Chapter 2 - Plate Tectonics: A Unifying Theory

1 As far back as 1620, Sir Francis Bacon commented on the similarity of the shorelines of western Africa and eastern South America and posited that the Old and New Worlds might once have been joined.

- ○ True
- ◉ False

2 Oceanic ridges are geologically stable features made up almost entirely of sedimentary rock.

- ○ True
- ◉ False

3 The paleomagnetism of geologically recent rocks from different continents is generally consistent with Earth's current magnetic field, whereas ancient rocks show different orientations.

- ◉ True
- ○ False

4 Earth's lithosphere is part of the asthenosphere, and is hot and semi-plastic.

- ○ True
- ◉ False

5 Features associated with convergent plate boundaries include volcanic island arcs, oceanic trenches, and mountain belts.

- ◉ True
- ○ False

6 Mantle plumes do not move with continental plates.

- ◉ True
- ○ False

7 To determine plate positions in various times in the past, geologists date the magnetic anomalies on the seafloor and determine the distance from the

ridge axis to that magnetic anomaly.

- ○ True
- ◉ False

8 Slab-pull and ridge-push are thought to be the primary facilitators of continental plate movement.

- ○ True
- ◉ False

9 The long, complex process of petroleum generation in the Persian Gulf began when the remains of marine organisms accumulated with bottom sediments and were buried.

- ◉ True
- ○ False

10 Plate movement plays a major role in the present non-random distribution of plants and animals.

- ◉ True
- ○ False

11 Why did Alexander du Toit feel it was necessary to propose a northern landmass he named Laurasia?

- ○ Pangaea did not account for all known landmasses.
- ◉ The landmass helped resolve climatological inconsistencies.
- ○ Paleomagnetic studies of the seafloor proved its existence.
- ○ A large mass of Gondwana had broken off and drifted northward.
- ○ Recent ocean voyages discovered remnants of its existence.

12 Gondwana consisted of which current continents?

- ◉ South America, Africa, Australia, Antarctica, and India
- ○ Africa, South America, Antarctica, and Australia
- ○ South America, Africa, India, and Australia
- ○ South Africa, India, Africa, and Australia
- ○ South America, Central America, and India

13 Who was the first person to suggest that all of the continents had originally been joined together as the supercontinent Pangaea?

- Snider-Pelligrini, in 1858
- Frank Taylor, in 1910
- Alfred Wegener, in 1912
- Alexander du Toit, in 1937
- Harry Hess, in 1962

14 Edward Suess thought the similarity of fossil plants and animals in Gondwana was due to ____.

- the appearance and disappearance of connecting land bridges on the southern continents
- the fact that Gondwana had always been one giant supercontinent
- the extremely slow rate of evolution that occurred during the late Paleozoic
- geographical barriers between Gondwana and Pangaea
- interbreeding among most related species

15 If the continents were once joined together, rocks and mountain ranges on the margins of each should have ____.

- formed under the same conditions and in the same sequence
- formed the same sequences but at different times
- formed under different conditions at different times
- formed different sequences at the same time
- slowed down the process of continental drift

16 Which statement *best* explains why glacial deposits have given strong evidence of the existence of Gondwana?

- A single continent in low latitudes would result in low latitude glaciation.
- Glacial striations have shown that all glaciers on each continent flowed to a central location.
- Fossil plants indicate a tropical climate in the northern continents.
- The existence of a single continent in high latitudes is more sensible than low latitude glaciation on several continents AND glacial striations have shown that all glaciers on each continent flowed from a central location.
- The existence of a single continent in high latitudes is more sensible than low latitude glaciation on several continents AND fossil plants indicate a tropical climate

in the northern continents.

17 Interest in continental drift waned until studies of Earth's magnetic field and oceanographic research showed that ____.

