weathering and erosion. | - Science Informational Text Strategic Questioning and Text rendering  
- Lab Practicals  
- Problem Based Assessments  
- Graphic Organizers  
- Warm-up pair and shares  
- Experimental Design  
- Exit ticket |
*Review Questions, diagramming, labs and homework.

-Observe and Measure:
  * Angle of slope in downhill movement of water
  * Amount of vegetation
  * Speed of wind
  * Cycles of freezing and thawing of water
  * Cycles of heating and cooling
  * Volume of water flow

Unit 2 Overview At-a-Glance

**Unit #2 – Title: Earth’s Processes**

**Unit Description:**
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.

**Essential Skills:**
- 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.

<table>
<thead>
<tr>
<th>Standards Addressed within this Unit</th>
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<tr>
<td><strong>Central Unit Standards</strong> - This unit will focus primarily on learning goals aligned with the following standards:</td>
</tr>
<tr>
<td>NJSLS 4-ESS2-2</td>
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<tr>
<td>NJSLS 4-ESS3-2</td>
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<tr>
<td>NJSLS 3-5-ETS1-2</td>
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<tr>
<td>NJSLS 3-5-ETS1-3</td>
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<tr>
<th>Supporting Unit Standards - This unit will also include activities aligned with the following standards:</th>
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<tr>
<td><strong>ELA/Literacy</strong></td>
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<tr>
<td>RI.4.1</td>
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<td>RI.4.7</td>
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<td>RI.4.7</td>
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<tr>
<td>W.4.7</td>
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<tr>
<td>W.4.8</td>
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<tr>
<td>W.4.9</td>
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</tbody>
</table>

| **Mathematics**                       |
| MP.2                                  |
| MP.4                                  |
| MP.5                                  |
| 4.MD.A.1                              |
| 4.MD.A.2                              |
| 4.OA.A.1                              |
## Unit Details

**Modifications for Special Education Students, English Language Learners, Students at Risk of Failure, and Gifted Students**

Modify instructional approach and/or assignments and evaluations as needed based for students with IEPs, 504s, ELLs and gifted and talented students including but not limited to:

- Structure lessons around questions that are authentic, relate to students’ interests, social/family background and knowledge of their community.
- Provide students with multiple choices for how they can represent their understandings (e.g. multisensory techniques - auditory/visual aids; pictures, illustrations, graphs, charts, data tables, multimedia, modeling).
- Provide opportunities for students to connect with people of similar backgrounds (e.g. conversations via digital tool such as SKYPE, experts from the community helping with a project, journal articles, and biographies).
- Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures (e.g. multiple representation and multimodal experiences).
- Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understandings.

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**Integration of 21st century skills through NJSLS 9 and Career Education:**

- Lessons, where appropriate, incorporate multiple perspectives to infuse cultural and global awareness.
- Learning incorporates skills focusing on financial, economic, business, and entrepreneurial literacy.
- Lessons integrate a focus on civic literacy so that students can better understand the rights and obligations of citizenship.
- Use project-based science learning to connect science with observable phenomena.
- Structure the learning around explaining or solving a social or community-based issue.
- Provide ELL students with multiple literacy strategies.

**Assessments- including benchmarks, formative, summative, and alternative 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

**Suggested Interdisciplinary Activities for this Unit**
- Career Education: Role-Play the job of a geologist
- Health/PE:
- English Language Arts/Literacy:
- Math: Compare and record data for pattern changes into a graph
- Science:
- Social Studies: How has changes in Earth’s surface displaced humans? Investigate
- Technical Subjects: Use a compass to locate specific areas on a map
- World Languages: Examine earthquakes in Japan
- Arts: Paint before and after picture of natural disaster
Unit Resources

Teachers should utilize school resources available in our Media Center to infuse alternate sources, perspectives, and approaches. Resources should include textual support but also span multimedia options to engage multiple modalities. In addition, to support struggling readers and increase rigor for advanced readers, the coursework may also draw on additional developmentally appropriate resources to facilitate challenging levels of work for all students.

Leveled Supplemental Materials and Media/School Library Resources

- **Engineering for the Three Little Pigs**: This activity helps to demonstrate the importance of rocks, soils, and minerals in engineering and how using the right material for the right job is important. The students build 3 different sand castles composed of varying amounts of sand, water, and glue. The 'buildings' in this lesson are made of sand and glue, sand being a soil and glue being composed of different minerals. They then test them for strength (load bearing), and resistance to weathering. The students will then compare possible solutions and discuss how well each is likely to work while meeting the criteria and constraints of the problem. The students will be the engineers who figure out which materials are best for the buildings they are making, taking into consideration all the properties of materials that are discussed in the lesson.

- **Building for the Big One**: This lesson plan details a Design Challenge in which students build and test structures while learning about the earthquakes that shake them. It is designed as a review or culmination of an Earthquake unit of study. The lesson plan allows teachers to connect back to previous lessons. The Tech Museum of Innovation also suggests that the lesson might be used as a form of introduction to a unit about earthquakes. The lesson would then be used to determine

Integration of the Technology Standard

- 8.1.5.A.1
- 8.1.5.A.2
students' prior knowledge to set the stage for the design challenge. This resource often mentions the effects of tectonic plates on earthquake location. Grade 4 curriculum does not include tectonic plates in their earth science curriculum. Tectonic plate information is included in the lesson as a resource for the teacher.

