USING KEY TERMS

1. Use the following terms in the same sentence: crust, mantle, and core.


Complete each of the following sentences by choosing the correct term from the word bank.

asthenosphere uplift
tension continental drift

2. The hypothesis that continents can drift apart and have done so in the past is known as _________________.

3. The _________________ is the soft layer of the mantle on which the tectonic plates move.

4. _________________ is stress that occurs when forces act to stretch an object.

5. The rising of regions of the Earth’s crust to higher elevations is called _________________.

UNDERSTANDING KEY IDEAS

Multiple Choice

6. The strong, lower part of the mantle is a physical layer called the
   a. lithosphere.
   b. mesosphere.
   c. asthenosphere.
   d. outer core.

7. The type of tectonic plate boundary that forms from a collision between two tectonic plates is a
   a. divergent plate boundary.
   b. transform plate boundary.
   c. convergent plate boundary.
   d. normal plate boundary.
Chapter Review continued

8. The bending of rock layers due to stress in the Earth’s crust is known as
   a. uplift.                c. faulting.
   b. folding.             d. subsidence.

9. The type of fault in which the hanging wall moves up relative to the footwall is called a
   a. strike-slip fault.    c. normal fault.
   b. fault-block fault.   d. reverse fault.

10. The type of mountain that forms when rock layers are squeezed together and pushed upward is the
    a. folded mountain.      c. volcanic mountain.
    b. fault-block mountain. d. strike-slip mountain.

11. Scientists’ knowledge of the Earth’s interior has come primarily from
    a. studying magnetic reversals in oceanic crust.
    b. using a system of satellites called the global positioning system.
    c. studying seismic waves generated by earthquakes.
    d. studying the pattern of fossils on different continents.

Short Answer

12. Explain how scientists use seismic waves to map the Earth’s interior.

13. How do magnetic reversals provide evidence of sea-floor spreading?

14. Explain how sea-floor spreading provides a way for continents to move.

15. Describe two types of stress that deform rock.

16. What is the global positioning system (GPS), and how does GPS allow scientists to measure the rate of motion of tectonic plates?
CRITICAL THINKING

17. Concept Mapping Use the following terms to create a concept map: sea-floor spreading, convergent boundary, divergent boundary, subduction zone, transform boundary, and tectonic plates.

18. Applying Concepts Why does oceanic lithosphere sink at subduction zones but not at mid-ocean ridges?

19. Identifying Relationships New tectonic material continually forms at divergent boundaries. Tectonic plate material is also continually destroyed in subduction zones at convergent boundaries. Do you think that the total amount of lithosphere formed on the Earth is about equal to the amount destroyed? Why?
20. **Applying Concepts**  Folded mountains usually form at the edge of a tectonic plate. How can you explain folded mountain ranges located in the middle of a tectonic plate?

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**INTERPRETING GRAPHICS**

Imagine that you could travel to the center of the Earth. Use the diagram below to answer the questions that follow.

<table>
<thead>
<tr>
<th><strong>Composition</strong></th>
<th><strong>Structure</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Crust (50 km)</td>
<td>Lithosphere (150 km)</td>
</tr>
<tr>
<td>Mantle (2,900 km)</td>
<td>Asthenosphere (250 km)</td>
</tr>
<tr>
<td></td>
<td>Mesosphere (2,550 km)</td>
</tr>
<tr>
<td>Core (3,430 km)</td>
<td>Outer core (2,200 km)</td>
</tr>
<tr>
<td></td>
<td>Inner core (1,228 km)</td>
</tr>
</tbody>
</table>

21. How far beneath the Earth’s surface would you have to go before you were no longer passing through rock that had the composition of granite?

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22. How far beneath the Earth’s surface would you have to go to find liquid material in the Earth’s core?

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23. At what depth would you find mantle material but still be within the lithosphere?

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24. How far beneath the Earth’s surface would you have to go to find solid iron and nickel in the Earth’s core?
SECTION: DEFORMING THE EARTH’S CRUST

1. Sample answer: Compression is stress that occurs when forces act to squeeze an object. Tension is stress that occurs when forces act to stretch an object.

2. Sample answer: Uplift is the rising of Earth's crust to higher elevations. Subsidence is the sinking of Earth's crust to lower elevations.

3. D

4. The three types of folds include anticlines, which are upward arching folds; synclines, which are downward-arching folds; and monoclines, in which rock layers are folded so that both ends of the fold are horizontal.

