



8th Grade Science Unit:
Geological Effects of Plate Tectonics
 Unit Snapshot

Topic: Physical Earth

Grade Level: 8

Duration:
14 days

Summary

The following activities provide students the opportunity to become familiar with the current theory of Plate Tectonics and the constructive and destructive process involved in plate motion and interaction, resulting in various geological events and features.

Clear Learning Targets

“I can”...statements

- ___ describe the movement and interaction of the 3 primary types of plate boundaries (convergent, divergent, transform).
- ___ use a boundary map to explain various plate interactions around the world.
- ___ explain the resulting geologic effects of plate boundary movement and interaction.
- ___ identify specific geologic events and features around the world and explain how plate movement or interaction is responsible for such events.

Activity Highlights and Suggested Timeframe

Days 1-2	Engagement: The objective of this activity is to engage students and assess student knowledge related to the current plate tectonics theory through the use of a mapping activity and interactive plate boundary map, guided-questions, and discussion. Students will map the locations of Earthquakes and Volcanoes around the world using data in order to infer the relationship between these events and plate boundaries.
Day 3-4	Exploration: Students will explore the movements of various tectonic plates and discover real-world events that occur due to plate interactions through interactive websites.
Days 5-7	Explanation: Students will gain deeper understanding of the current theory of plate tectonics and vocabulary through Earth Science Textbook guided reading and study, as well as a kinesthetic vocabulary reinforcement activity (Whoosh).
Day 8-12	Elaboration: Students will use research, explain details, and provide evidence related to Plate Tectonic Theory to explain the cause and effects of various geologic events that could possibly occur around the world. Students will use 21 st Century skills to create a news broadcast of an event.
Day 13 and on-going	Evaluation: The objective of the assessments is to focus on and assess student knowledge and growth to gain evidence of student learning or progress throughout the lesson, and to become aware of students misconceptions related to the current theory of plate tectonics. A teacher-created short-cycle assessment can be used to assess all learning targets (Day 13)
Day 14	Extension/Intervention: Based on the results of the short-cycle assessment, facilitate extension and/or intervention activities.

LESSON PLANS

NEW LEARNING STANDARDS:

8.ESS.2b -Earth's Crust consists of major and minor tectonic plates that move relative to each other.

There are three main types of plate boundaries: divergent, convergent and transform. Each type of boundary results in specific motion and causes events (such as earthquakes or volcanic activity) or features (such as mountains or trenches) that are indicative of the type of boundary.

SCIENTIFIC INQUIRY and APPLICATION PRACTICES:

During the years of grades K-12, all students must use the following scientific inquiry and application practices with appropriate laboratory safety techniques to construct their knowledge and understanding in all science content areas:

- Asking questions (for science) and defining problems (for engineering) that guide scientific investigations
- Developing descriptions, models, explanations and predictions.
- Planning and carrying out investigations
- Constructing explanations (for science) and designing solutions (for engineering) that conclude scientific investigations
- Using appropriate mathematics, tools, and techniques to gather data/information, and analyze and interpret data
- Engaging in argument from evidence
- Obtaining, evaluating, and communicating scientific procedures and explanations

*These practices are a combination of ODE Science Inquiry and Application and Framework for K-12 Science Education Scientific and Engineering Practices

COMMON CORE STATE STANDARDS for LITERACY in SCIENCE:

CCSS.ELA-Literacy.RST.6-8.7 Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).

CCSS.ELA-Literacy.WHST.6-8.8 Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation.

CCSS.ELA-Literacy.WHST.6-8.2b Develop the topic with relevant, well-chosen facts, definitions, concrete details, quotations, or other information and examples.

*For more information: http://www.corestandards.org/assets/CCSSI_ELA%20Standards.pdf

STUDENT KNOWLEDGE:

Prior Concepts Related to Forces, Movement and Igneous Environments

K-2: Properties of materials can change. Pushing and pulling can affect the motion of an object.

Grades 3-5: Forces change the motion of an object. Rocks have specific characteristics. Heat is a form of energy. Energy can be conserved. Earth's surface has specific characteristics. Heat results when materials rub against each other. Gravitational force and magnetism also are studied.

Grades 6-7: Rocks have characteristics that are related to the environment in which they form. Thermal energy is a measure of the motion of the atoms and molecules in a substance. Energy can be transformed, transferred and conserved. Thermal energy can be transferred through radiation, convection and conduction.

Future Application of Concepts

High School: Thermal energy, gravitational energy, radioactive decay and energy transfer are studied. In the grades 11/12 Physical Geology course, further studies of plate tectonics, seismology and volcanism are found.

