**Chapter 2: The Way the Earth Works: Plate Tectonics**

**LEARNING OBJECTIVES**

By the end of the chapter you should be able to . . .

2A. discuss the evidence that Alfred Wegener used to justify his proposal that continents drift.

2B. describe the process of sea-floor spreading and the observations that allowed geologists to confirm it takes place.

2C. contrast the lithosphere with the asthenosphere, identify major plates of the lithosphere, and explain how the boundaries between plates can be recognized.

2D. sketch the three types of plate boundaries, and describe the nature of motion that occurs across them.

2E. relate types of geologic activity to types of plate boundaries, and explain how new plate boundaries can form and existing ones can cease activity.

2F. outline the major ideas now included in the modern theory of plate tectonics, and reinterpret Wegener's observations in the context of his theory.

2G. describe how measurements of paleomagnetism have helped to prove plate tectonics happens.

2H. explain the methods scientists use to describe and measure the velocity of plate motion.

**CHAPTER 02 : The Way the Earth Works : Plate Tectonics**

**MULTIPLE CHOICE**

1. In Wegener's evidence for continental drift, continents were proposed to fit together, such as the east coast of South America with the

   a. west coast of Europe.
   b. northeast coast of Africa.
   c. west coast of Greenland.
   d. southern west coast of Africa.

ANS: D DIF: Moderate REF: 2.1

OBJ: 2A. Discuss the evidence that Alfred Wegener used to justify his proposal that continents drift.

MSC: Remembering

2. Evidence that glaciers once covered an area might include

a. glacial striations. c. remnants of ice.

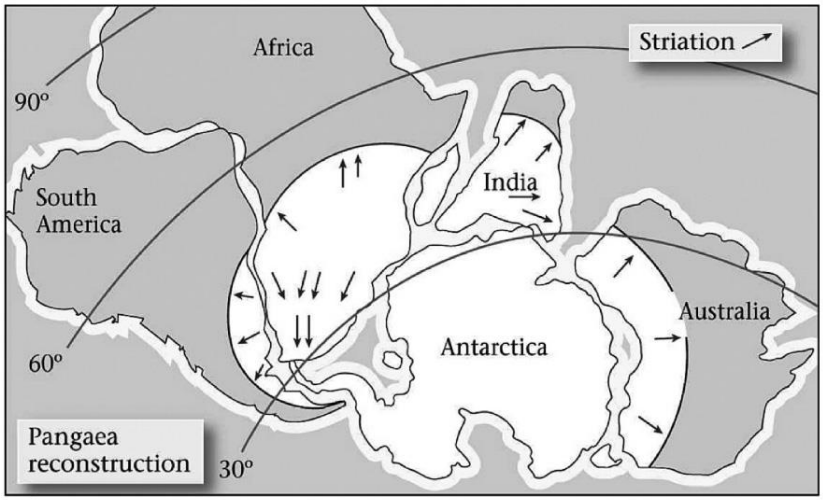
b. glacial piles. d. well-sorted sediment.

ANS: A DIF: Moderate REF: 2.2

OBJ: 2A. Discuss the evidence that Alfred Wegener used to justify his proposal that continents drift.

MSC: Remembering

3. Late Paleozoic glacial deposits are NOT found in




a. India. c. North America.

b. southern Africa. d. South America.

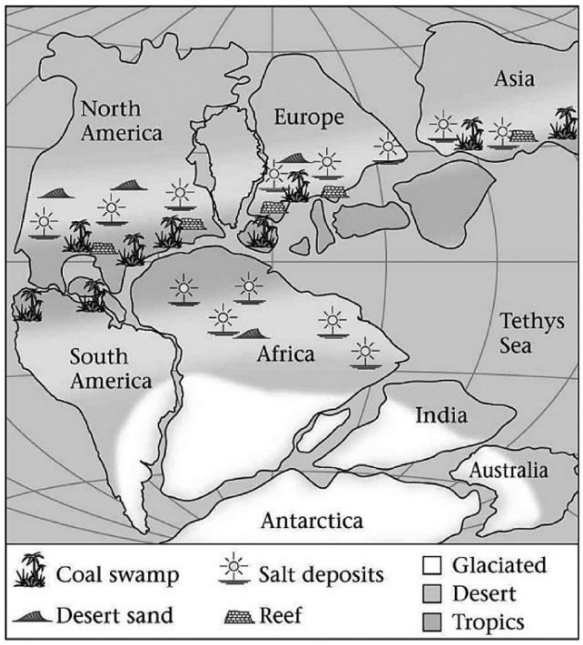
ANS: C DIF: Easy REF: 2.2

OBJ: 2A. Discuss the evidence that Alfred Wegener used to justify his proposal that

continents drift.

