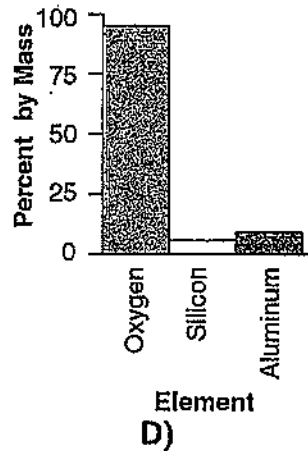
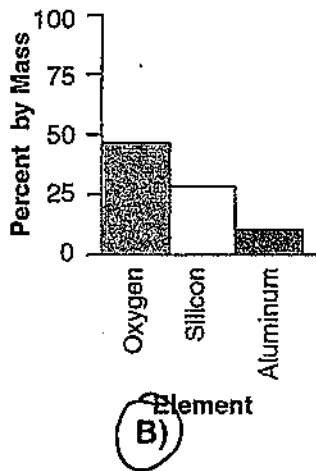
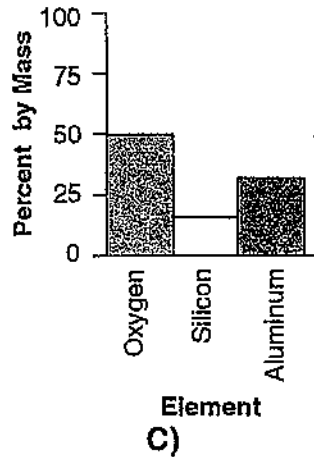
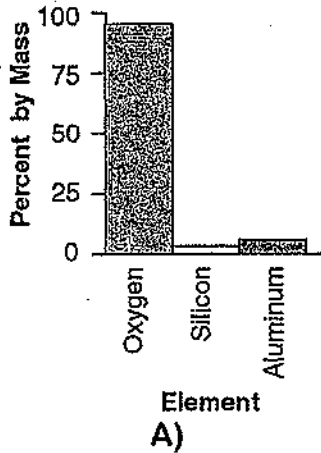


Name _____

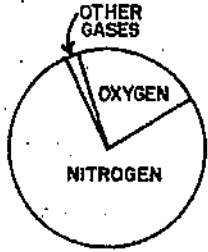
C 1. In order to make observations, an observer must always use

- A) proportions
- B) experiments
- C) the senses
- D) mathematical calculations

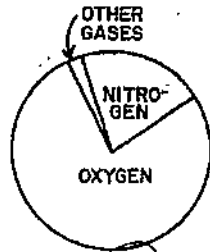
B 2. Which graph correctly represents the three most abundant elements, by mass, in Earth's crust?



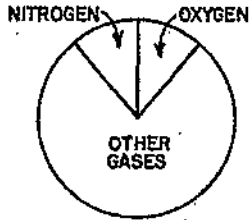
C 3. Which circle graph best represents the volume of gases in the troposphere?



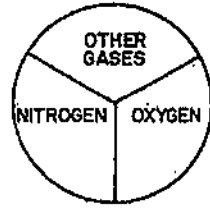
A)



B)



C)

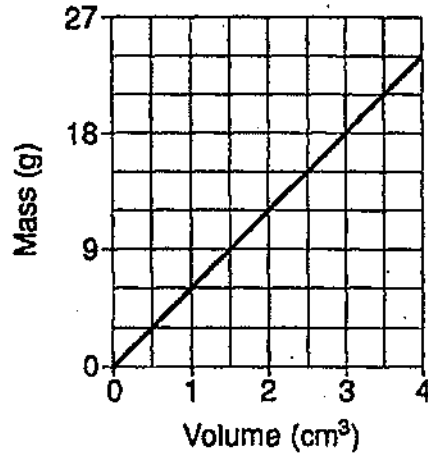


D)

A 4. Which statement made by a student after examining a rock specimen is an inference?

- A) The rock is of igneous origin.
- B) The rock is light-colored.
- C) The rock contains large crystals.
- D) The rock has rounded edges.

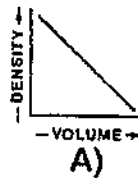
A 5. The graph below shows the relationship between the mass and volume of a mineral.



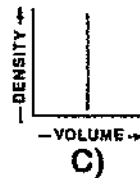
What is the density of this mineral?

- A) 6.0 g/cm³
- B) 9.0 g/cm³
- C) 3.0 g/cm³
- D) 4.5 g/cm³

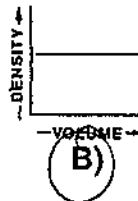
B 6. A student calculates the densities of five different pieces of aluminum, each having a different volume. Which graph best represents this relationship?



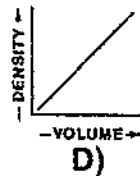
A)



C)

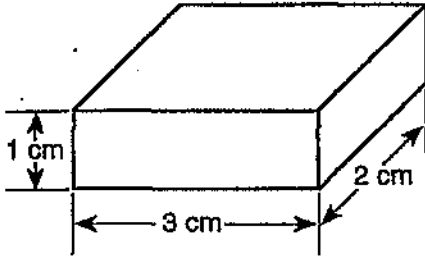


B)



D)

C7. The diagram below represents a solid object with a density of 3 grams per cubic centimeter.

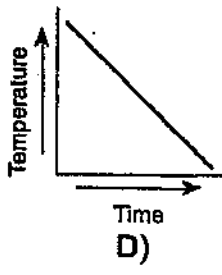
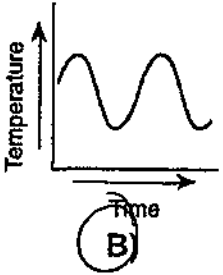
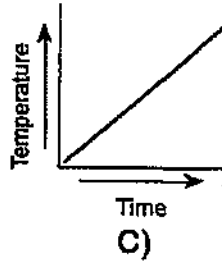
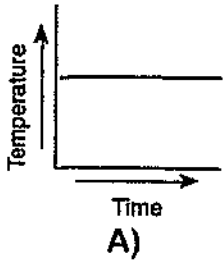


(Not drawn to scale)

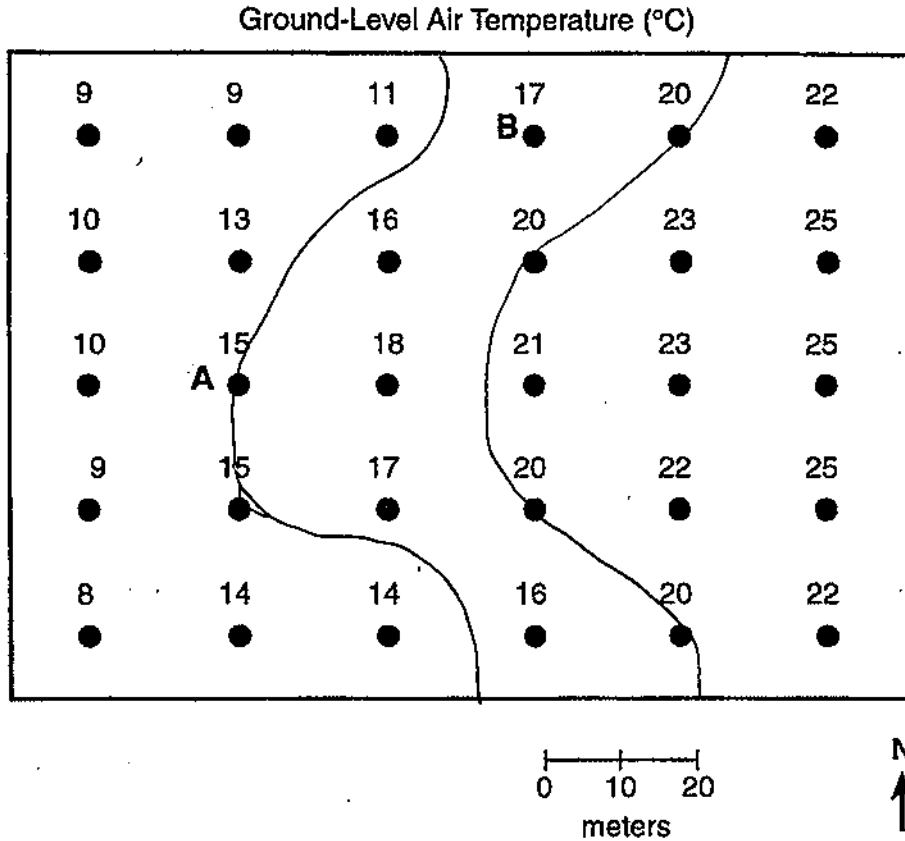
What is the mass of this object?

- A) 0.5 g
- B) 2 g
- C) 18 g
- D) 36 g

B 8. Which graph most likely illustrates a cyclic change?



Base your answers to questions 9 through 11 on the field map provided below. The field map shows air temperature at specific locations in an area near a school in New York State. Part of this area is a blacktop parking lot. Accurate temperature readings were taken by Earth science students at 10 a.m. on June 1. Two reference points, A and B, are shown.



9. On the field map provided, draw only the 15°C and the 20°C isotherms. Isotherms must be extended to the edge of the map.

10. Surface temperatures are higher on the east side of the field map, where the parking lot is located. Explain how a characteristic of the parking lot surface could cause these higher temperatures.

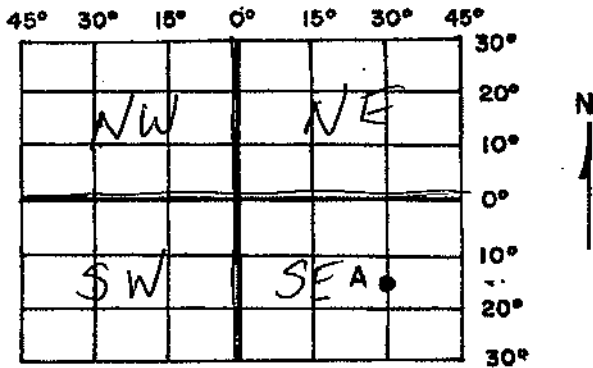
Dark colors absorb energy

11. Calculate the temperature gradient along a straight line between point A and point B on the map by following the directions below.
- Write the equation for determining the temperature gradient.
 - Substitute the correct values into the equation.
 - Solve the equation and record your answer in decimal form. Label the answer with the correct units.

$$\frac{17^{\circ} - 15^{\circ}}{50 \text{ meters}} = .04^{\circ}\text{C}/\text{meter}$$

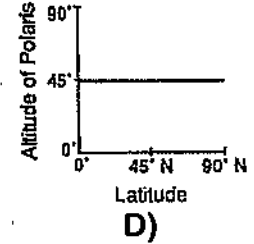
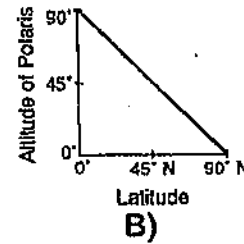
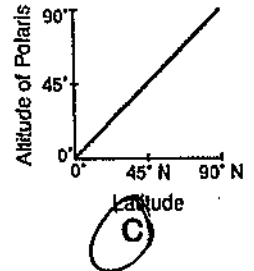
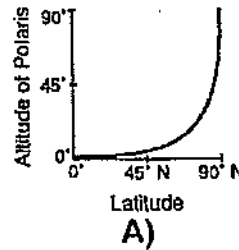
12. The true shape of the Earth is best described as a
- perfect sphere
 - highly eccentric ellipse
 - slightly oblate sphere
 - perfect ellipse

13. The diagram below represents a portion of a map of the Earth's grid system. What is the approximate latitude and longitude of point A?



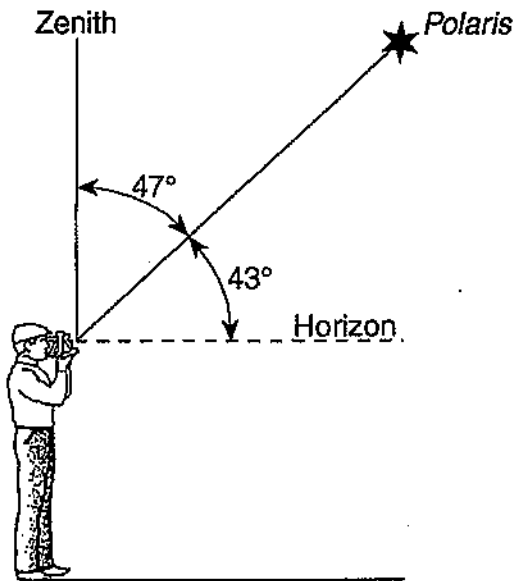
- 15°N. 30°E.
- 15°S. 30°W.
- 15°S. 30°E.
- 15°N. 30°W.

14. Which graph best represents the relationship between the latitude of an observer and the observed altitude of *Polaris* above the northern horizon?



15. What is the difference in mean solar time between 30° N 75° W and 30° N 90° W?
- 1 hour
 - 2 hours
 - 3 hours
 - 6 hours

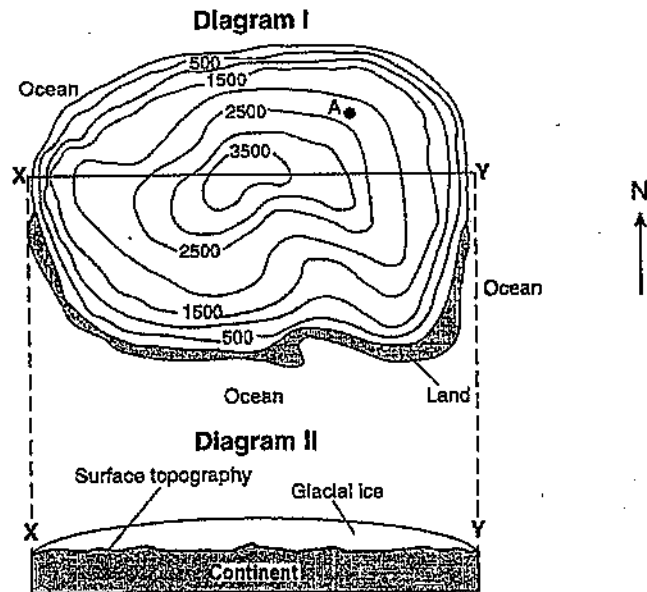
16. The diagram below shows an observer on Earth measuring the altitude of *Polaris*.



What is the latitude of this observer?

