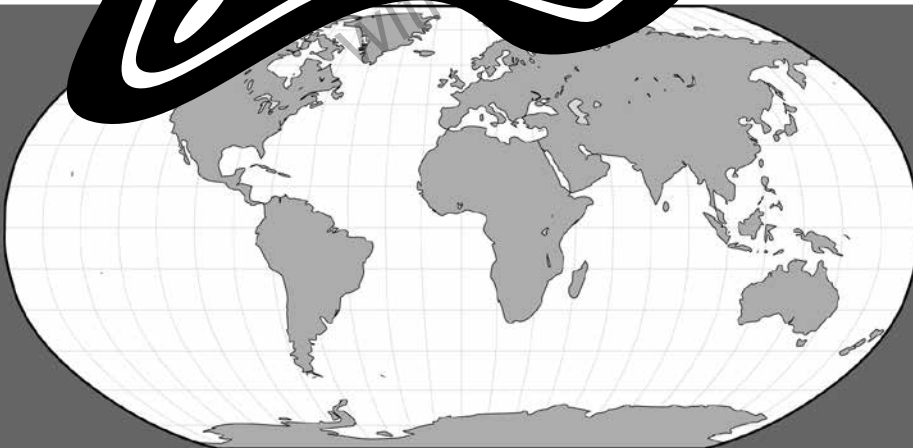


**FOCUS
ON
SCIENCE**

The Structure of Earth

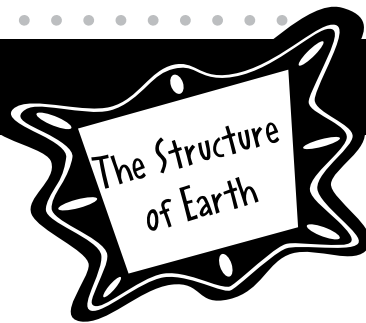
Below Level



Earth Science
Geology

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Scientific Inquiry

The central purpose of scientific inquiry is to develop explanations of natural phenomena in a continuing, creative process.

Construct explanations independently for natural phenomena, especially by proposing preliminary visual models of phenomena.

Differentiate among observations, inferences, predictions, and explanations.

The observations made while testing proposed explanations, when analyzed using conventional and invented methods, provide new insights into phenomena.

Design charts, tables, graphs, and other representations of observations in conventional and creative ways to help them address their research question or hypothesis.

Organize results, using appropriate graphs, diagrams, data tables, and other models to show relationships.

Earth Science

Many of the phenomena that we observe on Earth involve interactions among components of air, water, and land.

The interior of Earth is hot. Heat flow and movement of material within Earth cause sections of Earth's crust to move. This may result in earthquakes, volcanic eruption, and the creation of mountains and ocean basins.

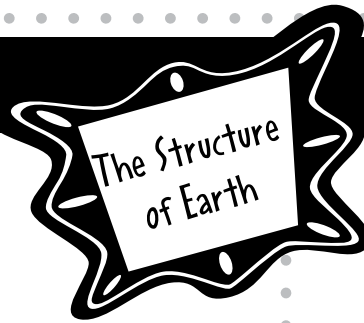
Analysis of earthquake wave data (vibrational disturbances) leads to the conclusion that there are layers within Earth. These layers—the crust, mantle, outer core, and inner core—have distinct properties.

Folded, tilted, faulted, and displaced rock layers suggest past crustal movement.

Continents fitting together like puzzle parts and fossil correlations provided initial evidence that continents were once together.

The Theory of Plate Tectonics explains how the “solid” lithosphere consists of a series of plates that “float” on the partially molten section of the mantle. Convection cells within the mantle may be the driving force for the movement of the plates.

Plates may collide, move apart, or slide past one another. Most volcanic activity and mountain building occur at the boundaries of these plates, often resulting in earthquakes.



English Language Arts

The following is a selective listing of the literacy competencies addressed in this book.

Literacy Competencies

Word Recognition

- Recognize at sight a large body of words and specialized-content vocabulary

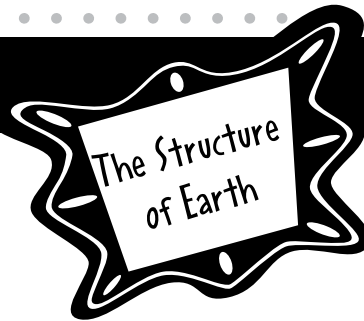
Background Knowledge and Vocabulary

- Determine the meaning of unfamiliar vocabulary and idioms by using prior knowledge and context clues

Comprehension Strategies

- Use a variety of comprehension strategies (e.g., predicting, questioning, summarizing, visualizing, and making connections) to support understanding and response to reading

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How to Help Your Students Make the Best Use of This Book

Encourage students to develop nonfiction literacy skills by completing the Active Reader activities. Also encourage them to . . .

- Underline main ideas in paragraphs.
- Circle details that support the main ideas.
- Write down questions as they read.
- Circle key words as well as unfamiliar words.

Printing Instructions

Student Book: print pages 5–30

Assessments: print pages 31–34

Answer Key: print pages 35–38

**FOCUS
ON
SCIENCE**

The Structure of Earth



How do we as scientists gather and interpret evidence that Earth is continually changing?

Over 200 million years ago Earth's continents were all connected. The land mass was called Pangaea. Later, this single continent split into smaller pieces. They drifted away from each other.

Today these pieces are the seven continents. They are still moving around Earth.

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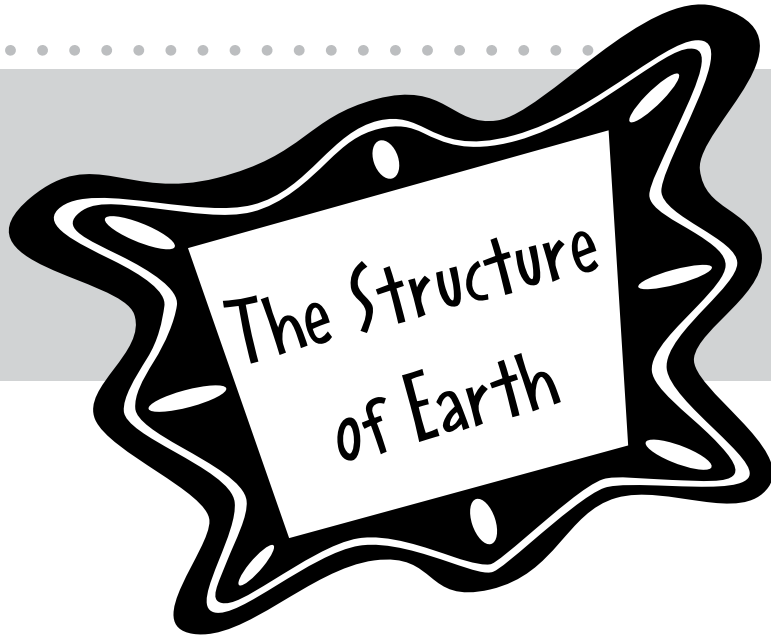


