Toms River Science Curriculum Board Approved: April 2016	
Course: Physical Science **Grade Level:** Four	**Title of Unit:** Energy
Stage 1 - Desired Results	
Understandings: *Students will understand that……..* ● When and where Energy is present and how it can be transferred. ● Natural resources are used to create energy and fuels ● Moving objects have energy ● When objects collide stored energy is transferred ● Energy can be changed from one form to another	Essential Questions: ● *What is energy and how is it related to motion?* ● *How is energy transferred?* ● *How can energy be used to solve problems?* ● *What is the relationship between the speed of an object and the energy of that object?* ● *Where do we get the energy we need for modern life?* ● *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?*
Knowledge: *Students will know……* ● Energy is present whenever there are moving objects, sound, light, or heat. ● 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. ● Energy and fuels that humans use are derived from natural sources. ● The use of energy and fuels from natural sources affects the environment in multiple ways. ● some resources are renewable over time, and others are not. ● The faster a given object is moving, the more energy it possesses. ● When objects collide, the contact forces transfer energy so as to change the object's' motions. ● The expression “produce energy” typically	**Skills:** *Students will be able to…..* ● Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric *(See Activity 1 and 2)* ● Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment *(See Activity 4)* ● Use evidence to construct an explanation relating the speed of an object to the energy of that object. *(See Activity 5)* ● Ask questions and predict outcomes about the changes in energy that occur when objects collide *(See Activity 6)* ● Apply scientific ideas to design, test, and refine a device that converts energy from one form to another (solar oven engineering activity)

refers to the conversion of stored energy into a desired form for practical use.	

Standards: (Note: Include reference to relevant standards in the Core Content Area as well as technology and 21st-century life and careers.)

NGSS:

4-PS3-1. Use evidence to construct an explanation relating the speed of an object to the energy of that object. [Assessment Boundary: Assessment does not include quantitative measures of changes in the speed of an object or on any precise or quantitative definition of energy.

4-PS3-2. Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents. [Assessment Boundary: Assessment does not include quantitative measurements of energy.]

4-PS3-3. Ask questions and predict outcomes about the changes in energy that occur when objects collide. [Clarification Statement: Emphasis is on the change in the energy due to the change in speed, not on the forces, as objects interact.] [Assessment Boundary: Assessment does not include quantitative measurements of energy.]

4-PS3-4. Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.* [Clarification Statement: Examples of devices could include electric circuits that convert electrical energy into motion energy of a vehicle, light, or sound; and, a passive solar heater that converts light into heat. Examples of constraints could include the materials, cost, or time to design the device.] [Assessment Boundary: 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.]

4-ESS3-1. Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment. [Clarification Statement: Examples of renewable energy resources could include wind energy, water behind dams, and sunlight; non-renewable energy resources are fossil fuels and fissile materials. Examples of environmental effects could include loss of habitat due to dams, loss of habitat due to surface mining, and air pollution from burning of fossil fuels.]

ELA CCSS:

W.4.2 Write informative/explanatory texts to examine a topic and convey ideas and information clearly. (4-PS3-1)

W.4.7 Conduct short research projects that build knowledge through investigation of different aspects of a topic. (4-PS3-2),(4-ESS3-1)

W.4.8 Recall relevant information from experiences or gather relevant information from print and digital sources; take notes and categorize information, and provide a list of sources. (4-PS3-2),(4-ESS3-1)

W.4.9 Draw evidence from literary or informational texts to support analysis, reflection, and research. (4-ESS3-1)

RI 4.1 Refer to details and examples in a text when explaining what the text says explicitly and when drawing inferences from the text.

RI.4.3 Explain events, procedures, ideas, or concepts in a historical, scientific, or technical text, including what happened and why, based on specific information in the text. (4-PS3-1)

RI.4.9 Integrate information from two texts on the same topic in order to write or speak about the subject knowledgeably. (4-PS3-1)

SL 4.5 Add audio recordings and visual displays to presentations when appropriate to enhance the development of main ideas or themes..