MSC: Understanding

4. Consult the figure below. Abundant swamps led to the formation of coal during the Late Paleozoic in which of the following places?




a. India c. North America

b. southern Africa d. Antarctica

ANS: C DIF: Easy REF: 2.2

OBJ: 2A. Discuss the evidence that Alfred Wegener used to justify his proposal that continents drift.

MSC: Understanding

5. Wegener's idea of continental drift was rejected by American geologists because

a. his research background in meteorology and glaciology disqualified him to study geology.

b. he could not conceive of a valid mechanism that would cause continents to shift positions.

c. he had relatively little evidence supporting the existence of a supercontinent.

d. the apparent fit of continental coastlines is blurred when the margins are defined by the edges of continental shelves rather than sea level.

ANS: B DIF: Moderate REF: 2.1 | 2.2

OBJ: 2A. Discuss the evidence that Alfred Wegener used to justify his proposal that continents drift.

MSC: Understanding

6. If a geologist discovered coal in a modern-day cold, snowy location, he or she could conclude that

a. a meteorite must have struck the area.

b. the area was once covered with swamps and/or jungles.

c. the area was once covered with an ocean.

d. this discovery was anomalous.

ANS: B DIF: Difficult REF: 2.2

OBJ: 2A. Discuss the evidence that Alfred Wegener used to justify his proposal that continents drift.

MSC: Applying

7. Which of the following is MOST true of the lithosphere?

a. It is composed of the crust and uppermost part of the mantle.

b. It is the same thing as the crust.

c. It is a very ductile layer in the upper part of the mantle.

d. It is the layer of the mantle directly below the asthenosphere.

ANS: A DIF: Easy REF: 2.4

OBJ: 2C. Contrast the lithosphere with the asthenosphere, identify major plates of the lithosphere, and explain how the boundaries between plates can be recognized.

MSC: Understanding

8. Which of the following was NOT used as evidence by Alfred Wegener to support his theory of continental drift?

a. fossils
c. seismic waves
b. matching mountain ranges
d. the “fit” of the continents

ANS: C DIF: Moderate REF: 2.2

OBJ: 2A. Discuss the evidence that Alfred Wegener used to justify his proposal that continents drift.

MSC: Analyzing

9. Subduction zones occur at

a. hot spots.
c. transform boundaries.
b. divergent boundaries.
d. convergent boundaries

ANS: D DIF: Easy REF: 2.5

OBJ: 2D. Sketch the three types of plate boundaries, and describe the nature of motion that occurs across them.

MSC: Remembering

10. The Himalayan Mountains are the result of

a. subduction.
c. continental collision.
b. continental rifting.
d. hot spot activity.

ANS: C DIF: Moderate REF: 2.6

OBJ: 2D. Sketch the three types of plate boundaries and describe the nature of motion

that occurs across them.

MSC: Remembering

11. In the geologic past, the polarity of Earth's magnetic field is

    a. unknown, but it is assumed to have been identical to today's.

    b. known to have stayed constant through geologic time, as shown by remnant magnetization of iron-rich minerals in rocks.

    c. known to have experienced numerous reversals, as shown by remnant magnetization of iron-rich minerals in rocks.

    d. known to have stayed constant through time, based on theoretical calculations.

    ANS: C DIF: Easy REF: 2.8

    OBJ: 2G. Describe how measurements of paleomagnetism have helped to prove plate tectonics happens.

    MSC: Understanding

12. Regions of the seafloor with positive magnetic anomalies were formed during times when Earth's magnetic field

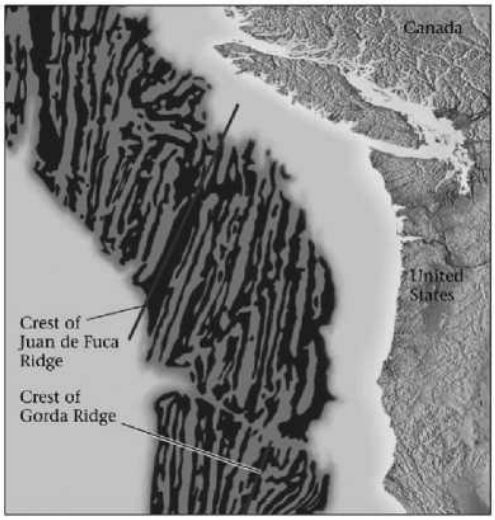
    a. was exceptionally strong.
    b. was exceptionally weak.
    c. had normal polarity.
    d. had reversed polarity.

    ANS: C DIF: Easy REF: 2.8

    OBJ: 2G. Describe how measurements of paleomagnetism have helped to prove plate tectonics happens.