<p>MATERIALS:</p> <p><u>Engage</u></p> <ul style="list-style-type: none"> • Earth Science Textbook Skills Lab Student Worksheets • Colored Pencils • Computer/Projector/Internet <p><u>Explore</u></p> <ul style="list-style-type: none"> • Computer/Projector/Internet • Optional: laptops, computer lab, iPads • 3 Primary Types of Plate Boundaries graphic organizers • Plates on the Move Student Sheets <p><u>Explain</u></p> <ul style="list-style-type: none"> • Earth Science Textbooks • Guided Reading and Study Worksheets from textbook resources • Review and Reinforce Worksheet from textbook resources <p><u>Elaborate</u></p> <ul style="list-style-type: none"> • Optional: laptops, computer lab, iPads • Earth Science Textbooks • Library Books or articles related to the given various geologic locations for research • Optional: Video cameras 	<p>VOCABULARY:</p> <p><u>Primary</u></p> <p>Convergent Divergent Earthquakes Transform Plate Boundaries Plate Tectonics Volcanism</p> <p><u>Secondary</u></p> <p>Convection Fault Hawaiian Islands Mariana Trench Mid-Atlantic Ridge New Madrid Fault System Ridge Ring of Fire San Andreas Fault Sea-Floor Spreading Trench Tsunami</p>		
<p>SAFETY</p>	<ul style="list-style-type: none"> • All CSS Safety and Laboratory Procedures/Rules apply. 		
<p>ADVANCED PREPARATION</p>	<ul style="list-style-type: none"> • Gather materials for laboratory investigations • Copy student worksheets • Reserve computer lab/laptops if possible 		
<p>ENGAGE (2 days)</p> <p>(What will draw students into the learning? How will you determine what your students already know about the topic? What can be done at this point to identify and address misconceptions? Where can connections be made to the real world?)</p>	<p>Objective: The objective of this activity is to engage students and assess student knowledge related to the current plate tectonics theory through the use of a mapping activity and interactive plate boundary map, guided-questions, and discussion. Students will map the locations of Earthquakes and Volcanoes around the world using data in order to infer the relationship between these events and plate boundaries.</p> <table border="1" data-bbox="467 1417 1521 1843"> <tr> <td data-bbox="467 1417 1016 1843"> <p><i>What is the teacher doing?</i></p> <p>Skills Lab: Mapping Earthquakes and Volcanoes (Day 1)</p> <ul style="list-style-type: none"> • Distribute the Earth Science Textbook Skills Lab Worksheets: Mapping Earthquakes and Volcanoes. This can be found in the All-In-One Teacher Resources Unit One Book pp. 448-450. • Provide colored pencils • Facilitate activity and follow-up with discussion. </td> <td data-bbox="1016 1417 1521 1843"> <p><i>What are the students doing?</i></p> <p>Skills Lab: Mapping Earthquakes and Volcanoes (Day 1)</p> <ol style="list-style-type: none"> 1. Students complete Skills Lab: Mapping Earthquakes and Volcanoes. </td> </tr> </table>	<p><i>What is the teacher doing?</i></p> <p>Skills Lab: Mapping Earthquakes and Volcanoes (Day 1)</p> <ul style="list-style-type: none"> • Distribute the Earth Science Textbook Skills Lab Worksheets: Mapping Earthquakes and Volcanoes. This can be found in the All-In-One Teacher Resources Unit One Book pp. 448-450. • Provide colored pencils • Facilitate activity and follow-up with discussion. 	<p><i>What are the students doing?</i></p> <p>Skills Lab: Mapping Earthquakes and Volcanoes (Day 1)</p> <ol style="list-style-type: none"> 1. Students complete Skills Lab: Mapping Earthquakes and Volcanoes.
<p><i>What is the teacher doing?</i></p> <p>Skills Lab: Mapping Earthquakes and Volcanoes (Day 1)</p> <ul style="list-style-type: none"> • Distribute the Earth Science Textbook Skills Lab Worksheets: Mapping Earthquakes and Volcanoes. This can be found in the All-In-One Teacher Resources Unit One Book pp. 448-450. • Provide colored pencils • Facilitate activity and follow-up with discussion. 	<p><i>What are the students doing?</i></p> <p>Skills Lab: Mapping Earthquakes and Volcanoes (Day 1)</p> <ol style="list-style-type: none"> 1. Students complete Skills Lab: Mapping Earthquakes and Volcanoes. 		

	<p><u>Plate Boundaries Map (Day 2)</u></p> <ul style="list-style-type: none"> • See Teacher Page • Project the following website module on the board and make sure you on the Maps Tab: http://ees.as.uky.edu/sites/default/files/elearning/module04swf.swf • Click on the Boundaries Tab to show the boundary lines between the plates. • Next click on the Volcanoes tab to show where volcanoes are located around the world, and that many of them are aligned along plate boundaries. • Next Click on Earthquakes to show the relationship between Volcanoes and Earthquakes. • Next Click on hotspots and explain the difference between plate boundaries and hotspots. • Next Click on the Velocity Tab to show the direction and movement of the plates. • Finally click on the names. • Facilitate a discussion using the map and the provided guided questions. <p>Consider showing the following Discovery Ed Video Clip if needed: Discovering Plate Tectonics [7:08] Plate Tectonics [5:46]</p>	<p>Plate Boundaries Map (Day 2)</p> <ol style="list-style-type: none"> 1. Students view the interactive website as a class. 2. Students are engaged in conversation related to the map features as the teacher facilitates. 3. Students use and analyze the map to answer teacher-guided questions.
<p><u>EXPLORE</u> (2 days) (How will the concept be developed? How is this relevant to students' lives? What can be done at this point to identify and address misconceptions?)</p>	<p>Objective: Students will explore the movements of various tectonic plates and discover real-world events that occur due to plate interactions through interactive websites.</p>	
	<p><i>What is the teacher doing?</i></p> <p><u>Plate Boundary Motion (Day 3)</u></p> <ul style="list-style-type: none"> • See TEACHER PAGE • Project the same website from Day 2: http://ees.as.uky.edu/sites/default/files/elearning/module04swf.swf or provide students with individual devices (computers, laptops, Ipads). • Distribute the 3 Primary Types of Plate Boundaries graphic organizer. 	<p><i>What are the students doing?</i></p> <p>Plate Boundary Motion (Day 3)</p>

