Chapter 19 CHANGING EARTH

Chapter 19 Assessment

Vocabulary

Select the correct term to complete the sentences.

Pangaea	core	seismologist
crust	sea-floor spreading	P-waves
lithosphere	seismic waves	S-waves
mantle	asthenosphere	mid-ocean ridges
lithospheric plates	continental drift	plate tectonics
subduction	mantle plume	deep-ocean trench
metamorphic rocks		

Section 19.1

1. _____ are seismic waves that do not pass through liquids.
2. A scientist that detects and interprets seismic waves at different locations on Earth is called a(n) _____.
3. Vibrations that travel through Earth are called _____.
4. _____ are seismic waves that move in a forward-and-backward motion.
5. Lithospheric plates slowly move over a soft, weak zone called the _____.
6. The largest part of Earth's interior that is made of rock, but flows, is the _____.
7. The _____ is the inner iron-containing layer of Earth.
8. Made of the crust and upper mantle, the _____ makes up the plates that move about Earth's surface.
9. The outermost surface of Earth is called the _____.

Section 19.2

10. _____, meaning "all land," is the name for the great landmass that existed millions of years ago.
11. The idea that the continents move around on Earth's surface is called _____.
12. The study of Earth's lithospheric plates is called _____.
13. When a plate is drawn into the mantle, _____ is taking place.
14. _____ move over the asthenosphere.
15. New ocean floor is created at the locations of these undersea features called _____.
16. Harry Hess proposed the idea of _____.
17. A hot spot is caused by a(n) _____.

Section 19.3 and Section 19.4

18. _____ form at convergent boundaries where conditions of high heat and high pressure exist.
19. A(n) _____ is a geologic feature that occurs when one oceanic plate subducts under another.

Concepts

Section 19.1

1. It is impossible to travel to the center of Earth. How then do scientists study what Earth looks like inside?
2. What are the differences between a P-wave, an S-wave, and a surface wave?
3. With all the layers that make up Earth, which layer is the densest and which is the least dense? Why?

4. How does the density of continental crust compare to oceanic crust?
5. The inner core is really hot but solid. Why isn't the inner core a liquid like the outer core?
6. What do you think would happen if convection in Earth's mantle ceased to occur?
7. The average thickness of the continental crust is 35 to 40 km, but sometimes the crust is as thick as 70 km. Describe and diagram a situation in which the crust might be 70 km thick.

Section 19.2

8. How do fossils support the idea of continental drift? Give one example.
9. The Mid-Atlantic Ridge is a mid-ocean ridge in the Atlantic Ocean. Is the Atlantic Ocean getting wider or narrower? Explain your answer.
10. Where would you find the oldest rocks on the sea floor? Where would you find the youngest rocks? Explain your answer.
11. A mantle plume beneath the oceanic crust and the islands it forms are useful for measuring the speed and direction of a lithospheric plate. How is this done?

Section 19.3

12. List the three types of plate boundaries. What famous feature in California represents one of these boundaries?
13. What kind of geologic feature forms when two continental plates collide? What kind of plate boundary is this?
14. What type of boundary does the East African Rift Valley represent? Research and list a few countries and volcanoes that are within the East African Rift Valley.
15. What type of plate boundary can be defined from a linear pattern of earthquakes?

Section 19.4

16. Metamorphic rocks are commonly formed at convergent plate boundaries. Why?
17. What is the difference between regional and contact metamorphism?
18. How do patterns of mountain ranges, ocean bathymetry, earthquakes, and most volcanoes relate to the characteristics of Earth's tectonic plates?

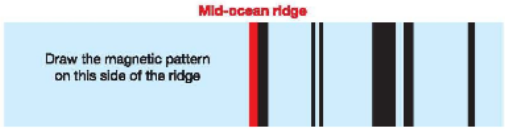
Problems

Section 19.1

1. Scientists have only been able to drill down into the lower part of Earth's crust. What percentage of Earth's radius have scientists drilled into?
   a. 100%
   b. more than 50%
   c. less than 1%
   d. about 25%
2. For each of these statements, identify the described location:
   a. 6,000 kilometers below Earth's surface where the temperature is more than 7,000°C.
   b. Convection cells occur in this, the largest layer of Earth's interior.
   c. 10 kilometers below the Earth's surface.

Section 19.2

3. Make a sketch of the magnetic pattern that would appear on the other side of the ridge shown in the graphic below.



4. If the speed of a plate is 8 centimeters per year, how far would it move in 200 years? Complete the following calculations. Use the formula distance = speed × time.
5. The oldest volcanic rocks on Kauai are 5.5 million years old whereas the oldest rocks on the "Big Island" of Hawaii are 0.7 million years old. Kauai is northwest of the "Big Island." Both islands were formed by a mantle plume.
   a. What is the length of time between the formation of the two islands?
   b. Given that Kauai and the "Big Island" are 240 kilometers apart, how fast has the Pacific Plate been moving? (speed = distance ÷ time)

Section 19.3

6. It takes 10 million years for the Pacific Plate to slide 600 kilometers past the North American Plate. How fast is the Pacific Plate moving in kilometers per million years? What kind of boundary exists between the Pacific Plate and the North American Plate?
7. There are two islands on opposite sides of a mid-ocean ridge. During the last 8 million years, the distance between the islands has increased by 200 kilometers. What is the speed at which the two plates are separating in km/million years? What kind of boundary exists between these plates?

Section 19.4

8. What type of metamorphism occurs under conditions of (a) high temperature and high pressure? (b) low temperature and low pressure? (c) high temperature and low pressure?

Applying Your Knowledge

Section 19.1

1. Since it is impossible to drill very deeply into Earth, scientists have used indirect evidence learned about the nature of the outer core. Describe an experience you have had in which you learned something new in an indirect way.

Section 19.2

2. Pangaea broke up by forming two large pieces. Research and list the names of these pieces. Include one interesting fact that you discovered in your research.
3. Plate tectonics has been developed by a number of scientists, including Bruce C. Heezen, Marie Tharp, Tanya Atwater, John Tuzo Wilson, Xavier Le Pichon, and Frederick Vine. Pick one and find out how they contributed to plate tectonics. Use your school library or the Internet to help you in your research. Write up your findings using a magazine-type essay format.

Section 19.3

4. The mid-ocean ridge in the Atlantic Ocean goes through the country of Iceland. What effects does it having on this country? How does Iceland take advantage of these effects?

Section 19.4

5. This image of a metamorphic rock shows wavy layers. How do you think the layers formed? How do you think the layers became wavy? Answer these questions using the principles of relative dating and what you learned in this chapter.

Photo courtesy of USGS