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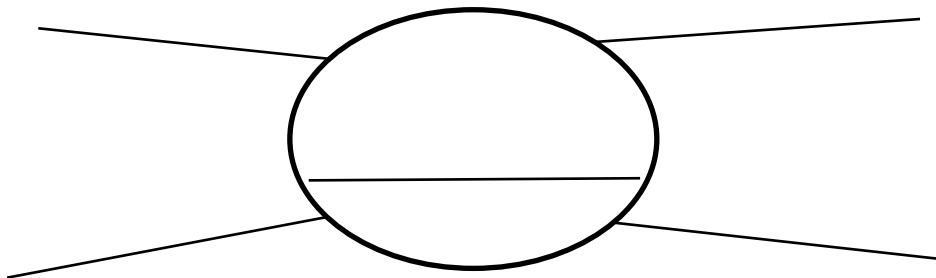
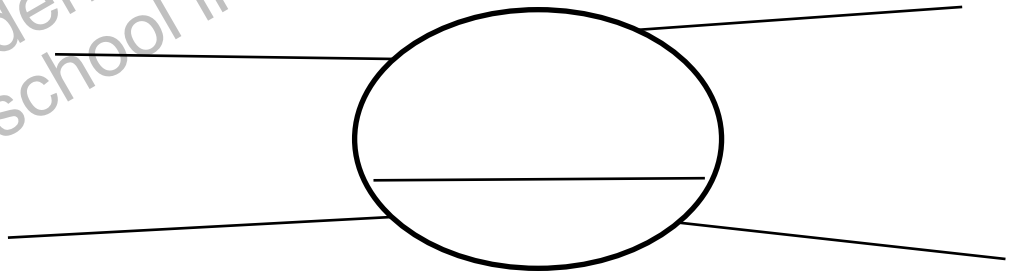
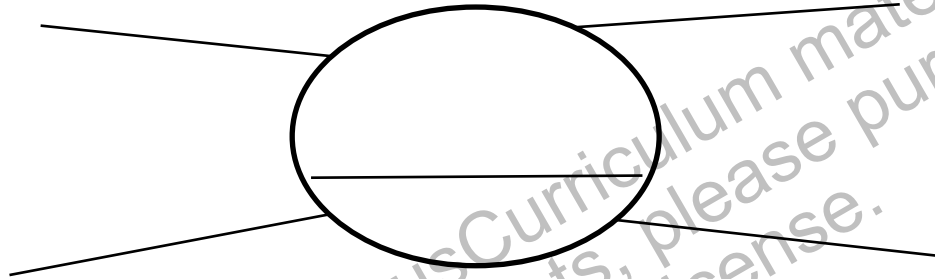


Build Background

Label It

Below are blank word webs, along with a list of words about geology at left. Choose three of the words and write each in the center of a word web. Then, on the spokes coming off the web, write words and phrases that describe or relate to the word about geology.

- volcanos
- rock cycle
- Earth's layers
- earthquakes
- mountains



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Key Vocabulary

Rate Your Knowledge

The words listed below have to do with the structure of Earth. Read each word. Then complete the chart. After completing this book, come back to this page and write the definitions of words you did not know.

| | I don't know it. | I've seen it and I think it means . . . | I know it well. It means . . . |
|---------------------|------------------|---|--------------------------------|
| lithosphere | | | |
| asthenosphere | | | |
| convection currents | | | |
| mid-ocean ridge | | | |
| subduction | | | |
| divergent | | | |
| convergent | | | |
| rift valley | | | |
| fault | | | |
| ocean trench | | | |



Key Concepts

The Rock Cycle

Recall the three types of rock: igneous, sedimentary, and metamorphic. The rock cycle describes how rocks change due to temperature and pressure within Earth.

Igneous rocks have formed from molten material produced during volcanic activity. Those that have cooled on the surface are called extrusive. Basalt is an example. Those that have cooled underground are called intrusive. Granite is an example.

Sedimentary rocks have formed when fragments of other rocks are pressed into layers. Sandstone and shale are examples.

Metamorphic rocks are igneous or sedimentary rocks that have been subjected to extreme heat or pressure underground. Marble is a metamorphic rock that was once sedimentary. Through heat and pressure, the chemical makeup of the rock was changed.

The Rock Cycle

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ACTIVE READER

1 Monitor Underline the three sentences that describe how each type of rock forms.

2 Recall What does the prefix bio- mean?

3 Visualize In the box at left and below, draw a diagram showing how the rock cycle works. Hint: Use arrows to show progression from one stage to another.

Good to Know

Thermal energy within Earth's mantle causes existing rock to melt and turn into molten magma. Granite is an intrusive igneous rock. It is molten magma that has cooled and crystallized under the surface of Earth.



Model the Rock Cycle The rock cycle explains how the three rock types are related to each other. It also shows how Earth processes change a rock from one type to another throughout geologic time. Plate tectonic movement is responsible for the recycling of rock materials and is the driving force of the rock cycle. Prepare the following materials to help you learn more about how the rock cycle works.

| | | |
|------------------|-----------------|-----------|
| Materials | | |
| sugar cube | test tube clamp | hand lens |
| candle | foil | goggles |

1. Examine the sugar cube with a hand lens. How is it like sedimentary rock?

2. Crush the sugar cube into a powder. What part of the rock cycle does this represent?

3. Make a boat with your foil. Pour the crushed sugar into the foil boat. What part of the rock cycle does this represent?

4. With the help of an adult, light the candle. Use the test tube clamp to hold the boat carefully over the candle flame. Observe as the sugar begins to melt. What part of the rock cycle does this represent?

5. Set the foil boat aside and let the sugar cool and harden. What part of the rock cycle does this represent?

6. Break the hardened sugar into pieces. What part of the rock cycle does this represent?

Chapter 1 Continental Drift

FOCUS

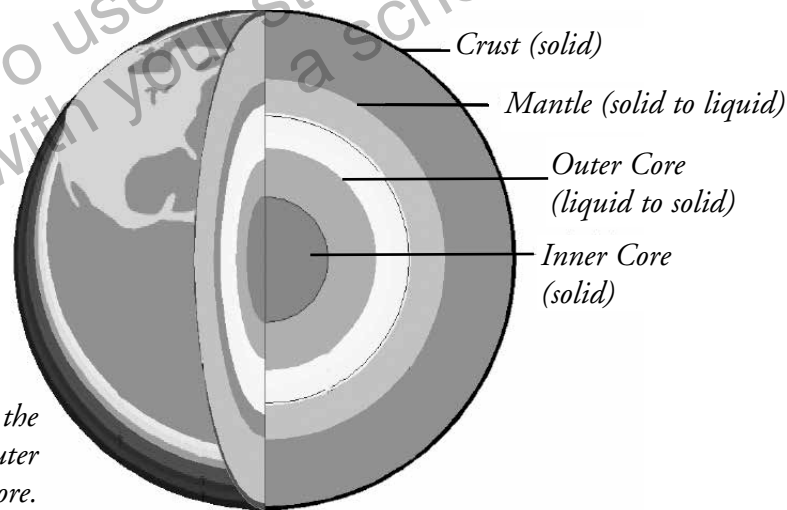
The underlined sentence states an important idea about why the structure of Earth matters. As you read this section, find out about the layers of Earth.

