

STAGE 1 – DESIRED RESULTS

Unit Title: Energy and Motion

Grade Level:4th

Length/Timing of Unit:

Teacher(s)/Designer(s): Pascack Valley Regional Science Committee

Science State standards addressed (verbatim):

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.]

Connections to Common Core Standards (verbatim):

ELA/Literacy

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. (4-PS3-1)

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)

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-PS3-3),(4-PS3-4)

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-PS3-1),(4-PS3-2),(4-PS3-3),(4-PS3-4)

W.4.9 Draw evidence from literary or informational texts to support analysis, reflection, and research. (4-PS3-1)

Mathematics

4.OA.A.3 Solve multistep word problems posed with whole numbers and having whole-number answers using the four operations, including problems in which remainders must be interpreted. Represent these problems using equations with a letter standing for the unknown quantity. Assess the reasonableness of answers using mental computation and estimation strategies including rounding. (4-PS3-4)

Essential Questions (3-4) in provocative, student-friendly language:

- **EQ1:** What is the relationship between speed and energy ?
- **EQ2:** How is energy transferable?
- **EQ3:** What happens to the energy when objects collide?

Big Ideas/ Enduring Understandings: *Students will understand that...*

EQ1:

- The faster an object is moving, the more energy it possesses.
- The slower an object is moving the less energy it possesses.

EQ2:

- Moving objects, sound, light and heat all have energy.
- Energy can be moved from place to place by moving objects through sound, light or electric currents.

EQ3:

- **When objects collide, the energy can be transferred from one object to another which causes their motion/direction to change.**
- **Distance affects the speed of something.**
- **Sound is produced when energy is transferred during a collision.**
- **Electric currents can produce motion, sound, heat or light.**

A list of factual knowledge to be taught – Students will know...

EQ1:

- energy types
- definitions of transfer, energy, collide, friction, incline, electric current, motion, force
- Newton's Laws of Motion

EQ2:

- Using evidence to construct an explanation. (Measurements, observations, & patterns)
- Newton's Laws of Motion

EQ3:

- The relationship between speed and the impact on an object
- Newton's Laws of Motion

A list of skills to be taught or reinforced (including habits of mind) – Students will be able to...

- Measure outcome from different energy sources
- Make observations that provide evidence that energy can be transferred
- Ask questions and predict outcomes about the changes in energy that occur when objects collide
- Apply scientific ideas to design and test a device that converts energy between forms
- Use evidence to construct an explanation relating the speed of an object to the energy of that object
- Make observations of speed changes
- Demonstrate how speed changes based on energy
- Analyze how energy can go through an electric current.
- Predict what would happen to the motion of an object during a collision
- Use evidence to determine how motion is affected by collisions
- Draw conclusions regarding the impact of friction on motion

STAGE 2 – SAMPLE ASSESSMENT

Assessments (Quizzes, tests, and a performance task to assess student mastery formatively and summatively, including an exemplar of proficient student work and a scoring guide for the performance task):

4-PS3-1

4-PS3-3

Goal: Students will use evidence to construct an explanation relating the speed of a ball traveling down an incline plane to the energy of the ball and ask questions and predict outcomes about the changes in energy that occur when a ball and a toy car or similar object collide.

Role: City park planners

Audience: Mayor

Situation: You are a park planner for your city. There is a hill in one of the city's parks where kids always sled, and the town leaders are worried about the kids' collisions with objects (kids, other sleds, etc.) at the

bottom of the hill since many kids have been getting hurt. The leaders don't want to stop kids from sledding, but they want to know how they can make the collisions less dangerous. Using the given supplies to create a ramp that represents the hill, the ball to represent the sledders, and the toy car (or other similar object) to represent the objects at the bottom of the hill, figure out how you can make a hill that would produce the smallest impact on the objects at the bottom of the hill.

