Name: _____

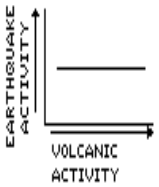
1) Which statement best describes the continental and oceanic crusts?

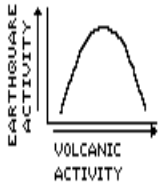
A) The continental crust is thicker and less dense than the oceanic crust.
B) The continental crust is thinner and more dense than the oceanic crust.
C) The continental crust is thinner and less dense than the oceanic crust.
D) The continental crust is thicker and more dense than the oceanic crust.

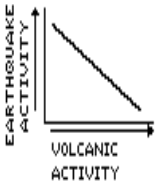
2) Recent volcanic activity in different parts of the world supports the inference that volcanoes are located mainly in

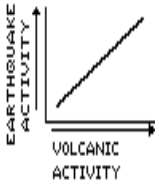
A) the central regions of continents
B) zones of crustal activity
C) zones in late stages of erosion
D) the centers of landscape regions

3) Which graph best represents the relationship between volcanic activity and earthquake activity in an area?

A) 

C) 

B) 

D) 

4) Folded sedimentary rock layers are usually caused by

A) crustal movement occurring after deposition
B) deposition of sediments in folded layers
C) a rise in sea level after deposition
D) differences in sediment density during deposition

5) The time that an earthquake occurs can be inferred by knowing the

A) distances between seismograph stations
B) epicenter distance and arrival time of the *P*-waves
C) travel time of the *S*-waves
D) arrival time of *P*-waves

6) A sandstone layer is found tilted at an angle of 75° from the horizontal. What probably caused this 75° tilt?

A) Nearly all sandstone layers are formed from wind-deposited sands.
B) The sediments that formed this sandstone layer were originally deposited at a 75° tilt.
C) This sandstone layer has recrystallized due to contact metamorphism.
D) This sandstone layer has changed position due to crustal movement.

Questions 7 through 11 refer to the following:

An earthquake originated in New York State. The *P*-wave travel time for this earthquake was recorded in the data table below for four widely separated seismic stations, *A*, *B*, *C*, and *D*.

DATA TABLE

Seismic Station	P - wave Travel Time
A	8 min 20 sec
B	0 min 31 sec
C	12 min 18 sec
D	3 min 20 sec

7) If the first *P*-wave arrived at seismic station *A* at 10hrs:22min:30sec, what was the origin time for the earthquake?

A) 02hrs:02min:30sec
B) 10hrs:30min:50sec
C) 10hrs:14min:10sec
D) 10hrs:22min:30sec

8) If it takes 50 seconds for the *P*-wave to arrive at Buffalo, about how long would it take for the *S*-wave from this same earthquake to arrive at Buffalo? [Refer to the *Earth Science Reference Tables*.]

A) 0min50sec
B) 6min40sec
C) 4min00sec
D) 1min40sec

9) What is the approximate distance between the earthquake's epicenter and station *A*? [Refer to the *Earth Science Reference Tables*.]

A) 7,500 km
B) 1,130 km
C) 5,100 km
D) 2,400 km

10) Which seismic station could be located in New York State?

A) *D* B) *C* C) *B* D) *A*

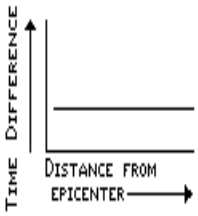
11) Which of the four seismic stations is located farthest from the epicenter?

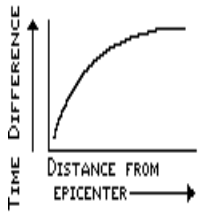
A) *B* B) *C* C) *D* D) *A*

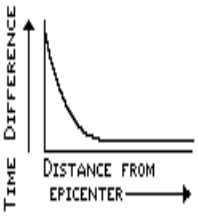
12) A seismograph station records a difference in arrival time between the *S*- and *P*-wave of 4 minutes. About how far away is the earthquake epicenter? [Refer to the *Earth Science Reference Tables*.]

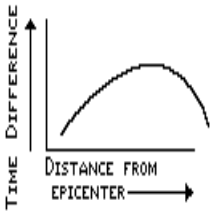
A) 1,000 km
B) 5,200 km
C) 2,600 km
D) 1,900 km

13) Which graph best represents the relationship between the differences in arrival times of *P*-waves and *S*-waves for locations at varying distances from an earthquake?

A) 

B) 

C) 

D) 

14) A large belt of mountain ranges and volcanoes surrounds the Pacific Ocean. Which events are most closely associated with these mountains and volcanoes?