Earth's Interior

Have you ever wondered how mountains are formed or why volcanoes erupt? You already know about the rock cycle. This chapter introduces the interior structure of Earth and the idea of tectonic plates. Together, this knowledge will help you to understand why volcanoes erupt, how mountains are formed, and why earthquakes occur.

In order to understand geologic processes, it is important to understand the interior structure of Earth. Scientists have used many tools and methods to study the size, shape, and density of Earth. Models, topographical maps, and globes display this research.

Using sonar-like waves beamed toward Earth's center, scientists have learned that Earth is divided into four primary layers. Each has distinct properties.



Earth has four main layers: the crust, the mantle, the outer core, and the inner core.

ACTIVE READER

1 List What are the three main layers of Earth?

a. _____

b. _____

c. _____

2 Explain What is the difference between a map and a globe?

Earth's Outer Layers

The outer layers of Earth are divided into the crust and mantle based on rock type. They are also divided into **lithosphere** and **asthenosphere** based on how rigid they are. The lithosphere is the solid, rigid part of Earth. It is made up of the crust and the upper mantle. It extends about 150 kilometers below the surface.

Tectonic plates are located within the lithosphere. A tectonic plate is a massive piece of continental or oceanic crust. Some can be up to 200 kilometers thick. Seven major plates cover the surface of Earth. These are the seven continents.

Beneath this layer of crust is the asthenosphere. It extends from the lithosphere to a depth of about 350 kilometers. The asthenosphere is flexible and not rigid. The rigid tectonic plates float on top of the asthenosphere.

The Core

Nearly 2,900 kilometers below the surface of Earth lies the core. It is made up of a very dense, molten outer core and a solid inner core. The core is made up of the metals iron and nickel. Because of the high temperature within the outer core, it is in a liquid state.

FOCUS QUESTIONS

1. Explain the relationship between tectonic plates and the asthenosphere.

2. What is the lithosphere?

ACTIVE READER

1 Monitor Underline the two ways that the outer layers of Earth are divided.

2 Identify Which two metals compose Earth's core?

Good to Know

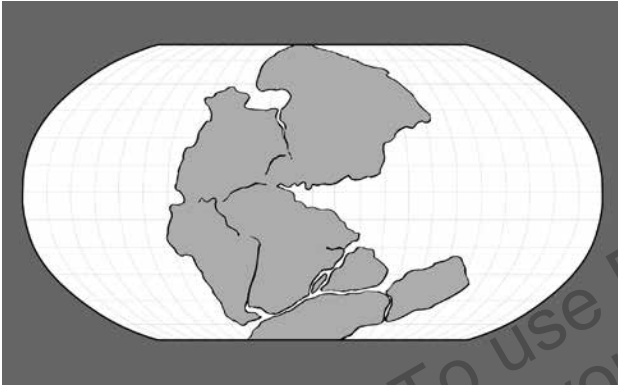
It was once believed that “drifting” tectonic plates plowed or pushed through the ocean floor. Scientists now know that the plates, located within the lithosphere, float on top of the hotter, less rigid asthenosphere.

FOCUS

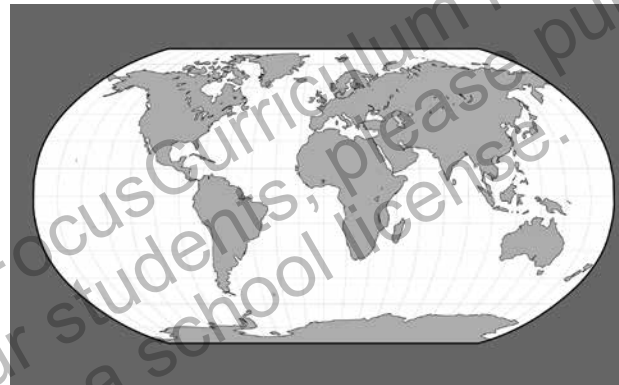
In this section you will learn about the origin of the continents. As you read, note what evidence exists for continental drift.

Puzzle Pieces

When you look at a globe or map of Earth, what do you notice about the shape of the continents? Look at the map at the right. Study the western coastline of Africa. Compare it to the eastern coastline of South America. Now imagine pushing the two continents together. They seem to fit together like pieces of a puzzle, don't they?



225 million years ago



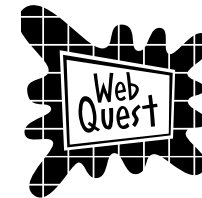
Present Day

In the 1920s, German scientist Alfred Wegener noticed the very same thing. He formed a theory called continental drift. Wegener claimed that the continents once formed one large land mass called Pangaea. He believed that about 200 million years ago the land mass began to break into pieces. These fragments drifted apart.

ACTIVE READER

1 Infer Use the map to describe the location of India 225 million years ago.

2 Identify Who proposed the theory of continental drift?



Did you know that Pangaea split into two large continents before fragmenting further?

Surf the Web to find information on Pangaea. Locate the names of the two continents that Pangaea split into before fragmenting into several smaller continents. How did they get these names?

Evidence for Continental Drift

Shapes of the Continents

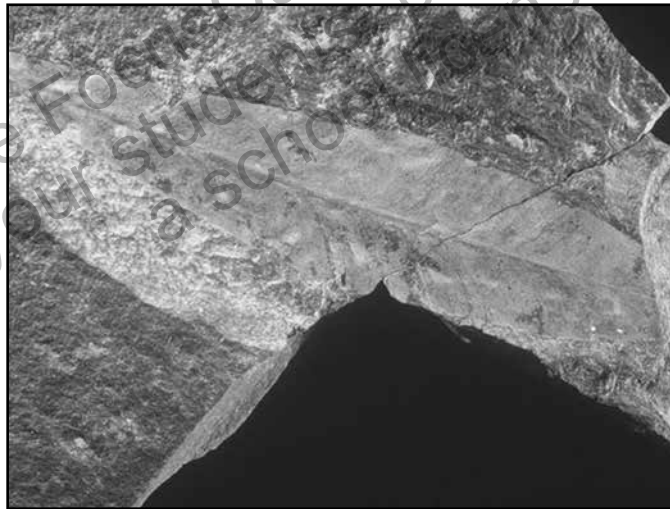
Wegener used a variety of evidence to support his theory. He noticed that when moved around a little, the continents seem to fit together. The coastlines of Africa and South America fit nicely together. Similarly, the coastlines of North America, Asia, and Australia seem to fit together.

Glaciers

Wegener also noticed that the location of glaciers supported his theory. Glaciers are large bodies of ice that move very slowly across the land, creating grooves in the landscape. The glacial grooves found in Australia, India, Africa, and South America support the idea that these areas were once one large glaciated area.

Fossils

Wegener also learned that fossils of an ancient reptile have been found in Brazil and South Africa. But this reptile would have been unable to swim across the Atlantic Ocean. *Glossopteris* was an ancient plant. Its fossils have been found on each continent, yet its seeds were heavy and did not float. It is more likely that the continents themselves drifted apart.



