



BIG Idea Most geologic activity occurs at the boundaries between plates.

Vocabulary

Key Concepts

Section 17.1 Drifting Continents

- continental drift (p. 469) ^A
- Pangaea (p. 469) ^B

- MAIN Idea** The shape and geology of the continents suggests that they were once joined together.
- The matching coastlines of continents on opposite sides of the Atlantic Ocean suggest that the continents were once joined.
 - Continental drift was the idea that continents move around on Earth's surface.
 - Wegener collected evidence from rocks, fossils, and ancient climates to support his theory.
 - Continental drift was not accepted because there was no explanation for how the continents moved or what caused their motion.

Section 17.2 Seafloor Spreading

- isochron (p. 477) ^A
- magnetic reversal (p. 476) ^B
- magnetometer (p. 473) ^C
- paleomagnetism (p. 476) ^D
- seafloor spreading (p. 479) ^E

- MAIN Idea** Oceanic crust forms at ocean ridges and becomes part of the seafloor.
- Studies of the seafloor provided evidence that the ocean floor is not flat and unchanging.
 - Oceanic crust is geologically young.
 - New oceanic crust forms as magma rises at ridges and solidifies.
 - As new oceanic crust forms, the older crust moves away from the ridges.

Section 17.3 Plate Boundaries

- convergent boundary (p. 482) ^A
- divergent boundary (p. 481) ^B
- rift valley (p. 481) ^C
- subduction (p. 482) ^D
- tectonic plate (p. 480) ^E
- transform boundary (p. 484) ^F

- MAIN Idea** Volcanoes, mountains, and deep-sea trenches form at the boundaries between the plates.
- Earth's crust and rigid upper mantle are broken into large slabs of rock called tectonic plates.
 - Plates move in different directions and at different rates over Earth's surface.
 - At divergent plate boundaries, plates move apart. At convergent boundaries, plates come together. At transform boundaries, plates slide horizontally past each other.
 - Each type of boundary is characterized by certain geologic features.

Section 17.4 Causes of Plate Motions

- ridge push (p. 488) ^A
- slab pull (p. 488) ^B

- MAIN Idea** Convection currents in the mantle cause plate motions.
- Convection is the transfer of energy via the movement of heated matter.
 - Convection currents in the mantle result in an energy transfer between Earth's hot interior and cooler exterior.
 - Plate movement results from the processes called ridge push and slab pull.

Vocabulary Review

Replace each italicized word with the correct vocabulary term from the Study Guide.

1. *Plate tectonics* is the name given to the single continent that existed 200 mya.
2. *Continental fracture* is the idea that continents now separated by an ocean were once attached.
3. The process in which tectonic plates sink back into the mantle is called *divergence*.
4. A boundary where two plates come together is a *transform boundary*.
5. A divergent boundary within a continent forms a *trench*.

Match each of the following phrases with a vocabulary term from the Study Guide.

6. a line on a map that denotes crust that formed at the same time
7. the process that creates new ocean crust by the upwelling of magma at ocean ridges
8. the study of the history of Earth's magnetic field
9. a device that measures magnetism

Define the following vocabulary terms in complete sentences.

10. tectonic plate
11. ridge push
12. slab pull

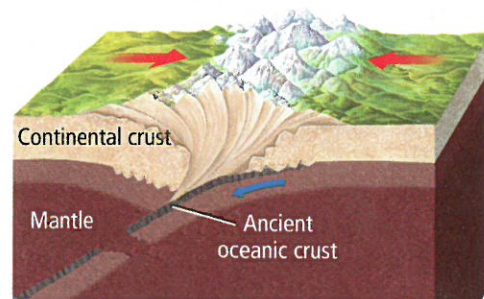
Use what you know about the vocabulary terms on the Study Guide to describe what the terms in each pair have in common.

13. divergent boundary, transform boundary
14. subduction, convergent boundary
15. continental drift, plate tectonics
16. seafloor spreading, magnetic reversal

Understand Key Concepts

17. Which suggested to early cartographers that the continents were once joined?
 - A. ocean depth
 - B. position of south pole
 - C. shape of continents
 - D. size of Atlantic Ocean
18. What was Wegener's hypothesis called?
 - A. seafloor spreading
 - B. plate tectonics
 - C. continental drift
 - D. slab pull

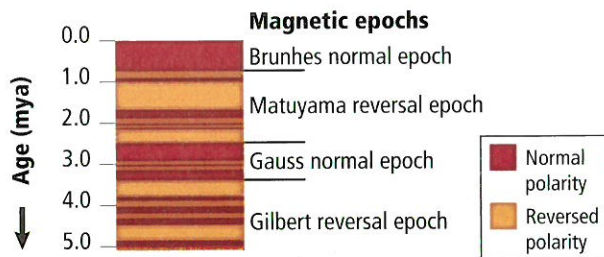
Use the figure below to answer Questions 19 and 20.