- **Earthquakes in the Classroom**: Students investigate which building types are structured to withstand earthquake damage. They take on the role of engineers as they design their own earthquake resistant buildings, then test them in a simulated earthquake activity. Students also develop an appreciation for the job of engineers who need to know about earthquakes and their causes in order to design resistant buildings. This lesson is one of several in the "Earthquakes Rock" unit provided by the Teach Engineering site. The unit "URL" listed here is not being reviewed for the Performance Expectation listed. It is offered as a supplemental concept and lesson background aid for teachers.
  

- **Getting the Right Angle on the Story**: This informational text shows students how tsunamis form and behave. It also describes how scientists are collecting data to create models that can be used to predict tsunamis. Animations/computer models are also included to enhance student knowledge of how tsunami warnings work. Models integrate new, unfamiliar vocabulary. Students could use the resource as a starting point for an earth systems unit; teachers could assign the site as a
one form of research where students gather data, take notes, and draw inferences from text. As students begin their study, they could generate a list of the earth's natural disasters and define their impact on human life and the environment. Their possible solutions for lessening that impact could also be incorporated.

- **DLESE Earth Science Literacy Maps** are a tool for teachers and students to find resources that relate to specific Earth science concepts. These maps illustrate connections between concepts and how they build upon one another across grade levels. Clicking on a concept within the maps will show DLESE resources related to the concept, as well as information about related AAAS Project 2061 Benchmarks and National Science Education Standards.

### Unit #2 Targeted Instructional Planning to Address Central Unit Standards:

<table>
<thead>
<tr>
<th>Central Unit Standard and Student Learning Objective</th>
<th>Suggested Instructional Activities</th>
<th>Suggested Student Output</th>
<th>Formative Assessments (Portfolios, Projects, Tasks, Evaluations, &amp; Rubrics)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NJSLS 4-ESS2-2 Analyze and interpret data from maps to describe patterns of Earth’s features</td>
<td>Teach using New Jersey Center for teaching and learning - <a href="https://njctl.org/courses/science/4th-grade-science/earths-systems/">https://njctl.org/courses/science/4th-grade-science/earths-systems/</a></td>
<td>--Brainstorm and list possible problems that Earth processes can cause for humans.</td>
<td>- Student and teacher generated rubrics - Round Robin Charts</td>
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<tr>
<td>NJSLS 4-ESS3-2 Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans</td>
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<tr>
<td>Provide Maps showing pattern changes in Earth’s Surface</td>
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<td>Provide Pictures that demonstrate changes made to improve the environment</td>
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<td>Show “Human and Environment” Brain Pop and use open floor discussion.</td>
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<td>Provide problem and solution practice in pair and shares</td>
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<tr>
<td>-Conduct group-work on problems such as the effects of volcanic eruptions on human</td>
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<td>Explain patterns through njctl practice/review questions and labs</td>
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<td>-As a class, determine criteria and possible constraints on the design solutions. Criteria might include: saving lives and/or reducing property loss.</td>
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<tr>
<td>-Small groups investigate how well the solutions perform under a range of likely conditions. This may involve additional research and analysis of available data or planning and conducting investigations to produce data that will serve as the basis for evidence. During this process, students should plan and carry out fair tests in which variables are controlled and failure points are considered in order to identify elements of the design solution that do and do not meet criteria.</td>
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<tr>
<td>-Compare the solutions based on how well they meet criteria and</td>
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</table>

| 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 |

Essential questions:
- 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?

- -PARCC/Common Core holistic rubrics
- Think-Pair-Share
- Science Informational Text Strategic Questioning and Text rendering
- Lab Practicals
- Problem Based Assessments
- Graphic Organizers
- Warm-up pair and shares
- Experimental Design
- Exit ticket
constraints, using data as evidence to support their thinking. At every stage, communicating with peers is an important part of the design process, because shared ideas can lead to improved designs.

-Getting the Right Angle on the Story: (https://spaceplace.nasa.gov/tsunami/en/). This informational text shows students how tsunamis form and behave. It also describes how scientists are collecting data to create models that can be used to predict tsunamis. Animations/computer models are also included to enhance student knowledge of how tsunami warnings work. Models integrate new, unfamiliar vocabulary. Students could use the resource as a starting point for an earth systems unit; teachers could assign the site as a form of research where students gather data, take notes, and draw inferences from text. As students begin their study, they could generate a list of the
Earth's natural disasters and define their impact on human life and the environment. Their possible solutions for lessening that impact could also be incorporated as an informal formative assessment to determine student prior knowledge.
- Identify and test cause-and-effect relationships and use these relationships to explain the changes that they observe as they test design solutions.
Unit 3 Overview At-a-Glance

Unit #3 – Title  Structure and Function and how Organisms Process Information

Unit Description:
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. 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.

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

Standards Addressed within this Unit

<table>
<thead>
<tr>
<th>Central Unit Standards</th>
<th>Supporting Unit Standards</th>
</tr>
</thead>
<tbody>
<tr>
<td>NJSLS 4-LS1-2</td>
<td>ELA/Literacy</td>
</tr>
<tr>
<td>NJSLS 4-LS4-2</td>
<td>Mathematics</td>
</tr>
<tr>
<td>NJSLS 4-LS1-1</td>
<td>W.4.1</td>
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<td></td>
<td>4.G.A.1</td>
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<td>S.L.4.5</td>
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<tr>
<td></td>
<td>4.G.A.3</td>
</tr>
</tbody>
</table>
## Unit Details

**Modifications for Special Education Students, English Language Learners, Students at Risk of Failure, and Gifted Students** - Modify instructional approach and/or assignments and evaluations as needed based for students with IEPs, 504s, ELLs and gifted and talented students including but not limited to:

- Structure lessons around questions that are authentic, relate to students’ interests, social/family background and knowledge of their community

- Provide students with multiple choices for how they can represent their understandings (e.g. multisensory techniques—auditory/visual aids; pictures, illustrations, graphs, charts, data tables, multimedia, modeling).