Glossopteris fossils are one form of evidence for continental drift.

ACTIVE READER

1 Explain Which piece of evidence do you find most convincing? Why?

2 Recall On which continents are Brazil and South Africa located?

Good to Know

Fossil remains of the freshwater reptile mesosaurus have been discovered in southern South America as well as in southern Africa. This fossil evidence further supports the theory of continental drift.

Rocks

The location of rocks also supported the theory of continental drift. Identical rock types have been collected from South America and Africa. Rock structures in the Appalachian Mountains in North America are very similar to rock structures in the mountains of Europe and Greenland. The location of mountain ranges also provides evidence. When the continents are pushed together the mountain belts of each continent line up. They are similar in age, sediment, and composition.

What Drives Continental Drift?

There seems to be plenty of evidence to support continental drift. But how do the continents move? Why did one large land mass break into smaller fragments that then drifted apart? Scientists of Wegener's day rejected his theory because he was never able to prove it. In the years after Wegener's death, advanced technology provided additional evidence for continental drift.

FOCUS QUESTIONS

1. Explain how fossil evidence supports Alfred Wegener's theory of continental drift.

2. Explain the "puzzle pieces" evidence for continental drift.

ACTIVE READER

1 List *The mountain belts of each continent are similar in what three ways?*

a. _____

b. _____

c. _____

2 Monitor *Underline the reason that scientists rejected Wegener's theory.*

3 Examine *Identify North America, Europe, and Greenland on a map. Can you see how they once fit together?*

Stop and Think

This page will help summarize what you have read so far.

1. Which statement describes the asthenosphere?

- (1) molten portion of the core
- (2) solid nickel and iron inner core
- (3) solid, rigid crust and upper mantle
- (4) pliable, hot, dense part of the mantle

Tip:
To answer question 1, scan the text for the bold-faced key word **asthenosphere**.

2. What was Alfred Wegener’s theory of continental drift?

- (1) The continents are slowly drifting toward one another.
- (2) A large land mass broke into smaller fragments that then drifted apart.
- (3) Plate motion is a direct result of the activity that occurs beneath Earth’s surface.
- (4) Rocks, plants, and animals have drifted from one continent to another over millions of years.

Base your answers to questions 3 and 4 on your knowledge of the theory of continental drift.

3. What is one example of evidence for continental drift?

4. Why did other scientists reject Wegener’s theory about continental drift when he first proposed it?

Dear Ms. Understanding,

I’ve just learned that North America is drifting from its current location and will be located elsewhere in 50 years. If this is true, should I start preparing to live in a different climate when I’m older?



Wondering in Watertown

Dear Wondering,

The North American continent is indeed moving. But don’t give away your summer clothes just yet! Currently, the continents are moving at a rate of 2-10 cm per year. You won’t notice the movement of the continents, nor will you live in a different climate when you’re “older.”



Ms. Understanding

Chapter 1 Plate Tectonics

FOCUS

This section explains the relationship between continental drift and the rock cycle. As you read, learn about volcanic activity, earthquakes, mountains, and rift valleys.

Plate Tectonics

You have learned about the interior structure of Earth and continental drift. Now, recall your knowledge of the rock cycle. Keep these concepts in mind as you learn about tectonic plates and the thermal forces within the mantle that cause them to move.

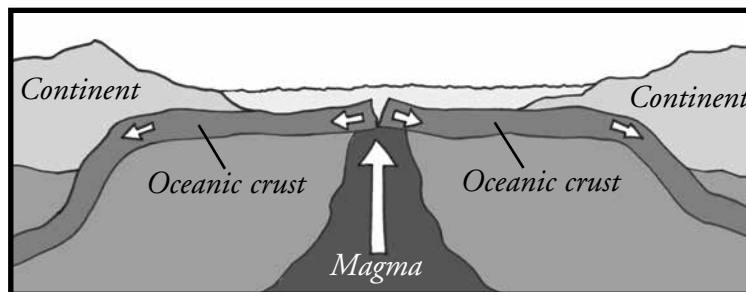
Sea Floor Spreading

In 1960 U.S. scientist Harry Hess proposed a theory called sea floor spreading. The theory explained continental drift. Hess believed that **convection currents** caused continental drift. These slow-moving currents of magma within the mantle caused the plates to move. Here is how it works.

Heated magma rises up at the **mid-ocean ridge**. It cools when it meets the water, creating new sea floor. The new sea floor pushes away from the ridge. As the sea floor slowly moves, it carries the continents with it.

Plenty of evidence exists to support this theory. The rocks that make up the sea floor are older the further they are from the mid-ocean ridges. And, the rock that makes up the oceanic crust is much younger than the continental crust. This supports the idea of **subduction**—that older oceanic crust has been pulled under another plate.

Rising magma creates a new sea floor which pushes away from the ridge.



ACTIVE READER

1 Define What is sea floor spreading?

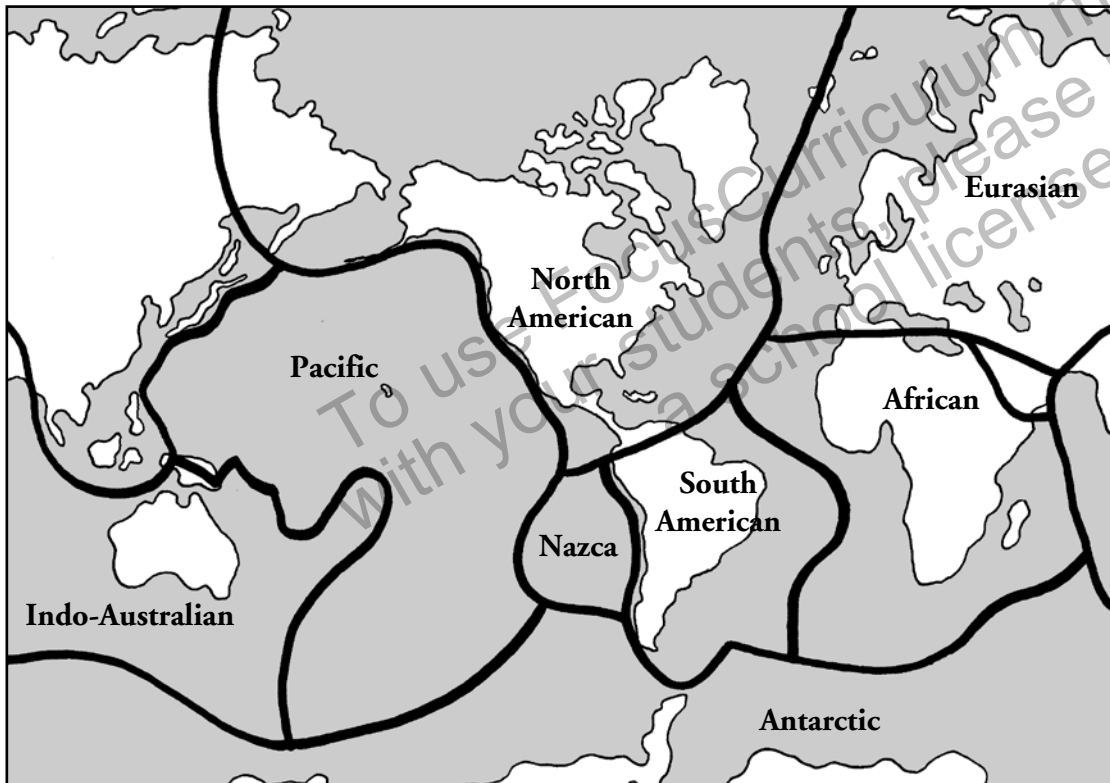
Good to Know

To better understand the convection process, imagine a pot of boiling water. As the water is heated tiny bubbles form and rise to the surface near the center of the pot. They then travel laterally to the outer edges of the pot. As the water cools slightly at the edges, it is drawn back to the bottom. Once there it is heated again, drawn to the center of the pot and pushed to the surface again. The convection process that is creating new sea floor acts in a similar fashion.

