

# *Greatest Discoveries With Bill Nye:* *Earth Science: Teacher's Guide*

**Grade Level:** 6–8

**Curriculum Focus:** Earth Science

**Lesson Duration:** Three class periods

## **Program Description**

*Inside Our Planet*—Examines Earth's inner and outer cores. *Exploring the Earth*—Illustrates plate tectonics. *Earth's Atmosphere*—Describes Earth's magnetic field and the effects of cosmic radiation. *Earth's Climate Changes*—Examines global warming and Earth's periodic ice ages. *Rocks of Ages*—Analyzes the methods scientists use to date rocks and minerals.

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## **Discussion Questions**

- What are the layers of the Earth?
  - What do changes in weather patterns and climate mean for the Earth?
  - How do we know the Earth's age?
  - Describe Earth's atmosphere.
  - What can rocks tell us about the history of our planet?
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## **Video Index**

### **Segment 1. Inside Our Planet (7 min.)**

#### *Description*

Thanks to the study of seismology, scientists know more about what goes on beneath Earth's surface. Learn about the planet's inner and outer cores and the differences between them.

#### *Pre-viewing question*

Q: Have you ever experienced an earthquake or volcanic eruption?

A: Answers will vary.

#### *Post-viewing question*

Q: What is the difference between Earth's outer and inner cores?

A: The inner core is made of solid iron; it's solid because gravity at the center of the Earth creates pressure 3 million times greater than the pressure exerted on the surface. The outer core is made of liquid iron and other elements. It is a hot, churning mass that generates electric currents, which in turn create the magnetic field that protects against cosmic radiation.

## Segment 2. Exploring the Earth (10 min.)

### *Description*

Examine plate tectonics and the theories of continental drift and seafloor spreading. Discover why geologists believe that Earth's continents may one day be rejoined as one landmass.

### *Pre-viewing question*

Q: Where have you seen evidence of the movement of Earth's plates?

A: Answers will vary.

### *Post-viewing question*

Q: Describe the relationship of continental drift and plate tectonics.

A: According to the continental drift theory, Earth's continents were once part of a giant landmass. Called Pangaea, meaning "all earth," this supercontinent split apart over a period of hundreds of millions of years. According to the theory of plate tectonics, the continents will eventually rejoin, due in part to the process of subduction, which is currently causing the Pacific Ocean's tectonic plate to be consumed and recycled.

## Segment 3. Earth's Atmosphere (9 min.)

### *Description*

Learn about cosmic radiation along with the discoveries that have allowed scientists to predict the weather and analyze Earth's magnetic field.

### *Pre-viewing question*

Q: How does the weather affect you in your daily life?

A: Answers will vary.

### *Post-viewing question*

Q: What are the troposphere and stratosphere?

A: The troposphere and stratosphere are layers in the Earth's atmosphere, each characterized by distinctive meteorological conditions. The troposphere, or sphere of change, is closest to the Earth. Rising from the surface to a distance of about 10 miles, it is where clouds form and weather occurs. Above it is the stratosphere, meaning "sphere of layers," which reaches 30 miles from the surface.

## Segment 4. Earth's Changing Climate (7 min.)

### *Description*

Discover what creates and affects global climate changes from periodic ice ages to global warming.

### *Pre-viewing question*

Q: What do you think causes an ice age to occur?



*Post-viewing question*

Q: What are some examples of global warming?

A: Answers will vary.

**Segment 5. Rocks of Ages (9 min.)**

*Description*

How old is Earth? Learn how geologists learn the ages of rocks and minerals, and find out geological discoveries tell us about Earth's history.

*Pre-viewing question*

Q: How do we measure time?

A: Answers will vary.

*Post-viewing question*

Q: How old is our planet?

A: The Earth is between 4.5 and 6 billion years old.

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## Lesson Plan

### Student Objectives

- Understand plate tectonics and the effects shifting plates have on the Earth.
- Understand the different types of plate boundaries.
- Map major earthquake epicenters and locations of different types of volcanoes.
- Connect different types of plate boundaries to specific earthquake epicenters and volcanoes on their map.

### Materials

- *Greatest Discoveries With Bill Nye: Earth Science* program
- Computer with Internet access
- Print materials with information on plate tectonics
- World map outlines with no place-name labels, 1 per student
- Pencils and erasers
- Markers, colored pencils, or crayons

### Procedures

1. Discover the concept of plate tectonics and how shifting plates affect our planet. Introduce this topic is by showing *Greatest Discoveries With Bill Nye: Earth Science*. Review examples of shifting



plate boundaries. What is taking place at the Mid-Atlantic Ridge? What are the types of plate boundaries? Discuss convergent boundaries, divergent boundaries, transform boundaries, and plate boundary zones. What kinds of Earth changes occur at each type of plate boundary?

