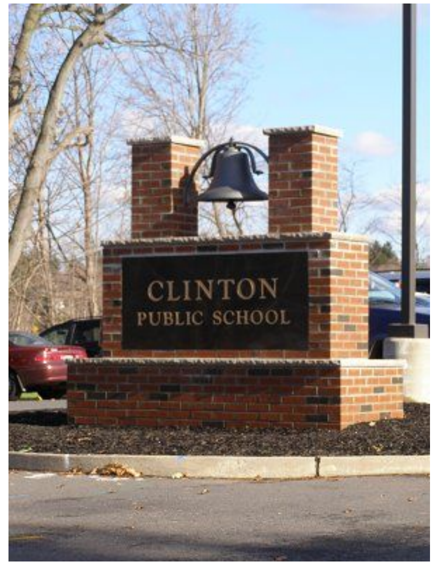
# Clinton-Glen Gardner School District




## Curriculum Management System

**SCIENCE**

**Grade:4**

* **For adoption by all regular education programs as specified and for adoption or adaptation by all Special Education Programs in accordance with Board of Education Policy #2200.**

**Board Approved: August 23, 2017**

# CLINTON-GLEN GARDNER SCHOOL DISTRICT

## ADMINISTRATION

Dr. Seth Cohen, Superintendent/Principal
Mrs. Lisa J. Craft, Business Administrator
Mrs. Jacqueline Turner, Assistant Principal
Mrs. Jenine Kastner, Director of Special Services

## Acknowledgments

**The following individuals are acknowledged for their assistance in the preparation of this Curriculum Management System:**

**Writers' Names: Barb Smith**

# Clinton-Glen Gardner School District

## Mission

The Clinton-Glen Gardner School District is a community who values traditions. Our MISSION is to nurture and cultivate each child to be a compassionate, curious, and creative thinker, entrusted and empowered to build and lead the future.

## Philosophy

Science, engineering, and technology influence and permeate every aspect of modern life. Some knowledge of science and engineering is required to engage with the major public policy issues of today as well as to make informed everyday decisions, such as selecting among alternative medical treatments or determining how to invest public funds for water supply options. In addition, understanding science and the extraordinary insights it has produced can be meaningful and relevant on a personal level, opening new worlds to explore and offering lifelong opportunities for enriching people's lives. In these contexts, learning science is important for everyone, even those who eventually choose careers in fields other than science or engineering.

The Next Generation Science Standards (NGSS) are K–12 science content standards. Standards set the expectations for what students should know and be able to do. The NGSS were developed by states to improve science education for all students.

A goal for developing the NGSS was to create a set of research-based, up-to-date K–12 science standards. These standards give local educators the flexibility to design classroom learning experiences that stimulate students' interests in science and prepares them for college, careers, and citizenship.  The CPS Science Curriculum is designed to address the goals and philosophy of the New Jersey Next Generation Science Standards.

# Grade 4
# Science
# Scope and Sequence

| Quarter I | |
|---|---|
| **Unit 1: Weathering and Erosion**<br>● How can evidence of the effects of weathering or the rate of erosion by water, ice , wind, or vegetation be observed or measured?<br>● What can rock formations tell us about the past? | **Unit 2: Earth Processes**<br>● What can maps tell us about the features of the world?<br>● In what ways can can the impacts of natural Earth processes on humans be reduced? |
| (The ones that apply for these units are in bold)<br><br>21st Century Skills<br>1. Creativity & Innovation<br>**2. Critical Thinking & Problem Solving**<br>**3. Communication & Collaboration**<br>4. Media Literacy<br>5. Information Literacy<br>6. Information, Communication & Technology | Cross Cutting Concepts<br>**1. Patterns**<br>**2. Cause and Effect**<br>3. Scale, Proportion and Quantity<br>4. System and System Models<br>5. Energy and Matter: flows, cycles and conservation<br>6. Structure and Function<br>7. Stability and Change |
| 21st Century Themes<br>**1. Global Awareness**<br>**2. Financial, Economic, Business and Entrepreneurial Literacy**<br>**3. Civic Literacy**<br>**4. Health Literacy**<br>5. **Environmental Literacy** | Scientific and Engineering Practices<br>**1. Asking questions or defining a problem**<br>**2. Developing and using models**<br>**3. Planning and carrying out investigations**<br>**4. Analyzing and interpreting data**<br>5. Using mathematics and computational thinking<br>**6. Constructing explanations or designing a solution**<br>7. Engaging in an argument from evidence<br>8. Obtaining, evaluating and communicating information |

Technology Infusion

http://www.state.nj.us/education/, Internet, Web Quests, content-related websites, wireless laptop computers, Chromebooks, computer laboratory, classroom computers, SMART Boards, CDs, DVDs, webinars, video streaming, podcasting

**Differentiation**

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.• 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)

**Assessment**

Various opportunities during lab investigations for formative assessment and anecdotal notes. Foss Kit I-Investigations at the end of each investigation as benchmark. Review of student documentation of learning process in Science notebook and observations of approach to investigations as formative assessment.