Theory of Plate Tectonics

The theory of plate tectonics was formed in the 1960s. Scientists explained that the lithosphere was made up of tectonic plates. Each plate may be made up of continental crust or oceanic crust.

It is common for the plates to interact with one another while drifting. The point at which two plates meet is called a plate boundary. Plates may interact with each other at boundaries in one of three ways. They may separate at a **divergent boundary**, collide at a **convergent boundary**, or slide past one another at a **transform boundary**.



There are eight major tectonic plates on Earth.

ACTIVE READER

1 Interpret Use the map to identify two sets of plates moving away from each other.

a. _____

b. _____

2 Connect The prefix *di-* comes from *dis-*, which means “apart.” The prefix *con-* means “together.” Based on this, provide a definition for divergent and convergent.

Divergent means _____

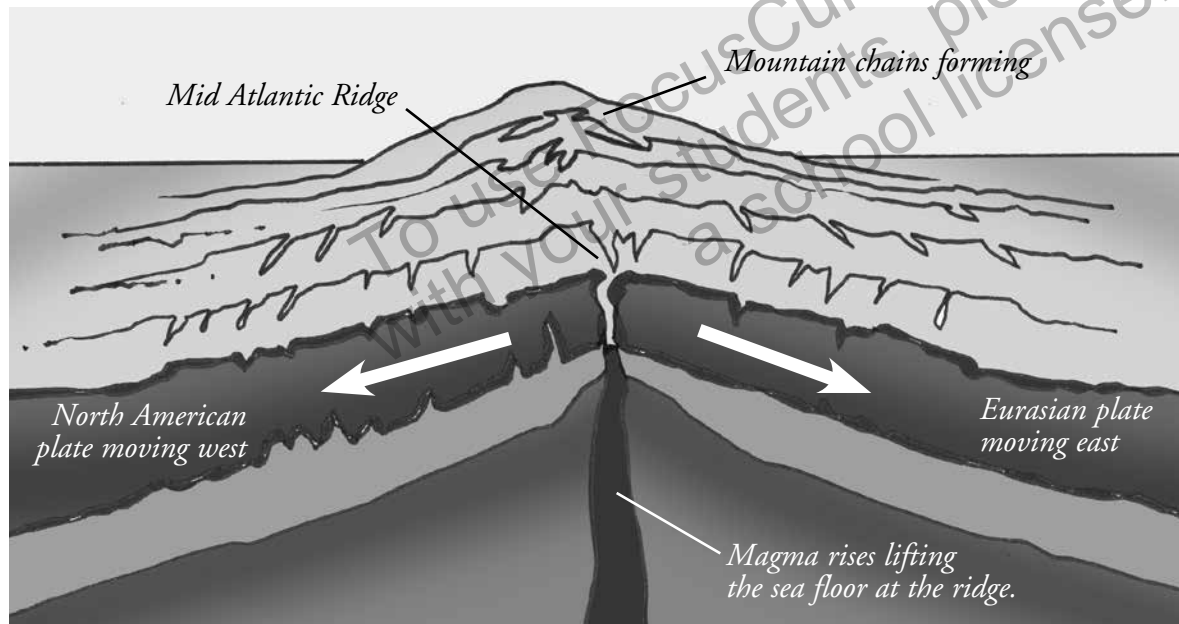
Convergent means _____

Divergent Plate Boundaries

Let's look at divergent plate boundaries. A divergent plate boundary occurs where tectonic plates pull apart from each other.

When Oceanic Plates Diverge

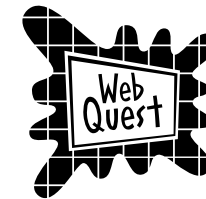
The Mid Atlantic Ridge is a good example of diverging oceanic plates. It lies at a divergent plate boundary along the floor of the Atlantic Ocean. The Eurasian Plate is moving in an easterly direction. The North American Plate is moving in a westerly direction. As these oceanic plates pull away from each other, magma flows to the surface. It becomes new sea floor. Because of the rising magma, the sea floor is lifted at the ridge, creating a mountain chain. This type of boundary can cause volcanic activity and earthquakes.



ACTIVE READER

1 Summarize Which two types of geologic activity can occur when two oceanic plates diverge?

2 Restate Which type of landform is produced at the Mid Atlantic Ridge?

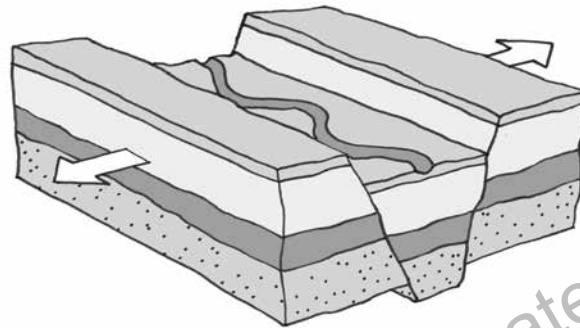


Use the Internet to find a map of Earth that outlines the sea floor. Locate the Mid Atlantic Ridge. What country lies at the northernmost point of the ridge?

When Continental Plates Diverge

A divergent boundary may also involve two continental plates. In this case a **rift valley** is formed.

The continental crust is stretched, becoming thinner. **Faults**, or fractures, form as the crust is pulled apart. Over time, a large valley begins to take shape. As it sinks lower, streams may flow into the valley, creating a lake.



A rift valley occurs when continental plates diverge.

ACTIVE READER

1 Connect Circle a synonym for fractures.

2 Summarize What happens when continental plates diverge?

FOCUS QUESTIONS

1. Compare and contrast diverging oceanic plates and diverging continental plates.

2. Explain sea floor spreading.

FOCUS

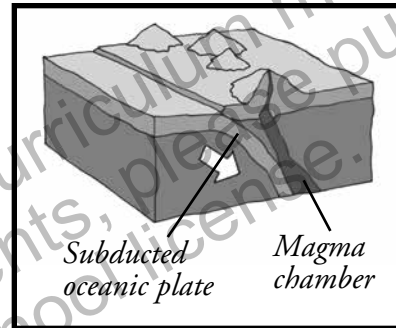
This section explains what occurs when tectonic plates collide. As you read, find out about the three different kinds of convergent plate boundaries.

