

## 5E Lesson Template

<b>Lesson Author(s)</b>	L Ochsie
<b>Lesson Title</b>	Let's Explore Plate Tectonics!
<b>Lesson Source</b>	<p>The Topography of Plate Tectonics in Google Earth  <a href="http://www.gearthblog.com/blog/archives/2014/03/topography-plate-tectonics-google-earth.html">http://www.gearthblog.com/blog/archives/2014/03/topography-plate-tectonics-google-earth.html</a></p> <p>Topography of Plate Tectonics  <a href="https://maps.google.com/maps/ms?msid=202977755949863934429.0004f306429540aff190e&amp;msa=0&amp;dg=feature">https://maps.google.com/maps/ms?msid=202977755949863934429.0004f306429540aff190e&amp;msa=0&amp;dg=feature</a></p> <p>NOAA: Touring the Ocean Bottom  <a href="http://www.youtube.com/watch?v=vpyNtxPReaw&amp;feature=youtu.be">http://www.youtube.com/watch?v=vpyNtxPReaw&amp;feature=youtu.be</a></p> <p>Earthguide Online Classroom, Scripps institution of Oceanography: Maps related to Plate Tectonics  <a href="http://earthguide.ucsd.edu/eoc/teachers/t_tectonics/p_map_plate_layers_bath.html">http://earthguide.ucsd.edu/eoc/teachers/t_tectonics/p_map_plate_layers_bath.html</a></p>
<b>Technology Needs (if any)</b>	Internet
<b>Date/Time Lesson to be Taught</b>	
<b>School</b>	
<b>Supervising Teacher</b>	
<b>Math or Science?</b>	Science—2 class periods
<b>Lesson Concepts</b>	Introduction to the relationship between plate boundaries & earthquakes, volcanoes, and mountains.
<b>Objectives</b>	Students will explore to become familiar with the icons on the map then research a particular geographic area (assigned) to report to the class. In doing so, students will discover that earthquakes, volcanoes & mountains occur along plate boundaries & are caused by plate movement.
<b>CO State Standards</b>	<p>7<sup>th</sup> grade Standard 3 Earth: Concept 1: Major geologic events such as earthquakes, volcanic eruptions, mid-ocean ridges, and mountain formation are associated with plate boundaries and attributed to plate motions</p> <p>a. Gather, analyze, and communicate data that explains Earth's plates, plate motions, and the results of plate motions (DOK 1-2)</p> <p>d. Use web-based or other technology tools to show connections and patterns in data about tectonic plate boundaries and earthquakes, volcanic eruptions, and mountain formation (DOK 1-2)</p>

<b>Materials List and Advanced Preparation</b>	<p>Students will need access to computers with internet.</p> <p>Students should have a general understanding of the difference between a hypothesis, theory &amp; law.</p> <p>Students should be familiar with Alfred Wegner’s Continental Drift hypothesis &amp; have general introductory knowledge that Earth’s crust is broken into “plates” that move, called the Plate Tectonic Theory.</p> <p>To help students to grasp the concepts, teacher should have the measurements from the video (given in km) calculated in miles and/or feet to use during video discussion</p>
<b>Safety</b>	Appropriate use of the internet.
<b>Accommodations for Learners with Special Needs</b>	Visual: adjust screen resolution; supply screen cover for those with sensitivity causing migraines, etc.

**5Es**

<b>1. ENGAGEMENT</b>		<b>Time:10 Minutes</b>
<b>What the Teacher Will Do</b>	<b>Probing/Eliciting Questions</b>	<b>Student Responses and Misconceptions</b>
Briefly review the idea Earth’s crust is broken into “plates” made of ocean and/or continental crust	What do we know about Earth’s crust? What’s the difference between ocean & continental crust? Who came up with the idea of plates? What’s the difference between Continental Drift and Plate Tectonics? What evidence do we have?	Earth’s crust is only land. Plates are either just continental or just ocean crust, never both. Alfred Wegner proved the continents moved (rather than just finding evidence of their movement without proof). No understanding of the difference between a hypothesis, theory & law.
<b>Evaluation/Decision Point Assessment</b>		<b>Student Outcomes</b>
Describe a plate and at least 2 points of evidence for plate movement/Continental Drift. Why wasn’t Wegner’s idea widely accepted?		Most plates have both ocean & continental crust. Evidence includes the “puzzle” fit of continents, plant & animal fossils, climate, geology. Wegner could not prove <u>how</u> the plates move.