- Provide opportunities for students to connect with people of similar backgrounds (e.g. conversations via digital tool such as SKYPE, experts from the community helping with a project, journal articles, and biographies).

- Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures (e.g. multiple representation and multimodal experiences).

- Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understandings.

## Integration of 21st century skills through NJSLS 9 and Career Education:

- Lessons, where appropriate, incorporate multiple perspectives to infuse cultural and global awareness.
- Learning incorporates skills focusing on financial, economic, business, and entrepreneurial literacy.
- Lessons integrate a focus on civic literacy so that students can better understand the rights and obligations of citizenship.
- Use project-based science learning to connect science with observable phenomena.
- Structure the learning around explaining or solving a social or community-based issue.
- Provide ELL students with multiple literacy strategies.
- Collaborate with after-school programs or clubs to extend learning opportunities.
- Restructure lesson using UDL principles ([http://www.cast.org/our-work/about-udl.html#VXmoXcfD_UA](http://www.cast.org/our-work/about-udl.html#VXmoXcfD_UA)).

### Assessments - including benchmarks, formative, summative, and alternative 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, Stomach, Stems, Lung, Roots, Brain, Colored petals, Skin and Heart
- Describe a system in terms of its components and their interactions.

### Suggested Interdisciplinary Activities for this Unit
- Career Education: Report how a surgical procedure done by a surgeon
- Health/PE: Survey Sugar intake and sleep and make a chart
- English Language Arts/Literacy: Write an informative report on types of diabetes
- Math: Calculate growth of plants over time with changed variables
- Social Studies: Explain the steps to undergoing surgery in a poster
- Technical Subjects: Design a model showing how an organ functions using a computer animated program
- World Languages: Compare baby care in China to USA in a report.
- Arts: Illustrate a body system in a cube model
- Use a model to test interactions concerning the functioning of a natural system.
- 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).
- Lab Practicals
- Problem-Based Assessments

**Unit Resources**

Teachers should utilize school resources available in our Media Center to infuse alternate sources, perspectives, and approaches. Resources should include textual support but also span multimedia options to engage multiple modalities. In addition, to support struggling readers and increase rigor for advanced readers, the coursework may also draw on additional developmentally appropriate resources to facilitate challenging levels of work for all students.

**Leveled Supplemental Materials and Media/School Library Resources**
- Two Eyes Are Better Than One (California Academy of Sciences)
- Pinhole Cameras and Eyes: [https://www.sciencelearn.org.nz/resources/58-pinhole-cameras-and-eyes](https://www.sciencelearn.org.nz/resources/58-pinhole-cameras-and-eyes) In this activity, students make a pinhole camera and see images formed on an internal screen. They then use a lens to see how this affects the images. Students investigate variables in its construction, and explore how it models the human eye's ability to receive and process information.

**Integration of the Technology Standard**
- 8.1.5.A.1
- 8.1.5.A.2
• Animal Mouth Structures
  (https://www.sciencelearn.org.nz/resources/58-pinhole-cameras-and-eyes) In this lesson, students gather evidence to understand features that enable them to meet their needs. In particular, they examine the mouth structures of different animals to help them understand how animals are adapted to obtain food in their environment.

• Time to Think?
  (http://serendip.brynmawr.edu/bb/reaction/index.html) This resource allows the user to accurately measure and experiment with human reaction time. An interactive program measures reaction times in milliseconds and compares them in different cases (from simply reacting to a visual cue to having to read and then make a decision before reacting). This site provides a wide range of information and activities on the connection between the brain and behavior. Note: Link is to main introductory page. Scroll down to find links for the activity and others pages that allow users to view the results of other participants and guidance for conducting further research.

• Videos: Animal Language and Communication (FOSSweb) ● All about Plant Adaptations (FOSSweb)
• Use Your Brain (Scishow Kids on youtube.com)
• Bill Nye Food Webs (DVD)

Unit #3 Targeted Instructional Planning to Address Central Unit Standards:

<table>
<thead>
<tr>
<th>Central Unit Standard and Student Learning Objective</th>
<th>Suggested Instructional Activities</th>
<th>Suggested Student Output</th>
<th>Formative Assessments (Portfolios, Projects, Tasks, Evaluations, &amp; Rubrics)</th>
</tr>
</thead>
</table>
- Teach using New Jersey Center for teaching and learning - [https://njctl.org/courses/science/4th-grade-science/earths-systems/](https://njctl.org/courses/science/4th-grade-science/earths-systems/)

- Provide examples (print and/or electronic) of systems of plants and animals.

- Provide examples (print and/or electronic) differences in younger and older species.