During Work Period adjust lessons for individual students and small groups of students based on formative and summative data (Go back and re-teach for those that did not meet standard on benchmark and plan accordingly for those that exceeded benchmark)

## Quarter II

| **Unit 3: Structure and Function** | **Unit 4: How Organisms Process Information** |
|---|---|
| ● How do internal and external parts of plants and animals help them to survive, grow, behave, and reproduce? | ● How do animals receive and process different types of information from their environment in order to respond appropriately?<br>● What happens when light from an object enters the eye? |

| (The ones that apply for these units are in bold)<br><br><u>21st Century Skills</u><br>1. Creativity & Innovation<br>**2. Critical Thinking & Problem Solving**<br>**3. Communication & Collaboration**<br>4. Media Literacy<br>**5. Information Literacy**<br>**6. Information, Communication & Technology** | <u>Cross Cutting Concepts</u><br>**1. Patterns**<br>**2. Cause and Effect**<br>3. Scale, Proportion and Quantity<br>**4. System and System Models**<br>**5. Energy and Matter: flows, cycles and conservation**<br>**6. Structure and Function**<br>7. Stability and Change |
|---|---|
| <u>21st Century Themes</u><br>**1. Global Awareness**<br>**2. Financial, Economic, Business and Entrepreneurial Literacy**<br>**3. Civic Literacy**<br>**4. Health Literacy**<br>**5. Environmental Literacy** | <u>Scientific and Engineering Practices</u><br>1. **Asking questions or defining a proble**m<br>**2. Developing and using models**<br>**3. Planning and carrying out investigations**<br>4. Analyzing and interpreting data<br>**5. Using mathematics and computational thinking**<br>6. Constructing explanations or designing a solution<br>7. Engaging in an argument from evidence<br>**8. Obtaining, evaluating and communicating information** |

## Technology Infusion

http://www.state.nj.us/education/, Internet, Web Quests, content-related websites, wireless laptop computers, computer laboratory, classroom computers, SMART Boards, CDs, DVDs, webinars, video streaming, podcasting

**Differentiation**

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.• 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)

**Assessment**

Foss Kit I-Investigations at the end of each investigation as benchmark. Review of student documentation of learning process in Science notebook and observations of approach to investigations as formative assessment. Various opportunities during lab investigations for formative assessment and anecdotal notes

During Work Period adjust lessons for individual students and small groups of students based on formative and summative data (Go back and re-teach for those that did not meet standard on benchmark and plan accordingly for those that exceeded benchmark)

## Quarter III

**Unit 5: Transfer of Energy**

- 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 6:Force and Motion**

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

(The ones that apply for these units are in bold)

21st Century Skills

1. **Creativity & Innovation**
2. **Critical Thinking & Problem Solving**
3. **Communication & Collaboration**
4. **Media Literacy**
5. **Information Literacy**
6. **Information, Communication & Technology**

Cross Cutting Concepts

1. **Patterns**
2. **Cause and Effec**t
3. Scale, Proportion and Quantity
4. System and System Models
5. **Energy and Matter: flows, cycles and conservation**
6. Structure and Function
7. Stability and Change

21st Century Themes

1. **Global Awareness**
2. **Financial, Economic, Business and Entrepreneurial Literacy**
3. Civic Literacy
4. Health Literacy
5. **Environmental Literacy**

Scientific and Engineering Practices

1. **Asking questions or defining a problem**
2. Developing and using models
3. **Planning and carrying out investigations**
4. **Analyzing and interpreting data**
5. **Using mathematics and computational thinking**
6. **Constructing explanations or designing a solution**
7. Engaging in an argument from evidence
8. Obtaining, evaluating and communicating information

Technology Infusion

http://www.state.nj.us/education/, Internet, Web Quests, content-related websites, wireless laptop computers, computer laboratory, classroom computers, SMART Boards, CDs, DVDs, webinars, video streaming, podcasting

**Differentiation**

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.• 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)

**Assessment**

Foss Kit I-Investigations at the end of each investigation as benchmark. Review of student documentation of learning process in Science notebook and observations of approach to investigations as formative assessment. Various opportunities during lab investigations for formative assessment and anecdotal notes
During Work Period adjust lessons for individual students and small groups of students based on formative and summative data (Go back and re-teach for those that did not meet standard on benchmark and plan accordingly for those that exceeded benchmark)

