- 1. Which two Earth layers are separated by the Moho boundary?
 - 1) rigid mantle and plastic mantle
 - 2) outer core and stiffer mantle
 - 3) stiffer mantle and asthenosphere
 - 4) crust and rigid mantle
- 2. A model of Earth's internal structure is shown below.



Analysis of which type of data led to the development of this model?

- 1) seismic waves
- 2) depth of Earth's oceans
- 3) electromagnetic radiation
- 4) isobar gradients

3. Base your answer to the following question on the cross section below, which shows the paths of seismic waves traveling from an earthquake epicenter through the different layers of Earth's interior.



No *P*-waves or *S*-waves are received in the shadow zone because

- 1) P-waves are absorbed and S-waves are refracted by Earth's outer core
- 2) P-waves are refracted and S-waves are absorbed by Earth's outer core
- 3) both the *P*-waves and *S*-waves are refracted by Earth's outer core
- 4) both the *P*-waves and *S*-waves are absorbed by Earth's outer core

4. The graph below shows the different velocities of P-waves and S-waves through Earth's interior.



Which cross section best shows the inferred thickness of Earth's interior layers that cause these different velocities?



RR#8 - Multiple Choice



- 5. Earth's outer core is best inferred to be
 - liquid, with an average density of approximately 4 g/cm³
 - liquid, with an average density of approximately 11 g/cm³
 - 3) solid, with an average density of approximately 4 g/cm^3
 - 4) solid, with an average density of approximately 11 g/cm³
- 6. Compared to the oceanic crust, the continental crust is usually
 - 1) thicker, with a less dense granitic composition
 - 2) thicker, with a more dense basaltic composition
 - 3) thinner, with a less dense granitic composition
 - 4) thinner, with a more dense basaltic composition

7. On the map below, locations *A* and *B* are reference points on the Earth's surface. Crustal thickness was measured beneath a line from *A* to *B*.



Which graph best represents the thickness of the Earth's crust from location A to location B?



8. Base your answer to the following question on the cross section below and on your knowledge of Earth science. The cross section represents the distance and age of ocean-floor bedrock found on both sides of the Mid-Atlantic Ridge.



Age of Ocean Floor (millions of years)

Which map best represents the pattern of magnetic polarity in the minerals of ocean-floor bedrock on each side of the Mid-Atlantic Ridge?

Кеу		
1	Normal magnetic polarity	
Reversed magnetic polarity		
	Mid-Atlantic Ridge	





- 9. The most abundant metallic element by mass in Earth's crust makes up 8.23% of the crust. Which group of minerals all normally contain this metallic element in their compositions?
 - 1) garnet, calcite, pyrite, and galena
 - 2) biotite mica, muscovite mica, fluorite, and halite
 - 3) talc, quartz, graphite, and olivine
 - 4) plagioclase feldspar, amphibole, pyroxene, and potassium feldspar
- 10. The basaltic bedrock of the oceanic crust is classified as
 - 1) felsic, with a density of 2.7 g/cm^3
 - 2) felsic, with a density of 3.0 g/cm^3
 - 3) mafic, with a density of 2.7 g/cm^3
 - 4) mafic, with a density of 3.0 g/cm^3

11. Base your answer to the following question on the map below. The map shows the continents of Africa and South America, the ocean between them, and the ocean ridge and transform faults. Locations *A* and *D* are on the continents. Locations *B* and *C* are on the ocean floor.



Which table best shows the relative densities of the crustal bedrock at locations A, B, C, and D?

2)

1) Relative Densities of Crust

More Dense	Less Dense
А, В	C, D

3) Relative Densities of Crust

More Dense	Less Dense
C, D	A, B

Relative Densities of Crust

More Dense	Less Dense
B, C	A, D

4) Relative Densities of Crust

More Dense	Less Dense
A, D	B, C

12. The pie graph below represents the composition, in percent by mass, of the chemical elements found in an Earth layer.



The composition of which Earth layer is represented by the pie graph?

1) crust	2) outer core	3) troposphere	4) hydrosphere
1) 01000	2) outer core	J) doposphere	i) ilguiospiicie

- 13. The inferred temperature and pressure of Earth's interior at a depth of 3,000 kilometers are approximately
 - 1) 1000°C and 0.5 million atmospheres
 - 2) 1000°C and 1.0 million atmospheres
 - 3) 5000°C and 1.5 million atmospheres
 - 4) 5000°C and 3.0 million atmospheres
- 14. What caused the interior of Earth to separate into layers?
 - 1) a decrease in the rate of rotation of Earth
 - 2) the gravitational pull on materials of varying densities
 - 3) variations in heating by the Sun due to Earth's tilt
 - 4) collisions with meteors and comets

15. The diagram below shows the cutaway views of the inferred interior layers of the planets Mercury and Venus.



(Not drawn to scale)

What is the reason for the development of the interior layers of these two planets?