- A) 47° N
- B) 47° S
- C) 43° S
- D) 43° N

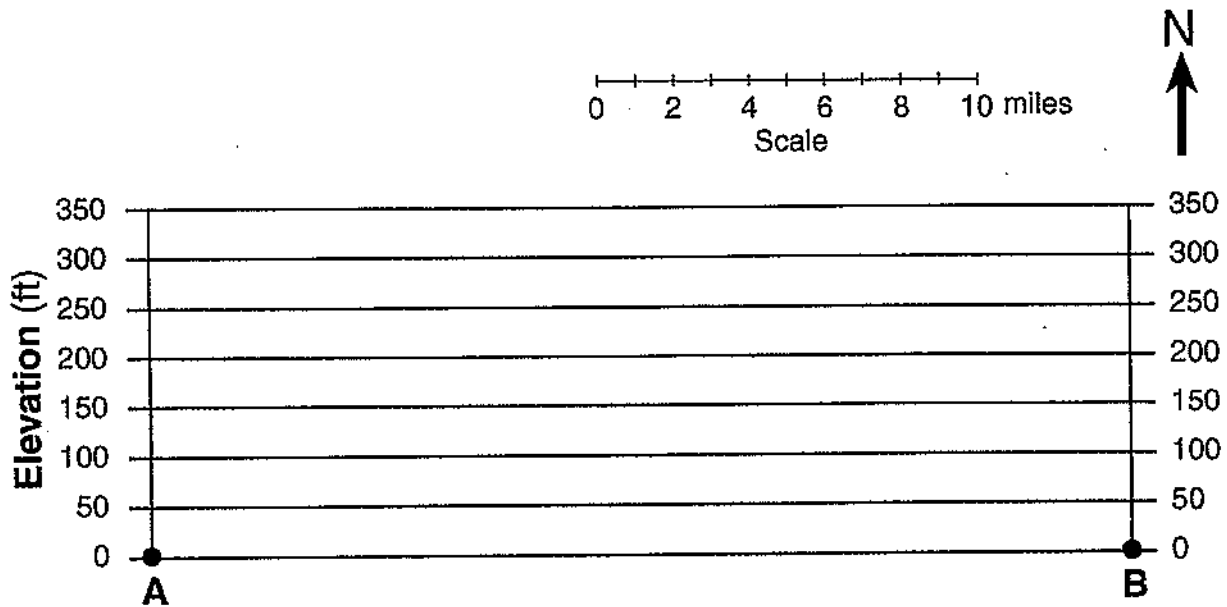
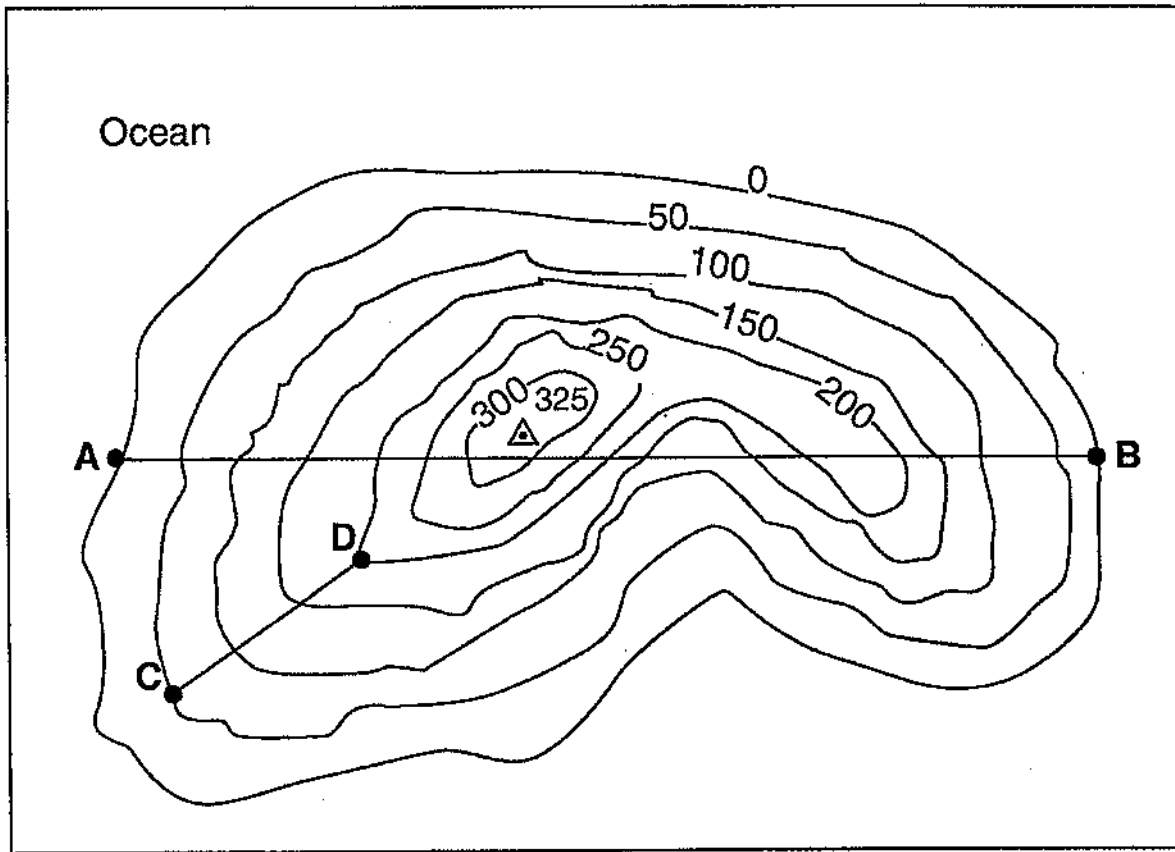
17. Base your answer to the following question on the diagrams below. Diagram I shows an imaginary present-day continent covered by an advancing glacial ice sheet. Isolines called isopachs are drawn, representing the thickness of the ice sheet in meters. Diagram II shows a cross section of it along reference line XY. Point A is a location on the glacier.



Which statement best describes the movement of this continental glacier?

- A) The glacier is advancing from north to south, only.
- B) The glacier is advancing from south to north, only.
- C) The glacier is moving outward in all directions from the central zone of accumulation.
- D) The glacier is moving inward from all directions toward the center of the continent.

18. Base your answer to the following question on the topographic map of an island shown below. Elevations are expressed in feet. Points *A*, *B*, *C*, and *D* are locations on the island. A triangulation point shows the highest elevation on the island.



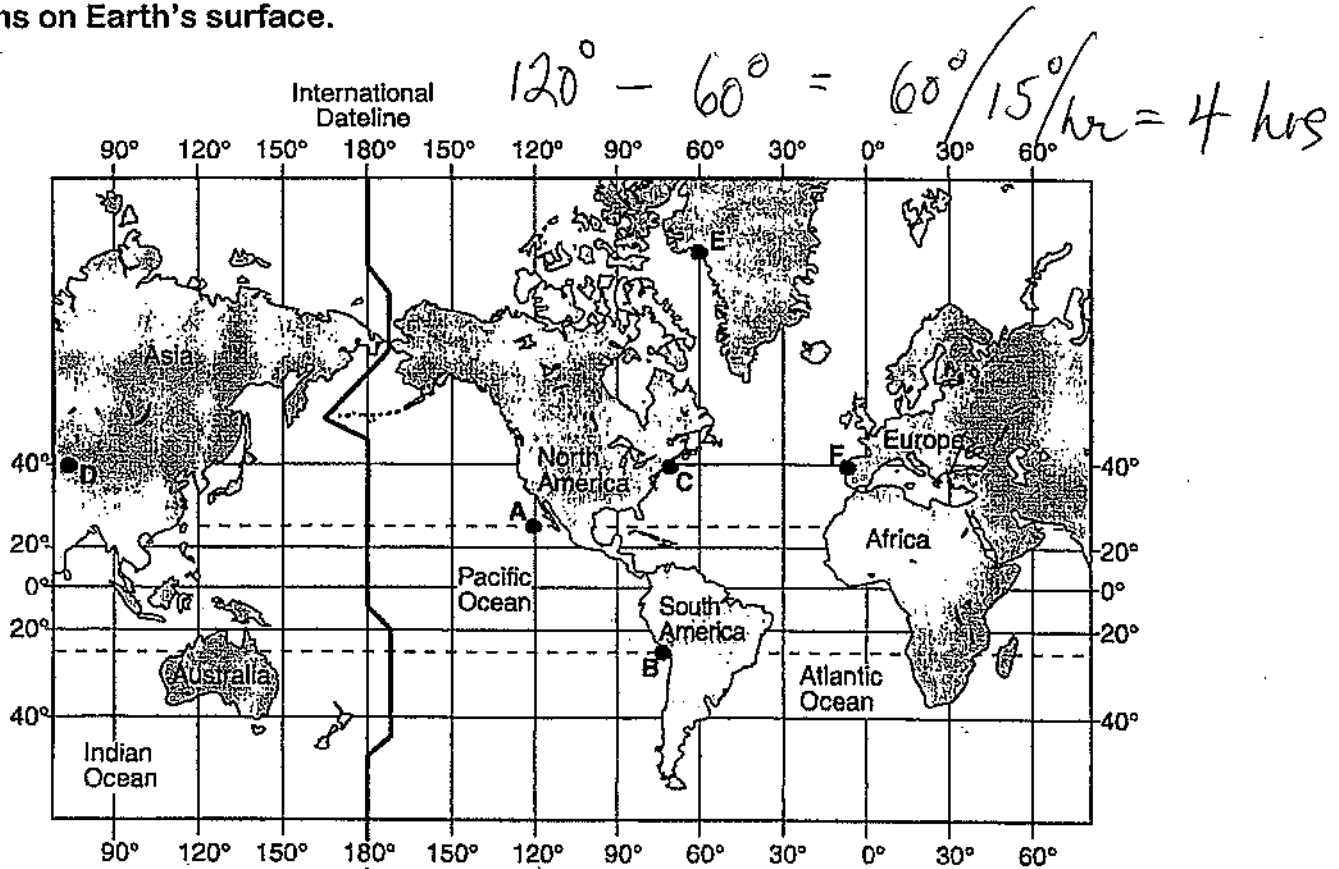
On the grid provided above, construct a topographic profile representing the cross-sectional view between point *A* and point *B*, following the directions below.

a Plot the elevation of the land along line *AB* by marking, with a dot, the elevation of *each* point where a contour line is crossed by line *AB*.

b Connect the dots with a smooth, curved line to complete the topographic profile.

19. Base your answer to the following question on the map below. Letters A through F are locations on Earth's surface.

B

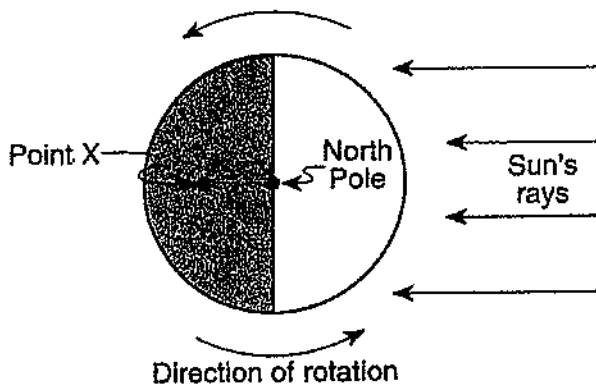


When solar time at location E is 12 noon, solar time at location A is closest to

- A) 6 a.m. B) 8 a.m. C) 12 noon D) 4 p.m.

east increase
west less

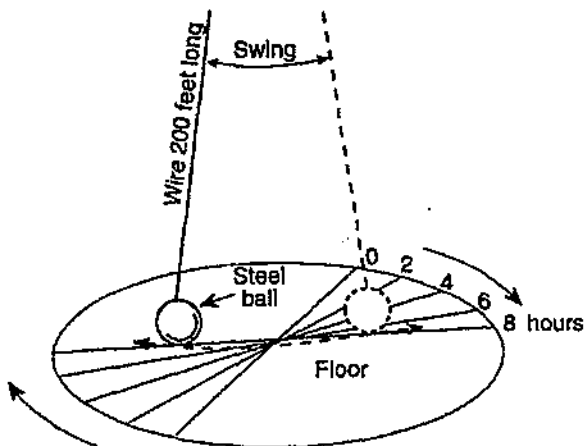
- B** 20. The diagram below represents the direction of Earth's rotation as it appears from above the North Pole. Point X is a location on Earth's surface.



The time at point X is closest to

- A) 12 noon C) 9 p.m.
 B) 12 midnight D) 9 a.m.

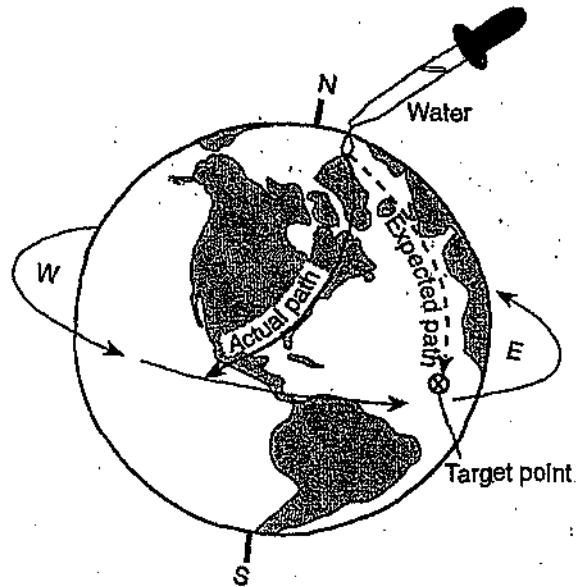
- A** 21. The diagram below represents a Foucault pendulum swinging freely for 8 hours.



The pendulum appears to change its direction of swing because of Earth's

- A) rotation
 B) tectonic plate movement
 C) force of gravity
 D) revolution

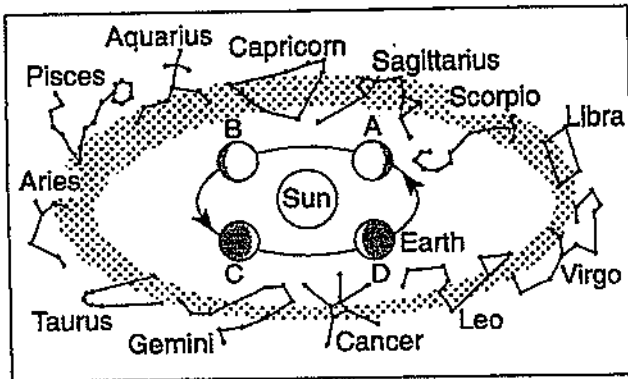
- D** 22. The diagram below represents an activity in which an eye dropper was used to place a drop of water on a spinning globe. Instead of flowing due south toward the target point, the drop followed a curved path and missed the target.



The actual path results from

- A) dynamic equilibrium
 B) the globe's revolution
 C) the tilt of the globe's axis
 D) the Coriolis effect

B 23. Base your answer to the following question on the diagram below which shows twelve constellations that are visible in the night sky to an observer in New York State, over the course of a year. Different positions of Earth are represented by letters *A* through *D*. The arrows represent the direction of Earth's motion around the Sun.

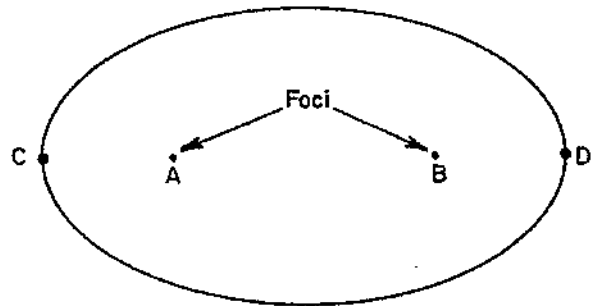


(Not drawn to scale)

The constellations observed from New York State when Earth is at position *A* are different from the constellations observed when Earth is at position *C* because

- A) Earth is tilted on its axis
- B) Earth moves in its orbit
- C) the stars move around Earth as shown by star trails
- D) the lengths of day and night are different

A 24. What is the approximate eccentricity of the ellipse shown below?



