Name: _____

1) What is the approximate density of a mineral with a mass of 262.2 grams that displaces 46 cubic centimeters of water?

A) 6.1 g/cm^3
B) 5.7 g/cm^3
C) 1.8 g/cm^3
D) 12.2 g/cm^3

2) In which two Earth regions is oxygen the second most abundant element by volume?

A) core and crust
B) hydrosphere and troposphere
C) crust and hydrosphere
D) troposphere and core

Questions 3 through 5 refer to the following:

The data table below lists some properties of four minerals that are used as ores of zinc (Zn).

Mineral Property	Mineral			
	Smithsonite	Sphalerite	Willemite	Zincite
Composition	$ZnCO_3$	ZnS	Zn_2SiO_4	ZnO
Hardness	4–4.5	3.5–4	5.5	4
Density (g/cm^3)	4.4	4.0	4.0	5.6
Color	white, gray, green, blue, yellow	brown, yellow, red, green, black	white, yellow, green, reddish brown, black	deep red to orange yellow
Streak	white	white to yellow to brown	white	orange yellow

3) A sample of sphalerite has a mass of 176.0 grams. What is the volume of the sample?

A) 31.4 cm^3
B) 40.0 cm^3
C) 22.7 cm^3
D) 44.0 cm^3

4) A mineral with a hardness of 5 would scratch which of the minerals listed in the data table?

A) zincite, sphalerite, and smithsonite, but not willemite
B) zincite, but not sphalerite, smithsonite, or willemite
C) all four zinc minerals in the table
D) zincite and sphalerite, but not smithsonite or willemite

5) Which mineral in the data table belongs in the same mineral group as quartz and olivine?

A) sphalerite
B) smithsonite
C) zincite
D) willemite

6) Which event is cyclic and predictable?

A) an earthquake occurring at the San Andreas Fault
B) Jupiter's apparent movement across the night sky
C) a volcano erupting above a subducting tectonic plate
D) an asteroid striking Earth's surface

7) If an observer on Earth views *Polaris* on the horizon, the observer is located at the

A) equator (0D)
B) North Pole (90DN)
C) Tropic of Capricorn (23.5DS)
D) Tropic of Cancer (23.5DN)

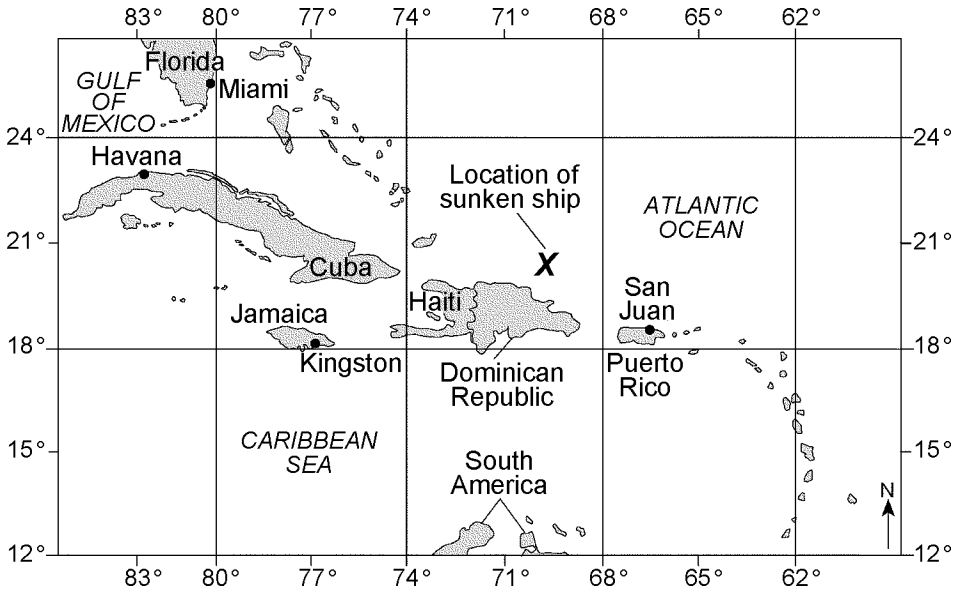
8) What is the approximate altitude of *Polaris* at Syracuse, New York?

A) 43D
B) 76D
C) 90D
D) 47D

Questions 9 through 12 refer to the following:

The map below shows sections of the Atlantic Ocean, the Caribbean Sea, and the Gulf of Mexico.

SHIPWRECK:
In 1641, the crew of the ship *Concepcion* used the Sun and stars for navigation. The crew thought that the ship was just north of Puerto Rico, but ocean currents had carried them off course. The ship hit a coral reef and sank off the coast of the Dominican Republic. The **X** on the map marks the location of the sunken ship.



9) At which location on the given map does *Polaris* appear the *highest* in the nighttime sky?

A) Miami, Florida
B) Kingston, Jamaica
C) Havana, Cuba
D) San Juan, Puerto Rico

10) According to the given map, what is the approximate latitude and longitude of the sunken ship?

A) 20.5DN 70DE
B) 20.5DS 70DW
C) 20.5DS 70DE
D) 20.5DN 70DW

11) The *Concepcion* was carried off course to the northwest by an ocean current flowing from the

A) Florida Current
B) Gulf Stream Current
C) North Equatorial Current
D) North Atlantic Current

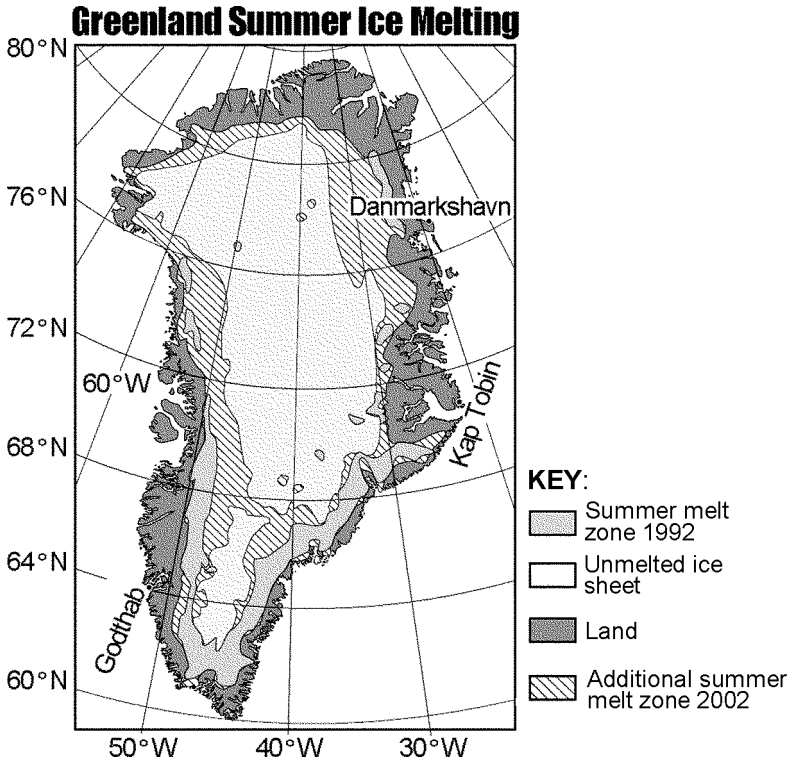
12) On which tectonic plate is Puerto Rico located?

A) South American Plate
B) Caribbean Plate
C) North American Plate
D) Cocos Plate

13) Near which two latitudes are *most* of Earth's major deserts located?

A) 30DS and 60DS
B) 60DS and 60DN
C) 0D and 90DN
D) 30DN and 30DS

14) The map below shows the extent of summer ice-melt zones on Greenland in 1992 and 2002. The summer melt zone is an area where summer heat turns snow and ice around the edges of the ice sheet into slush and ponds of meltwater. Three coastal locations are shown on the map.



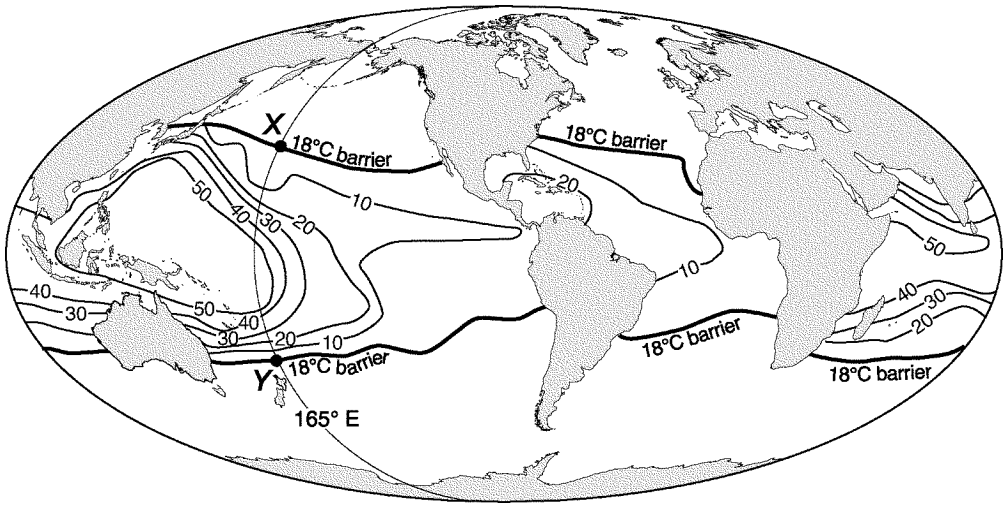
ARCTIC MELTDOWN:
Scientists are concerned because average arctic temperatures are rising. The Greenland Ice Sheet, the dominant area of continental ice in the arctic region, broke all previous records for melting in 2002. In 2004, the total amount of ice resting on top of the continental crust in the arctic region was estimated to be about 3,100,000 cubic kilometers. If all this ice were to melt, the ocean levels would rise approximately 8.5 meters. A reduction in ice-covered areas exposes more land surfaces. This increases absorption of insolation and accelerates arctic warming. Scientists continue to collect data to define the role of greenhouse gases in the warming of the arctic region.

What is the approximate latitude and longitude of Godthab, Greenland?

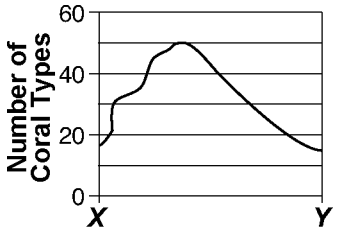
A) 51.5DN 64DW B) 22DN 70.5DW C) 64DN 51.5DW D) 70.5DN 22DW

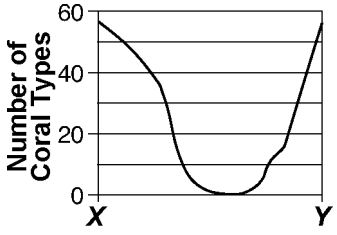
Questions 15 and 16 refer to the following:

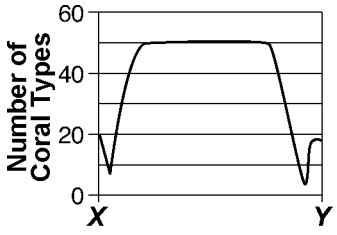
The map below shows coral reef distribution and diversity (number of different coral types) around the world. Isolines on the map represent the number of different types of coral. Coral reefs are found mostly in shallow tropical waters and do not grow when ocean temperatures fall below 18°C. The 18°C barrier ( ) represents the outer boundaries within which coral reefs normally grow. Points *X* and *Y* are locations on the map.

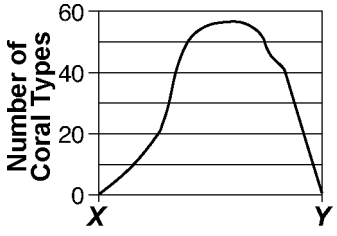


15) Which graph shows the number of coral types found along the 165° east longitude line between point *X* and point *Y* in the map shown?

A)


B)


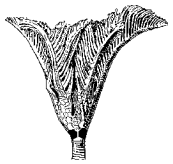
C)


D)


16) Which index fossil is an ancestor of the organisms whose distribution is shown on the map?

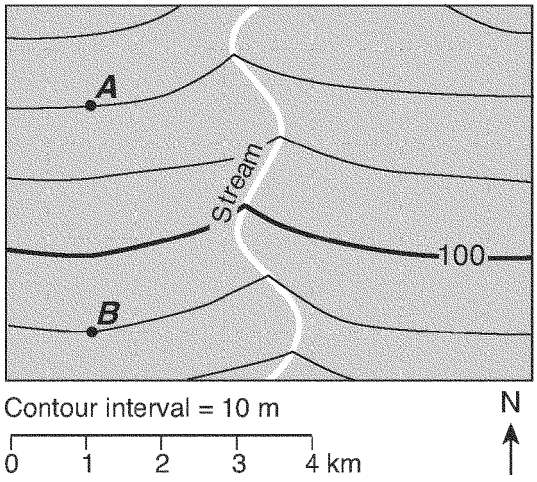
A)


C)


B)


D)

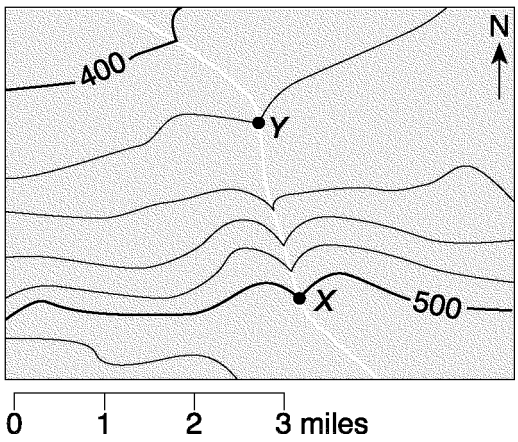

17) The topographic map below shows the location of a stream. Points *A* and *B* are locations on Earth's surface.



What is the gradient between points *A* and *B*?

A) 10 m/km
B) 20 m/km
C) 2 m/km
D) 1 m/km

18) The topographic map below shows a stream crossing several contour lines and passing through points *X* and *Y*. Elevations are measured in feet.

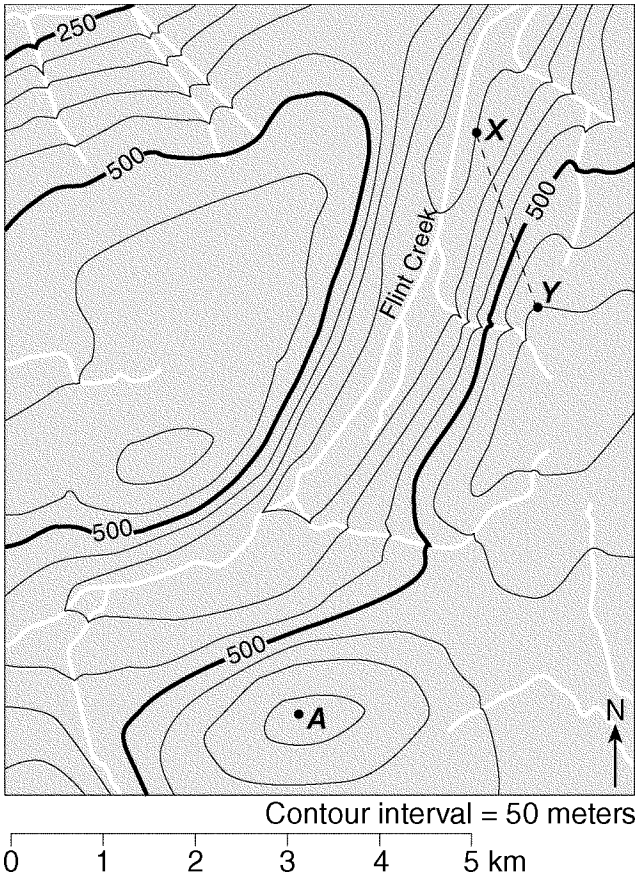


What is the approximate gradient between point *X* and point *Y*?

A) 80 ft/mi
B) 20 ft/mi
C) 10 ft/mi
D) 40 ft/mi

Questions 19 through 21 refer to the following:

Points *A*, *X*, and *Y* are reference points on the topographic map below.



19) What is the approximate gradient along the straight dashed line between points *X* and *Y* on the given map?

A) 50 m/km
B) 100 m/km
C) 150 m/km
D) 300 m/km

20) What is a possible elevation of point *A* on the given map?

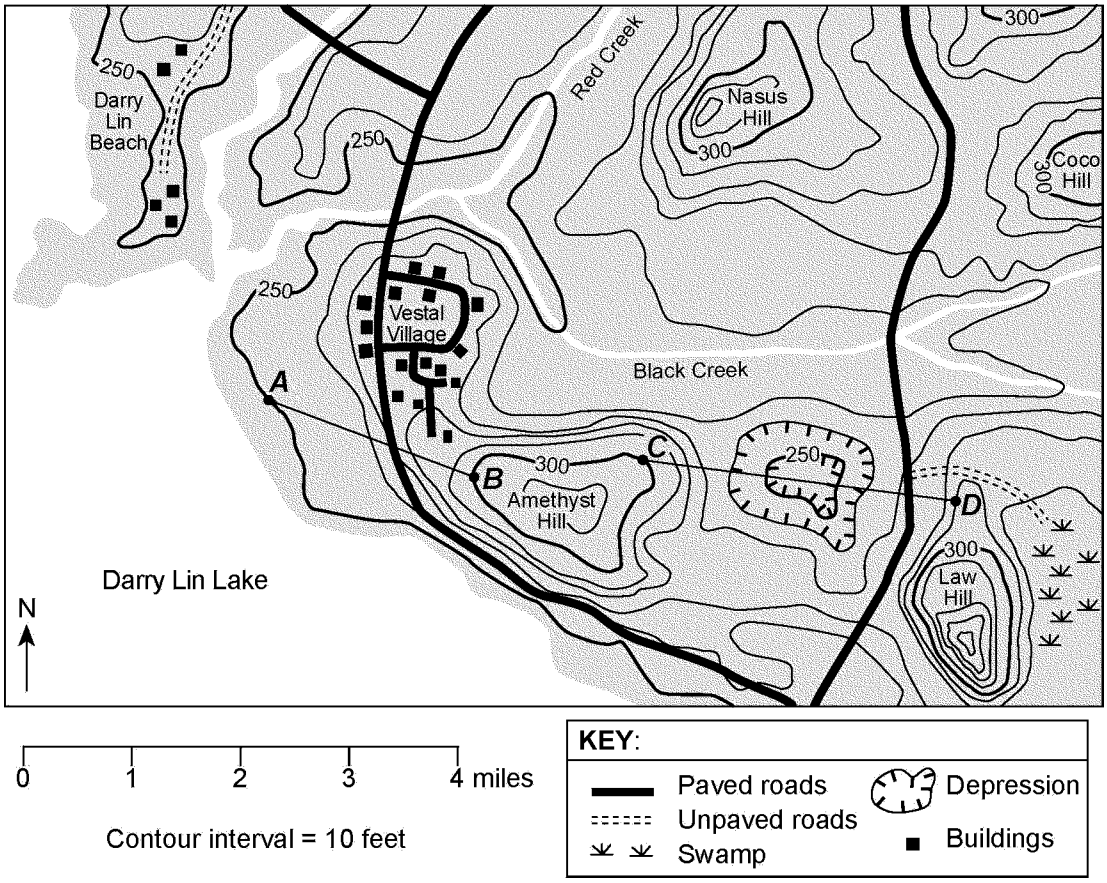
A) 575 meters
B) 655 meters
C) 600 meters
D) 710 meters

21) In which general direction does Flint Creek flow on the given map?

A) southwest
B) northeast
C) northwest
D) southeast

Questions 22 through 25 refer to the following:

Points *A*, *B*, *C*, and *D* represent locations on the surface of Earth. Elevations are measured in feet.



22) Based on the topographic map shown, in which general direction does Red Creek flow?

A) northeast
B) southwest
C) northwest
D) southeast

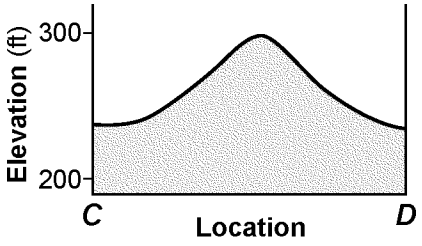
23) What is the approximate gradient from point *A* to point *B* on the given topographic map?

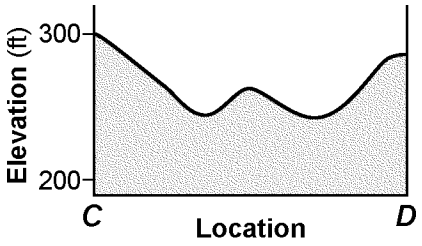
A) 100 feet per mile
B) 75 feet per mile
C) 50 feet per mile
D) 25 feet per mile

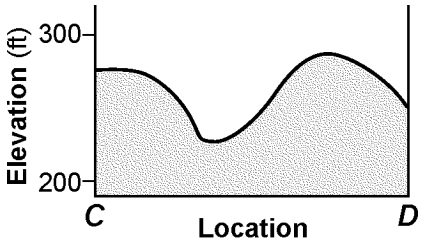
24) What is a possible elevation for the surface of Darry Lin Lake in the given topographic map?

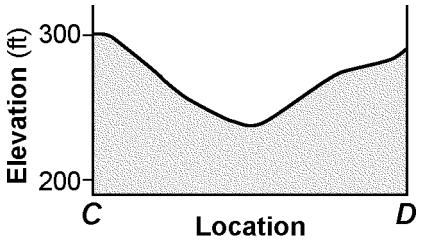
A) 228 feet
B) 255 feet
C) 242 feet
D) 268 feet

25) Which cross section represents an accurate profile of the landscape between points *C* and *D* on the given topographic map?

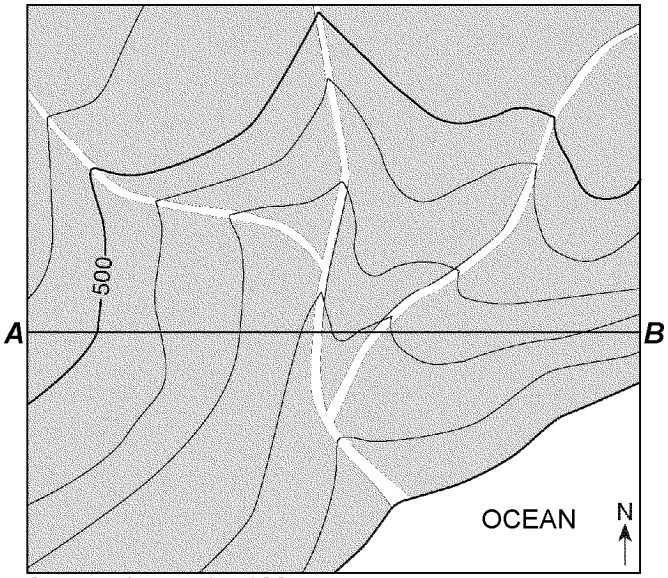
A)


B)


C)


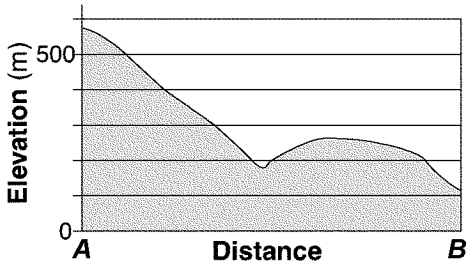
D)


26) The contour map below shows elevations recorded in meters. Line *AB* is a reference line on the map.

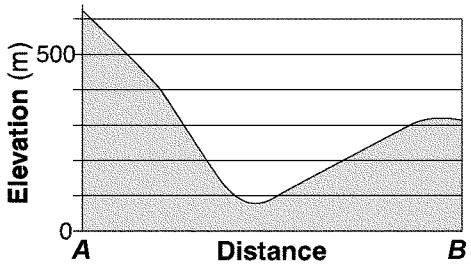


Which graph *best* represents the profile from point *A* to point *B*?