- 1) Impact events added the mantle rock above the cores.
- 2) Heat from the Sun melted the surface rocks to form the mantles above the cores.
- 3) Gravity separated the cores and mantles due to their density differences.
- 4) Rapid heat loss caused the cores to solidify before the mantles.

16. Which temperature is inferred to exist in Earth's plastic mantle?	19. Which statement about the Earth's mantle is correct?		
 1) 2000°C 2) 3000°C 3) 5000°C 4) 6000°C 1) The dense below the below the selow the selew th	sity of the mantle is greatest 300 km he Earth's surface. hest temperatures within the Earth occur antle. htest pressures within the Earth exist in the. perature of the mantle 300 km below h's surface is very near its melting point.		

20. Base your answer to the following question on the passage and cross section below and on your knowledge of Earth science. The cross section represents one theory of the movement of rock materials in Earth's dynamic interior. Some mantle plumes that are slowly rising from the boundary between Earth's outer core and stiffer mantle are indicated.

Hot Spots and Mantle Plumes

Research of mantle hot spots indicates that mantle plumes form in a variety of sizes and shapes. These mantle plumes range in diameter from several hundred kilometers to 1000 kilometers. Some plumes rise as blobs rather than in a continuous streak; however, most plumes are long, slender columns of hot rock slowly rising in Earth's stiffer mantle. One theory is that most plumes form at the boundary between the outer core and the stiffer mantle. They may reach Earth's surface in the center of plates or at plate boundaries, producing volcanoes or large domes.



(Not drawn to scale)

Compared to the surrounding material, mantle plumes rise toward Earth's surface from the core-mantle boundary because they are

1) cooler and less dense

2) cooler and more dense

3) hotter and less dense

4) hotter and more dense

21. The cross section below represents several rock units within Earth's crust. Letter *A* represents Earth's surface. Letters *B*, *C*, and *D* indicate boundaries between rock units. One of the unconformities is labeled.



Which lettered boundary is most likely another unconformity?

- 1) A 2) B 3) C
- 22. The sequence of block diagrams below shows stages of development of a landscape. The stages are labeled *A*, *B*, and *C*.



Which sequence of geologic processes best describes the events that created each stage shown?

- 1) erosion \rightarrow subsidence and deposition \rightarrow uplift and faulting
- 2) uplift and deposition \rightarrow flooding \rightarrow folding and erosion
- 3) metamorphism \rightarrow erosion and deposition \rightarrow volcanic eruptions
- 4) uplift and erosion \rightarrow subsidence and erosion \rightarrow folding

23. The diagram below shows a cross section of sedimentary rock layers.

4) D



Which statement about the deposition of the sediments best explains why these layers have the curved shape shown?

- 1) Sediments were deposited in horizontal layers and later disturbed by crustal activity.
- 2) Sediments were deposited on an uneven curving seafloor.
- 3) Sediments were deposited after widespread volcanic eruptions.
- Sediments were deposited between two diverging oceanic plates.

- 24. The Himalaya Mountains are located along a portion of the southern boundary of the Eurasian Plate. At the top of Mt. Everest (29,028 feet) in the Himalaya Mountains, climbers have found fossilized marine shells in the surface bedrock. From this observation, which statement is the best inference about the origin of the Himalaya Mountains?
 - 1) The Himalaya Mountains were formed by volcanic activity.
 - 2) Sea level has been lowered more than 29,000 feet since the shells were fossilized.
 - 3) The bedrock containing the fossil shells is part of an uplifted seafloor.
 - 4) The Himalaya Mountains formed at a divergent plate boundary.
- 25. The diagram below shows land features that have been disrupted by an earthquake.



Which type of crustal movement most likely caused the displacement of features in this area?