- Click on the “Details” Tab and show or allow students on their own to view each animation and the related information.
 - Ocean-Continent Subduction
 - Continent-Continent Collision
 - Ocean to Ocean Subduction
 - Continental Rift
 - Mid-Ocean Ridge
 - Continental Transform
 - Oceanic Transform
 - Oceanic Hot Spots
 - Continental Hot Spots
- Assist students with completing the graphic organizer using the information from this website.

Plates on the Move (Day 4)

- Either project the following website on the board or have students use individual devices to view:
<http://www.amnh.org/ology/features/plates/index.php>



- Assist students in completing page one of the handout.
- Click on:



- The Intro should be read aloud. Emphasize that students may NOT click on “Skip the Intro”. This is the core explanation.
- Assist students with completing part 2 of the worksheet individually, in partners, or as a class.

1. Students view various animations related to plate boundary movement and complete the graphic organizer using the information related to the animation.

Plates on the Move (Day 4)

1. Students use the website information and interactive animations to learn more about the plate boundaries and the events caused by plate interactions or movements.
2. Students complete Plates on the move student worksheet.

<p style="text-align: center;"><u>EXPLAIN</u> (3 days)</p> <p>(What products could the students develop and share? How will students share what they have learned? What can be done at this point to identify and address misconceptions?)</p>	<p>Objective: Students will gain deeper understanding of the current theory of plate tectonics and vocabulary through Earth Science Textbook guided reading and study, as well as a kinesthetic vocabulary reinforcement activity (Whoosh).</p>	
	<p><i>What is the teacher doing?</i></p> <p>Guided Reading and Study/Review and Reinforce (Days 5-6)</p> <ul style="list-style-type: none"> • Provide students with the Earth Science Textbook and Plate Tectonics Guided reading and Study Worksheet/Review and Reinforce pages from the Earth Science All-In-One Teacher Resources Unit One Book pp. 337-340. • Assist students as they read and complete the worksheets. <p><u>Plate Tectonics WHOOSH (Day 7)</u></p> <ul style="list-style-type: none"> • See TEACHER PAGE • A WHOOSH is used as a kinesthetic way to get students excited about vocabulary. • Begin by modeling a WHOOSH for your students • Students will develop their own movements to go along with the unit's vocabulary and share their movements with a partner. • The teacher will tell a story using the new vocabulary words. When a student hears these words, they will do their corresponding movement. • The class will then split into small groups and each group will create their own story using the vocabulary. • Groups will then present their WHOOSH to the class and the teacher can assess their learning of new vocabulary. <p>Optional HW or RICA: Earth Science Textbook All-In-One Teacher Resources Unit One: Enrich – The Birth of the Himalayas p.341</p>	<p><i>What are the students doing?</i></p> <p>Guided Reading and Study/ Review and Reinforce (Days 5-6)</p> <ol style="list-style-type: none"> 1. Students complete the Plate Tectonics Guided Reading and Study. <p>Plate Tectonics WHOOSH (Day 7)</p> <ol style="list-style-type: none"> 2. Students participate in the Whoosh activity by creating movements that represent vocabulary words related to Plate Tectonics Theory.

<p style="text-align: center;"><u>ELABORATE</u> (5 days)</p> <p>(How will the new knowledge be reinforced, transferred to new and unique situations, or integrated with related concepts?)</p>	<p>Objective: Students will use research, explain details, and provide evidence related to Plate Tectonic Theory to explain the cause and effects of various geologic events that could possibly be occurring around the world. Students will use 21st Century skills to create a news broadcast of an event.</p>	
	<p><i>What is the teacher doing?</i></p> <p><u>Earthquake Entrance Ticket (Day 8)</u></p> <ul style="list-style-type: none"> • Distribute the provided Entrance ticket. • If needed, show students a plate boundaries map. • Discuss student responses. • Optional Article: GeoFacts No. 3: Earthquakes and Seismic Risk in Ohio. http://www.dnr.state.oh.us/Portals/10/pdf/GeoFacts/geof03.pdf <p><u>ENN Breaking News Report (Days 8-12)</u></p> <ul style="list-style-type: none"> • See TEACHER PAGE • Distribute the ENN Breaking News Task Sheet and Rubric. • Go over the task with the students. Ask for a student to paraphrase the directions. • Group students into production teams to allow for differentiation and have them research an event (simple one for lower level, increasing complexity for more advanced learners.) • Assist as students plan their "broadcast" and model, and assign roles within the group. Teacher ensures that students will have the materials necessary to build the models. • Assist students as they write the script and begin rehearsing, while teacher facilitates the groups' progress. • Assist as students build the model and practice their broadcast. • Students present their broadcasts while teacher assesses learning outcomes. 	<p><i>What are the students doing?</i></p> <p><u>Earthquake Entrance Ticket (Day 8)</u></p> <ol style="list-style-type: none"> 1. Complete entrance ticket 2. Discuss answers. <p><u>ENN Breaking News Report (Days 8-12)</u></p> <ol style="list-style-type: none"> 3. Students are placed into production teams. 4. Students are given one of the following topics to study: <ul style="list-style-type: none"> • Volcanic Eruption - Ring of Fire • Volcanic Eruption – Hawaiian Islands • Earthquakes near San Andreas Fault • Hot Springs and Geysers – Yellowstone • Hot Springs-Iceland • Earthquakes-New Madrid Fault System • Earthquakes near the Himalayan Mountains 5. Students plan and develop their broadcast and develop their model. 6. Students practice their broadcast. 7. Students perform and/or video record their news broadcast.