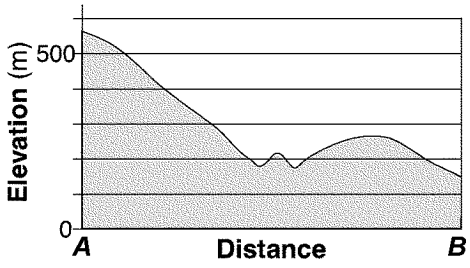
A)



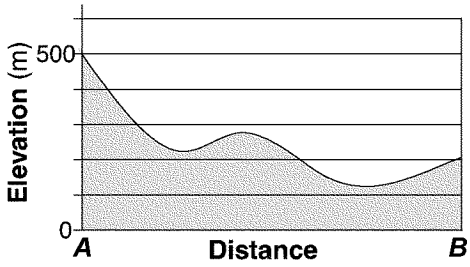
B)



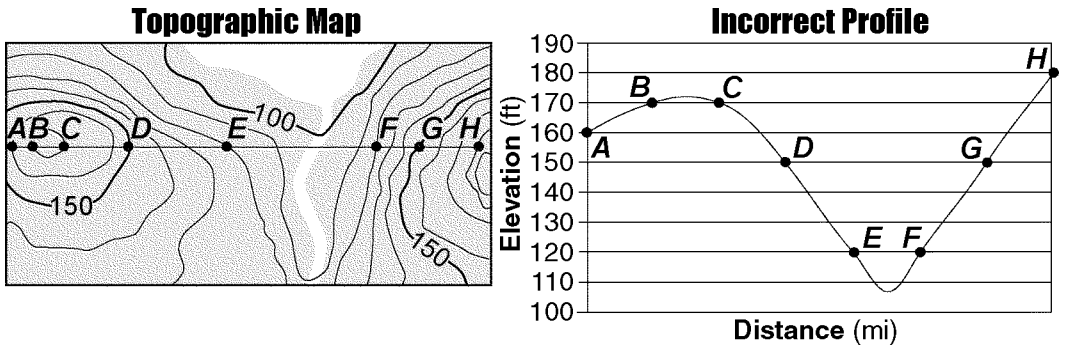
C)



D)



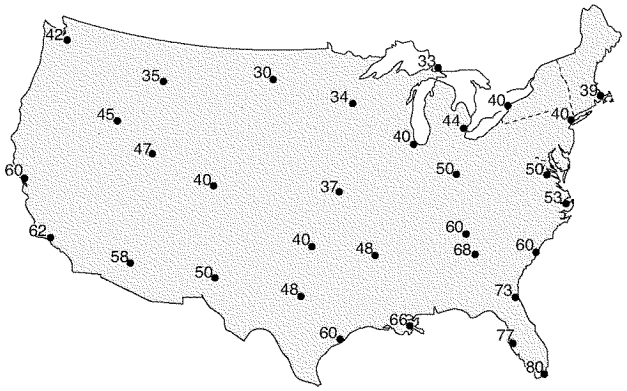
27) A topographic map and an incorrectly constructed profile from point *A* to point *H* on the map are shown below.



What mistake was made in the construction of this profile?

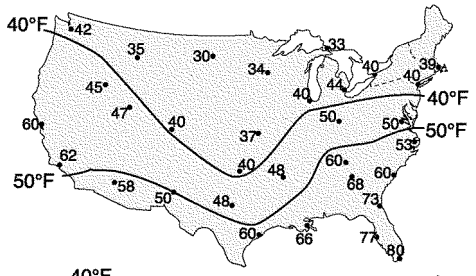
A) plotting points *A* through *H* the same distance apart horizontally
B) drawing a curved line instead of a straight line from point *B* to point *C*
C) using a contour interval of 10 feet
D) increasing the elevation from point *F* to point *H*

28) The weather map below shows the air temperatures recorded at the same time at cities across the United States.

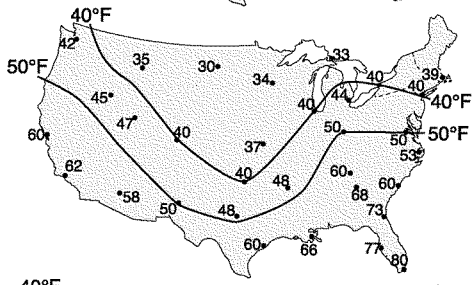


Which map correctly shows the locations of the 40DF and 50DF isotherms?

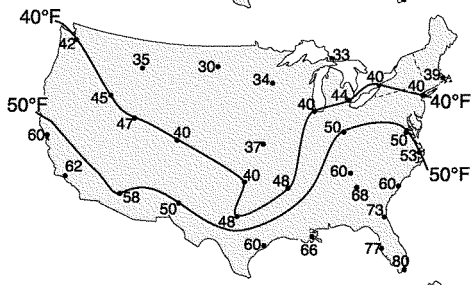
A)



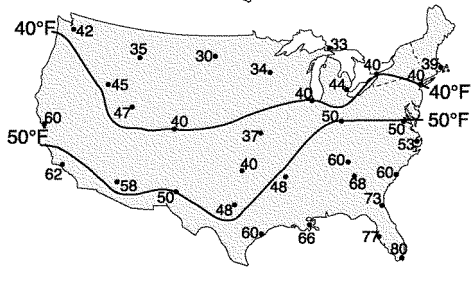
B)



C)



D)



29) Most of Earth's weather events take place in the

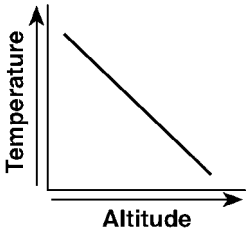
A) stratosphere
B) troposphere
C) mesosphere
D) thermosphere

30) Scientists infer that *most* of Earth's earliest atmosphere was produced by

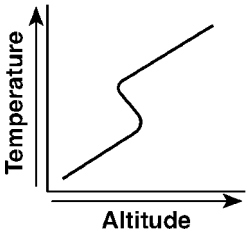
A) the escape of gases from Earth's molten surface
B) vaporizing comets that impacted Earth's surface
C) capturing gases from a nearby planet
D) a collision with a giant gas cloud

31) Which graph *best* shows the general relationship between altitude and temperature in the troposphere?

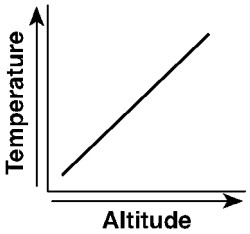
A)



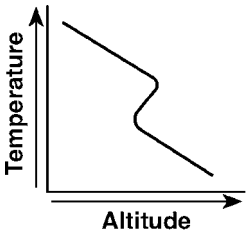
B)



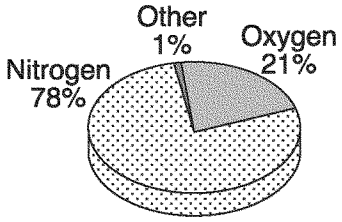
C)

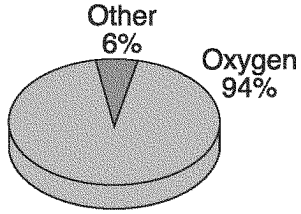


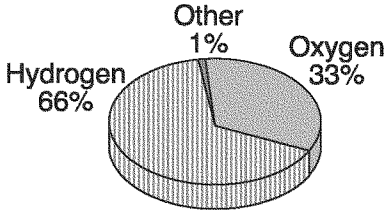
D)

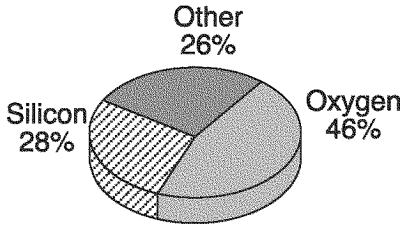


32) Which pie graph correctly shows the percentage of elements by volume in Earth's troposphere?

A)


B)


C)


D)


33) What is the approximate percent of oxygen by volume present in Earth's lower atmosphere?

A) 46%
B) 21%
C) 33%
D) 94%

34) Which atmospheric temperature zone is located between 8 and 32 miles above Earth's surface and contains an abundance of ozone?

A) stratosphere
B) mesosphere
C) thermosphere
D) troposphere

35) At what approximate altitude in the atmosphere can stratospheric ozone be found?

A) 70 km
B) 30 km
C) 100 km
D) 10 km

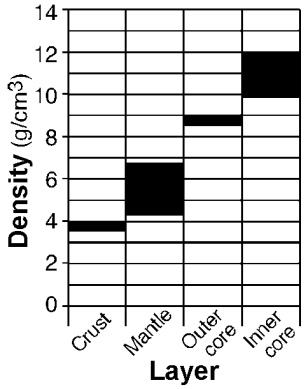
36) Compared to the oceanic crust, the continental crust is

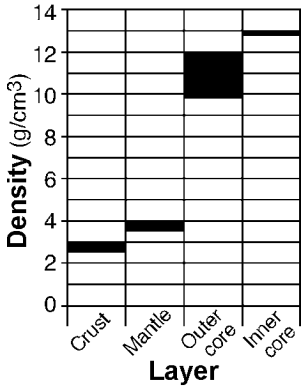
A) less dense and more felsic
B) less dense and more basaltic
C) more dense and more granitic
D) more dense and more mafic

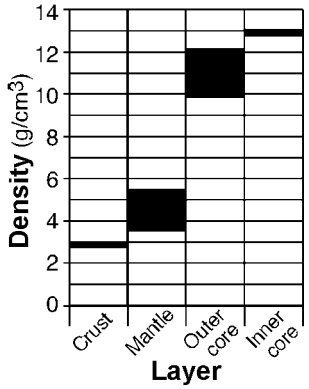
37) Which element, found in *both* biotite mica and muscovite mica, makes up the *greatest* percent by volume of Earth's crust?

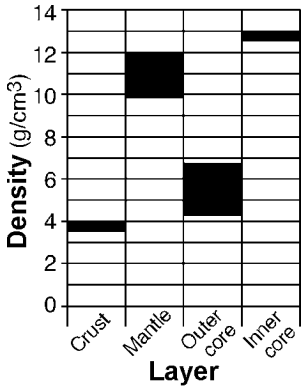
A) nitrogen
B) silicon
C) oxygen
D) potassium

38) Which graph *best* shows the range of density in each of Earth's layers?

A)


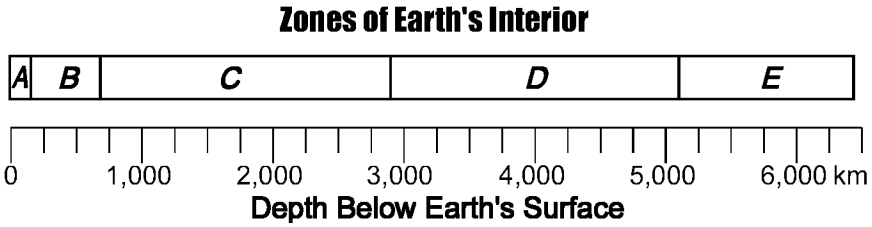
B)


C)


D)


Questions 39 through 43 refer to the following:

The diagram below represents zones of Earth's interior, identified by letters *A* through *E*. The scale shows depths below Earth's surface, measured in kilometers.



39) In what zone of the given diagram is the Moho boundary located?

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

40) What is the approximate thickness of zone *C* in the diagram shown?

A) 2,900 km
B) 650 km
C) 1,600 km
D) 2,250 km

41) Which zone in the given diagram is characterized by partially melted rock and large-scale convection currents?

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

42) Which zone of Earth's interior has a density *closest* to the densities of the other terrestrial planets?

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

43) *S*-waves produced by an earthquake are transmitted through zones

A) *D* and *E*, but not zones *A*, *B*, and *C*
B) *C*, *D*, and *E*, but not zones *A* and *B*
C) *A* and *B*, but not zones *C*, *D*, and *E*
D) *A*, *B*, and *C*, but not zones *D* and *E*

44) The inferred temperature at the interface between the stiffer mantle and the asthenosphere is *closest* to

A) 4,500DC
B) 1,000DC
C) 2,500DC
D) 5,000DC

45) What is the inferred pressure, in millions of atmospheres, in Earth's interior at a depth of 2,900 kilometers?

A) 4,900
B) 9.9
C) 3.0
D) 1.4

46) In which Earth layer does the pressure reach 3.5 million atmospheres?

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

47) Scientists infer that the universe began approximately

A) 13.7 billion years ago
B) 8.2 billion years ago
C) 3.3 billion years ago
D) 1.0 billion years ago

48) Which of the following evidence *best* supports the Big Bang theory?

A) rate of rotation of the Sun
B) existence of cosmic background radiation
C) uniform radioactive decay of uranium-238
D) separation of Earth's interior into different layers

49) Cosmic background radiation provides direct evidence for the origin of

A) Earth's ozone layer
B) the universe
C) our solar system
D) Earth's earliest atmosphere

50) Which information *best* supports the inference that the universe began with an explosion?

A) measurements of cosmic background radiation
B) calculations of the temperature and luminosity of stars
C) calculations of the distance from the Sun to each asteroid in the asteroid belt
D) measurements of rates of decay using carbon-14

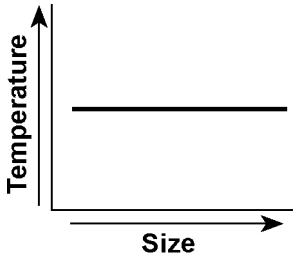
51) Cosmic microwave background radiation is classified as a form of electromagnetic energy because it

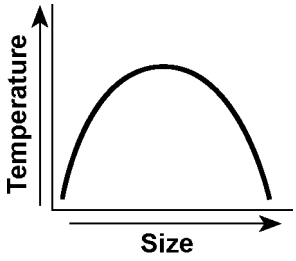
A) travels in waves through space
B) moves due to particle collisions
C) is visible to humans
D) moves faster than the speed of light

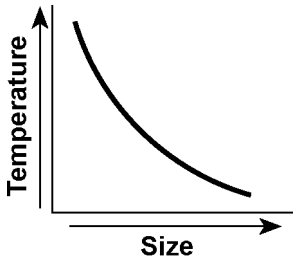
Questions 52 through 54 refer to the following:

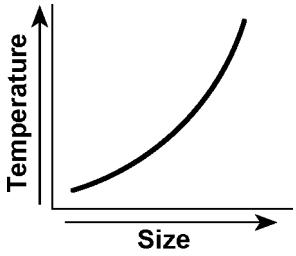
COSMIC MICROWAVE BACKGROUND RADIATION:
In the 1920s, Edwin Hubble's discovery of a pattern in the red shift of light from galaxies moving away from Earth led to the theory of an expanding universe. This expansion implies that the universe was smaller, denser, and hotter in the past. In the 1940s, scientists predicted that heat (identified as cosmic microwave background radiation) left over from the Big Bang would fill the universe. In the 1960s, satellite probes found that cosmic microwave background radiation fills the universe uniformly in every direction, and indicated a temperature of about 3 kelvins (K). This radiation has been cooling as the universe has been expanding.

52) Which graph best shows the relationship of the size of the universe to the temperature indicated by the cosmic microwave background radiation?

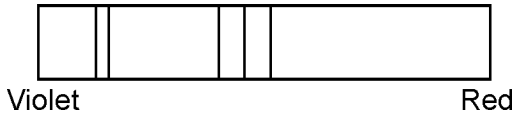
A)


B)


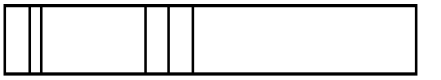
C)


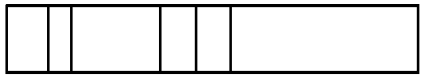
D)


53) The diagram below represents the spectral lines from the light of an element in a laboratory on Earth.

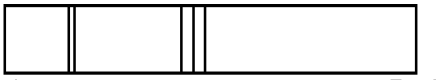


Which diagram below best represents the pattern of spectral lines from the same element when it was observed by Edwin Hubble in the light of one of the distant galaxies?

A)


B)


C)


D)


54) The current temperature indicated by the cosmic microwave background radiation is

A) lower than the temperature at which water freezes
B) between room temperature and the temperature at which water freezes
C) between the temperature at which water boils and room temperature
D) higher than the temperature at which water boils

55) The theory that the universe is expanding is supported by the

A) blue shift of light from distant galaxies
B) nuclear fusion occurring in the Sun
C) red shift of light from distant galaxies
D) radioactive decay occurring in the Sun

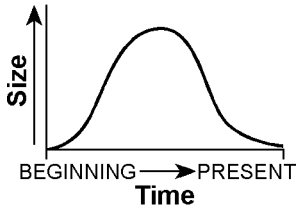
56) The red shift of light from *most* galaxies is evidence that

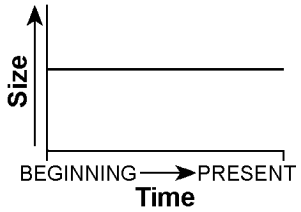
A) red light travels faster than other colors of light
B) a majority of stars in most galaxies are red giants
C) most galaxies are moving away from Earth
D) the light slows down as it nears Earth

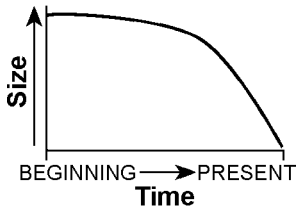
57) A blue shift of the light from a star indicates that the star

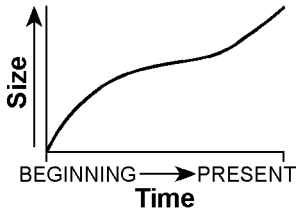
A) is moving closer to Earth
B) will soon become a giant star
C) will soon become a main sequence star
D) is moving away from Earth

58) According to the Big Bang theory, which graph *best* represents the relationship between time and the size of the universe from the beginning of the universe to the present?

A) 

B) 

C) 

D) 

59) The symbols below represent star masses and distances.

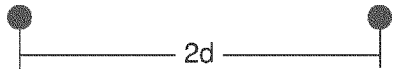
● represents a star with a mass the same as the Sun's mass

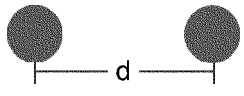
● represents a star with a mass greater than the Sun's mass

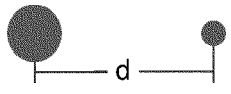
d represents a certain distance between star centers

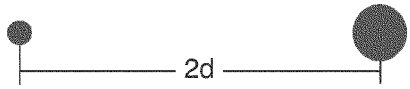
2d represents twice the distance between star centers

Which diagram shows two stars that have the *greatest* gravitational force between them?

A) 

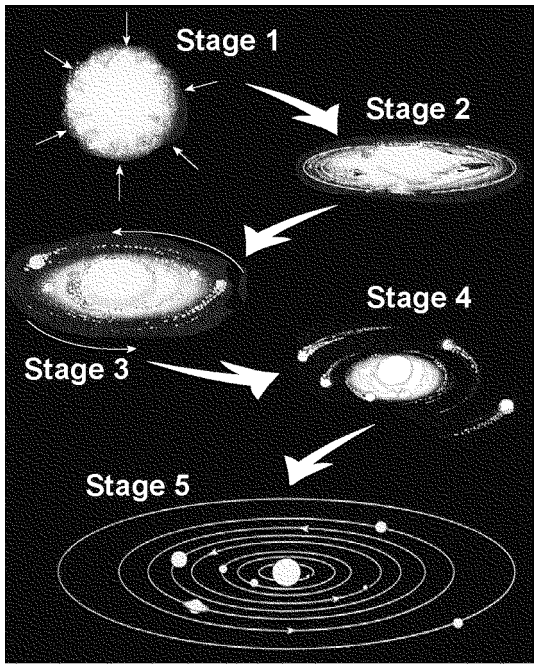
B) 

C) 

D) 

Questions 60 through 63 refer to the following:

The diagram below represents the inferred stages in the formation of our solar system. Stage 1 shows a contracting gas cloud. The remaining stages show the gas cloud flattening into a spinning disk as planets formed around our Sun.



(not drawn to scale)

60) Which force was mostly responsible for the contraction of the gas cloud shown?

A) gravity
B) magnetism
C) inertia
D) friction

61) Which process was occurring during some of the given stages that resulted in the formation of *heavier* elements from *lighter* elements?

A) radiation
B) radioactive decay
C) nuclear fusion
D) conduction

62) Approximately how long ago did stage 4 on the given diagram end and stage 5 begin?

A) 20 billion years
B) 100 billion years
C) 1 billion years
D) 5 billion years

63) Compared to the terrestrial planets, the Jovian planets in stage 5 on the given diagram have

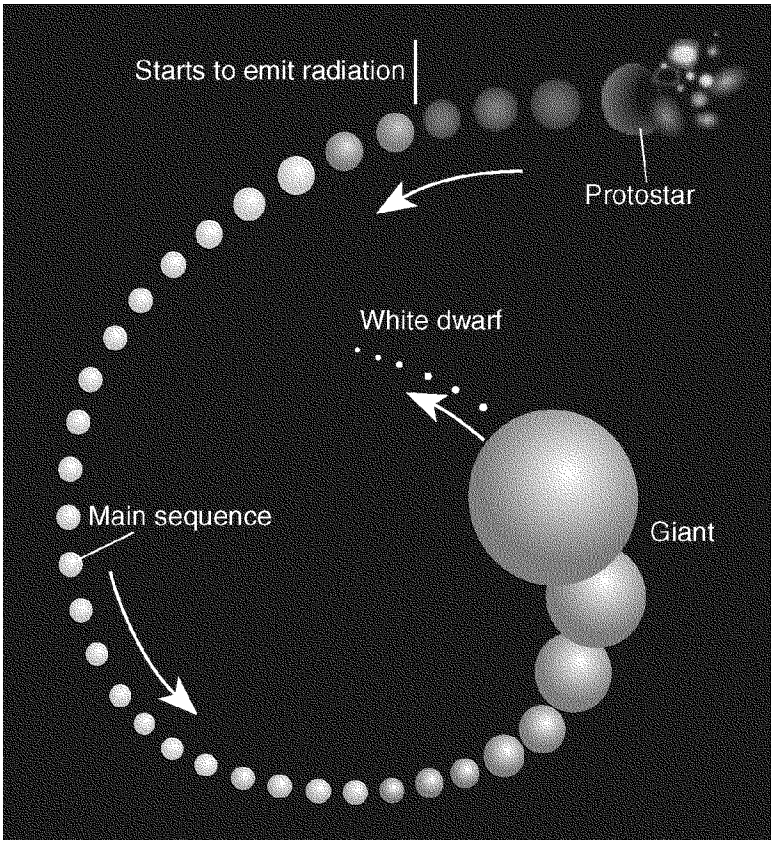
A) larger diameters
B) higher densities
C) longer periods of rotation
D) shorter periods of revolution

64) Compared to the luminosity and surface temperature of red main sequence stars, blue supergiants are

A) more luminous and have a higher surface temperature
B) more luminous and have a lower surface temperature
C) less luminous and have a lower surface temperature
D) less luminous and have a higher surface temperature

Questions 65 and 66 refer to the following:

The diagram below shows the change in the size of a star such as our Sun as it evolves from a protostar to a white dwarf star.



65) During which stage of development does the given star have a cool surface temperature and the *greatest* luminosity?

A) white dwarf
B) main sequence
C) giant
D) protostar

66) Which process produces the energy radiated by the given star when it becomes a main sequence star?