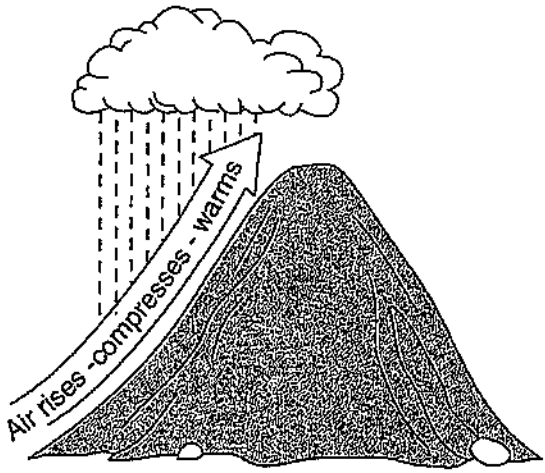
DRAWN TO SCALE

- A) 0.50
- B) 2.0
- C) 0.25
- D) 4.0

C 25. The elliptical shape of the Earth's orbit results in

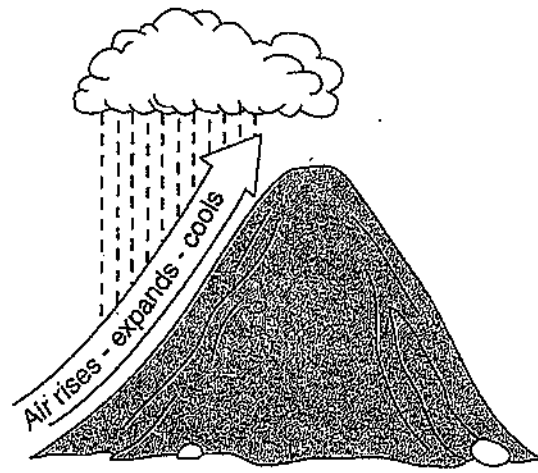
- A) the phases of the Moon
- B) tilting of the Earth's axis
- C) changes in the orbital velocity of the Earth
- D) the oblate spheroid shape of the Earth

26. Which diagram best illustrates how air rising over a mountain produces precipitation?



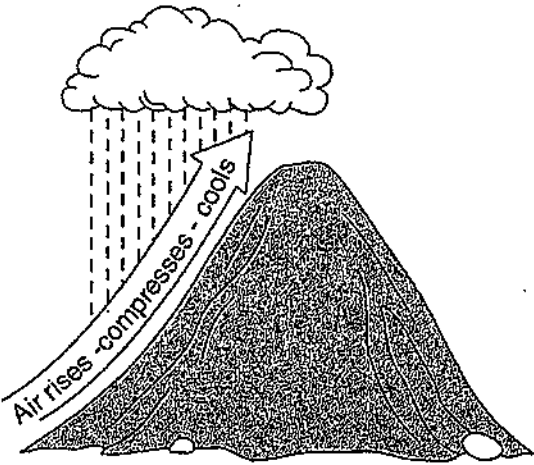
Mountain

A)



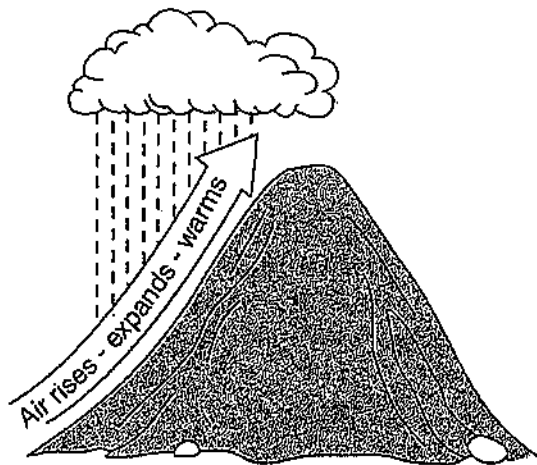
Mountain

C)



Mountain

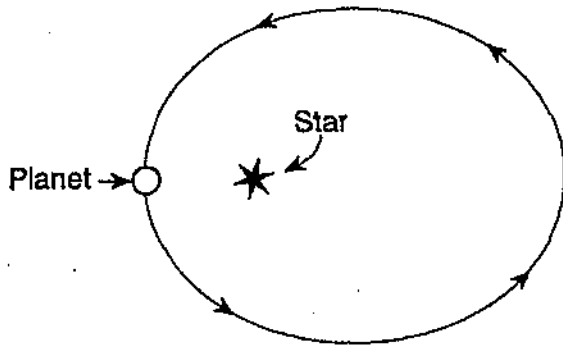
B)



Mountain

D)

27. The diagram below represents a planet revolving in an elliptical orbit around a star.



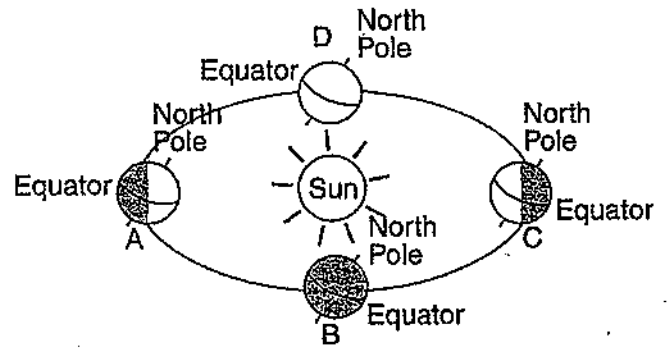
As the planet makes one complete revolution around the star, starting at the position shown, the gravitational attraction between the star and the planet will

- A) decrease, then increase
- B) increase, then decrease
- C) continually decrease
- D) remain the same

C. 28. In New York State, solar noon occurs each day when the

- A) Sun is directly overhead
- B) observer's shadow is longest
- C) Sun is at its highest altitude
- D) clock reads 12 o'clock noon

D. 29. The diagram below represents Earth at four different positions, A, B, C, and D, in its orbit around the Sun.

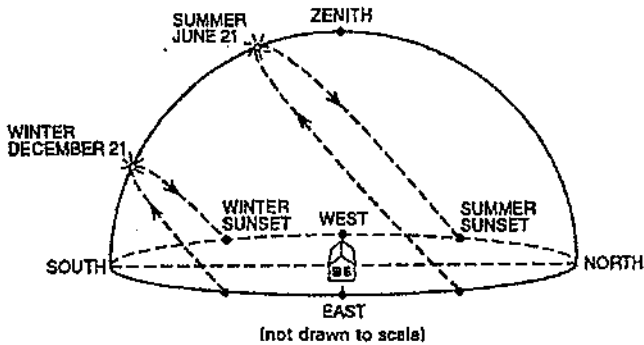


(Not drawn to scale)

Between which positions would New York State be experiencing the summer season?

- A) D and A
- B) C and D
- C) B and C
- D) A and B

- A 30. The diagram below shows the apparent paths of the Sun in relation to a house in New York State on June 21 and December 21.



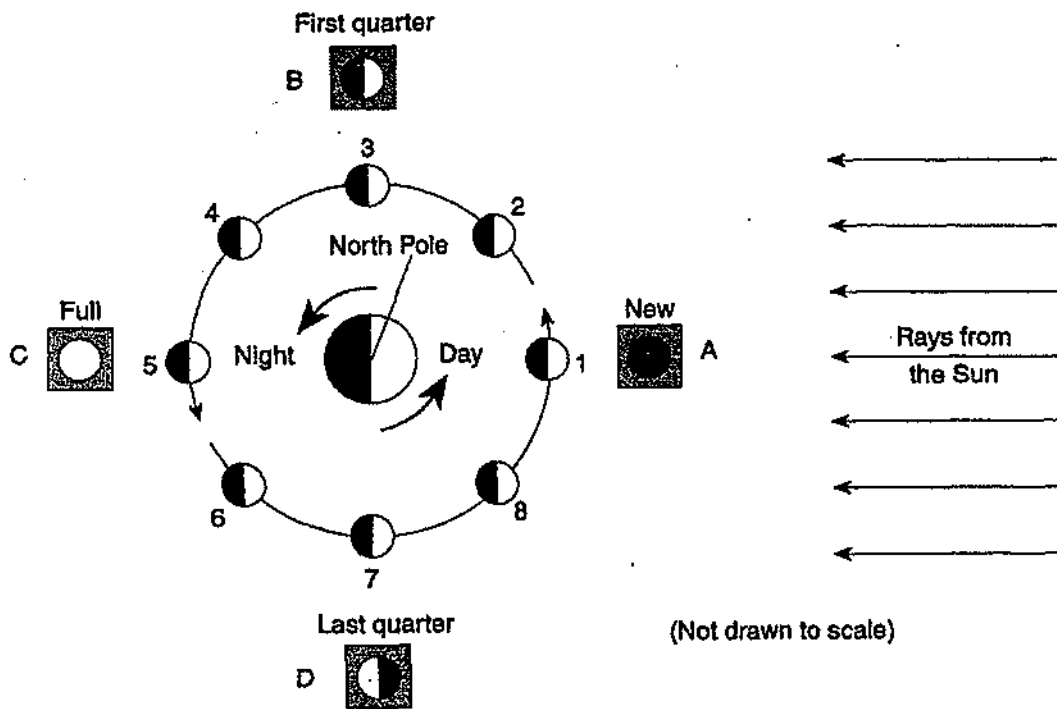
Which statement best explains the cause of this apparent change in the Sun's path?

- (A) The Earth's axis is tilted $23\frac{1}{2}^\circ$
B) The Sun's axis is tilted $23\frac{1}{2}^\circ$
C) The Earth's orbital velocity changes as it revolves around the Sun.
D) The Sun's orbital velocity changes as it revolves around the Earth.

- b 31. Which location on the Earth would the Sun's vertical rays strike on December 21?

- A) Tropic of Cancer ($23\frac{1}{2}^\circ$ N)
(B) Tropic of Capricorn ($23\frac{1}{2}^\circ$ S)
C) South Pole (90° S)
D) Equator (0°)

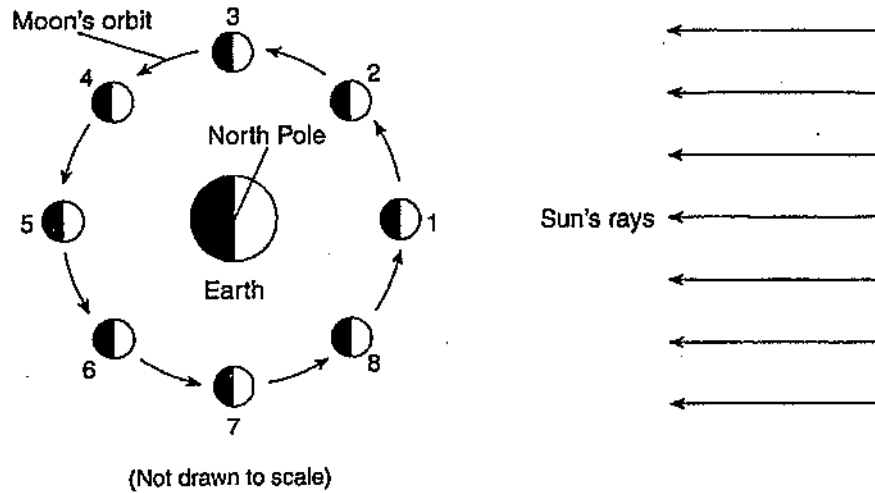
Base your answers to questions 32 and 33 on the diagram below, which represents a model of the Earth-Moon system as viewed from above the North Pole. The numbers 1 through 8 represent positions of the Moon as it revolves around Earth. The parts of the diagram labeled A through D show how the Moon's phases appear to an observer in New York State.



B 32. The time required for the Moon to complete one cycle of phases is about one
 A) week B) month C) day D) year

D 33. Which motion causes the Moon to show phases when viewed from Earth?
 A) rotation of the Moon C) revolution of Earth
 B) rotation of Earth D) revolution of the Moon

34. Base your answer to the following question on the diagram below, which represents the Moon orbiting Earth as viewed from space above the North Pole. The Moon is shown at eight different positions in its orbit.

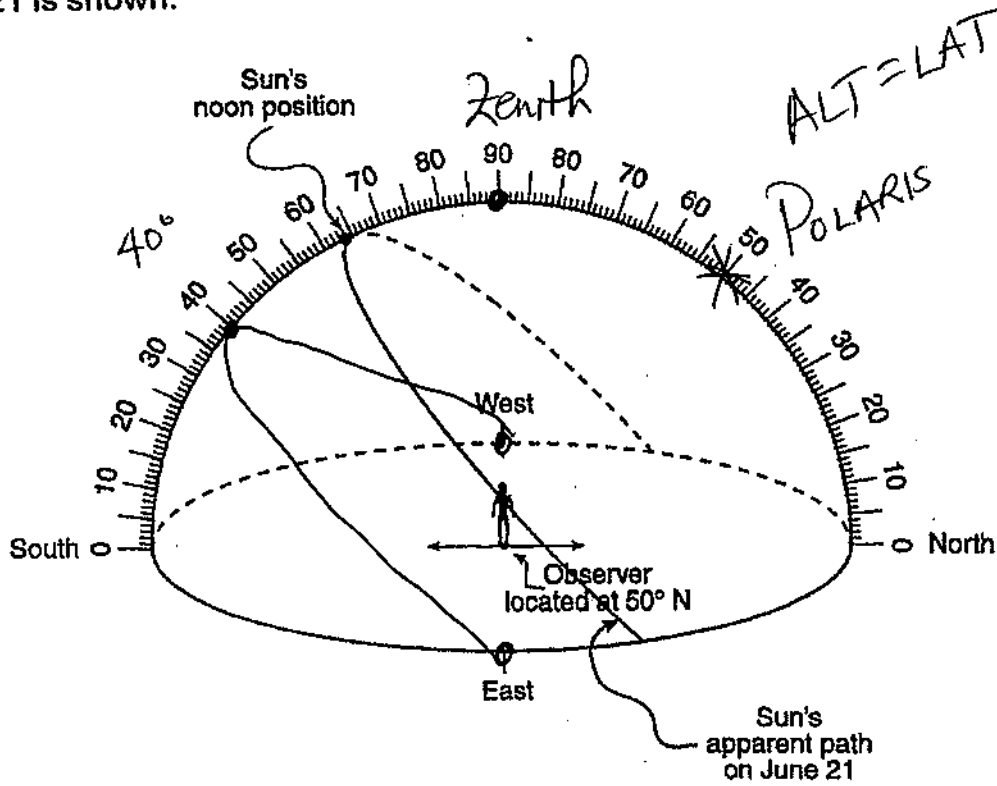


Key	
	Lighted, visible part of the Moon
	Dark, invisible part of the Moon

When the Moon is in position 2, which phase would be visible to an observer in New York State?



Base your answers to questions 35 through 37 on the diagram below. The diagram is a model of the sky (celestial sphere) for an observer at 50° N latitude. The Sun's apparent path on June 21 is shown.