- Model what happens to our ability to see objects in a room with no light, and what happens when different types of materials are placed in the path

- Using a variety of plants and animals as examples to:
  - Explore plants and examine structure and functions
  - Explore different animals
  - Compare and contrast differences
  - Diagram each (plants and animals)
  - Observe animals, either through direct observation or using text and digital resources, they should use models, such as drawings, diagrams, and pictures, to describe the ways that animals (and humans) receive, process, store, and respond to information from the environment in order to survive, grow, and reproduce. Using the following websites - Invent an Insect (California Academy of Sciences)
  - Observing Variations (California Academy of Science)
  - Ruminating on the Digestive System (California Academy of Sciences)

- Student and teacher generated rubrics
  - Round Robin Charts
  - PARCC/Common Core holistic rubrics
  - Think-Pair-Share
  - Science Informational Text Strategic Questioning and Text rendering
  - Lab Practicals
  - Problem Based Assessments
  - Graphic Organizers
  - Warm-up pair and shares
  - Experimental Design
  - Exit ticket
of a beam of light. (If necessary, demonstrate using flashlights and a variety of transparent, translucent, and opaque materials). Discuss and explain

| Flowers Seeking Pollinators (California Academy of Sciences) |
| Chew, Bite, Chomp (California Academy of Sciences) |
| Camouflage, Countershading and Adaptations (ngss.nsta.org) |
| Baffling Banana [tl1](hookedonscience.org) |

- Describe the internal and external structures of a plant or animal and the function of each of those structures. Description should explain how each structure serves various functions in growth, survival, behavior, and/or reproduction.

- Describe the interactions that occur among the structures within the plant or animal system.

- Examine what happens to light when it comes in contact with mirrors and lenses.
- Experiment with light as it travels straight and bends around different objects.
Unit 4 Overview At-a-Glance

Unit #4 – Title -Transfer of Energy

Unit Description:
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.

Essential Skills:
● 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

Standards Addressed within this Unit

<table>
<thead>
<tr>
<th>Central Unit Standards- This unit will focus primarily on learning goals aligned with the following standards:</th>
<th>Supporting Unit Standards- This unit will also include activities aligned with the following standards:</th>
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<tbody>
<tr>
<td>4-PS3-2</td>
<td>ELA</td>
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<tr>
<td>4-ESS3-1.</td>
<td>W.4.7</td>
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<td>W.4.8</td>
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<td>W.4.9</td>
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<td></td>
<td>Math</td>
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<td></td>
<td>MP.2</td>
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<td>MP.4</td>
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<tr>
<td></td>
<td>4.OA.A.1</td>
</tr>
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**Unit Details**

**Modifications for Special Education Students, English Language Learners, Students at Risk of Failure, and Gifted Students** - Modify instructional approach and/or assignments and evaluations as needed based for students with IEPs, 504s, ELLs and gifted and talented students including but not limited to:

- Structure lessons around questions that are authentic, relate to students’ interests, social/family background and knowledge of their community
- Provide students with multiple choices for how they can represent their understandings (e.g. multisensory techniques - auditory/visual aids; pictures, illustrations, graphs, charts, data tables, multimedia, modeling).
- Provide opportunities for students to connect with people of similar backgrounds (e.g. conversations via digital tool such as SKYPE, experts from the community helping with a project, journal articles, and biographies).
- Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures (e.g. multiple representation and multimodal experiences).
- Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understandings.

**Integration of 21st century skills through NJSLS 9 and Career Education:**

- 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.
- CRP12. Work productively in teams while using cultural global competence.
- Use project-based science learning to connect science with observable phenomena.

- Structure the learning around explaining or solving a social or community-based issue.

- Provide ELL students with multiple literacy strategies.

- Collaborate with after-school programs or clubs to extend learning opportunities.


### Assessments- including benchmarks, formative, summative, and alternative 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

### Suggested Interdisciplinary Activities for this Unit

Career Education: Reporter- Report an Oil Spill and its effects
Health/PE: Explain how your temperature goes up in a journal writing.
English Language Arts/Literacy: Write a story about Energy transfer.
Math: Track changes in temperature throughout the day on different colors of paper.
Social Studies: Compare 2 different Recycling policies- Explain to class.
Technical Subjects: Use different forms of light to investigate how energy is transferred differently.  Keep a log.
World Languages: Create a song about the Greek Myths of the Sun
Arts: Create a model of a changed area from human impact
could include: Wind energy, Water behind dams, and 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, and

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<tr>
<td>Leveled Supplemental Materials and Media/School Library Resources</td>
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<td>- Energy and Waves: An NGSS Unit designed by McCracken County Schools in Kentucky contains a large number of lesson and activities to engage students in the transfer of energy. Activities include creating catapults and solar ovens, marble collisions, the energy of the playground, and much more.</td>
</tr>
<tr>
<td>Integration of the Technology Standard</td>
</tr>
<tr>
<td>- 8.1.5.A.1</td>
</tr>
<tr>
<td>- 8.1.5.A.2</td>
</tr>
<tr>
<td>- 8.1.5.A.3</td>
</tr>
<tr>
<td>- 8.1.5.A.4</td>
</tr>
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- **Advanced High-Powered Rockets**: Students select a flight mission (what they want the rocket to do) and design and construct a highpower paper rocket that will achieve the mission. They construct their rocket, predict its performance, fly the rocket, and file a post-flight mission report. Missions include achieving high altitude records, landing on a "planetary" target, carrying payloads, testing a rocket recovery system, and more.

- **Force and Motion**: This video segment from IdahoPTV's D4K defines gravity, force, friction and inertia through examples from amusement park rides. Examples and explanations of Sir Isaac Newton's Three Laws of Motion are also included.