A) radioactive decay
B) conduction
C) convection
D) nuclear fusion

67) Energy is produced within a star's core by the process of

A) conduction
B) nuclear fusion
C) radioactive decay
D) insolation

68) Great amounts of energy are released in the core of a star as lighter elements combine and form heavier elements during the process of

A) nuclear fusion
B) condensation
C) radioactive decay
D) compaction

69) To an observer on Earth, the Sun appears brighter than the star *Rigel* because the Sun is

A) hotter than *Rigel*
B) closer than *Rigel*
C) larger than *Rigel*
D) more luminous than *Rigel*

70) Which star is cooler and *less* luminous than the Sun?

A) *Rigel*
B) *Proxima Centauri*
C) *40 Eridani B*
D) *Pollux*

71) Which one of the following stars has a surface temperature *most* similar to the surface temperature of *Alpha Centauri*?

A) *Betelgeuse*
B) *Procyon B*
C) *Polaris*
D) *Sirius*

72) Which sequence of stars is listed in order of increasing luminosity?

A) *Barnard's Star*, *Alpha Centauri*, *Rigel*, *Spica*
B) *Spica*, *Rigel*, *Deneb*, *Betelgeuse*
C) *Procyon B*, *Sun*, *Sirius*, *Betelgeuse*
D) *Polaris*, *Deneb*, *40 Eridani B*, *Proxima Centauri*

73) The Sun revolves around the center of

A) *Aldebaran*
B) Earth
C) *Polaris*
D) the Milky Way Galaxy

74) Which process combines lighter elements into heavier elements and produces energy within the Sun and other stars?

A) insolation
B) radioactive decay
C) conduction
D) fusion

75) Which event occurred approximately 4.6 billion years ago?

A) evolution of stromatolites
B) formation of Earth and our solar system
C) formation of the oldest known Earth rocks
D) evolution of the earliest fish

76) Why do the planets in our solar system have a layered internal structure?

A) Cosmic dust settled in layers on the planets' surfaces.
B) The Sun exerts a gravitational force on the planets.
C) All planets cooled rapidly after they formed.
D) Each planet is composed of materials of different densities.

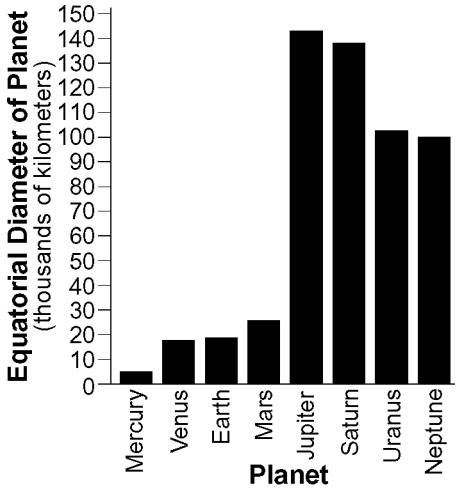
77) The terrestrial planets differ from the Jovian planets because the terrestrial planets are

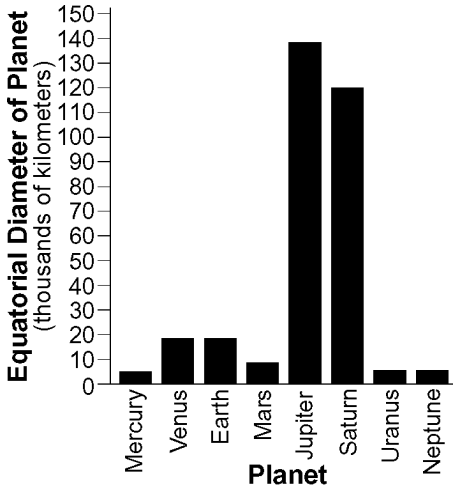
A) less dense and larger
B) more dense and smaller
C) less dense and smaller
D) more dense and larger

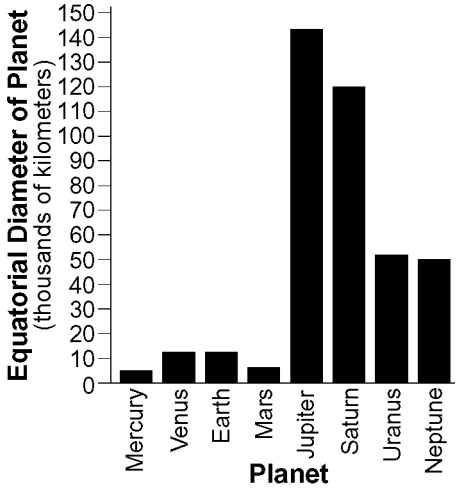
78) Which two characteristics do all Jovian planets have in common?

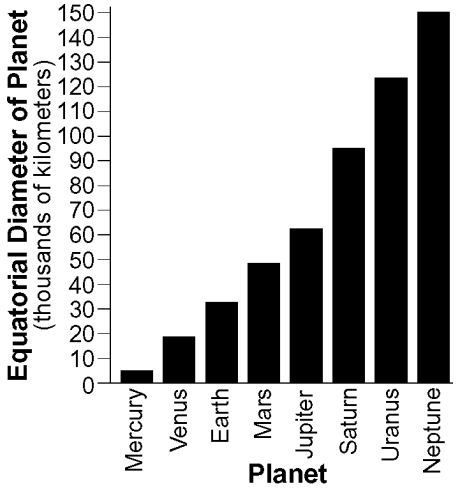
A) small diameters and high densities
B) large diameters and high densities
C) small diameters and low densities
D) large diameters and low densities

79) Which bar graph *best* represents the equatorial diameters of the eight planets of our solar system?

A)


C)


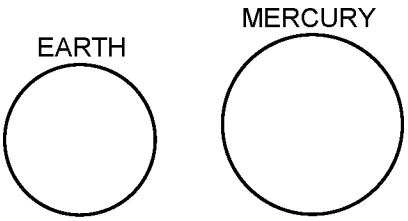
B)


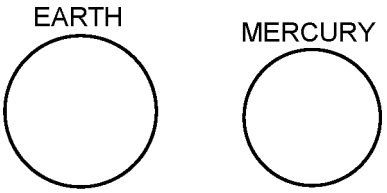
D)


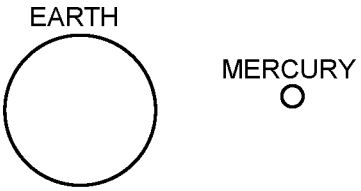
80) Why is the surface of Mercury covered with meteor impact craters, while Earth's surface has relatively few craters?

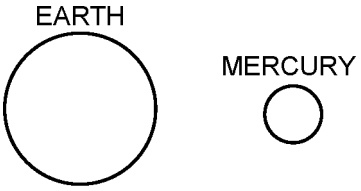
A) Mercury is larger than Earth, so it gets hit with more meteors.
B) Earth's hydrosphere and atmosphere destroyed or buried most meteor impact sites.
C) Earth's less dense water surface attracts fewer meteors.
D) Mercury is an older planet, so it has a longer history of meteor impacts.

81) Which diagram most accurately represents the relative diameters of Earth and Mercury?

A)


B)


C)


D)


82) Ocean tides observed at coastal locations each day are primarily caused by

A) Earth's revolution around the Sun
B) the gravitational attraction between the Moon and Earth
C) the changing phases of the Moon
D) seasonal changes in the compass location of sunrise

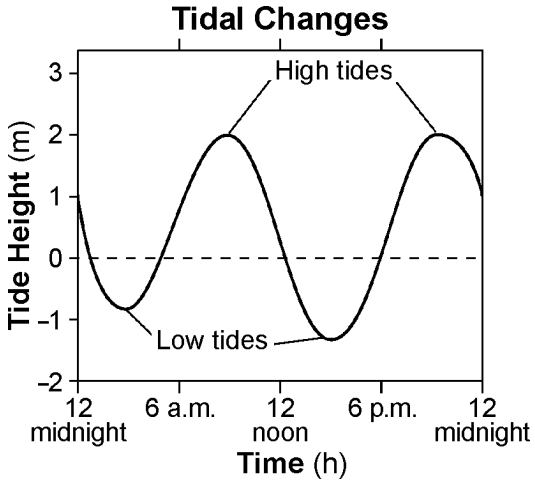
83) Why does the Moon's gravity have a *greater* effect on Earth's ocean tides than the Sun's gravity?

A) The Moon has a greater mass.
B) The Moon is much closer to Earth.
C) The Sun's gravity influences more planets.
D) The Sun is composed mostly of gases.

84) A high tide occurred at 6:00 a.m. at a beach on Long Island. The next high tide at this same beach would occur at approximately

A) 7:00 a.m. on the following day
B) 6:30 p.m. on the same day
C) 12:15 p.m. on the same day
D) 12:45 p.m. on the following day

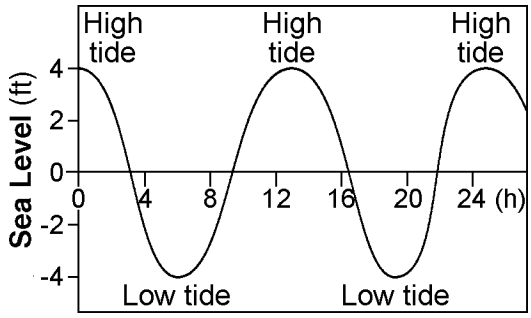
85) The graph below shows the tidal changes in ocean water level, in meters, recorded at a coastal location on a certain day.



Approximately how many hours apart were the two high tides?

A) 24 h
B) 6 h
C) 12 h
D) 18 h

86) A graph of tidal sea-level changes at a coastal city is shown below.

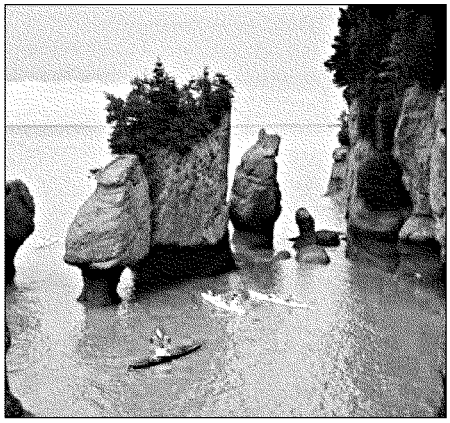


The number of hours from one high tide to the next high tide is approximately

A) 12 h
B) 8 h
C) 24 h
D) 4 h

87) The photographs below show the same coastal location at two different times during the same day.

People on Beach
12:40 p.m.



People Boating
6:52 p.m.

SOURCE: thehopewellrocks.ca (adapted)

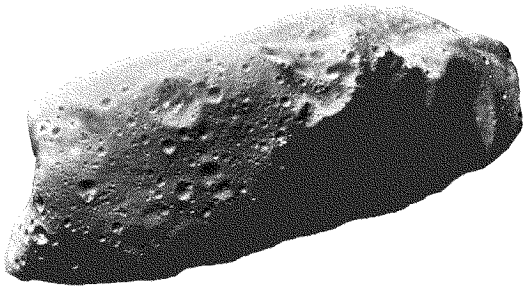
Which statement *best* explains the cause for the higher water level at 6:52 p.m.?

A) Earth's tilted axis causes different amounts of insolation throughout the day.
B) Earth's rotation causes a deflection of surface ocean currents.
C) The Moon rotates on its axis at the same rate that it revolves around Earth.
D) The Moon exerts a gravitational pull on a rotating Earth.

88) Many meteors are believed to be fragments of celestial objects normally found between the orbits of Mars and Jupiter. These objects are classified as

A) moons
B) planets
C) stars
D) asteroids

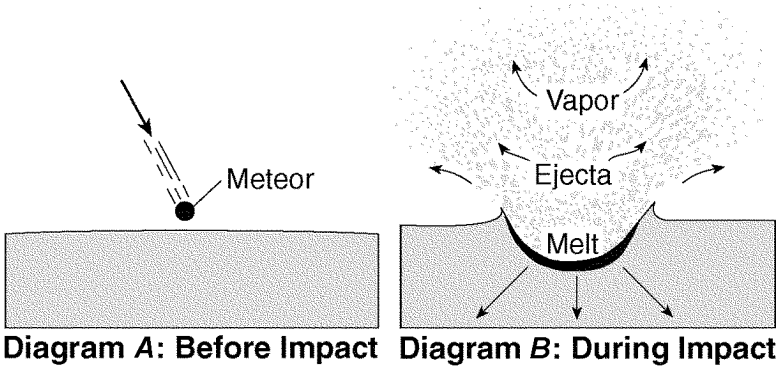
89) The solar system object in the photograph below is 56 kilometers long.



The object in the photograph is most likely

A) Neptune
B) Mercury
C) Earth's Moon
D) an asteroid

90) The diagrams below represent the events that occur when a large meteor, such as the one believed to have caused the extinction of many organisms, impacts Earth's surface. Diagram *A* shows the meteor just before impact. Diagram *B* represents the crater forming, along with the vapor and ejecta (the fragmented rock and dust) thrown into the atmosphere.



Which statement *best* explains how global climate would most likely be affected after the large meteor impact shown in the diagram?

A) Forest fires produced from the vapor and ejecta would raise global temperatures.
B) Large quantities of ejecta in the atmosphere would block insolation and lower global temperatures.
C) An increase in vapor and ejecta would allow radiation to escape Earth's atmosphere and lower global temperatures.
D) Ejecta settling in thick layers would increase the absorption of insolation by Earth's surface and raise global temperatures.

91) The modern heliocentric model of planetary motion states that the planets travel around

A) Earth in circular orbits
B) the Sun in circular orbits
C) the Sun in slightly elliptical orbits
D) Earth in slightly elliptical orbits

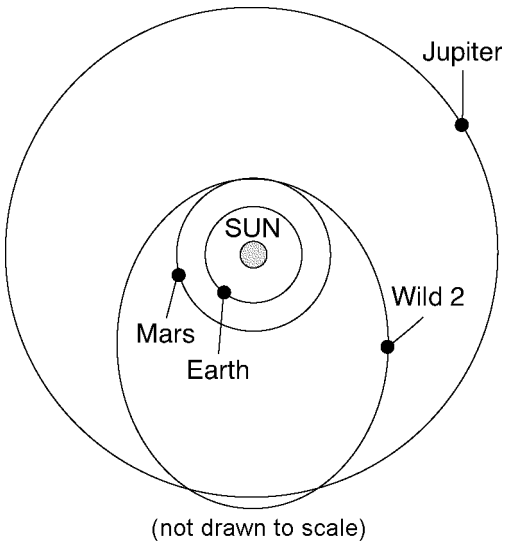
92) As Earth travels in its orbit, Earth's axis

A) remains parallel to itself at all Earth positions
B) is perpendicular to the Moon's axis
C) is pointing toward the center of the Milky Way
D) remains aligned with the Sun's axis

93) Compared to Jovian planets, terrestrial planets have

A) shorter periods of rotation
B) larger masses
C) larger equatorial diameters
D) shorter periods of revolution

94) The diagram below shows the orbital paths of Earth, Mars, Jupiter, and a comet named Wild 2.



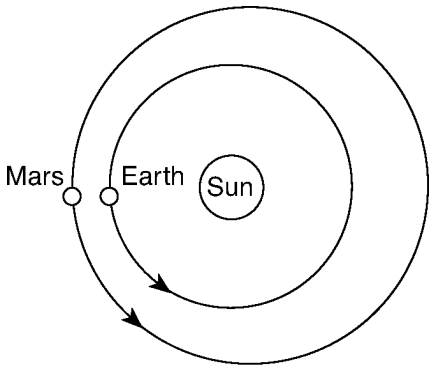
What is the approximate distance between the Sun and Wild 2 when this comet is *closest* to the Sun?

A) 228 million kilometers
B) 820 million kilometers
C) 150 million kilometers
D) 778 million kilometers

95) During which Northern Hemisphere season is Earth *closest* to the Sun?

A) summer
B) winter
C) autumn
D) spring

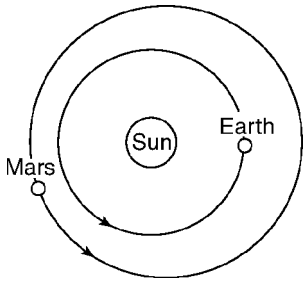
96) The diagram below shows the relative positions of Earth and Mars in their orbits on a particular date during the winter of 2007.



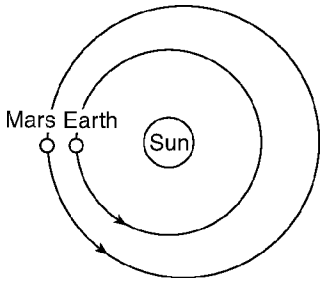
(not drawn to scale)

Which diagram correctly shows the locations of Earth and Mars on the same date during the winter of 2008?

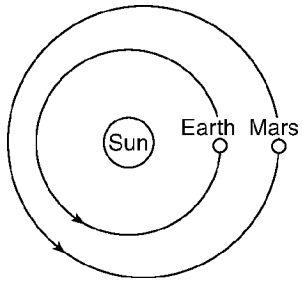
A)



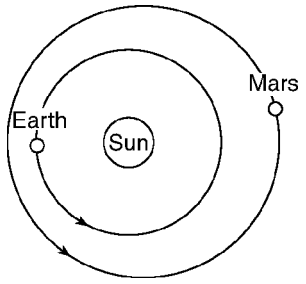
C)



B)

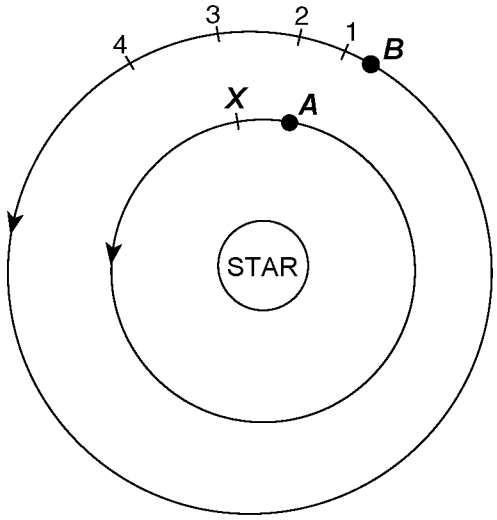


D)



Questions 97 and 98 refer to the following:

The diagram below represents the current locations of two planets, *A* and *B*, orbiting a star. Letter *X* indicates a position in the orbit of planet *A*. Numbers 1 through 4 indicate positions in the orbit of planet *B*.



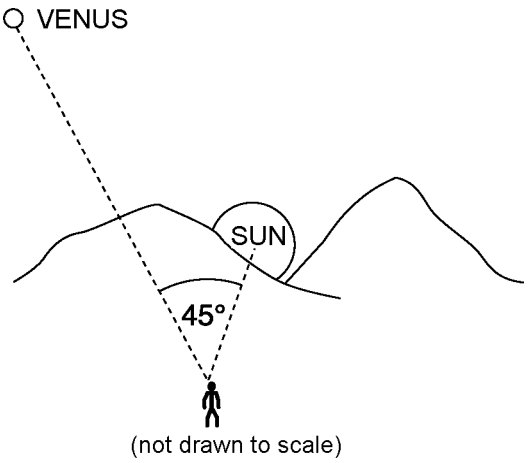
97) As planet *A* moves in orbit from its current location on the given map to position *X*, planet *B* most likely moves in orbit from its current location to position

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

98) If the given diagram represents our solar system and planet *B* is Venus, which planet is represented by planet *A*?

A) Mars
B) Mercury
C) Jupiter
D) Earth

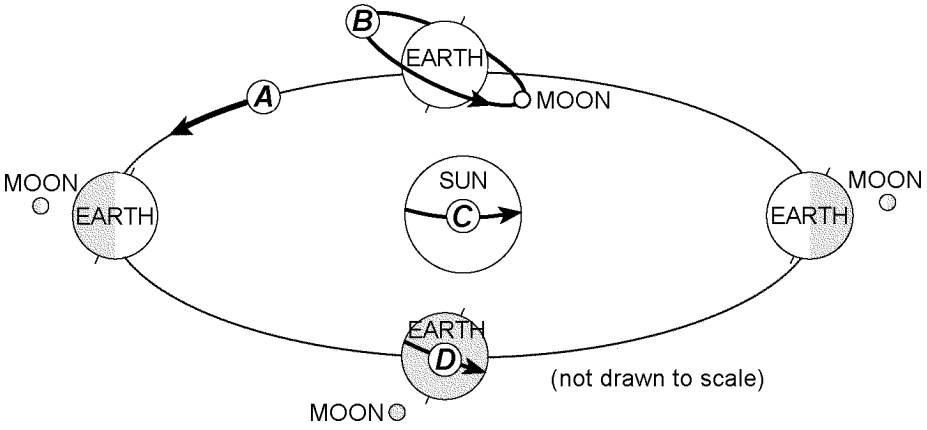
99) An observer on Earth measures the angle of sight between Venus and the setting Sun.



Which one of the following statements *best* describes and explains the apparent motion of Venus over the next few hours?

A) Venus will set 1 hour after the Sun because Earth rotates at 45D per hour.
B) Venus will set 4 hours after the Sun because Venus orbits Earth slower than the Sun orbits Earth.
C) Venus will set 3 hours after the Sun because Earth rotates at 15D per hour.
D) Venus will set 2 hours after the Sun because Venus orbits Earth faster than the Sun orbits Earth.

100) The diagram below shows Earth and the Moon in four locations during their orbits. Arrows *A* through *D* represent different motions of Earth, the Moon, and the Sun.



Which arrow represents a rate of movement of approximately 1D per day?

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

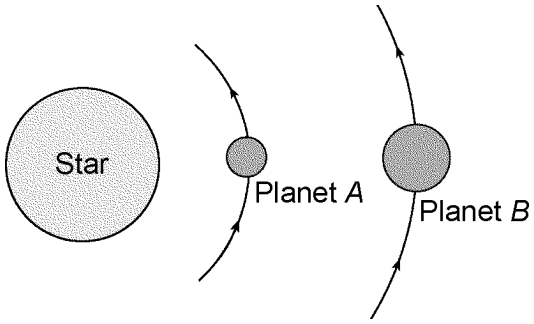
101) If Earth's rate of rotation increases, the length of one Earth day will be

A) shorter than 24 hours
B) longer than 24 hours
C) 24 hours, with a shorter nighttime period
D) 24 hours, with a longer nighttime period

102) Which planet's day (period of rotation) is *longer* than its year (period of revolution)?

A) Venus
B) Mercury
C) Saturn
D) Jupiter

103) The diagram below represents planets *A* and *B*, of equal mass, revolving around a star.



Compared to planet *A*, planet *B* has a

A) weaker gravitational attraction to the star and a shorter period of revolution
B) stronger gravitational attraction to the star and a longer period of revolution
C) stronger gravitational attraction to the star and a shorter period of revolution
D) weaker gravitational attraction to the star and a longer period of revolution

104) What is the eccentricity of the Moon's orbit?

A) 0.055
B) 0.723
C) 0.017
D) 0.386

105) Evidence that Earth revolves around the Sun is provided by the

A) seasonal changes in the apparent positions of constellations
B) apparent rising and setting of the Sun during one day
C) apparent rising and setting of *Polaris* during one day
D) hourly changes in the apparent direction of the swing of a Foucault pendulum

106) How many degrees does the Sun appear to move across the sky in four hours?

A) 60D
B) 4D
C) 45D
D) 15D

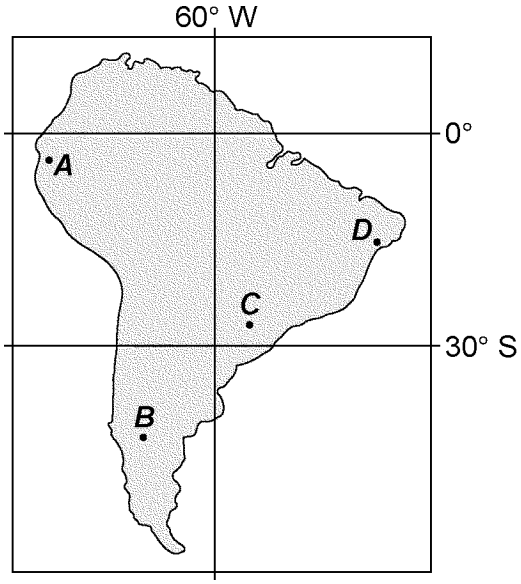
107) During which month does the Sun appear to rise *farthest* north of due east for an observer in New York State?

