Englewood Public School District
Science
Grade 6
First Marking Period

Unit 1: Earth Systems – Plate Tectonics, Earthquakes, & Volcanos

Overview: Students examine geoscience data in order to understand processes and events in Earth's history. Important crosscutting concepts in this unit are *scale, proportion, and quantity*, *stability and change*, and *patterns* in relation to the different ways geologic processes operate over geologic time. An important aspect of the history of Earth is that geologic events and conditions have affected the evolution of life, but different life forms have also played important roles in altering Earth's systems. Students understand how Earth's geosystems operate by modeling the flow of energy and cycling of matter within and among different systems. Students investigate the controlling properties of important materials and construct explanations based on the analysis of real geoscience data. Students are expected to demonstrate proficiency in *analyzing and interpreting* data and *constructing explanations*. They are also expected to use these practices to demonstrate understanding of the core ideas.

Time Frame: 40 to 45 Days

Enduring Understandings:
The transfer of energy inside Earth and how it affects the surface

Essential Questions:
If no one was there, how do we know the Earth's history and structure?
What provides the forces that drive Earth's systems?

Standards	Topics and Objectives	Activities	Resources	Assessments
(MS-ESS1-4) Construct a scientific explanation based on evidence from rock strata for how the geologic time scale is used to organize Earth's 4.6-billion-year-old history.	**Topics** Earth's Interior **Objectives** Students will: Use direct and indirect evidence to explain the structure of Earth.	Students will complete the Discover Activity (Inside Earth p.6) How do scientists find out what's inside the earth? (CRP8, 8.2.8.B.5)(9.2.8.B.3) Students will discover the construct of the Earth's layers by completing Apples, Eggs, and the Earth lesson plan.	**Text:** Prentice Hall Science Explorer: Inside Earth **Materials:** For Discover Activity (Inside Earth p.6) How do scientists find out what's inside the earth?: • 3 film canisters with tops • 3 different materials to fill film canisters (i.e. Water, sand, rock, marble, etc.)	**Formative Assessments:** Do Now/Ticket to Leave Class Discussion Journal Entries **Benchmark Assessments:** Common Formative Assessment Exact Path

(MS-ESS2-1) **Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process.** **(MS-ESS2-2)** **Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales.** **(MS-ESS2-3)** **Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions.**	Evaluate the merits of different models used to represent Earth.	Students will explore the Journey to the Center of the Earth and Dynamic Earth websites to experience an interactive explanation of Earth's layers. (MS-ESS1-4) **Enrichment Activities:** Students will simulate the Earth's mantle plasticity with cornstarch and water. (CRP6) Students will compare Earth's Layers to a Ring Ding. (CRP4)	• Masking tape and permanent marker to label film canisters For Apples, Eggs, and the Earth lesson plan: • Hard boiled eggs (one per group) • Apples (one per group) • Small sharp knives (one per group) • Paper for drawing observations • Crayons or colored pens • Basketball • Solid rubber ball For simulating the Earth's mantle plasticity Enrichment Activity: • Cornstarch • Water • Cups for mixing • Spoons • Dropper **Websites:** • Journey to the Center of the Earth • Dynamic Earth **Enrichment Lesson Plans:** • Simulating Plasticity • Earth's Layers to a Ring Ding	**Summative Assessments**: Students will complete the assessments in the *Apples, Eggs, and the Earth Activity* and explain what evidence scientists have to support the descriptions of each layer of Earth. Computer Research **Alternative Assessments**: Students will support an argument with evidence, data, or a model. Checklists Journals Peer Reviews Graphic organizers Self-Assessments Visual Representations
	Topics Convection Currents Continental Drift	Students will complete the Discover Activity (p14) How can heat cause motion in a liquid? Students will enhance their understanding of convection in	**Text:** Prentice Hall Science Explorer: Inside Earth **Materials:** For Discover Activity (p14) How can heat cause motion in a	**Formative Assessment:** Do Now/Ticket to Leave Class Discussion Journal Entries

Objectives

Students will:

Explain how convection currents are formed.

Explain how convection currents influence plate movement.

Cite evidence supporting continental drift.