## Quarter IV

| Unit 7: Using Engineering Design with Force and Motion Systems | Unit 8: Waves and Information |
|---|---|
| ● How can scientific ideas be applied to design, test, and refine a device that converts energy from one form to another? | ● If a beach ball lands in the surf, beyond the breakers, what will happen to it?<br>● Which team can design a way to use patterns to communicate with someone across the room? |
| | Cross Cutting Concepts |

| 21st Century Skills | |
|---|---|
| 1. **Creativity & Innovation**<br>2. **Critical Thinking & Problem Solving**<br>3. **Communication & Collaboration**<br>4. **Media Literacy**<br>5. **Information Literacy**<br>6. **Information, Communication & Technology** | 1. Patterns<br>2. Cause and Effect<br>3. **Scale, Proportion and Quantity**<br>4. System and System Models<br>5. **Energy and Matter: flows, cycles and conservation**<br>6. Structure and Function<br>7. Stability and Change |
| 21st Century Themes<br>6. **Global Awareness**<br>7. **Financial, Economic, Business and Entrepreneurial Literacy**<br>8. Civic Literacy<br>9. Health Literacy<br>10. **Environmental Literacy** | Scientific and Engineering Practices<br>1. **Asking questions or defining a problem**<br>2. **Developing and using models**<br>3. **Planning and carrying out investigations**<br>4. **Analyzing and interpreting data**<br>5. **Using mathematics and computational thinking**<br>6. **Constructing explanations or designing a solution**<br>7. **Engaging in an argument from evidence**<br>8. **Obtaining, evaluating and communicating information** |

## Technology Infusion

http://www.state.nj.us/education/, Internet, Web Quests, content-related websites, wireless laptop computers, computer laboratory, classroom computers, SMART Boards, CDs, DVDs, webinars, video streaming, podcasting

**Differentiation**

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.• 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)

**Assessment**

Various opportunities during lab investigations for formative assessment and anecdotal notes. Foss Kit I-Investigations at the end of each investigation as benchmark. Review of student documentation of learning process in Science notebook and observations of approach to investigations as formative assessment.

During Work Period adjust lessons for individual students and small groups of students based on formative and summative data (Go back and re-teach for those that did not meet standard on benchmark and plan accordingly for those that exceeded benchmark)

| Grade 4 | Topic: Weathering and Erosion |
|---|---|
| **Sept.** | |
| **Essential Questions:** | What is soil?<br>What causes big rocks to break down into smaller rocks?<br>How are rocks affected by acid rain?<br>What's in our schoolyard soils?<br>How do weathered rock pieces move from one place to another?<br>How does slope affect erosion and deposition?<br>How do floods affect erosion and deposition?<br>Where are erosion and deposition happening in our schoolyard?<br>How do fossils get in rocks and what can they tell us about the past? |
| **Disciplinary Core Concepts:** | ESS2.A: Earth Materials and Systems<br><br>● Rainfall helps to shape the land and affects the types of living things found in a region.. Water, ice, wind, living organisms, and gravity break rocks, soils, and sediments into smaller particles<br>and move them around. (4-ESS2<br><br>ESS2.E: Biogeology<br><br>● Living things affect the physical characteristics of their regions. (4-ESS2<br><br>ESS1.C: The History of Planet Earth |

| | |
|---|---|
| | • Local, regional, and global patterns of rock formations reveal changes over time due to earth forces, such as earthquakes. |
| **How will they learn it? Learning Activities:** | **Investigation 1- Soils and Weathering**<br>• Students investigate properties of soil by comparing four different soils. They begin to explore how rocks break into smaller pieces through physical and chemical weathering.<br><br>**Investigation 2- Landforms**<br>• Students use stream-table models to observe that water moves earth materials.<br>• Students think about what happens to sediments over long periods of time. |
| **Resources:** | **Science Resources Book**<br>"What Is Soil?"<br>"Weathering"<br>**Videos**<br>"Weathering and Erosion"<br>"Soils"<br>"Erosion and Deposition"<br>"Fossils Tell a Story"<br>"Pieces of a Dinosaur Puzzle" |

| | |
|---|---|
| **How do we know that they know it? Assessment:** | Benchmark assessments are short summative assessments given after each investigation. These I-Checks are actually hybrid tools: they provide summative information about students' achievement, and because they occur soon after teaching each investigation, they can be used diagnostically as well. Reviewing specific items on an I-Check with the class provides additional opportunities for students to clarify their thinking. The embedded assessments are based on authentic work produced by students during the course of participating in the FOSS activities. Students do their science, and teachers review their notebook entries. Bullet points in the Guiding the Investigation tell you specifically what students should know and be able to communicate. If student work is incorrect or incomplete, you know that there has been a breakdown in the learning/communicating process. The assessment system then provides a menu of next-step strategies to resolve the situation. Embedded assessment is assessment for learning, not assessment of learning. |
| **Interdisciplinary Connections:** | **English Language Arts**<br>To support integration of the NJSLS 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.<br><br>**Mathematics**<br><br>Use measurements to determine how far earthquakes and volcanoes tend to occur from continental |