- present-day oceans basins are old features that resulted from the breakup of Pangaea
- continents were constantly being pulled toward the poles by magnetic forces
- present-day ocean basins are not as old as continents but instead, are geologically young features that resulted from the breakup of Pangaea
- iron-rich continental plate material was being pulled into the ocean by Earth's magnetic field
- present-day ocean basins are old features that resulted from erosion of continental coastlines

18 Glacially deposited strata were important in the development of continental drift theory because ____.

- the distribution of glacial deposits indicated that the entire Earth must have been glaciated at one time
- the distribution of coal-swamp deposits indicated that the entire Earth must have been very warm while glaciers formed
- they indicated that large glaciers affect the rate of continental drift
- the glacial deposits indicated that all of the southern continents must have been closer to the South Pole and contiguous
- they showed how glacier formation remained constant even when continents drifted

19 Wegener's critics pointed out to him that the configuration of coastlines results from erosional and depositional processes and therefore is continuously being modified. What idea were they arguing *against*?

- continental movement due to erosion and deposition rather than plate tectonics
- continental fit between South America and Africa
- land bridges continually appearing and disappearing
- ocean currents having minimal effect on large landmasses
- using coastline geology for predicting movements of continents

20 A continental margin ____.

- is primarily above sea level
- is the transition zone from the exposed land to the ocean floor
- does not include the continental slope
- always transitions to an oceanic ridge
- are where submarine hydrothermal vents are found

21 What is produced by the combination of thermal and compositional convection within Earth's liquid metallic outer core and Earth's rotation?

- iron pyrite
- gravity
- global wind currents
- dipolar magnetism
- magnetic field

22 The study of paleomagnetism is possible because ____.

- the magnetic minerals in rocks create Earth's magnetic field
- most rocks contain no magnetic minerals
- each continent has its own magnetic pole
- the magnetic minerals in a cooling lava point toward the north magnetic pole
- the Curie point of minerals changes constantly

23 The Curie point is ____.

- where Earth's magnetic poles reverse
- the temperature at which iron-bearing minerals gain their magnetization
- the point at which remnant magnetism is equal to gravity
- where heat escapes from Earth's crust
- the north magnetic pole

24 What have differing paleomagnetic records for each continent shown?

- Each continent had its own magnetic pole during successive geological periods.
- Magnetic poles for each continent have moved over geological time.
- Magnetic poles have remained in one location and each of the continents has moved.
- Both the poles and the continents have moved over time.
- Some data are inconsistent with the theory of polar

wandering, indicating that further research must be done.

25 Magnetic reversals ____.

- occur in a matter of months
- occur when magnetic north and magnetic south poles switch positions
- have no affect on iron-bearing minerals
- are very well understood and can be predicted
- cause seafloor spreading to reverse directions

26 The seafloor spreading hypothesis indicates what as the primary cause of continental movement?

- volcanism in the ocean crust
- convergence of tectonic plates
- the formation and destruction of ocean basins
- the convection of mantle heat
- the decay of radioactive isotopes

27 What is the driving mechanism for plate tectonics?

- heat deep within Earth
- tidal forces caused by the moon
- volcanoes and earthquakes at plate boundaries
- gravity and magnetism acting on continents
- strong ocean currents and global winds

28 Geologists know that oceanic ridges are geologically very active because they ____.

- have a high diversity of oceanic life
- have many layers of sedimentary rock
- are the site of ancient continental slopes
- have many small earthquakes and are the site of recent volcanic eruptions
- are the site of oceanic trenches

29 What evidence has shown conclusively that the oceanic crust is geologically young and that the parallel magnetic striping pattern of basalts is symmetrical with regard to oceanic ridges?

