

## Earthquakes 6-8

### Earthquake Science

## LESSON PLAN 2

# Plates of the World

Young people will understand where most seismic activity occurs and why by learning about the plates of the earth.

### Key Terms and Concepts

continental crust	earthquakes	Ring of Fire
convection currents	landforms	seismicity
convergent plates	oceanic crust	subduction zones
divergent plates	plate tectonics	volcanoes

### Purposes

To impart basic ideas about the plates of the earth, that they float apart, collide and slip beside each other

To enable students to understand that the movement of the earth's plates through the ages accounts for earthquakes, volcanic eruptions and changes to the surface of the earth

### Objectives

The students will—

- Define the terms “convergent” and “divergent.”
- Use *Plate Tectonics in a Box* to demonstrate oceanic and continental plate movement.
- Complete a diagram on *Reading Earth's Features* to analyze plate movements and the features the movements create, both above and below water. (Linking Across the Curriculum)
- Identify the Ring of Fire and the correlation between the features of the earth and its seismicity by following *Epicenters Around the World* and *Earth's Moving Plates*.
- Use *Earth's Moving Plates* to identify the cause of the earth's major features. (Linking Across the Curriculum)
- Conduct research on the Internet to locate volcanic activity within the Ring of Fire. (Linking Across the Curriculum)
- Write stories to explain the movement of shells and other sea fossils from the ocean floor to the mountains of Alaska. (Linking Across the Curriculum)
- Write monologues from the point of view of a landform to describe its birth and evolution across the millennia. (Linking Across the Curriculum)

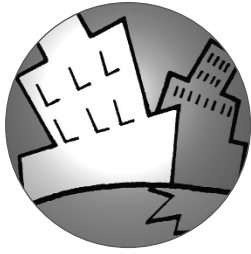
### Activities

“How Plates Collide”

“The Ring of Fire”



Visit the American Red Cross Web site  
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# Earthquakes

## 6–8

### LESSON PLAN 2

## Plates of the World

### Materials

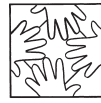
- Chalkboard and chalk or chart paper and markers

For each group, or 1 class demonstration set:

- *Plate Tectonics in a Box*
- Scissors
- Shoebox
- Several sheets of plain paper
- 2 sheets of cardboard
- Tape
- Markers
- *Reading Earth's Movements*, 1 copy per student (Linking Across the Curriculum)



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## “How Plates Collide”

**SET UP** 15 minutes **CONDUCT** 60 minutes, plus time for any necessary research

**Science:** Earth Science; **Language Arts:** Research and Presentation

**TEACHING NOTE** You may divide the class into small groups and have each group demonstrate different ways tectonic plates move in relation to each other. As an alternative, you may complete the activity as a class demonstration.

-  Write the terms “convergent” and “divergent” on the chalkboard. Have the students discuss the meanings of the words: In what ways have they seen them used?  
(Answers may include—in mathematics, a series of numbers or lines that come together; in biology, different evolutionary lines that come together or take different tracks; in geology, plate movements; in the news, coming together or moving apart on an issue; and in language, the same and different.)  
What words or meanings can they see within them?  
(Answers may include—*Con-* is a prefix that means coming together or meeting, like convention or convene. *Di-* is a prefix that means different or apart, like diverse cultures. *Verge-* is a boundary or limit, or the edge or brink; the shoulder of a road is the verge.)  
How are the terms used when talking about the earth’s tectonic plates?  
(Answers may include—Plates that move toward each other are convergent, and plates that move apart are divergent.)
2. Divide the class into small groups and distribute *Plate Tectonics in a Box* to each. Assign each group a type of plate movement to demonstrate for the class.



### Wrap-Up

Once the groups have set up their assigned demonstrations, bring the groups back together to present them to the class.



As groups demonstrate each concept, make sure they illustrate a clear, graphic understanding of the following:

*Divergent Plates:* Plate boundaries are moving apart. As they separate, magma seeps upward to fill the gap, and it hardens as it cools to form new oceanic crust, at mid-ocean ridges.

*Convergent Oceanic and Continental Plates:* Plate boundaries move together. If one plate is oceanic and the other continental, the less dense, oceanic crust will dive below the denser, continental crust, as seen at subduction zones.

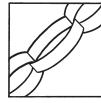
*Convergent Continental Plates:* If both plates are continental, the plates collide and can form mountain ranges, such as the Himalaya Mountains.