CCSS Mathematics

4.G.A.1 Draw points, lines, line segments, rays, angles (right, acute, obtuse), and perpendicular and parallel lines. Identify these in two-dimensional figures.

4.OA.A.1 Interpret a multiplication equation as a comparison, e.g., interpret 35 = 5 × 7 as a statement that 35 is 5 times as many as 7 and 7 times as many as 5. Represent verbal statements of multiplicative comparisons as multiplication equations. (4-ESS3-1)

Stage 2- Assessment Evidence:

Performance Tasks and other evidence:

Students can demonstrate competency with tasks like:

- developing and refining models
- generating, discussing and analyzing data;
- constructing spoken and written scientific explanations;
- engaging in evidence-based argumentation; and
- reflecting on their own understanding.

Summative Assessments

- RST- Research Simulation Task
- Associated Unit tests, quizzes
- Labs and engineering based projects

Formative Assessments

- Graphic Organizers & Guided Note Taking
- Directed Reading

- Cooperative Group Learning
- Journal Entries/Foldables

Stage 3 – Learning Plan

Learning Activities:

Activity 1
Conduct simple investigations, using thermometers to measure changes in temperature as heat energy is transferred from a warmer object to a colder one.

- hot water can be poured into a large Styrofoam cup, and then a smaller plastic cup of cold water can be placed inside the larger cup of water. A thermometer can be placed in each cup, and students can observe and record changes in the temperature of the water in each cup every minute over the course of about 10–15 minutes, or until the temperatures are the same. use data as evidence to explain that some of the heat energy from the hot water transferred to the cold water. This transfer of heat caused the cold water to become gradually warmer and the hot water to cool. This process continued until the cups of water reached the same temperature.
- place a thermometer in the palm of their hands, close their hands around it, and measure the temperature. then place a piece or two of ice into their palms and close their fists around the ice until it melts. measure the temperature of their palms, they will observe a change. use these data to describe how some of the heat from their hands transferred to the ice, causing it to melt, while the ice also decreased the temperature of their hand. It is important that students understand that heat is transferred from warmer to colder objects. When an object cools, it loses heat energy. When an object gets warmer, it gains heat energy.

Activity 2
Build simple electric circuits.

- add a bulb to the circuit in order to observe and describe the ways in which energy is transferred in the circuit.stored energy in a battery is transferred into electrical energy, which is then transferred into light energy if a bulb is added to the circuit. The energy transfers from the battery to the wire and then to the bulb.
- Add a buzzer to the circuit in order to observe and describe the ways in which energy is transferred in the circuit. The stored energy in the battery is transferred into electrical energy, which is then transferred into sound energy.

(Keep in mind that energy is not actually produced. When we say that energy is "produced," this typically refers to the conversion of stored energy into a desired form for practical use. Students should be encouraged to use the term "transferred" rather than "produced").

Activity 3
Create a list of events in which energy is transferred.

- when a ball is thrown against a wall, some of the motion energy is transferred to sound energy;
- when water boils on the stove top, heat energy from the stove is transferred to the pot and to the water in the pot;
- when a doorbell is rung, electrical energy is transferred into sound energy.

Activity 4
Conduct research using books and other reliable media to determine which natural resources are sources of energy.

- Light, heat, sound, wind, water, sunlight, fossil fuels, and electricity are all forms of energy.
- determine which sources are renewable and which are nonrenewable. (a fuel or source of energy is considered nonrenewable if that source is limited in supply and cannot be replenished by natural means within a reasonable amount of time. Renewable sources of energy are those

that are replenished constantly by natural means. Using this general description, all fossil fuels are considered nonrenewable. wind, moving water, and sunlight are renewable sources of energy.)

Students should conduct further research to determine how the use of renewable and nonrenewable resources affects the environment. Some examples include:

- Changes in and loss of natural habitat due to the building of dams and the change in the flow of water;
- Changes in and loss of natural habitat due to surface mining; and
- Air pollution caused by the burning of fossil fuels in factories, cars, and homes.