2. EXPLORATION		Time: 40 Minutes
What the Teacher Will Do	Probing/Eliciting Questions	Student Responses and Misconceptions
<p>a. Introduce the idea that Wegner lacked the necessary technology to prove his theory.</p> <p>b. Show &amp; discuss video clip (show once in completion, then replay as pause multiple times to explain &amp; discuss): NOAA: Touring the Ocean Bottom <a href="http://www.youtube.com/watch?v=vpyNtxPReaw&amp;feature=youtu.be">http://www.youtube.com/watch?v=vpyNtxPReaw&amp;feature=youtu.be</a></p> <p>c. Introduce map. Give students 5-10 minutes to explore the map &amp; icons. The Topography of Plate Tectonics in Google Earth <a href="http://www.gearthblog.com/blog/archives/2014/03/topography-plate-tectonics-google-earth.html">http://www.gearthblog.com/blog/archives/2014/03/topography-plate-tectonics-google-earth.html</a> Topography of Plate Tectonics <a href="https://maps.google.com/maps/ms?msid=202977755949863934429_0004f306429540aff190e&amp;msa=0&amp;dg=feature">https://maps.google.com/maps/ms?msid=202977755949863934429_0004f306429540aff190e&amp;msa=0&amp;dg=feature</a></p> <p>d. Assign students a region to study in detail. They will have the remainder of the class period (approx. 10 minutes and half of next class). Findings must be presented in a written bulleted list:</p> <ul style="list-style-type: none"> <li>- their region</li> <li>- the number &amp; type of icons</li> <li>- 3 specific facts found by clicking on those specific icons.</li> <li>- the location of their region &amp; the icons with respect to plate boundaries</li> <li>- what they believe is causing the earthquakes, volcanoes, mountains in their region</li> </ul>	<p>a1. Why do you think Wegner couldn't prove his hypothesis?</p> <p>b1. What in the video proves Wegner didn't have the technology?</p> <p>b2. Describe the ocean floor near the edges of the continents.</p> <p>b3. Do you think the continental shelf might make the "puzzle pieces" of the continents fit better or worse?</p> <p>b4. What other evidence did you see in the video that Wegner didn't have?</p> <p>b5. Does anyone know how deep is the ocean compared to our highest mountains?</p>	<p>a. Wegner did prove his hypothesis.</p> <p>b. Wegner couldn't go to the ocean bottom &amp; didn't have a video camera. The ocean floor drops off as soon as you're a couple hundred feet from shore. Oceans are about the same depth as large lakes. All the plates fit together perfectly.</p>
<b>Evaluation/Decision Point Assessment</b>		<b>Student Outcomes</b>

<p>What advantage do we have over Wegner?</p> <p>Describe the ocean floor in comparison to continents. How does knowing what the ocean floor is like help prove Wegner's hypothesis?</p>	<p>Technology!</p> <p>The continents seem to continue out into the ocean before dropping off sharply &amp; deeply! Seeing the ocean floor features gives proof to Wegner's hypothesis, including mid-ocean ridges, ocean trenches, and continental shelves.</p>
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<b>3. EXPLANATION</b>		<b>Time: 20 Minutes</b>
<b>What the Teacher Will Do</b>	<b>Probing/Eliciting Questions</b>	<b>Student Responses and Misconceptions</b>
<p>Have the map on an overhead screen. Lead a discussion as students present:</p> <ul style="list-style-type: none"> <li>- their region (teacher will point out the region on the map before the student continues)</li> <li>- the number &amp; type of icons</li> <li>- 3 specific facts found by clicking on those specific icons.</li> <li>- the location of their region &amp; the icons with respect to plate boundaries</li> <li>- what they believe is causing the earthquakes, volcanoes, mountains in their region</li> </ul>	<p>What specific/interesting things did you learn by clicking on the icons in your area?</p> <p>How many volcanoes/ earthquakes were there?</p> <p>What is the relationship between your region &amp; plate boundaries?</p> <p>Why do you think these earthquakes, volcanoes &amp; mountains are happening?</p>	<p>There wasn't a plate boundary in my region.</p> <p>The earthquakes, volcanoes &amp; mountains are causing the plates to move.</p>
<b>Evaluation/Decision Point Assessment</b>		<b>Student Outcomes</b>
<p>Students recognize most earthquakes, volcanoes &amp; mountains happen along plate boundaries, both on land &amp; in the ocean</p>		<p>Student will turn in the completed assignment (bulleted list).</p> <p>Students recognize that earthquakes, volcanoes &amp; mountains happen along plate boundaries</p>