19. What type of boundary is shown?
 - A. an ocean ridge
 - B. a continental-continental boundary
 - C. a transform boundary
 - D. an oceanic-continental boundary
20. Which feature forms along this type of boundary?
 - A. subduction zones
 - B. oceanic trenches
 - C. island arcs
 - D. folded mountains
21. The weight of a subducting plate helps pull it into a subduction zone in which process?

A. slab pull	C. slab push
B. ridge push	D. ridge pull
22. Which is a convergent boundary that does not have a subduction zone?
 - A. oceanic-oceanic
 - B. oceanic-continental
 - C. continental-continental
 - D. transform

Use the figure below to answer Questions 23 and 24.



23. Approximately how long did the Gauss epoch last?
 - A. 5 million years
 - B. 3 million years
 - C. 1 million years
 - D. 100,000 years
24. Which epoch saw the most fluctuations between normal and reverse polarity?
 - A. Gauss
 - B. Matuyama
 - C. Gilbert
 - D. Brunhes
25. Generally, what is the age of oceanic crust?
 - A. the same age as the continental crust
 - B. younger than the continental crust
 - C. older than the continental crust
 - D. science has never determined its age
26. Which observation was not instrumental in formulating the hypothesis of seafloor spreading?
 - A. magnetization of the oceanic crust
 - B. depth of the ocean
 - C. thickness of seafloor sediments
 - D. identifying the location of glacial deposits
27. How fast do plates move relative to each other?
 - A. millimeters per day
 - B. centimeters per year
 - C. meters per year
 - D. centimeters per day
28. What process creates deep-sea trenches?
 - A. subduction
 - B. magnetism
 - C. earthquakes
 - D. transform boundaries

Use the photo below to answer Questions 29 and 30.



29. As shown, which direction does the icy water move?
 - A. up
 - B. down
 - C. remains in the same place
 - D. sideways
30. Which is modeled by the water movement?
 - A. subduction
 - B. continental drift
 - C. magnetic reversal
 - D. mantle convection
31. Which is not a force causing plates to move?
 - A. ridge push
 - B. slab pull
 - C. volcanism
 - D. convection

Constructed Response

32. **Summarize** What observations led to the proposal of continental drift?
33. **CAREERS IN EARTH SCIENCE** Explain why oceanographers have found that the thickness of seafloor sediments increases with increasing distance from the ocean ridge.
34. **Differentiate** between the magnetic field generated in Earth's core and the magnetization preserved in the oceanic crust.
35. **Analyze** why there are differences between continental-continental convergent boundaries and oceanic-oceanic convergent boundaries.
36. **Summarize** Why was the idea of moving continents more widely accepted after seafloor spreading was proposed?

Think Critically

Use the map below to answer Question 37.



- 37. **Infer** If 200 million-year-old oil deposits were discovered in Namibia, where might geologists also expect to find oil deposits of a similar age? Explain.
- 38. **Compare and contrast** ridge push and slab pull.
- 39. **Summarize** How have satellite monitoring systems such as GPS made it much easier and cheaper to study the motion of tectonic plates?
- 40. **Consider** Do plates always stay the same shape and size? Explain.
- 41. **Critique** this statement: There are two kinds of tectonic plates—continental plates and oceanic plates.

Concept Mapping

- 42. Create a concept map using the following terms: *convergent, rift valley, divergent, transform, island arc, shallow earthquakes, mountain range, and plate boundary*. Refer to the *Skillbuilder Handbook* for more information.

Challenge Question

- 43. **Predict** Assuming that Earth's tectonic plates will continue moving in the directions shown in **Figure 17.2**, sketch a globe showing the relative positions of the continents in 60 million years.