A) July
B) January
C) December
D) June

108) On which day of the year does the Sun reach the *greatest* altitude at solar noon in New York City?

A) September 21
B) June 21
C) August 21
D) July 21

109) The map below shows four locations, *A*, *B*, *C*, and *D*, on the continent of South America.

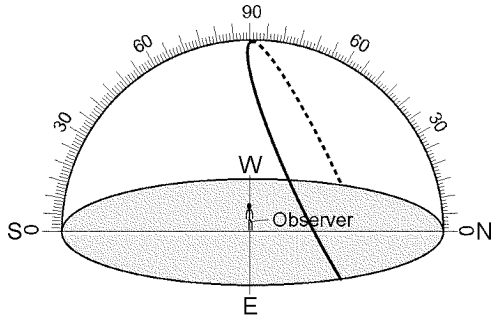


Which location is the first to experience sunset on September 23?

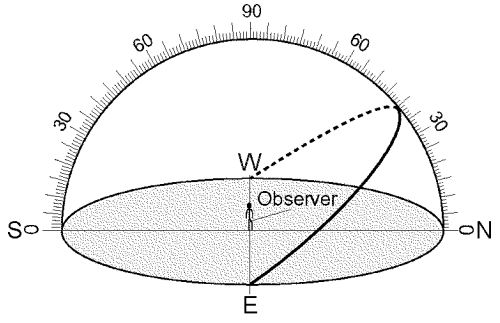
A) *A*
B) *B*
C) *C*
D) *D*

110) Which diagram represents the apparent path of the Sun on March 21 for an observer at the equator?

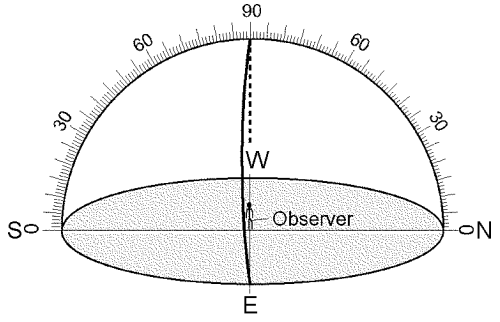
A)



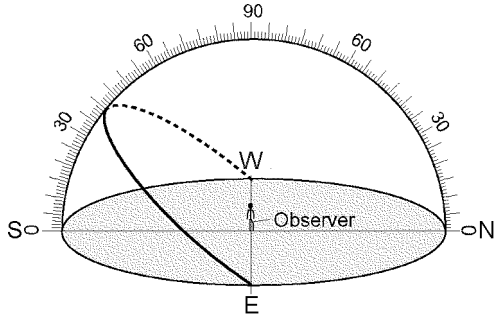
B)



C)

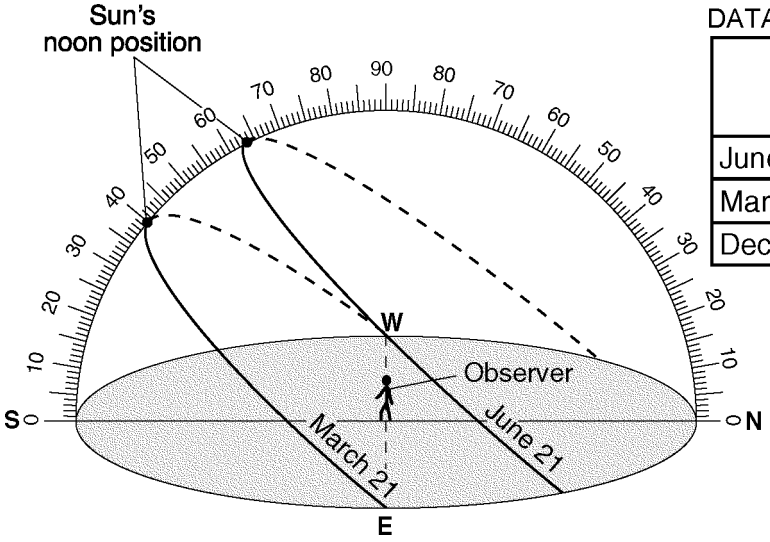


D)



Questions 111 through 114 refer to the following:

The diagram below represents the Sun's apparent paths as viewed by an observer located at 50DN latitude on June 21 and March 21. The data table shows the Sun's maximum altitude for the same two dates of the year. The Sun's maximum altitude for December 21 has been left blank.



DATA TABLE

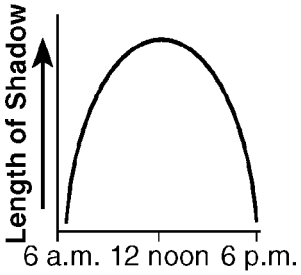
Date	Sun's Maximum Altitude
June 21	63.5°
March 21	40°
December 21	

111) Which value should be placed in the given data table for the Sun's maximum altitude on December 21?

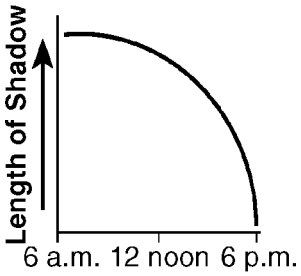
A) 90D
B) 40D
C) 23.5D
D) 16.5D

112) Which graph *best* represents the relationship between the time of day and the length of a shadow cast by the observer on March 21?

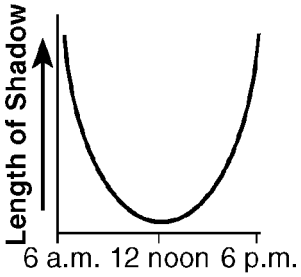
A)



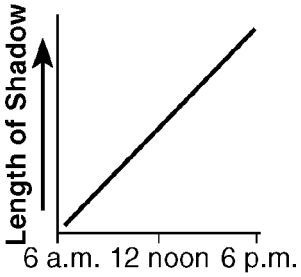
B)



C)

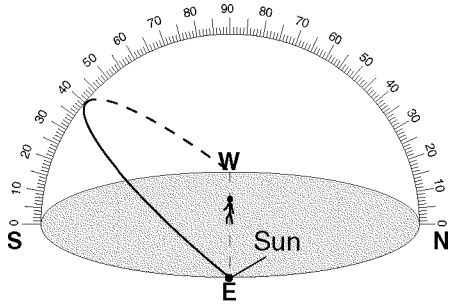


D)

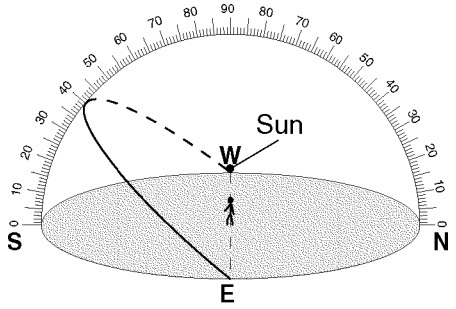


113) Which diagram represents the approximate location of the Sun at 3 p.m. on March 21?

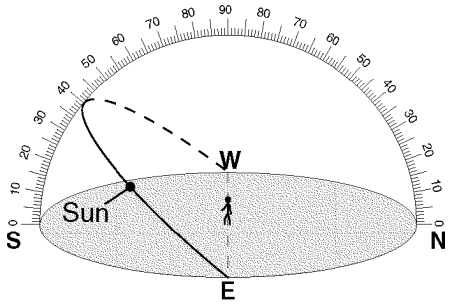
A)



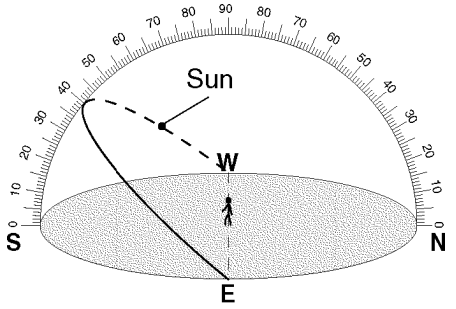
B)



C)



D)



114) Which statement *best* compares the intensity and angle of insolation at noon on March 21 and June 21?

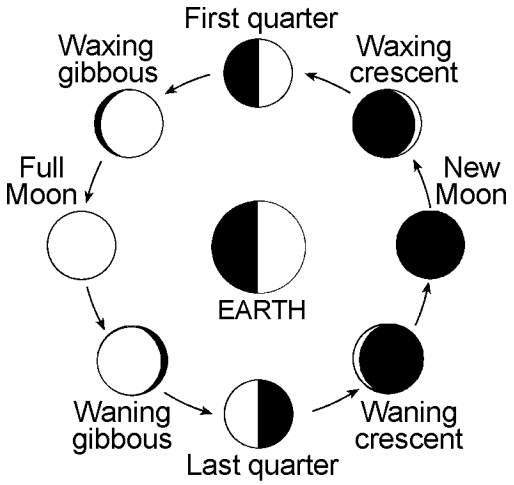
A) The intensity and angle of insolation are greatest on June 21.
B) The intensity of insolation is greatest on March 21 and the angle of insolation is greatest on June 21.
C) The intensity of insolation is greatest on June 21 and the angle of insolation is greatest on March 21.
D) The intensity and angle of insolation are greatest on March 21.

115) Which one of the following statements *best* explains why the same side of the Moon is viewed from Earth as the Moon goes through its phases?

A) The Moon's period of rotation equals Earth's period of rotation.
B) The Moon does not rotate as it revolves around Earth.
C) The Moon's period of rotation equals Earth's period of revolution around the Sun.
D) The Moon's period of rotation equals the Moon's period of revolution around Earth.

Questions 116 and 117 refer to the following:

The diagram below shows positions of the Moon in its orbit and phases of the Moon as viewed from New York State.



(not drawn to scale)

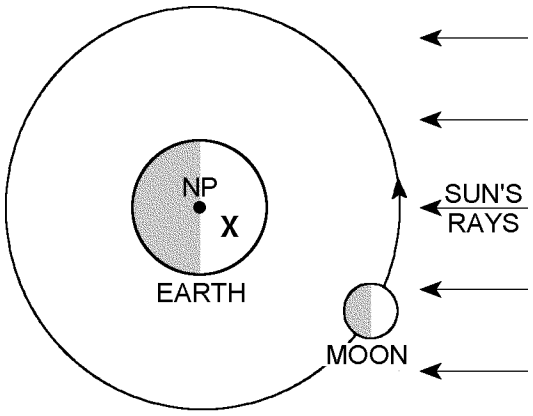
116) Approximately how many days occur between the Moon's first-quarter phase and the Moon's last-quarter phase?

A) 365.26 d
B) 29.5 d
C) 7 d
D) 15 d

117) During which Moon phase might a solar eclipse be viewed on Earth?

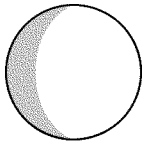
A) new Moon
B) full Moon
C) last quarter
D) first quarter

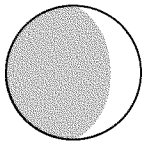
118) The diagram below shows the Moon at one position in its orbit around Earth. Letter *X* indicates the location of an observer in New York State.

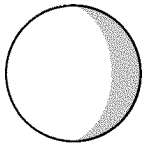


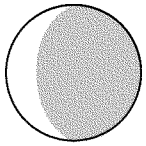
(not drawn to scale)

Which phase of the Moon will the observer see when the Moon is at the position shown in its orbit?

A) 

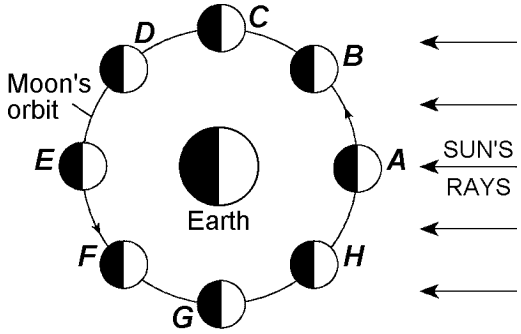
C) 

B) 

D) 

Questions 119 through 121 refer to the following:

The diagram below represents the Moon in eight positions, *A* through *H*, in its orbit around Earth.



(not drawn to scale)

119) When a solar eclipse is viewed from Earth, the Moon must be located at which orbital position shown in the diagram?

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

120) How many days are required for the Moon to complete a cycle of phases from the New Moon position represented in the diagram to the New Moon the following month?

A) 27.3 d
B) 2.2 d
C) 365.26 d
D) 29.5 d

121) Which Moon phase is observed in New York State when the Moon is located at position *F* in the diagram?

A) 

C) 

B) 

D) 

Questions 122 and 123 refer to the following:

The calendar below shows the month of July of a recent year. The dates of major Moon phases, as seen in New York State, are shown.

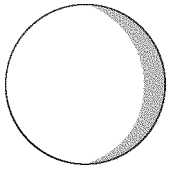
July

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

KEY:

- New Moon
- First-quarter Moon
- Full Moon
- Last-quarter Moon

122) The diagram below represents the phase of the Moon observed from New York State one night during the month of July.



On which date on the calendar was this phase of the Moon visible from New York State?

A) July 4
B) July 26
C) July 19
D) July 11

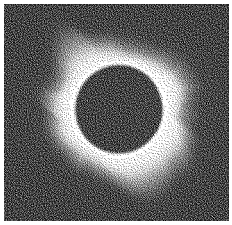
123) On which date on the calendar will the next first-quarter Moon phase occur?

A) August 16
B) August 22
C) August 10
D) August 6

124) Eclipses do *not* occur every month because the Moon's

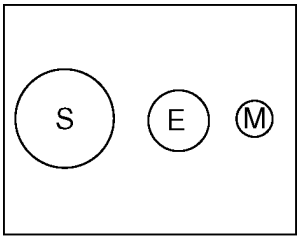
A) rate of rotation is 15D each hour
B) period of rotation and period of revolution are the same
C) orbit is inclined to Earth's orbit
D) period of revolution is 27.3 days

125) The diagram below represents a total solar eclipse as seen from Earth.

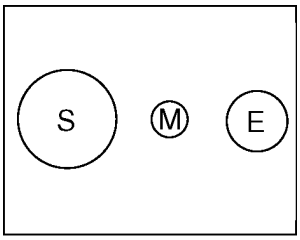


Which diagram correctly represents the relative positions of the Sun (S), Earth (E), and the Moon (M) in space during a total solar eclipse? [*The diagrams are not drawn to scale.*]

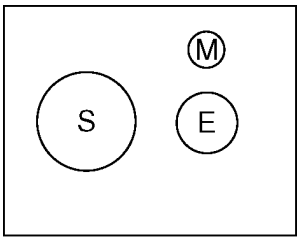
A)



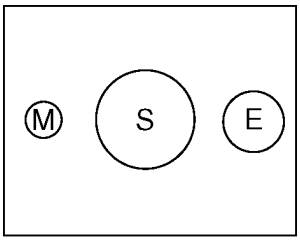
B)



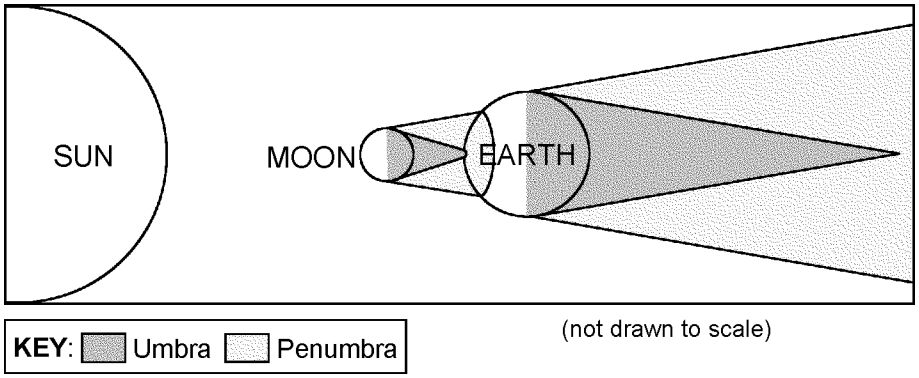
C)



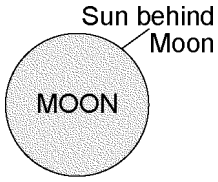
D)

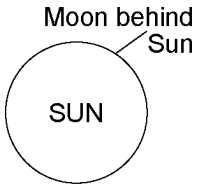


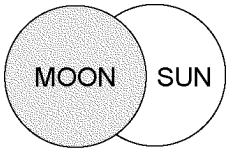
126) The diagram below shows the position of the Sun, the Moon, and Earth during a solar eclipse. The full shadow (umbra) and partial shadow (penumbra) of the Moon and Earth are shown.

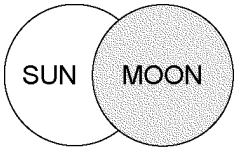


Which diagram *best* represents the appearance of the Sun and the Moon to an observer located within the umbra of the Moon's shadow on Earth's surface?

A)


B)


C)


D)


127) Which motion is responsible for the regular seasonal changes of the constellations visible in the night sky?

A) Earth orbits the Sun.
B) The stars orbit the Sun.
C) The Moon orbits Earth.
D) The stars orbit Earth.

128) Which motion causes some constellations to be visible in New York State only during winter nights and other constellations to be visible only during summer nights?

A) Stars in constellations revolve around the Sun.
B) Earth rotates on its axis.
C) Stars in constellations revolve around Earth.
D) Earth revolves around the Sun.

Questions 129 and 130 refer to the following:

The data table below shows some constellations that can be seen by an observer in New York State during different seasons.

Season	Constellations
spring	Ursa Minor, Orion, Leo, Scorpius
summer	Ursa Minor, Leo, Scorpius, Aquarius
fall	Ursa Minor, Orion, Scorpius, Aquarius
winter	Ursa Minor, Orion, Leo, Aquarius

129) Which statement best explains why some constellations are *not* seen during all four seasons?

A) Constellations revolve around the Sun.
B) The Moon revolves around Earth.
C) The Sun revolves around the center of the Milky Way.
D) Earth revolves around the Sun.

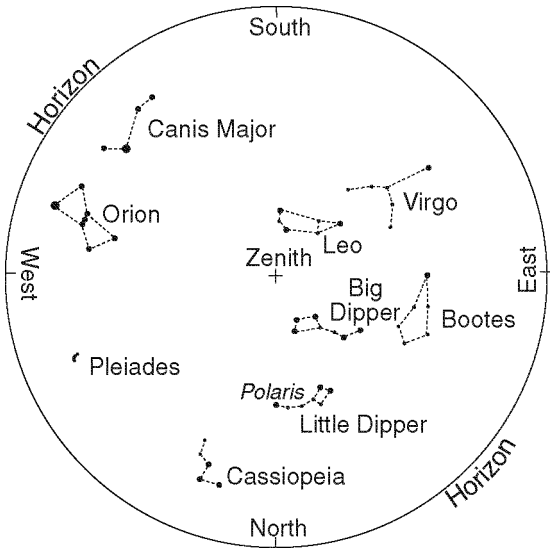
130) The diagram below represents a portion of the constellation Ursa Minor. The star *Polaris* is identified.

Ursa Minor can be seen by an observer in New York State during all four seasons because Ursa Minor is located almost directly

A) above Earth's North Pole
B) between Earth and the center of the Milky Way
C) above Earth's equator
D) overhead in New York State

Questions 131 and 132 refer to the following:

The map of the night sky below represents the apparent locations of some of the constellations that are visible to an observer at approximately 40DN latitude at 9 p.m. in April. The point directly above the observer is labeled zenith.

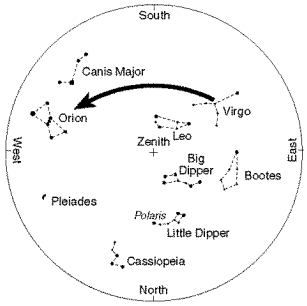


131) Which motion causes the constellation Leo to no longer be visible to an observer at 40DN in October?

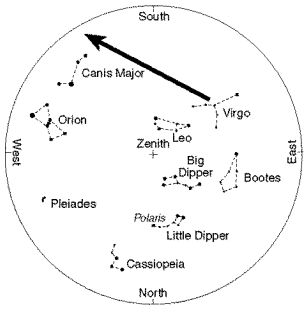
A) spin of Earth on its axis
B) revolution of Earth around the Sun
C) revolution of the constellation around the Sun
D) spin of the constellation on its axis

132) Which map *best* illustrates the apparent path of Virgo during the next 4 hours?

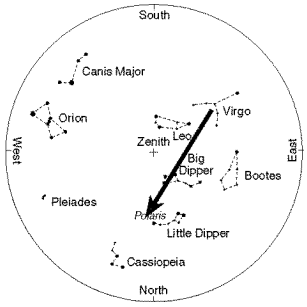
A)



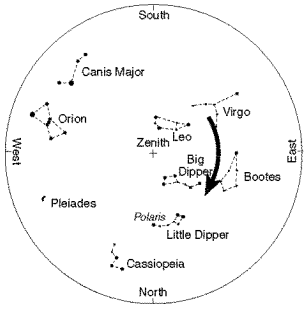
B)



C)



D)

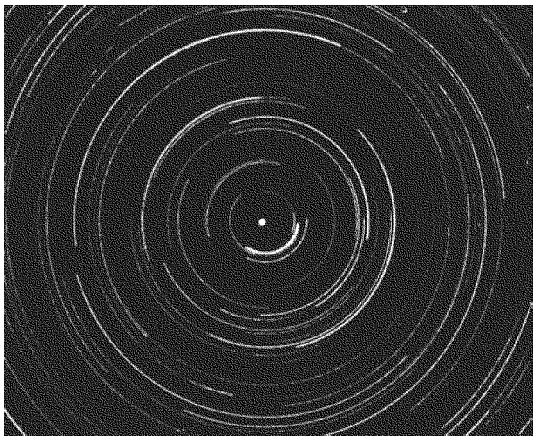


133) To a nighttime observer on Earth, how many degrees do the stars appear to move around *Polaris* in 3 hours?

A) 45D
B) 3D
C) 60D
D) 15D

Questions 134 and 135 refer to the following:

The time-exposure photograph shown below was taken by aiming a camera at a portion of the night sky above a New York State location and leaving the camera's shutter open for a period of time to record star trails.



134) Which celestial object is shown in the given photograph near the center of the star trails?

A) *Polaris*
B) the Sun
C) the Moon
D) *Sirius*

135) During the time exposure of the given photograph, the stars appear to have moved through an arc of 120D. How many hours did this time exposure take?

A) 12 h
B) 5 h
C) 15 h
D) 8 h

136) The motion of a Foucault pendulum provides evidence that Earth

A) spins on its axis
B) varies in distance from the Sun
C) is tilted on its axis
D) travels around the Sun

137) A Foucault pendulum appears to change its direction of swing because Earth

A) is tilted on its axis
B) has a curved surface
C) is spinning on its axis
D) has a density of 5.5 g/cm^3

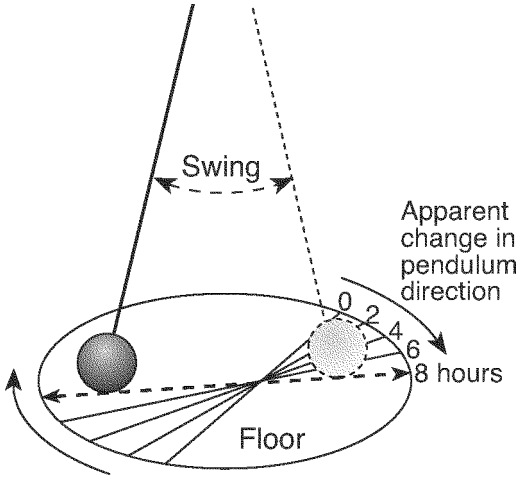
138) The direction of swing of a Foucault pendulum appears to change due to Earth's

A) spherical shape
B) elliptical orbit
C) revolution
D) rotation

139) The *best* evidence that Earth rotates on its axis is the changing

A) apparent path of a Foucault pendulum
B) altitude of the noontime Sun from day to day
C) phases of the Moon
D) velocity of Earth in its orbit

140) The diagram below shows a large pendulum in motion over an 8-hour period.