<p style="text-align: center;">EVALUATE (on-going)</p> <p>(What opportunities will students have to express their thinking? When will students reflect on what they have learned? How will you measure learning as it occurs? What evidence of student learning will you be looking for and/or collecting?)</p>	<p>Objective: The objective of the assessments is to focus on and assess student knowledge and growth to gain evidence of student learning or progress throughout the lesson, and to become aware of students' misconceptions related to the current theory of plate tectonics. A teacher-created short-cycle assessment can be used to assess all learning targets (Day 13)</p>	
	<p>Formative <i>How will you measure learning as it occurs?</i></p> <ul style="list-style-type: none"> • Consider developing a teacher-created formative assessment <ol style="list-style-type: none"> 1. The Skills Lab engage activity and Plate Boundaries Map with discussion can assess students' prior knowledge of the current Theory of Plate Tectonics. 2. Plates on the Move and textbook guided reading activities can assess student progression towards mastery of the objectives. 	<p>Summative <i>What evidence of learning will demonstrate to you that a student has met the learning objectives?</i></p> <ol style="list-style-type: none"> 1. ENN News Broadcast can assess students' ability to explain current plate tectonic theory as it relates to a real-world geologic event. 2. Teacher-created short cycle assessment will assess all clear learning targets. Consider utilizing assessment questions from the Earth Science Textbook Chapter Test on pp.356-359 in the Earth Science Textbook All-In-One Teacher Resources Unit One Book.
<p style="text-align: center;">EXTENSION/ INTERVENTION (1 day or as needed)</p>	<p>EXTENSION</p>	
	<ol style="list-style-type: none"> 1. Earth Science Textbook Performance Assessment: Modeling Plate Boundaries. This can be found on p. 355 in the Earth Science Textbook All-In-One Teacher Resources Unit One Book. 2. Earth Science Textbook Chapter Project: Design and Build an Earthquake-Safe House. This can be found on pp.370-376 in the Earth Science Textbook All-In-One Teacher Resources Unit One Book. 3. Earth Science Textbook Enrich: Magnetic Reversals Through the Ages. This can be found on p. 350 in the Earth Science Textbook All-In-One Teacher Resources Unit One Book. 	<p>INTERVENTION</p> <ol style="list-style-type: none"> 1. Discovery Ed (www.unitedstreaming.com) related videos. 2. www.explorelarning.com GIZMO: Plate Tectonics

COMMON MISCONCEPTIONS

- Only continents move (Wegener's original concept, along with the common use of 'Continental Drift' term in general texts, secondary education earth science films, etc.)
- Most crust motions (especially those associated with processes of mountain building or deep sea trench formation) are due to vertical motions, not lateral (terms like 'mountain uplift' and earth science textbook terminology, as well as relict idea from old cosmologies).
- Divergent ocean ridges are due to vertical uplift or convergence, rather than divergence (In students' experience, buckling is usually due to convergence or uplift, not heat/density differences, so illustrations of ridges do not readily fit with a pulling apart motion).
- Present oceans only began as Pangea broke apart - tied to general idea that Pangea was the original continent at the Earth's start (few educational earth science films mention what came before Pangea & emphasis on Atlantic spreading leads to Pacific being overlooked).
- Plate movement is imperceptible on a human timeframe (common use of fingernail growth analogy is only true for slowest plates and underestimates importance of motion).
- Plate motion is rapid enough that continent collision can cause financial and political chaos, while rifting can divide families or separate a species from its food source.
- Oceans are responsible for oceanic crust (rather than being closer to other way round).
- Continental 'shelves' are similar to shelves in homes, extend out over edge of continent and can break and collapse to form tsunamis (so Boxing Day tsunami was due to shelf collapse)
- The edge of a continent is the same thing as a plate boundary.
- A plate boundary type is the same thing as a plate. For example, a plate has to be divergent or convergent.