- radiometric dating of oceanic basalts and sequences from continents exclusively
- the unusually thin layer of oceanic sediments and ages of contained fossils exclusively

- ○ the existence of the same magnetic anomaly patterns in all ocean basins
- ◉ radiometric dating of oceanic basalts and sequences from continents AND the unusually thin layer of oceanic sediments and ages of contained fossils
- ○ magnetic reversals contained in continental crusts that were at one time oceanic basalts

30 What statement *most accurately* describes the theory of seafloor spreading?

- ○ Subduction zones produce oceanic crust that moves away from these zones by seafloor spreading toward mid-oceanic ridges where it is consumed.
- ○ Oceanic crust continuously forms across the seafloor and is moved by subduction zones toward mid-oceanic ridges where it is consumed.
- ◉ Oceanic crust continuously forms at mid-oceanic ridges, moves away from these ridges by seafloor spreading, and is consumed at subduction zones.
- ○ Earth's molten core material erupts at mid-oceanic ridges, moves away from these ridges by seafloor spreading, and is consumed at subduction zones.
- ○ Subduction zones force oceanic crust to spread across the seafloor before being consumed at a fault valley.

31 An easy way to visualize plate movement is to think of a(n) ____.

- ○ water-skier skimming across the water of a lake
- ○ car rolling down the road
- ○ electron's movement around the nucleus of an atom
- ○ tractor pulling a hay cart up a hill
- ◉ conveyer belt moving luggage from one place to another

32 At transform plate boundaries, ____.

- ○ lithosphere is neither created or destroyed
- ○ plates move horizontally past each other
- ○ active volcanism is abruptly stopped
- ◉ plates move laterally past each other and active volcanism occurs
- ○ continental crust is transformed into seafloor crust

33 One of the best-known transform faults is the San Andreas Fault in California. This fault ____.

- is completely oceanic
- creates new lithosphere
- destroys old lithosphere
- separates the Pacific plate from the North American plate
- has little impact on earthquake activity in California

34 What are the three major types of plate boundaries?

- resurgent, divergent, and emergent
- convergent, divergent, and transform
- transcurrent, oblique, and resurgent
- emergent, oblique, and convergent
- transform, transcurrent, and translateral

35 What operating forces are primarily at work at divergent plate boundaries?

- compressional
- lateral shearing
- tensional
- thrusting
- strike-slip

36 Divergent plate boundaries most commonly occur along ____.

- continental margins
- mountain belts
- oceanic trenches
- the crests of oceanic ridges
- fault valleys

37 When two continents collide, they are welded together along a zone marking the former site of subduction. At this continental-continental plate boundary, a(n) ____ is formed.

- island arc
- abyssal plain
- trench
- interior mountain belt
- transform fault

38 Mantle plumes and hot spots help geologists ____.

- explain some of the geologic activity occurring at or near plate boundaries
- determine both direction and rate of plate

movement
- predict the formation of new continents
- determine the nearest divergent plate boundary
- understand the fossil distribution found in igneous rocks

39 Many metallic mineral deposits such as copper, gold, lead, silver, tin, and zinc are related to igneous and associated ____ activity.

- metamorphic
- subducting
- hydrothermal
- transform fault
- sedimentary

40 Climatic or geographic barriers are the most common province boundaries, and these are mostly controlled by ____.

- plate movement
- temperature
- rainfall
- soil type
- heat deep within Earth's core

41 As far back as 1620, Sir Francis Bacon commented on the similarity of the shorelines of western _____ and eastern _____.

Answer:
Africa, South America

42 Evidence for Late Paleozoic Era glaciation includes layers of _____ (sediments deposited by glaciers) and glacial _____ (scratch marks) in the bedrock beneath the sediments.

Answer:
till, striations

43 _____ rise more than one kilometer above the seafloor, and if flat-topped, they are called _____.

Answer:
Seamounts, guyots

44 An important aspect of the magnetic field is that the _____ poles, where the lines of force leave and enter Earth, do not coincide with the _____ poles.

Answer:
magnetic, geographic

45 Magnetic surveys of the oceanic crust revealed a pattern of striped magnetic anomalies in the rocks that are both _____ and _____ around the oceanic ridges.

Answer:
parallel, symmetricalsymmetrical, parallel

46 Geologists view many geologic processes from the perspective of plate tectonic theory in which plate interaction along plate margins is responsible for such phenomena as mountain building, earthquakes, and _____.

Answer:
volcanism

47 Divergent plate boundaries are present under continents during the early stages of continental breakup. When magma wells up beneath a continent, the crust is initially elevated, stretched, and thinned, producing _____.