What is the *main* reason the pendulum appears to change its direction of swing over time?

A) revolution of Earth in its orbit
B) tilt of Earth on its axis
C) speed of Earth in its orbit
D) rotation of Earth on its axis

141) What causes the planetary winds and ocean currents to be deflected to the right in the Northern Hemisphere and to the left in the Southern Hemisphere?

A) seasonal changes
B) the Coriolis effect
C) plate tectonics
D) the Doppler effect

142) What causes many surface winds to deflect to the right in the Northern Hemisphere?

A) gravitational force of the Moon
B) unequal heating of Earth's surface
C) gravitational force of the Sun
D) rotation of Earth on its axis

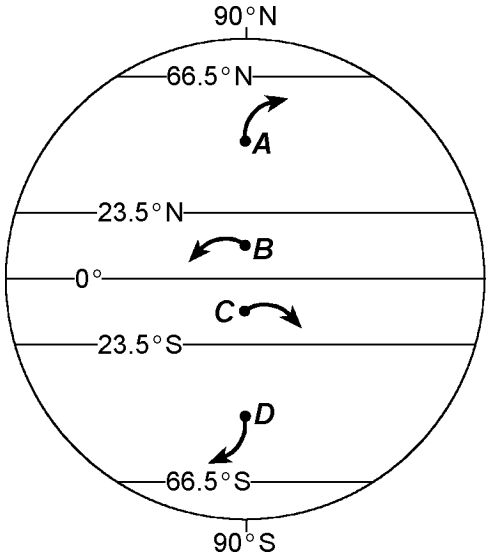
143) The curving of the planetary winds to the right in the Northern Hemisphere is evidence of

A) the tilt of Earth's axis
B) high-and low-pressure belts
C) the Coriolis effect
D) Earth's revolution

144) In the Northern Hemisphere, planetary winds deflect to the

A) left, due to the Doppler effect
B) left, due to the Coriolis effect
C) right, due to the Doppler effect
D) right, due to the Coriolis effect

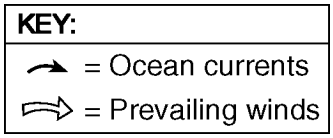
145) The arrows in the diagram below show changes in the direction of surface winds at four lettered locations, *A*, *B*, *C*, and *D*, on Earth.



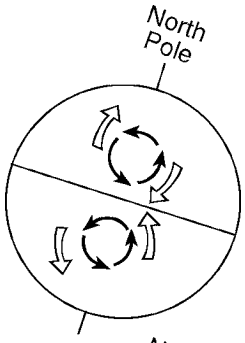
The arrow at which location correctly shows a deflection of the wind that could be due to the Coriolis effect?

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

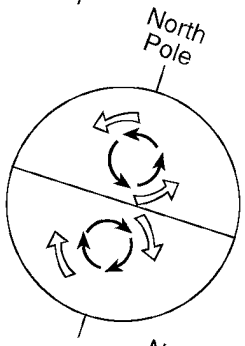
146) Which diagram correctly represents the curving of Earth's ocean currents and prevailing winds due to the Coriolis effect?



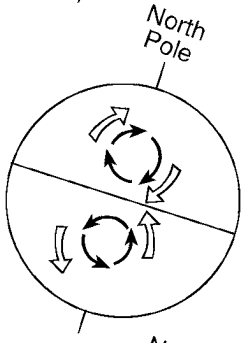
A)



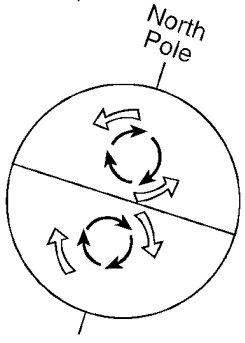
B)



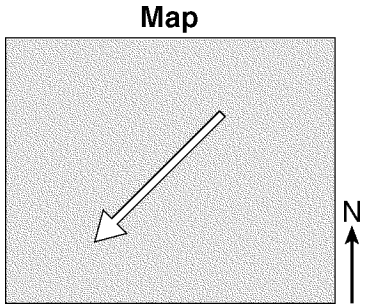
C)



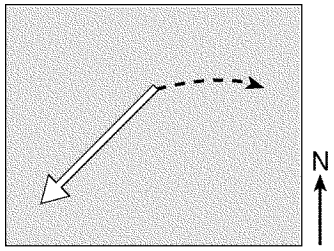
D)

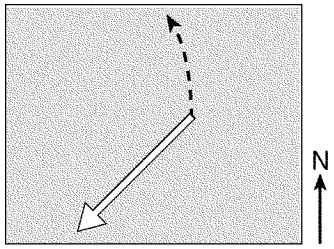


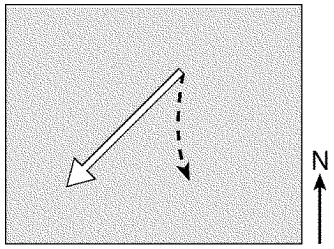
147) The arrow on the map below represents the direction a wind is blowing over a land surface in the Northern Hemisphere without showing the Coriolis effect.

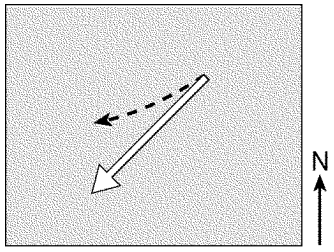


Which dashed arrow represents how the wind direction will change in the Northern Hemisphere due to the Coriolis effect?

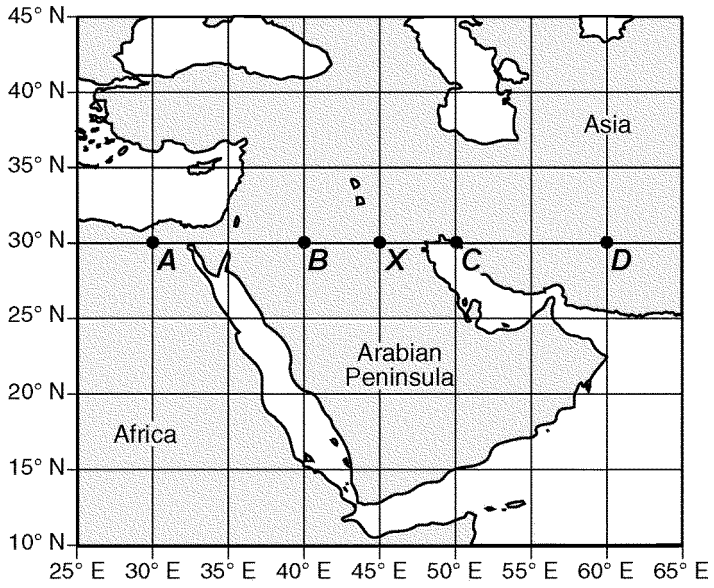
A)


B)


C)


D)


148) The map below shows a portion of the Middle East. Points *A*, *B*, *C*, *D*, and *X* are locations on Earth's surface.



When it is 10:00 a.m. solar time at location *X*, at which location is 11:00 a.m. solar time being observed?

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

149) Which form of electromagnetic energy has the *longest* wavelength?

A) ultraviolet rays
B) gamma rays
C) radio waves
D) visible light

150) Most of the electromagnetic energy radiated from Earth's surface is in the form of

A) infrared rays
B) gamma rays
C) x-rays
D) ultraviolet rays

151) Energy is transferred from *Barnard's Star* to Earth mainly by

A) electromagnetic waves
B) red shifts
C) conduction
D) density currents

152) During which phase change will the *greatest* amount of energy be absorbed by 1 gram of water?

A) freezing
B) melting
C) condensation
D) evaporation

153) Which factor has the *greatest* influence on the number of daylight hours that a particular Earth surface location receives?

A) longitude
B) distance from the Sun
C) latitude
D) diameter of Earth

154) Which hot spot location on Earth's surface usually receives the greatest intensity of insolation on June 21?

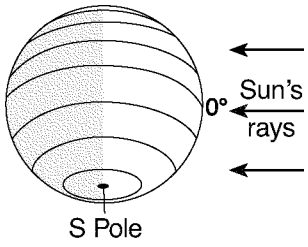
A) Yellowstone
B) Easter Island
C) Hawaii
D) Iceland

155) To an observer in New York State the duration of daylight increases continuously from

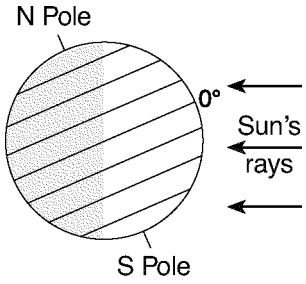
A) December 1 to February 1
B) September 1 to November 1
C) June 1 to August 1
D) March 1 to May 1

156) Which diagram represents the tilt of Earth's axis relative to the Sun's rays on December 15?

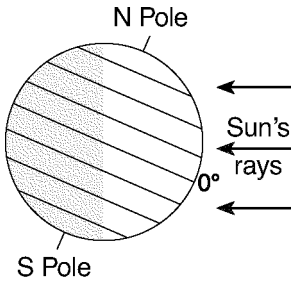
A)



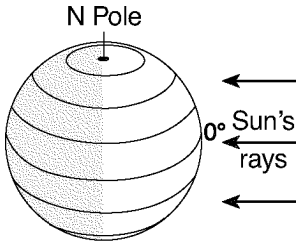
B)



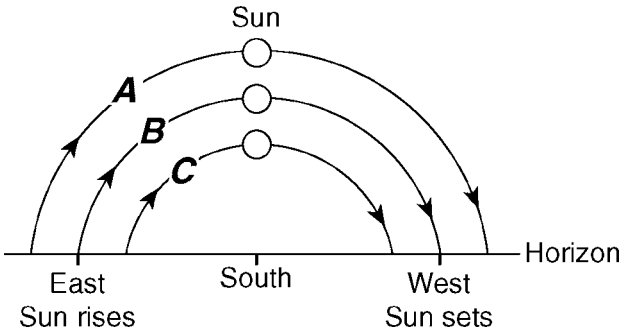
C)



D)



157) The diagram below represents the horizon and the Sun's apparent paths, *A*, *B*, and *C*, on three different dates, as viewed from the same location in New York State.



Which table correctly shows the dates on which the apparent paths of the Sun were observed?

A)

Path of Sun	Date
A	December 21
B	March 21
C	June 21

B)

Path of Sun	Date
A	June 21
B	March 21
C	December 21

C)

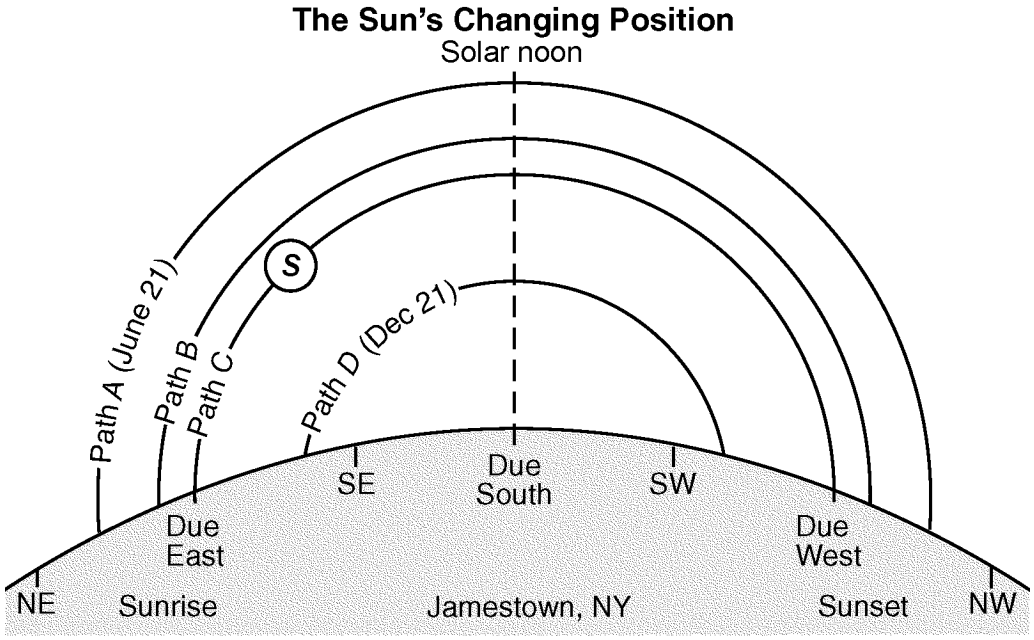
Path of Sun	Date
A	March 21
B	September 23
C	June 21

D)

Path of Sun	Date
A	December 21
B	September 23
C	March 21

Questions 158 through 160 refer to the following:

The diagram below represents four apparent paths of the Sun, labeled *A*, *B*, *C*, and *D*, observed in Jamestown, New York. The June 21 and December 21 sunrise and sunset positions are indicated. Letter *S* identifies the Sun's position on path *C* at a specific time of day. Compass directions are indicated along the horizon.



158) The *greatest* duration of insolation in Jamestown occurs when the Sun appears to travel along which path in the given diagram?

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

159) At what time of day is the Sun at position *S* in the given diagram?

A) 6 a.m.
B) 9 a.m.
C) 6 p.m.
D) 3 p.m.

160) When the Sun appears to travel along path *D* at Jamestown in the diagram shown, which latitude on Earth receives the most direct rays from the Sun?

A) 42D N
B) 0D
C) 23.5D S
D) 23.5D N

161) Which type of land surface will most likely absorb the *greatest* amount of incoming solar radiation?

A) rough, light-colored surface
B) rough, dark-colored surface
C) smooth, dark-colored surface
D) smooth, light-colored surface

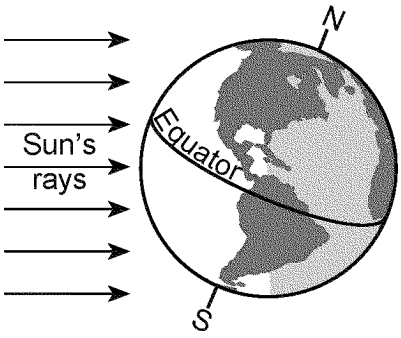
162) A decrease in areas covered in snow and ice leads to an increase in the absorption of insolation because exposed land surfaces are

A) rougher and lighter
B) smoother and lighter
C) smoother and darker
D) rougher and darker

163) Seasonal changes on Earth are primarily caused by the

A) parallelism of the Sun's axis as the Sun revolves around Earth
B) changes in distance between Earth and the Sun
C) elliptical shape of Earth's orbit around the Sun
D) tilt of Earth's axis as Earth revolves around the Sun

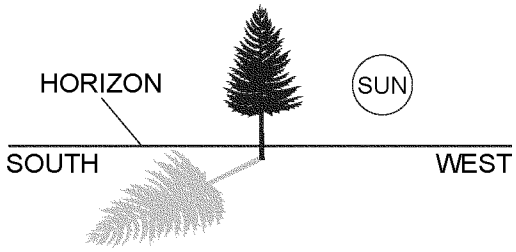
164) The diagram below represents Earth in space on the first day of a season.



Which season is beginning in New York State on the day represented in the diagram?

A) winter
B) summer
C) fall
D) spring

165) A tree in New York State casts a shadow as shown in the diagram below.



What time of day and season are represented by the diagram?

A) late afternoon in winter
B) late afternoon in summer
C) early morning in winter
D) early morning in summer

166) Global warming is most likely occurring due to an increase in

A) visible light and radio waves reflected from Earth
B) oxygen and nitrogen gases in the atmosphere
C) carbon dioxide and methane gases in the atmosphere
D) ultraviolet radiation and x-rays reflected from Earth

167) Two of the greenhouse gases that may be responsible for the increased ice melting in Greenland are

A) oxygen and silicon
B) hydrogen and helium
C) nitrogen and oxygen
D) carbon dioxide and methane

168) An increase in which gas in Earth's atmosphere will most significantly increase global temperatures?

A) oxygen
B) hydrogen
C) methane
D) nitrogen

169) Evidence supports the idea that increases in carbon dioxide and methane in Earth's atmosphere are major contributors to global warming. This is based primarily on the fact that carbon dioxide and methane are excellent absorbers of

A) gamma rays
B) infrared radiation
C) microwaves
D) visible light

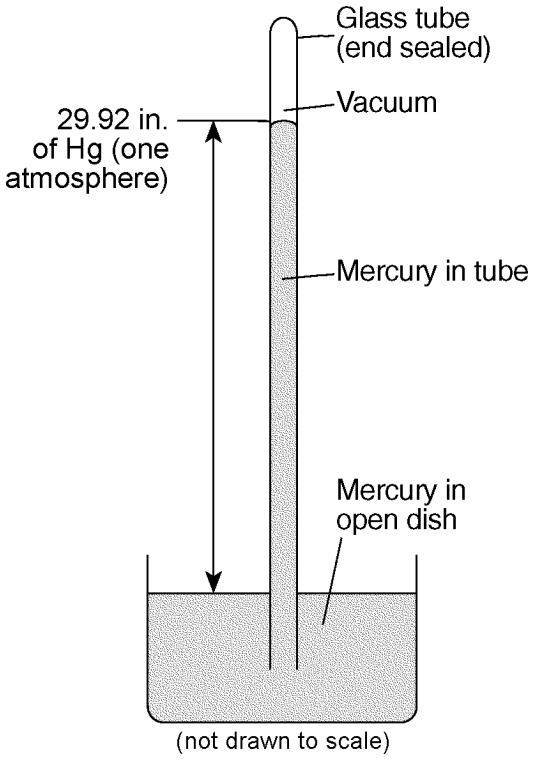
170) An increase in the transparency of Earth's atmosphere is often caused by

A) an increase in the duration of insolation
B) a decrease in cloud cover
C) an increase in airborne dust particles
D) a decrease in solar radiation

171) Which weather variable is measured by a barometer?

A) visibility
B) air pressure
C) wind speed
D) dewpoint

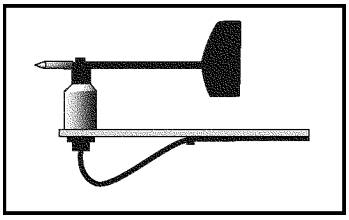
172) The diagram below represents a weather instrument.



Which weather variable was this instrument designed to measure?

A) amount of precipitation
B) dewpoint
C) relative humidity
D) air pressure

173) The diagram below shows a weather instrument found at most weather stations.



The main function of this instrument is to measure which weather variable?

A) air pressure
B) wind speed
C) relative humidity
D) wind direction

174) Which set of instruments is correctly paired with the weather variables that they measure?

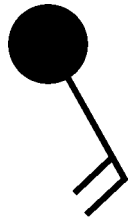
A)
wind speed – anemometer
wind direction – barometer

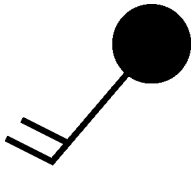
B)
wind speed – barometer
wind direction – wind vane

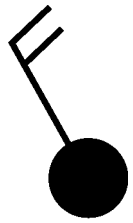
C)
wind speed – wind vane
wind direction – barometer

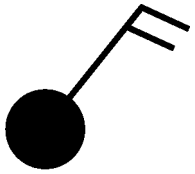
D)
wind speed – anemometer
wind direction – wind vane

175) Which station model shows a wind direction from the southeast?

A) 

C) 

B) 

D) 

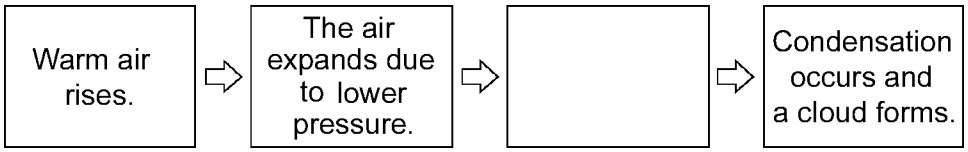
176) Which transfer of energy occurs mainly through the process of convection?

A) heated air in the lower atmosphere transferred upward by density differences
B) heat from radioactive decay transferred by molecular collisions to surrounding mantle rock
C) solar energy transferred through space to Earth's surface
D) electromagnetic energy transferred from the Sun to the Moon

177) Most of the air in the lower troposphere at the equatorial low-pressure belt is

A) warm, moist, and rising
B) cool, moist, and sinking
C) cool, dry, and sinking
D) warm, dry, and rising

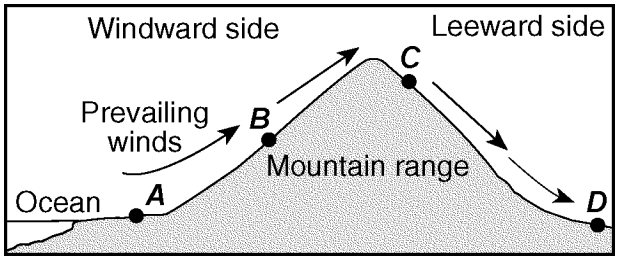
178) The incomplete flowchart below shows some of the changes that occur in warm air as it rises to form a cloud.



Which statement should be placed in the empty box to accurately complete the flowchart?

A) The air warms as it expands.
B) The air cools until it reaches the dewpoint.
C) The air enters the thermosphere.
D) The air's relative humidity decreases to zero.

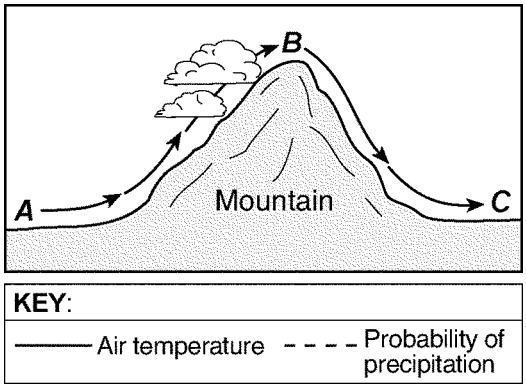
179) The cross section below represents prevailing winds moving over a coastal mountain range. Letters *A* through *D* represent locations on Earth's surface.



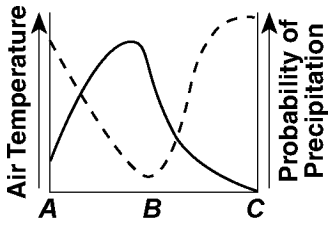
Which location will most likely have the *least* annual precipitation?

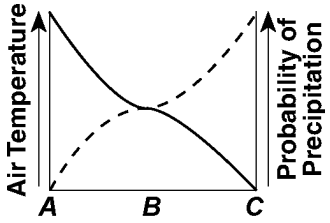
A) *A*
B) *B*
C) *C*
D) *D*

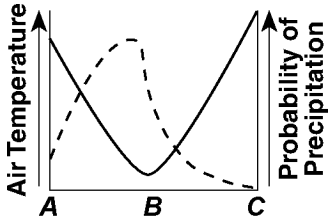
180) The diagram below shows the flow of air over a mountain, from location *A* to *B* to *C*.

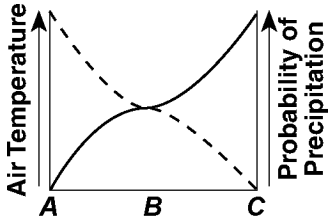


Which graph *best* shows how the air temperature and probability of precipitation change during this air movement?