Earth's mantle by interacting with the web model: Convection Currents Animation (MS-ESS2-1,RI.6.5)

Students will construct the Supercontinent of Pangea via the lesson, Come Visit Me in Tropical... Antarctica? (6.EE.6)

Enrichment Activity:
Students will make S'mores to demonstrate types of heat transfer.
(MS-ESS2-2)

liquid?:

- Shallow pan
- Clear plastic cup
- Hot water
- Cold water
- Plastic dropper
- Food coloring

For Come Visit Me in Tropical... Antarctica?:

- Copies of continent maps (one per student)
- Photos or pictures from magazines cut in a jigsaw pattern
- Scissors
- Paste (glue sticks are best)
- Paper

For S'mores Enrichment Activity

- S'mores materials (see Enrichment Activity)

Websites:

- Conduction Convection Radiation Tutorial
- Convection Currents and Sea Floor Spreading

Video:

- Mantle Convection and Continental Drift

Enrichment Lesson Plan:
Summertime STEM: Fun Physics with Marshmallows
http://wellermommablog.com/summertime-stem-fun-physics/

Summative Assessment:
Students will complete the questions from *Convection Currents Animation and Assessment Questions* to display their ability to apply information regarding convection currents to real world settings.

Students will describe evidence supporting the theory of continental drift. *Come Visit Me in Tropical... Antarctica?*

Alternative Assessments:
Response Logs

Think Pair Share

Simulations

Discussions

	Topics Sea-Floor Spreading **Objectives** Students will: Explain evidence for sea-floor spreading. Explain the causes and effects of sea-floor spreading.	Students will complete the text activities: 1. Discover Activity (p23) What is the effect of a change in density? 2. Reversing Poles (p27) 3. Modeling Sea-floor Spreading (p30) Sea-Floor Spreading Videos (MS-ESS2-3)	**Text:** Prentice Hall Science Explorer: Inside Earth **Materials:** For Discover Activity (p23) What is the effect of a change in density? • Sink or large dishpan • Water • Washcloth For Reversing Poles (p27): • Audiotape • Scissors • Metric ruler • Plastic tape • Bar magnet For Modeling Sea-floor Spreading (p30): • 2 sheets of unlined paper, • Colored marker **Websites:** • Convection Currents and Sea Floor Spreading **Video:** • ALVIN Investigates Sea Floor Spreading • Sea Floor Spreading & Magnetic Polarity Stripes • Sea Floor Spreading With Bill Nye	**Formative Assessments:** Do Now/Ticket to Leave Class Discussion Journal Entries **Summative Assessments:** Students will be evaluated based upon their understanding of Sea-Floor Spreading as displayed in their model and follow up questions. **Alternative Assessments**: Response Logs Think Pair Share Simulations Discussions Graphic Organizers
	Topics The Theory of Plate Tectonics **Objectives**	Students will complete the text activities: 1. Discover Activity (p32) How well do the continents fit together? 2. Lab - Modeling Mantle	**Text:** Prentice Hall Science Explorer: Inside Earth **Materials:** For Discover Activity (p32)	**Formative Assessments:** Do Now/Ticket to Leave Class Discussion Journal Entries

Students will:

Explain the theory of Plate Tectonics.

Describe the three types of plate boundaries and features of each.

Convection Currents

Students will enhance their understanding of Plate Tectonics by interacting with the web-based lesson, "Mountain Maker".

Enrichment Activities
Students will view the Ted Ed video, *Pangaea Pop-up Book*

Students will view the video, *Crust in Pieces and Pangaea Song.*

Students will complete the Milky Way Plate Tectonics Activity.

How well do the continents fit together?

- World map
- Tracing paper
- Scissors
- Sheet of paper
- Tape

For Lab - Modeling Mantle Convection Currents:

- Large plastic bottle
- Food coloring
- Small glass jar
- Aluminum foil
- Rubber band
- Several small pieces of paper - about 5 cm square
- Tap water

For Milky Way Enrichment Activity:

- Milk Way bars (one per student)

Websites:

- "Mountain Maker" http://www.pbs.org/wgbh/aso/tryit/tectonics/\
- The Breakup of Pangaeahttp://www.exploratorium.edu/origins/antarctica/ideas/gondwana2.html

Video:

- Pangaea Pop-Up Book
- Crust in Pieces Song
- Pangaea Song

Enrichment Lesson:
Milky Way Plate Tectonics

Summative Assessments:
Students will be evaluated on their responses to the Lab and Plate Tectonics Activity questions.

