

StarLab Planetarium

Plate Tectonics

Lesson Plan

Adapted from “The Changing Earth”
Astronomy and More, www.starlab.com

Title:	The Ever Changing Earth
Brief Overview:	In this lesson students will be able to see the correlation between the formation of the Earth’s crust and its movements, collisions, and destruction.
Objectives:	<ul style="list-style-type: none">• Student will able to understand the Theory of Plate Tectonics and the movement of crustal plates over time.• Students will be able to describe the three types of plate boundaries, (constructive boundaries-ridges, destructive boundaries-ocean trenches, and transform boundaries-fault zones).• Students will be able to use the Plate Tectonics Cylinder and a map of the earth to locate the following areas and mark them on the map: volcanoes, earthquakes, ridge, plate boundaries.• Students will be able to explain why earthquakes and volcanoes occur near plate boundaries.
Purpose:	To review the Theory of Plate Tectonics and emphasize the relationship between volcanoes, earthquakes and plate boundaries.
MA DOE Science and Technology/Engineering Learning Standards	Earth and Space Science Grades 6-8 5. Describe how the movement of the earth’s crustal plates causes both slow changes in the earth’s surface (e.g., formation of mountains and ocean basins) and rapid ones (e.g., volcanic eruptions and earthquakes). <i>Taken From: http://www.doe.mass.edu/frameworks/scitech/1006.doc</i>
Framing the Learning	These are the steps in the completion of this activity. <ol style="list-style-type: none">1. Remind the students of all the rules concerning entering and exiting the Starlab Planetarium.<ol style="list-style-type: none">a. Take off your shoes before entering the Starlab.b. Don’t touch or sit on the walls of the Starlab.c. Walk to carpet square and remain seated.d. Keep your hands to yourself.e. Listen to the teacher, absolutely no talking.2. Allow the students 4-5 minutes for their eyes to adjust.3. Turn on the Celestial Coordinates cylinder after all students are seated and ready.4. Introduce the activity with this information: The earth seems to be a peaceful planet most of the time. Day and night follow each other, the air temperature rises and falls, storms come and go. Such changes usually

do not upset people's lives very much. At times, however, violent changes occur. An earthquake may rumble across the earth, changing the shape of the land. A volcano may erupt, burying the ground for kilometers with ash and lava. Events like these can affect both people and the earth itself. In today's lesson you will have the opportunity to investigate how movements of the top layers of the earth can cause earthquakes, volcanoes, and the formation of mountains.

To begin our exploration of plate tectonics, we are going to gather some facts about the earth using a special projection on the dome overhead. Rather than the dome representing the sky, today it will represent a huge globe with us in the middle. This globe has been carefully labeled to show the location of different features on the earth. Your job will be to find certain features on the dome and mark their location on the maps of the earth you will be getting. You will be doing this in small groups with each group working on a different feature. Once all the information has been gathered, we will spend time comparing the maps from the different groups.

Procedure A

- Divide the class into four groups of 3, 4 or 5 students each. Assign each group a different feature to locate and mark on their maps: volcanoes, active ridges, faults, plate boundaries.
- Distribute the earth maps and pencils to the students. Bring down the lights. Turn on the projector. Give students a moment to look at the projection on the dome, and then explain the legend (volcanoes are represented by dots, faults by lines, etc.). Turn on the reading lights.
- Circulate among the groups as they work, offering help as needed. After approximately 10-15 minutes, turn on the room lights and ask the students to stop working. Explain that in order to evaluate the information that was collected, each student will need to compare their group's map with the maps that were completed by the other groups. While they are doing this, they will also have to complete a worksheet that will ask various questions about their data.

- Worksheets will be distributed to the students. Ask the students in group 1 to work with a partner from group 2, and the students in group 3 to work with a partner in group 4. After a short work period, ask students to switch one last time. Group 1 students should work with group 4 and group 2 with group 3 students.
- After the students have had time to compare their data with those from the other groups, the earth map will be distributed showing the location of earthquakes and students will then complete the last two questions on the worksheet. They should do this individually and not as a group. When students have finished this last task, engage them in a discussion on their findings.

Procedure B

To demonstrate to the class how plates rubbing together can cause an earthquake, we will conduct this following activity. Students will be asked to press their two palms together tightly. As they press their palms together, instruct them to try to rub one palm over the other. Their palms will suddenly slip past each other. This action would be similar to an earthquake at a fault zone. The lesson will then be summarized as follows:

The Theory of Plate Tectonics helps to explain the formation of the earth's crust and movements, collisions, and destruction. This theory suggests that the crust of the earth is made up of a number of large rigid plates and a number of small ones. The layer of the earth under the crust is the mantle. The upper mantle is made up of hot rock. The plates on the crust float on this hot rock. The whole system of plates is like a jigsaw puzzle. One plate can not move without affecting the other plates. The plates collide in some places and slip past or over each other. Many of the features you found today-volcanoes, earthquakes, etc.-are to be found at the boundaries of the plates, where the plates are spreading, colliding or rubbing against each other. Forces that cause the plates to move are not fully understood. Many scientists believe that differences in heat and density in the mantle cause material to flow. Thus moving parts of crust. Others think that convection in the mantle produces up-currents under ocean ridges and down currents under trenches, other ideas have been suggested, but as of yet we just don't know the answer.

	<p><u>Procedure C</u></p> <p>To conclude this lesson it will explained that scientists and geologists will continue to gather data about the changing earth.</p> <p>In 1976 a satellite was placed in orbit above the earth. This particular satellite looked like a like a giant brass golf ball covered with 425 small reflectors the reflectors bounced back high-powered pulses of laser light that were aimed at the satellite. The time it takes for the light to be reflected back was measured, and in this way scientists could calculate the exact distance to the satellite. By placing laser guns around the world, on various plates, scientists are able to track the exact rate and direction of the plates as they move about the ever-changing earth.</p>
Assessment	<p><i>The following will provide evidence of understanding:</i></p> <ul style="list-style-type: none">• The Changing Earth: STARLAB Activity One• Group Participation• The Changing Earth: STARLAB Activity Two