    MSC: Understanding

13. According to the figure below, marine magnetic anomalies lay roughly _____ to mid-ocean ridges.




a. perpendicular

b. parallel

c. adjacent

d. at an obtuse angle

ANS: B DIF: Easy REF: 2.8

OBJ: 2G. Describe how measurements of paleomagnetism have helped to prove plate tectonics happens.

MSC: Applying

14. Seafloor spreading

a. recycles old oceanic crust.
c. creates new continental crust.

b. closes ocean basins.
d. creates new oceanic crust.

ANS: D DIF: Easy REF: 2.3

OBJ: 2B. Describe the process of sea-floor spreading and the observations that allowed geologists to confirm it takes place.

MSC: Understanding

15. Seafloor spreading occurs at _____ boundaries.

a. divergent c. transform

b. convergent d. transvergent

ANS: A DIF: Easy REF: 2.5

OBJ: 2B. Describe the process of sea-floor spreading and the observations that allowed geologists to confirm it takes place.

MSC: Remembering

16. The discovery of seafloor spreading finally provided a mechanism for

a. subduction zones. c. transgressions.

b. continental drift. d. normal faulting.

ANS: B DIF: Moderate REF: 2.3

OBJ: 2B. Describe the process of sea-floor spreading and the observations that allowed geologists to confirm it takes place.

MSC: Remembering

17. Seafloor spreading is driven by volcanic activity

a. in the middle of abyssal plains. c. at the edges of continental shelves.

b. along mid-ocean ridges. d. along fracture zones.

ANS: B DIF: Easy REF: 2.3 | 2.5

OBJ: 2B. Describe the process of sea-floor spreading and the observations that allowed geologists to confirm it takes place.

MSC: Understanding

18. Globally, the rate of seafloor spreading takes place at the same rate as

a. ocean subsidence. c. subduction.

b. transgression. d. erosion of the seafloor.

ANS: C DIF: Moderate REF: 2.3

OBJ: 2B. Describe the process of sea-floor spreading and the observations that allowed geologists to confirm it takes place.

MSC: Applying

19. Marine magnetic anomalies can be used to estimate the

a. rate of seafloor spreading.
c. age of the seafloor sediments.
b. rate of seafloor subsidence.
d. rate of Earth's expansion.

ANS: A DIF: Difficult REF: 2.8

OBJ: 2G. Describe how measurements of paleomagnetism have helped to prove plate tectonics happens.

MSC: Understanding

20. Younger oceanic crust will have _____ ocean sediments, whereas older oceanic crust will have _____ oceanic sediments.

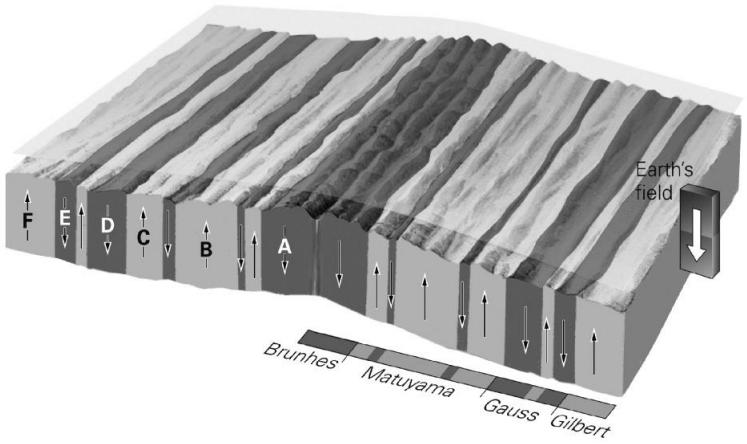
a. older; younger
c. thicker; thinner
b. carbonate; silicic
d. thinner; thicker

ANS: D DIF: Difficult REF: 2.5

OBJ: 2B. Describe the process of sea-floor spreading and the observations that allowed geologists to confirm it takes place.