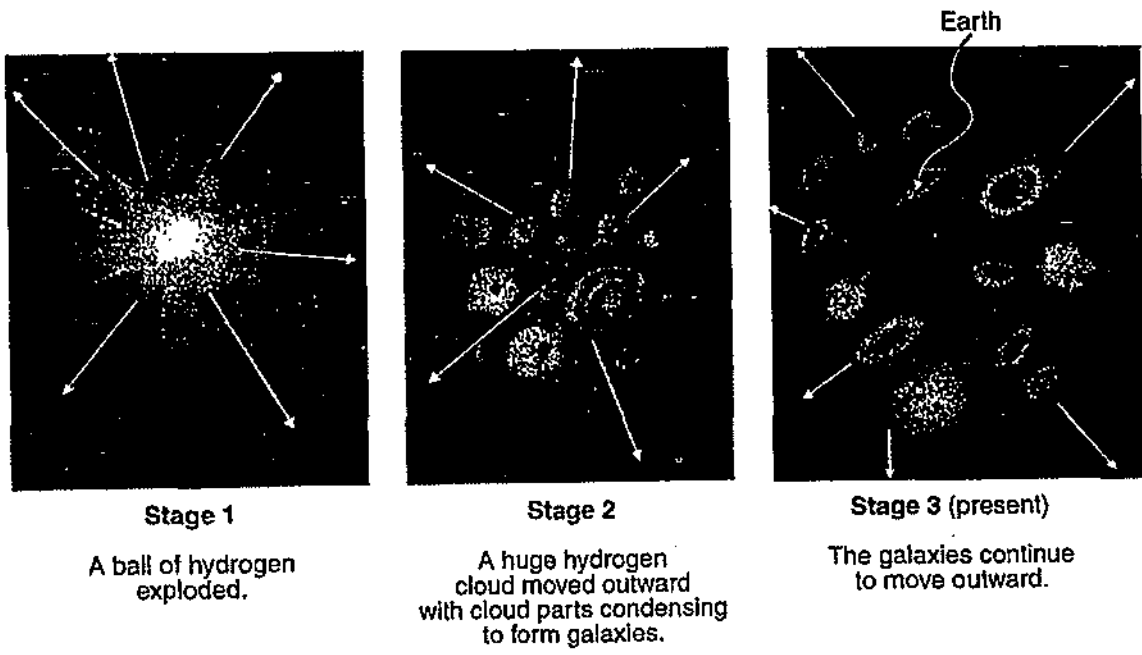


35. On the diagram mark with a dot the position of *Polaris* as viewed by the observer. Label this dot "*Polaris*."

36. On the diagram mark with a dot the position of the observer's zenith. Label this dot "*Zenith*."

37. The altitude of the Sun's position at noon on March 21 is 40° at this location. On the diagram draw and label the approximate apparent path of the Sun on March 21.

38. The diagram below illustrates three stages of a current theory of the formation of the universe.



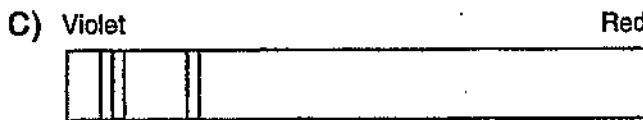
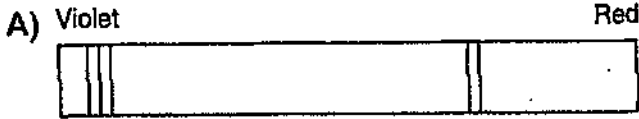
A major piece of scientific evidence supporting this theory is the fact that wavelengths of light from galaxies moving away from Earth in stage 3 are observed to be

A) shorter than normal (a blue shift) C) longer than normal (a red shift)
B) shorter than normal (a red shift) D) longer than normal (a blue shift)

39. The diagram below represents a standard dark-line spectrum for an element.



The spectral lines of this element are observed in light from a distant galaxy. Which diagram represents these spectral lines?



A 40. Two stars of the same color are plotted on an H-R diagram. Star A is more luminous than star B. Which one of the following statements could explain this?

- A)** Star A is larger than star B.
- B) Star A is more distant than star B.
- C) Star A is hotter than star B.
- D) Star A appears brighter in the sky than star B.

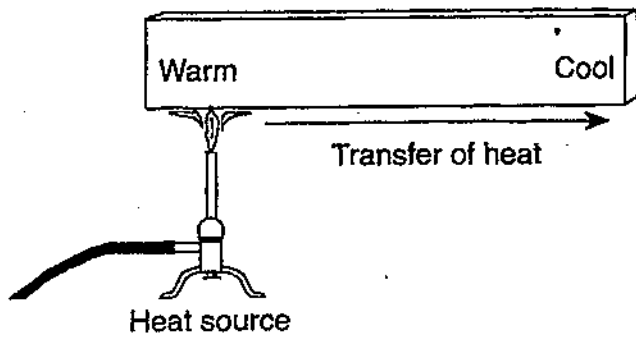
A 41. What is the basic difference between ultraviolet, visible, and infrared radiation?

- A)** wavelength C) half-life
- B) temperature D) wave velocity

A 42. In which list are the forms of electromagnetic energy arranged in order from longest to shortest wavelengths?

- A)** radio waves, infrared rays, visible light, ultraviolet rays
- B) x-rays, infrared rays, blue light, gamma rays
- C) infrared rays, radio waves, blue light, red light
- D) gamma rays, x-rays, ultraviolet rays, visible light

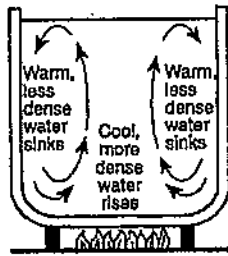
C 43. The diagram below shows a solid iron bar that is being heated in a flame.



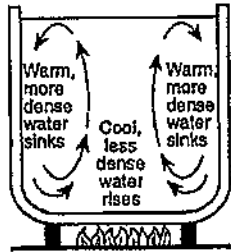
The primary method of heat transfer in the solid iron bar is

- A) absorption C) conduction
 B) advection D) convection

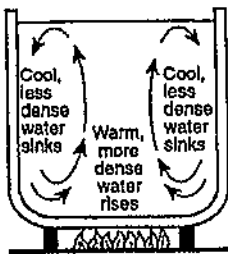
D 44. Which diagram correctly indicates why convection currents form in water when water is heated?



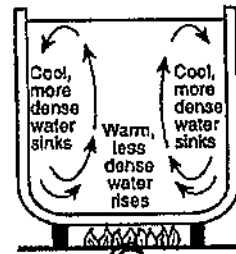
A)



C)

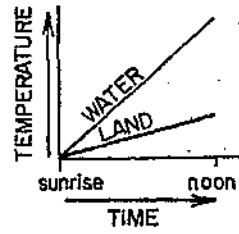


B)

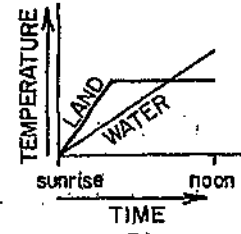


D)

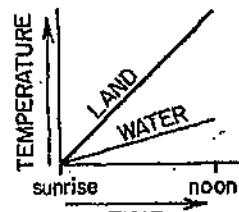
B 45. Which graph best illustrates the temperature changes on adjacent land and water surfaces as they are heated by the Sun from sunrise to noon on the same day?



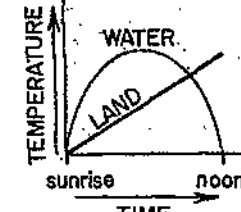
A)



C)

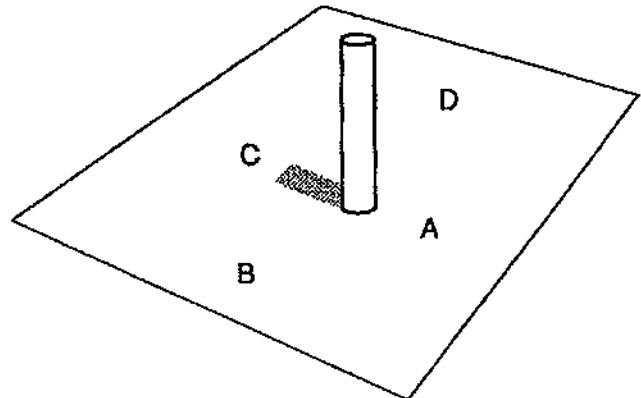


B)



D)

A 46. The diagram below shows the noontime shadow cast by a vertical post located in New York State. Which letter indicates a location south of the post?



- A) A
 B) B



- C) C
 D) D

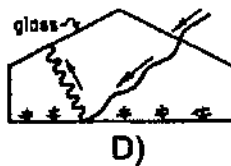
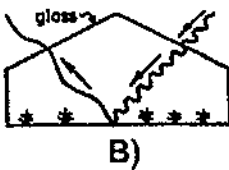
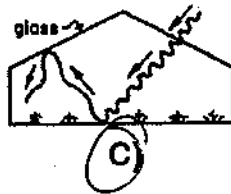
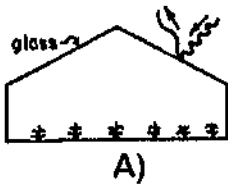
- C 47. On which date does the maximum duration of insolation occur in the Northern Hemisphere?
- A) December 21 C) June 21
 B) September 23 D) March 21

- D 48. What is the usual cause of the drop in temperature that occurs between sunset and sunrise at most New York State locations?
- A) strong winds
 B) cloud formation
C) heavy precipitation
D) ground radiation

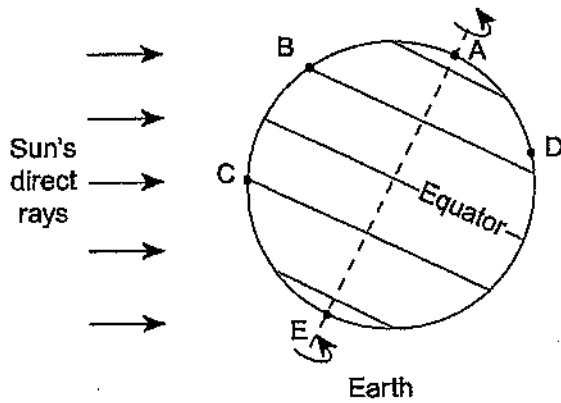
- C 49. Which model best represents how a greenhouse remains warm as a result of insolation from the Sun?

KEY:

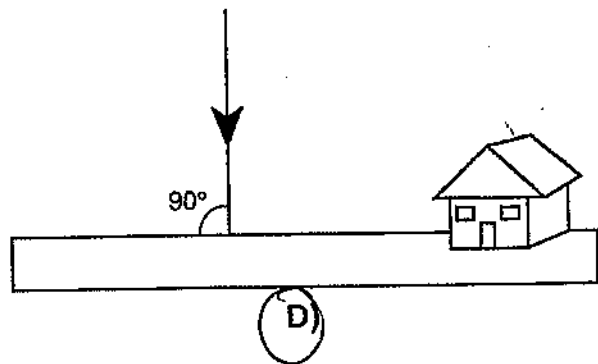
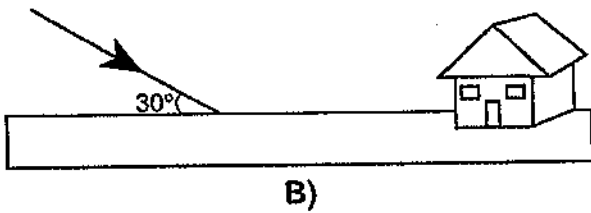
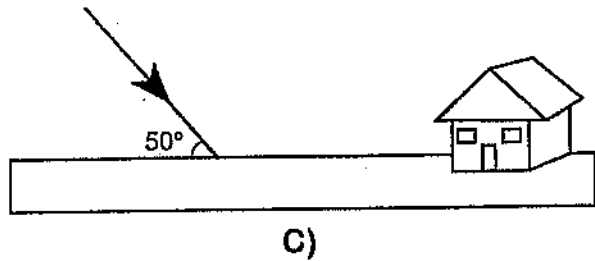
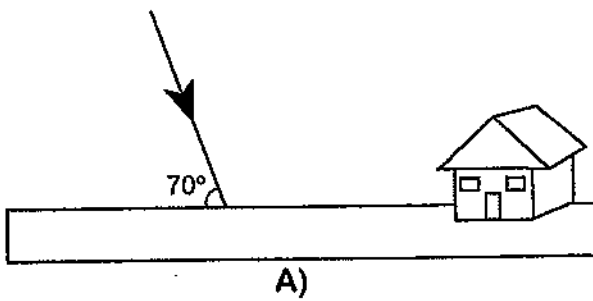
 Short waves
 Long waves



Base your answers to questions 50 and 51 on the diagram below, which shows the tilt of Earth on its axis in relation to the Sun on one particular day. Points *A* through *E* are locations on Earth's surface. Point *D* is located in New York State. The dashed line represents Earth's axis.



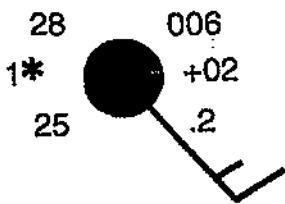
50. Which diagram best represents the angle of the Sun's rays received at location *C* at noon on this day?



51. On this day, which location has the greatest number of hours of daylight?

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

D 52. What is the air pressure indicated on the weather station model shown below?

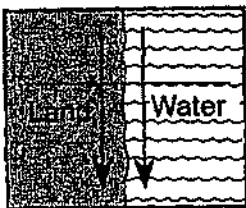


- A) 960.0 mb C) 1006.0 mb
 B) 900.6 mb D) 1000.6 mb

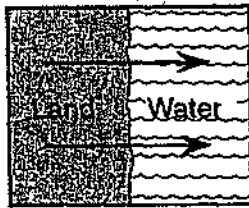
B 53. When the dry-bulb temperature is 14°C and the wet-bulb temperature is 8°C , the relative humidity is

- A) 25% C) 22%
B) 41% D) 6%

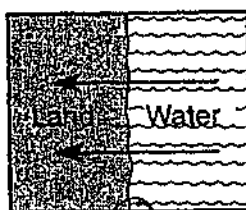
B 54. Adjacent water and land surfaces have the same temperature at sunrise on a clear, calm day. A surface wind develops after the water and land are heated by the Sun for a few hours. On which map do the arrows best represent the direction of this wind?



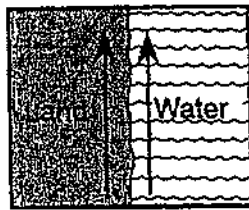
A)



C)



B)

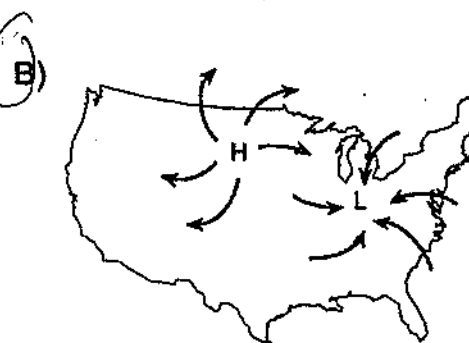


D)

B 55. Approximately how many degrees does the Earth rotate on its axis in 1 hour?