*The misconceptions listed above came from:

http://serc.carleton.edu/NAGTWorkshops/intro/misconception_list.html

Strategies to address misconceptions:

Misconceptions can be addressed through the use of www.unitedstreaming.com video clips, pictures/diagrams of plate interactions, boundaries, and geologic events/features, through the use of models, and on-line simulations/animations.

<p style="text-align: center;">DIFFERENTIATION</p>	<p>Lower-level: Provide additional text resources (tradebooks, articles) that are appropriate for the reading level of the student. Integrate www.unitedstreaming.com videos into instruction. Provide pictures and diagrams to help students visualize plate tectonics concepts. Provide an alternative or appropriate revised version of the broadcast project to meet the needs of your students.</p> <p>Higher-Level: Consider having students interpret real-data as evidence for plate movement. Consider having students compare and contrast former theories related to Earth's surface movements (i.e. Continental Drift) with the more current theory. Consider assigning extension activities.</p> <p>Strategies for meeting the needs of all learners including gifted students, English Language Learners (ELL) and students with disabilities can be found at the following sites: ELL Learners: http://www.ode.state.oh.us/GD/DocumentManagement/DocumentDownload.aspx?DocumentID=105521 Gifted Learners: http://www.ode.state.oh.us/GD/DocumentManagement/DocumentDownload.aspx?DocumentID=105522 Students with Disabilities: http://www.education.ohio.gov/GD/DocumentManagement/DocumentDownload.aspx?DocumentID=105523</p>
<p style="text-align: center;">ADDITIONAL RESOURCES</p>	<p>Textbook Resources: <i>Pearson/Prentice Hall Earth Science Textbook</i></p> <ul style="list-style-type: none"> • Chapter 5.5 The Theory of Plate Tectonics pp.150-158. • Chapter 6.1 Forces in Earth's Crust pp. 162-168 • Chapter 7.1: Volcanoes and Plate Tectonics pp.200-204 <p>Websites:</p> <ul style="list-style-type: none"> • Plate Boundary information: http://www.platetectonics.com/book/page_5.asp • Plate and Boundaries – Annenberg Interactives: http://www.learner.org/interactives/dynamiearth/plate.html • http://www.iris.edu/hq/files/programs/education_and_outreach/aotm/11/2a.PlateBoundaries_Background.pdf • Mountain Maker, Earth Shaker: http://www.pbs.org/wgbh/aso/tryit/tectonics/ <p>Discovery Ed/Other Video Links:</p> <ul style="list-style-type: none"> • Discovering Plate Tectonics [7:08] • Plate Tectonics [5:46] • Hot Spots and Plate Tectonics [2:35] • Plate Tectonics, Volcanoes, and Earthquakes [4:50]

Literature/Articles:

- Stille, Darlene, R. (2007). *Plate Tectonics: Earth's Moving Crust*. Minneapolis, Minn.: Compass Point Books.
- Silverstein, Alvin. (2009). *Plate Tectonics*. Minneapolis, Minn.: Twenty-First Century Books.
- Saunders, Craig. (2011). *What Is the Theory of Plate Tectonics?* New York: Crabtree Publishing.
- Erikson, Jon. (2001). *Plate Tectonics: Unraveling The Mysteries of the Earth*. New York: Facts on File.
- Snedden, Robert. (2010). *Earth's Shifting Surface*. Chicago, Ill.: Raintree Publishing.
- Hooper, Meredith. (2004). *Island That Moved: How Shifting Forces Shape Our Earth*. New York: Viking Publishers.
- GeoFacts #3 - Earthquakes and Seismic Risk in Ohio:
<http://www.dnr.state.oh.us/Portals/10/pdf/GeoFacts/geof03.pdf>
- Science News for Kids - A Volcano Wakes Up, by Kate Ramsayer:
<http://www.sciencenewsforkids.com.php5-17.dfw1-2.websitetestlink.com/wp/2004/12/a-volcano-wakes-up-2/>

ENGAGE: Plate Boundary Map – TEACHER PAGE

(Day 2)

1. Project the following website module on the board and make sure you are on the Maps Tab:
<http://ees.as.uky.edu/sites/default/files/elearning/module04swf.swf>
2. Click on the **Boundaries** Tab to show the boundary lines between the plates.
3. Next click on the **Volcanoes** tab to show where volcanoes are located around the world, and that many of them are aligned along plate boundaries.
4. Next Click on **Earthquakes** to show the relationship between Volcanoes and Earthquakes.
5. Next Click on **Hotspots** and explain the difference between plate boundaries and hotspots.
6. Next Click on the **Velocity** Tab to show the direction and movement of the plates.
7. Finally click on the **Names**.
8. Facilitate a discussion using the map and the following guided questions:
 - A. Where are some areas where two plates are coming together? Plate Names?
Answer: North American Plate and Pacific Plate; Eurasian plate and Pacific Plate/Indian-Australian Plate/Arabian Plate/African Plate
 - B. Where are some areas where two plates are moving apart? Plate Names?
Answer: Antarctic Plate and Pacific Plate/ Indian-Australian Plate; African and Eurasian Plates; North American and Eurasian Plates; North American and African Plates; South American and African Plates; Nazca and Pacific Plates; Cocos and Pacific Plates
 - C. Where are some areas where two plates are sliding past one another? Plate Names?
Answer: Scotia and Antarctic/South American Plate; Antarctic and African Plates; African and South American Plates; Caribbean and North American Plates
 - D. Do you see volcanoes forming more around certain types of plate boundary movement?
Answer: Yes – Volcanoes form more around plates that move towards one another (convergent boundaries).