- 1) vertical lifting of surface rock
- 2) folding of surface rock
- 3) down-warping of the crust
- 4) movement along a transform fault
- 26. How long after receiving the first P-wave from an earthquake centered 4000 kilometers away does a seismic station receive its first S-wave from the same earthquake?
 - 1) 1 minute
 - 2) 5 minutes 35 seconds
 - 3) 7 minutes
 - 4) 12 minutes 40 seconds
- 27. What is the approximate *P*-wave travel time from an earthquake if the *P*-wave arrives at the seismic station 8 minutes before the *S*-wave?
 - 1) 4 minutes 20 seconds
 - 2) 6 minutes 30 seconds
 - 3) 10 minutes 0 seconds
 - 4) 11 minutes 20 seconds

28. The epicenter of an earthquake is located 6,500 kilometers away from a seismic station. If the first S -wave arrived at this seismic station at 1:30 p.m., at what time did the first P-wave arrive?

1)	1:20 p.m.	2)	1:22 p.m.
3)	1:38 p.m.	4)	1:40 p.m.

29. The cross section of Earth below represents a *P* -wave moving away from an earthquake epicenter. Seismic station *A* is shown on Earth's surface.



At station *A*, the first *P*-wave arrives 11 minutes 40 seconds after the earthquake. How long after the first *P*-wave arrives will the first *S*-wave arrive?

- 1) 5 minutes 00 second
- 2) 8 minutes 40 seconds
- 3) 9 minutes 40 seconds
- 4) 21 minutes 20 seconds

Base your answers to questions **30** and **31** on the diagrams below. Diagram 1 represents a cross section of Earth and its interior layers. The asterisk (*) shows the location of an earthquake epicenter. Letters A through D are seismic stations on Earth's surface. Diagram 2 shows four seismograms labeled I, II, III, and IV, which were recorded at seismic stations A, B, C, and D during the same time interval.



- 30. Station *D* is 8000 kilometers from the earthquake epicenter. How long did it take for the first *P*-wave to travel from the epicenter to station *D*?
 - 1) 9 minutes 20 seconds

2) 11 minutes 20 seconds

3) 20 minutes 40 seconds

4) 4 minutes 20 seconds

- 31. Which list correctly matches the seismograms with the seismic stations where they were recorded?
 - 1) seismogram I station A seismogram II - station B seismogram III - station C seismogram IV - station D 2) seismogram I - station B seismogram II - station Dseismogram III - station A seismogram IV - station C3) seismogram I - station Cseismogram II - station B seismogram III - station D seismogram IV - station A 4) seismogram I - station A seismogram II - station Dseismogram III - station B seismogram IV - station C
- 32. What is the average velocity of an earthquake's S-wave in its first 4 minutes of travel?
 - 1) 1 km/min 2) 250 km/min
 - 3) 500 km/min 4) 4 km/min

Base your answers to questions **33** and **34** on the map below. The map shows point X, which is the location of an earthquake epicenter, and point A, which is the location of a seismic station.



- 33. Approximately how long did the earthquake's *P* -wave take to arrive at the seismic station?
 - 1) 3 min 40 sec 2) 5 min 10 sec
 - 3) 6 min 20 sec 4) 11 min 5 sec
- 34. Which statement best describes the arrival of the initial *S*-wave at the seismic station?
 - 1) It arrived later than the *P*-wave because *S* -waves travel more slowly.
 - 2) It arrived earlier than the *P*-wave because *S* -waves travel faster.
 - 3) It arrived at the same time as the *P*-wave because *S*-waves and *P*-waves have the same velocity on Earth's surface.
 - 4) It never reached location *A* because *S*-waves can travel only through a liquid medium.

35. Base your answer to the following question on the diagram below, which represents zones of Earth's interior, identified by letters *A* through *E*. The scale shows depths below Earth's surface, measured in kilometers.



- 38. When the seafloor moves as a result of an underwater earthquake and a large tsunami develops, what will most likely occur?
 - 1) Deep-ocean sediments will be transported over great distances.
 - 2) No destruction will occur near the origin of the earthquake.
 - 3) The direction of the tsunami will be determined by the magnitude of the earthquake.
 - 4) Severe destruction will occur in coastal areas.

39. Base your answer to the following question on the cross section of Earth below and on your knowledge of Earth science. The cross section represents the pattern of seismic wave movement away from an earthquake. Point *W* represents a location at the boundary between two layers of Earth's interior. Points *X*, *Y*, and Z represent seismic stations on Earth's surface.



The diagram below represents the seismograms of this earthquake recorded at seismic stations X, Y, and Z.



Which table best matches each seismic station with its likely seismogram?