MSC: Understanding

21. Using the image below, which marine magnetic anomalies show a reversed polarity?




a. A; D; E c. B; C; F

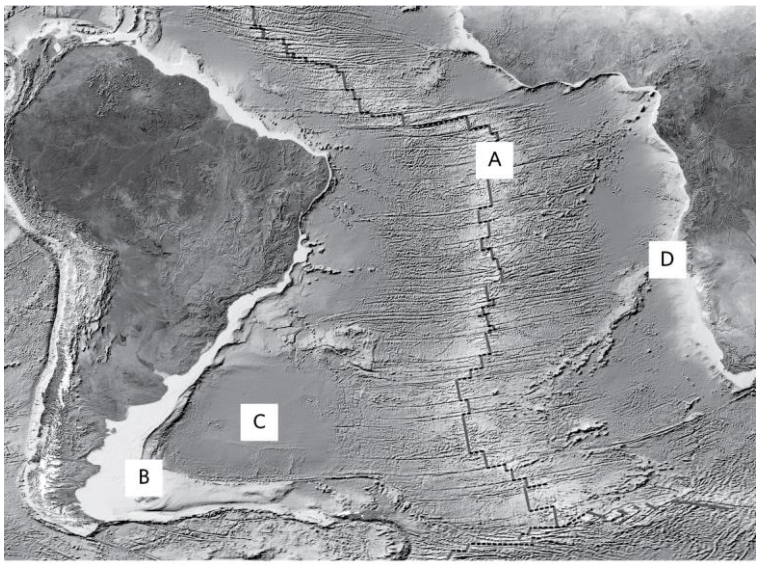
b. A; B; F d. C; D; F

ANS: C DIF: Moderate REF: 2.8

OBJ: 2G. Describe how measurements of paleomagnetism have helped to prove plate tectonics happens.

MSC: Applying

22. According to the image below, where is new oceanic crust being formed?




a. A c. C

b. B d. D

ANS: A DIF: Moderate REF: 2.8

OBJ: 2B. Describe the process of sea-floor spreading and the observations that allowed geologists to confirm it takes place.

MSC: Applying

23. A geologist aboard a deep-sea research vessel has collected several drill cores of oceanic crust from the bottom of the ocean. The cores are collected in order from east to west along the bottom of the basin and are labeled A1, B1, C1, and D1, respectively. Core A1 has 2.88 meters (m) of clay and siliceous ooze covering 4.86 m of pillow basalt. Core B1 has 2.37 m of muddy, clay ooze covering 3.57 m of basalt. Core C1 has 2.11 m of clay and siliceous ooze above 3.2 m of basalt. Core D1 has 1.87 m of siliceous ooze over 2.54 m of basalt. Which core is closest to the mid-ocean ridge?

a. A1 c. C1

b. B1 d. D1

ANS: D DIF: Difficult REF: 2.8

OBJ: 2B. Describe the process of sea-floor spreading and the observations that allowed geologists to confirm it takes place.

MSC: Applying

24. Which of the following was NOT used as evidence for seafloor spreading?

a. high heat flow at mid-ocean ridges
c. progressive change in age of crust

b. jigsaw puzzle fit of the continents
d. changes in thickness of sediments

ANS: B DIF: Difficult REF: 2.3

OBJ: 2B. Describe the process of sea-floor spreading and the observations that allowed geologists to confirm it takes place.

MSC: Applying

25. The discovery of marine magnetic anomalies was so important to the theory of seafloor spreading because they

a. showed a record of marine fossils, which can be linked to geologic time.

b. proved that Earth's magnetic field reverses polarity throughout history.

c. showed an accurate record of the creation and movement of oceanic crust.

d. allowed geologists to record the amount of oceanic crust formed.

ANS: C DIF: Moderate REF: 2.8

OBJ: 2G. Describe how measurements of paleomagnetism have helped to prove plate tectonics happens.

MSC: Analyzing

26. Continental coastlines that occur within the interior of a tectonic plate are called _____ margins.

a. internal c. active

b. passive d. inert

ANS: B DIF: Easy REF: 2.4

OBJ: 2F. Outline the major ideas now included in the modern theory of plate tectonics, and reinterpret Wegener's observations in the context of his theory.

MSC: Remembering

27. The theory of _____ states that the lithosphere is broken into a series of plates that move relative to each other.

a. plate drift c. continental drift

b. seafloor spreading d. plate tectonics

ANS: D DIF: Easy REF: 2.4

OBJ: 2F. Outline the major ideas now included in the modern theory of plate tectonics, and reinterpret Wegener's observations in the context of his theory.

MSC: Remembering

28. Compared with typical oceanic lithosphere, the thickness of continental lithosphere is

a. less.

b. greater.

c. approximately the same.

d. There is not a consistent pattern of lithospheric thickness.

ANS: B DIF: Moderate REF: 2.4

OBJ: 2F. Outline the major ideas now included in the modern theory of plate tectonics, and reinterpret Wegener's observations in the context of his theory.

MSC: Remembering

29. Under the theory of plate tectonics, the plates themselves are

a. discrete pieces of lithosphere at the surface of the solid Earth that move with respect to one another.

b. discrete layers of lithosphere that are vertically stacked one atop the other.

c. composed only of continental rocks that plow through the weaker oceanic rocks.

d. very thick (approximately one-quarter of Earth’s radius).