| | |
|---|---|
| | boundaries.<br><br>Analyze data to determine patterns of change that occur in areas where volcanoes erupt, earthquakes occur, and in flood zones.<br><br>Reason abstractly and quantitatively to draw diagrams to build scale models.<br><br>Analyze timelines, charts, and graphs to determine patterns in Earth's features and patterns of change caused by earth processes.<br><br>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. |
| **What will students be able to do as a result of the learning in this unit?** | Students who understand the concepts can:<br><br>● Support explanations using patterns as evidence.<br>● Identify the evidence that supports particular points in an explanation.<br><br>● Identify evidence from patterns in rock formations and fossils in rock layers to support an explanation for changes in a landscape over time.<br>(Note: Examples of evidence from patterns could include:**)**<br>● Rock layers with marine shell fossils above rock layers with plant fossil and no shells, indicating a change from land to water over time.<br>● 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 |

| Grade 4 | Topic: Earth's Processes | |
|---|---|---|
| **Oct/Nov.** | | |
| **Essential Questions:** | How can we represent the different elevations of landforms?<br>How can we draw a profile of a mountain from a topographic map?<br>How can scientists and engineers help reduce the impacts that events like volcanic eruptions might have on people?<br>What events can change Earth's surface quickly?<br>What are natural resources and what is important to know about them?<br>How are natural resources used to make concrete?<br>How do people use natural resources to make or build things? | |
| **Disciplinary Core Concepts:** | ESS2.B: Plate Tectonics and Large-Scale System Interactions<br>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. Maps can help locate the different land and water features. | |
| **How will they learn it? Learning Activities:** | **Investigation 3- Mapping Earth's Surface**<br>● Students are introduced to the study of topography by building a model of a landform—a mountain.<br>● Students learn about volcanoes.<br><br>**Investigation 4- Natural Resources** | |

| | | |
|---|---|---|
| | • Students focus on earth materials as renewable and nonrenewable natural resources. | |
| **Resources:** | **Science Resources Book**<br>“Monumental Rocks”<br>“Geoscientists at Work”<br>“Making Concrete”<br>“Earth Materials in Art”<br>“Where Do Rocks Come From?”<br>(optional)<br>**Videos**<br>“Topographic Maps”<br>“The Story of Mount Shasta”<br>“It Happened So Fast!”<br>“Volcanoes”<br>“Mount St. Helens Impact”<br>**Online Activity**<br>“Topographer” | |
| **How do we know that they know it? Assessment:** | Benchmark assessments are short summative assessments given after each investigation. These I-Checks are actually hybrid tools: they provide summative information about students’ achievement, and because they occur soon after teaching each investigation, they can be used diagnostically as well. Reviewing specific items on an I-Check with the class provides additional opportunities for students to clarify their thinking. The embedded assessments are based on authentic work produced by students during the course of participating in the FOSS activities. Students do their science, and teachers review their notebook entries. Bullet points in the Guiding the Investigation tell you specifically what students should know and be able to communicate. If student work is incorrect or incomplete, you know that there has been a breakdown in the learning/communicating process. The assessment system then provides a menu of next-step strategies to resolve the situation. Embedded assessment is assessment for learning, not assessment of learning. | |
| **Interdisciplinary Connections:** | **English Language Arts**<br>To support integration of the NJSLS 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.<br>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.<br><br>**Mathematics**<br>Use measurements to determine how far earthquakes and volcanoes tend to occur from continental boundaries.<br><br>Analyze data to determine patterns of change that occur in areas where volcanoes erupt, earthquakes occur, and in flood zones.<br><br>Reason abstractly and quantitatively to draw diagrams to build scale models.<br><br>Analyze timelines, charts, and graphs to determine patterns in Earth's features and patterns of change caused by earth processes.<br><br>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. | |
| **What will students be able to do as a result of learning in this** | Students who understand the concepts are able to:<br><br>Support an explanation using patterns as evidence. | |

| | | |
|---|---|---|
| **unit?** | Analyze and interpret data to make sense of phenomena using logical reasoning.<br><br>Analyze and interpret data from maps to describe patterns of Earth's features. Maps can include:<br>● Topographic maps of Earth's land<br>● Topographic maps of Earth's ocean floor<br>● Locations of mountains<br>● Locations of continental boundaries<br>● Locations of volcanoes and earthquakes | |
| | | |
| **Grade 4** | **Topic: Structures and Functions** | |
| **Dec./Jan** | | |
| **Essential Questions:** | How do mealworm structures and behaviors help them grow and survive?<br>What are the characteristics of animals living in the leaf-litter environment?<br>What are the environmental factors in an aquatic system?<br>What are the roles of organisms in a food chain?<br>How does food affect a population in its home range?<br>How much water is needed for early growth of different kinds of plants?<br>How does mapping the plants in the schoolyard help us to investigate environmental factors?<br>What are some examples of plant adaptations? | |
| **Disciplinary Core Concepts:** | Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction. | |
| **How will they** | **Investigation 1: Environmental Factors** | |