(As students conduct research and gather information from a variety of reliable resources, they can take notes and use the information to describe and explain the impact that human use of natural resources has on the environment)

Activity 5

Students can roll balls down ramps, build and race rubber band cars, or build roller coasters. As they observe the motion of objects, they should collect data about the relative speed of objects in relation to the strength of the force applied to them. For example,

- when a ball is placed at the top of a ramp, it has stored energy, due to the force of gravity acting on it. When the ball is released, that stored energy is changed (transferred) into motion energy. Increasing the height of a ramp also increases the amount of stored energy in the ball at the top of the ramp. If the ball is released from a higher starting point, it rolls faster and farther.
- winding the rubber band in a rubber band car stores energy in the rubber band, which is then changed, or transferred, into motion energy (kinetic) as the car moves forward. The more times you wind the rubber band, the greater the amount of stored energy in the rubber band, and the farther and faster the car goes.

(As students investigate these types of force and motion systems, they should conduct multiple trials, increasing and decreasing the amount of energy, then collect data as they observe the impact differing amounts of energy have on the relative speed of the object in motion. Students should then use their data as evidence to support their explanation of the relationship between the relative speed of an object and its energy)

Activity 6

Observe objects colliding and ask questions that lead to further investigation. For example, if students roll a ball towards a wall, or roll two balls so that they collide, they may observe any or all of the following:

- Change(s) in the direction of motion
- Change(s) in speed
- Change(s) in the type of energy (e.g., motion energy to sound energy, sound energy to heat energy)
- Change(s) in the type of motion (rolling to bouncing).

Resource Links:

- NGSS powerpoints, activities, articles and quizzes
- Switch Energy Project: The Educator Portal provides free access to a documentary, energy labs, videos, and study guides.
- Wind Generator: Windmills have been used for hundreds of years to collect energy from the wind in order to pump water, grind grain, and more recently generate electricity. There are many

possible designs for the blades of a wind generator and engineers are always trying new ones. Design and test your own wind generator, then try to improve it by running a small electric motor connected to a voltage sensor.

- Thermal Energy Transfer: Explore the three methods of thermal energy transfer: conduction, convection, and radiation, in this interactive from WGBH, through animations and real-life examples in Earth and space science, physical science, life science, and technology.
- Spool Racers: This resource includes three parts: a video clip from the TV show, Zoom, to introduce the activity, an essay with background information about energy, and a set of printable instructions. Students use a spool, a toothpick, a washer, a rubber band, and a pencil to build a racer. They conduct tests with the racer by varying the number of twists in the rubber band or changing other design features. These websites provide additional ideas for modifying the basic rubber band racer design: http://www.scienceworld.ca/resources/activities/popcan-porsche and http://pbskids.org/designsquad/build/rubber-band-car/.
- Force and Motion: This video segment from Idaho PTV'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.
- Design a Lantern
- Energy at Play Design Challenge
- Go With the Flow Activity

Read Alouds:

- The Boy Who Harnessed the Wind By William Kamkawamba and Bryan Mealer
- Energy Island: How One Community Harnessed the Wind and Changed Their World by Alan Drummond

Notes: Indicate any special considerations as well as materials, resources (online, print, video, audio) or equipment.