- A) 1° C) 24°
B) 15° D) 360°

B 56. Which map correctly shows the wind directions of the high-pressure and low-pressure systems?



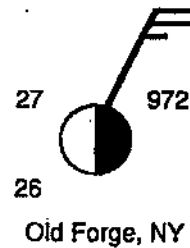
A 57. When did the Jurassic Period end?

- A) 144 million years ago
- B) 66 million years ago
- C) 163 million years ago
- D) 190 million years ago

A 58. In New York State, dry, cool air masses (cP) often interact with moist, warm air masses (mT). Which statement correctly matches each air mass with its usual geographic source region?

- A) cP is from northern Canada and mT is from the Gulf of Mexico.
- B) cP is from the North Atlantic Ocean and mT is from the deserts of the southwestern United States.
- C) cP is from northern Canada and mT is from the deserts of the southwestern United States.
- D) cP is from the North Atlantic Ocean and mT is from the Gulf of Mexico.

A 59. The station model below provides weather data for Old Forge, New York.



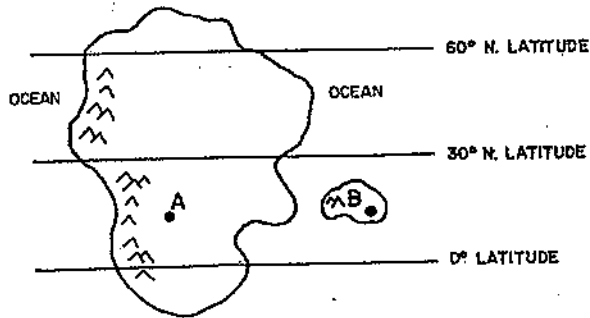
Which set of factors best describes the conditions at Old Forge?

- A) northeast wind at 25 knots, dewpoint 26°F, air pressure 997.2 mb
- B) southwest wind at 25 knots, dewpoint 26°F, air pressure 997.2 mb
- C) northeast wind at 25 knots, dewpoint 27°F, air pressure 1,097.2 mb
- D) southwest wind at 25 knots, dewpoint 27°F, air pressure 1,097.2 mb

D 60. The rate of evaporation of water can be increased by

- A) decreasing the circulation of the air
- B) increasing the amount of moisture in the air
- C) decreasing the temperature of the water
- D) increasing the temperature of the air

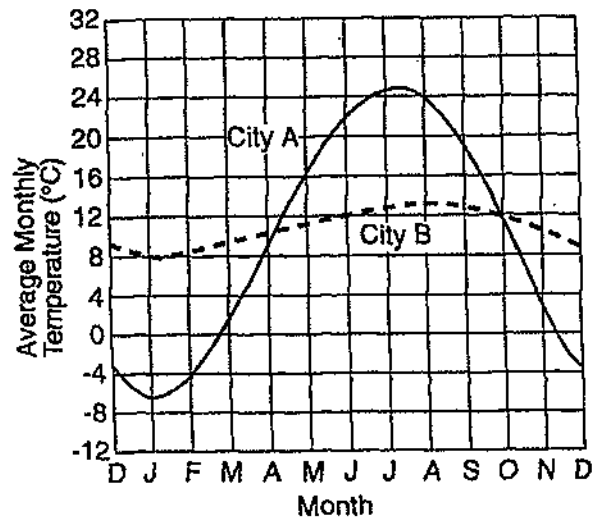
A 61. The diagram below represents an imaginary continent and a nearby island.



Which climatic variable causes location *A* to have cooler winters and warmer summers than location *B*?

- A) distance from a large body of water
- B) latitude
- C) location of mountain barriers
- D) direction of the planetary winds

B 62. The graph below shows the average monthly temperatures for two cities, *A* and *B*, which are both located at 41° north latitude.

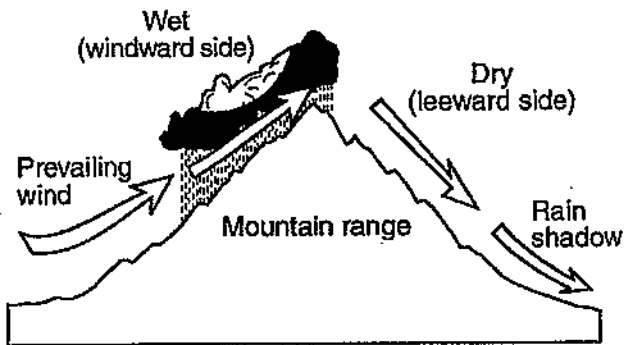


Which statement best explains the difference in the average yearly temperature range for the two cities?

- A) City *B* is located in a different planetary wind belt.
- B) City *B* is located near a large body of water.
- C) City *B* receives less yearly precipitation
- D) City *B* has a greater yearly duration of insolation.

B

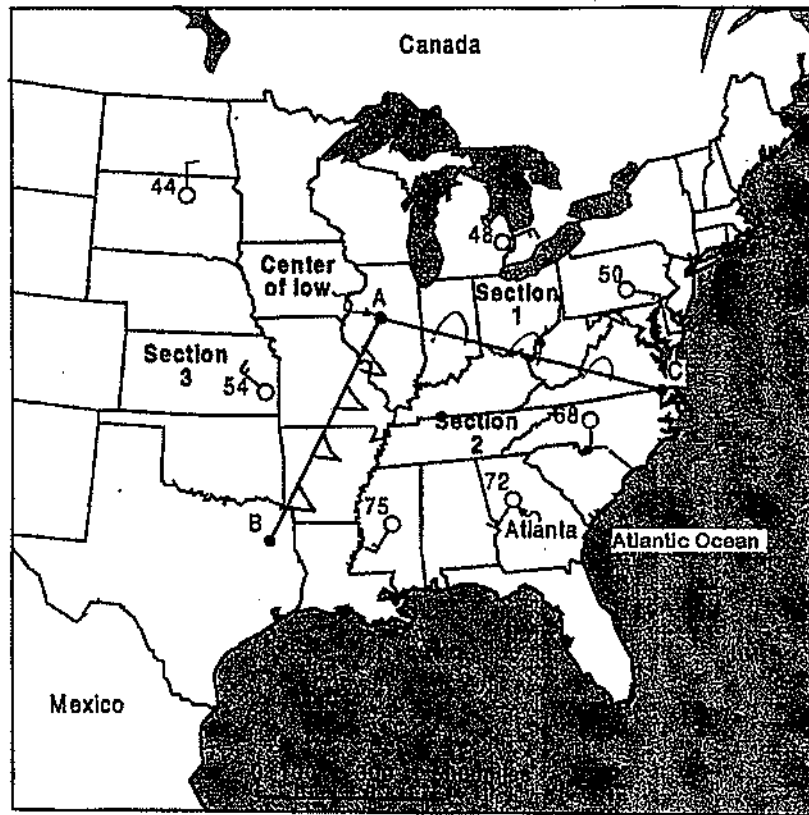
63. The cross section below shows how prevailing winds have caused different climates on the windward and leeward sides of a mountain range.



Why does the windward side of this mountain have a wet climate?

- A) Rising air compresses and warms, causing the water vapor to condense.
- B) Rising air expands and cools, causing the water vapor to condense.
- C) Rising air expands and warms, causing the water droplets to evaporate.
- D) Rising air compresses and cools, causing the water droplets to evaporate.

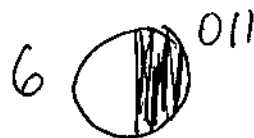
64. Base your answer to the following question on the weather map below, which shows partial weather data for several weather stations. Point A is the center of a low-pressure system. Lines AB and AC represent the frontal boundaries between different air masses. Some questions may require the use of the *Earth Science Reference Tables*.



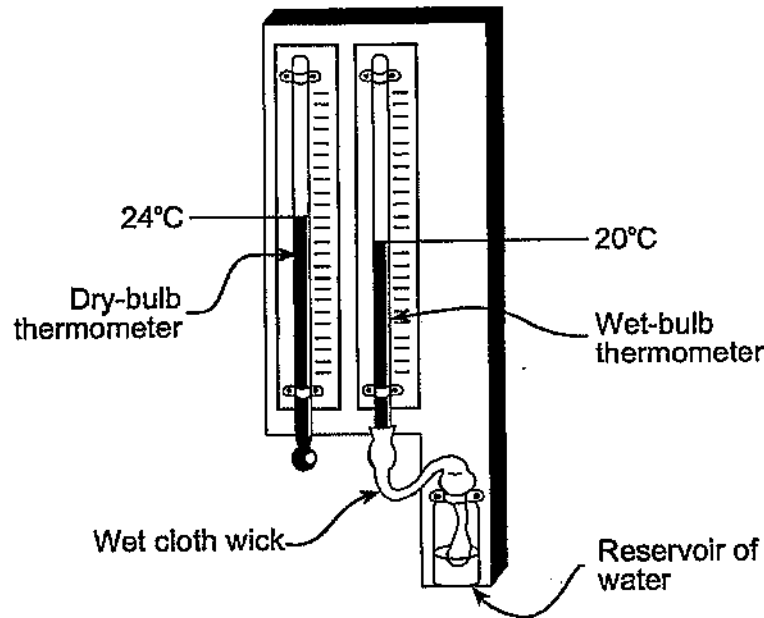
Atlanta, Georgia, has the following additional weather variable measurements.

- Visibility = 6 miles
- Amount of cloud cover = 1/2 or 50%
- Air pressure = 1001.1 millibars

On the station model provided, place these *three* weather measurements in their correct location using the proper format.



Base your answers to questions 65 through 67 on the diagram below, which shows a hygrometer located on a wall in a classroom. The hygrometer's temperature readings are used by the students to determine the relative humidity of the air in the classroom.



65. Based on the temperature readings shown in this diagram, determine the relative humidity of the air in the classroom.

69%

66. Besides relative humidity, identify another weather variable of the air in the classroom that may be determined by using both temperature readings on the hygrometer.

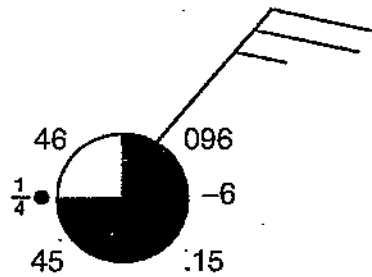
dewpoint T

67. Describe how water evaporating from the wick attached to the wetbulb thermometer lowers the temperature reading of that thermometer.

Evaporation is a cooling effect

2260 joules
absorbed.

68. The atmospheric conditions at a given location are represented by the weather station model below.



On the lines provided below, fill in the correct information for *each* variable listed, based on this weather station model.

Air Pressure: 1009.6 mb

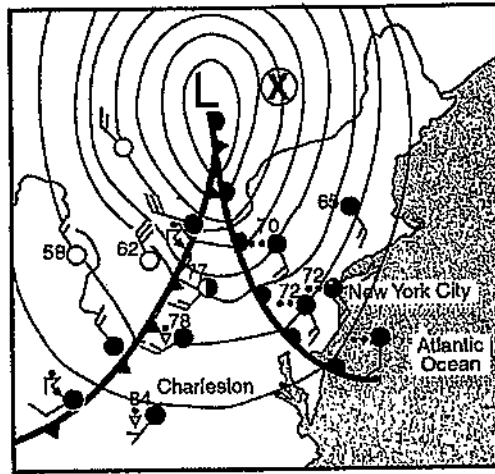
Air Temperature: 46 °F

Amount of precipitation during last six hours: .15 inch(es)

Cloud Cover: 75 %

Present Weather: rain

Base your answers to questions 69 and 70 on the weather map below, which shows a weather system over the northeastern United States and weather data for several locations. Isobars show a low-pressure (L) center. Point X is a location in Canada.



Weather Conditions	Description
(1) Air temperature	84° F
(2) Present weather	rain showers
(3) Wind speed	5 Knots
(4) Wind direction	From SW
(5) Cloud cover	100%

69. Describe the five specific weather conditions for Charleston indicated by the station model on the weather map. Complete the chart provided above and include appropriate units where necessary.

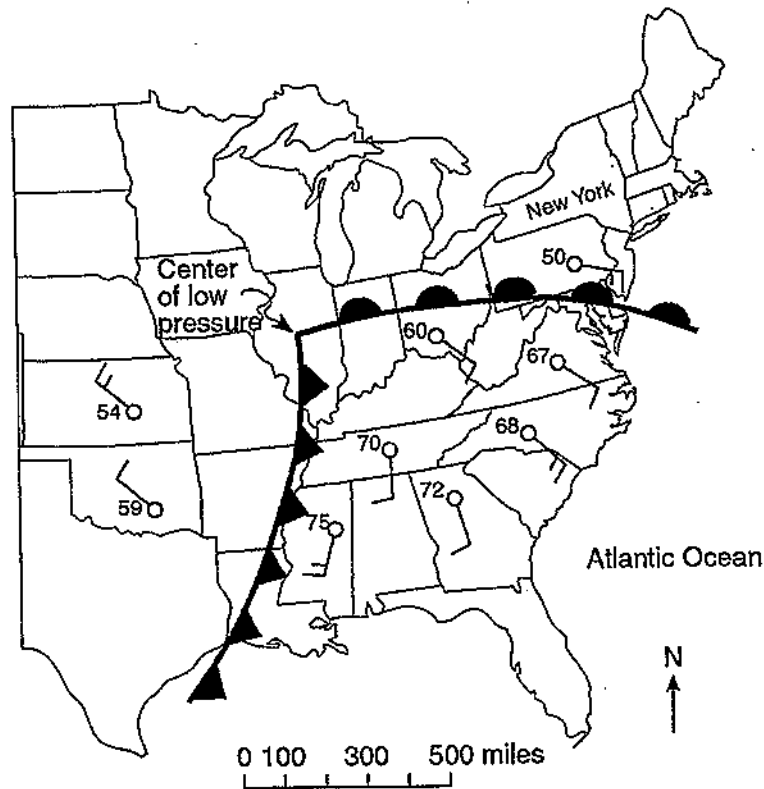
70. Describe how clouds form when warm, humid air rises along the cold front.

- a Include the terms *dewpoint* and either *expansion* or *expands* in your answer.
 b State the phase change that occurs at the dewpoint.

A warm, humid air rises, expands and cools to the dewpoint and condensation occurs and clouds form

b Condensation

Base your answers to questions 71 through 73 on the weather map below, which shows air temperature and winds for a few locations in the eastern half of the United States. A large low-pressure system is shown on the map.



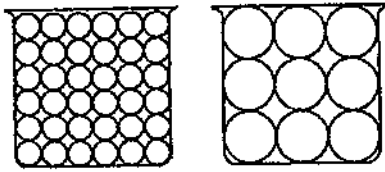
- C 71. Surface winds within this low-pressure system generally flow
- A) clockwise and away from the center of the system
 - B) counterclockwise and away from the center of the system
 - C) counterclockwise and toward the center of the system
 - D) clockwise and toward the center of the system

- A 72. Which type of front extends eastward from the low-pressure center?
- A) warm
 - B) cold
 - C) stationary
 - D) occluded

- D 73. If the low-pressure center follows a typical storm track, it will move toward the
- A) northwest
 - B) southeast
 - C) southwest
 - D) northeast

- B 74. Most infiltration of precipitation will occur when the Earth's soil is
- A) unsaturated and impermeable
 - B) unsaturated and permeable
 - C) saturated and permeable
 - D) saturated and impermeable

- C 75. The diagrams below represent two identical containers filled with nonporous uniform particles. The containers represent models of two different sizes of soil particles.



