

CHAPTER 2 The Way the Earth Works: Plate Tectonics

MULTIPLE CHOICE

1. Wegener proposed continental drift after he observed evidence from fossils, glacial deposits, and the fit of the continents that suggested all of the continents were once _____.
 - a. aligned north to south along the prime meridian during the late Cenozoic
 - b. aligned east to west along the equator during the late Mesozoic through the Cenozoic
 - c. combined to form a supercontinent (he termed Rodinia) in the Proterozoic
 - d. combined to form a supercontinent (he termed Pangaea) in the late Paleozoic through the Mesozoic

ANS: D

2. Late Paleozoic glacial deposits are NOT found in which of the following places?
 - a. India
 - b. southern Africa
 - c. North America
 - d. South America

ANS: C

3. Abundant swamps led to the formation of coal during the Late Paleozoic in which of the following places?
 - a. India
 - b. southern Africa
 - c. North America
 - d. Antarctica

ANS: C

4. Which plant genus dominated glaciated regions during the late Paleozoic and early Mesozoic?
 - a. *Ginkgo*
 - b. *Glossopteris*
 - c. *Neuropteris*
 - d. *Quercas*

ANS: B

5. Wegener's idea of continental drift was rejected by American geologists because _____.
 - a. his English was too poor to be understood by them
 - 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 at sea level

ANS: B

6. Currently, most geologists _____.
- continue to reject continental drift
 - agree that continental drift occurs, but they still do not understand why it occurs
 - agree that continental drift occurs; the mechanisms that drive drift are at work in the ocean basins and upper mantle and were unknown in Wegener's time
 - agree that continental drift occurs; the mechanisms that drive drift are at work in the lower mantle and outer core and were unknown in Wegener's time

ANS: C

7. The magnetic field of Earth in the geologic past is _____.
- unknown, but it is assumed to have been identical to today's
 - known to have been constant through geologic time, due to remnant magnetization of iron-rich minerals in rocks
 - known to have experienced numerous polarity reversals, due to remnant magnetization of iron-rich minerals in rocks
 - known to have been constant through time, on the basis of theoretical calculations

ANS: A

8. The apparent tendency of the north (or south) magnetic pole to vary in position over time is termed _____.
- dipole
 - magnetic declination
 - magnetic inclination
 - polar wander

ANS: D

9. The apparent polar-wander paths for continents that were not connected over some span of geologic history will likely _____ concerning the positions of the ancient magnetic pole.
- agree
 - disagree

ANS: B

10. Sea-floor spreading is driven by volcanic activity _____.
- in the middle of abyssal plains
 - along mid-ocean ridges
 - at the edges of continental shelves
 - along fracture zones

ANS: B

11. Within the sea floor, the rate of heat flow is greatest _____.
- along mid-ocean ridges
 - along fracture zones
 - at the edges of ocean basins
 - in the center of abyssal plains

ANS: A

12. Regions of the sea floor with positive magnetic anomalies were formed during times when Earth's magnetic field _____.
- was exceptionally strong
 - was exceptionally weak
 - had normal polarity
 - had reversed polarity

ANS: C

13. Regions of the sea floor with negative magnetic anomalies were formed during times when Earth's magnetic field _____.
- was exceptionally strong
 - was exceptionally weak
 - had normal polarity
 - had reversed polarity

ANS: D

14. Marine magnetic anomaly belts run parallel to _____.
- mid-ocean ridges
 - fracture zones
 - continental coastlines
 - continental shelves

ANS: A

15. Marine magnetic anomaly belts are widest when and where _____.
- continents are joined to form supercontinents
 - sea-floor spreading rates are relatively rapid
 - sea-floor spreading rates are relatively slow

ANS: B

16. The age of oceanic crust _____ with increasing distance from a mid-ocean ridge.
- increases
 - decreases

ANS: A

17. Wegener's evidence for a united Pangaea was so compelling that virtually all geologists agreed with the idea of continental drift during his lifetime.
- true
 - false

ANS: B

18. Distinctive rock sequences on South America terminate at the Atlantic Ocean but reappear on the continent of _____.
- Africa
 - Europe
 - North America
 - Australia