ANS: A DIF: Moderate REF: 2.4

OBJ: 2F. Outline the major ideas now included in the modern theory of plate tectonics, and reinterpret Wegener's observations in the context of his theory.

MSC: Understanding

30. Unlike the lithosphere, the asthenosphere

a. is able to flow over long periods.
c. varies in thickness from place to place.
b. has a density similar to the core.
d. is relatively cool.

ANS: A DIF: Moderate REF: 2.4

OBJ: 2C. Contrast the lithosphere with the asthenosphere, identify major plates of the lithosphere, and explain how the boundaries between plates can be recognized.

MSC: Understanding

31. The thickness of oceanic lithosphere is

a. nearly uniformly 100 km.
b. greatest at the geographic poles and least near the equator.
c. greatest near the mid-ocean ridges and thins out away from the ridges.
d. least near the mid-ocean ridges and thickens away from the ridges.

ANS: D DIF: Moderate REF: 2.5

OBJ: 2F. Outline the major ideas now included in the modern theory of plate tectonics, and reinterpret Wegener's observations in the context of his theory.

MSC: Applying

32. Deformed (bent, stretched, or cracked) lithosphere occurs

a. randomly over the surface of Earth.
b. primarily within the interiors of tectonic plates.
c. primarily on the margins of tectonic plates.
d. primarily at hot spots.

ANS: C DIF: Difficult REF: 2.4

OBJ: 2F. Outline the major ideas now included in the modern theory of plate tectonics,

and reinterpret Wegener's observations in the context of his theory.

MSC: Applying

33. The primary difference between lithospheric and asthenospheric mantle that gives rise to numerous different patterns of physical behavior is

a. physical state: the lithosphere is solid; the asthenosphere is liquid.

b. chemical composition: the lithosphere is mafic; the asthenosphere is felsic.

c. temperature: the lithosphere is cooler than the asthenosphere.

d. chemical composition: the lithosphere is felsic; the asthenosphere is mafic.

ANS: C DIF: Difficult REF: 2.4

OBJ: 2C. Contrast the lithosphere with the asthenosphere, identify major plates of the lithosphere, and explain how the boundaries between plates can be recognized.

MSC: Analyzing

34. At a subduction zone, the down-going (subducting) plate

a. is always composed of continental lithosphere.

b. is always composed of oceanic lithosphere.

c. may be composed of either oceanic or continental lithosphere.

d. is composed entirely of asthenosphere.

ANS: B DIF: Easy REF: 2.5

OBJ: 2D. Sketch the three types of plate boundaries, and describe the nature of motion that occurs across them.

MSC: Understanding

35. The distribution of _____ across the globe provides the primary indicator of boundaries between all tectonic plates.

a. mountain ranges
c. mid-ocean ridges
b. volcanoes
d. earthquakes

ANS: D DIF: Moderate REF: 2.4

OBJ: 2F. Outline the major ideas now included in the modern theory of plate tectonics, and reinterpret Wegener's observations in the context of his theory.

MSC: Understanding

36. Which of these parts of the deep-ocean floor is flat and nearly featureless?

a. ridge axis
c. guyot
b. abyssal plain
d. trench

ANS: B DIF: Easy REF: 2.3

OBJ: 2D. Sketch the three types of plate boundaries, and describe the nature of motion that occurs across them.

MSC: Remembering

37. Beneath a blanket of sediments, oceanic crust is primarily composed of

a. granite.
c. limestone.
b. basalt.
d. coal.

ANS: B DIF: Moderate REF: 2.3

OBJ: 2B. Describe the process of sea-floor spreading and the observations that allowed geologists to confirm it takes place.

MSC: Remembering

38. With increasing distance from a mid-ocean ridge, the age of oceanic crust

a. increases.
c. stays constant.
b. decreases.
d. varies randomly.

ANS: A DIF: Easy REF: 2.5

OBJ: 2D. Sketch the three types of plate boundaries, and describe the nature of motion that occurs across them.

MSC: Understanding

39. Slab pull occurs because subducting slabs are _____ and therefore _____ than surrounding asthenosphere.

a. less mafic; less dense
b. cooler; more dense
c. hotter; more dense
d. cooler; less dense

ANS: B DIF: Moderate REF: 2.9

OBJ: 2H. Explain the methods scientists use to describe and measure the velocity of plate motion.

MSC: Understanding

40. Transform boundaries occur MOST commonly perpendicular to _____ boundaries in order to break the _____ into segments so as to accommodate motion on a sphere.