Product/Performance/Purpose:

Students will develop questions and make predictions about how they can change the ramp to change the energy and the impact. They will design ramps and refine their designs as they investigate. They will create a table of the speeds of the ball in relationship to the height of the ramp, a table of the distance the object at the bottom of the ramp travels in relationship to the speed of the ball, and a written argument about which ramp would be safest. They will present their arguments orally to the mayor (teacher) and utilize their data as evidence. Their argument must incorporate their knowledge of energy and corresponding terminology as previously learned during this unit.

Supplies needed: cardboard for ramps, balls, cars (or similar objects), timers, rulers or measuring tapes.

Tip: Ramps should be as long as possible to allow for measurement of time to take place.

Ramps should not be higher than 25 cm. high.

Standards/Criteria for Success:

Students will be evaluated based on their oral presentations to the mayor. This includes:

- Ability to explain the relationship between the speed of the ball and the distance the object at the bottom of the ramp traveled
- Use of concepts about energy to explain this relationship
- Use of data as evidence to support their explanations

4-PS3-2

4-PS3-4

Goal: Students will make observations to provide evidence that energy can be transferred from place to place by electric currents and apply scientific ideas to design, test, and refine a device that converts energy from electric energy to light.

Product: Students will design a circuit that will be able to light a light bulb. They will write or draw a journal response that explains their observations of the transference of energy.

Note: If supplies are not available to create circuits, students can use an online simulator such as the one found at: <http://phet.colorado.edu/en/simulation/circuit-construction-kit-dc>

Standards/Criteria for Success:

Students will be evaluated based on the accuracy and clarity of their drawings/written responses.

STAGE 3 – LEARNING PLAN

Summary of Learning Activities (Lectures, mini-lessons, readalouds, independent reading, films, website exploration, discussions, dialogues, debates, partner or small-group work, student presentations, reports, journals, reflections, in-class assessments, written reports, essays, research, and homework):

Independent Reading/ Read Alouds

- Energy Makes Things Happen by: Kimberly Brubaker Bradley
- Exploring Forces by: Claire Liewellyn
- Newton's Law of Motion by: Jenny Karpelenia

Videos

- Youtube: Newton's Law of Motion - <http://www.watchknowlearn.org/Video.aspx?VideoID=30312>
- Science of Disney Imagineering: Newton's 3 Laws of Motion - Classroom Edition- <https://www.youtube.com/watch?v=QpF3m02rGI>

Resources

- StudyJams <http://studyjams.scholastic.com/studyjams/>
- Science A-Z (Subscription Service) <https://www.sciencea-z.com/>
- Online Circuit Simulator <http://phet.colorado.edu/en/simulation/circuit-construction-kit-dc>
- Various Science Resources <http://sciencenetlinks.com/tools/>
- Learning game <http://sciencenetlinks.com/media/filer/2011/10/07/powerup.swf>

Born: June 2015

STAGE 1 – DESIRED RESULTS

Unit Title: Waves

Grade Level: 4

Length/Timing of Unit:

Teacher(s)/Designer(s): Pascack Valley Regional Science Committee.

Science State standards addressed (verbatim):

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-PS4-2. 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.]

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.]

Common Core State Standards Connections:

ELA/Literacy

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. (4-PS4-3)

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),(4-PS4-2)

Mathematics

MP.4 Model with mathematics. (4-PS4-1),(4-PS4-2)

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-PS4-1),(4-PS4-2)

Essential Questions (3-4) in provocative, student-friendly language:

- EQ1. How are wavelength, frequency and wave speed related?
- EQ2. How do technology and waves interact?
- EQ3. What do waves look like in the air, water, etc..
- EQ4. What is the relationship between vision and light?

Big Ideas/ Enduring Understandings: *Students will understand that...*

EQ1:

- Energy can be transmitted from a source as waves.
- Waves carry energy from one place to another

EQ2:

- The electromagnetic spectrum in increasing frequencies includes microwaves, infrared light, visible light, ultraviolet light, X rays and Gamma rays.