| | | |
|---|---|---|
| **learn it? Learning Activities:** | • Students observe and describe the living and nonliving components (biotic and abiotic factors) in terrestrial environments.<br>• Students investigate how isopods respond to environmental factors<br><br>**Investigation 2: Ecosystems**<br>• Students set up a freshwater aquarium with different kinds of fish, plants, and other organisms.<br>• Students monitor the environmental factors in the system<br>• Students explore how animals receive information from their environment through their sensory system<br><br>**Investigation 3: Range of Tolerance**<br>• Students set up and monitor experiments to determine the range of tolerance of water for germination of four kinds of seeds: corn, pea, barley, and radish.<br>• Students test the effect of salinity<br>• Students look at plant adaptations | |
| **Resources:** | **Science Resource Books**<br>"Two Terrestrial Environments"<br>"Darkling Beetles"<br>"Setting Up a Terrarium"<br>"Isopods"<br>"Amazon Rain Forest Journal"<br>"Freshwater Environments"<br>"What Is an Ecosystem?"<br>"Food Chains and Food Webs"<br>"Human Activities and Aquatic Ecosystems"<br>"Comparing Aquatic and Terrestrial Ecosystems" | |
| **How do we know that they** | Benchmark assessments are short summative assessments given after each investigation. These I-Checks are | |

| | | |
|---|---|---|
| **know it? Assessment:** | actually hybrid tools: they provide summative information about students' achievement, and because they occur soon after teaching each investigation, they can be used diagnostically as well. Reviewing specific items on an I-Check with the class provides additional opportunities for students to clarify their thinking. The embedded assessments are based on authentic work produced by students during the course of participating in the FOSS activities. Students do their science, and teachers review their notebook entries. Bullet points in the Guiding the Investigation tell you specifically what students should know and be able to communicate. If student work is incorrect or incomplete, you know that there has been a breakdown in the learning/communicating process. The assessment system then provides a menu of next-step strategies to resolve the situation. Embedded assessment is assessment for learning, not assessment of learning. | |
| **Interdisciplinary Core Concepts:** | English Language Arts:<br>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.<br><br>Mathematics:<br>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. | |
| **What will students be able to do as a result of learning in this unit?** | Students who understand the concepts are able to:<br><br>● Describe a system in terms of its components and their interactions.<br><br>● Construct an argument with evidence, data, and/or a model.<br><br>● Construct an argument to support the claim that plants and animals have internal and external structures that function to support survival, growth,<br>behavior, and reproduction.<br>(Assessment is limited to macroscopic structures within plant and animal systems.)<br>Examples of structures could include:<br>Thorns | |

| | | |
|---|---|---|
| | Stems<br>Roots<br>Colored<br>petals<br>Heart<br>Stomach<br>Lung<br>Brain | |
| **Grade 4** | **Topic: How Organisms Process Information** | |
| **Jan./Feb.** | | |
| **Essential Questions:** | How do animals use their sense of hearing?<br>What light conditions do isopods prefer?<br>How do animals receive information<br>from their environment through their sensory<br>system and use the information to guide their actions? | |
| **Disciplinary Core Connections:** | LS1.D: Information Processing: 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. (4-LS1-2)<br>PS4.B: Electromagnetic Radiation:An object can be seen when light reflected from<br>its surface enters the eyes. (4-PS4-2) | |
| **How will they learn it? Learning Activities:** | **Investigation 2: Ecosystems (See Structures and Functions)**<br>● Students explore how animals receive information from their environment through their sensory system<br>● 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<br>● Develop a model to describe that light reflecting from objects and entering the eye | |
| **Resources:** | "Animal Sensory Systems"<br>"Saving Murrelets through Mimicry" | |