1)	$\mathbf{Seismic}$	Seismogram
	Station	
	Х	1
	Y	2
	Ζ	3
2)	Seismic	Seismogram
	Station	
	Х	3
	Y	2
	Ζ	1
3)	Seismic	Seismogram
3)	Seismic Station	Seismogram
3)	Seismic Station X	Seismogram 2
3)	Seismic Station X Y	Seismogram 2 3
3)	Seismic Station X Y Z	Seismogram 2 3 1
3) 4)	Seismic Station X Y Z Seismic	Seismogram 2 3 1 Seismogram
3) 4)	Seismic Station X Y Z Seismic Station	Seismogram 2 3 1 Seismogram
3) 4)	Seismic Station X Y Z Seismic Station X	Seismogram 2 3 1 Seismogram 1
3)	Seismic Station X Y Z Seismic Station X Y	Seismogram 2 3 1 Seismogram 1 1 3

- 40. An earthquake occurs at 12:02 p.m. A seismic station records the first S-wave at 12:19 p.m. Which set of data shows the approximate arrival time of the first *P*-wave and the distance to the epicenter?
 - 1) 12:11:25 p.m. and 4000 km
 - 2) 12:11:25 p.m. and 6000 km
 - 3) 12:19:40 p.m. and 4000 km
 - 4) 12:19:40 p.m. and 6000 km

41. Which seismogram was recorded approximately 4,000 kilometers from an earthquake epicenter?



Base your answers to questions 42 and 43 on the map below, which shows the depths of selected earthquakes along the crustal plate boundary near the west coast of South America. Letters A, B, C, and D are epicenter locations along a west-to-east line at the surface. The relative depth of each earthquake is indicated.



42. The earthquake beneath epicenter D occurred in which part of Earth's interior?

1) crust 2) rigid mantle 3) asthenosphere 4) stiffer mantle

43. Which graph best shows the depth of earthquakes beneath epicenters A, B, C, and D?



44. The seismogram below shows *P*-wave and *S*-wave arrival times at a seismic station following an earthquake.



The distance from this seismic station to the epicenter of the earthquake is approximately

- 1) 1,600 km 2) 3,200 km
- 3) 4,400 km 4) 5,600 km

Base your answers to questions 45 and 46 on the earthquake seismogram below.



- 45. How many additional seismic stations must report seismogram information in order to locate this earthquake?
 - 1) one 2) two 3) three 4) four
- 46. When did the first *P*-waves arrive at this seismic station?
 - 1) 3 minutes after an earthquake occurred 2,600 km away
 - 2) 5 minutes after an earthquake occurred 2,600 km away
 - 3) 9 minutes after an earthquake occurred 3,500 km away
 - 4) 11 minutes after an earthquake occurred 3,500 km away

47. Base your answer to the following question on the diagram below, which represents seismic stations *A*, *B*, and *C*. The distance from each station to an earthquake's epicenter is plotted.



The epicenter is closest to point

1) D 2) E 3) F 4) G

Base your answers to questions **48** through **50** on the map and table of the Modified Mercalli Scale below. The map shows the intensities of the earthquake that occurred slightly southwest of New Madrid, Missouri, on December 16, 1811. The numbered areas on the map were determined from the Modified Mercalli Scale according to the observed effects of the earthquake.



Modified Mercalli Scale

Intensity	Observed Effects
Ι	Felt by only a few people under very special circumstances
П	Felt by only a few people at rest, especially on the upper floors of buildings
	Felt noticeably indoors, especially on upper floors of buildings
IV	Felt indoors by many people, outdoors by a few; some awaken
V	Felt by nearly everyone; many awaken; dishes and windows break; plaster cracks
VI	Felt by everyone; many frightened and run outdoors; heavy furniture moves
VII	Everyone runs outdoors; slight to moderate damage in ordinary structures
VIII	Considerable damage in ordinary structures; chimneys and monuments fall
IX	Considerable damage in all structures; ground cracks; underground pipes break
Х	Most structures destroyed; rails bend; landslides occur; water splashes over banks
XI	Few structures left standing; bridges destroyed; broad fissures in the ground; underground pipes break
XII	Damage total; waves seen on ground surfaces; objects thrown in air

48. Which city would have issued the report: "Heavy furniture moved, everyone felt the earthquake, and many people were frightened and ran outdoors"?

1) Cincinnati 2) Pittsburgh 3) Syracuse 4) Boston

49. What was the approximate travel time for the earthquake's *P*-wave from the epicenter to Syracuse, New York?

1) 1 min 2) 5 min 3) 3 min 4) 10 min

RR#8 - Multiple Choice

- 50. What is the approximate location of the earthquake's epicenter?
 - 1) 36° N, 90° W 2) 90° N, 36° W 3) 36° N, 90° E 4) 90° N, 36° E
- 51. The diagrams below represent seismograms of the same earthquake recorded in four different locations. Which seismogram was recorded closest to the epicenter of the earthquake?