EQ3:

- Waves have different properties and relationships..

EQ4:

- The absorption and reflection of light waves by various materials result in the human perception of color.

A list of factual knowledge to be taught: Students will know.....

EQ1:

- Key vocabulary terms such as: wave, wave peak, amplitude, wavelength, radiation, magnetism, electromagnetic,

EQ2:

- Patterns can transfer information

EQ3:

- Properties of waves
- The relationship between mass and space (ductility, elasticity, hardness and tenacity)

EQ4:

- The electromagnetic spectrum is the full range of wavelengths of radiation from the sun, and it includes visible light, heat energy, sound waves, and many other types of energy (microwave, radar, X-ray, and gamma radiation).

A list of skills to be taught or reinforced (including habits of mind):

Students will be able to...

- Ask questions and predict outcomes about changes in patterns of wavelengths
- Develop a model of waves to describe patterns of amplitude and wavelengths
- Analyze how light reflects from objects and enters the eye

- Make observations of the behavior of waves in air and water.
- Demonstrate different amplitudes and pitch using musical instruments
- Apply scientific ideas to design and test a device that uses patterns to transfer information.

STAGE 2 – SAMPLE ASSESSMENT

Assessments (Quizzes, tests, and a performance task to assess student mastery formatively and summatively, including an exemplar of proficient student work and a scoring guide for the performance task):

4-PS4-1

Goal: Students will develop a model of waves to describe patterns in terms of amplitude and wavelength and that waves can cause objects to move.

Role: Slinky movement commentator

Audience: Class

Situation: You have been asked to use a slinky to simulate 3 types of waves. If slinkies are not available you can use string, or yarn, or a jump rope.

Product/Performance and Purpose: Students need to utilize slinkies to help illustrate how sound waves are formed and how they move through air and water. Students will provide a visual using slinkies, water, small containers of water, timers, and present their models to the class.

Standards and Criteria for Success:

Students will be evaluated based on their visual representation of all three waves using chart paper. Students will also list similarities and differences of the three types of waves.

4-PS4-2.

Goal: Develop a model to describe that light reflecting from objects and entering the eye allows objects to be seen

Product: Students use string to trace the path that waves would take in being transferred from a light source, to an object, to their eyes. Students will create a drawing depicting their model and an accompanying brief written explanation.

4-PS4-3

Goal: Students will be able to generate and compare multiple solutions that use patterns to transfer information.

Role: Sailor

Audience: A fellow sailor

Situation: You are a sailor who have been given a job working for a company that owns many boats. As part

of your job, you need to communicate with sailors on the other boats as they pass by. You've discovered that the sailors on the other boats don't speak English, so you need another system to communicate. You must develop this system and be able to communicate three separate messages to a sailor from your group on the other side of the classroom without speaking. The messages you must communicate are "All is well," "We need more supplies, and "Help!"

Product/Performance and Purpose: Students will use materials such as drums (box and pencils could serve as drums in classrooms without access to drums) and flashlights to create patterns and use waves to transfer information to their partners. They will work with their partners/group to create a pattern, test it, demonstrate its effectiveness by communicating the message with the teachers' supervision.

Standards and Criteria for Success:

Students will be evaluated based on their ability to create a pattern and transfer the messages to their group members. They then must also explain what type of waves allowed them to communicate their messages and create a drawing depicting the transference of this information in terms of waves (i.e. draw the light waves traveling from a flashlight to their group members across the room).