# Earthquakes 6-8

## LESSON PLAN 2 Plates of the World

*Transform (Lateral) Plate Movement:* When two plates slide horizontally past each other, they will catch or get stuck, and the pressure to move will increase. The increasing stress builds until the plates break free, releasing the energy in the form of an earthquake.

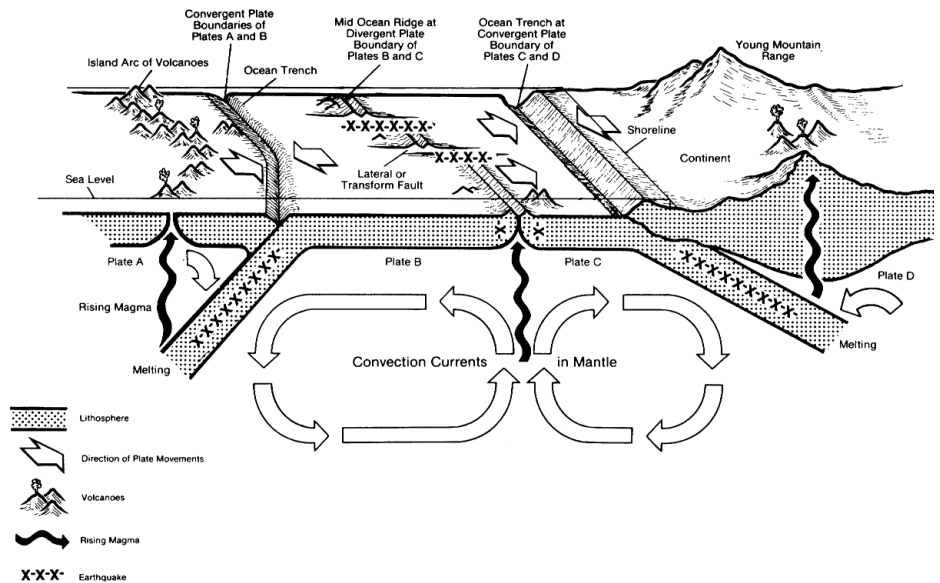


### Linking Across the Curriculum

**Science:** Earth Science; **Social Studies:** Geography; **Language Arts:** Reading

Guide the students to apply their understanding of convection currents and plate boundaries and movement. Distribute *Reading Earth's Features*. Have students work alone or in pairs to interpret plate movement to identify what's happening to the earth's crust, both above and below sea level.

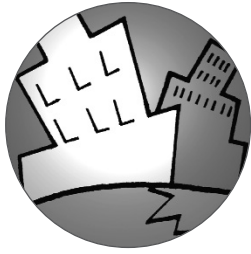
### Answers to *Reading Earth's Features*



1. Island Arc of Volcanoes
2. Convergent Plate Boundary of Plates A and B
3. Ocean Trench
4. Mid-Ocean Ridge at Divergent Plate Boundary of Plates B and C
5. Ocean Trench at Convergent Plate Boundary of Plates C and D
6. Young Mountain Range
7. Lateral or Transform Fault



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# Earthquakes

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## LESSON PLAN 2

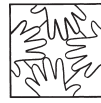
### Plates of the World

#### Materials

- World map or globe
- Push pins or small, clear "sticky" notes, possibly in the shape of arrows
- *Epicenters Around the World*, 1 copy per student
- *Earth's Moving Plates*, 1 copy per student
- Markers
- *Earth's Moving Plates*, 1 copy per student (Linking Across the Curriculum)



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## "The Ring of Fire"

SET UP 15 minutes CONDUCT 1 or 2 class sessions

Science: Earth Science; Social Studies: Geography

1. As a whole class, have the students use the world map or globe to point out where they believe earthquakes occur. If possible, place push pins or sticky arrows at each point.
2. Distribute *Epicenters Around the World* to the students. Have them compare their suggested earthquake events to actual events. What surprised them the most? What areas were the most obvious to them? Why? Where is the Ring of Fire and why is it named that? (The Ring of Fire refers to a zone or arc around the edge of the plate that starts at New Zealand, moves north along the east side of Asia, across Alaska's Aleutian Islands and south along the west coast of North and South America. Many volcanoes are located and earthquakes occur along the Ring of Fire.)
3. Next, distribute *Earth's Moving Plates* and have the students compare this map with *Epicenters Around the World*. What have they discovered? (Most tectonic events occur directly along plate boundaries.)