A) tornadoes
B) earthquakes
C) sandstorms
D) hurricanes

15) According to the *Earth Science Reference Tables*, in which group are the zones of the Earth's interior correctly arranged in order of increasing average density?

A) crust, mantle, inner core, outer core
B) crust, mantle, outer core, inner core
C) inner core, outer core, mantle, crust
D) outer core, inner core, mantle, crust

16) To get a sample material from the mantle, drilling will be done through the oceanic crust rather than through the continental crust because oceanic crust is

A) younger than continental crust
B) more dense than continental crust
C) thinner than continental crust
D) softer than continental crust

17) According to the *Earth Science Reference Tables*, at 4,500 kilometers below the surface of the Earth, the pressure is estimated to be

A) 1.4 million atmospheres
B) 2.0 million atmospheres
C) 2.8 million atmospheres
D) 3.1 million atmospheres

18) The composition of some meteorites supports the inference that the Earth's core is composed of

A) magnesium and potassium
B) silicon and oxygen
C) iron and nickel
D) aluminum and calcium

19) Fossils of organisms that lived in shallow water can be found in horizontal sedimentary rock layers at great ocean depths. This fact is generally interpreted by most Earth scientists as evidence that

A) the cold water deep in the ocean kills shallow-water organisms
B) sections of the Earth's crust have changed their elevations relative to sea level
C) sunlight once penetrated to the deepest parts of the ocean
D) organisms that live in deep water evolved from species that once lived in shallow water

20) Where are earthquakes most likely to take place?

A) along the core-mantle interface
B) where the composition of the Earth tends to be uniform
C) near the Earth's Equator
D) near a fault zone

21) A *P*-wave reaches a seismograph station 2,600 kilometers from an earthquake epicenter at 12:10 p.m. According to the *Earth Science Reference Tables*, at what time did the earthquake occur?

A) 12:01 p.m.
B) 12:15 p.m.
C) 12:19 p.m.
D) 12:05 p.m.

22) The inference that the inner core of the Earth is solid is based on analysis of

A) seismic data
B) crustal rock
C) radioactive data
D) meteorite composition

23) According to the *Earth Science Reference Tables*, the rate of temperature increase below the Earth's surface is *greatest* between depths of

A) 3500 and 4000 km
B) 250 and 500 km
C) 1500 and 2500 km
D) 2500 and 3500 km

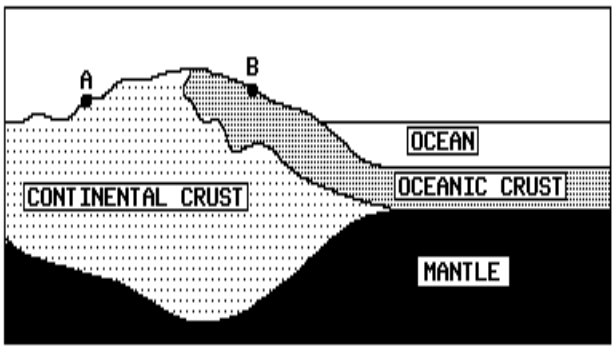
24) An earthquake occurred at 5:00:00 a.m. According to the *Earth Science Reference Tables*, at what time would the *P*-wave reach a seismic station 3,000 kilometers from the epicenter?

A) 5:04:30 a.m.
B) 5:05:40 a.m.
C) 5:01:40 a.m.
D) 5:10:15 a.m.

25) Which is the best evidence that the Earth's crust has been uplifted?

A) marine fossils found at high elevations above sea level
B) younger fossils above older fossils in layers of rock
C) shallow-water fossils found at great ocean depths
D) marine fossils found in horizontal sedimentary layers

26) In the diagram below, letters *A* and *B* represent locations near the edge of a continent.

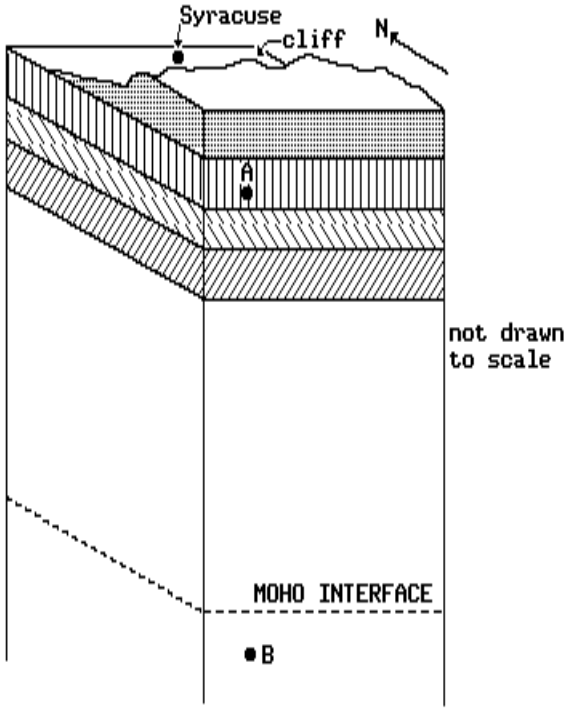


A geologist who compares nonsedimentary rock samples from locations *A* and *B* would probably find that the samples from location *A* contain