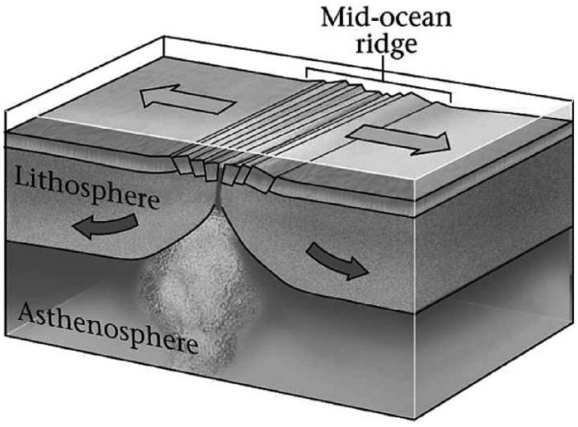
a. convergent; accretionary prisms
b. convergent; deep ocean trenches
c. divergent; mid-ocean ridges
d. divergent; magnetic anomalies

ANS: C DIF: Difficult REF: 2.5

OBJ: 2D. Sketch the three types of plate boundaries, and describe the nature of motion that occurs across them.

MSC: Understanding

41. Which basic type of plate boundary is shown in the image below?



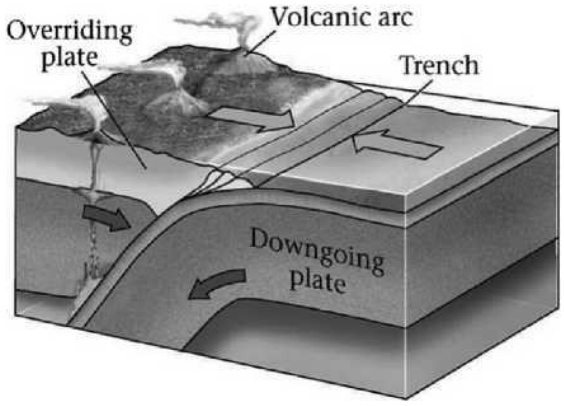

a. divergent
c. transvergent
b. convergent
d. transform

ANS: A DIF: Easy REF: 2.5

OBJ: 2D. Sketch the three types of plate boundaries, and describe the nature of motion that occurs across them.

MSC: Applying

42. Which basic type of plate boundary is shown in the image below?




a. divergent
c. transvergent
b. convergent
d. transform

ANS: B DIF: Easy REF: 2.5

OBJ: 2D. Sketch the three types of plate boundaries, and describe the nature of motion

that occurs across them.

MSC: Applying

43. At transform plate boundaries,

a. earthquakes are common but volcanoes are absent.

b. volcanoes are common but earthquakes do not occur.

c. both earthquakes and volcanoes are common.

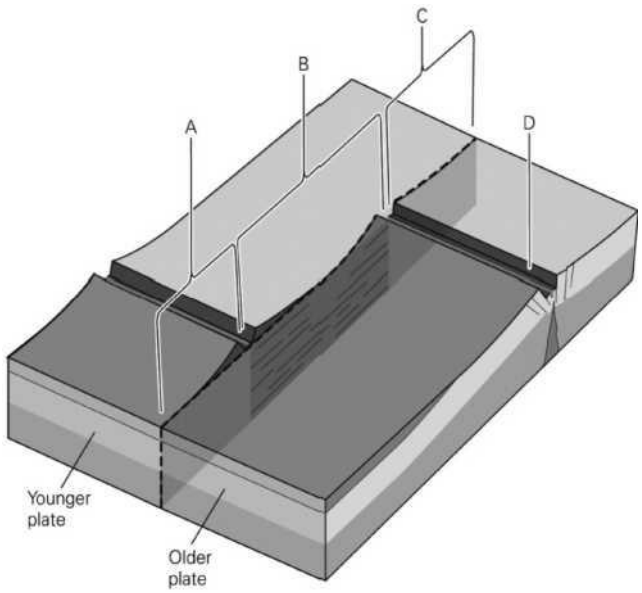
d. neither earthquakes nor volcanoes are common.

ANS: A DIF: Moderate REF: 2.5

OBJ: 2D. Sketch the three types of plate boundaries, and describe the nature of motion that occurs across them.

MSC: Applying

44. The image below shows a view of a typical segmented mid-ocean ridge. Which letter below marks the location of the active transform fault?




a. A

b. B

c. C

d. D

ANS: B DIF: Difficult REF: 2.5

OBJ: 2D. Sketch the three types of plate boundaries, and describe the nature of motion that occurs across them.

MSC: Applying

45. The mid-ocean ridges are elevated above the surrounding seafloor because

a. ridge rocks are hot and therefore have relatively low density.

b. the lithosphere is thickest at the ridges so they stand up taller.

c. rising ocean currents create a vacuum that pulls ridges up.

d. ridge rocks are mafic, which are less dense than ultramafic ocean basin rock.