#### Wrap-Up

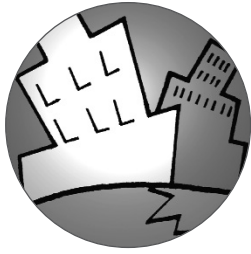
Have the students work in small groups with the handout *Earth's Moving Plates* to identify whether the plates are converging, diverging or moving laterally (transforming) at the points where they meet.



Based on what they've learned, have the groups select different plate boundaries and project what geologic events or changes might occur there in the future.

For example:

- At the Pacific Plate and the Nazca Plate, new crust is developed as the plates continue to diverge.
- The Andes Mountains will continue to rise, and the crust of the Nazca Plate will plunge into the magma where the South American and Nazca Plates converge.
- The Pacific and North American Plates will continue to collide and scrape as they move laterally, the Pacific Plate moves to the north, while the North American Plate remains relatively still.

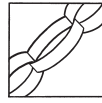


# Earthquakes

## 6–8

### LESSON PLAN 2

### Plates of the World



#### Linking Across the Curriculum

##### Social Studies: Geography; Science: Earth Science

Using a map of the world and the handout *Earth's Moving Plates*, have the students identify features or events that have been caused by the movement of the earth's plates. For example: the volcanic islands that form Hawaii; the tsunami in the Indian Ocean; and the Himalaya Mountains, the earth's newest and tallest mountains, which were formed as the Australian-Indian Plate converged with the Eurasian Plate.

##### Social Studies: Geography; Science: Earth Science



The Ring of Fire is home to many of earth's major volcanoes. Have student groups identify and research some of these volcanoes and complete the following fields of information to create a class chart.

Name of Volcano	Location	Type of Volcano	Last Major Eruption	Current Activity	Photo
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The following are excellent research sites:

Volcano World at <http://volcano.und.edu/>

Volcanoes! at <http://volcano.und.edu/volcanoes.html>

##### Language Arts: Writing; Science: Earth Science

Adventurers in the Rocky Mountains have found tiny shells and other sea fossils. Challenge the students to write a story about a sea creature that dies and falls to the ocean floor and ends up as the discovery of a hiker in the mountains of Alaska. What plates would have carried it to its mountain destination? What events may have moved it from place to place? Direct students to base their stories on information about plate tectonics.

##### Language Arts: Writing and Presentation; Social Studies: Geography

Have the students choose a place where boundary plates have changed the surrounding land, such as a mountain or volcano, a new continent or island or a fault. Writing from the point of view of the landform they have chosen, assign the students to prepare a monologue, explaining the beginnings and development of the landform.

The students must be specific about the country and location of their chosen landform. First, they must research this feature to find—

- Where it is—continent, country and locality.
- What might this landform have been like 10 million years ago? Would it even have existed? When did it begin its development?
- What changes might have happened to this landform over the long course of time?
- What forces do they suppose caused these changes?

Have volunteers share their monologues with the class.

**TEACHING NOTE** Remind students that landforms are affected by forces in addition to tectonic forces, such as erosion, ice or human interaction.



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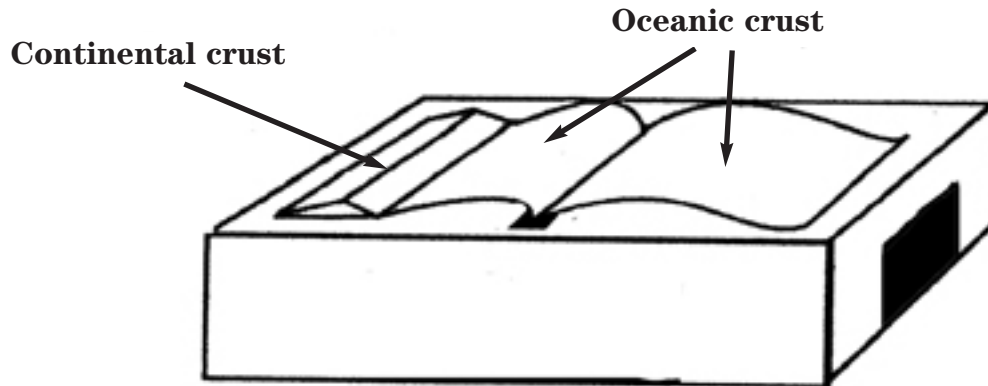


# Plate Tectonics in a Box

Page 1 of 3

Name \_\_\_\_\_

**Directions:** The earth's tectonic plates converge, diverge or just slip by each other. To explain concepts that we cannot see, scientists often build models. Follow the steps below to illustrate "tectonics in a box."