| | | |
|---|---|---|
| **How do we know that they know it? Assessment:** | Benchmark assessments are short summative assessments given after each investigation. These I-Checks are actually hybrid tools: they provide summative information about students' achievement, and because they occur soon after teaching each investigation, they can be used diagnostically as well. Reviewing specific items on an I-Check with the class provides additional opportunities for students to clarify their thinking. The embedded assessments are based on authentic work produced by students during the course of participating in the FOSS activities. Students do their science, and teachers review their notebook entries. Bullet points in the Guiding the Investigation tell you specifically what students should know and be able to communicate. If student work is incorrect or incomplete, you know that there has been a breakdown in the learning/communicating process. The assessment system then provides a menu of next-step strategies to resolve the situation. Embedded assessment is assessment for learning, not assessment of learning. | |
| **Interdisciplinary Core Concepts:** | English Language Arts<br>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.<br><br>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. | |
| **What will students be able to do as a result of learning in this unit?** | Students who understand the concepts are able to:<br>● Describe a system in terms of its components and their interactions.<br>● Use a model to test interactions concerning the functioning of a natural system.<br>● 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.<br>Students who understand the concepts are able to:<br>● Identify cause-and effect relationships.<br>● Develop a model to describe phenomena.<br>● Develop a model to describe that light reflecting from objects and entering the eye allows objects to be seen. | |

| | | |
|---|---|---|
| | | |
| **Grade 4** | **Topic: Transfer of Energy** | |
| **Feb./March** | | |
| **Essential Questions:** | What is needed to light a bulb?<br>What is needed to make a complete pathway for current to flow in a circuit?<br>How can you light two bulbs brightly with one D-cell?<br>Which design is better for manufacturing long strings of lights—series or parallel?<br>What materials sticks to magnets?<br>What happens when two or more magnets interact?<br>What happens when a piece of iron comes close to or touches a permanent magnet?<br>What happens to the force of attraction between two magnets as the distance between them changes? | |
| **Disciplinary Core Connections:** | PS3.A: Definition of Energy<br>● Energy can be moved from one place to another by moving objects or through sound, light, or electric currents. (4-PS3-2)<br>PS3.B: Conservation of Energy and Energy Transfer<br>● Energy is present everywhere there are moving objects, sound, light, or heat.(4-P53-2)<br><br>ES53.A: Natural Resources<br>● Energy and fuels that humans use are derived from natural resources.<br>● Their use affects the environment.<br>● Some resources are renewable and some are not. | |
| **How will they learn it? Learning Activities:** | **Investigation 1- Energy and Circuits**<br>● Students investigate electric current and circuits, the pathways through which electricity flows.<br><br>**Investigation 2- The Force of Magnetism** | |

| | | |
|---|---|---|
| | • Students investigate the properties of magnets and their interactions with materials and each other.<br><br>**Investigation 3- Energy Transfer**<br>• Students observe energy transfer that results in heat, light, sound, and motion and they are introduced to sources of energy and components that store energy. | |
| **Resources:** | **Science Resources Book**<br>"Edison Sees the Light"<br>"Energy Sources"<br>"Series and Parallel Circuits"<br>"Science Practices"<br><br>**Online Activities**<br>"Lighting a Bulb"<br>"Flow of electricity"<br>"Tutorial: Simple Circuits"<br>"Tutorial: Conductors and Insulators"<br>"Turn on the Switch"<br>"Conductor Detector"<br>"D-cell Orientation" | |
| **How do we know that they know it? Assessment:** | Benchmark assessments are short summative assessments given after each investigation. These I-Checks are actually hybrid tools: they provide summative information about students' achievement, and because they occur soon after teaching each investigation, they can be used diagnostically as well. Reviewing specific items on an I-Check with the class provides additional opportunities for students to clarify their thinking. The embedded assessments are based on authentic work produced by students during the course of participating in the FOSS activities. Students do their science, and teachers review their notebook entries. Bullet points in the Guiding the Investigation tell you specifically what students should know and be able to communicate. If student work is incorrect or incomplete, you know that there has been a breakdown in the learning/communicating process. The assessment system then provides a menu of next-step strategies to resolve the situation. Embedded | |

| | | |
|---|---|---|
| | assessment is assessment for learning, not assessment of learning. | |
| **Interdisciplinary Core Concepts:**<br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br>**What will students be able to do as a result of learning in this unit?** | English Language Arts<br>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 information texts in order to analyze and reflect on their findings. Students can also read, take<br>notes, and construct responses using text and digital resources such as Scholastic<br>News, Nat Geo Kids, Study Jams (Scholastic), Reading A–Z.com, NREL.com,switchenergyproject.com, and NOVA Labs by PBS.<br><br>Mathematics<br>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 than 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.<br><br>Students who understand the concepts are able to:<br>● 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.<br>● Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.<br>● Identify cause -and -effect relationships in order to explain change.<br>● Obtain and combine information from books and other reliable media to explain phenomena.<br>● Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment. | |