A)


B)


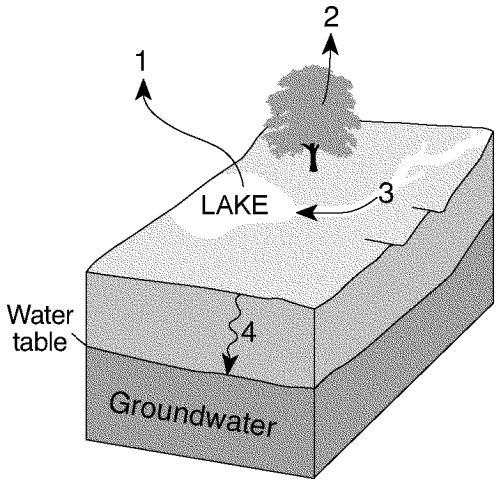
C)


D)


181) Which processes of the water cycle return water vapor directly to the atmosphere?

A) evaporation and transpiration
B) water retention and runoff
C) infiltration and capillarity
D) freezing and precipitation

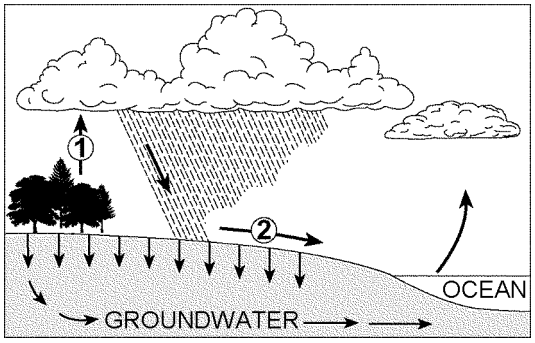
182) The arrows in the block diagram below show the movement of water after it has fallen as precipitation.



Which arrow indicates the process of transpiration?

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

183) The arrows in the diagram below represent processes in the water cycle.

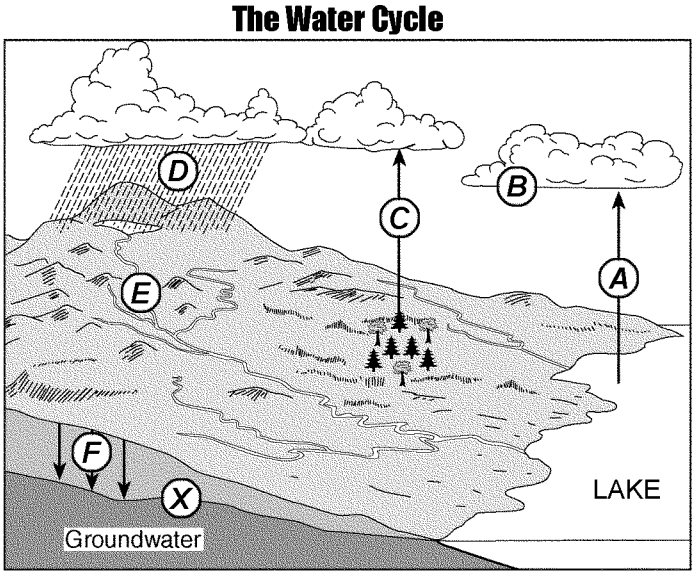


Which processes in the water cycle are identified by the numbered arrows?

A) Process 1 is precipitation; process 2 is runoff.
B) Process 1 is evaporation; process 2 is infiltration.
C) Process 1 is transpiration; process 2 is runoff.
D) Process 1 is condensation; process 2 is infiltration.

Questions 184 through 187 refer to the following:

The diagram below shows a model of the water cycle. Letters *A* through *F* represent some processes of the water cycle. Letter *X* indicates the top of the underground zone that is saturated with water.



(not drawn to scale)

184) Which process is represented by letter *F* in the given diagram?

A) condensation
B) capillarity
C) vaporization
D) infiltration

185) What does letter *X* in the water cycle diagram represent?

A) a floodplain
B) impermeable rock
C) sea level
D) the water table

186) If the surface soil in the given diagram is saturated and precipitation increases, there will be

A) a decrease in the surface elevation of the lake
B) an increase in the amount of runoff
C) an increase in the rate of capillarity
D) a decrease in the amount of groundwater

187) The processes of transpiration and evaporation are represented by which letters in the water cycle diagram?

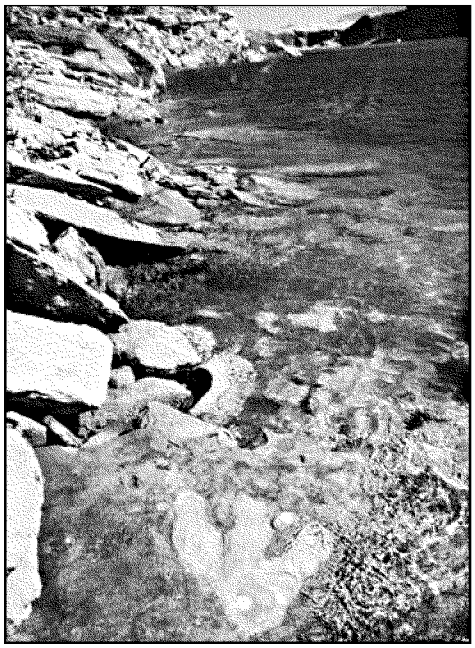
A) *C* and *A*
B) *B* and *E*
C) *D* and *F*
D) *D* and *A*

Questions 188 and 189 refer to the following:

DINOSAUR TRACKS REVEALED AFTER YEARS OF DRY WEATHER.

By April 2005, the surface of Lake Powell, a human-made lake in Utah and Arizona, had fallen 145 feet below its highest level. This revealed many traces of ancient life that had not been observed since this area had been covered with water. Among these traces, discovered in sandstone bedrock, were many dinosaur tracks, ranging in age between 170 and 200 million years old.

Dinosaur Track on Shoreline of Lake Powell



SOURCE: Andre Delgalvis, *Arizona Highways*, February 2006

188) Which conditions before April 2005 in the Lake Powell region most likely produced the *decrease* in the water level of Lake Powell?

A) Precipitation exceeded evaporation.
B) Precipitation exceeded runoff.
C) Runoff exceeded precipitation.
D) Evaporation exceeded precipitation.

189) The events listed below led to the formation and exposure of the dinosaur tracks shown.

A. Rock layers above the dinosaur tracks are eroded.
B. Tracks are made in loose sand by dinosaurs.
C. Sediments are compressed and cemented.
D. Sedimentation buries tracks.
E. The water level of Lake Powell drops.

What is the correct sequence of the events listed above that led to the formation and exposure of the dinosaur tracks in the surface bedrock along the shoreline of Lake Powell?

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

190) The *least* amount of surface water runoff will occur when soil pore spaces are

A) saturated and the slope is steep
B) saturated and the slope is gentle
C) unsaturated and the slope is steep
D) unsaturated and the slope is gentle

191) A paved blacktop parking lot was built on what was once a soil-covered field. This area will now experience increased runoff when rain occurs because the paved parking lot has

A) greater porosity
B) less permeability
C) greater infiltration
D) less capillarity

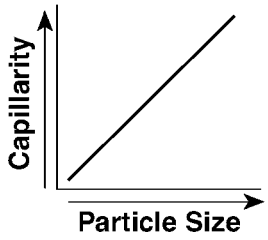
192) Sediment samples *A* through *D* below have the same volume and packing, but contain different percentages of various particle sizes.

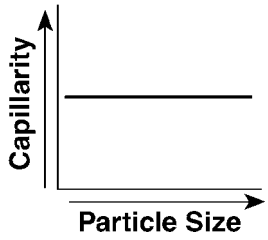
Sample *A*: 75% clay and 25% silt
Sample *B*: 25% clay and 75% sand
Sample *C*: 50% pebbles and 50% sand
Sample *D*: 50% pebbles and 50% cobbles

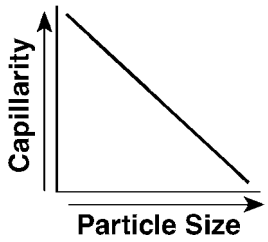
Which sample most likely has the *greatest* permeability?

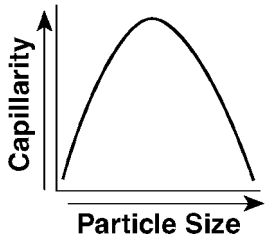
A) *A*
B) *B*
C) *C*
D) *D*

193) Which graph shows the general relationship between soil particle size and the capillarity of the soil?

A)


B)


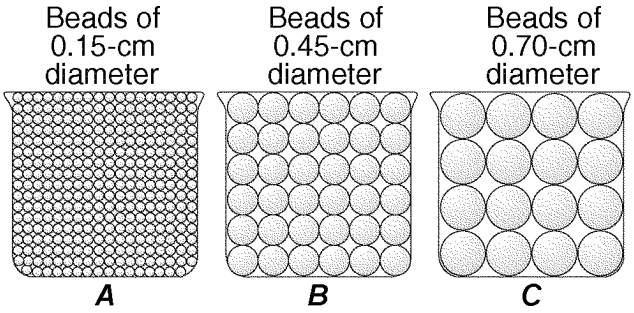
C)


D)


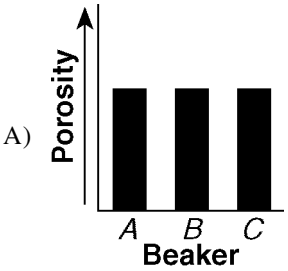
194) Which soil characteristic allows *greater* amounts of water retention?

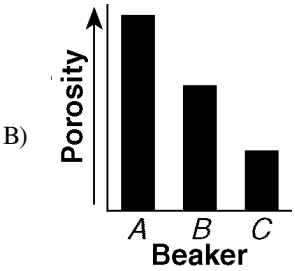
A) large-size particles
B) small-size particles
C) low-density particles
D) high-density particles

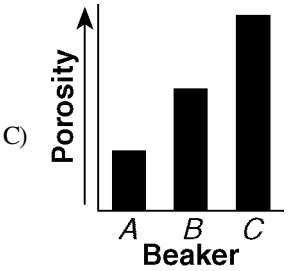
195) The diagram below represents three identical beakers filled to the same level with spherical beads.

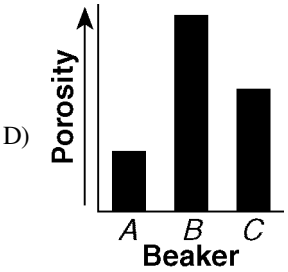


If the packing of the beads within each beaker is the same, which graph *best* represents the porosity within each beaker?

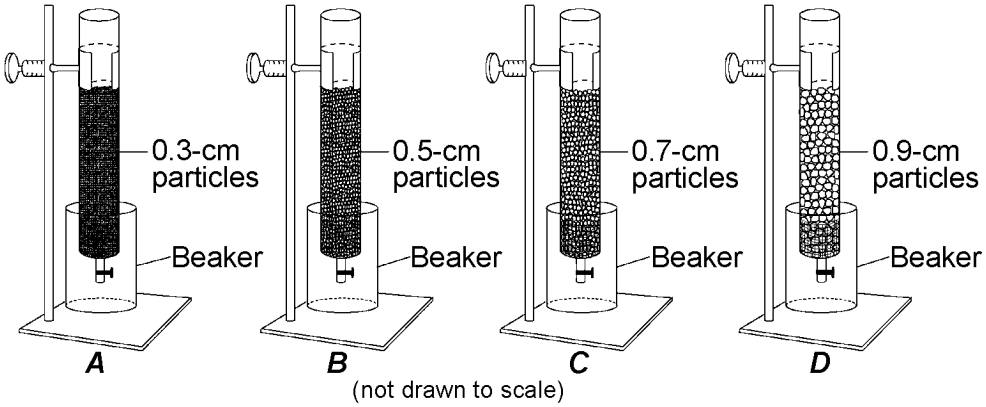
A)


B)


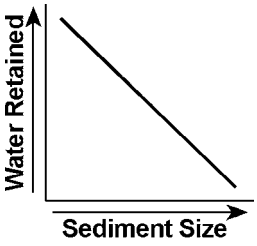
C)


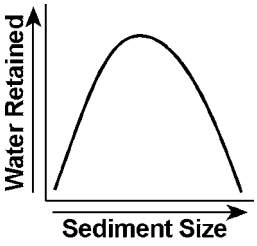
D)


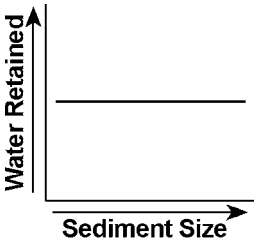
196) The diagram below represents the setup for an experiment for studying groundwater. Tubes *A*, *B*, *C*, and *D* contain equal volumes of sediments. Within each tube, the sediments are uniform in size, shape, and packing. A test for water retention was conducted by first filling each tube with water and then draining the water into beakers.

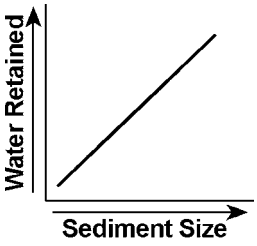


Which graph represents the general relationship between the sediment size and the amount of water retained by the sediments after the tubes had drained?

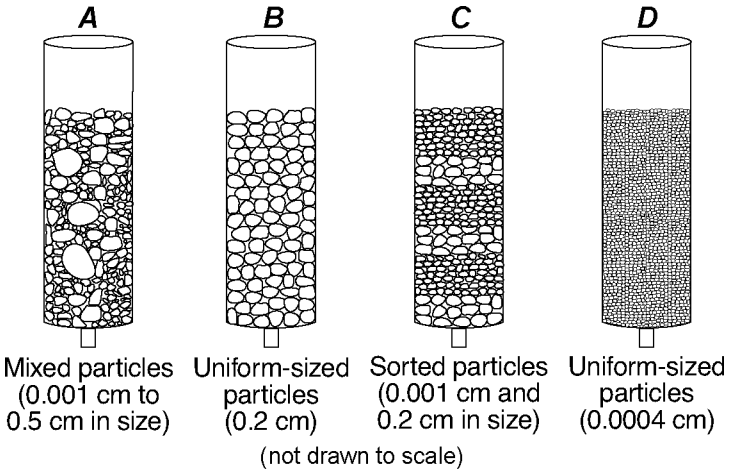
A)


B)


C)


D)


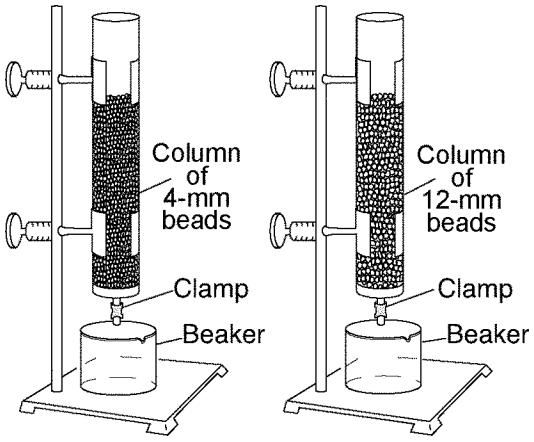
197) The diagram below shows columns *A*, *B*, *C*, and *D* that contain different sediments. Equal volumes of water were poured through each column.



Which column of sediment retained the *most* water?

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

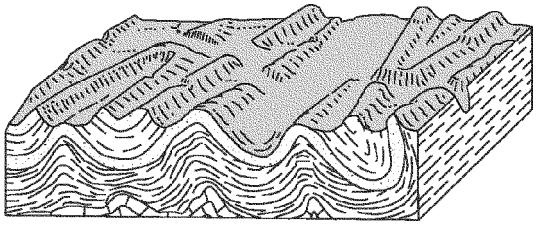
198) The diagram below shows an experimental setup to compare water retention and permeability in two columns with equal volumes of spherical plastic beads of different diameters.



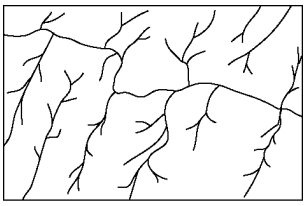
Which statement *best* describes the water retention and permeability in the two columns of beads?

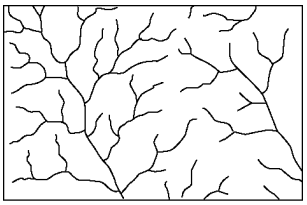
A) The column with 12-mm beads has greater water retention and the column with 4-mm beads has greater permeability.
B) The column with 4-mm beads has greater water retention and the column with 12-mm beads has greater permeability.
C) The column with 4-mm beads has greater water retention and permeability.
D) The column with 12-mm beads has greater water retention and permeability.

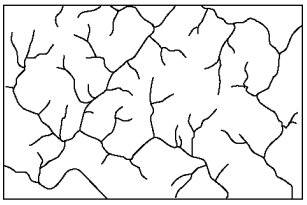
199) The block diagram below shows a portion of Earth's crust.

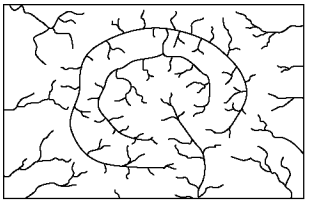


Which stream drainage pattern is most likely present on this crustal surface?

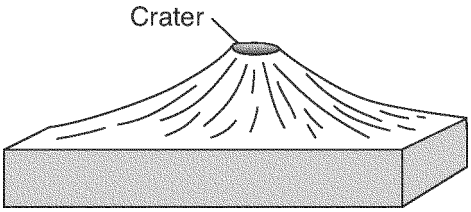
A)


B)


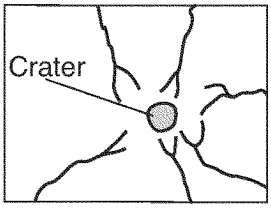
C)


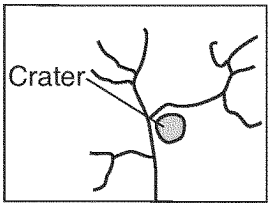
D)


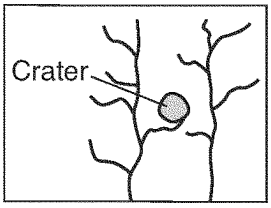
200) The block diagram below shows a volcano.

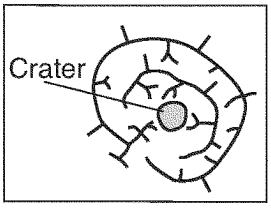


Which map shows the stream drainage pattern that most likely formed on the surface of this volcano?

A)


B)


C)


D)


201) Which air mass is associated with low relative humidity and high air temperature?

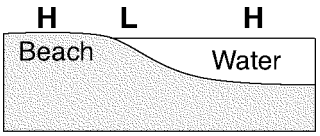
A) maritime polar
B) continental tropical
C) maritime tropical
D) continental polar

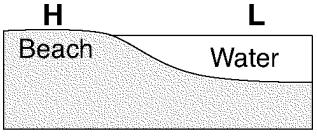
202) Which weather variable generally decreases when wind speed is increasing, clouds are thickening, and visibility drops?

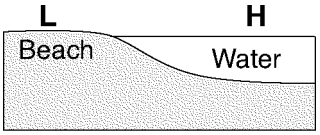
A) air pressure
B) dewpoint
C) relative humidity
D) precipitation

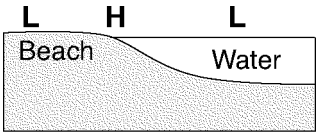
203) Which cross section below *best* shows the locations of high air pressure and low air pressure near a beach on a hot, sunny, summer afternoon?

KEY:
H High air pressure
L Low air pressure

A)


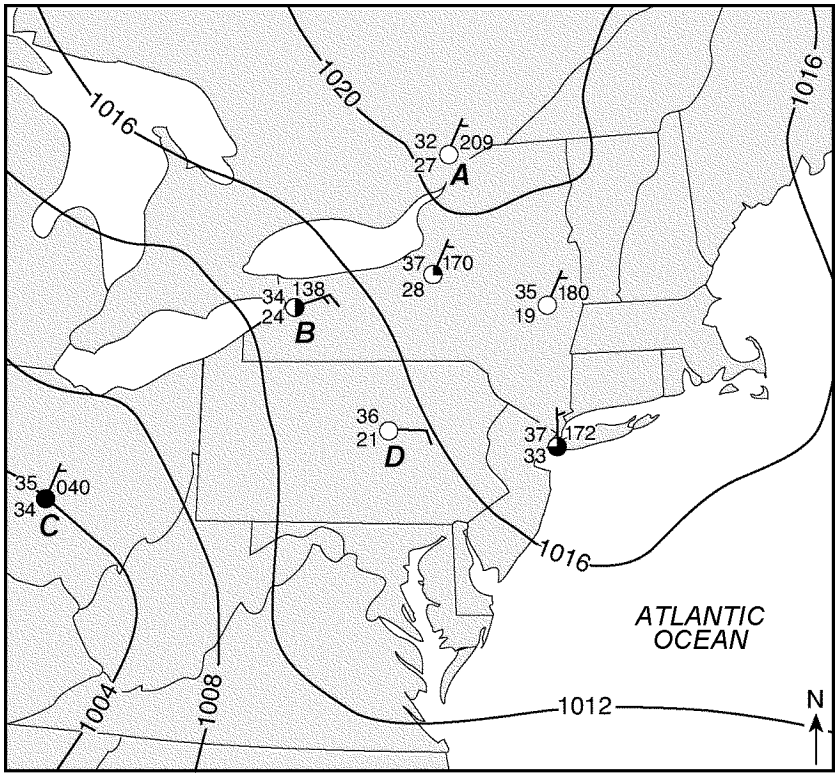
B)


C)


D)


Questions 204 through 207 refer to the following:

The weather map below shows isobars and seven weather station models. Four of the weather stations are identified by letters *A*, *B*, *C*, and *D*.



204) Which New York State weather station on the given weather map had clear skies?

A) New York City
B) Albany
C) Buffalo
D) Syracuse

205) Which of the weather stations on the given weather map had the *highest* relative humidity?

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

206) What was the probable air pressure, in millibars, at station *D* on the given weather map?

A) 1017.0 mb
B) 1036.0 mb
C) 1021.0 mb
D) 1015.0 mb

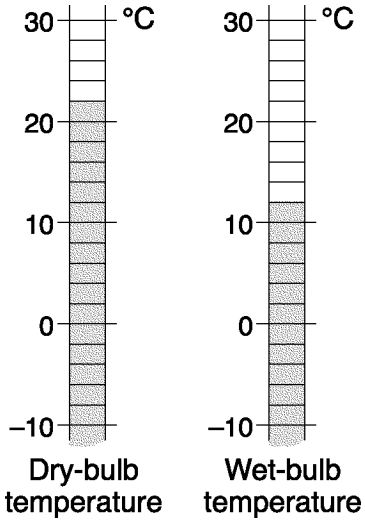
207) Which weather information shown at station *B* on the given weather map was measured with an anemometer and weather vane?

A) 34
B) 138
C) 
D) 

208) What is the dewpoint when the dry-bulb temperature is 8DC and the wet-bulb temperature is 2DC?

A) -9DC
B) 3DC
C) 6DC
D) 28DC

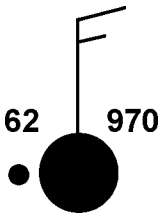
209) The diagram below shows dry-bulb and wet-bulb temperature readings for a parcel of air.



What is the dewpoint of the air?

A) 3DC
B) -5DC
C) 27DC
D) 10DC

210) The station model below shows several weather variables recorded at a particular location.



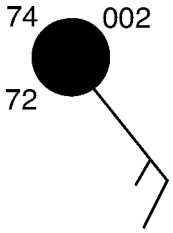
What was the most likely dewpoint at this location?

A) 32DF
B) 70DF
C) 61DF
D) 40DF

211) What is the dewpoint when the air temperature is 26DC and the relative humidity is 77%?