**Note:** An excellent resource can be found at the U.S. Geological Survey's Web site at <http://pubs.usgs.gov/gip/dynamic/understanding.html>.

## Materials:

- Scissors
- Shoebox
- Several sheets of plain paper
- 1 sheet of cardboard
- Markers
- Tape

## Build the Box:

**Step 1:** Slice a narrow slit in the top of the box, long enough and thick enough for two pieces of paper to slide through.

**Step 2:** Cut a large square in one of the short sides of the box, large enough for you to put your hand through.





# Plate Tectonics in a Box

Page 2 of 3

## Demonstration of Divergent Plates

1. Write “Oceanic Crust” across each of two sheets of paper.
2. Slide the sheets of paper, words facing each other, through the slit, more than halfway into the box.
3. Now, slowly push the paper up through the slit. The papers will fall to either side of the box, revealing the words “Oceanic Crust.”

How does this illustrate what happens when tectonic plates diverge?

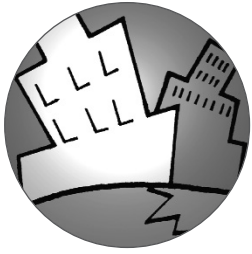
## Demonstration of Convergent Plates: Oceanic and Continental Plates

1. Write “Oceanic Plate” on one sheet of paper. Cut two 1-inch strips from the cardboard. Fold them in half lengthwise. Then, tape the strips across the top third of a second sheet of paper. Write “Continental Plate” across the cardboard folds.
2. Slide the ends of the papers, words facing each other, into the slit, about one-third down.
3. Now, putting your hand in the side opening, slowly pull down the papers through the slit. What happens when the folded strips of “continental plate” get near the slit? What happens to the “oceanic plate”?

How does this illustrate what happens when oceanic and continental plates converge?







# Plate Tectonics in a Box

Page 3 of 3

## Demonstration of Convergent Continental Plates

1. Cut four 1-inch strips from the cardboard. Fold them in half lengthwise. Then, tape two strips across the top third of each of two sheets of paper. Write “Continental Plate” across the cardboard folds.
2. Slide the ends of the papers, words facing each other, into the slit, about one-third down.
3. Now, slowly pull the papers down through the slit. What happens when the folded strips of “continental plate” get near the slit?

How does this illustrate what happens when continental plates converge?

## Demonstration of Transform (Lateral) Plates

1. Cut one sheet of paper in half lengthwise. Cut four 1-inch strips from the cardboard. Fold them in half lengthwise. Cut the strips to fit the width of the paper. Tape four folded strips across the top third of each of the two halves of paper. Write “Continental Plate” across the cardboard folds.
2. Slide one sheet of paper, words and “landmasses” facing inward, into one side of the slit, about one-third down. Slide the other, words and “landmasses” facing inward, into the other side of the slit.
3. Now, slide one paper sideways toward the other. What happens when the landmasses touch?

How does this illustrate what happens when continental plates slide by each other?