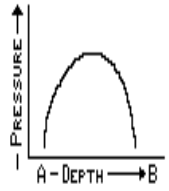
A) more fossils
B) the same minerals and fossils
C) more granite
D) more basalt

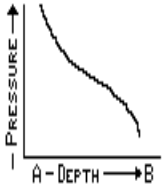
Questions 27 through 29 refer to the following:

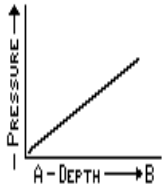
The diagram below is a block section of central New York State that extends deep into the Earth's interior. Points *A* and *B* represent reference points within the Earth.

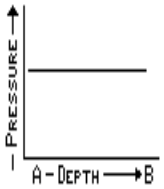


27) Which graph best represents the relationship between pressure and depth from point *A* to point *B*?

A)


C)


B)


D)


28) Which two zones of the Earth's interior are represented in the diagram?

A) crust and outer core
B) mantle and outer core
C) crust and mantle
D) outer core and inner core

29) According to the *Earth Science Reference Tables*, the inferred average density of the rock in the region around point *B* is most likely

A) 3.5 g/cm^3
B) 9.2 g/cm^3
C) 11.5 g/cm^3
D) 2.7 g/cm^3

30) The presence of marine fossils at elevations high above sea level provides good evidence for

A) volcanic eruptions
B) crustal erosion
C) continental glaciation
D) crustal uplift

31) The epicenter of an earthquake is located near Massena, New York. According to the *Earth Science Reference Tables*, the greatest difference in arrival times of the *P*- and *S*-waves for this earthquake would be recorded in

A) Utica, New York
B) Binghamton, New York
C) Plattsburgh, New York
D) Albany, New York

32) According to the *Earth Science Reference Tables*, the temperature of rock located 1,000 kilometers below the Earth's surface is about

A) 200° C
B) 2,100° C
C) 2,800° C
D) 3,200° C

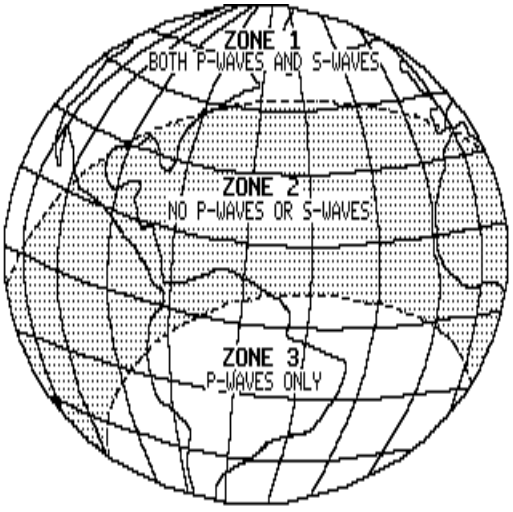
33) According to the *Earth Science Reference Tables*, as the depth within the Earth's interior increases, the

A) density, temperature, and pressure decrease
B) density increases, but temperature and pressure decrease
C) density and temperature increase, but pressure decreases
D) density, temperature, and pressure increase

34) It is suggested that the outer core of the Earth is liquid. Which is the *strongest* evidence for this?

A) *P*-waves disappear as they move through the outer core.
B) *S*-waves disappear as they move through the outer core.
C) *S*-waves speed up as they move through the outer core.
D) *P*-waves are transmitted through the outer core.

35) The diagram below of the Earth shows the observed pattern waves recorded after an earthquake.



The lack of *S*-waves in zone 3 can best be explained by the presence within the Earth of

A) a solid inner core
B) mantle convection cells
C) a liquid outer core
D) density changes

36) The thinnest section of the Earth's crust is found beneath

A) coastal plains
B) desert regions
C) mountain regions
D) oceans

37) A part of which zone of the Earth's interior is inferred to have a density of 10.0 grams per cubic centimeter? [Refer to the *Earth Science Reference Tables*.]