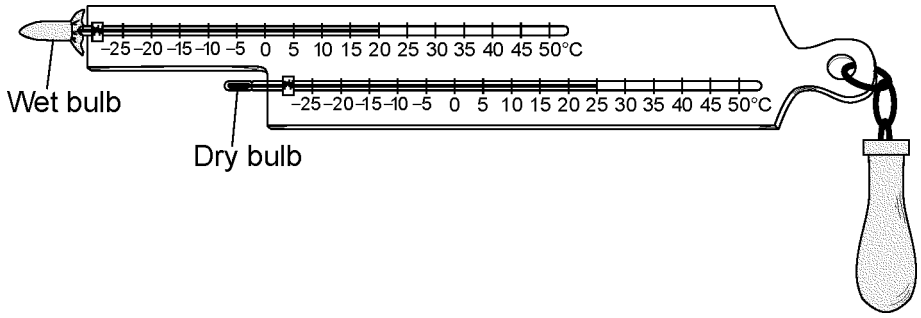
A) 23DC
B) 20DC
C) 22DC
D) 3DC

212) What are the dewpoint and wind direction shown on the station model below?



A) 74DF and wind from the northwest
B) 72DF and wind from the southeast
C) 74DF and wind from the southwest
D) 72DF and wind from the northeast

213) The diagram below represents the wet-bulb and dry-bulb temperatures on a sling psychrometer.



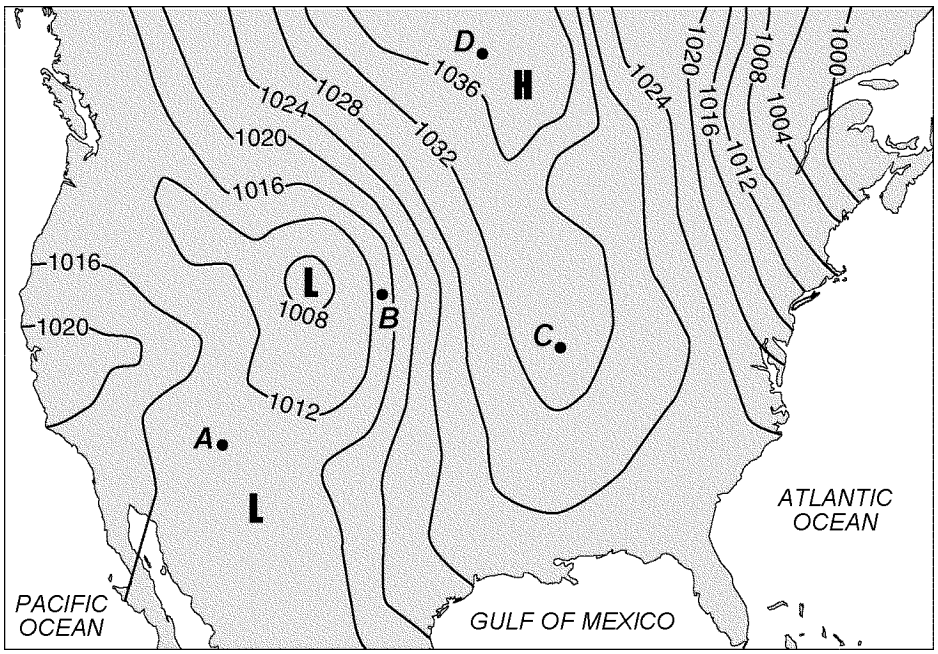
What was the relative humidity of the air when these temperatures were recorded?

A) 63%
B) 17%
C) 5%
D) 20%

214) The *highest* surface wind speeds occur when there is a

A) 4-millibar air-pressure difference between two nearby locations
B) 20-millibar air-pressure difference between two distant locations
C) 20-millibar air-pressure difference between two nearby locations
D) 4-millibar air-pressure difference between two distant locations

215) The weather map below shows isobars labeled in millibars. Points *A*, *B*, C, and *D* are locations on Earth's surface.



Which location was probably experiencing the *highest* wind speed?

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

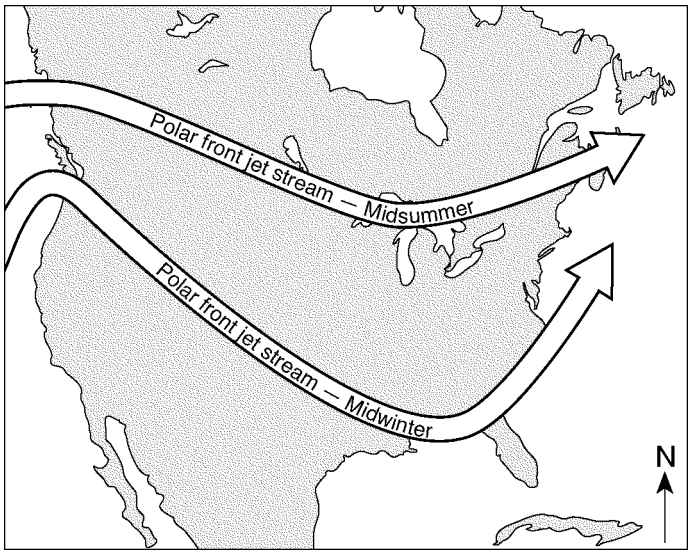
216) In which layer of the atmosphere is the jet stream located?

A) thermosphere C) stratosphere
B) mesosphere D) troposphere

217) Jet stream winds over the United States generally move from

A) north to south C) south to north
B) east to west D) west to east

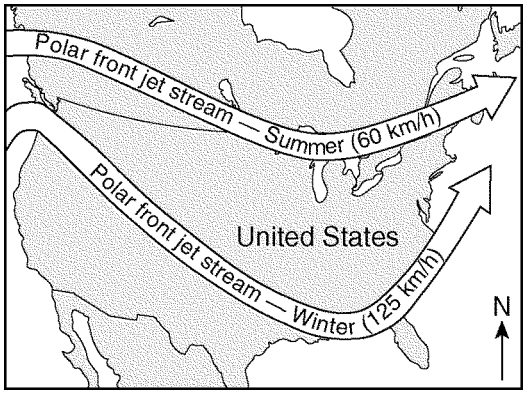
218) The map below shows two seasonal positions of the polar front jet stream over North America.



Which statement *best* explains why the position of the polar front jet stream varies with the seasons?

A) Water heats and cools more rapidly than land in winter.
B) Prevailing winds reverse direction in summer.
C) The vertical rays of the Sun shift north of the equator in summer.
D) Rising air compresses and cools in winter.

219) The map below shows a typical position and average velocity of the polar front jet stream during two different seasons.



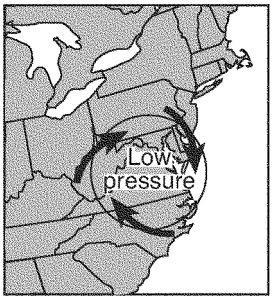
For the eastern United States, the change of the polar front jet stream from this summer position to this winter position causes

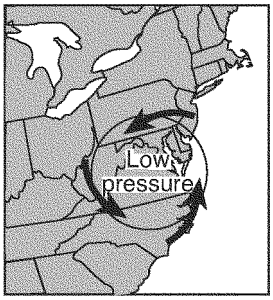
A) cooler temperatures farther south and causes storms to move more rapidly
B) warmer temperatures farther north and causes storms to move more slowly
C) cooler temperatures farther south and causes storms to move more slowly
D) warmer temperatures farther north and causes storms to move more rapidly

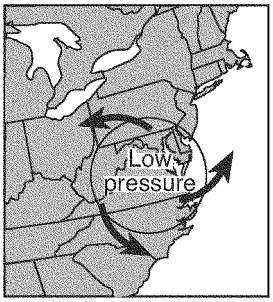
220) What is the usual surface wind pattern within a Northern Hemisphere low-pressure system?

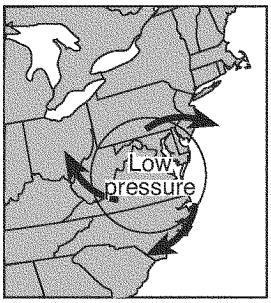
A) counterclockwise and outward
B) clockwise and inward
C) counterclockwise and inward
D) clockwise and outward

221) Which map *best* shows the general surface wind pattern in a low-pressure system located over the eastern United States?

A)


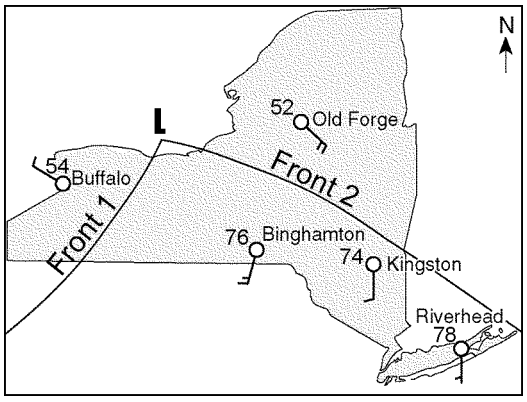
B)


C)


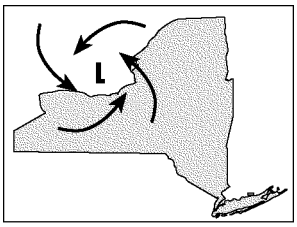
D)


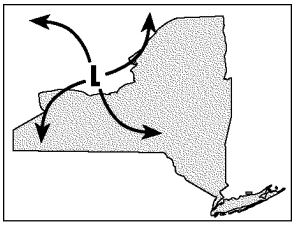
Questions 222 and 223 refer to the following:

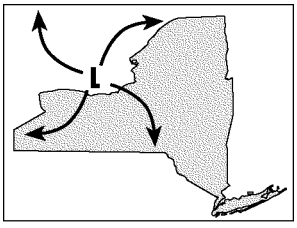
The weather map below represents a low-pressure system over New York State. The **L** on the map represents the center of the low-pressure system. Two fronts extend from the center of the low, and are labeled front 1 and front 2. Cloud cover has been omitted from the station models.

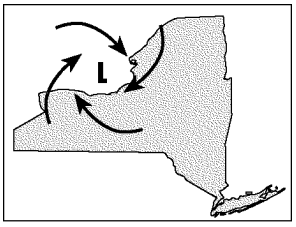


222) The arrows on which map *best* represent the surface wind pattern around the low-pressure center shown?

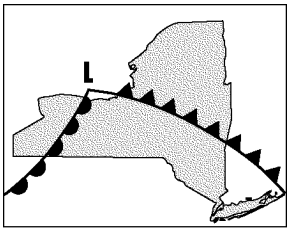
A)


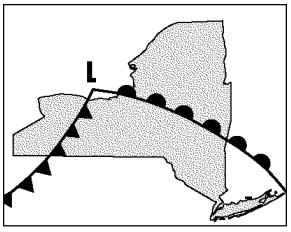
B)


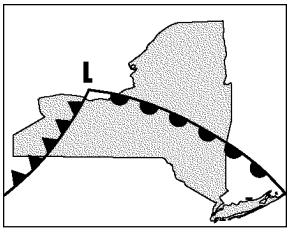
C)


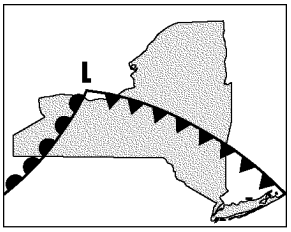
D)


223) Which map *best* represents the type of fronts and direction of movement of these fronts in relation to the low-pressure center shown?

A)


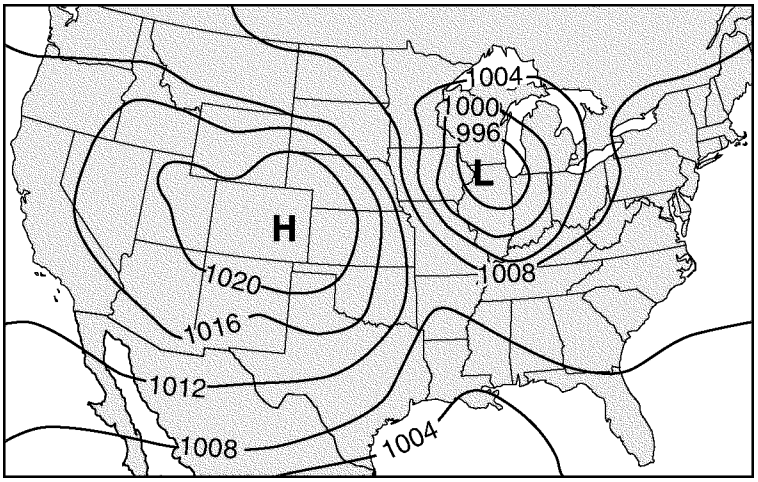
B)


C)


D)


Questions 224 through 227 refer to the following:

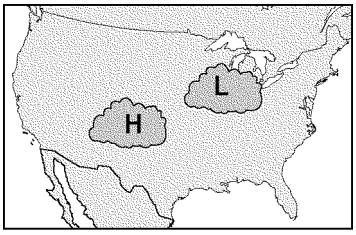
The weather map below shows the locations of a high-pressure center (**H**) and a low-pressure center (**L**) over a portion of North America. The isolines indicate surface air pressures.

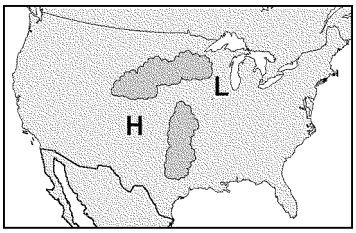


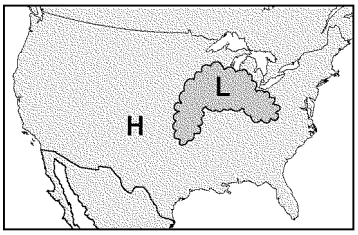
224) The data used to construct the isolines on the given map were recorded in which units?

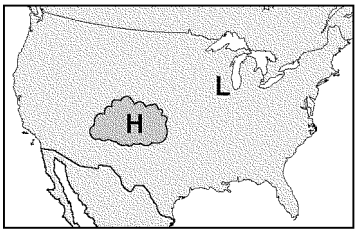
A) meters
B) feet
C) millibars
D) inches

225) Which map shows the most likely location of clouds associated with the given pressure centers?

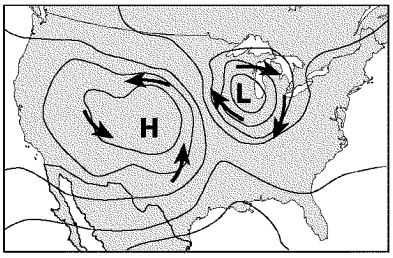
A)


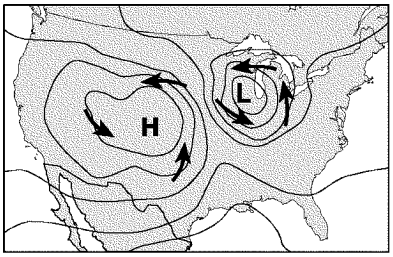
B)


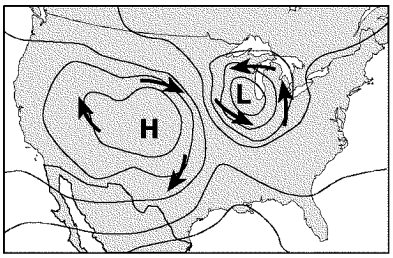
C)


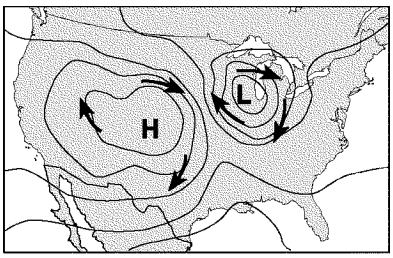
D)


226) The arrows on which map *best* show the pattern of surface winds around the two given pressure centers?

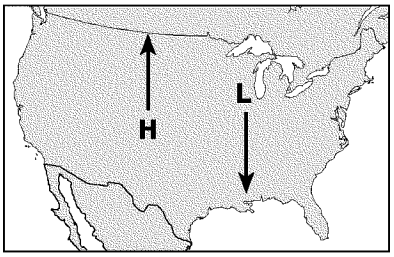
A)


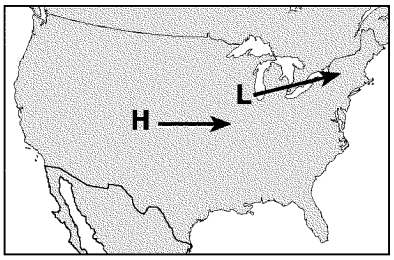
B)


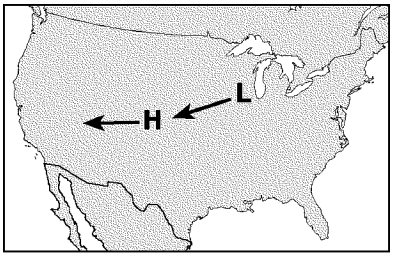
C)


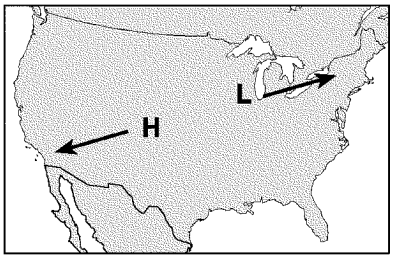
D)


227) The arrows on which map show the most likely path in which the two given pressure centers will move over the next few days?

A)


B)


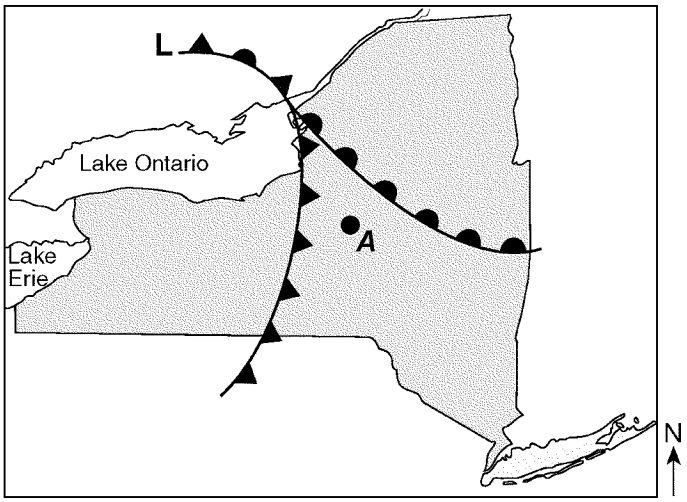
C)


D)


228) The winds shift from southwest to northwest as heavy rains and hail begin to fall in Albany, New York. These changes are most likely caused by the arrival of

A) a cold front
B) a warm front
C) an **mT** air mass
D) a **cT** air mass

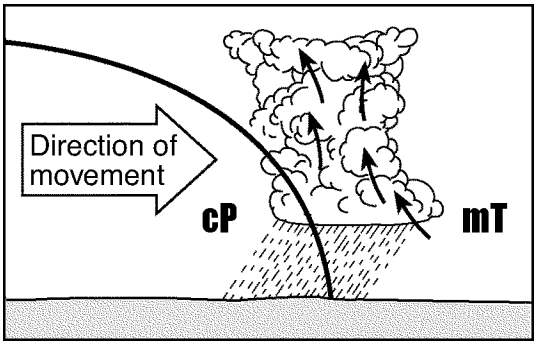
229) The weather map below shows a portion of a low-pressure system.



Which type of front will most likely pass over location *A* during the next two hours?

A) cold
B) warm
C) stationary
D) occluded

230) A cross section of a weather front is shown below.



Which symbol would be used to represent this front on a weather map?

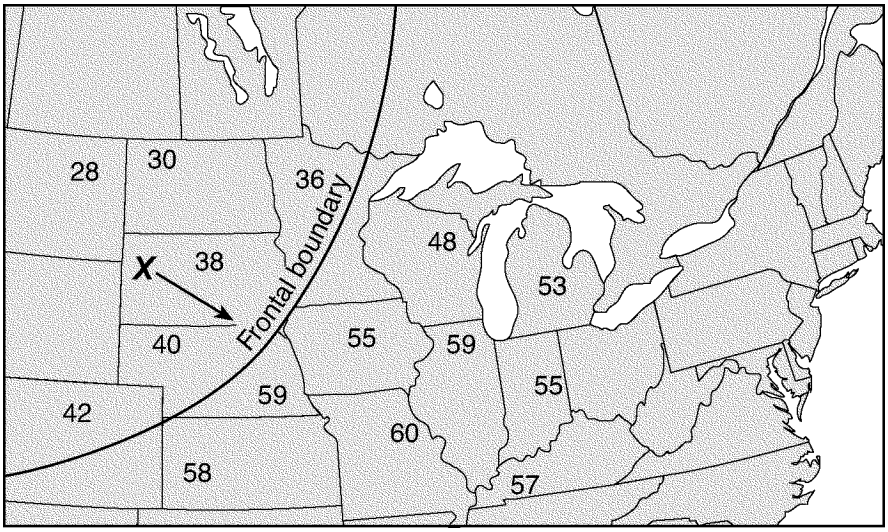
A) 

C) 

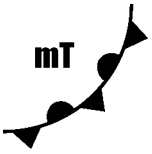
B) 

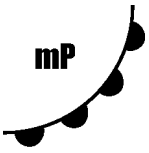
D) 

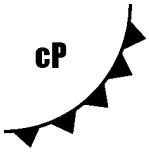
231) The map below shows surface air temperatures, in degrees Fahrenheit, reported by weather stations in the north-central United States. Letter ***X*** represents an air mass moving in the direction shown by the arrow. A line marks a frontal boundary advancing in a southeasterly direction.

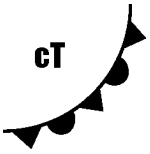


Which weather-map symbols *best* represent air-mass ***X*** and the frontal boundary shown on the map?

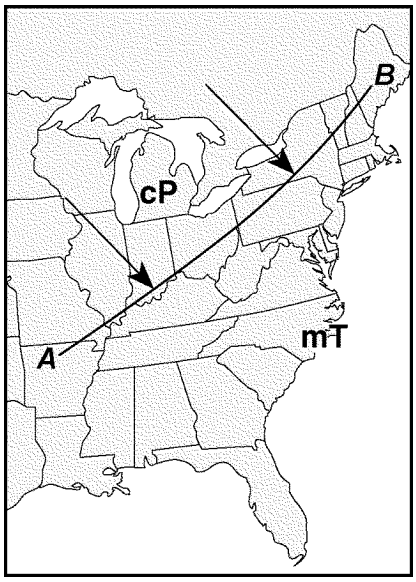
A) 

B) 

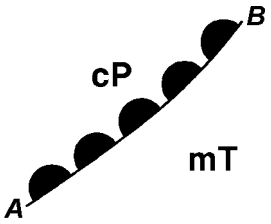
C) 

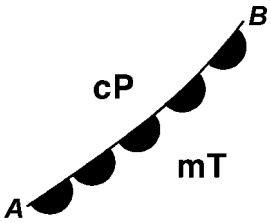
D) 

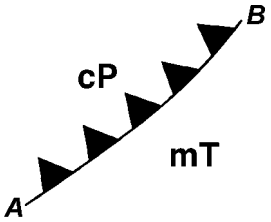
232) The weather map below shows a portion of the United States. Line *AB* represents a frontal boundary between two air masses. The two large arrows indicate the direction that a **cP** air mass is moving.

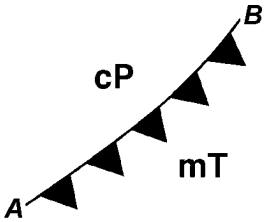


Which symbol correctly represents the frontal boundary at line *AB*?