Convergent Plate Boundaries

Now, let's examine the various types of convergent plate boundaries. A convergent plate boundary occurs where two tectonic plates collide.

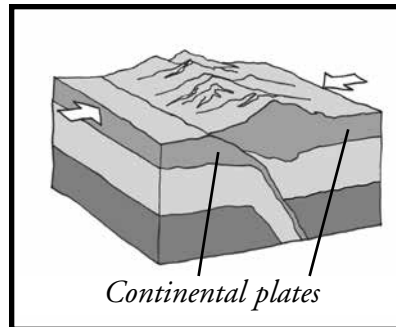
When Oceanic Plates Converge

When oceanic plates converge, the older, denser oceanic plate is subducted. The point of subduction is called an **ocean trench**. The subducted plate is exposed to heat as it sinks into the mantle. Then, molten magma rises up through large underground pools called **magma chambers**. Some magma chambers break through the surface. They form a volcanic cone on the ocean floor. Over time these cones can grow so large that they rise up out of the water. Island chains such as the Aleutian Islands were produced this way.



When Continental Plates Converge

Subduction rarely occurs at a boundary where continental plates converge. When continental plates converge, it generally produces faulting and folding. Mountain ranges rise up as a result. Earthquakes are also common at these boundaries.



ACTIVE READER

1 Connect Circle a synonym for converge.

2 Define What is a magma chamber?

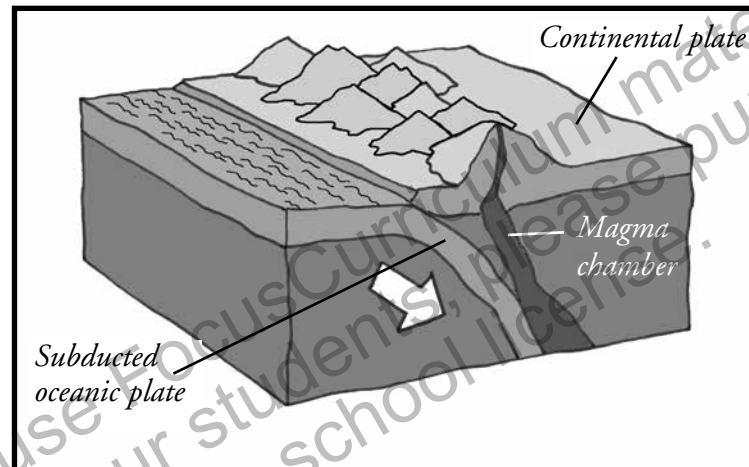
Good to Know

A rift valley can be the very beginning of a new ocean basin. As the continent rifts, the crust becomes thinner until it eventually splits apart. The two separate pieces of crust continue to pull away from each other and ocean waters fill the rift.

When Oceanic Plates Converge with Continental Plates

When an oceanic plate collides with a continental plate, the oceanic plate is subducted. The oceanic plate is heated to melting point as it descends into the mantle. Magma chambers allow the molten material to rise up to the surface in the form of a volcano. The Andes Mountain Range is an example. It is a convergent boundary between the Nazca Plate and the South American Plate.

The convergence of the Nazca and South American Plates has formed the peaks of the Andes.



ACTIVE READER

1 Infer *The Andes Mountain Range is located on which continent?*

2 Identify *Which plate is subducted when an oceanic plate converges with a continental plate?*

FOCUS QUESTIONS

1. How are volcanic cones produced?

2. Describe the two situations when converging plates result in subduction.

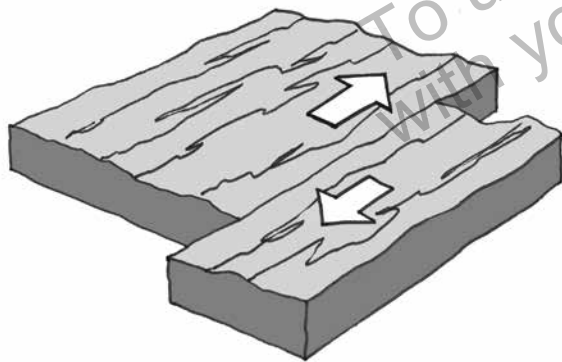
FOCUS

The underlined sentence states an important idea about transform plate boundaries. As you read, find out about hot spots and how they are formed.

Transform Plate Boundaries

Transform plate boundaries occur when two plates slide past one another. The plates may move in opposite directions. Or, they may move in the same direction at different speeds. As the plates move past one another, a transform fault, or crack, in the lithosphere results. Frequent earthquakes occur at transform plate boundaries.

The San Andreas Fault in California is an example. The Pacific Plate and the North American Plate are both moving north. But, the Pacific Plate is moving much faster.



The San Andreas Fault is an example of a transform plate boundary.

ACTIVE READER

1 Recall List the three types of plate boundaries.

1. _____

2. _____

3. _____

2 Explain Which two ways can a transform plate boundary occur?

Good to Know

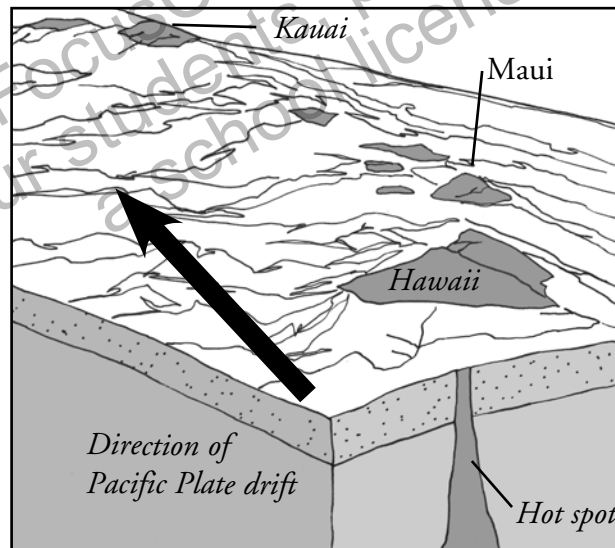
In 1989 a major earthquake shook the San Francisco Bay area. The San Andreas fault was the culprit. Many scientists believe that another major earthquake will occur at this transform plate boundary in the near future.

Hot Spots

Another geologic process caused by plate movement is a **hot spot**. A hot spot is a small, extremely hot region in the mantle. This source of heat melts existing rock, creating molten magma. The magma is pushed through the lithosphere. It often erupts in the form of a volcano at the surface. As the tectonic plate slides over the hot spot, a chain of volcanoes is produced.

The Hawaiian Islands were created through this process. A hot spot weakened the Pacific Plate. When magma pushes through to the surface, it erupts onto the ocean floor. The lava builds up, reaching sea level and eventually becoming an island volcano.

Study the layout of the Hawaiian Islands. As the Pacific Plate moves, the island volcanoes on the sea floor move with it. When the island volcano drifts beyond the hot spot it is **dormant**. As new sea floor moves over the hot spot, the process repeats itself. Can you guess which islands in the chain are oldest?