A) outer core
B) inner core
C) crust
D) mantle

38) The analysis of seismic data from an earthquake shows that some locations received both *P*-waves and *S*-waves, but other locations received only *P*-waves. What is the best inference that can be made from these observations?

A) A zone of liquid rock exists within the Earth.
B) *S*-waves are very weak.
C) Some seismographs are more sensitive than others.
D) Iron in some rocks prevents *S*-waves from traveling.

39) Earthquakes generate compressional waves (*P*-waves) and shear waves (*S*-waves). Compared to the speed of shear waves in a given earth material, the speed of compressional waves is

A) always faster
B) always slower
C) always the same
D) sometimes faster and sometimes slower

40) Two geologic surveys of the same area, made 50 years apart, showed that the area had been uplifted 5 centimeters during the interval. If the rate of uplift remains constant, how many years will it take for this area to be uplifted a total of 70 centimeters?

A) 350 years
B) 250 years
C) 700 years
D) 500 years

41) The difference in arrival times for *P*- and *S*-waves from an earthquake is 5.0 minutes. According to the *Earth Science Reference Tables*, how far away is the epicenter of the earthquake?

A) 2.6×10^3 km
B) 8.1×10^3 km
C) 3.5×10^3 km
D) 1.3×10^3 km

42) A seismograph station records a travel time difference of 7 minutes between *P*-waves and *S*-waves of an earthquake. Approximately how far is the seismograph station from the epicenter of the earthquake? [Refer to the *Earth Science Reference Tables*.]

A) 4.0×10^3 km
B) 5.5×10^3 km
C) 2.9×10^3 km
D) 1.9×10^3 km

43) Which evidence best supports the inference that the Earth's outer core possesses liquid characteristics?

A) The velocities of both primary and shear waves increase through the outer core.
B) Both primary waves and shear waves pass through the outer core.
C) Primary waves pass through the outer core but shear waves do not.
D) The primary wave velocity decreases, while the shear wave velocity increases in the outer core.

44) According to the *Earth Science Reference Tables*, in which zone of the Earth's interior is the melting point of the rock inferred to be lower than the actual temperature of the rock?

A) outer core
B) mantle
C) inner core
D) crust

45) Four seismograph stations receive data from the same earthquake. The table below shows the differences in travel times for the *P*- and *S*-waves recorded at each station. Which station is closest to the epicenter of the earthquake?

STATION	TRAVEL-TIME DIFFERENCE
A	4 min 32 sec
B	3 min 52 sec
C	3 min 10 sec
D	4 min 17 sec

A) *A*
B) *D*
C) *B*
D) *C*

46) Theories about the composition of the Earth's core are supported by meteorites that are composed primarily of

A) aluminum and oxygen
B) oxygen and silicon
C) iron and nickel
D) aluminum and iron

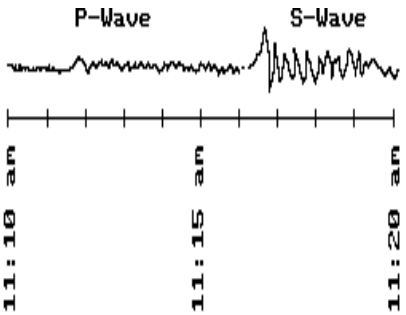
47) A seismograph station records a difference between the arrival times of the *P*-wave and *S*-wave of 7 minutes 30 seconds. About how far away is this station from the earthquake epicenter? [Refer to the *Earth Science Reference Tables*.]

A) 6,000 km
B) 4,400 km
C) 7,200 km
D) 2,100 km

48) A seismographic station determines that its distance from the epicenter of an earthquake is 4,000 kilometers. According to the *Earth Science Reference Tables*, if the *P*-wave arrived at the station at 10:15 a.m., the time of the earthquake's origin was

A) 10:22 a.m.
B) 10:08 a.m.
C) 10:02 a.m.
D) 10:10 a.m.