Course: Earth Sciences **Grade Level**: Fourth	**Title of Unit:** Earth's System's: Processes That Shape The Earth
Stage 1 - Desired Results	
Understandings: *Students will understand that……..* ● over time the Earth surface will change shape due to erosion and weathering ● fossils help to identify the order of rock layers ● wind, water, and ice cause changes to the earth's surface.	**Essential Questions:** 1. How can water, ice, wind, and vegetation change the land? 2. What physical features on Earth can be used to order events that occurred? 3. What do the shapes of landforms and rock formations tell us about the past? 4. Is it possible to engineer ways to protect humans from Earth's naturally occurring events? 5. What patterns of Earth's feature can be determined by looking at maps?
Knowledge: *Students will know……* ● the Earth changes over time ● landforms develop and are weathered and eroded ● erosion can help show the history of the landscape. ● rock formations show changes over time ● the location of fossil types indicates the order in which rocks were layered ● water, ice, wind, living organisms, and gravity break rocks, soils, and sediments into smaller particles and move them around. ● living things affect the physical characteristics of their regions. ● rainfall helps to shape the land and affects the types of living things found in a region. ● 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	**Skills:** *Students will be able to…..* ● identify evidence from patterns in rock formations and fossils in rock layers to support an explanation for changes in a landscape over time. ● make observations of their local environment to examine the types of living things that are common in the region and how they impede the environment. ● look for evidence that water, ice, wind, organisms, or gravity have broken down rocks, soils, and sediments into smaller pieces and have moved them from one place to another. ● build and use models that demonstrate how water, and ice cause change to the surface of the earth. ● build and use models to simulate the effects of wind on earth materials (sand, soil, clay. silt) ● create models in which plants affect the weathering and erosion of earth materials. ● analyze and interpret data from maps to

between continents and oceans. ● major mountain chains form inside continents or near their edges. ● humans cannot eliminate natural hazards (e.g. earthquakes, tsunamis, volcanic eruptions) but can take steps to reduce their impacts.	describe patterns of Earth's features (include topographic maps of land and ocean floor, location of mountains, continental boundaries, volcanoes, and earthquakes) ● create solutions to reduce the impacts of natural Earth's natural disasters on humans

Standards: (Note: Include reference to relevant standards in the Core Content Area as well as technology and 21st-century life and careers.)

NGSS:
4-ESS1-1: Identify evidence from patterns in rock formations and fossils in rock layers to support an explanation for changes in a landscape over time.
4-ESS2-1: Make observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation.
4-ESS2-2: Analyze and interpret data from maps to describe patterns of Earth's features.
4-ESS3-2: Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans.

CCSS ELA:
RI.4.1 - Refer to details and examples in a text when explaining what the text says explicitly and when drawing inferences from the text
RI.4.7 - Interpret information presented visually, orally, or quantitatively (e.g., in charts, graphs, diagrams, time lines, animations, or interactive elements on Web pages) and explain how the information contributes to an understanding of the text in which it appears
RI.4.9 - Integrate information from two texts on the same topic in order to write or speak about the subject knowledgeably.
W.4.7 - Conduct short research projects that build knowledge through investigation of different aspects of a topic.
W.4.8 - Recall relevant information from experiences or gather relevant information from print and digital sources; take notes and categorize information, and provide a list of sources.
W.4.9 - Draw evidence from literary or informational texts to support analysis, reflection, and research.
W.4.9.A - Apply *grade 4 Reading standards* to literature (e.g., "Describe in depth a character, setting, or event in a story or drama, drawing on specific details in the text [e.g., a character's thoughts, words, or actions].").
W.4.9.B - Apply *grade 4 Reading standards* to informational texts (e.g., "Explain how an author uses reasons and evidence to support particular points in a text").

CCSS MATHEMATICS
4.MD.A.1 - Know relative sizes of measurement units within one system of units including km, m, cm; kg, g; lb, oz.; l, ml; hr, min, sec. Within a single system of measurement, express measurements in a larger unit in terms of a smaller unit. Record measurement equivalents in a two-column table. *For example, know that 1 ft is 12 times as long as 1 in. Express the length of a 4 ft snake as 48 in. Generate a conversion table for feet and inches listing the number pairs (1, 12), (2, 24), (3, 36), ...*

4.MD.A.2 - Use the four operations to solve word problems involving distances, intervals of time, liquid volumes, masses of objects, and money, including problems involving simple fractions or decimals, and problems that require expressing measurements given in a larger unit in terms of a smaller unit. Represent measurement quantities using diagrams such as number line diagrams that feature a measurement scale.
4.OA.A.1 - Interpret a multiplication equation as a comparison, e.g., interpret 35 = 5 × 7 as a statement that 35 is 5 times as many as 7 and 7 times as many as 5. Represent verbal statements of multiplicative comparisons as multiplication equations.