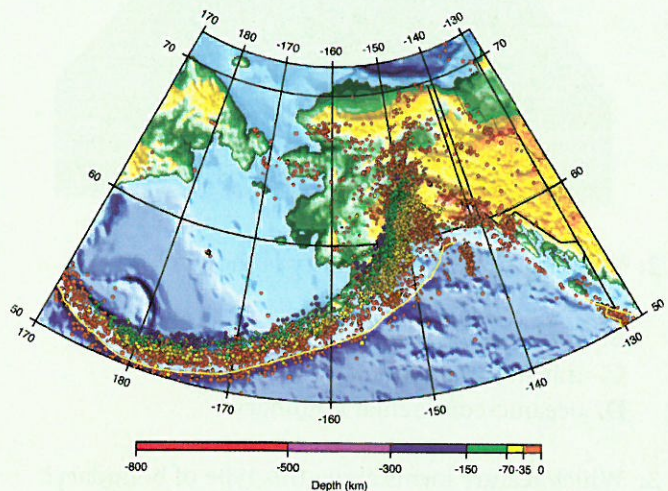
Additional Assessment

- 44. **WRITING in Earth Science** Imagine you are on a sailboat anchored off the coast of Chile. You hear loud rumbling. Then GPS data indicates a part of the coast shifted up by about 1.5 m. Write a journal entry to describe the geologic phenomena you are seeing and experiencing.

DBQ Document-Based Questions

Data obtained from: Seismicity of the Central United States: 1990–2000. *USGS National Earthquake Information Center*.

Most earthquakes occur at plate boundaries as plates slide by each other. This map shows the location and depth of earthquakes between 1990 and 2000 in Alaska.



- 45. Identify which plate is subducting and provide evidence from the figure to support your answer.
- 46. Compare this map to **Figure 17.15**, which shows the location of plate boundaries. Why do parts of the plate boundaries have few or no earthquakes?

Cumulative Review

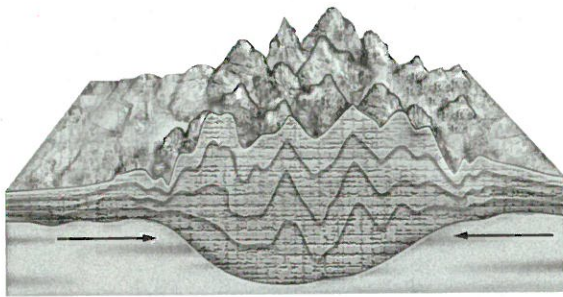
- 47. How do Landsat satellites collect and analyze data to map Earth's surface? (**Chapter 2**)
- 48. How can scientists use glaciers to study Earth's past? (**Chapter 8**)
- 49. Describe the major parameters used in the Köppen Classification System. (**Chapter 14**)

Standardized Test Practice

Multiple Choice

- How does the building of jetties negatively effect coastlines?
 - They fill in anchorage used to harbor boats with sediment.
 - They hinder breakwater from moving sediments away from the area.
 - They reflect energy back toward beaches, increasing erosion.
 - They deprive beaches down the coast from the jetty of sand.

Use the diagram below to answer Questions 2 and 3.



- What type of plate boundary is shown?
 - ocean ridge
 - continental-continental boundary
 - transform boundary
 - oceanic-continental boundary
- Which feature forms along this type of boundary?
 - subduction zones
 - oceanic trenches
 - island arcs
 - folded mountains
- What is the best way to get out of a rip current?
 - swim parallel to the shore
 - swim with the rip current
 - swim against the rip current
 - swim under the rip current
- The smooth parts of the ocean floor located 5 to 6 km below sea level are called the
 - mid-ocean ridges
 - deep-sea trenches
 - abyssal plains
 - continental rises

Use the table below to answer Questions 6–8.

Exercise and Heart Rates			
Subject	Resting	Fast Walk	Slow Jog
1	65	72	110
2	78	88	120
3	72	83	125
4	69	78	105
5	75	90	135
Averages	71.8	82.2	119

- The table shows heart rates before and after a 10-min session. Which statement best summarizes the data?
 - There is no relationship between heart rate and exercise.
 - Exercise increased the heart rate of the participants.
 - Heart rate increased as exercise became more strenuous.
 - Ten minutes of exercise was not enough to increase heart rate.
- According to the data, which subject appears to be in the best shape and why?
 - Subject 1 because the subject had the lowest resting heart rate
 - Subject 4 because the subject had the lowest heart rate during a slow jog
 - Subject 5 because the subject had the fastest resting heart rate
 - This cannot be determined from the table because not enough information is given about each of the subjects.
- What would be the best graph to use in order to present the data found?
 - bar graph
 - line graph
 - circle graph
 - a model