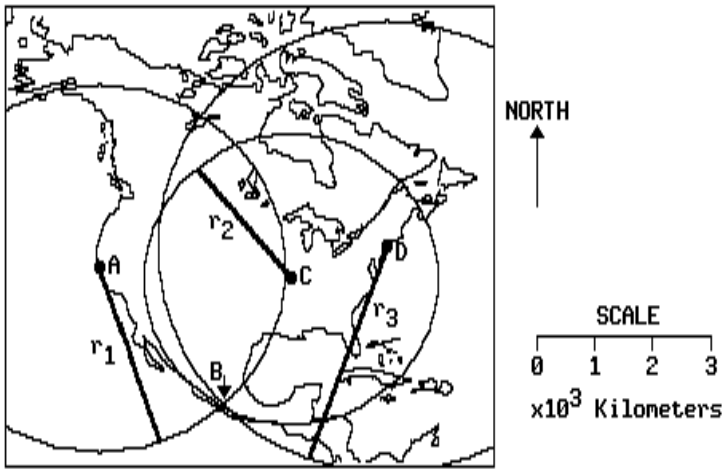
49) The diagram below represents the seismogram recorded at a seismograph station as a result of an earthquake. Based on the data provided by the seismogram, what is the approximate distance between the station and the earthquake epicenter? [Refer to the *Earth Science Reference Tables*.]



A) 1,300 km
B) 2,600 km
C) 5,200 km
D) 3,400 km

Questions 50 and 51 refer to the following:

The map below shows three circles used to locate an earthquake epicenter. Five lettered locations, *A*, *B*, *C*, *D*, and *E*, are shown as reference points. Epicenter distances from three locations are represented by r_1, r_2, and r_3.



50) On another day, location *A* records the arrival of compression waves (*P*-waves), but not shear waves (*S*-waves), from a distant earthquake. Which statement best explains why shear waves were *not* received?

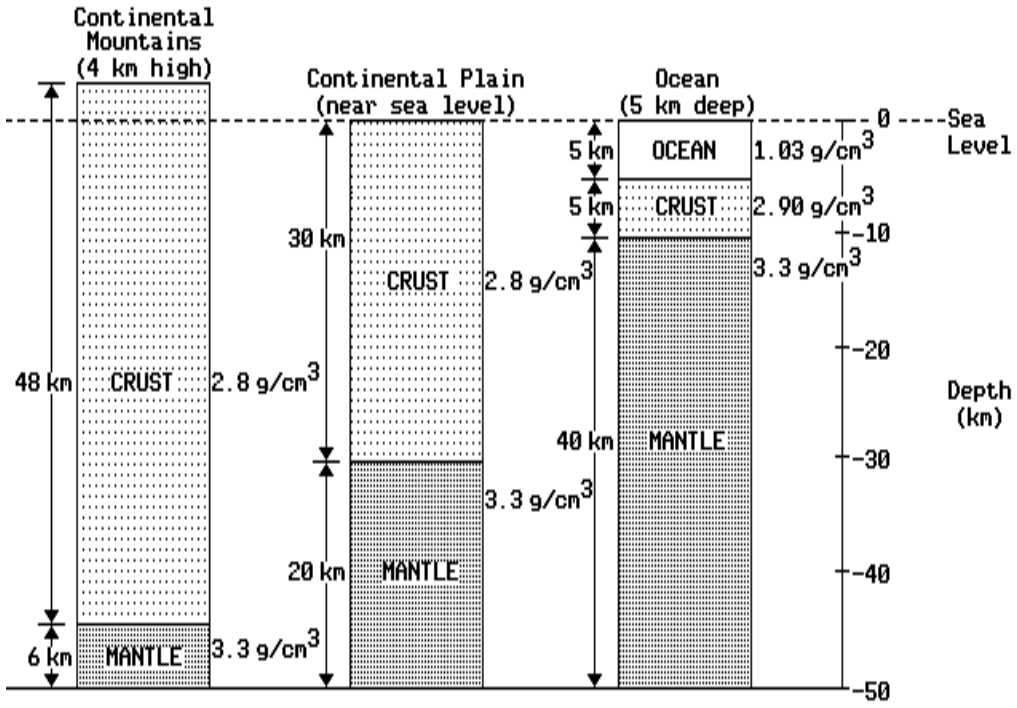
A) Shear waves are stopped by the iron and nickel inner core.
B) Shear waves are transmitted through all parts of the Earth.
C) Shear waves are not transmitted through the Earth's outer core.
D) Shear waves are faster than compression waves.

51) Location D is about 3,500 kilometers from the epicenter. What was the *S*-wave travel time to location *D*? [Refer to the *Earth Science Reference Tables*.]

A) 5 minutes 10 seconds
B) 6 minutes 20 seconds
C) 11 minutes 30 seconds
D) 7 minutes 40 seconds

Questions 52 through 56 refer to the following:

The diagram below represents three cross sections of the Earth at different locations to a depth of 50 kilometers below sea level. The measurements given with each cross section indicate the thickness and the density of the layers.



52) In which group are the layers of the Earth arranged in order of increasing average density?