| | | |
|---|---|---|
| | | |
| **Grade 4** | **Topic: Force and Motion** | |
| **March/April** | | |
| **Essential Questions:** | What do we observe that provides evidence that energy is<br>present?<br>How does the starting position affect the speed of a ball rolling down a ramp?<br>What happens when objects collide? | |
| **Disciplinary Core Connections:** | S3.A:<br>PS3.A: Definitions of Energy<br>● The faster a given object is moving, the more energy it possesses. (4-PS3-1)<br>● Energy can be moved from place to place by<br>moving objects or through sound, light, or electric currents. (4-PS3-3)<br><br>PS3.B: Conservation of Energy and Energy Transfer<br>● 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. (4-PS3-3)<br><br>PS3.C: Relationship Between Energy and Forces<br>● When objects collide, the contact forces transfer energy | |
| **How will they learn it? Learning Activities:** | **Investigation 4: Energy Transfer**<br>● Students observe energy transfer that results in heat, light, sound, and motion and they are introduced to sources of energy and components that store energy.<br>● They conduct structured investigations with steel balls and ramps | |

| | | |
|---|---|---|
| | ● Students test the variables of mass and release position | |
| **Resources:** | **Science Resources Book**<br>“Energy”<br>“What Causes Change of Motion?”<br>“Bowling”<br>“Force and energy”<br>“Potential and Kinetic Energy at Work”<br>**Videos**<br>Soccer<br>(optional)<br>Ball on Table<br>(optional)<br>Wagon<br>(optional)<br>All about the Transfer of Energy | |
| **How do we know that they know it? Assessment:** | Benchmark assessments are short summative assessments given after each investigation. These I-Checks are actually hybrid tools: they provide summative information about students’ achievement, and because they occur soon after teaching each investigation, they can be used diagnostically as well. Reviewing specific items on an I-Check<br>with the class provides additional opportunities for students to clarify their thinking.<br><br>The embedded assessments are based on authentic work produced by students during the course of participating in the FOSS activities. Students do their science, and teachers review their notebook entries. Bullet points in the Guiding the Investigation tell you specifically what<br>students should know and be able to communicate. If student work is incorrect or incomplete, you know that there has been a breakdown in the learning/communicating process. The<br>assessment system then provides a menu of next-step strategies to resolve the situation. Embedded assessment is assessment for learning, not assessment of learning. | |
| **Interdisciplinary Connections:** | English Language Arts/ Literacy | |

| | | |
|---|---|---|
| | 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. | |
| **What will students be able to do as a result of learning in this unit?** | Students who understand the concepts will be able to:<br>● Describe various ways that energy can be transferred between objects.<br>● Use evidence (e.g., measurements, observations, patterns) to construct an explanation.<br>● Use evidence to construct an explanation relating the speed of an object to the energy of that object.<br>● Describe the various ways that energy can be transferred between objects.<br>● Ask questions that can be investigated and predict reasonable outcomes based on patterns such as cause and effect relationships.<br>● Ask questions and predict outcomes about the changes in energy that occur when objects collide. | |
| **Grade 4** | **Topic: Using Engineering Design with Force and Motion Systems** | |
| **April/May** | | |
| **Essential Questions:** | How can scientific ideas be applied to design, test, and refine a device that converts energy from one form to another? | |
| **Disciplinary Core Connections:** | PS3.B: Conservation of Energy and Energy Transfer<br>● 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. (4 -PS3-4)<br>PS3.C: Relationship Between Energy and Forces<br>● When objects collide, the contact forces transfer energy so as to change the objects' motions. (4 | |