EXPLORE: Plate Boundary Movement – TEACHER PAGE

(Day 3)

1. Project the same website from Day 2:
<http://ees.as.uky.edu/sites/default/files/elearning/module04swf.swf>
or provide students with individual devices (computers, laptops, Ipads).
2. Distribute the 3 Primary Types of Plate Boundaries graphic organizer.
3. Click on the “Details” Tab and show or allow students on their own to view each animation and the related information.
 - Ocean-Continent Subduction
 - Continent-Continent Collision
 - Ocean to Ocean Subduction
 - Continental Rift
 - Mid-Ocean Ridge
 - Continental Transform
 - Oceanic Transform
 - Oceanic Hot Spots (optional)
 - Continental Hot Spots (optional)
4. Assist students with completing the graphic organizer using the information from this website.

Explore: Three Primary Types of Plate Boundaries

Directions:

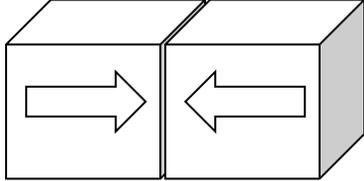
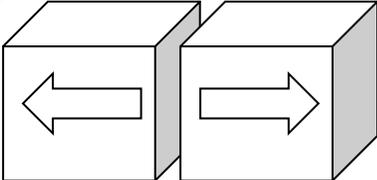
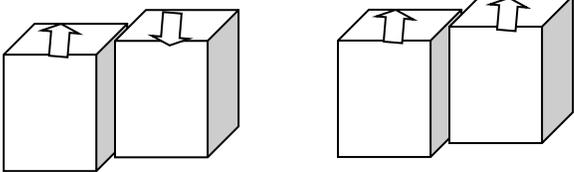
- 1) In Box 1, List the various types of crust movements for each type of boundary.
- 2) In Box 2, describe what type of movement is occurring in each type of plate boundary.
- 3) List the major geological events that result from each type of plate boundary movement.

1) CONVERGENT Boundary	2) Directions of Plate Movement:
	3) Major Geological Events:
2) DIVERGENT Boundary	2) Directions of Plate Movement:
	3) Major Geological Events:
3) TRANSFORM Boundary	2) Directions of Plate Movement:
	3) Major Geological Events:

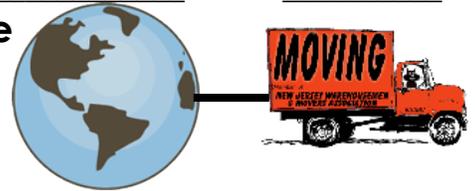
Explore: Three Primary Types of Plate Boundaries

Directions:

- 1) In Box 1, List the various types of crust movements for each type of boundary.
- 2) In Box 2, describe what type of movement is occurring in each type of plate boundary.
- 3) List the major geological events that result from each type of plate boundary movement.

<p>1) CONVERGENT Boundary</p> <p><i>Oceanic-Continent Subduction</i> <i>Continent-Continent Collision</i> <i>Ocean-Ocean Subduction</i></p>	<p>2) Directions of Plate Movement:</p> 
<p>2) DIVERGENT Boundary</p> <p><i>Continental Rift</i> <i>Mid-Ocean Ridge</i></p>	<p>2) Directions of Plate Movement:</p> 
<p>3) TRANSFORM Boundary</p> <p><i>Continental Transform</i> <i>Oceanic Transform</i></p>	<p>2) Directions of Plate Movement:</p> 
	<p>3) Major Geological Events:</p> <p><i>Volcanism</i> <i>Mountain Building</i> <i>Earthquakes</i></p>
	<p>3) Major Geological Events:</p> <p><i>Sea-Floor Spreading</i> <i>Ocean Basins creation</i> <i>Faults</i> <i>Small Volcanic Eruptions</i> <i>Earthquakes</i></p>
	<p>3) Major Geological Events:</p> <p><i>Faults</i> <i>Earthquakes</i></p>

Explore: Plates on the Move



Google: Plates on the move

Or <http://www.amnh.org/ology/features/plates/index.php>

	When the edges of plates meet, four things can happen:	DESCRIPTION	ARROWS
1	SLIP (transform boundary)		
2	SPREADING (divergent boundary)		
3	COLLISION (convergent boundary)		
4	SUBDUCTION		

CLICK on:



1. Click on a red dot to explore a volcano, mountain, hot spot, or earthquake.
2. After you zoom into it, look at the map to see how the plates are moving. Record the location, the plates involved, and the type of plate interaction/movement (slip, spreading, collision, subduction, hotspot).
3. To the left play the animation about the plate interaction.
4. Click on STATS, and record information.
5. CLICK on STORY. Write 4 sentences about the location.