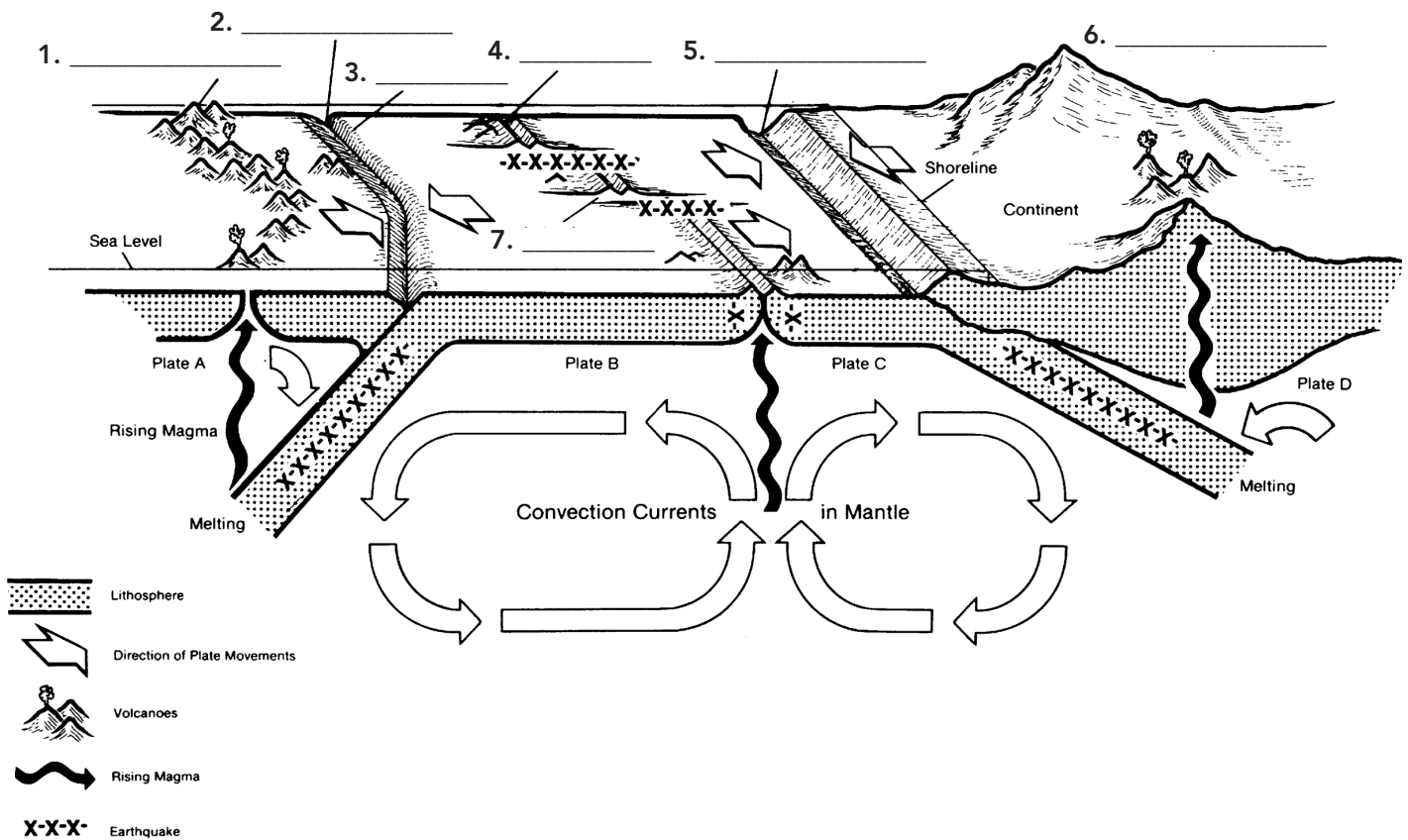


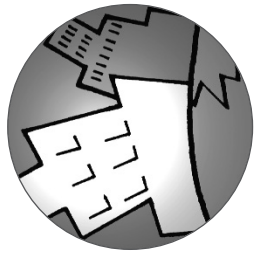
# Reading Earth's Features

Page 1 of 1

Name \_\_\_\_\_

**Directions:** Convection currents in the mantle of the earth cause the movement of the massive plates of the earth. Study the diagram below, following the movements of the plates. Then, label each of the numbered features on the plates to complete the diagram.





# Epicenters Around the World

Page 1 of 1

Name \_\_\_\_\_

**Directions:** This is a map of the epicenters of earthquakes that have occurred around the world. Compare what you see with your ideas of where most earthquakes occur.





# Earth's Moving Plates

Page 1 of 1

Name \_\_\_\_\_

**Directions:** The earth's plates are constantly moving due to the convection currents within the magma. The movement is very slow, about 1 to 2 inches (2.5 to 5 centimeters) per year, or about as fast as your fingernails grow.

The arrows on the plates shown on this map illustrate the direction in which each plate moves. Plates may converge (come together), diverge (pull away from each other) or move laterally (transform).

Use your understanding of the moving plates and the events and changes they cause to describe geologic events that could occur in the future. In each of your geologic suppositions, make sure to include the names of the plates involved, the type of movement and a description of the events or earth changes.