STAGE 3 – LEARNING PLAN

Summary of Learning Activities (Lectures, mini-lessons, readalouds, independent reading, films, website exploration, discussions, dialogues, debates, partner or small-group work, student presentations, reports, journals, reflections, in-class assessments, written reports, essays, research, and homework):

Resources

- StudyJams <http://studyjams.scholastic.com/studyjams/>
- Science A-Z (Subscription Service) <https://www.sciencea-z.com/>
- *Bill Nye the Science Guy*: "Sound Travels in Waves" (Short Clip, 1:20) <https://www.youtube.com/watch?v=ACeUO4ufx2I>
- *Bill Nye the Science Guy*: "Waves" (Full Episode) <https://www.youtube.com/watch?v=fuM06zp48w4>

Born: June 2015

STAGE 1 – DESIRED RESULTS

Unit Title: Molecules to Organisms

Grade Level: 4

Length/Timing of Unit:

Teacher(s)/Designer(s): Pascack Valley Regional Science Committee

Science State standards addressed (verbatim):

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.]

Connections to Common Core Standards (verbatim):

ELA/Literacy

W.4.1 Write opinion pieces on topics or texts, supporting a point of view with reasons and information. (4-LS1-1)

SL.4.5 Add audio recordings and visual displays to presentations when appropriate to enhance the development of main ideas or themes. (4-LS1-2)

Mathematics

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 across the line into matching parts. Identify line-symmetric figures and draw lines of symmetry. (4-LS1-1)

Essential Questions (3-4) in provocative, student-friendly language:

- EQ1. How are growth, behavior and reproduction important to plant and animal life?
- EQ2. How do animals process the world around them?
- EQ3. How is survival for animals & plants similar/different?

Big Ideas/ Enduring Understandings: *Students will understand that...*

EQ1:

- Plants and animals both have internal and external structures
- The structures of plants and animals help them grow survive and reproduce

EQ2:

- **Sense receptors give different information to animals**
- **Information travels through the brain on different paths**
- **Animals use perceptions and memories to guide actions**
- **How animal senses impact their survival, growth, behavior and reproduction**

EQ3:

- **What structures do plants and animals have that help them survive.**

A list of factual knowledge to be taught: *Students will know...*

Key vocabulary terms such as internal structure (heart, stomach, lung ,brain) and external structures (thorn, stem, root, colored petals, skin), adaptation, growth, survival, behavior, reproduction, perception

EQ 1:

- The structures that help plants and animals grow
- The structures that help plants and animals survive.

EQ 2:

- The structures that help plants and animals process information about their environment
- The senses used to receive information
- The different paths used by sensory receptors to get information to the brain

EQ 3:

- The structures that help plants and animals survive
- Different adaptations for survival of plants and animals
- Difference between physical adaptation and behavioral adaptation

A list of skills to be taught or reinforced (including habits of mind): *Students will be able to...*

- Label plant parts used for reproduction
- Classify animals based on their survival adaptations
- Classify plants based on their survival adaptations
- Use a model to describe how animals receive information through their senses
- Identify the different paths that carry information in the brain

STAGE 2 – SAMPLE ASSESSMENT

Assessments (Quizzes, tests, and a performance task to assess student mastery formatively and summatively, including an exemplar of proficient student work and a scoring guide for the performance task):

Goal: Students will construct an argument about which plants and animals have internal and external structures that allow it to survive, grow and reproduce in a specific biome. They will also 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.

Role: Environment Designer for a new Biodome which will be built in the community.

Audience: The planning committee for the Biodome.

Situation: Create a specific environment for the Biodome including plants and animals that will be able to survive in the environment.

Product/Performance/Purpose: Each student group is assigned a specific environment: desert, arctic, tropical, wetland. Teachers will need to provide students with details about their assigned environments or lead them in finding research as background knowledge for this performance. Students will determine which plants and animals will adapt, survive, and reproduce in that environment. They must write an argument as to why each plant/animal is suited to function in that environment based on its internal and external structures. Students will also use a model to describe how one animal in their biodome will receive a piece of information through its senses, process the information in its brain, and respond to the information.

Standards and Criteria:

Students need to examine the abiotic parts of the environment :climate and geology. Create a list of potential aspects in the environment that will present challenges for biotic elements. Develop a list of behavioral and structural adaptations that plants and animals will need to have. Include the plants and animals for the specific biome and be able to explain how they will interact and survive.