Answer:
rift valleysfracturesfaultsvolcanic activity

48 At a convergent plate boundary a dipping plane of earthquake foci, called a(n) _____, defines subduction zones.

Answer:
Benioff zone

49 Volcanoes are found at _____ plate boundaries and _____ plate boundaries.

Answer:
divergent, convergentconvergent, divergent

50 The world's biota occupy _____, which are regions characterized b a distinctive assemblage of plants and animals.

Answer:
biotic provincesprovinces

51 Where do active continental margins develop?

Answer:

Active continental margins develop at the leading edge of a continental plate where oceanic lithosphere is subducted.

52 What are the three possible explanations for the distribution of paleomagnetic data? Which one of these explanations is correct?

Answer:

(1) The continent remained fixed and the north magnetic pole moved; (2) the north magnetic pole stayed still and the continent moved; (3) both the continent and north magnetic pole moved. The correct explanation is that both the continent and north magnetic pole moved.

53 How does convection transfer heat?

Answer:

As a material is heated, it expands and its density decreases. The less dense material then rises. After rising some distance, the material begins to cool, contract, and become denser. The material sinks and returns to the original level where it will eventually be heated and rise again.

54 Briefly explain the concepts of "slab-pull" and "ridge-push."

Answer:

In slab-pull, the subducting cold slab of lithosphere pulls the rest of the plate along as it descends into the asthenosphere. Ridge-push occurs because oceanic ridges are higher than the surrounding oceanic crust. Gravity pushes the oceanic lithosphere away from ridges and toward the trenches, where it is subducted back into Earth.

55

How does plate tectonics theory relate to world economics?

Answer:

By understanding the geologic history of a particular region of the world, geologists are better able to predict whether it will be a worthwhile location to search for economically important petroleum or ore deposits.

56 Who is generally credited with developing the concept of continental drift? Briefly summarize his idea. List at least three examples of evidence he claimed supported his hypothesis. Why was his idea, at least in part, rejected by many geologists of his time?

Answer:

Alfred Wegener is generally credited with developing the hypothesis of continental drift. Wegener proposed that all landmasses are slowly moving across Earth's surface. He portrayed his grand concept of continental movement in a series of maps showing the breakup of a supercontinent he named Pangaea and the movement of the various continents to their present-day locations.

Evidence he gave supporting his claim included continental fit, similarity of rock sequences and mountain ranges, glacial evidence, and fossil evidence.

Many geologists rejected his idea because no one could provide a suitable mechanism to explain how continents could move over Earth's surface.

57 Briefly explain how the Hawaiian Island chain formed. The definitions of hot spot and mantle plume should be included in your explanation.

Answer:

The Hawaiian Island chain formed as the Pacific plate traveled over a hot spot on the Earth's surface created by a mantle plume. A hot spot is a location on Earth's surface where a stationary column of magma, originating deep within the mantle--a mantle plume, has slowly risen to the surface and formed a volcano. Because the mantle plumes apparently remain stationary within the mantle while the plates move over them, the resulting hot spots leave a trail of extinct and progressively older volcanoes. This trail of extinct volcanoes is the Hawaiian Island chain.

58 Explain the mantle convection cell model and what it describes.

Answer:

A convection cell is a heat system formed primarily from decay of radioactive elements in Earth's core and lower mantle. In the mantle convection cell model heat from the core, supplemented by heat generated from radioactive decay, drives large mantle convection cells. In this manner, hot rock from the interior rises toward the surface, loses heat to the overlying lithosphere, becomes denser as it cools, and then sinks back into the interior where it is heated, and the process repeats itself. The convection cells therefore determine the location of spreading ridges and trenches, with the lithosphere lying above the convection cells. Spreading ridges mark the ascending limbs of adjacent convection cells and trenches are present where convection cells descend back into Earth's interior. Thus, each plate corresponds to a single convection cell that moves as a result of the convective movement of the cell itself. This model describes one mechanism for continental drift theory.