- **Advanced High-Powered Rockets**: Students select a flight mission (what they want the rocket to do) and design and construct a highpower paper rocket that will achieve the mission. They construct their rocket, predict its performance, fly the rocket, and file a post-flight mission report. Missions include achieving high altitude records, landing on a "planetary" target, carrying payloads, testing a rocket recovery system, and more.

- **Videos**: Bill Nye: Energy How Does Light Travel (youtube.com)

### Unit #4 Targeted Instructional Planning to Address Central Unit Standards:

<table>
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<tr>
<th>Central Unit Standard and Student Learning Objective</th>
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<th>Suggested Student Output</th>
<th>Formative Assessments (Portfolios, Projects, Tasks, Evaluations, &amp; Rubrics)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NJSLS 4-PS3-2&lt;br&gt;Make observations to provide evidence that energy can be transferred from place to place</td>
<td>- Teach using New Jersey Center for teaching and learning - <a href="https://njctl.org/courses/science/4th-grade-science/earths-systems/">https://njctl.org/courses/science/4th-grade-science/earths-systems/</a></td>
<td>- Observe and discuss observation of different types of energy transferred&lt;br&gt;- Conduct investigations to observe that energy can be transferred</td>
<td>- Student and teacher generated rubrics&lt;br&gt;- Round Robin Charts</td>
</tr>
</tbody>
</table>

- NJSLS 4-ESS3-1
by sound, light, heat, and electrical currents. Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment.

**Essential Questions:** 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?

- Provide examples of energy transferred from place to place by sound, light, heat, and electrical currents. They describe that energy and fuels are derived from natural resources and that their uses affect the environment. Throughout this unit, students obtain, evaluate, and communicate information as they examine cause-and-effect relationships between energy and matter.
- Conduct simple investigations, using thermometers to measure changes in temperature as heat energy is transferred from a warmer object to a colder one and other simple investigations.
- Collect data from investigations and use data as evidence to explain that some of the heat energy transferred.
- Create a list of events in which energy is transferred.
- Research using books, articles (dogonews.com) and other reliable media to determine which natural resources are sources of energy. Design a diagram of effects on the environment from humans.

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| -PARCC/Common Core holistic rubrics |
| -Think-Pair-Share |
| - Science Informational Text Strategic Questioning and Text rendering |
| - Lab Practicals |
| - Problem Based Assessments |
| - Graphic Organizers |
| - Warm-up pair and shares |
| - Experimental Design |
| - Exit ticket |
Unit 5 Overview At-a-Glance

Unit #5 – Title Force and Motion

Unit Description: 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.

Essential Skills:
- 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

Standards Addressed within this Unit

<table>
<thead>
<tr>
<th>Central Unit Standards- This unit will focus primarily on learning goals aligned with the following standards:</th>
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<tbody>
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</tr>
<tr>
<td>NJSL 4-PS3-3.</td>
</tr>
</tbody>
</table>

<table>
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<th>Supporting Unit Standards- This unit will also include activities aligned with the following standards:</th>
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<tbody>
<tr>
<td>ELA/Literacy</td>
</tr>
<tr>
<td>RI.4.1</td>
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**Unit Details**

**Modifications for Special Education Students, English Language Learners, Students at Risk of Failure, and Gifted Students** - Modify instructional approach and/or assignments and evaluations as needed based for students with IEPs, 504s, ELLs and gifted and talented students including but not limited to:
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- Provide students with multiple choices for how they can represent their understandings (e.g. multisensory techniques-auditory/visual aids; pictures, illustrations, graphs, charts, data tables, multimedia, modeling).
- Provide opportunities for students to connect with people of similar backgrounds (e.g. conversations via digital tool such as SKYPE, experts from the community helping with a project, journal articles, and biographies).

**Integration of 21st century skills through NJSLS 9 and Career Education:**
- 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.
- CRP12. Work productively in teams while using cultural global competence.
- Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures (e.g. multiple representation and multimodal experiences).

- Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understandings.

- Use project-based science learning to connect science with observable phenomena.

- Structure the learning around explaining or solving a social or community-based issue.

- Provide ELL students with multiple literacy strategies.

- Collaborate with after-school programs or clubs to extend learning opportunities.

- Restructure lesson using UDL principles ([http://www.cast.org/our-work/about-udl.html#.VXmoXcfD_UA](http://www.cast.org/our-work/about-udl.html#.VXmoXcfD_UA)).

**Assessments- including benchmarks, formative, summative, and alternative assessments**

- Describe various ways that energy can be transferred between objects.
- Use evidence (e.g., measurements, observations, patterns) to construct an explanation.

**Suggested Interdisciplinary Activities for this Unit**

Career Education: Write questions to interview a Bridge Engineer
English Language Arts/Literacy: Debate seatbelt use with a partner.
Math: Calculate Speed of marbles of different sizes in an experiment.
- 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.)
- Lab Practicals
- Problem-Based Assessments

Social Studies: Research speeding laws in another country and report finding to the entire class.
Technical Subjects: Use calculators to identify speed of marbles
World Languages: Research how to say “Speed” in 2 other languages. Report back.
Arts: Capture an object speeding with a camera

**Unit Resources**

Teachers should utilize school resources available in our Media Center to infuse alternate sources, perspectives, and approaches. Resources should include textual support but also span multimedia options to engage multiple modalities. In addition, to support struggling readers and increase rigor for advanced readers, the coursework may also draw on additional developmentally appropriate resources to facilitate challenging levels of work for all students.