ANS: A DIF: Difficult REF: 2.5

OBJ: 2D. Sketch the three types of plate boundaries, and describe the nature of motion that occurs across them.

MSC: Analyzing

46. The rate of motion of a lithospheric plate with respect to a stationary location inside Earth is termed _____ *plate velocity,* whereas the motion of a plate with respect to another is termed _____ *plate velocity*.

a. absolute; relative

b. relative; absolute

c. Both *absolute* and *relative* plate velocity are measures of absolute velocity.

d. Both *absolute* and *relative* plate velocity are measures of relative velocity.

ANS: A DIF: Moderate REF: 2.9

OBJ: 2H. Explain the methods scientists use to describe and measure the velocity of plate motion.

MSC: Remembering

47. Seafloor spreading is MOST likely to occur at

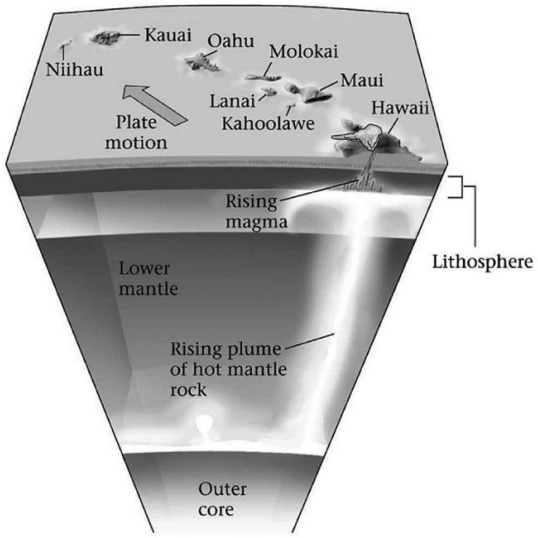
a. convergent boundaries.
c. divergent boundaries.
b. transform boundaries.
d. hot spots.

ANS: C DIF: Moderate REF: 2.5

OBJ: 2D. Sketch the three types of plate boundaries, and describe the nature of motion that occurs across them.

MSC: Understanding

48. Consult the figure below. Hawaii is an example of




a. hot-spot volcanism.
b. mid-ocean ridge volcanism.
c. a volcanic island arc formed by subduction.
d. transform margin.

ANS: A DIF: Easy REF: 2.7

OBJ: 2F. Outline the major ideas now included in the modern theory of plate tectonics, and reinterpret Wegener's observations in the context of his theory.

MSC: Applying

49. Hot spots can occur

a. only within continental plates.

b. only within oceanic plates.

c. within either continental or oceanic plates.

d. only when the thickness of the crust is less than 10 km.

ANS: C DIF: Moderate REF: 2.7

OBJ: 2F. Outline the major ideas now included in the modern theory of plate tectonics, and reinterpret Wegener's observations in the context of his theory.

MSC: Applying

50. What would happen if the rate of seafloor spreading was faster than the rate of subduction?

a. Arc volcanoes would not form. c. The Earth would become smaller.

b. The ocean basins would shrink. d. The Earth would grow larger.

ANS: D DIF: Moderate REF: 2.3

OBJ: 2B. Describe the process of sea-floor spreading and the observations that allowed geologists to confirm it takes place.

MSC: Analyzing

**SHORT ANSWER**

1. Explain why Wegener’s theory of continental drift was not originally accepted by geologists of his time.

ANS:

Wegener could not provide a plausible mechanism for the movement of continents. Leading geologists of the day argued that no forces are strong enough to move continents.

DIF: Easy REF: 2.2

OBJ: 2A. Discuss the evidence that Alfred Wegener used to justify his proposal that continents drift.

MSC: Understanding

2. Describe the process of seafloor spreading, making sure to address why the diameter of Earth is not growing.

ANS:

As plates move apart at a divergent plate boundary, magma rises into the new space, erupting at the surface to form pillow basalts and cooling along the sides of the fracture to form gabbro dikes. These pillow basalts and gabbro dikes become new oceanic crusts that then move away from each other, and again more magma moves toward the surface to start the process again. This slowly moves the plates apart, forming new oceanic crust and new ocean basins. The newly formed crust is balanced by the recycling of old oceanic crust into subduction zones at convergent boundaries on the opposite sides of ocean basins.

DIF: Moderate REF: 2.3

OBJ: 2B. Describe the process of sea-floor spreading and the observations that allowed geologists to confirm it takes place.

MSC: Understanding

3. Plate tectonics theory is often referred to as the “unifying” theory in geology. Explain why plate tectonics is such an important theory to the study of Earth.