Stage 2- Assessment Evidence:

Performance Tasks and other evidence:

Students can demonstrate competency with tasks like:

- developing and refining models
- generating, discussing and analyzing data;
- constructing spoken and written scientific explanations;
- engaging in evidence-based argumentation; and
- reflecting on their own understanding.

Summative Assessments

- RST- Research Simulation Task
- Associated Unit tests, quizzes
- Labs and engineering based projects

Formative Assessments

- Graphic Organizers & Guided Note Taking
- Directed Reading
- Cooperative Group Learning
- Journal Entries/Foldables

Stage 3 – Learning Plan

Learning Activities:

Activity 1

Use stream tables, soil, sand, and water to simulate the effects of moving water (rain, rivers) on rocks and soil. Following these types of experiences, students need opportunities to ask questions that will lead to further investigations. They can change a variable—such as the type of earth material (sand, soil, clay, silt), the angle of a hill's slope, the volume of water flow, the speed of water flow, and the relative rate of deposition—then collect and analyze data in order to determine the effects.

Activity 2

Walk around the schoolyard and nearby neighborhoods to look for examples of plants that are used to prevent erosion. Students can easily find examples in their own environment of growing plant and tree

roots causing rocks, sidewalks, and driveways to crack and break down into smaller and smaller components.

Activity 3
soak lima beans in water overnight, then “plant” them in small cups containing a 2–3 cm. layer of wet Plaster of Paris on top of potting soil. (One or two seeds should be placed in the wet layer of plaster.) After a few days, the seeds will germinate and grow, eventually causing the dried plaster to crack. Again, students need opportunities to change variables, such as the number of seeds planted (one seed vs. multiple seeds, for example) and the type of seeds, then make observations and collect data to determine the amount of weathering each change causes to the dried plaster.

Activity 4
Students can support explanations for changes in a landscape over time in multiple ways, including the following:

- Pictures of a variety of landforms, such as sand dunes and canyons, can be used to show change due to weathering and erosion that have occurred over time.
- Pictures or diagrams of rock layers with marine shell fossils above rock layers with plant fossils and no shells can be used to indicate a change from land to water over long periods of time.
- Pictures of a canyon with different rock layers in the walls and a river at the bottom can be used to show that over time a river cut through the rock to form the canyon.

(As students collect evidence, either from firsthand observations or from media resources, they should attempt to explain the changes that have occurred over time in each of the landscapes observed)

Resource Links:

- NGSS powerpoints, activities, articles and quizzes
- Glaciers, Water, and Wind, 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.
- 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.

- Earth science activities and lessons
- Museum of Innovation Earthquakes/Seismic Engineering
- Engineering and design earthquakes
- Effects of slope and speed on weathering and erosion
- Developing mapping skills through earth science activities
- Engineering for Earth; Teach Engineering
- Earthquake in the classroom

Read Alouds:

- Planting the Trees of Kenya (schoolwide mentor text - Erosion)
- *Erosion: Changing Earth’s Surface* by Robin Koontz

Notes: Indicate any special considerations as well as materials, resources (online, print, video, audio) or equipment.