**Leveled Supplemental Materials and Media/School Library Resources**

- **Energy and Waves:** An NGSS Unit designed by McCracken County Schools in Kentucky contains a large number of lesson and activities to engage students in the transfer of energy. Activities include creating catapults and solar ovens, marble collisions, the energy of the playground, and much more.

**Integration of the Technology Standard**

- 8.1.5.A.1
- 8.1.5.A.2
- **Advanced High-Powered Rockets**: Students select a flight mission (what they want the rocket to do) and design and construct a high power paper rocket that will achieve the mission. They construct their rocket, predict its performance, fly the rocket, and file a post-flight mission report. Missions include achieving high altitude records, landing on a "planetary" target, carrying payloads, testing a rocket recovery system, and more.

- **Force and Motion**: This video segment from IdahoPTV's D4K defines gravity, force, friction and inertia through examples from amusement park rides. Examples and explanations of Sir Isaac Newton's Three Laws of Motion are also included.

- **Videos**: Bill Nye:
  - Energy How Does Light Travel (youtube.com)

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| NJSLS 4-PS3-1                                          | - Teach using New Jersey Center for teaching and learning - [https://njctl.org/courses/science/4th-grade-science/earths-systems/](https://njctl.org/courses/science/4th-grade-science/earths-systems/)  
- Provide examples (print, electronic and/or models) of objects moving at different speeds. Discuss | - Diagram different objects moving at different speeds and discuss in pair and share reasons that this happens  
- Formulate questions to answer in an experiment testing different objects speed, energy and collision | - Student and teacher generated rubrics  
- Round Robin Charts  
- -PARCC/Common Core holistic rubrics  
- Think-Pair-Share |
| NJSLS 4-PS3-3                                          |                                   |                           |                                                                  |

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.
| Essential questions:                      | - Instruct how to write questions in experiments. |
| * In what ways does the energy change when objects collide? | - Provide reading ([https://www.dogonews.com/search/forces](https://www.dogonews.com/search/forces)) and vocab to review unit terms |
|                                           | Experiment with testing different objects on ramps in an attempt to answer formulated questions. |
|                                           | - Respond to essential questions from njctl site in a review/practice |
|                                           | - Play a Force and Motion game of I have who has. ([http://www.teacherspayteachers.com/Product/Force-and-Motion-I-have-Who-Has-139427](http://www.teacherspayteachers.com/Product/Force-and-Motion-I-have-Who-Has-139427)) |
|                                           | - Science Informational Text Strategic Questioning and Text rendering |
|                                           | - Lab Practicals |
|                                           | - Problem Based Assessments |
|                                           | - Graphic Organizers |
|                                           | - Warm-up pair and shares |
|                                           | - Experimental Design |
|                                           | - Exit ticket |

**Unit 6 Overview At-a-Glance**

**Unit #6 — Title Engineering Design with Force and Motion Systems**

**Unit Description:**
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.

**Essential Skills:**
- Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.

**Standards Addressed within this Unit**

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<tr>
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<td><strong>Mathematics</strong></td>
</tr>
<tr>
<td>W.4.8</td>
<td>4.OA.A.3</td>
</tr>
<tr>
<td>RI.5.1</td>
<td>3.OA</td>
</tr>
<tr>
<td>RI.5.9</td>
<td>MP.2</td>
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<tr>
<td>W.5.7</td>
<td>MP.5</td>
</tr>
<tr>
<td>W.5.8</td>
<td>3-5AOA</td>
</tr>
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</table>

**Unit Details**

**Modifications for Special Education Students, English Language Learners, Students at Risk of Failure, and Gifted Students**- Modify instructional approach and/or assignments and evaluations as needed based for students with IEPs, 504s, ELLs and gifted and talented students including but not limited to:
- Structure lessons around questions that are authentic, relate to students’ interests, social/family background and knowledge of their community
- Provide students with multiple choices for how they can represent their understandings (e.g. multisensory techniques-

**Integration of 21st century skills through NJSLS 9 and Career Education:**
- 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.
- CRP12. Work productively in teams while using cultural global competence.
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<th>● Provide opportunities for students to connect with people of similar backgrounds (e.g. conversations via digital tool such as SKYPE, experts from the community helping with a project, journal articles, and biographies).</th>
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<td>● Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures (e.g. multiple representation and multimodal experiences).</td>
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<td>● Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understandings.</td>
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<td>● Use project-based science learning to connect science with observable phenomena.</td>
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<td>● Structure the learning around explaining or solving a social or community-based issue.</td>
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<td>● Provide ELL students with multiple literacy strategies.</td>
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<td>● Collaborate with after-school programs or clubs to extend learning opportunities.</td>
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<tr>
<td>● Restructure lesson using UDL principles (<a href="http://www.cast.org/our-work/about-udl.html#VXmoXcfD_UA">http://www.cast.org/our-work/about-udl.html#VXmoXcfD_UA</a>).</td>
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auditory/visual aids; pictures, illustrations, graphs, charts, data tables, multimedia, modeling).
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<th>Assessments- including benchmarks, formative, summative, and alternative assessments</th>
<th>Suggested Interdisciplinary Activities for this Unit</th>
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</table>
| ● 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 | Career Education: Explain what a Physicist does  
English Language Arts/Literacy: Create an invitation to a car race competition  
Math: Create a Line graph showing how speed changes  
Science: Test dropping marbles of different sizes  
Social Studies: Examine different types of bridges and the reason for different slopes. Create a poster.  
Technical Subjects: Use a stopwatch to track speed of an object  
World Languages: How does the different type of roads in Ireland change the speed of the car traveling on them. Explain to someone in your morning group.  
Arts: Draw a new bridge design |