The Hawaiian Islands drift beyond the hot spot as the Pacific Plate moves.

ACTIVE READER

1 Infer *Is the Pacific Plate a continental plate or an oceanic plate?*

2 Explain *Do hot spots move? Why or why not?*



Use the Internet to learn more about hot spots. Find a web page that illustrates the movement of the Hawaiian Islands. Find out which direction the islands are moving.

Kauai is the oldest of the Hawaiian Islands. It is farthest away from the hot spot. Its volcano is now dormant. The "Big Island," or Hawaii, is still positioned above the hot spot. Thus, new volcanic rock is continually being formed.

FOCUS QUESTIONS

1. What two ways can a transform plate boundary occur?

Handwriting lines for question 1.

2. Explain how hot spots create volcanoes.

Handwriting lines for question 2.

ACTIVE READER

1 Define Based on what you read, define the word dormant.

Handwriting lines for active reader question 1.

2 Interpret Which is the second oldest Hawaiian Island?

Handwriting lines for active reader question 2.

3 Explain When the "Big Island," or Hawaii, drifts beyond the hot spot, will it still have volcanic activity? Why or why not?

Handwriting lines for active reader question 3.

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Stop and Think

This page will help summarize what you have read so far.

1. Along the Washington-Oregon coastline the Juan de Fuca Plate is sliding under the North American Plate. This plate movement is producing volcanoes known as the Cascade Mountain Range.

What type of plate boundary is this?

- (1) hot spot
- (2) divergent plate boundary
- (3) transform plate boundary
- (4) convergent plate boundary

2. Which statement describes how new sea floor is produced?

- (1) Faults, or fractures, form as the crust is stretched and pulled apart.
- (2) A subducted plate is exposed to heat as it descends into the mantle.
- (3) Magma rises up at the mid-ocean ridge and cools when it meets the water.
- (4) Magma is pushed through the lithosphere, erupting in the form of a volcano at the surface.

Base your answers to questions 3 and 4 on your knowledge of science.

3. What are the two types of divergent plate boundaries?

4. What geologic activity results from each type of divergent plate boundary?

Tip:
Remember that the type of plate boundary determines the type of geologic activity.

Dear Ms. Understanding,

I'm pretty sure that the Hawaiian islands are a chain of mountains that rise up from the sea floor. Each of them was created at about the same time, so they're all the same age, right?



Curious in Canarsie

Dear Curious,

Well, you're right and you're wrong. The islands are volcanic mountains that extend up from the ocean floor. But because they are a result of molten magma that has been released through a magma chamber or hot spot on the sea floor, each island was created as the sea floor drifted directly over the hot spot. The islands vary in age according to their current distance from the hot spot.



Ms. Understanding



Cotton Plates At a convergent boundary, two continental plates are colliding. The results of this type of plate collision may vary, depending on the type of plate. However, when two continental plates are colliding the result is almost always the folding of continental crust.

Procedure

To demonstrate how this folding takes place, gather two cotton towels of at least three different colors. For example, you may use two red towels, two blue towels, and two yellow towels. The colors represent the different rock layers.

Fold one red towel in half. Then fold a blue towel in half and place it on top. Fold a yellow towel in half and place it on top of the blue towel. Do the same with the second group of towels, making sure that the color order remains the same. Place the two piles side by side, about an inch apart. Each pile represents a tectonic plate.

1. Predict what will happen if you slide the two piles together.

2. Next, place a hand on each plate and push them together. Observe what happens when the towels converge.

3. Explain the behavior of each “cotton plate” when the edges met. Was your prediction accurate?

4. What happens to the “rock layers”?

5. Use the map on page 19 to locate two convergent continental plates. Write the names of the two plates.

6. What type of geologic feature is located where these two plates meet? What is its proper name?

Glossary

asthenosphere – the pliable, dense, upper part of the mantle

convection currents – slow-moving currents of magma within the mantle

convergent boundary – where two plates collide

divergent boundary – where two plates move away from each other

dormant – no longer active or erupting, but capable of erupting one day

faults – fractures that form where crust is stretched apart

hot spot – a small, extremely hot region within the mantle

lithosphere – the solid, rigid part of Earth comprising the crust and the upper mantle

magma chambers – large underground pools of molten magma

mid-ocean ridge – underwater mountain range produced by a divergent plate boundary

ocean trench – where oceanic plates converge and the older, denser oceanic plate is subducted

rift valley – a valley that forms where continental crust is stretched and becomes thin

subduction – the process of an older oceanic plate being pulled under another plate

transform boundary – where two plates slide past one another

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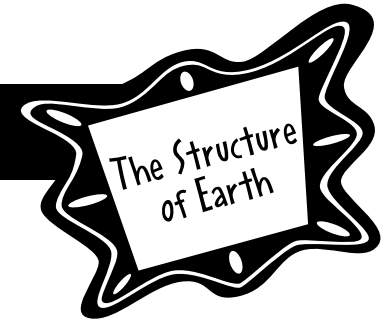
**FOCUS
ON
SCIENCE**

The Structure of Earth

Assessments

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Check Understanding



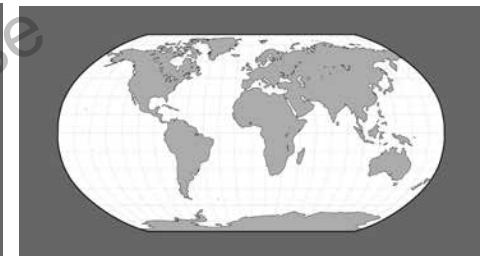
In the Answer Document on this page, mark your answer in the row of circles for each question by filling in the circle that has the same number as the answer you have chosen.

1. In what layer of Earth are tectonic plates located?
 - (1) core
 - (2) mantle
 - (3) lithosphere
 - (4) asthenosphere
2. When is a rift valley likely to form?
 - (1) when oceanic plates diverge
 - (2) when oceanic plates converge
 - (3) when continental plates diverge
 - (4) when continental plates converge

Base your answer to question 3 on the maps below and on your knowledge of science.



115 million years ago



Present Day

3. The maps above show how Earth's surface looked during two different time periods.

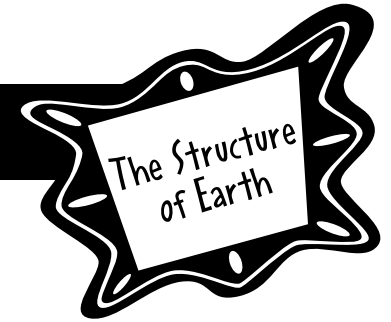
Which phrase best describes the geologic activity shown in the maps?