Course: Life Sciences **Grade Level:** Fourth	**Title of Unit:** Structure, Function, and Information Processing
Stage 1 - Desired Results	
Understandings: *Students will understand that……..* ● objects can be seen when light reflected from any surface enters the eye. Light traveling from the object to the eye determines what is seen. ● different sense receptors are used for different kinds of information. ● sensory information is processed by the brain and can be stored as memories. ● animals are able to use their perceptions and memories to guide their actions. ● plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction.	**Essential Questions:** 1. How does the reflection of light aid in sight? 2. How do animals receive information and how do they respond to the information in different ways? 3. How do internal and external structures support the survival, growth, behavior, and reproduction of plants and animals?
Knowledge: *Students will know……* ● light enters the eye, allowing objects to be seen. ● light reflects off of objects, and then can travel and enter the eye. ● objects can be seen only if light follows a path between a light source, the object, and the eye. ● animals use their sense to detect different types of information from the environment (sound, odor, light, temperature). ● animals use their body parts in different ways to grow, change, and survive. ● plants have different parts that help them grow, survive, and reproduce.	**Skills**: *Students will be able to…..* ● develop a model or diagram to describe light reflecting from objects and entering the eye. (The model should include the light source, objects, the path that light follows, and the eye) ● 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 (animals reaction to the smell of rotten food or another animal with bright colors). ● students make a claim and construct an argument to support the idea that a plant or animals have internal and external structures that function together as part of a system to support survival, growth, behavior, and reproduction (animal or plant adaptation).

Standards: (Note: Include reference to relevant standards in the Core Content Area as well as technology and 21st-century life and careers.)

NGSS:

4-LS1-1. Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction. . [Clarification Statement: Examples of structures could include thorns, stems, roots, colored petals, heart, stomach, lung, brain, and skin.] [Assessment Boundary: Assessment is limited to macroscopic structures within plant and animal systems.]

4-LS1-2. Use a model to describe that animals receive different types of information through their senses, process the information in their brain, and respond to the information in different ways. [Clarification Statement: Emphasis is on systems of information transfer.] [Assessment Boundary: Assessment does not include the mechanisms by which the brain stores and recalls information or the mechanisms of how sensory receptors function.]

4-PS4-2. Develop a model to describe that light reflecting from objects and entering the eye allows objects to be seen. [Assessment Boundary: Assessment does not include knowledge of specific colors reflected and seen, the cellular mechanisms of vision, or how the retina works.]

CCSS ELA

W.4.1 Write opinion pieces on topics or texts, supporting a point of view with reasons and information.

SL.4.5 Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on *grade 4 topics and texts*, building on others' ideas and expressing their own clearly.

CCSS Mathematics

MP.4 Model with mathematics.

4.G.A.1 Draw points, lines, line segments, rays, angles (right, acute, obtuse), and perpendicular and parallel lines. Identify these in two-dimensional figures.

4.G.A.3 Recognize a line of symmetry for a two-dimensional figure as a line across the figure such that the figure can be folded along the line into matching parts. Identify line-symmetric figures and draw lines of symmetry.

Stage 2- Assessment Evidence:

Performance Tasks and other evidence:

Students can demonstrate competency with tasks like:

- developing and refining models
- generating, discussing and analyzing data;
- constructing spoken and written scientific explanations;
- engaging in evidence-based argumentation; and
- reflecting on their own understanding.

Summative Assessments

- RST- Research Simulation Task
- Associated Unit tests, quizzes

- Labs and engineering based projects

Formative Assessments

- Graphic Organizers & Guided Note Taking
- Directed Reading
- Cooperative Group Learning
- Journal Entries/Foldables

Stage 3 – Learning Plan

Learning Activities:

Activity 1

Using a variety of plants and animals as examples, have students:

- 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.
- As students observe the structures of an animal or plant, explain the function of each, and describe how these structures help the animal grow, survive, and/or reproduce, they should use evidence from their observations to support their explanations.

Activity 2

Students 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.

Activity 3

Using penlights, a variety of lenses, mirrors, and pieces of cardboard, allow students to explore the behavior of light when it comes into contact with these objects. Have students draw and describe what they observe.

Activity 4

Have students use pinhole viewers. Then have students go outside and view objects using the pinhole viewers. As students make observations, they should document what they observed. As a class, discuss what students observed, then draw a model on the board that depicts the phenomenon. With guidance, as needed, have students draw models/diagrams of the pinhole viewer and the human eye, and have them describe what they observed.

Resource Links:

- NGSS powerpoints, activities, articles and quizzes
- Animal Mouth Structures 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
- 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.