Alternative Assessments:
Response Logs

Think Pair Share

Simulations

Discussions

Graphic Organizers

Review Games

	Topics Forces in Earth's Crust **Objectives** Students will: Explain how stress in the crust changes Earth's surface. Model fault formations. Identify land features that result from plate movement**.**	Students will complete the text activities: 1. Discover Activity (p44) How Does Stress Affect Earth's Crust? 2. Modeling Lab- Forces in Earth's Crust **Enrichment Activity:** Students will analyze computer and paper models of faults based on their relative strengths and limitations. (8.2.8.A.5)	**Text:** Prentice Hall Science Explorer: Inside Earth **Materials:** • Craft sticks • Scissors • Tape • Markers **Websites:** • Folds, Faults and Mountains https://ees.as.uky.edu/sites/default/files/elearning/module10swf.swf	**Formative Assessments:** Do Now/Ticket to Leave Class Discussion Journal Entries **Summative Assessments**: Students' growth and areas of need will be evaluated based upon their responses on the Modeling Lab questions. **Alternative Assessments**: Students will support an argument with evidence, data, or a model. Checklists Journals Peer Reviews Graphic organizers Self-Assessments Visual Representations
(MS-ESS3-2) **Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.**	**Topics** Earthquakes Seismic Waves Monitoring Earthquakes Earthquake Safety	Students will complete the text activities: 1. Discover Activity (p51) How Do Seismic Waves Travel Through Earth? 2. Might Wave Maker Website (see resources) 3. Finding the Epicenter PBL Math class (p58)	**Text:** Prentice Hall Science Explorer: Inside Earth **Materials:** For Discover Activity (p51) How Do Seismic Waves Travel Through Earth?: • Spring toy	**Formative Assessments:** Do Now/Ticket to Leave Class Discussion Journal Entries **Summative Assessments:**

(MS-ETS1-1)
Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.

(MS-ETS1-2)
Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.

(MS-ETS1-3)
Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.

(MS-ETS1-4)
Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.

Objectives

Students will:

Describe how energy travels through Earth.

Debate the merits and limitations of different methods of measuring and locating earthquakes.

Use design principals to construct and test a seismograph and an earthquake proof building.

Research causes and effects of famous earthquakes and present findings to classmates.

4. Discover Activity (p60) How can seismic waves be detected?
5. Measuring Friction (p64)
6. Design a Seismograph (p66)
7. Discover Activity (p4) Can bracing prevent building collapse?
8. Stable or Unstable? (p70)

Students will complete an Earthquake research project.

Students will create an earthquake proof building.

Enrichment Activity:
Students will identify criteria to evaluate which seismograph and/or earthquake proof house design is the most effective. (MS-ETS1-3, 6.EE.6,W.6.9, 8.2.8.A.2)

For Finding the Epicenter PBL Math class (p58):

- Drawing compass
- Outline map of the United States

For Discover Activity (p60) How can seismic waves be detected?:

- Pan with 2-3 cm of gelatin
- 4 plastic stirrers
- Pencil with eraser

For Measuring Friction (p64):

- Small weight
- Spring scale
- Sandpaper
- Masking tape

For Design a Seismograph (p66):

- Large book
- Pencil
- Pen
- 2 strips of paper
- Alternate materials such as cardboard boxes, paper towel tubes, rubber bands, and wooden dowels

For Discover Activity (p4) Can bracing prevent building collapse?

- 5 straws
- Tape

For Stable or Unstable? (p70)

- 10 various sized books
- 2 dish towels

For earthquake proof building:

Students will be evaluated based upon the completion of, Finding the Epicenter PBL Math class lesson.

Students' progress will be identified on their Seismograph design and reflection.

Students will be evaluated using a rubric to evaluate the quality of the students' Famous Earthquake Presentations.

Students Earthquake Proof Building Journal will be used to analyze students' overall understanding of the destructive nature of Earthquakes.

Alternative Assessments:

Students will support an argument with evidence, data, or a model.