4. ELABORATION		Time: 20 Minutes
What the Teacher Will Do	Probing/Eliciting Questions	Student Responses and Misconceptions
<p>Go to <a href="http://earthguide.ucsd.edu/eoc/teachers/tectonics/p_map_plate_layers_bath.html">http://earthguide.ucsd.edu/eoc/teachers/tectonics/p_map_plate_layers_bath.html</a> Click on "Plates", "Subduction Zones" "Mid-Ocean Ridge"</p> <p>Replay the video, then point out the locations from the video on either (both) maps.</p> <p>Draw attention to the fact plate boundaries have <i>either</i> a trench or a mid-ocean ridge, not both.</p> <p>Briefly introduce vocabulary:</p> <ul style="list-style-type: none"> <li>- Convergent Boundary</li> <li>- Divergent Boundary</li> <li>- Subduction zone</li> </ul> <p>(If students notice some boundaries have neither, tell them that will be discussed another day (Transform))</p>	<p>What differences do you see in the ocean floor between the boundaries where there's a trench vs. a mid-ocean ridge?</p> <p>Why couldn't a boundary have both a trench and a mid-ocean ridge?</p> <p>How do we know the plates are moving at all?</p>	<p>There's no difference, just in some places the ocean is deeper.</p> <p>The trench goes up, the mid-ocean ridge goes down.</p> <p>You can't move toward something and away at the same time.</p> <p>We know plates are moving because of earthquakes &amp; volcanoes &amp; mountains.</p>
Evaluation/Decision Point Assessment		Student Outcomes
<p>Why do we know Earth is moving at these boundaries?</p> <p>How do we know the plates are moving in different directions?</p>		<p>Earthquakes, volcanoes &amp; mountains</p> <p>There are both mid-ocean ridges &amp; trenches</p>

<b>5. EVALUATION</b>		<b>Time: 10 Minutes</b>
<b>What the Teacher Will Do</b>	<b>Probing/Eliciting Questions</b>	<b>Student Responses and Misconceptions</b>
Review student assignment, particularly last question (what they believe is causing the earthquakes, volcanoes, mountains in their region).	Exit ticket: - Why didn't Wegner know all this? - What is the relationship between plate boundaries & earthquakes, volcanoes & mountains?	<ul style="list-style-type: none"> <li>- Wegner didn't have the technology</li> <li>- Earthquakes, volcanoes &amp; mountains occur along plate boundaries</li> </ul>
<b>Differentiation</b>		<b>Time: N/A</b>
<b>Students who are behind or need support.</b>	<b>For advanced or gifted students.</b>	
<ul style="list-style-type: none"> <li>- Help them find &amp; understand the info on the map/icon links.</li> <li>- Shorten written assignment</li> <li>- If an entire class, delete the portion about the continental shelf/slope</li> </ul>	<ul style="list-style-type: none"> <li>- Use their knowledge of prefixes &amp; suffixes to figure out the difference between a convergent &amp; divergent boundary, and the meaning of subduction.</li> <li>- Investigate the depth of the Marianas Trench in comparison to the Grand Canyon &amp; Mt. Everest.</li> </ul>	