- The Life of Environments This unit is designed to address the concept that organisms sense the environment in order to live. It is a far-ranging and comprehensive unit that is designed to address multiple NGSS performance expectations (4-LS1-2, 4LS1-2, 4-PS3-2, 4-PS4-2) in seven explorative sections, with an additional summative assessment step.
- Time to Think? 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.
- Catch It! This lesson sequence involves student investigation of human reaction time and variables that may affect it. An intitial phase has students practice catching a dropped ruler and converting the distance it drops to the length of time it took to react. This provides an opportunity for data collection, graphing, and writing a conclusion. After this guided inquiry phase, students may conduct research on human senses and reaction time, or move on to designing their own investigations of the effects of variables of their choosing on their reaction times. *PLEASE NOTE - the link is to the CT Department of Education Science Curriculum page. Scroll to find that you can select Word, PDF, and Spanish versions of this resource under the title Grade 5 Embedded Task.*
- Structures and Functions Activities
- Floating Garden activity
- Disappearing Color Wheel Activity
- Color Changing Flowers

Suggested Read Alouds:
The Brain: Our Nervous System by Seymour Simon

Notes: Indicate any special considerations as well as materials, resources (online, print, video, audio) or equipment.

Course: Physical Sciences **Grade** Level: 4	**Title of Unit:** Waves and Information Transfer
Stage 1 - Desired Results	
Understandings: *Students will understand that……..* ● waves of the same type can differ in amplitude (height of the wave) and wavelength (spacing between wave peaks). ● waves are regular patterns of motion and can be made with different types of materials by disturbing the surface (water, rope, air). ● digitized information can be transmitted over long distances with high-tech devices (cellphones, computers) using waves. ● information can be received and decoded over waves.	**Essential Questions:** ● What are waves and what are some things they can do? ● How can we use waves to gather and transmit information into patterns?
Knowledge: *Students will know……* ● wave can differ in amplitude and wavelength ● waves can cause objects to move ● information can be converted from a sound wave into a digital signal ● high-tech devices can be used to help us convert and transmit information	**Skills:** *Students will be able to…..* ● develop a model of waves to describe patterns of waves in terms of amplitude and wavelength (See Activity 1) ● show that waves can cause objects to move. ● demonstrate the transfer of information using technological resources.

Standards: (Note: Include reference to relevant standards in the Core Content Area as well as technology and 21st-century life and careers.)

NGSS Standards:
4-PS4-1. Develop a model of waves to describe patterns in terms of amplitude and wavelength and that waves can cause objects to move. [Clarification Statement: Examples of models could include diagrams, analogies, and physical models using wire to illustrate wavelength and amplitude of waves.] [Assessment Boundary: Assessment does not include interference effects, electromagnetic waves, non-periodic waves, or quantitative models of amplitude and wavelength.]

4-PS4-3. Generate and compare multiple solutions that use patterns to transfer information.*

[Clarification Statement: Examples of solutions could include drums sending coded information through sound waves, using a grid of 1's and 0's representing black and white to send information about a picture, and using Morse code to send text.]

CCSS ELA

RI.4.9 Integrate information from two texts on the same topic in order to write or speak about the subject knowledgeably. (4-PS4-3)

SL.4.5 Add audio recordings and visual displays to presentations when appropriate to enhance the development of main ideas or themes. (4-PS4-1)

RI.5.1 Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently. (3-5-ETS1-2)

RI.5.9 Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably. (3-5-ETS1-2)

W.5.7 Conduct short research projects that use several sources to build knowledge through investigation of different aspects of a topic. (3-5-ETS1-3)

W.5.8 Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase information in notes and finished work, and provide a list of sources. (3-5-ETS1-3)

W.5.9 Draw evidence from literary or informational texts to support analysis, reflection, and research. (3-5-ETS1-3)

CCSS Mathematics

3-5.OA Operations and Algebraic Thinking (3-ETS1-2)

4.G.A.1 Draw points, lines, line segments, rays, angles (right, acute, obtuse), and perpendicular and parallel lines. Identify these in two-dimensional figures. (4- PS4-2)

Stage 2- Assessment Evidence:

Performance Tasks and other evidence:

Students can demonstrate competency with tasks like:

- developing and refining models
- generating, discussing and analyzing data;
- constructing spoken and written scientific explanations;
- engaging in evidence-based argumentation; and
- reflecting on their own understanding.