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<th>Unit Resources</th>
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<tr>
<td>Teachers should utilize school resources available in our Media Center to infuse alternate sources, perspectives, and approaches. Resources should include textual support but also span multimedia options to engage multiple modalities. In addition, to support struggling readers and increase rigor for advanced readers, the coursework may also draw on additional developmentally appropriate resources to facilitate challenging levels of work for all students.</td>
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<tr>
<th>Leveled Supplemental Materials and Media/School Library Resources</th>
<th>Integration of the Technology Standard</th>
</tr>
</thead>
</table>
| ● **Energy Makes Things Happen**: The Boy Who Harnessed the Wind: This article from Science and Children provides ideas for using the trade book, The Boy Who Harnessed the Wind, as a foundation for a lesson on generators. This beautiful book is the | ● 8.1.5.A.1  
● 8.1.5.A.2  
● 8.1.5.A.3 |
inspiring true story of a teenager in Malawi who built a generator from found materials to create much-needed electricity. The lesson allows students to explore the concept of energy transfer using crank generators. Students then design improvements to the crank mechanism on the generator. The lesson may be extended by having students build their own generators.

- **Light Your Way**: Using the engineering design process, students will be designing and building a lantern that they will hypothetically be taking with them as they explore a newly discovered cave. The criteria of the completed lantern will include: hands need to be free for climbing, the lantern must have an on/off switch, it must point ahead when they are walking so they can see in the dark, and the lantern must be able to stay lit for at least 15 minutes. The constraints of the activity will be limited materials with which to build. At the completion of the activity, the students will present their final lantern to the class explaining how they revised and adapted the lantern to meet the criteria of the project. Students will include in the presentation the sketch of the model they created prior to building showing the labeled circuit they designed.

## Unit #4 Targeted Instructional Planning to Address Central Unit Standards:

<table>
<thead>
<tr>
<th>Central Unit Standard and Student Learning Objective</th>
<th>Suggested Instructional Activities</th>
<th>Suggested Student Output</th>
<th>Formative Assessments (Portfolios, Projects, Tasks, Evaluations, &amp; Rubrics)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NJSLS 4-PS3-4, NJSLS 3-5-ETS1-1, 3-5-ETS1-2, NJSLS 3-5-ETS1-3. Apply scientific ideas to design, test, and refine a device that</td>
<td>-Review Forces and Motion concepts</td>
<td>-Create a list of all the concepts that they have learned about</td>
<td>- Student and teacher generated rubrics</td>
</tr>
<tr>
<td></td>
<td>-Review Safety Rules</td>
<td></td>
<td>-Round Robin Charts</td>
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</table>
converts energy from one form to another.

<table>
<thead>
<tr>
<th>-Teach how to use an Experimental Design Template</th>
<th>force, motion, and energy showing the following:</th>
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<tbody>
<tr>
<td>*The faster a given object is moving, the more energy it possesses.</td>
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<tr>
<td>*Energy is present whenever there are moving objects, sound, light, or heat.</td>
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<tr>
<td>*Energy can be transferred in various ways and between objects.</td>
<td></td>
</tr>
<tr>
<td>*Energy can be moved from place to place by moving objects or through sound, light, or electric currents. 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 object’s motions</td>
<td></td>
</tr>
</tbody>
</table>

- PARCC/Common Core holistic rubrics
- Think-Pair-Share
- Science Informational Text Strategic Questioning and Text rendering
- Lab Practicals
- Problem Based Assessments
- Graphic Organizers
- Warm-up pair and shares
- Experimental Design
- Exit ticket
| -Brainstorm examples of simple devices that convert energy from one form to another. |
| -Describe how each device converts energy from one form to another. |
| -Design and build a simple device that converts energy from one form to another. (limit the devices to those that convert motion energy to electric energy or that use stored energy to cause motion or produce light or sound). |
| -Conduct research, using several sources of information, to build understanding of “stored energy.” (Stretched rubber bands, compressed springs, wound or twisted rubber bands, batteries, wind-up toys, and objects at the top of a ramp or held at a height above the ground all have stored energy). |
| -Analyze and determine criteria and possible constraints on the design solutions. (For example, devices are only required to |
perform a single energy conversion (i.e., transfer energy from one form to another), and devices must transfer stored energy to motion, light, or sound).

*Work in small, collaborative groups to design and build their device. (Examples of possible devices could include: o A simple rubber band car that converts the stored energy in a twisted rubber band into motion energy. o A simple roller coaster that converts the stored energy in a marble held at the top of the roller coaster into motion energy. o A whirly bird that converts stored energy (in a student’s muscles) into motion energy. o A ball launcher that converts stored energy in a compressed spring, compressed suction cup, or stretched rubber band into motion energy when the ball is launched).

- Create a poster that includes a diagram of the device and a description of how the device
transfers energy from one form to another.

- Present their device and explain how it works.