| | | |
|---|---|---|
| | -PS3-3)<br>PS3.D: Energy in Chemical Processes and Everyday Life<br>● The expression “produce energy” typically refers to the conversion of stored energy into a desired form for practical use. (4-PS3-4)<br>ETS1.A: Defining and Delimiting Engineering Problems<br>● Possible solutions to a problem are limited by available materials and resources (constraints).<br>● The success of a designed solution is determined by considering the desired features of a solution<br>● 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.<br>(3-5-ETS1<br>ETS1.B: Developing Possible Solutions<br>● 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. (3-5-ETS 1-2)<br>● 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. (3-5-ETS1-2)<br>● Tests are often designed to identify failure points or difficulties, which suggest the elements of the design that need to be improved. (3-5-ETS1-3)<br>ETS1.C: Optimizing the Design Solution<br>● Different solutions need to be tested in order to determine which of them best solves the problem. | |
| **How will they learn it? Learning Activities:** | **Investigation 4: Energy Transfer**<br>● Using controlled experiments, students test the variables of mass and release position to find out how these variables affect energy transfer.<br>● Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost<br>● 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.<br>● 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:** | **Science Resources Book**<br>“Energy”<br>“What Causes Change of Motion?”<br>“Bowling”<br>“Force and energy”<br>“Potential and Kinetic Energy at Work”<br>**Videos**<br>Soccer<br>(optional)<br>Ball on Table<br>(optional)<br>Wagon<br>(optional)<br>All about the Transfer of Energy | |
| **How do we know that they know it? Assessment:** | Benchmark assessments are short summative assessments given after each investigation. These I-Checks are actually hybrid tools: they provide summative information about students’ achievement, and because they occur soon after teaching each investigation, they can be used diagnostically as well. Reviewing specific items on an I-Check with the class provides additional opportunities for students to clarify their thinking. The embedded assessments are based on authentic work produced by students during the course of participating in the FOSS activities. Students do their science, and teachers review their notebook entries. Bullet points in the Guiding the Investigation tell you specifically what students should know and be able to communicate. If student work is incorrect or incomplete, you know that there has been a breakdown in the learning/communicating process. The assessment system then provides a menu of next-step strategies to resolve the situation. Embedded assessment is assessment for learning, not assessment of learning. | |
| **Interdisciplinary Core Connections:** | English Language Arts<br>● 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<br>Students can:<br>● Solve multistep word problems, using the four operations.<br>● Represent these problems using equations with a letter standing for the unknown quantity.<br>● Assess the reasonableness of answers using mental computation and estimating strategies, including rounding.<br>● Analyze constraints on materials, time, or cost to determine what implications the constraints have for design solutions. | |
| **What will students be able to do as a result of learning in this unit?** | Students who understand the concepts are able to:<br>● Describe the various ways that energy can be transferred between objects.<br>● Apply scientific ideas to solve design problems.<br>● Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.<br>● 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.<br>● Plan and carry out fair tests in which variables are controlled and failure points are considered. | |
| **Grade 4** | **Topic: Waves and Information** | |
| **May/June** | | |
| **Essential Questions:** | How are waves involved in energy transfer?<br>How does light travel?<br>How can you make a motor run faster using solar cells? | |
| **Disciplinary Core Connections:** | S4.A: Wave Properties<br>● 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 | |

<table>
<tr><td></td><td>motion in the direction of the wave except when the water meets a beach.<br>ETS1.C: Optimizing The Design Solution<ul><li>Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints.(secondary to 4-PS4-3)</li></ul>ETS1.B: Developing Possible Solutions<ul><li>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. (3-5-ETS1-2)</li><li>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. (3-5-ETS1-2)</li><li>Tests are often designed to identify failure points or difficulties, which suggest the elements of the design that need to be improved. (3-5-ETS1-3)</li></ul>ETS1.C: Optimizing the Design Solution<ul><li>Different solutions need to be tested in order to determine which of them best solves the problem.</li></ul></td><td></td></tr>
<tr><td>How will they learn it? Learning Activities:</td><td>Investigation 5: Waves<ul><li>Students experience waves through firsthand experiences using ropes, demonstrations with waves in water, spring toys, and a sound generator.</li><li>Students use mirrors to experience reflecting light.</li><li>Students design series and parallel solar cell circuits and observe the effect on the speed of a motor.</li></ul></td><td></td></tr>
<tr><td>Resources:</td><td>Science Resources Book<br>“Waves”<br>“More about Sound”<br>“Light Interactions”<br>“Throw a Little Light on Sight”<br>“More Light on the Subject”<br>“Alternative Sources of electricity”<br>“Ms. Osgood’s Class Report”<br>Videos</td><td></td></tr>
</table>

| | | |
|---|---|---|
| | Sound Energy<br>Waves<br>Real World Science: Sound<br>All about Waves<br>All about Light Wave<br>**Online Activities**<br>“Reflecting Light”<br>“Colored Light“ | |
| **How do we know that they know it? Assessment:** | Benchmark assessments are short summative assessments given after each investigation. These I-Checks are actually hybrid tools: they provide summative information about students’ achievement, and because they occur soon after teaching each investigation, they can be used diagnostically as well. Reviewing specific items on an I-Check with the class provides additional opportunities for students to clarify their thinking. The embedded assessments are based on authentic work produced by students during the course of participating in the FOSS activities. Students do their science, and teachers review their notebook entries. Bullet points in the Guiding the Investigation tell you specifically what students should know and be able to communicate. If student work is incorrect or incomplete, you know that there has been a breakdown in the learning/communicating process. The assessment system then provides a menu of next-step strategies to resolve the situation. Embedded assessment is assessment for learning, not assessment of learning. | |
| **Interdisciplinary Core Connections:** | English Language Arts/Literacy<br>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.<br><br>Mathematics<br>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 ident ify these in two-dimensional drawings as they identify rays and angles in drawings of the ways in which waves move.<br>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. 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. | |
| **What will students be able to do as a result of learning in this unit?** | Students who understand the concepts can:<br><br>● Sort and classify natural phenomena using similarities and differences in patterns.<br>● Develop a model using an analogy, example, or abstract representation to describe a scientific principle.<br>● 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. | |