A) ocean water, mantle, crust
B) crust, mantle, ocean water
C) ocean water, crust, mantle
D) mantle, crust, ocean water

53) Which material is most likely to be found 20 kilometers below sea level at the continental mountain location? [Refer to the *Earth Science Reference Tables*.]

A) granite
B) basalt
C) limestone
D) shale

54) Which statement about the Earth's mantle is confirmed by the diagram?

A) The mantle has the same composition as the crust.
B) The mantle is liquid.
C) The mantle does not exist under continental mountains.
D) The mantle is located at different depths below the Earth's surface.

55) Compared with the oceanic crust, the continental crust is

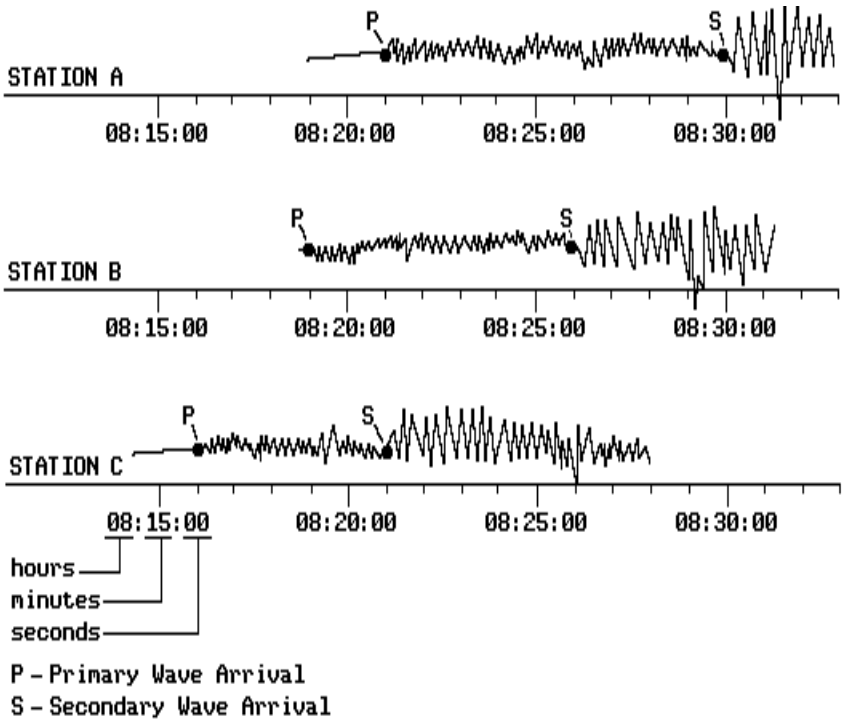
A) thinner and more dense
B) thicker and less dense
C) thinner and less dense
D) thicker and more dense

56) The division of the Earth's interior into crust and mantle, as shown in the diagram, is based primarily on the study of

A) radioactive dating
B) volcanic eruptions
C) gravity measurements
D) seismic waves

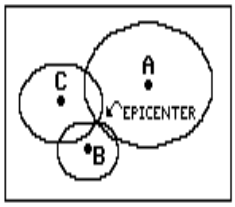
Questions 57 through 60 refer to the following:

The seismograms were recorded at earthquake recording stations *A*, *B*, and *C*. The letters *P* and *S* on each seismogram indicate the arrival times of the compressional (primary) and shear (secondary) seismic waves.

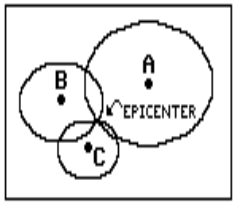


57) The radius of each circle on the maps below represents the distance from each seismograph recording station to the epicenter. Which map correctly illustrates the position of the three recording stations relative to the location of the earthquake epicenter?

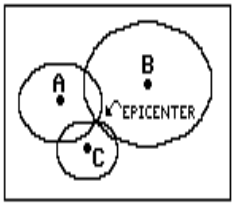
A)



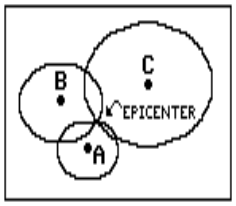
B)



C)



D)



58) A fourth station recorded the same earthquake. The *P*-wave arrived, but the *S*-wave did *not* arrive. The best explanation for the absence of the *S*-wave is that the

A) *S*-wave traveled only on the Earth's surface and did not penetrate the Earth's interior
B) *S*-wave stopped when it reached a solid part of the Earth's interior
C) *S*-wave stopped when it reached a liquid part of the Earth's interior
D) *S*-wave was never transmitted by the earthquake