ANS:

There are many good answers to this; however, a few good answers might reference how, before plate tectonics, we did not really understand how mountains formed, why volcanoes

formed where they did, why earthquakes occur where they do, and so on. Plate tectonics also allows us to explain how and why rocks move through the rock cycle, how oceans form, or why marine fossils can be found at the top of Mount Everest. Any good answer will explain that before the theory of plate tectonics there were very many processes we did not understand, and since plate tectonic theory has been around we have been able to explain many of these processes.

DIF: Difficult REF: 2.4

OBJ: 2F. Outline the major ideas now included in the modern theory of plate tectonics, and reinterpret Wegener's observations in the context of his theory.

MSC: Analyzing

4. Discuss why transform boundaries are found in conjunction with divergent boundaries.

ANS:

Transform boundaries are found along mid-ocean ridges (MORs). They break the MORs into smaller segments, which allows the spreading of the plates at MORs to be accommodated on the three-dimensional, spherical surface of Earth.

DIF: Difficult REF: 2.5

OBJ: 2D. Sketch the three types of plate boundaries, and describe the nature of motion that occurs across them.

MSC: Analyzing

5. A geologist measures the amount of seafloor produced along a mid-ocean ridge (MOR) to be 45 km. The oldest crust produced is 4.5 Ma. What is the spreading rate of the MOR in centimeters per year? Show your work.

ANS:

First convert km à cm: $\frac{45\ km}{1} \times \frac{1000}{1km} \times \frac{100cm}{1m} = 4{,}500{,}000\ cm$

Convert Ma à yr: $\frac{4.5\ Ma}{1} \times \frac{1{,}000{,}000yr}{1ma} = 4{,}500{,}000\ yr$

Plug into v = d/t: $\frac{4{,}500{,}000\ cm}{4{,}500{,}000\ yr} = 1\ \frac{cm}{yr}$

DIF: Difficult REF: 2.9

OBJ: 2H. Explain the methods scientists use to describe and measure the velocity of plate motion.

MSC: Applying

6. Compare the oceanic crust to the continental crust with respect to age. Why is this so?

ANS:

Oceanic crust is younger than continental crust because it is created at mid-ocean ridges and recycled back into the mantle at subduction zones. Continental crust does not get recycled back into the mantle via subduction, so it is generally much older.

DIF: Difficult REF: 2.5

OBJ: 2D. Sketch the three types of plate boundaries, and describe the nature of motion that occurs across them.

MSC: Analyzing

7. Compare and contrast the lithospheric mantle and the asthenosphere compositionally and behaviorally. Why is this so?

ANS:

The lithospheric mantle and the asthenosphere are compositionally the same; they are both primarily peridotite. However, the lithospheric mantle behaves as rigid solid, whereas the asthenosphere behaves plastically. The difference between them is their respective

temperatures. The asthenosphere is hotter than the lithosphere because it is deeper within the Earth.

DIF: Moderate REF: 2.4

OBJ: 2C. Contrast the lithosphere with the asthenosphere, identify major plates of the lithosphere, and explain how the boundaries between plates can be recognized.

MSC: Analyzing

8. Are ocean floors uniformly flat? Explain why or why not.

ANS:

The ocean floors are not uniformly flat. The ocean floor contains features including mid-ocean ridges, abyssal plains, and seamounts.

DIF: Moderate REF: 2.3

OBJ: 2F. Outline the major ideas now included in the modern theory of plate tectonics, and reinterpret Wegener's observations in the context of his theory.

MSC: Understanding

9. What happens when a continental plate meets an oceanic plate at a convergent boundary?

ANS:

When a continental plate and an oceanic plate come together at a convergent boundary, subduction takes place. During subduction, the denser oceanic plate sinks into the asthenosphere beneath the overriding continental plate. A continental arc develops along the edge of the continent where the oceanic plate subducts.

DIF: Moderate REF: 2.5

OBJ: 2D. Sketch the three types of plate boundaries, and describe the nature of motion that occurs across them.

MSC: Understanding

10. How can hotspot volcanoes be used to measure past plate velocities?

ANS:

Hot spot volcanic islands form on the surface of the Earth directly above hot spots. As tectonic plates slowly move over time, these volcanic islands are moved off of and away from the hot spot. The volcanic islands become extinct and slowly subside below sea level, becoming sea mounts. The chain of inactive volcanic islands and seamounts is known as a hot spot track. Using the ages and distances between the islands and seamounts, plate velocity can be calculated.

DIF: Difficult REF: 2.9

OBJ: 2H. Explain the methods scientists use to describe and measure the velocity of plate motion.

MSC: Applying