- Compare each of the design solutions based on how well they meet criteria and constraints, giving evidence to support their thinking. When giving feedback to the groups, students should identify which criteria were/were not met, and how the design might be improved. Small groups should then have the opportunity to refine their designs based on the feedback from the class. At every stage, communicating with peers is an important part of the design process, because shared ideas can lead to improved designs. It is also important that students describe the ways in which energy is transferred between objects and from one form to another.
# Unit 7 Overview At-a-Glance

## Unit #7 – Title Waves and Information

### Unit Description:
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.

### Essential Skills:
- 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

### Standards Addressed within this Unit

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Unit Details

Modifications for Special Education Students, English Language Learners, Students at Risk of Failure, and Gifted Students- Modify instructional approach and/or assignments and evaluations as needed based for students with IEPs, 504s, ELLs and gifted and talented students including but not limited to:

- Structure lessons around questions that are authentic, relate to students’ interests, social/family background and knowledge of their community
- Provide students with multiple choices for how they can represent their understandings (e.g. multisensory techniques-auditory/visual aids; pictures, illustrations, graphs, charts, data tables, multimedia, modeling).
- Provide opportunities for students to connect with people of similar backgrounds (e.g. conversations via digital tool such as Integration of 21st century skills through NJSLS 9 and Career Education:

- CRP6. Demonstrate creativity and innovation.
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- CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.
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SKYPE, experts from the community helping with a project, journal articles, and biographies.

- Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures (e.g. multiple representation and multimodal experiences).

- Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understandings.

- Use project-based science learning to connect science with observable phenomena.

- Structure the learning around explaining or solving a social or community-based issue.

- Provide ELL students with multiple literacy strategies.

- Collaborate with after-school programs or clubs to extend learning opportunities.

- Restructure lesson using UDL principles (http://www.cast.org/our-work/about-udl.html#VXmoXcfD_UA).

**Assessments- including benchmarks, formative, summative, and alternative assessments**

- Sort and classify natural phenomena using similarities and differences in patterns.

**Suggested Interdisciplinary Activities for this Unit**

Career Education: Explain what a seismologist does for a living in a report.
● Develop a model using an analogy, example, or abstract representation to describe a scientific principle.

● Develop a model (e.g., diagram, analogy, or physical model) of waves to describe patterns in terms of amplitude and wavelength, and that waves can cause objects to move. (Assessment does not include interference effects, electromagnetic waves, nonperiodic waves, or quantitative models of amplitude and wavelength).

● 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: o Drums sending coded information through sound waves; o Using a grid of ones and zeroes representing black and white to send information about a picture; o 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.

Health/Pe:  What does it mean to be “tone-deaf?” Share your research in a pair and share activity.

English Language Arts/Literacy: Read and share a story about Surviving a Tsunami

Math: Calculate the time it takes for Tsunami to reach land. Record on a chart.

Social Studies: Where are Northern Lights best seen in the world and why? Explain in a journal writing

Technical Subjects: Use tuning forks to examine different tunes and record levels on a visual graph

World Languages: How do people living near oceans prepare for Tsunami? Write a story and share.

Arts: Create a clay model of changing waves
Teachers should utilize school resources available in our Media Center to infuse alternate sources, perspectives, and approaches. Resources should include textual support but also span multimedia options to engage multiple modalities. In addition, to support struggling readers and increase rigor for advanced readers, the coursework may also draw on additional developmentally appropriate resources to facilitate challenging levels of work for all students.

**Leveled Supplemental Materials and Media/School Library Resources**

- **The Sound of Science**: Students are given a scenario/problem that needs to be solved: Their school is on a field trip to the city to listen to a rock band concert. After arriving at the concert, the students find out that the band’s instruments were damaged during travel. The band needs help to design and build a stringed instrument with the available materials, satisfying the following criteria and constraints: 1) Produce three different pitched sounds. 2) Include at least one string. 3) Use only available materials. 4) Be no longer than 30 cm / 1 foot. The challenge is divided into 4 activities. Each activity is designed to build on students’ understanding of the characteristics and properties of sound. By using what they learn about sound from these activities, students are then encouraged to apply what they know about sound to complete the engineering design challenge.

- Energy in Waves
  [https://www.youtube.com/watch?v=tRzl7Z_VC08](https://www.youtube.com/watch?v=tRzl7Z_VC08)

**Integration of the Technology Standard**

- 8.1.5.A.1
- 8.1.5.A.2

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<td>- Teach that waves, which are regular patterns of motion, can differ in amplitude (height of the wave) and wavelength (spacing between wave peaks). Provide opportunity to end understanding through researching - Provide examples and models - Provide opportunity for see and hear such waves (<a href="http://twobitcircus.org/wp-content/uploads/2017/03/Waves-4th-grade.pdf">http://twobitcircus.org/wp-content/uploads/2017/03/Waves-4th-grade.pdf</a>).</td>
<td>- Research meaning of key terms, discuss in small groups and share as a whole class - Develop and use models to describe patterns of waves in terms of amplitude and wavelength and to show that waves can cause objects to move. - Model the properties of waves by disturbing the surface of water in a variety of pans and buckets. - Make and record observations when strike the surface of the water with small and large objects, such as marbles and rocks. - Analyze and record the effects of the wave patterns created on the surface of the water Read and share information on real-world problems - Recommend solutions to such problems a Tsunami and prevention ideas.</td>
<td>Student and teacher generated rubrics - PARCC/Common Core holistic rubrics - Science Literature Review - Lab Practicals - Problem Based Assessments - Graphic Organizers - Warm-up pair and shares - Experimental Design - Exit ticket</td>
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