2. Give students outline maps of the world and tell them to show areas of seismic activity and active volcanoes. Each finished map must have at least six volcanoes and ten recent or historically important earthquakes from sites from all over the world. Have students create a key, using colored symbols to indicate volcanoes and a scale of seismic magnitude. Students must label the continents, too.
3. Allow students to use the Internet to complete their maps. The following Web sites have information on seismic activity and volcano locations:
  - The Virtual Times: Recent Earthquakes & Active Volcanoes  
<http://www.hsv.com/scitech/earthsci/quake.htm>
  - U.S. Geological Survey: Earthquake Hazards Program  
[http://www.neic.cr.usgs.gov/current\\_maps.html](http://www.neic.cr.usgs.gov/current_maps.html)
  - Geographic Region: Earth's Active Volcanoes  
<http://www.geo.mtu.edu/volcanoes/world.html>
  - U.S. Geological Survey: Earthquakes, Volcanoes, and Plate Tectonics  
[http://vulcan.wr.usgs.gov/Glossary/PlateTectonics/Maps/map\\_quakes\\_volcanoes\\_plates.html](http://vulcan.wr.usgs.gov/Glossary/PlateTectonics/Maps/map_quakes_volcanoes_plates.html)
4. Next, have students research plate boundaries to determine which type of plate movement is occurring at each location on their maps.
5. Have students work with a partner to discuss their findings. Walk around the classroom to assess understanding of plate tectonics and the different types of plate boundaries.

### *Assessment*

Use the following three-point rubric to evaluate students' work during this lesson.

- 3 points: Students were highly engaged in class and partner discussions; created maps that correctly and clearly mapped at least six volcanoes and ten examples of earthquake activity around the world; and correctly identified types of plate boundaries occurring at all their mapped sites.
- 2 points: Students were engaged in class and partner discussions; created maps that correctly and clearly mapped at least four volcanoes and seven examples of earthquake activity around the world; and correctly identified some types of plate boundaries occurring at their most of their mapped sites.
- 1 point: Students participated minimally in class and partner discussions; created unfinished maps that mapped at least three volcanoes and five examples of earthquake activity around the world or used incorrect keys and did not create clearly labeled maps; and did not identify types of plate boundaries occurring at their mapped sites.



## Vocabulary

### **crust**

*Definition:* The outer layer of the Earth

*Context:* The Earth's crust is thicker under the continents than it is under the oceans.

### **earthquake**

*Definition:* Shaking and vibrating at the surface of the Earth resulting from underground movement along a fault plane

*Context:* Earthquakes have helped scientists define the size and shape of tectonic plates.

### **mantle**

*Definition:* The layer of the Earth between the crust and the core

*Context:* The melted rock in the mantle causes the Earth's plates to move.

### **Mid-Atlantic Ridge**

*Definition:* An underwater mountain range in the Atlantic Ocean, stretching from Iceland to Antarctica

*Context:* Eruptions from the Mid-Atlantic Ridge creates new oceanic crust.

### **plate tectonics**

*Definition:* A scientific theory that unifies many of the features and characteristics of continental drift and seafloor spreading into a coherent model; it has revolutionized geologists' understanding of continents, ocean basins, mountains, and Earth history.

*Context:* The theory of plate tectonics did not gain wide scientific interest until the 1960s.

### **subduction**

*Definition:* When an oceanic plate collides with a continental plate and sinks below the latter; results in the creation of oceanic trenches and mountain building

*Context:* Subduction of an oceanic plate consumes, or recycles, the crust.

### **volcano**

*Definition:* A fissure in the Earth's crust through which molten lava and gasses erupts

*Context:* Mount St. Helens is an active volcano in Washington State.

## Academic Standards

### **National Academy of Sciences**

The National Academy of Sciences provides guidelines for teaching science in grades K-12 to promote scientific literacy. To view the standards, visit this Web site:

<http://books.nap.edu/html/nses/html/overview.html#content>.



This lesson plan addresses the following national standards:

- Earth and Space Science: Structure of the Earth's system; Geochemical cycles; Properties of earth materials
- Science and Technology in Society: Science and technology in society
- Science in Personal and Social Perspectives: Natural and human induced hazards; Science and technology in local, national, and global challenges
- History and Nature of Science: History of science; Historical perspectives; Science as a human endeavor

### **Mid-continent Research for Education and Learning (McREL)**

McREL's Content Knowledge: A Compendium of Standards and Benchmarks for K-12 Education addresses 14 content areas. To view the standards and benchmarks, visit

<http://www.mcrel.org/compendium/browse.asp>.

This lesson plan addresses the following national standards:

- Science – Life Sciences: Understands relationships among organisms and their physical environment
- Language Arts – Viewing: Uses viewing skills and strategies to understand and interpret visual media; Writing: Gathers and uses information for research purposes
- Visual Arts – Understands the visual arts in relation to history and cultures
- Science, Technology, and Society

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## **Support Materials**

Develop custom worksheets, educational puzzles, online quizzes, and more with the free teaching tools offered on the Discoveryschool.com Web site. Create and print support materials, or save them to a Custom Classroom account for future use. To learn more, visit

- <http://school.discovery.com/teachingtools/teachingtools.html>