5. The three types of faults include normal faults, in which the hanging wall moves down relative to the footwall; reverse faults, in which the hanging wall moves up relative to the footwall; and strike-slip faults, in which opposing forces cause rock to break and move horizontally.

6. The most common types of mountains are folded mountains, fault-block mountains, and volcanic mountains.

7. Rebound is a process in which Earth's crust slowly springs back to its original elevation.

8. Rift zones are a set of deep cracks in the Earth's crust that form when two tectonic plates are pulling away from each other. As tectonic plates pull apart, stress builds up between the plates. This stress causes strain in the Earth's crust, and a series of faults forms along the rift zone.

9. A reverse fault is likely to form because both reverse faults and folding occur in areas where compression takes place.

10. No; you would be more likely to see volcanic mountains where magma is rising along the mid-ocean ridge spreading center.

11. a reverse fault

12. a convergent boundary

Chapter Review

1. Scientists divide the Earth into the crust, mantle, and core based on the chemical elements that make up each of these layers.

2. continental drift

3. asthenosphere

4. Tension

5. uplift

6. B

7. C

8. B

9. D

10. A

11. C

12. Scientists can measure the differences in the speeds of seismic waves that travel through the Earth's interior to calculate the density and thickness of each of the Earth's physical layers.

13. As oceanic crust spreads away from a mid-ocean ridge, the crust carries bands that contain minerals that were aligned with Earth's magnetic field when the crust was formed. The similar sequence of bands on both sides of a mid-ocean ridge, even at a large distance from the ridge, indicates that the sea floor is spreading away from a center.

14. As new crust forms at mid-ocean ridges, older crust gets pushed away from ridges.

15. Compression and tension are two types of stress that deform rock. Compression squeezes rock at convergent plate boundaries; tension stretches rock at divergent plate boundaries.

16. The global positioning system is a system of satellites that orbit the Earth. Radio signals are continuously beamed from these satellites to ground stations. The distance between satellites and ground stations is recorded. By recording the time it takes for ground stations to move a given distance, scientists can measure the rate at which tectonic plates move.

17. An answer to this exercise can be found at the back of this book.
18. Answers will vary. At a subduction zone, the lithosphere is denser than it is at a mid-ocean ridge. Convection causes oceanic lithosphere to move away from the mid ocean ridge. Oceanic lithosphere is also higher at a mid-ocean ridge, so oceanic lithosphere moves down toward the subduction zone because of gravity.

19. Answers will vary. The amount of crust formed is roughly equal to the amount of crust destroyed globally. If this were not true, the Earth would either be expanding or shrinking.

20. At the time they formed, the folded mountains must have been on the edge of a tectonic plate. New material was later added to the tectonic plate, causing the folded mountains to be located closer to the center of the continent.

21. 50 km
22. 150 km + 250 km + 2,550 km = 2,950 km
23. between 50 km and 150 km
24. 150 km + 250 km + 2,550 km + 2,200 km = 5,150 km

Reinforcement

THE LAYERED EARTH
1. Crust
2. Mantle
3. Outer core
4. Inner core
5. Crust
6. Asthenosphere
7. Mesosphere

A MOVING JIGSAW PUZZLE
1. divergent
2. transform
3. convergent

Critical Thinking

1. Answers will vary. Sample answer: Athena may have a liquid center surrounded by a solid, flexible outer layer.
2. Answers will vary. Sample answer: Athena's top layer must be made of a material less rigid and more flexible than the rock of Earth's crust. Otherwise, it would probably crack due to the stress.
3. The color of the sky and the smell of the air probably do not indicate anything about the planet's inner structure.
4. Answers will vary. Sample answer: If there are events like earthquakes on the planet, they could use seismographs to measure the speed and angles of any seismic waves produced. They also might try to drill into the planet's surface in order to see the layers.
5. Answers will vary. Sample answer: They should discuss their findings with other scientists in the field first. They should then make sure that no other hypotheses can be supported by their data.

Section Quizzes

SECTION: INSIDE THE EARTH
1. C
2. A
3. D
4. B
5. C
6. E
7. A
8. F

SECTION: RESTLESS CONTINENTS
1. D
2. A
3. B
4. B
5. A
6. D
7. C
8. E

SECTION: THE THEORY OF PLATE TECTONICS
1. A
2. C
3. D
4. A
5. E
6. C
7. B
8. F