ANS: A

19. If we mentally align the continents to fit Wegener's concept of Pangaea, evidence of late Paleozoic glacial deposits _____.
- is more difficult to explain than in the modern continental configuration
 - is much more readily explained than in the modern continental configuration
 - makes very little sense in either the Pangaea configuration or the modern configuration

ANS: B

20. The apparent polar-wander path obtained from magnetite crystals in basalts on the North American continent is now interpreted to be the result of _____.
- wandering of the geomagnetic north pole
 - drifting of the North American continent

ANS: B

21. The deep ocean floor is flat and nearly featureless.
- true
 - false

ANS: B

22. Beneath a blanket of sediments, oceanic crust is primarily composed of two rocks, _____.
- granite and diorite
 - gabbro and basalt
 - sandstone and shale
 - slate and gneiss

ANS: B

23. All basalts younger than 700,000 years old _____.
- have normal magnetic polarity
 - have reverse magnetic polarity
 - are found on the ocean floor very far from mid-ocean ridges
 - are found on the continents

ANS: A

24. Marine magnetic anomalies result from sea-floor spreading in conjunction with _____.
- global warming
 - magnetic storms on the surface of the Sun
 - magnetic polarity reversals
 - apparent wander of the magnetic poles

ANS: C

25. The oldest sediments on the ocean floor are about _____ years old.
- 50 thousand
 - 4 billion

- c. 200 million
- d. 2.5 million

ANS: C

26. The primary difference between lithospheric and asthenospheric mantle that gives rise to numerous divergent patterns of physical behavior, is _____.
- a. physical state (the lithosphere is solid, and the asthenosphere is liquid)
 - b. chemical composition (the lithosphere is mafic, and the asthenosphere is felsic)
 - c. temperature (the lithosphere is cooler than the asthenosphere)
 - d. chemical composition (the lithosphere is felsic, and the asthenosphere is mafic)

ANS: C

27. The theory of plate tectonics _____.
- a. incorporates continental drift but not sea-floor spreading
 - b. incorporates sea-floor spreading but not continental drift
 - c. incorporates and explains both sea-floor spreading and continental drift
 - d. does not incorporate sea-floor spreading or continental drift

ANS: C

28. Unlike the lithosphere, the asthenosphere _____.
- a. is relatively weak and flows readily
 - b. has a density similar to the core
 - c. varies in thickness from place to place
 - d. is relatively cool

ANS: A

29. Continental lithosphere _____.
- a. is thicker than oceanic lithosphere
 - b. contains more mafic rocks than oceanic lithosphere
 - c. is denser than oceanic lithosphere
 - d. contains no crustal material, consisting solely of lithified upper mantle

ANS: A

30. The average thickness of continental lithosphere is about _____.
- a. 30 km
 - b. 60 km
 - c. 150 km
 - d. 10,000 km

ANS: C

31. The thickness of oceanic lithosphere is _____.
- a. 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

32. 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, which plow through the weaker oceanic rocks
 - d. very thick (approximately one-quarter of Earth's radius)

ANS: A

33. In the terminology of plate tectonics, an active margin is _____.
- a. synonymous with "subduction zone"
 - b. a 5-mile radius surrounding an active volcano
 - c. a continental coastline that coincides with a plate boundary
 - d. anywhere on Earth where earthquakes are especially frequent

ANS: C

34. Continental coastlines that occur within the interior of a tectonic plate are called _____.
- a. internal margins
 - b. passive margins
 - c. active margins
 - d. inert margins

ANS: B

35. Broad, sediment-covered continental shelves are found along _____.
- a. active margins
 - b. passive margins

ANS: B

36. Tectonic plates might consist of _____.
- a. continental lithosphere only
 - b. oceanic lithosphere only
 - c. oceanic or continental lithosphere or a combination of both
 - d. either oceanic or continental lithosphere, but not both

ANS: C

37. 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

ANS: C

38. Every plate boundary can be recognized by _____.
- a. the presence of active volcanoes
 - b. the presence of an earthquake belt
 - c. a deep chasm which can be seen from space
 - d. none of the above