Summative Assessments

- RST- Research Simulation Task
- Associated Unit tests, quizzes

- Labs and engineering based projects

Formative Assessments

- Graphic Organizers & Guided Note Taking
- Directed Reading
- Cooperative Group Learning
- Journal Entries/Foldables

Stage 3 – Learning Plan

Learning Activities:

Activity 1

Students can model the properties of waves by disturbing the surface of water in a variety of pans and buckets. Students should make observations as they strike the surface of the water with small and large objects, such as marbles and rocks. In addition, smaller pans can be tilted in different directions in order to observe the effect on the wave patterns created on the surface of the water. Students should observe and describe a number of similarities and differences in the wave patterns created, including the following:

- When an object hits the surface of water, waves move across the surface.
- Waves move up and down across the surface of the water away from the point of contact.
- Waves on the surface of the water move away from the point of contact in increasingly larger circles.
- When waves hit another surface, the waves change direction and move away from the surface with which they come into contact.
- The height of the wave (amplitude) and the distance between the peaks of waves (wavelength) varies depending upon the intensity of the disturbance, and/or the size (mass, volume) of the object disturbing the surface of the water

Activity 2

Students should develop a model using drawings, diagrams, or physical models (such as a slinky or jump rope) to show the basic properties of waves (amplitude and wavelength). To begin the engineering design process, students are challenged to design a way to use patterns to transfer information. This process should include the following steps:

1. As a class, brainstorm a list of ways in which patterns have been used in the past to communicate over distance. (examples: smoke signals, drums, and Morse code)
2. As a class, determine criteria and possible constraints on the design solutions. (Criteria- must communicate information using patterns, communicate over a predetermined distance, and must be able to describe how patterns were used in the design to communicate over a distance. Possible constraints- materials available to build/create a device and the amount of time available to design and build.)
3. Small groups work collaboratively to design and build a device or design a process for communicating information over a distance. *(examples: Drums sending coded information through sound waves. Use a flashlight to convey information using a pattern of on and off. Use Morse code to send information. Build an instrument with a box and rubber bands of varying sizes that can be plucked in a pattern to communicate information. Use musical patterns on a xylophone or tuning forks to convey information. Use string and cups to build a simple "phone" to send information.)*
4. After small groups finish designing and building, they should put together a presentation that includes a written description/explanation of how patterns are used to communicate information.
5. After observing each design solution, students should classify each based on the type or

types of patterns used to communicate (e.g., sound, light, or both).
6. Students investigate how well the solutions perform under a range of likely conditions (e.g., environmental noise or light, increases in distance).
7. Students compare the solutions, determining which can be used to successfully communicate information over a distance using patterns. Students should determine how well each design solution meets criteria, using data as evidence to support their thinking.

Resource Links:

- NGSS powerpoints, activities, articles and quizzes
- Singing Rod Activity
- Sound Blaster Activity
- Application of Waves - Coding Activity
- Teach Engineering - Make Some Waves/Sound and Light Waves
- Sound Waves activities
- Teaching about Code
- How cell phones work with waves
- Bill Nye - Sound f
- Frequency Hearing Test
- Making Waves - Measuring Wavelengths
- Waves on a String phET simulation (NOT usable with chromebooks)
- Bending Light phET Simulation
- Color Vision phET Simulation
- Wave Interference phET Simulation

Suggested Read Alouds:

Eye: How It Works by David Macaulay

Notes: Indicate any special considerations as well as materials, resources (online, print, video, audio) or equipment.