Checklists

Journals

Peer Reviews

Graphic organizers

Self-Assessment

			• 30 toothpicks (per student) • 30 miniature marshmallows (per student) • Eight 8½-inch square disposable baking dishes, or one 8½ x 11-inch disposable roasting or baking pan • 8 boxes Jell-O® (plus a stove, water and pan to make the Jell-O® in advance) **Websites:** • Mighty Wave Maker • Earthquake in the Classroom https://www.teachengineering.org/activities/view/cub_natdis_lesson03_activity1 **Video:** • Earthquake Drills in California • Earthquake Rumble Song **Earthquake Research Project:** http://sotoscience12.weebly.com/uploads/8/3/8/3/8383194/earthquake_research_project_instructions_2015.pdf	
	Topics Volcanoes Properties of Magma Volcanic Eruptions Volcanic Landforms	Students will complete the text activities: 1. Mapping Earthquakes and Volcanoes (p86) 2. Hot Spot in a Box (p85) 3. Volcano Songs (see resources) 4. Discover Activity (p87) How fast do liquids Flow? *extend activity by repeating	**Text:** Prentice Hall Science Explorer: Inside Earth **Materials:** For Mapping Earthquakes and Volcanoes (p 86): • Outline of world map showing longitude and latitude	**Formative Assessments:** Do Now/Ticket to Leave Class Discussion Journal Entries **Summative Assessments:** Students will be evaluated on the Mapping

Objectives

Students will:

Map volcanos and earthquakes to find patterns in distribution on Earth.

Determine factors that influence the viscosity of magma.

Explain the types and stage of volcanic activity.

Describe and identify different types of volcanic landforms.

with heated honey and oil
5. Discover Activity (p91) What are Volcanic Rocks Like?
6. Gases in Magma (p94)
7. Discover Activity (p99) How can Volcanic Activity Change Earth's Surface?
8. Lab - Gelatin Volcanoes (p106)

Students will create a volcano travel brochure. (MS-ETS1-4,W.6.2)

Enrichment Activity:
Students will make a Volcanos And People Documentary Video (p81). (MS-ETS1-4)

- 4 different colored pencils

For Hot Spot in a Box (p85):
- Plastic box
- Cold water
- Hot water
- Red food coloring
- Small narrow-necked bottle
- Flat piece of plastic foam

For Discover Activity (p87) How fast do liquids Flow?
- 2 small plastic cups
- 1 larger cup
- Oil
- Honey
- Stopwatch

For Discover Activity (p91) What are Volcanic Rocks Like?:
- Samples of pumice and obsidian
- Hand lens

For Gases in Magma (p94)
- 1-2n liter plastic bottle
- 10g baking soda
- 65mL water
- 6 raisins
- 65mL vinegar

For Discover Activity (p99) How can Volcanic Activity Change Earth's Surface?
- Tape
- Balloon
- Straw
- Box
- Damp sand

Earthquakes and Volcanoes activity.

Students will be evaluated on the "How fast do liquids flow" activity reflection.

Students will receive a grade for accurately completing the Gelatin Volcanoes Lab.

A rubric will be used to identify student success on the creation of their Volcano Travel Brochure.

Alternative Assessments:

Students will support an argument with evidence, data, or a model.

Checklists

Journals

Peer Reviews

Graphic organizers

Self-Assessments

Visual Representations

For Lab - Gelatin Volcanoes (p106)

- Plastic cup
- Tray or shallow pan
- Aluminum pizza pan with holes punched at 2.5 cm intervals
- Plastic knife
- Unflavored gelatin mold in bowl
- Red food coloring and water
- Plastic syringe, (10cc)
- Rubber gloves
- Unlined paper
- 3 small cardboard oatmeal boxes

Websites:

- Volcano 101
- National Geographic Volcanoes

Video:

- Volcanoes Song
- Ring of Fire Song
- Discovery Channel School Video

Volcano Travel Brochure:

I Lava Volcanoes!
Volcano Travel Brochure
http://teamcfa.school/app/uploads/sites/13/2016/01/Volcano-Travel-Brochure.pdf

Accommodations and Modifications:

Students with special needs: Support staff will be available to aid students related to IEP specifications. 504 accommodations will also be attended to by all instructional leaders. Physical expectations and modifications, alternative assessments, and scaffolding strategies will be used to support this learning. The use of Universal Design for Learning (UDL) will be considered for all students as teaching strategies are considered.

ELL/ESL students: Students will be supported according to the recommendations for "can do's" as outlined by WIDA – https://www.wida.us/standards/CAN_DOs/
This particular unit has limited language barriers due to the physical nature of the curriculum.

Students at risk of school failure: Formative and summative data will be used to monitor student success at first signs of failure student work will be Reviewed to determine support. This may include parent consultation, basic skills review and differentiation strategies. With considerations to UDL, time may be a factor in overcoming developmental considerations. More time and will be made available with a certified instructor to aid students in reaching the standards.

Gifted and Talented Students: Students excelling in mastery of standards will be challenged with complex, high level challenges related to the complexity in planning and carrying out investigations and analyzing and interpreting data.