Name _____ Date _____ Period _____

PLATES ON THE MOVE

Location 1 : _____

Plates Involved are: _____

Type of interaction: (circle one)

SLIP (transform)	SPREADING (divergent)	COLLISION (convergent)	SUBDUCTION (convergent)	HOT SPOT
---------------------	--------------------------	---------------------------	----------------------------	----------

****Play animation****

STATS:

Event: _____ Date: _____

STORY: _____

Location 2 : _____

Plates Involved are: _____

Type of interaction: (circle one)

SLIP (transform)	SPREADING (divergent)	COLLISION (convergent)	SUBDUCTION (convergent)	HOT SPOT
---------------------	--------------------------	---------------------------	----------------------------	----------

****Play animation****

STATS:

Event: _____ Date: _____

STORY: _____

Explore: Plates on the Move



Google: Plates on the move

Or <http://www.amnh.org/ology/features/plates/index.php>

	When the edges of plates meet, four things can happen:	DESCRIPTION	ARROWS
1	SLIP (transform boundary)	Two plates slide past each other	
2	SPREADING (divergent boundary)	Two plates move a part from each other	
3	COLLISION (convergent boundary)	Two plates crash and fold up	
4	SUBDUCTION	One plate sinks below the other	

CLICK on:



1. Click on a red dot to explore a volcano, mountain, hot spot, or earthquake.
2. After you zoom into it, look at the map to see how the plates are moving. Record the location, the plates involved, and the type of plate interaction/movement (slip, spreading, collision, subduction, hot spot).
3. To the left play the animation about the plate interaction.
4. Click on STATS, and record information.
5. CLICK on STORY. Write 4 sentences about the location.

Answers Will Vary

WHOOSH!

Teacher Page

A WOOSH is used as a kinesthetic way to get students excited about vocabulary.

- Begin by modeling a WHOOSH for your students
- Students will develop their own movements to go along with the unit's vocabulary and share their movements with a partner.
- The teacher will tell a story using the new vocabulary words. When a student hears these words, they will do their corresponding movement.
- The class will then split into small groups and each group will create their own story using the vocabulary.
- Groups will then present their WHOOSH to the class and the teacher can assess their learning of new vocabulary.

Use the following story as a guide on how to facilitate a Whoosh in your class.

1. Explain to students that they will begin the unit by giving movement to the vocabulary they will be learning.
2. The class will form a circle, and you will tell a story using three of the unit's vocabulary words.
 - a. As you read the story, pull individual students out to perform the movement you assign. Movement is indicated by (parenthesis)
3. When WHOOSH is called all students return to their spots in the circle.

Story using: Tectonic Plates, Convection Currents, Fossils, Climate, Convergent Boundary, Divergent Boundary, & Transform Boundary

The earth's crust is made up of tectonic plates **(Student crosses arms)** that are in constant motion. Through years of researching fossils **(student makes a "T-Rex" pose)**, and changes in climate **(student begins fanning themselves to shivering as if cold)** scientists have discovered the plates are moving because of convection currents **(Student moves arms in a circular motion)**.

WHOOSH! (All Students return to their spots in the circle)

These Convection Currents **(Student moves arms in a circular motion)** move the plates into each other, convergent boundaries **(two students with crossed arms bump into each other)** move them away from each other, divergent boundaries **(two students with crossed arms begin back to back, and then move away from each other)**, and move by sliding past each other, transform boundaries **(Two students with crossed arms move in opposing directions and lightly bump shoulders)**

WHOOSH! (All Students return to their spots in the circle)
Repeat multiple times to allow all students to participate.

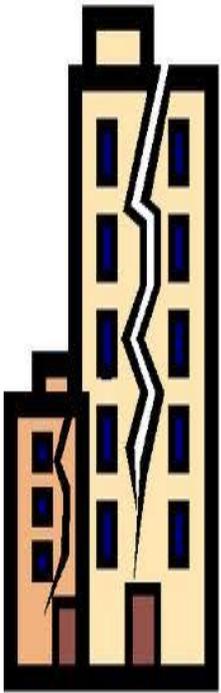
Now pair up students to create their own whoosh using the following vocabulary words and a Prentice Hall Earth Science Textbook: pp. 122 – 155

- **Plate Tectonic Theory**
- **Continental Drift**
- **Convection Theory**
- **Sea Floor Spreading**
- **Plate boundaries**
- **Convection Currents**
- **Earthquakes**
- **Faults**

For additional information about Whoosh, go to:

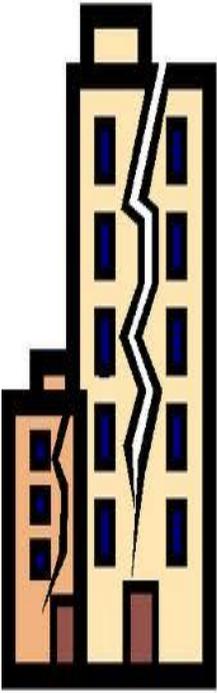
<http://dramaresource.com/resources/features/284-whoosh>

Name _____ Date _____ Period _____



Entrance Ticket: We practice tornado and fire drills, but not earthquake drills. Should we have earthquake drills? Explain why or why not.