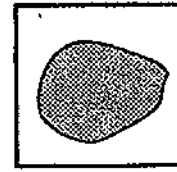
Compared to the model containing larger particles, the model containing smaller particles has

- A) less permeability and greater porosity
- B) greater permeability and greater porosity
- C) less permeability and greater capillarity
- D) greater porosity and greater capillarity

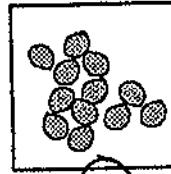
- B 76. The four limestone samples illustrated below have the same composition, mass, and volume. Under the same climatic conditions, which sample will weather fastest?



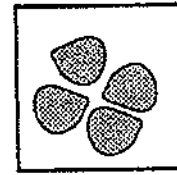
A)



C)



B)

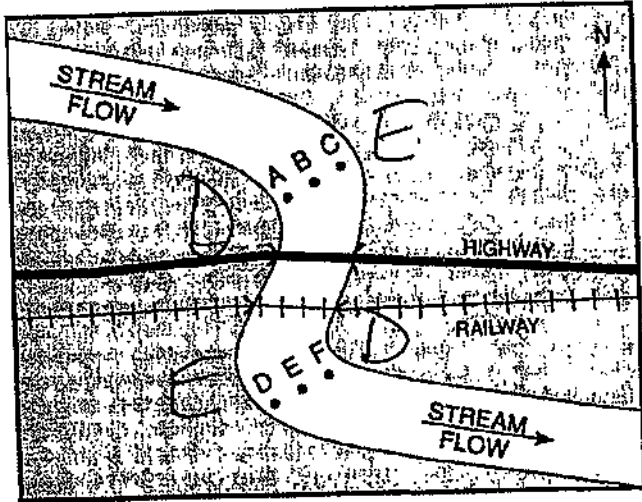


D)

- B 77. Which factors most directly control the development of soils?
- A) direction of prevailing winds and storm tracks
 - B) bedrock composition and climate characteristics
 - C) earthquake intensity and volcanic activity
 - D) soil particle sizes and method of deposition

- C 78. The greater the time that stream sediment is transported, the greater the probability that the sediment will become more
- A) rounded and larger
 - B) angular and larger
 - C) rounded and smaller
 - D) angular and smaller

Base your answers to questions 79 through 83 on the map below, which represents a meandering stream with a constant gradient. The arrows show the direction of stream flow. Points A through F are locations in the stream.



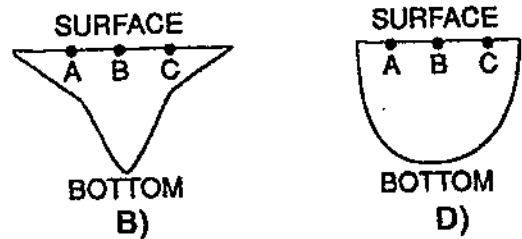
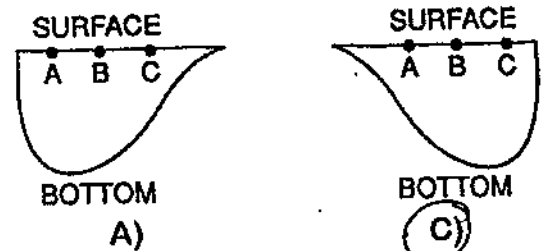
- A** 79. At which point would the most material be deposited by the stream?
- A) F C) C
 B) B D) D

- D** 80. Which sediment would usually be deposited by the stream first?
- A) clay C) silt
 B) sand D) pebbles

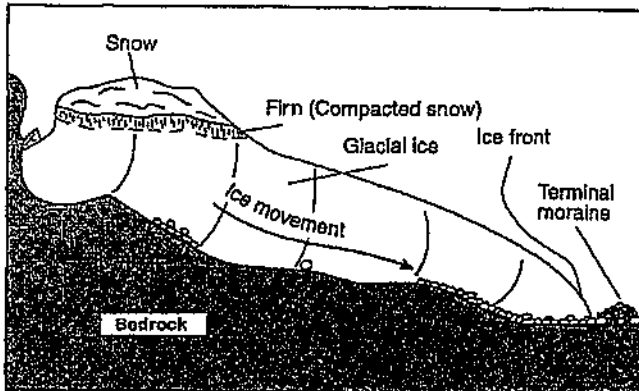
- B** 81. With which landscape feature would this meandering stream most likely be associated?
- A) a mountainous area
 B) a gently sloping plain
 C) a canyon
 D) a large area of rapids

- C** 82. At which point would the stream most likely be flowing fastest?
- A) A C) C
 B) B D) F

- C** 83. Which diagram best represents the cross section of the stream through points A, B, and C?



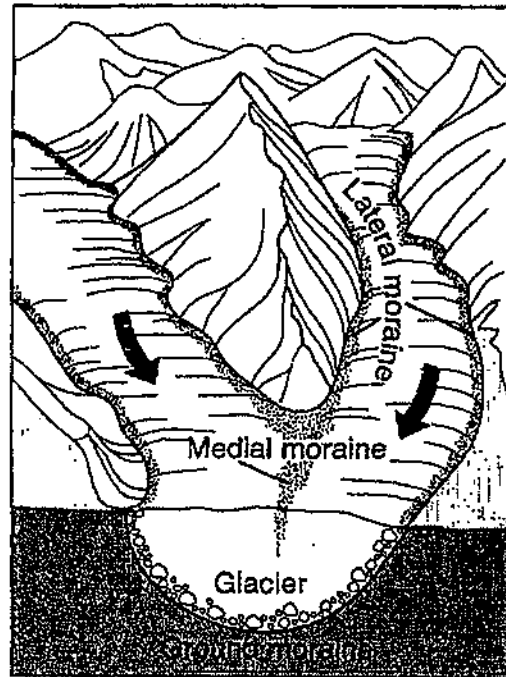
- B 84. Base your answer to the following question on the diagram which represents a profile of a mountain glacier in the northern United States.



The downhill movement of mountain glaciers such as the one shown in the diagram is primarily caused by

- A) water flowing over the glacier
- B) the force of gravity pulling on the glacier
- C) snow blowing across the top of the glacier
- D) evaporation of ice directly from the glacier

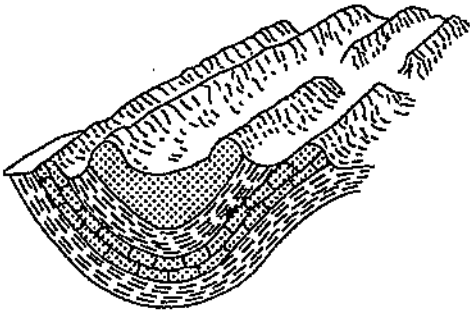
- B 85. The diagram below shows rock material being transported by a mountain glacier.



The moraine deposits left when this glacier melts will generally be

- A) sorted by size and unlayered
- B) unsorted by size and unlayered
- C) unsorted by size and layered
- D) sorted by size and layered

D 86. The diagram below shows the surface features and rock structure of a section of Earth's crust.



Which stream pattern would most likely form on this landscape region?



A)



C)

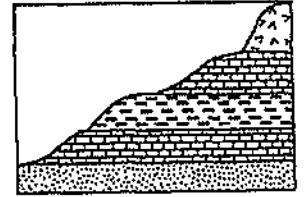
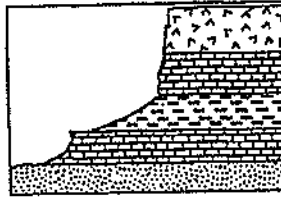


B)



D

B 87. The diagrams below represent geologic cross sections from two widely separated regions.



The layers of rock appear very similar, but the hillslopes and shapes are different. These differences are most likely the result of

- A) soil formation
- B) climate variations
- C) earthquake activity
- D) volcanic eruptions

D 88. The physical properties of minerals result from their

- A) type of cleavage and hardness
- B) texture and color of streak
- C) density and color
- D) internal arrangement of atoms

D 89. An unidentified mineral that is softer than calcite exhibits a metallic luster and cubic cleavage. This mineral most likely is

- A) pyroxene
- B) halite
- C) pyrite
- D) galena

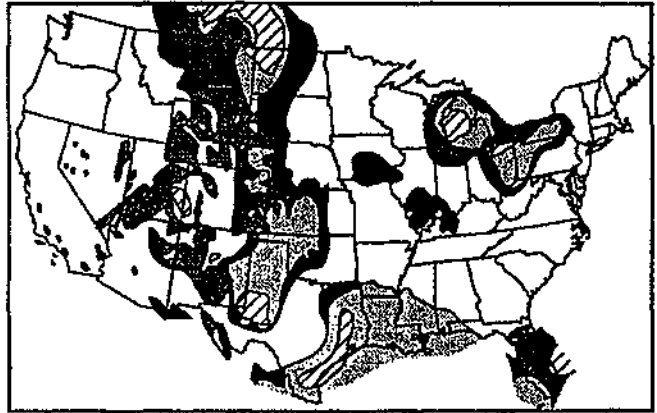
C 90. A rock is composed of several large, rounded pebbles and sand grains cemented together. Which inference about the rock is best supported by this description?

- A) The rock is igneous.
- B) The rock is older than the pebbles.
- C) The rock is sedimentary.
- D) The rock resulted from evaporation of sea water.




D 91. Limestone, gypsum, and salt are rocks formed by the processes of

- A) weathering and metamorphism
- B) melting and solidification
- C) erosion and deposition
- D) evaporation and precipitation

D 92. The map below shows certain mineral deposits in the surface bedrock in areas of the United States.



KEY

-  Gypsum
-  Gypsum and halite
-  Gypsum, halite, and potassium salts

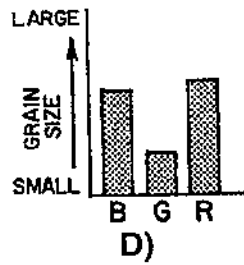
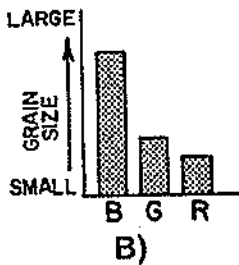
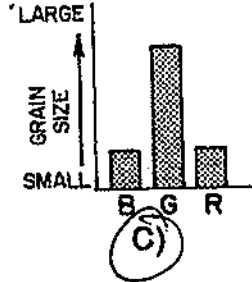
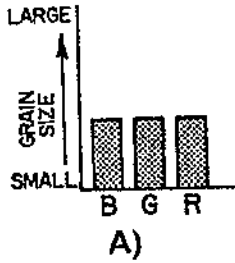
What do each of these areas of mineral deposits have in common?

- A) They presently have hot, dry climates.
- B) They are sites of active volcanoes.
- C) They are active fault zones of the Earth's crust.
- D) They were once covered by evaporating seas.

93. Which graph best represents the comparison of the average grain sizes in basalt, granite, and rhyolite?

Key to Graph Abbreviations

B - Basalt
G - Granite
R - Rhyolite



94. A coarse-grained rock contains 50% plagioclase, 45% pyroxene, and 5% hornblende. This rock should be identified as

- A) granite C) basalt
B) rhyolite D) gabbro

95. What is the main difference between metamorphic rocks and most other rocks?

- A) Many metamorphic rocks exhibit banding and distortion of structure.
B) Many metamorphic rocks contain a high amount of oxygen-silicon tetrahedra.
C) Many metamorphic rocks contain only one mineral.
D) Many metamorphic rocks have an organic composition.

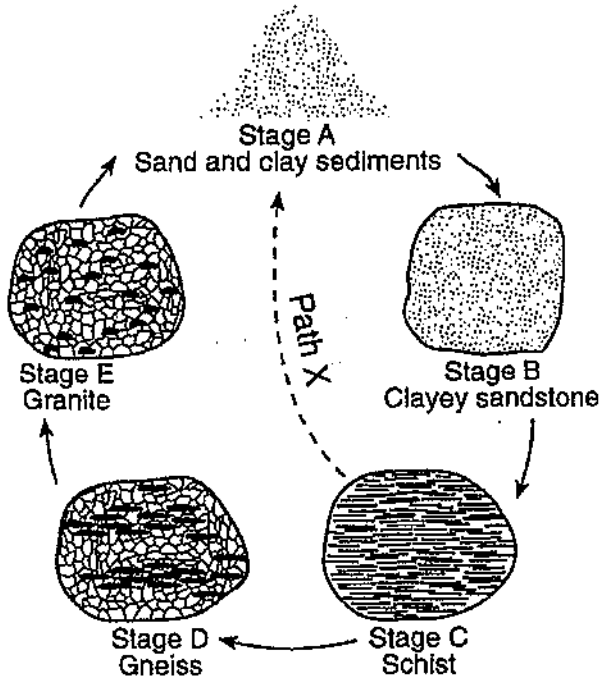
96. A mafic igneous rock is most likely to be relatively

- A) high in density and light in color
B) low in density and dark in color
C) low in density and light in color
D) high in density and dark in color

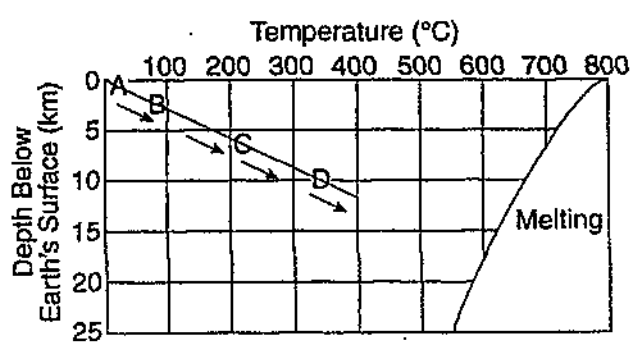
B

97. Base your answer to the following question on the diagrams below which represents the same rock material at five stages of development. The graph below shows the temperature and depth of burial at which stages A through D develop. Stage E has intentionally been omitted from the graph.

A Simple Rock Cycle



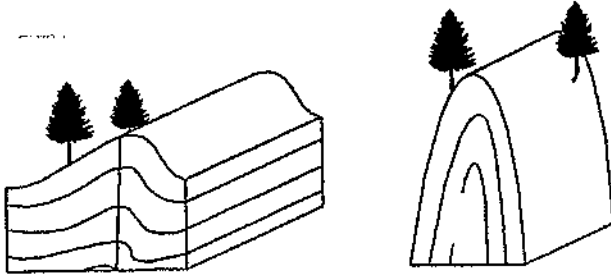
Environment of Rock Stages



The rocks in stages C and D are both
A) glassy B) foliated

C) noncrystalline D) clastic

A 98. The cross sections of crust below represent two regions of sedimentary rock layers that have been altered.