- 52. An earthquake *P*-wave arrived at a seismograph station at 01 hour 21 minutes 40 seconds. The distance from the station to the epicenter is 3,000 kilometers. The earthquake's origin time was
 - 1) 01 h 11 min 40 sec 2) 01 h 16 min 00 sec
 - 3) 01 h 20 min 20 sec 4) 01 h 27 min 20 sec
- 53. An earthquake occurred in Massena, New York. For which two locations would the *P*-wave arrival times be approximately the same?
 - 1) Rochester and New York City
 - 2) Binghamton and Slide Mountain
 - 3) Utica and Watertown
 - 4) Watertown and Oswego
- 54. The arrival of *P*-waves and *S*-waves at a seismic station indicated that an earthquake occurred 4,000 kilometers from the station. The *P*-wave arrived at 3:32:30 p.m. When did the earthquake occur?

1) :	3:25:30 p.m.	2) 3:32:23 p.m.
-) -	p	_) = P

3) 3:27:00 p.m. 4) 3:39:30 p.m.

- 55. Which tectonic feature is associated with a complex or uncertain plate boundary?
 - 1) Southwest Indian Ridge
 - 2) East African Rift
 - 3) Mariana Trench
 - 4) Galapagos Hot Spot

Base your answers to questions 56 and 57 on

the map below and on your knowledge of Earth science. The map shows the coast of the northwestern United States. The Explorer and Gorda ridges and plates are parts of the Juan de Fuca tectonic system.



56. The Explorer Ridge is the boundary between the Explorer Plate and the

1) North American Plate

2) Pacific Plate

3) Juan de Fuca Plate

4) Gorda Plate

57. The arrow on which map best shows the direction of movement of the Juan de Fuca Plate in relation to the Juan de Fuca Ridge?



RR#8 - Multiple Choice



3)

- 58. The Aleutian Islands extend westward from southern Alaska to form the northern boundary of the Pacific Ocean. These volcanic islands were formed by the nearby
 - 1) subduction of a continental plate
 - 2) subduction of an oceanic plate
 - 3) divergence of a continental plate
 - 4) divergence of an oceanic plate
- 59. Base your answer to the following question on

the cross section below, which shows the boundary between two lithospheric plates. Point X is a location in the continental lithosphere. The depth below Earth's surface is labeled in kilometers.



Between which two lithospheric plates could this boundary be located?

- 1) South American Plate and African Plate 2) Scotia Plate and Antarctic Plate
- 3) Nazca Plate and South American Plate 4)
- 4) African Plate and Arabian Plate

60. Which block diagram best represents the relative direction of plate motion at the San Andreas Fault?



61. On the map below, line *AB* is drawn across several of Earth's tectonic plates in the South Atlantic Ocean.



Which cross section best represents the plate boundaries and mantle movement beneath line AB?





62. The diagram below shows some features of Earth's crust and upper mantle.



Which model most accurately shows the movements (arrows) associated with the surface features shown in the diagram?



Base your answers to questions **63** through **65** on the passage below.

Crustal Activity at Mid-Ocean Ridges

Mid-ocean ridges are found at one type of tectonic plate boundary. These ridges consist of extensive underwater mountain ranges split by rift valleys. The rift valleys mark places where two crustal plates are pulling apart, widening the ocean basins, and allowing magma from the asthenosphere to move upward. In some cases, mid-ocean ridges have migrated toward nearby mantle hot spots. This explains why mid-ocean ridges and mantle hot spots are found together at several locations.

63. The map below shows a part of Earth's surface. Points A through D are locations on the ocean floor.



At which location is the temperature of the ocean floor bedrock most likely highest?

1) A 2) B 3) C 4) D

64. Which mantle hot spot is located closest to a mid-ocean ridge?

1) Canary Islands 2) Easter Island 3) Hawaii 4) Tasman

65. Which type of tectonic plate boundary is located at mid-ocean ridges?

1) convergent 2) transform 3) divergent 4) complex

66. The diagram below shows the magnetic polarity preserved by minerals within the bedrock of the oceanic crust near the Mid-Atlantic Ridge. Letters *A*, *B*, *C*, and *D* represent locations in the ocean-floor bedrock.



The most recently formed bedrock is found at location

1) A 2) B 3) C 4) D

67. The map below shows a portion of Earth's surface. Points X and Y are locations on the lithosphere.



Which cross section shows the inferred movement of material in the asthenosphere beneath points X and Y?