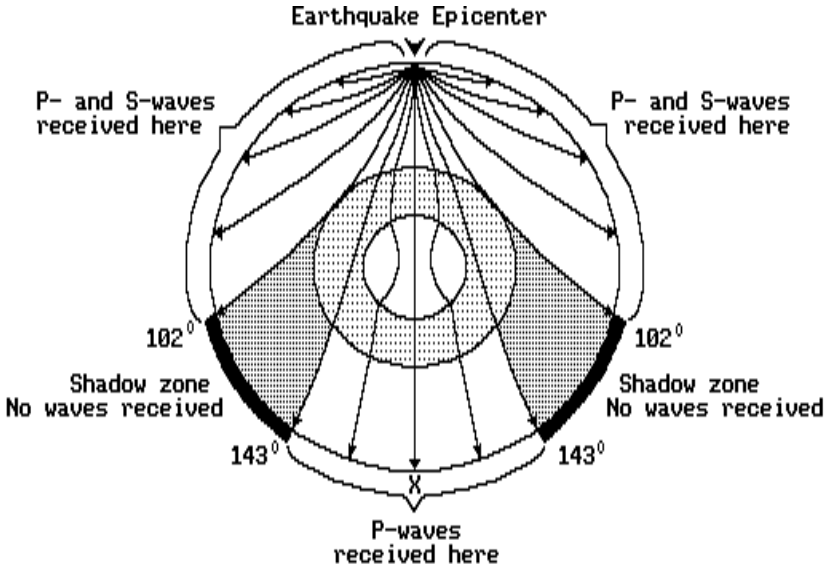
59) Approximately how far from station *B* is the earthquake epicenter located? [Refer to the *Earth Science Reference Tables*.]

A) 6,300 km
B) 4,300 km
C) 5,300 km
D) 3,500 km

60) The epicenter distance from station *A* was calculated to be 7,600 kilometers. Approximately how long did the *P*-wave take to get to station *A*? [Refer to the *Earth Science Reference Tables*.]

A) 11 minutes
B) 10 minutes
C) 12 minutes
D) 9 minutes

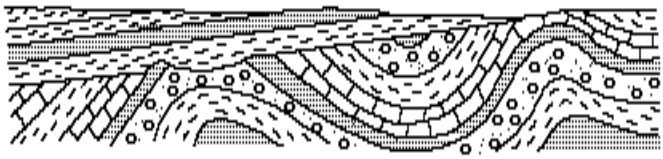
61) The cross-sectional diagram below of the Earth shows the paths of seismic waves from an earthquake. Letter *X* represents the location of a seismic station.



Which statement best explains why station *X* received only *P*-waves?

A) A liquid zone within the Earth stops *S*-waves.
B) *P*-waves and *S*-waves are refracted by the Earth's core.
C) Station *X* is too far from the focus for *S*-waves to reach.
D) *S*-waves traveled too slowly for seismographs to detect them.

62) The diagram below represents a cross section of a portion of the Earth's crust.

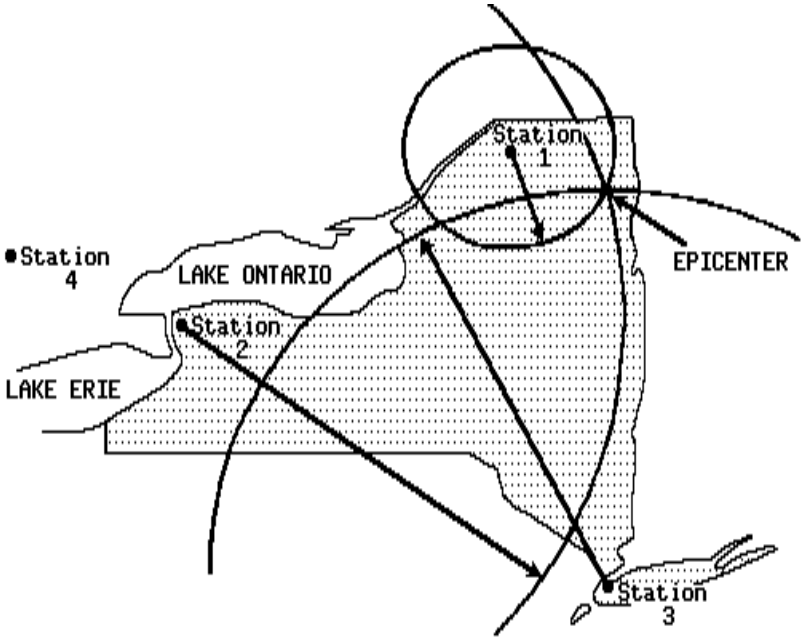


Which past activity in this region is suggested by the shape of these sedimentary rock layers?