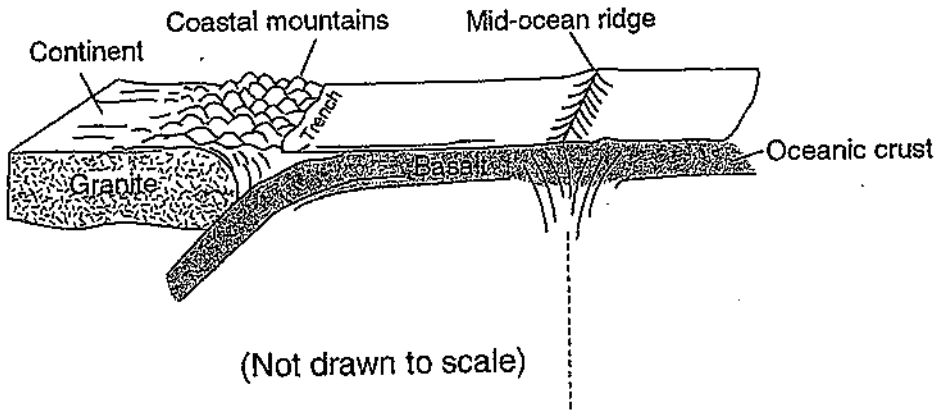


The sedimentary bedrock in both regions originally formed as

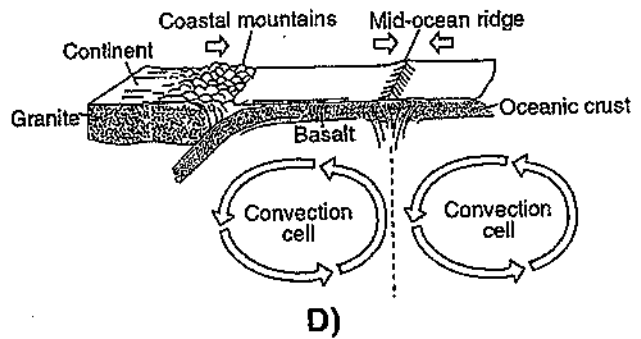
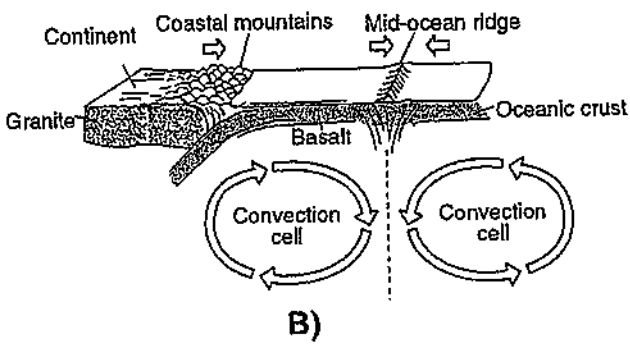
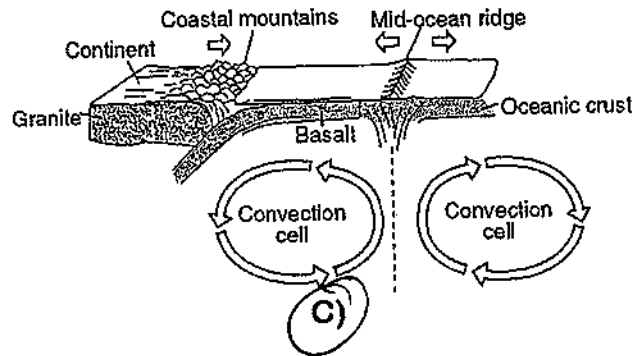
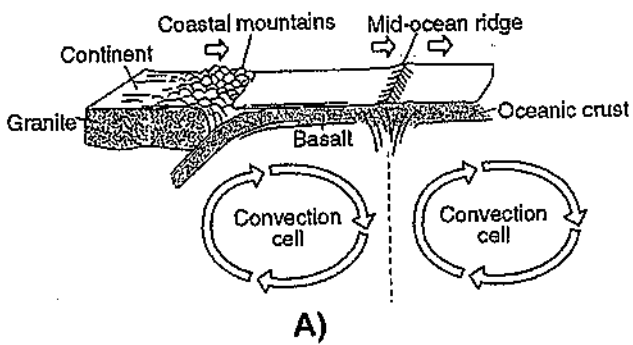
- A) horizontal layers
- B) faulted layers
- C) folded layers
- D) recrystallized layers

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

C

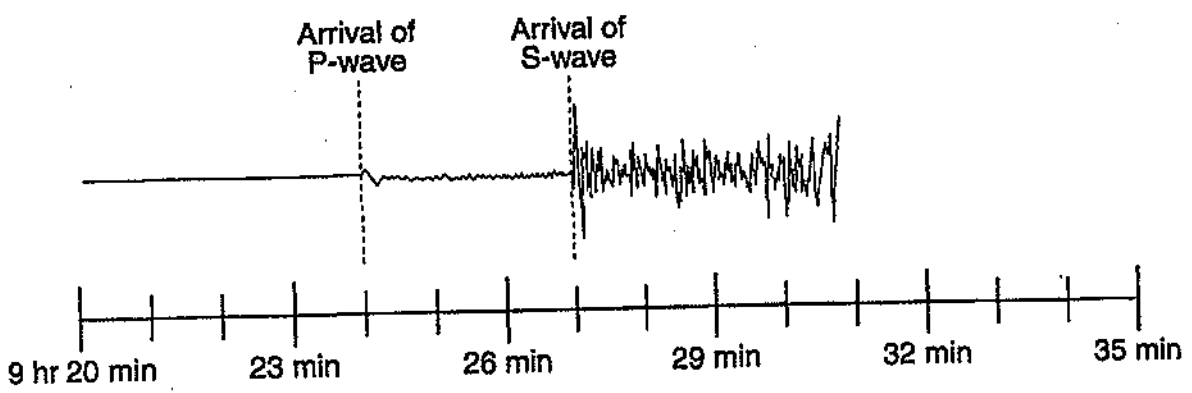


Which model most accurately shows the movements (arrows) associated with the surface features shown in the diagram?



100. Which statement best supports the theory that all the continents were once a single landmass?
- A) Great thicknesses of shallow-water sediments are found at interior locations on some continents.
 - B) Marine fossils can be found at high elevations above sea level on all continents.
 - C) Rocks of the ocean ridges are older than those of the adjacent sea floor.
 - D) Rock and fossil correlation can be made where the continents appear to fit together.

101. The seismogram below shows the arrival times of an earthquake's P-wave and S-wave recorded at a seismic station in Portland, Oregon.

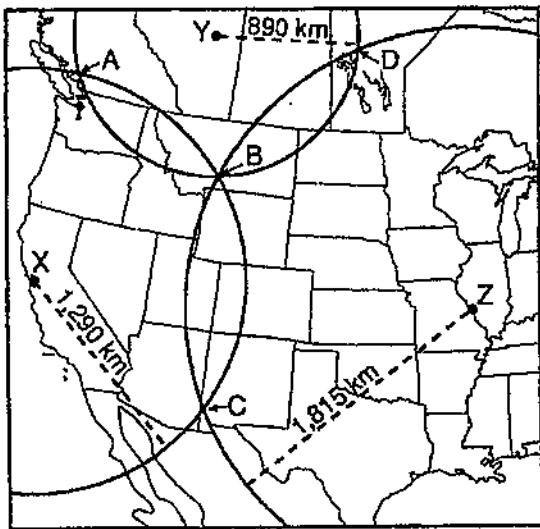


What was the distance from Portland to the earthquake's epicenter?

- A) 4100 km
- B) 1800 km
- C) 2500 km
- D) 3200 km

$$\begin{array}{r}
 27:00 \\
 - 24:00 \\
 \hline
 3:00
 \end{array}$$

- B 102. The circles on the map below show the distances from three seismic stations, X, Y, and Z, to the epicenter of an earthquake.



Which location is closest to the earthquake epicenter?

- A) A C) C
 B) B D) D

- B 103. 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?
- A) 3:39:30 p.m. C) 3:27:00 p.m.
 B) 3:25:30 p.m. D) 3:32:23 p.m.

- C 104. What is the relationship between density, temperature, and pressure inside the Earth?
- A) As depth increases, density increases, but temperature and pressure decrease.
 B) As depth increases, density, temperature, and pressure decrease.
 C) As depth increases, density, temperature, and pressure increase.
 D) As depth increases, density and temperature increase, but pressure decreases.

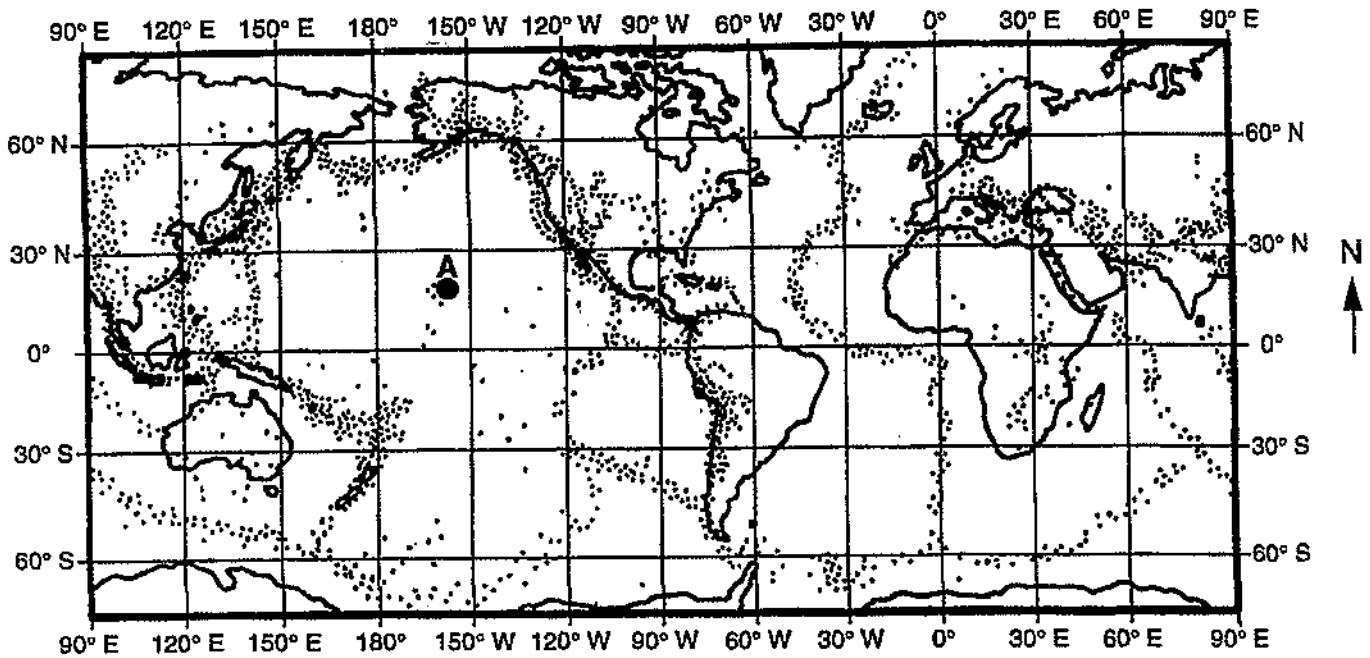
4000 Kms =

P wave travel time

7:00 minutes

$$\begin{array}{r} 3:32:30 \\ - \quad 7:00 \\ \hline 3:25:30 \end{array}$$

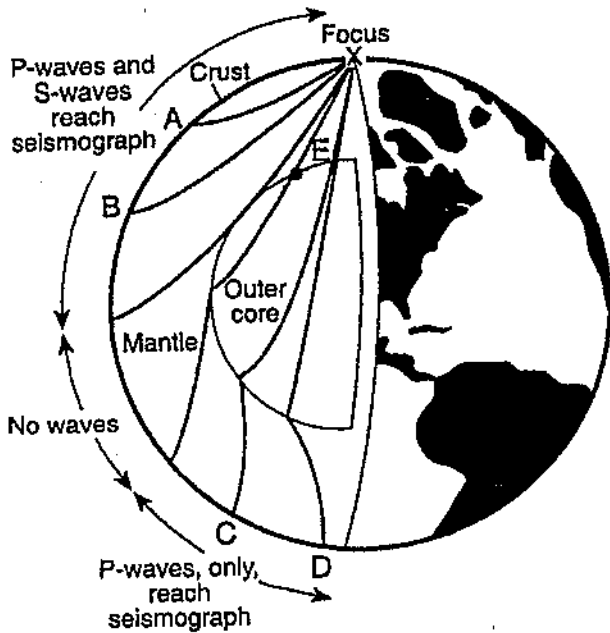
Base your answers to questions 105 and 106 on the map below. Dots on the map show the distribution of major earthquake epicenters. The shaded circle labeled *A* represents a location on Earth's surface.



- C 105. Which conclusion can best be inferred from the data shown on this map?
- A) Most earthquakes occur west of the Prime Meridian and north of the Equator.
 - B) Earthquakes generally are evenly distributed over the surface of Earth.
 - C) Most earthquakes are concentrated in zones along plate boundaries.
 - D) Most earthquakes occur on continents.

- A 106. Location *A* is best described as an area that is
- A) above a mantle hot spot near the center of a crustal plate
 - B) at the boundary between two diverging plates
 - C) within a rift valley at a mid-ocean ridge
 - D) within a deep-sea trench between two converging plates

107. Base your answer to the following question on the diagram below, which shows a cutaway view of Earth in which the interior layers are visible. The paths of earthquake waves generated at point *X* are shown. *A*, *B*, *C*, and *D* are locations of seismic stations on Earth's surface, and point *E* is located in Earth's interior.



Both *P*-waves and *S*-waves were received at seismic stations *A* and *B*, but only *P*-waves were received at seismic stations *C* and *D*. Which statement best explains why this occurred?

- A) The solid outer core prevents *S*-waves from traveling to seismic stations *C* and *D*.
- B) The liquid outer core prevents *S*-waves from traveling to seismic stations *C* and *D*.
- C) *S*-waves travel faster than *P*-waves.
- D) *S*-waves are much weaker than *P*-waves.

Base your answers to questions 108 and 109 on the news article and map below. Points A and map are reference points.