- (1) Pangaea
- (2) subduction
- (3) continental drift
- (4) Mid Atlantic Ridge

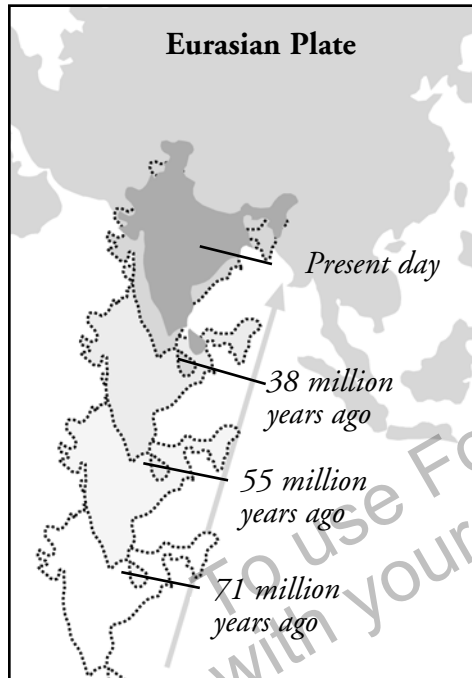
Answer Document

- | | | | | | | | | | |
|----|---|---|---|---|----|---|---|---|---|
| 1. | ① | ② | ③ | ④ | 3. | ① | ② | ③ | ④ |
| 2. | ① | ② | ③ | ④ | | | | | |

Check Understanding



Base your answer to question 4 on the diagram below. It shows the movement over time of the land mass we know as India.



4. What landform was produced by the collision of the India land mass with the Eurasian continental plate?
- (1) volcano
 - (2) rift valley
 - (3) earthquake
 - (4) mountain range

Answer Document

4. ① ② ③ ④

5. What process, discovered in 1960, explained Alfred Wegener's theory about continental drift?

6. Describe the process.

**FOCUS
ON
SCIENCE**

The Structure of Earth

Answer Key

Answer Key

Page 8: Starting Points

Build Background

Label It: Sample answers: Volcano: ring of fire, magma, builds islands, lava, erupts, on Earth's crust, smoke, ash; Rock Cycle: sedimentary, igneous, metamorphic, temperature, pressure, chemical change, physical change; Earth's layers: crust, core, mantle, liquid, solid, magma; Earthquake: faults, plates move, ring of fire, subduction, convergence, divergence; Mountains: uplift, pressure, plates move, ring of fire, subduction, convergence

Page 9: Starting Points

Key Vocabulary

Rate Your Knowledge: Answers will vary according to the student's prior knowledge.

Page 10: Starting Points

Key Concepts

Active Reader: 1. Underline the first sentence in paragraphs 2-4. 2. Life; 3. Diagrams will vary but should convey that the rock cycle is a cyclical process.

Page 11: Hands On Science

Model the Rock Cycle: 1. It is a conglomerate of smaller fragments. 2. Weathering and erosion; 3. Transport of sedimentary rocks; 4. Melting/metamorphic processes, heat, pressure; 5. Crystallization/cooling; 6. Weathering and erosion

Page 12: Chapter 1

Active Reader: 1. crust, mantle, core; 2. A map is flat and a globe is three-dimensional, a sphere.

Page 13: Chapter 1

Active Reader: 1. Underline: based on rock type, based on how rigid they are; 2. iron and nickel

Focus Questions: 1. The tectonic plates in the lithosphere float on top of the asthenosphere, which is part of the mantle. 2. The lithosphere is the solid, rigid part of Earth made of the crust and the upper mantle.

Page 14: Chapter 1

Active Reader: 1. India was further south and located between Africa, Antarctica, and Australia. 2. Alfred Wegener

Page 15: Chapter 1

Active Reader: 1. Answers will vary. 2. South America and Africa

Page 16: Chapter 1

Active Reader: 1. age, sediment, composition; 2. Underline: he was never able to prove it.

Focus Questions: 1. Sample answer: Fossils of a reptile have been found in Brazil and South Africa. But the animal was unable to swim. This suggests the continents were once connected. 2. The present day continents look as if they could fit together well. This suggests that

they were once all connected.

Page 17: Chapter 1

Stop and Think

1. (4); 2. (2); 3. Sample answer: The location of glacial grooves in Australia, India, Africa, and South American suggests that all these land masses were once connected as one; 4. Continental drift was rejected because Wegener was unable to prove it.

Answer Key

Page 18: Chapter 2

Active Reader: 1. Sea floor spreading is when heated magma rises up at the mid-ocean ridge, cools, and creates new sea floor, pushing the older sea floor away and causing the continents to move.

Page 19: Chapter 2

Active Reader: 1. Sample answer: North American plate and African plate, Antarctic plate and Indo-Australian plate; 2. Divergent means to move apart; Convergent means to move together.

Page 20: Chapter 2

Active Reader: 1. volcanic activity and earthquakes; 2. mountain chain

Page 21: Chapter 2

Active Reader: 1. Circle: faults; 2. A rift valley is formed where the continental crust is stretched. Over time the valley sinks lower.

Focus Questions: 1. Both sets of plates are moving away from each other. Both can cause earthquakes. Diverging oceanic plates produce new sea floor and may cause volcanic activity. Diverging continental plates create rift valleys and earthquakes. 2. Convection currents in the mantle cause the plates to move. Heated magma rises up and cools when it meets the water. The new sea floor pushes the older floor away from the ridge, moving the continents.

Page 22: Chapter 2

Active Reader: 1. Circle: collide; 2. A magma chamber is a large underground pool of molten magma.

Page 23: Chapter 2

Active Reader: 1. South America; 2. oceanic plate

Focus Questions: 1. When oceanic plates converge, magma chambers that reach the surface become volcanic cones. 2. When the oceanic plates converge the older, denser plate is subducted. When oceanic and continental plates converge, the oceanic plate is subducted.

Page 24: Chapter 2

Active Reader: 1. divergent plate boundaries, convergent plate boundaries, transform plate boundaries; 2. The plates can slide past each other when moving in opposite directions or they can slide past each other when moving in the same direction at different speeds.

Page 25: Chapter 2

Active Reader: 1. Oceanic; 2. No, hot spots do not move. They are part of the mantle. Only the tectonic plates move.

Page 26: Chapter 2

Active Reader: 1. Sample answer: No longer erupting; 2. Oahu; 3. No, because it is no longer over a hot spot.

Focus Questions: 1. When two plates slide past each other in opposite directions or when two plates are moving in

the same direction but one is moving faster than the other. 2. The heat in a hot spot melts rock, creating magma that pushes through the lithosphere in the form of a volcano.

Page 27: Chapter 2

Stop and Think

1. (4); 2. (3); 3. divergent oceanic plates and divergent continental plates; 4. In both situations, earthquakes may result. When oceanic plates diverge, volcanic activity may also result. A rift valley may form when continental plates diverge.

Page 28: Hands On Science

Cotton Plates: 1. Sample answer: One pile will fold over the other pile. 3. The edges of the the towels met and began to bunch up, lift up, and/or fold. 4. They are displaced. 5. Sample answer: Indian and Eurasian 6. Folded mountains; The Himalayas

Page 33

Check Understanding

1. (3); 2. (3); 3. (3)

Page 34

Check Understanding

4. (4); 5. Sea floor spreading; 6. Magma rises up and then cools when it meets water, creating new sea floor. The new sea floor pushes older sea floor away from this ridge. As the sea floor moves, the continents do as well.

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