STAGE 3 – LEARNING PLAN

Summary of Learning Activities (Lectures, mini-lessons, readalouds, independent reading, films, website exploration, discussions, dialogues, debates, partner or small-group work, student presentations, reports, journals, reflections, in-class assessments, written reports, essays, research, and homework):

Independent Reading/Read Alouds

- Plant Reproduction: How do you Grow a Giant Pumpkin? by: Cath Senker
- Reproduction in Plants by: Julie K. Lundgren

- Supersense: Perception in the Animal World by: John Downer
- How Animals See: Other Visions of Our World by: Sandra Sinclair
- Animal Adaptations by: Julie K. Lundgren
- National Geographic Learning: Animal Adaptations
- Classifying Plants and Animals by: Lewis Parker
- Sense and Sensibilities by: Jillyn Smith
- Sensory Exotica: A World Beyond Human Experience by: Howard Hughes

Videos

- Science of Disney Imagineering: Animal Adaptations: Communication Classroom Edition
- Brain Pop: Asexual Reproduction
- Youtube: Animal Adaptations
- <http://streaming.discoveryeducation.com>

Activities

Resources

- StudyJams <http://studyjams.scholastic.com/studyjams/>
- Science A-Z (Subscription Service) <https://www.sciencea-z.com/>
- National Geographic for Kids <http://kids.nationalgeographic.com/>

Activities:

EQ1.:

- Give students different plants and have them dissect them and label its parts. Then they must classify which parts are used for each adaptation (example thorn for survival/protection)
- http://www.bbc.co.uk/schools/scienceclips/ages/5_6/growing_plants.shtml

EQ2:

-

EQ4.:

- plant seeds and chart growth
- <https://faculty.washington.edu/chudler/amaze.html>
- Observe and comparative a virtual or live dissection to examine the structures of a plant and an animal. Discuss and record how different structures of the plant or animal function to help the organism grow, survive and reproduce. (Carnations are a great flower to dissect.)

STAGE 1 – DESIRED RESULTS

Unit Title: Earth’s Place in the Universe/Earth’s System

Grade Level: 4

Length/Timing of Unit:

Designer(s): Pascack Valley Regional Science Committee

Science State standards addressed (verbatim):

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. [Clarification Statement: Examples of evidence from patterns could include rock layers with marine shell fossils above rock layers with plant fossils and no shells, indicating a change from land to water over time; and, 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.] [Assessment Boundary: Assessment does not include specific knowledge of the mechanism of rock formation or memorization of specific rock formations and layers. Assessment is limited to relative time.]

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. [Clarification Statement: Examples of variables to test could include angle of slope in the downhill movement of water, amount of vegetation, speed of wind, relative rate of deposition, cycles of freezing and thawing of water, cycles of heating and cooling, and volume of water flow.] [Assessment Boundary: Assessment is limited to a single form of weathering or erosion.]

4-ESS2-2. Analyze and interpret data from maps to describe patterns of Earth’s features. [Clarification Statement: Maps can include topographic maps of Earth’s land and ocean floor, as well as maps of the locations of mountains, continental boundaries, volcanoes, and earthquakes.]

Connections to Common Core Standards (verbatim):

ELA/Literacy

W.4.7 Conduct short research projects that build knowledge through investigation of different aspects of a topic. (4-ESS1-1)

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-ESS1-1)

W.4.9 Draw evidence from literary or informational texts to support analysis, reflection, and research. (4-ESS1-1)

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. (4-ESS2-2)

Mathematics

MP.2 Reason abstractly and quantitatively. (4-ESS2-1)

MP.4 Model with mathematics. (4-ESS2-1)

MP.5 Use appropriate tools strategically. (4-ESS2-1)

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. (4-ESS2-1)

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-ESS2-1),(4-ESS2-2)

Essential Questions (3-4) in provocative, student-friendly language:

- EQ1. Why does our planet look the way it does?
- EQ2. How and why do the Earth's features constantly change?
- EQ3. How does the Earth's constant change affect our future?