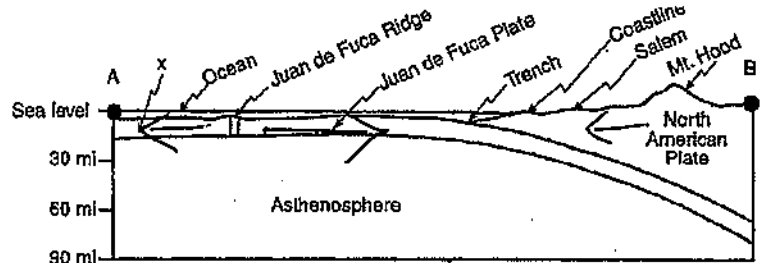
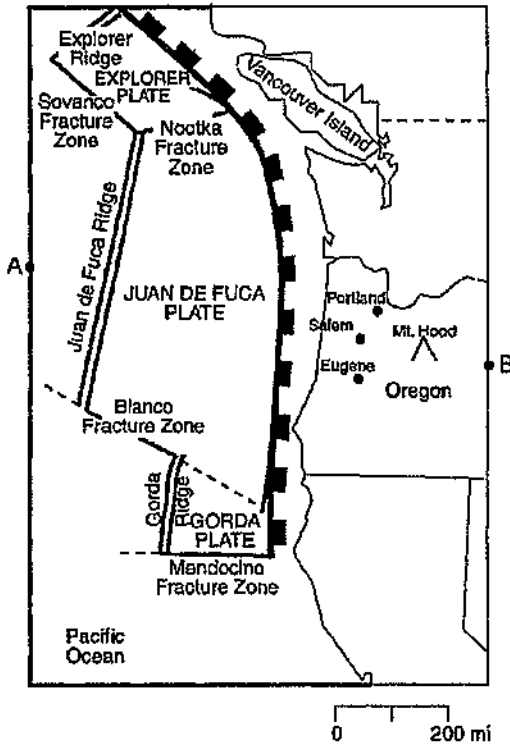
Huge Quake Possible In Oregon Valley

Scientists have warned for years that a magnitude 8 or 9 earthquake could strike about 30 miles off the Oregon coast, causing huge tsunamis (large ocean waves) and tremendous damage.

Now scientists say these earthquakes could be centered much farther inland and cause severe damage to a larger area, including cities in Oregon such as Portland, Salem, and Eugene.

Geologic evidence suggests that strong quakes in this area occur about every 400 years, plus or minus 200 years. The last one, believed to be a magnitude 9, occurred 300 years ago.

A magnitude 8 quake can cause tremendous damage. The San Francisco quake of 1906 has been estimated at 7.9. The Mexico City quake of 1985 that left thousands dead was measured at 8.1.



B: divergent
 C: Pacific
 D: increases

108. The cross section shows the lithosphere and asthenosphere between points A and B on the map.

a On the cross section provided, draw an arrow in the Juan de Fuca Plate to indicate the direction of the relative movement of the plate.

b Identify the type of tectonic plate boundary that exists at the Juan de Fuca Ridge.

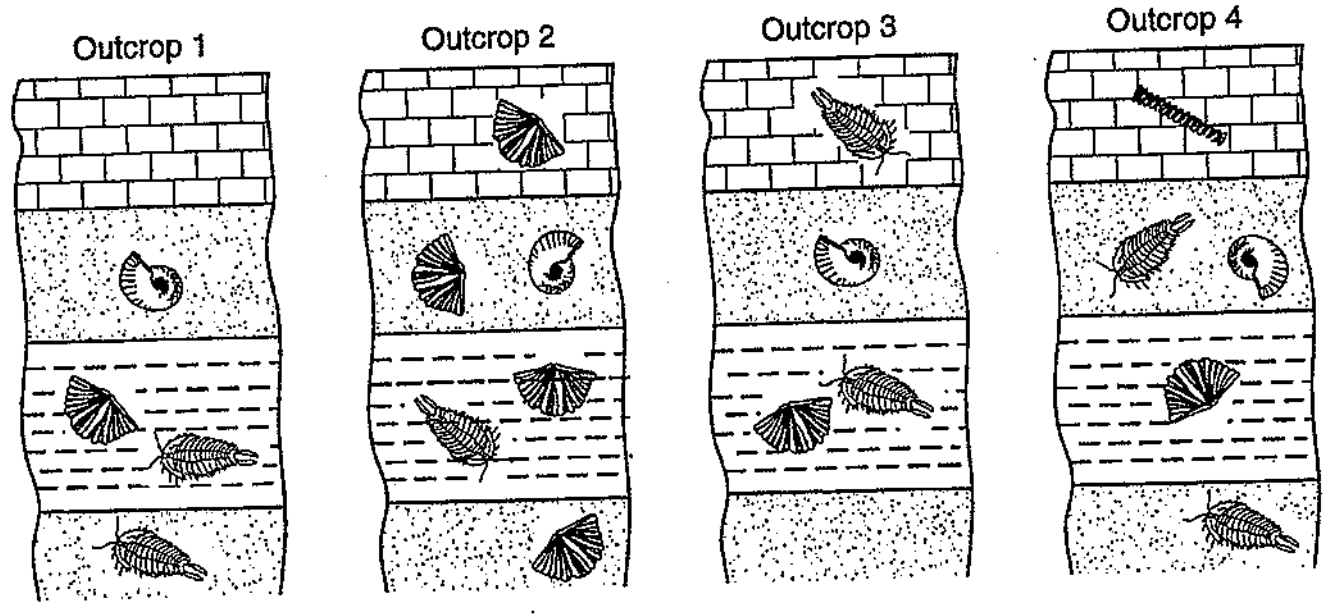
c Identify the name of the plate in the cross section labeled x.

d How does the average earthquake depth beneath the Oregon coastline compare to the average earthquake depth beneath Mt. Hood?

109. An emergency management specialist in Portland, Oregon, is developing a plan that would help save lives or prevent property damage in the event of a future earthquake. Describe *two* actions or ideas that should be included in the plan.

- ① Medical supplies
- ② Water
- ③ Evacuation route

110. The diagrams below represent the rock layers and fossils found at four widely separated rock outcrops.



Which fossil appears to be the best index fossil?

- A) 
- B) 
- C) 
- D) 

111. An archeologist found an ancient skeleton estimated to be 10,000 to 25,000 years old. Which radioactive isotope would be most useful for finding the age of the skeleton?

- A) uranium-238
- B) carbon-14
- C) rubidium-87
- D) potassium-40

112. The table below gives information about the radioactive decay of carbon-14. Part of the table has been deliberately left blank for student use.

Half-life	Mass of Original Carbon-14 Remaining (grams)	Number of Years
0	1	0
1	$\frac{1}{2}$	5,700
2	$\frac{1}{4}$	11,400
3	$\frac{1}{8}$	17,100
4	$\frac{1}{16}$	
5	$\frac{1}{32}$	
6	$\frac{1}{64}$	
7	$\frac{1}{128}$	

$$\begin{array}{r} 5700 \\ \times 7 \text{ yrs} \\ \hline 39,900 \end{array}$$

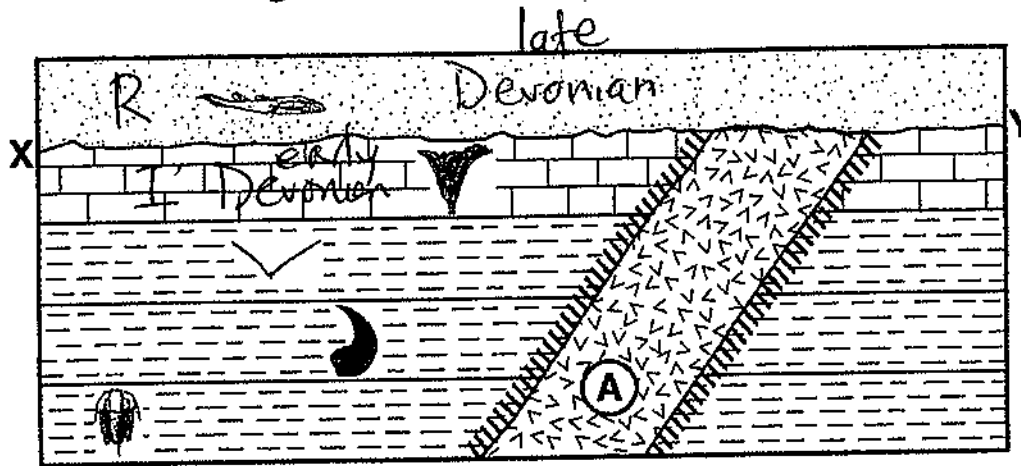
After how many years will $\frac{1}{128}$ gram of the original carbon-14 remain?

- A) 22,800 yr C) 34,200 yr
 B) 28,500 yr **D) 39,900 yr**

A 113. A sample of wood that originally contained 100 grams of carbon-14 now contains only 25 grams of carbon-14. Approximately how many years ago was this sample part of a living tree?

- A) 11,400 years** C) 17,100 years
 B) 2,850 years D) 5,700 years

Base your answers to questions 114 through 118 on the geologic cross section below. The cross section shows New York State index fossils in rock layers that have not been overturned. Rock unit A is an igneous intrusion and line XY represents an unconformity.



Key	
Index Fossils	
	<i>Bothriolepis</i>
	<i>Ctenocrinus</i>
	<i>Dicellograptus</i>
	<i>Valcouroceras</i>
	<i>Elliptocephala</i>

Key	
Rock Units	
	Sedimentary rocks

114. Based on fossil evidence, determine the geologic period during which the unconformity formed.

Devonian

115. Identify the coral index fossil that would most likely be found in the same layer as the index fossil *Ctenocrinus*.

V - *Pleurodictym*

116. Each index fossil existed for a relatively short geologic time interval. State one other characteristic that each fossil must have to be considered an index fossil.

widespread distribution

117. Describe the type of depositional environment in which the fossilized organisms lived.

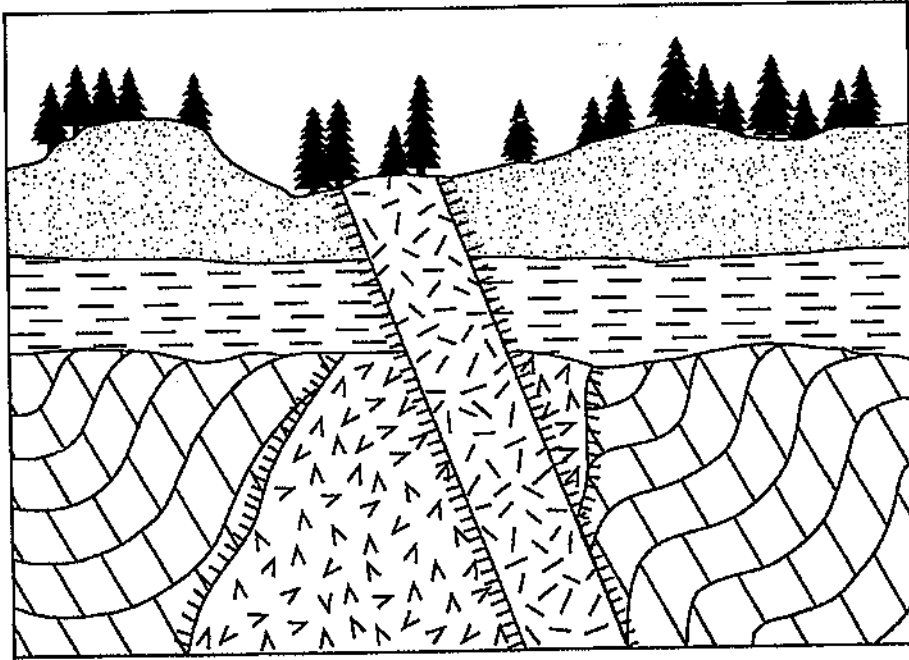
Marine - ocean.

118. Identify one piece of evidence shown in this cross section that indicates that the igneous intrusion, A, is older than the sandstone layer.







A Unconformity

B ~~No contact metamorphism~~

19. Base your answer to the following question on the information and diagram below. The diagram represents a cliff of exposed bedrock that was investigated by an Earth science class.



Key to Rock Symbols

 Sandstone	 Folded limestone	 Granite
 Basalt	 Shale	 Contact metamorphism

After the students examined the cliff, they made three correct inferences about the geologic history of the bedrock.

Inference 1: The shale layer is older than the basaltic intrusion.

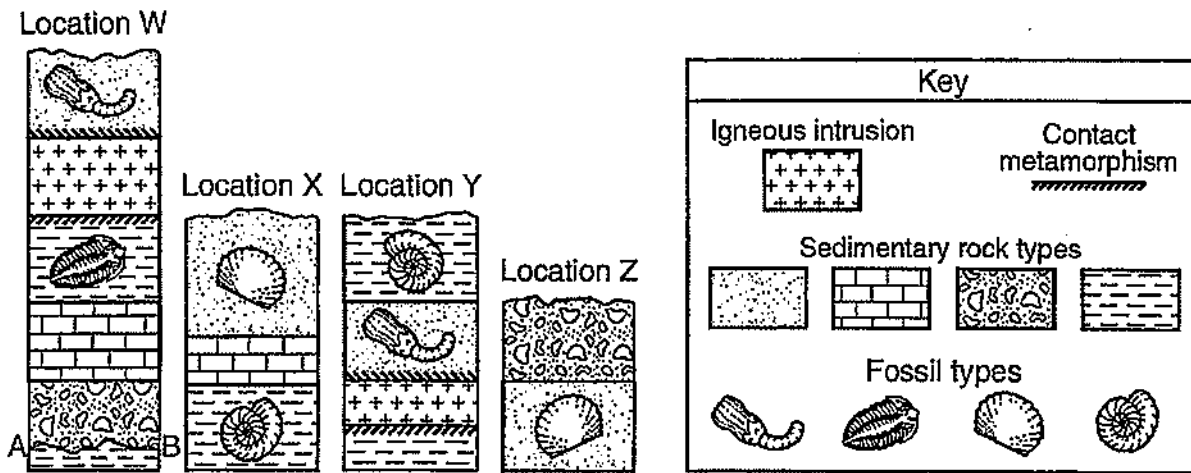
Inference 2: The shale layer is older than the sandstone layer.

Inference 3: An unconformity exists directly under the shale layer.

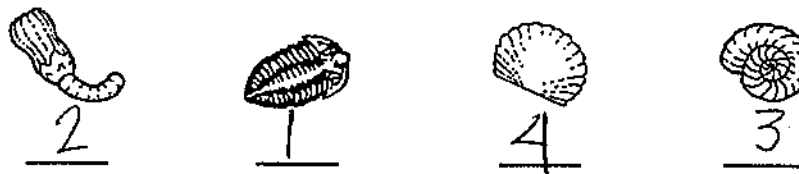
Explain how *each* inference is supported by evidence shown in the diagram.

- ①
 - Ⓐ Intrusion cuts across (basalt) shale layer (shale-older) (Basalt-younger)
 - Ⓑ Shale is contact metamorphosed - had to be there when intrusion happened.
- ② Below sandstone
- ③ Tilted layers below - horizontal layers above

Base your answers to questions 120 through 122 on the cross sections below, which show widely separated outcrops at locations *W*, *X*, *Y*, and *Z*. The rock layers have not been overturned. Line *AB* in the cross section at location *W* represents an unconformity. Fossils are shown in some of the layers.



(Not drawn to scale)



120. Determine the relative geologic age of the four fossils by correlating the rock layers between these outcrops. Number the fossils from 1 to 4 in order of relative age, with 1 as the oldest and 4 as the youngest.

121. What evidence shown in the outcrop at location *W* suggests that the igneous intrusion occurred after both fossils were deposited at location *W*?

Contact metamorphism of both layers

122. Identify *two* of the processes involved in the formation of the unconformity represented by line *AB* in the cross section at location *W*.

① Deposition
Uplift
Weathering/EROSION
SUBMERGENCE - SINKING