A) horizontal sorting
B) crustal movements
C) widespread volcanic activity
D) glacial deposition

Questions 63 through 67 refer to the following:

The map below shows how the epicenter of an earthquake is located using observations at seismograph stations 1, 2, and 3 in New York State. Station 4 is a seismograph station located in Canada.



63) Another seismograph station in the United States recorded the difference in arrival times between *P*-waves and *S*-waves as 6 minutes. According to the *Earth Science Reference Tables*, approximately how far from the epicenter would this station be located?

A) 1.6×10^3 km
B) 3.3×10^3 km
C) 4.4×10^3 km
D) 9.2×10^3 km

64) Station 3 is approximately 400 kilometers from the epicenter of this earthquake. According to the Earth Science Reference Tables, approximately how much time did the *P*-wave take to travel to station 3?

A) 1 minute 40 seconds
B) 50 seconds
C) 5 minutes
D) 2 seconds

65) Which statement about the arrival times of the seismic waves at station 2 is correct?

A) The *P*-wave and *S*-wave arrived at the same time.
B) The *S*-wave arrived first.
C) Only the *S*-wave arrived.
D) The *P*-wave arrived first.

66) How would the difference in arrival times of the *P*-waves and *S*-waves at station 4 compare with the difference in arrival times of these waves at station 3?

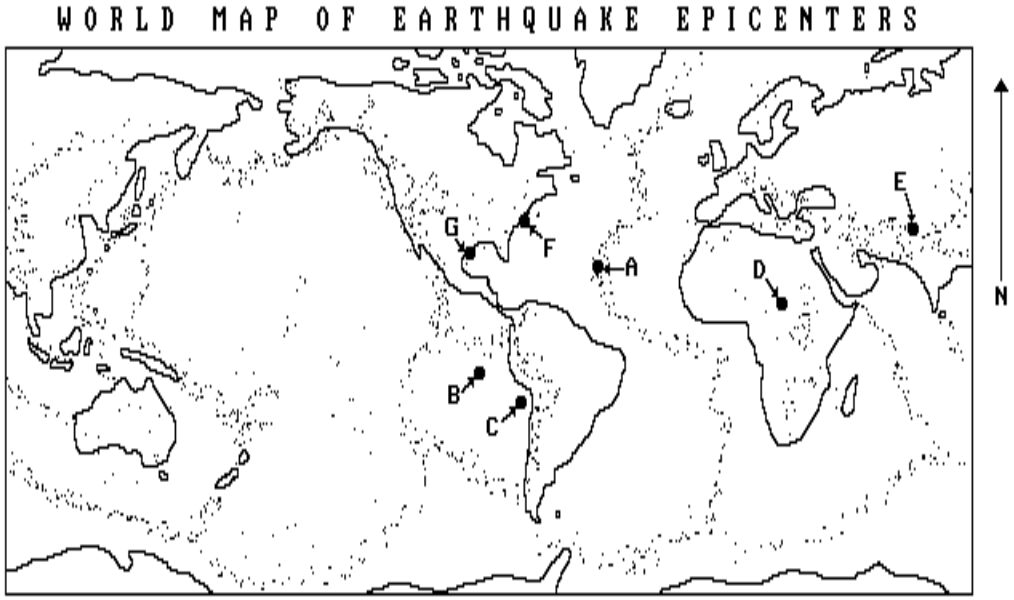
A) The difference would be greater at station 3.
B) The difference would be the same at both stations.
C) The difference would be greater at station 4.

67) Using the seismic reading received at station 1 only, an observer would be able to determine

A) both the distance and the direction of the epicenter from station 1
B) the distance of the epicenter from station 1, only
C) neither the distance nor the direction of the epicenter from station 1
D) the direction of the epicenter from station 1, only

Questions 68 and 69 refer to the following:

The dots on the map below indicate the locations of epicenters of major earthquakes over a five-year period. Points *A* through *G* are locations on the map.



68) How would a map showing the location of active volcanoes compare to the map showing the location of earthquake epicenters?

A) Only a small percentage of volcano locations would be in the same regions as the epicenters.
B) The location of the volcanoes and the epicenters would only match in the ocean regions.
C) A large percentage of volcano locations would be in the same regions as the epicenters.
D) There would be no match between the locations of the volcanoes and the epicenters.

69) Where do most major earthquakes occur?

A) randomly over the Earth's surface
B) in specific earthquake belts within the crust
C) in the continental interiors
D) at the mantle-core boundary