Big Ideas/ Enduring Understandings: *Students will understand that...*

EQ 1:

- Earthquakes, other natural disasters, and tectonics are responsible for the patterns and changes of Earth's rock formations.
- The locations of fossils show the order in which rock layers were formed.

EQ 2:

- Climate and weather shape the land and determine which living things are found in a region.
- The locations of mountain ranges, deep ocean trenches, ocean floor structures, earthquakes, and 5-Volcanoes occur in patterns.
- Living things affect the physical features of a region.

EQ3:

- **Plate tectonics cause volcanoes and earthquakes**

A list of factual knowledge to be taught: Students will know...

Key vocabulary terms such as Igneous, metamorphic, sedimentary, erosion, weathering, climate, fossil, variables, Moh's hardness scale, plate tectonics, seismograph, geologist

Students will know...

EQ 1:

- Global patterns of rock formations
- How to classify rocks based on physical appearance and makeup

EQ 2:

- Rocks change over time for many reasons (wind, water, weathering, human and animal interactions)

EQ 3:

- Landforms correlate with movement of tectonic plates
- The interior of the planet earth, affects the exterior of the planet

A list of skills to be taught or reinforced (including habits of mind) – Students will be able to...

Students will be able to...

- Identify rock layers and their meaning
- Demonstrate how water, wind and gravity break rocks, soils into small particles
- Identify and label fault lines on a map
- Analyze map of earth's continental boundaries and mountains
- Locate on a map sites of massive natural disasters through the years
- Draw conclusions about the formation of fossils
- Predict the effect of human activities on the environment
- Identify differences between interior and exterior earth

STAGE 2 – SAMPLE ASSESSMENT

Assessments (Quizzes, tests, and a performance task to assess student mastery formatively and summatively, including an exemplar of proficient student work and a scoring guide for the performance task):

4-ESS2-1

4-ESS2-2

Goal: Students will make observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation. They will also analyze and interpret data from maps to describe patterns of Earth's features.

Role: Students

Audience: New Jersey's environmentalists

Situation: Our beaches are essential to life in New Jersey. They provide a place for resources and leisure activity. You have studied nature's forces in class. Now environmentalists are asking you to explain what changes that are happening to our beaches. You need to observe data and make claims as to what is occurring and why.

Product/Performance/Purpose: Students will observe time lapse videos/photographs/maps of coastal erosion, analyze any changes, and write an argument that supports what is happening and why. Students will include predictions of what will occur if things continue in the same way.

Some resources that teachers can use as models of erosion are:

- Pre- and Post- Hurricane Sandy Photographs of Beach Erosion
<http://coastal.er.usgs.gov/hurricanes/sandy/photo-comparisons/newjersey.php>
- Coastal Erosion and Shoreline Management Maps and Data
<http://apps.environment-agency.gov.uk/wiyby/134808.aspx>
- Florida Institute of Technology's Time Lapse of Shoreline Erosion Simulation
<http://blogs.fit.edu/blog/campus/marine-environmental/wavetank/time-lapse-of-shoreline-erosion/>
- (Beyond New Jersey) Time Lapse of Coastal Erosion in Cape Cod over 30 Years
<http://www.weather.com/science/environment/news/cape-cod-time-lapse-nasa-satellite-photos-2014-0521>

Standards and Criteria: Students will be evaluated based on their written explanations of coastal erosion and their predictions for the effects of future erosion. This will include their ability to include specific data from their observations of the models (videos, photographs, maps, etc.).

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.

Goal: Students will show their understanding of fossils by analyzing layers of fossils in a model.

Product/Performance/Purpose: Students will use shells, and other objects to create a 5 layer model of the earth and form a fossil imprint in each of the layers. The model will be exchanged with another student model. Students receive the new model, take it apart, attempt to determine the type of plant or animal that formed the fossil, and then communicate their finding. Students will use observed changes to construct an argument on how the observation indicates what that layer of Earth was like years ago.