English Language Learners	**Special Education**	**At-Risk**	**Gifted and Talented**
● Have student repeat direction back ● Speak and display terminology ● Teacher modeling ● Peer modeling ● Provide ELL students with multiple literacy strategies. ● Word walls ● Use peer readers ● Give page numbers to help the students find answers ● Provide a computer for written work	● Provide concrete examples ● Utilize modifications & accommodations delineated in the student's IEP ● Work with paraprofessional ● Use multi-sensory teaching approaches. ● Work with a partner ● Restructure lesson using UDL principals (http://www.cast.org/our-work/about-udl.html#.VXmoXcfD_UA).	● Use graphic organizers ● Using visual demonstrations, illustrations, and models ● Give directions/instructions verbally and in simple written format. Oral prompts can be given. ● Peer Support ● Increase one on one time ● Teachers may modify instructions by modeling what the student is expected to do ● Instructions may be printed out in large print and hung up for the student to see during the time of the	● Inquiry-based instruction ● Independent study ● Higher order thinking skills ● Adjusting the pace of lessons ● Interest based content ● Real world scenarios ● Student Driven Instruction ● 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

• Provide two sets of textbooks, one for home and one for school • Provide visual aides • Provide additional time to complete a task	• 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).	lesson. • Review behavior expectations and make adjustments for personal space or other behaviors as needed. • Structure lessons around questions that are authentic, relate to students' interests, social/family background and knowledge of their community. • 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).	community-based issue. • Collaborate with after-school programs or clubs to extend learning opportunities.

Interdisciplinary Connections:

ELA-NJSLS/ELA:
W.6.9: Draw evidence from literary or informational texts to support analysis, reflection, and research.
W.6.2: Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content.
RI.6.5: Analyze how a particular sentence, paragraph, chapter, or section fits into the overall structure of a text and contributes to the development of the ideas.

Mathematics:
6.EE.6: Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set.

Career Ready Practices:
CRP4: Communicate clearly and effectively and with reason.
CRP8: Utilize critical thinking to make sense of problems and persevere in solving them.
CRP6: Demonstrate creativity and innovation.

Integration of Technology Standards NJSLS 8:
8.1.5.F.1: Apply digital tools to collect, organize, and analyze data that supports a scientific finding.

Integration of 21st Century Standards NJSLS 9:
9.2.8.B.3
Evaluate communication, collaboration, and leadership skills that can be developed through school, home, work, and extracurricular activities for use in a career.

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Developing and Using Models • Develop and use a model to describe phenomena. (MS-ESS2-1) **Constructing Explanations and Designing Solutions** • Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students' own experiments) and the assumption that theories and laws that describe nature operate today as they did in the past and will continue to do so in the future. (MS-ESS1-4),(MS-ESS2-2) **Analyzing and Interpreting Data** • Analyze and interpret data to provide evidence for phenomena. (MS-ESS2-3)	**ESS1.C: The History of Planet Earth** • The geologic time scale interpreted from rock strata provides a way to organize Earth's history. Analyses of rock strata and the fossil record provide only relative dates, not an absolute scale. (MS-ESS1-4) **ESS2.A: Earth's Materials and Systems** • All Earth processes are the result of energy flowing and matter cycling within and among the planet's systems. This energy is derived from the sun and Earth's hot interior. The energy that flows and matter that cycles produce chemical and physical changes in Earth's materials and living organisms. (MS-ESS2-1) • The planet's systems interact over scales that range from microscopic to global in size, and	**Stability and Change** • Explanations of stability and change in natural or designed systems can be constructed by examining the changes over time and processes at different scales, including the atomic scale. (MS-ESS2-1) **Scale Proportion and Quantity** • Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small. (MS-ESS1-4),(MS-ESS2-2) **Patterns** • Patterns in rates of change and other numerical relationships can provide information about natural systems. (MS-ESS2-3)

		they operate over fractions of a second to billions of years. These interactions have shaped Earth's history and will determine its future. (MS-ESS2-2) **ESS2.B: Plate Tectonics and Large-Scale System Interactions** • Maps of ancient land and water patterns, based on investigations of rocks and fossils, make clear how Earth's plates have moved great distances, collided, and spread apart. (MS-ESS2-3)	- ***Connections to Nature of Science*** **Scientific Knowledge is Open to Revision in Light of New Evidence** • Science findings are frequently revised and/or reinterpreted based on new evidence. (MS-ESS2-3)			