ANS: B

39. Tectonic plates move at rates that are approximately _____.
- 1 to 5 cm every 1,000 years
 - 1 to 15 cm/year
 - 1 to 15 m/year
 - 10 to 100 m/year

ANS: B

40. At a divergent plate boundary, two opposed plates _____.
- move toward one another
 - move away from one another
 - slide past one another

ANS: B

41. At a convergent plate boundary, two opposed plates _____.
- move toward one another
 - move away from one another
 - slide past one another

ANS: A

42. At a transform plate boundary, two opposed plates _____.
- move toward one another
 - move away from one another
 - slide past one another

ANS: C

43. Mid-ocean ridges are _____.
- convergent plate boundaries
 - divergent plate boundaries
 - transform plate boundaries

ANS: B

44. As compared to a slowly spreading mid-ocean ridge, a rapidly spreading ridge is _____.
- wider
 - narrower
 - more silicic in lava composition

ANS: A

45. All lithospheric plates are approximately the same size and contain a combination of oceanic and continental crust.
- true
 - false

ANS: B

46. The youngest sea floor occurs _____.
- along passive margins
 - along active margins
 - along mid-ocean ridges
 - randomly over the entire ocean basin

ANS: C

47. Oceanic lithosphere thickens away from the mid-ocean ridge primarily due to _____.
- the addition of new crust due to hot-spot volcanism
 - the addition of new crust due to sedimentation
 - the addition of new lithospheric mantle as a result of cooling
 - reasons that geologists cannot determine at present

ANS: C

48. Subduction zones are _____.
- convergent plate boundaries
 - divergent plate boundaries
 - transform plate boundaries

ANS: A

49. At a subduction zone, the overriding plate _____.
- is always composed of continental lithosphere
 - is always composed of oceanic lithosphere
 - may be composed of either oceanic or continental lithosphere

ANS: C

50. At a subduction zone, the downgoing (subducting) plate _____.
- is always composed of continental lithosphere
 - is always composed of oceanic lithosphere
 - may be composed of either oceanic or continental lithosphere

ANS: B

51. The Wadati-Benioff zone is a belt of earthquakes found _____.
- within an otherwise stable continental interior
 - within an overriding plate at a subduction zone
 - within a downgoing plate at a subduction zone
 - along mid-ocean ridges

ANS: C

52. The Wadati-Benioff zone extends down within the mantle to a maximum depth of _____.
- 30 km
 - 150 km
 - 670 km
 - 990 km

ANS: C

53. At transform plate boundaries _____.
- earthquakes are common, but volcanoes are absent
 - volcanoes are common, but earthquakes do not occur
 - both earthquakes and volcanoes are common

ANS: A

54. A triple junction is a place on Earth's surface where _____.
- three volcanoes form a tight, triangular cluster
 - glacial ice, continental rocks, and the ocean can be found together
 - the boundaries of three lithospheric plates meet at a single point
 - the boundaries of three lithospheric plates meet to form an elongate surface

ANS: C

55. The mid-ocean ridges are elevated above the surrounding sea floor because _____.
- ridge rocks are hot and therefore of relatively low density
 - the lithospheric plates are thickest at the ridges so they stand up taller
 - rising ocean currents leave a vacuum above the ridge
 - ridge rocks are mafic, whereas the ocean basin crust consists of ultramafic rock

ANS: A

56. Hawaii is an example of _____.
- hot-spot volcanism
 - mid-ocean ridge volcanism
 - a volcanic island arc
 - a transform margin

ANS: A

57. Segments of the mid-ocean ridge system are offset. Between the offset segments we observe _____.
- a second series of ridges, perpendicular to the main set
 - deep-ocean trenches
 - transform faults
 - None of the above is correct.

ANS: C

58. When two bodies of continental lithosphere are pushed together at a convergent boundary, the result is _____.
- subduction
 - collision and mountain formation

ANS: B

59. Most of the pushing force that drives plate motion is produced _____.
- at mid-ocean ridges
 - at subduction zones
 - at collision zones
 - in the interiors of continental plates

ANS: A

60. Most of the pulling force that drives plate motion is produced _____.
- a. at mid-ocean ridges
 - b. at subduction zones
 - c. at collision zones
 - d. in the interiors of continental plates

ANS: B