Standards and Criteria: Students will be assessed based on their ability to determine the type of plant or animal that formed the fossil and their ability to use the observed changed to create their argument about that layer of Earth years prior.

STAGE 3 – LEARNING PLAN

Summary of Learning Activities (Lectures, mini-lessons, readalouds, independent reading, films, website exploration, discussions, dialogues, debates, partner or small-group work, student presentations, reports, journals, reflections, in-class assessments, written reports, essays, research, and homework):

Independent Reading/ Read Alouds:

- The Creation of Mountains by Jeri Freedman
- Super Storms that Rocked the World by Mark Shulman
- Shaping the Earth by Dorothy Hinshaw
- Natural Disasters by Claire Watts
- Earth's Changing Crust by Rebecca Harmen

Videos

- Youtube: Plate Tectonics for Kids: www.makemegenius.com
- National Geographic Classics: Natural Disasters
- Bill Nye the Science Guy: Earth's Crust Classroom Edition

Resources

- studyjams
- science A-Z
- national geographic for kids
- United States Geological Survey
<http://education.usgs.gov/primary.html>
- Earth visualizations
https://www.classzone.com/books/earth_science/terc/navigation/visualization.cfm
- Science Kids: Earth for Kids <http://www.sciencekids.co.nz/earth.html>
- Make Me a Genius: Weathering and Erosion for Kids Video
http://www.makemegenius.com/science-videos/grade_4/weathering-and-erosion-for-kids

STAGE 1 – DESIRED RESULTS

Unit Title: Earth and Human Activity

Grade Level: 4

Length/Timing of Unit:

Teacher(s)/Designer(s): Pascack Valley Regional Science Committee

Science State standards addressed (verbatim):

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; nonrenewable 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.]

4-ESS3-2. Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans.* [Clarification Statement: Examples of solutions could include designing an earthquake resistant building and improving monitoring of volcanic activity.] [Assessment Boundary: Assessment is limited to earthquakes, floods, tsunamis, and volcanic eruptions.]

Connections to Common Core Standards (verbatim):

ELA/Literacy

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. (4-ESS3-2)

RI.4.9 Integrate information from two texts on the same topic in order to write or speak about the subject knowledgeably. (4-ESS3-2)

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

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

Mathematics

MP.2 Reason abstractly and quantitatively. (4-ESS3-1),(4-ESS3-2)

MP.4 Model with mathematics. (4-ESS3-1),(4-ESS3-2)

4.OA.A.1 Interpret a multiplication equation as a comparison, e.g., interpret $35 = 5 \times 7$ 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),(4-ESS3-2)

Essential Questions (3-4) in provocative, student-friendly language:

- EQ1. Why are natural resources important to the environment?
- EQ2. How can humans protect Earth more effectively?
- EQ3. Why are natural resources in jeopardy? How?
- EQ4. How can we use science and technology to protect earth and earth's plant and animal populations?

Big Ideas/ Enduring Understandings: Students will understand that...

EQ1:

- Energy and fuels used by humans affects the environment in multiple ways.

EQ2:

- Humans are able to reduce the impact of natural disasters.

EQ3:

- A variety of hazards result from natural processes (earthquakes, volcanic eruptions, etc.)

EQ4:

- Testing a solution under a range of likely conditions will affect the outcome.

A list of factual knowledge to be taught: Students will know...

- The difference between renewable and nonrenewable resources
- The definition of "hazard," "fossil fuels," "natural resources" and "tsunamis"
- How do volcanoes erupt and why? Vocabulary (conduit, magma, crust, lava)
- Layers of the Earth/ Plate Tectonics

A list of skills to be taught or reinforced (including habits of mind) – Students will be able to...

- Generate and compare multiple solutions to reduce the impact of natural disasters. (earthquake, flood walls, tsunamis, volcanoes, etc.)

- Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment.
- How to conduct an experiment (Purpose, materials, hypothesis, observation, analysis of results and conclusion)
- Propose multiple solutions for one problem

STAGE 2 – SAMPLE ASSESSMENT

Assessments (Quizzes, tests, and a performance task to assess student mastery formatively and summatively, including an exemplar of proficient student work and a scoring guide for the performance task):

4-ESS3-1

Goal: Students will also obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment.

Product: Students will communicate to their peers their findings using a mini-brochure showing graphs & facts of natural resources in our region. Students must include the uses and misuses of those resources, and how they affect the environment.

Standards and Criteria for Success: Students will be assessed on the information of how energy and fuels are created from their assigned natural resource. This evaluation will include the communication of the graphs and facts they include in these brochures, as well as their explanations of the effects of these natural resources on the environment. They will also be evaluated on their communication skills in orally conveying this information to their peers.

4-ESS3-2

Goal: Students will generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans. In order to do this, students will become forecasters of natural disaster events. They will be able to predict the type of disaster and its magnitude and explain to an audience of their peers why these disasters are occurring. In this way anyone who understands what is happening can prepare for managing it.

Role: Environment Forecaster. Each group will be responsible for forecasting a different natural disaster.

Audience: Local Community

Situation: Your community is about to be faced with a major natural disaster. Your job is to help prepare the community by explaining the science behind what is happening.

Product/Performance/ Service: Students will research the history of a certain natural disaster in a certain area, using resources such as <http://www.ready.gov/kids/know-the-facts> and <http://earthobservatory.nasa.gov/NaturalHazards/>. They will then create a presentation for the local community. This will include a map or timeline of natural disasters that they students will create using their interpretations of the data of past natural disasters, models (physical or drawn diagrams) showing why the

natural disasters occurs and why they can never be eliminated, and an evacuation plan that explains their solution to the communities natural disaster problem. Throughout their presentation, the students will be using their data, their model, and their other research as evidence to convince the people in their community to evacuate.

Standards and Criteria for Success: Students will be evaluated based on how well they supported their evacuation argument using data, modeling, oral and written communication. This will include the accuracy of their interpretation of the data and the accuracy of the science concepts in their models and arguments.

STAGE 3 – LEARNING PLAN

Summary of Learning Activities (Lectures, mini-lessons, read alouds, independent reading, films, website exploration, discussions, dialogues, debates, partner or small-group work, student presentations, reports, journals, reflections, in-class assessments, written reports, essays, research, and homework):

Distance Learning Project with The Grand Canyon on Rocks and Minerals.

Resources

- StudyJams
<http://studyjams.scholastic.com/studyjams/>
- Science A-Z (Subscription Service)
<https://www.sciencea-z.com/>
- National Geographic for Kids
<http://kids.nationalgeographic.com/>
- Center for Teaching and Learning: 4th Grade Lessons for Energy and Natural Resources
<https://www.njctl.org/courses/science/4th-grade-science/energy-natural-resources/energy-natural-resources-2/>
- Exploring Earth Textbook with Interactive Diagrams
https://www.classzone.com/books/earth_science/terc/navigation/visualization.cfm
- The U.S. Government's Children's Resource for Natural Disaster Readiness
<http://www.ready.gov/kids/know-the-facts>
- Earth Observatory's Maps and Photographs of Natural Hazards
<http://earthobservatory.nasa.gov/NaturalHazards/>
- Grand Canyon
<http://www.nps.gov/teachers/index.htm>
- Pbs Eco-World
<http://pbskids.org/eeeworld/>
- *Bill Nye the Science Guy*: "Erosion" (Full Episode)
<https://www.youtube.com/watch?v=D7WFeh30UpY>
- American Red Cross Disaster Preparedness
<http://www.redcross.org/prepare/disaster>

- Kids Do Ecology

<http://kids.nceas.ucsb.edu/>