Name _____ Date _____ Period _____



Entrance Ticket: We practice tornado and fire drills, but not earthquake drills. Should we have earthquake drills? Explain why or why not.

ENN: Earth News Network – TEACHER PAGE

1. Distribute the ENN Breaking News Task Sheet and Rubric.
2. Go over the task with the students. Ask for a student to paraphrase the directions.
3. Group students into production teams to allow for differentiation and have them research an event (simple one for lower level, increasing complexity for more advanced learners.)

Possible EVENT Topics:

- A. **Volcanic Eruption @ Mount. St. Helens:** Highlights should include – location(Ring of Fire), plate movement impacting volcano formation/eruption, the process involved in the eruption; effects of volcanic eruptions on environment and civilization.
 - B. **Volcanic Eruption – Hawaiian Islands:** Highlights should include – location (Hot Spot), plate movement affecting formation of island chain, the process involved in the eruption; effects of volcanic eruptions on environment and civilization.
 - C. **Earthquakes - San Andreas Fault, California:** Highlights should include – location(fault line/transform plate boundary); plate movement causing the Earthquakes; Seismic waves; effects of Earthquakes on the environment and civilization.
 - D. **Hot Springs ,Geysers, or Volcanism –Yellowstone National Park:** Highlights should include – location (hot spot/supervolcano below the surface); plate movement causing geologic activity; hot spring/geyser/volcano formation; effects of hot springs, geysers, or volcanism on the environment.
 - E. **Hot Springs-Iceland:** Highlights should include- location (Mid-Atlantic Ridge); plate movement/divergent boundary and the effects of sea-floor spreading; Hot spring formation; Effects on environment and civilization.
 - F. **Earthquakes-New Madrid Fault System:** Highlights include – location (fault line); description of plate movement; seismic waves; effects on environment and civilization.
 - G. **Earthquakes near the Himalayan Mountains:** Highlights should include- location (convergent boundary); plate movement causing earthquakes due to the compression forces; mountain building process; seismic waves; effects on the environment and civilization.
 - H. **Tsunami headed towards Hawaii due to an Earthquake in Japan:** Highlights should include- location (Japan...Ring of Fire); plate movement causing Earthquakes; seismic waves traveling through water; effects on the environment and civilization.
4. Students plan their “broadcast” and model, and assign roles within the group. Teacher ensures that students will have the materials necessary to build the models.
 5. Students write the script and begin rehearsing, while teacher facilitates the groups’ progress.
 6. Students build the model and practice their broadcast.
 7. Teacher facilitates and critiques the rehearsals.
 8. Students present their broadcasts while teacher assesses learning outcomes.

EARTH NEWS NETWORK



****Breaking**News****Breaking**
News****Breaking **News****

There are geologic phenomena and events occurring all over the Earth!

As an Earth Science Expert for ENN, you will be given a specific phenomenon/event that is occurring in a certain location and must go before the viewing audience to explain the following:

1. Where the phenomenon/event is occurring
2. Why the phenomenon/event is occurring – the cause as it relates to plate tectonics theory
3. When did the phenomenon/event start and how long it will continue
4. Details that explain the phenomenon/event more in depth
5. How this phenomenon/event influences the population and environment of the affected areas

Our audience expects to see ACTION, so you must include a working model to demonstrate the processes, which caused the event. You must assemble a team of no more than 4 to gather the facts, create a model, write the script, and perform your broadcast.

EARTH NEWS NETWORK

Rubric

	4	3	2	1
Plate Tectonics	The presentation exhibits an exemplary understanding of the current scientific view of Earth's dynamics involved in plate movement.	The presentation exhibits a proficient knowledge of the current scientific view of Earth's dynamics involved in plate movement.	The presentation exhibits a basic understanding of the current scientific view of Earth's dynamics involved in plate movement.	There are considerable confusions or major misconceptions about plate tectonics evident in the presentation.
Model	An original model (physical or digital) is constructed which is scientifically accurate and movable to show how the event happened. Exceptional care and effort have been taken to make the model neat and interesting to view.	An original model (physical or digital) is constructed which is mostly scientifically accurate and movable to show how the event happened. Care and effort have been taken to make the model neat and interesting to view.	An original model (physical or digital) is constructed which is moderately accurate to show how the event happened. Some care and effort have been taken to make the model neat and interesting to view.	An original model (physical or digital) is constructed which is movable to show how the event happened. Little care and effort have been taken to make the model neat and interesting to view.
Camera Presence	Voice is <u>clear</u> and <u>loud</u> . <u>Eye contact</u> is maintained with the camera. Speaker shows <u>respect</u> to the viewing audience.	3 out of 4 of the underlined items are met.	2 out of 4 of the underlined items are met.	1 out of 4 of the underlined items are met.
Optional: Use of Data	The presentation includes GPS and Seismic data related to the event and the relevance of the data is clearly explained to the viewers.	The presentation includes GPS or Seismic data related to the event and the relevance of the data is clearly explained to the viewers.	The presentation includes GPS or Seismic data related to the event and the relevance of the data is mentioned to the viewers.	The presentation includes GPS or Seismic data related to the event with no accompanying explanation to the viewers.