Base your answers to questions **68** and **69** on the map of the Mid-Atlantic Ridge shown below. Points A through D are locations on the ocean floor. Line XY connects locations in North America and Africa.



- 68. Samples of ocean-floor bedrock were collected at points *A*, *B*, *C*, and *D*. Which sequence show the correct order of the age of the bedrock from from oldest to youngest?
 - 1) $D \to C \to B \to A$ 2) $A \to D \to B \to C$ 3) $C \to B \to D \to A$ 4) $A \to B \to D \to C$
- 69. In which cross section do the arrows best show the convection occurring within the asthenosphere beneath line *XY*?





RR#8 - Multiple Choice

70. The map below shows the Atlantic Ocean divided into zones *A*, *B*, *C*, and *D*. The Mid-Atlantic Ridge is located between zones *B* and *C*.



Which graph best represents the geologic age of the surface bedrock on the ocean bottom?



Base your answers to questions **71** through **74** on the information and diagram below.

At intervals in the past, the Earth's magnetic field has reversed. The present North magnetic pole was once the South magnetic pole, and the present South magnetic pole was once the North magnetic pole. A record of these changes is preserved in the igneous rocks that formed at mid-ocean ridges and moved away from the ridges.

The diagram below represents the pattern of normal and reversed magnetic polarity in the igneous rocks composing the ocean crust on the east side of a mid-ocean ridge.



71. The younger extrusive igneous rocks on the ocean floor have a higher heat flow rate than older extrusive igneous rocks. Which graph best shows the relationship between heat flow rate and distance from the mid ocean ridge?



72. Which diagram below best shows the pattern of normal and reversed polarity on the west side of the mid-ocean ridge?



- 73. The igneous material along this mid-ocean ridge was found to be younger than the igneous material farther from the ridge. This fact supports the theory of
 - 1) crustal subsidence
 - 2) seafloor spreading
 - 3) superposition
 - 4) dynamic equilibrium
- 74. Approximately how many million years were required to form the material shown between *A* and *B* in the diagram?
 - 1) 2.5 2) 1.8 3) 1.1 4) 0.7
- 75. Which landmass is moving northward with Australia as part of the same tectonic plate'?
 - 1) India 2) Antarctica
 - 3) North America 4) South America
- 76. The theory of continental drift suggests that the
 - 1) continents moved due to changes in the Earth's orbital velocity
 - 2) continents moved due to the Coriolis effect caused by the Earth's rotation
 - present-day continents of South America and Africa are moving toward each other
 - 4) present-day continents of South America and Africa once fit together like puzzle parts

- 77. During which geologic period were the continents all part of one landmass, with North America and South America joined to Africa?
 - 1) Tertiary 2) Cretaceous
 - 3) Triassic 4) Carboniferous
- 78. The map below shows the present-day locations of South America and Africa. Remains of *Mesosaurus*, an extinct freshwater reptile, have been found in similarly aged bedrock formed from lake sediments at locations *X* and *Y*.



Which statement represents the most logical conclusion to draw from this evidence?

- 1) *Mesosaurus* migrated across the ocean from location *X* to location *Y*.
- 2) *Mesosaurus* came into existence on several widely separated continents at different times.
- 3) The continents of South America and Africa were joined when *Mesosaurus* lived.
- 4) The present climates at locations *X* and *Y* are similar.

RR#8 - Multiple Choice

Base your answers to questions **79** and **80** on cross section below, which shows an underwater mountain range in the Atlantic Ocean. The oceanic bedrock is composed mainly of basalt. Points X and Y are locations in the bedrock that have been diverging at the same rate. The movement of the North American Plate and Eurasian Plate is shown by the two arrows.





79. Which cross section best represents the relative locations of Earth's asthenosphere, rigid mantle, and stiffer mantle? (The cross sections are not drawn to scale.)



- 80. Which statements best describe the age and magnetic orientation of the basalts found at locations *X* and *Y*?
 - 1) The basalt at location *X* is younger than the basalt at location *Y*. Both locations have the same magnetic orientation.
 - 2) The basalts at locations *X* and *Y*are the same age. Both locations have the same magnetic orientation.
 - The basalts at locations X and Y are the same age. Location X has normal magnetic orientation and location Y has reversed magnetic orientation.
 - 4) The basalt at location *X* is older than the basalt at location *Y*. Location *X* has reversed magnetic orientation and location *Y* has normal magnetic orientation.