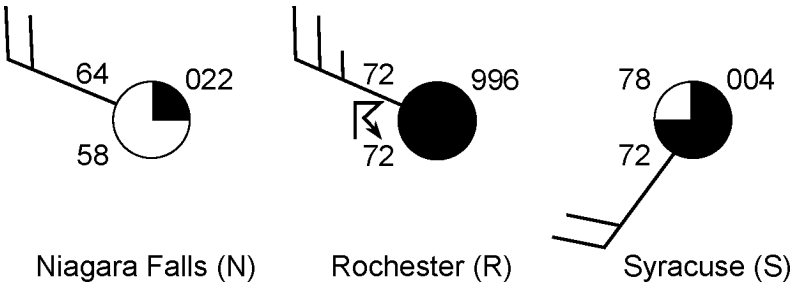
A)


B)


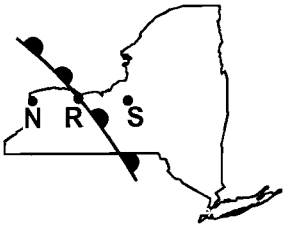
C)


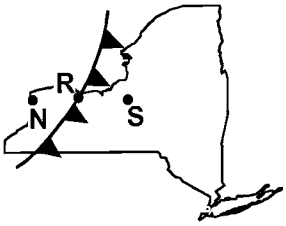
D)


233) Weather station models for three New York State cities on the same day at the same time are shown below.

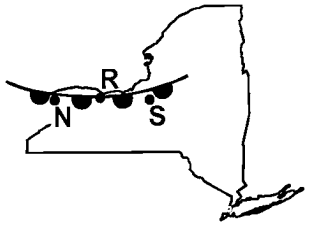


Which map shows the front that was most likely passing through Rochester at that time?

A)


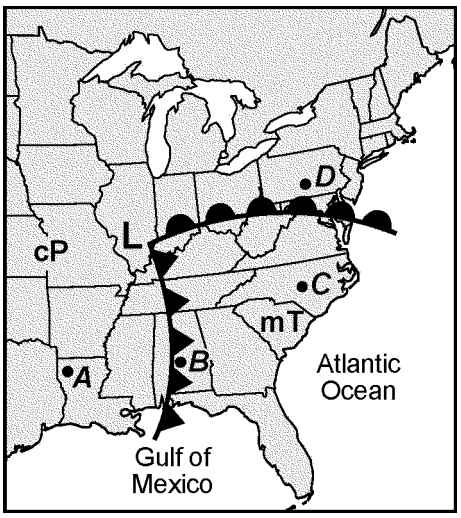
B)


C)


D)


Questions 234 through 236 refer to the following:

The weather map below shows a low-pressure system with two fronts extending from its center (**L**). Points *A*, *B*, *C*, and *D* represent locations on Earth's surface. Two different air masses are labeled.



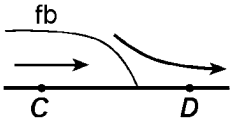
234) Which atmospheric conditions describe the air mass that is influencing weather conditions at location *C* on the given weather map?

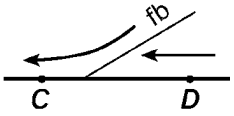
A) cool and moist
B) cool and dry
C) warm and dry
D) warm and moist

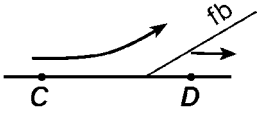
235) Which locations on the weather map shown are most likely experiencing precipitation?

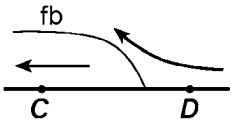
A) *B* and *C*
B) *D* and *B*
C) *C* and *D*
D) *A* and *B*

236) Which cross section *best* represents the frontal boundary (*fb*) and general pattern of air movements between locations *C* and *D* on the given weather map?

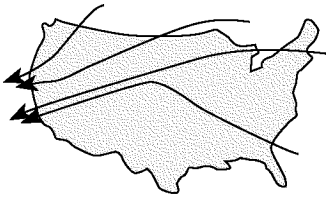
A) 

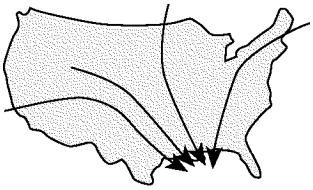
B) 

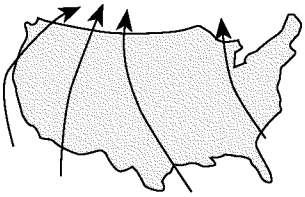
C) 

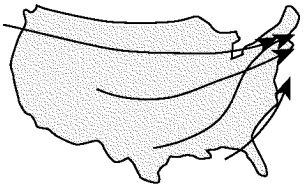
D) 

237) Which map shows normal paths followed by low-pressure storm centers as they pass across the United States?

A) 

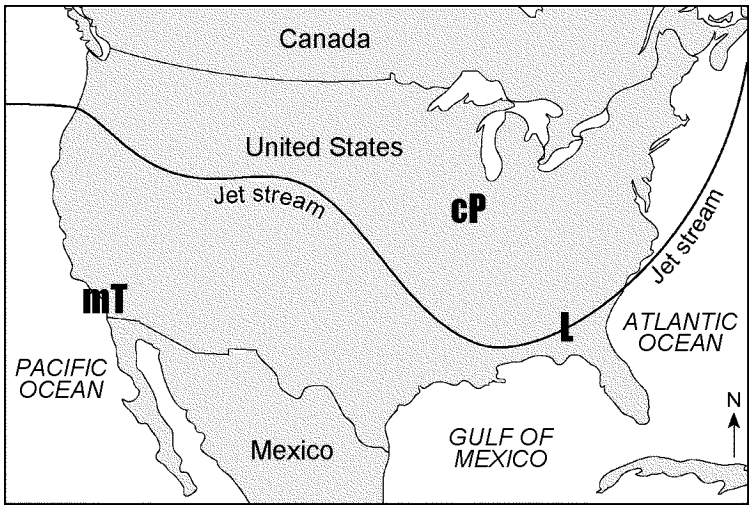
B) 

C) 

D) 

Questions 238 through 240 refer to the following:

The map below shows the position of the jet stream relative to two air masses and a low-pressure center (**L**) over the United States.



238) What is the difference in the air temperature and humidity between the **cP** and **mT** air masses on the given map?

A) The **cP** air mass is warmer and less humid.
B) The **mT** air mass is colder and less humid.
C) The **mT** air mass is warmer and more humid.
D) The **cP** air mass is colder and more humid.

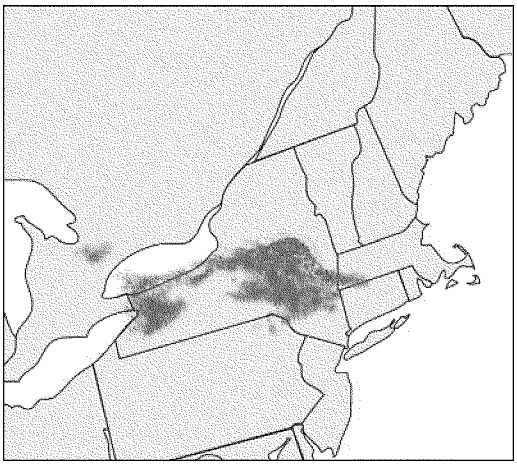
239) What is the general movement of the surface winds around the center of the low-pressure area shown on the map?

A) counterclockwise and inward
B) clockwise and inward
C) counterclockwise and outward
D) clockwise and outward

240) Assuming the low-pressure center (**L**) follows a typical storm track, it will move

A) along the path of the jet stream to the southwest
B) along the path of the jet stream to the northeast
C) into the **mT** air mass to the west
D) into the **cP** air mass to the northwest

241) On the map below, dark-gray areas represent regions of lake-effect snow on a December day.

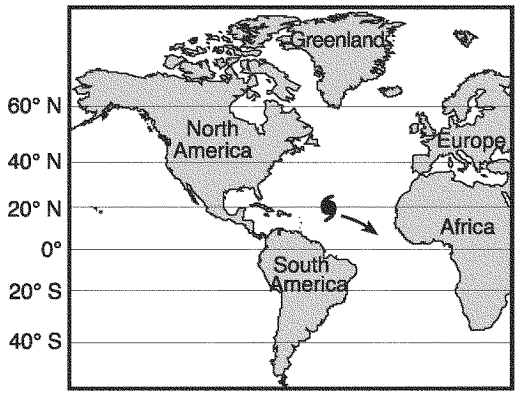


Which New York State location appears to be experiencing a lake-effect snowstorm?

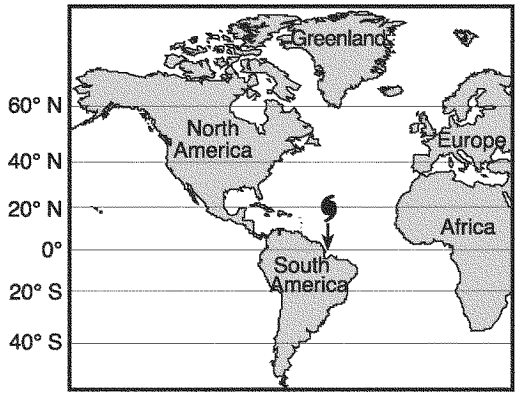
A) Watertown
B) New York City
C) Utica
D) Plattsburgh

242) Which map below shows the most likely storm track for a hurricane (🌀) in the Atlantic Ocean?

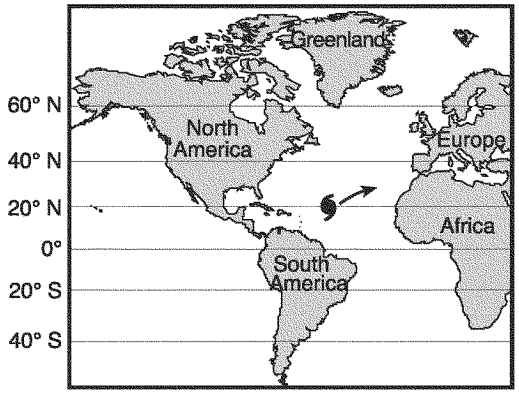
A)



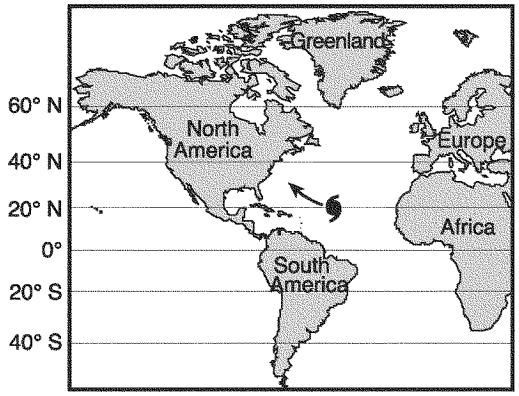
B)



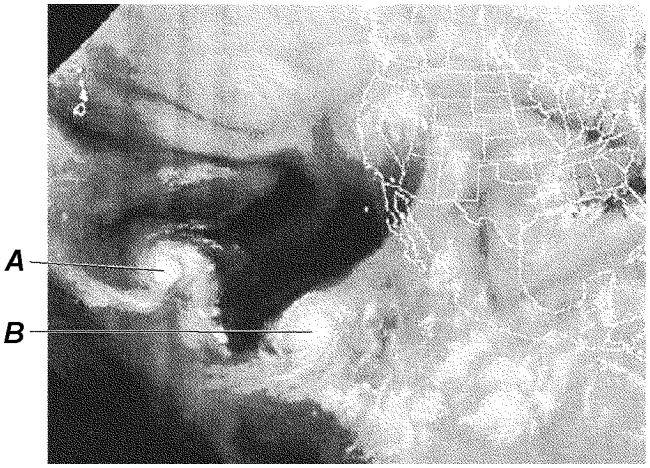
C)



D)



243) The weather satellite image below shows two large swirl-shaped cloud formations, labeled *A* and *B*, over the Pacific Ocean.



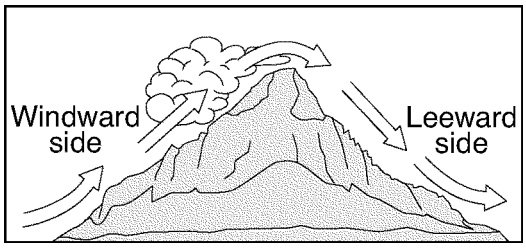
These large swirl-shaped cloud formations most likely represent

A) hurricanes B) warm fronts C) tornadoes D) polar air masses

244) In which planetary wind belt do most storms move toward the northeast?

A) 30D N to 60D N C) 30D S to 60D S
B) 0D to 30D N D) 0D to 30D S

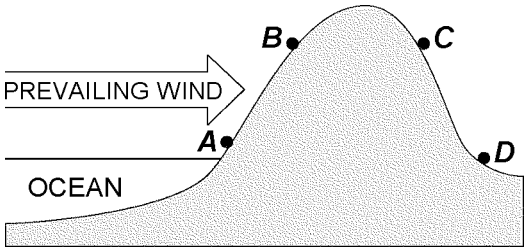
245) The diagram below shows air movement over a mountain.



Compared to the climate on the windward side of the mountain, the climate on the leeward side of the mountain is

A) more humid and warmer
B) more humid and cooler
C) drier and cooler
D) drier and warmer

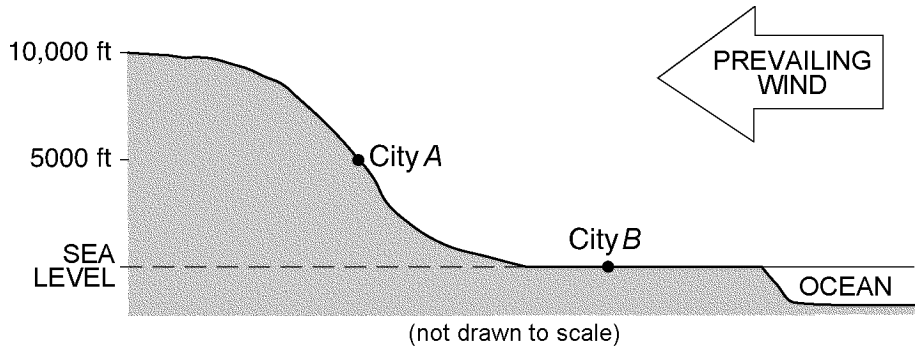
246) The cross section below represents four locations on a mountain. The arrow indicates the prevailing wind direction.



Which location has the *warmest* and *most* arid climate?

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

247) The cross section below shows two cities, *A* and *B*, at different elevations.



Compared to the yearly temperature and precipitation at city *B*, city *A* most likely has

A) lower temperatures and less precipitation
B) higher temperatures and more precipitation
C) higher temperatures and less precipitation
D) lower temperatures and more precipitation

248) The direction of movement of the major surface ocean currents is *most* affected by Earth's

A) tidal action
B) prevailing winds
C) rate of revolution
D) tilted axis

249) What controls the direction of movement of *most* surface ocean currents?

A) prevailing winds
B) varying salt content in the ocean
C) seismic activity
D) density differences at various ocean depths

250) Which ocean current warms the climate of northwestern Europe?

A) North Equatorial Current
B) Canary Current
C) Labrador Current
D) North Atlantic Current

251) The Gulf Stream and North Atlantic Current modify the climate of northwestern Europe by making the climate

A) cooler and more humid
B) warmer and drier
C) warmer and more humid
D) cooler and drier

252) Which two 23.5D-latitude locations are influenced by cool surface ocean currents?

A) the west coast of North America and the west coast of South America
B) the east coast of Asia and the east coast of North America
C) the west coast of Africa and the east coast of South America
D) the east coast of North America and the west coast of Australia

253) Which natural event temporarily slows or reverses surface ocean currents in the equatorial region of the Pacific Ocean, causing a disruption of normal weather patterns?

A) volcanic eruptions
B) monsoons
C) El Niño
D) deforestation

254) During an El Niño event, surface water temperatures increase along the west coast of South America. Which weather changes are likely to occur in this region?

A) decreased air temperature and increased precipitation
B) increased air temperature and increased precipitation
C) increased air temperature and decreased precipitation
D) decreased air temperature and decreased precipitation

255) The table below shows the average January air temperature from 1901 to 2006 in two different cities in New York State.

DATA TABLE

City	Average January Air Temperature (°F)
Albany	21.4
New York City	29.7

The most likely cause of this air temperature difference is that New York City is located

A) at a higher elevation
B) at a higher latitude
C) in a different prevailing wind belt
D) near a large body of water

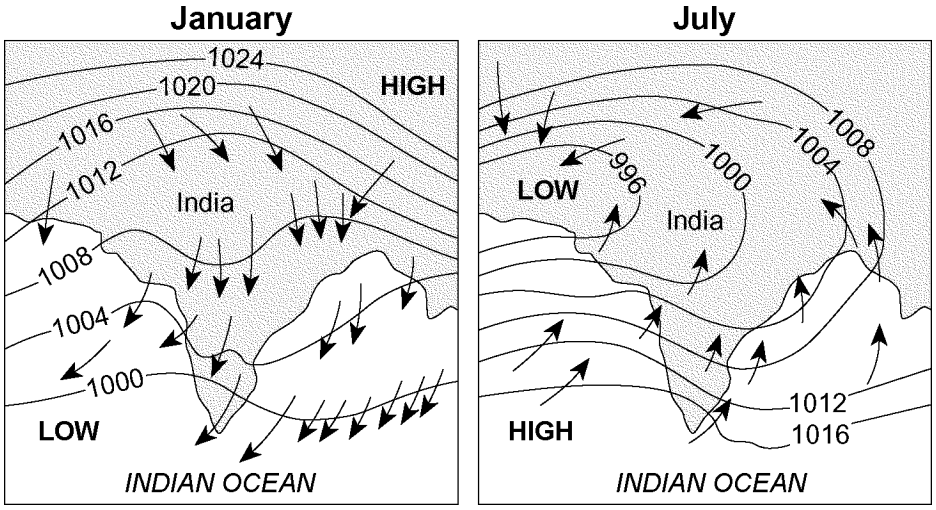
256) A city located on the coast of North America has warmer winters and cooler summers than a city at the same elevation and latitude located near the center of North America. Which one of the following statements *best* explains the difference between the climates of the two cities?

A) Wind speeds are usually greater over land than over ocean water.
B) Ocean surfaces change temperature more slowly than land surfaces.
C) Warm, moist air rises when it meets cool, dry air.
D) Water has a lower specific heat than land.

257) Monsoons develop as a result of

A) air sinking over Earth's polar regions
B) a continent and neighboring oceans having nearly the same temperatures
C) air rising over Earth's equatorial region
D) large changes between the temperatures of a continent and neighboring oceans

258) Arrows on the maps below show differences in the direction of winds in the region of India and the Indian Ocean during January and July. Isobar values are recorded in millibars.

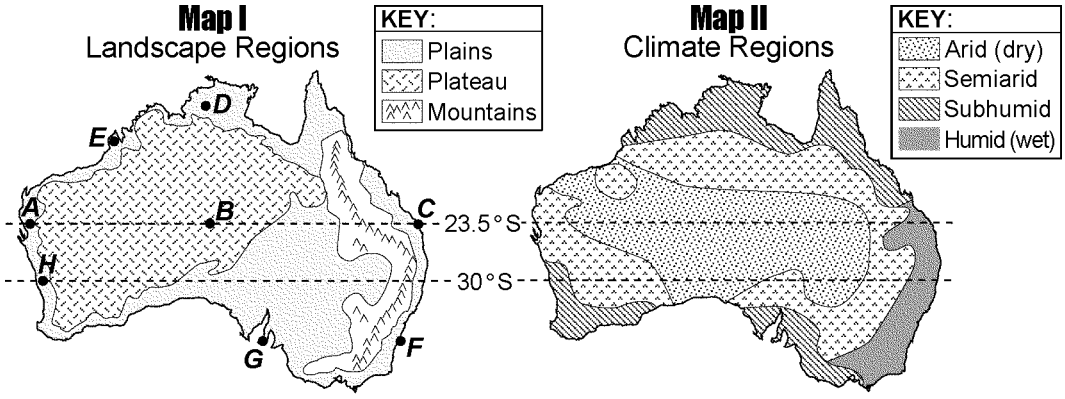


Heavy monsoon rains usually occur in India during

A) January, when winds blow toward high pressure
B) July, when winds blow toward high pressure
C) July, when winds blow from the ocean
D) January, when winds blow from the land

Questions 259 through 262 refer to the following:

Two maps of Australia are shown below.Map *I* shows Australia's major landscape regions. Letters *A* through *H* represent locations in Australia. Map *II* shows Australia's general climate regions.



259) The *greatest* yearly temperature range was most likely recorded at which location on the given map?

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

260) Which location on the map has a climate that is *most* affected by the East Australia Current?

A) *H* C) *E*
B) *G* D) *F*

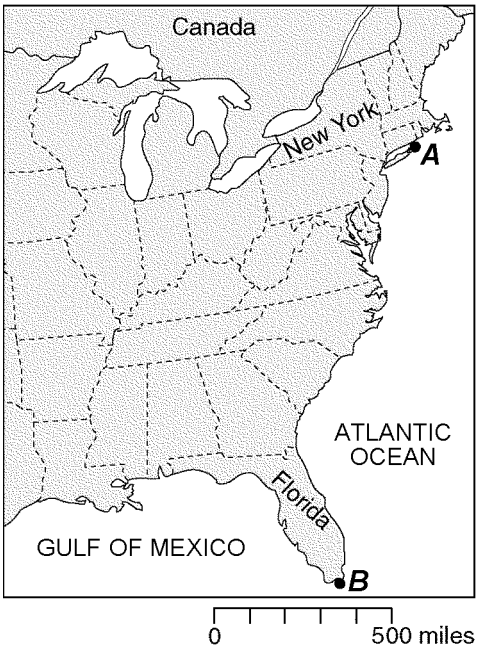
261) Which two locations on the given map have the *driest* climates?

A) *G* and *H* C) *C* and *F*
B) *A* and *B* D) *D* and *E*

262) Location *B* on the given map is in a landscape region that has

A) high elevations and horizontal bedrock
B) high elevations and deformed bedrock
C) low elevations and deformed bedrock
D) low elevations and horizontal bedrock

263) The map below shows an eastern portion of North America. Points *A* and *B* represent locations on the eastern shoreline.



Which factor is primarily responsible for location *A* having a *lower* average yearly temperature than location *B*?

A) elevation
B) nearness to a large body of water
C) latitude
D) prevailing winds

264) El Cuy is a South American city located at 40D south latitude. The first day of winter at this location occurs on June 21. During which month would the *coldest* day of the year most likely occur at this location?

A) July C) January
B) May D) November

265) What *best* explains why, in early spring, ice remains longer on Lake Erie than on the surrounding land areas when the air temperature is above freezing?

A) Water has a higher specific heat than land.
B) Air temperature does not affect water temperature.
C) Energy is needed for water to evaporate.
D) Cool winds from the surrounding land cool the ice on the lake.

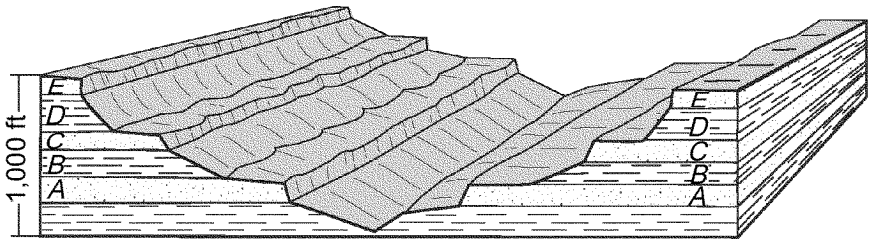
266) The formation of soil is primarily the result of

A) precipitation and wind erosion
B) stream erosion and mass movement
C) stream deposition and runoff
D) weathering and biological activity

267) Which mineral would most likely become rounded at the *fastest* rate when tumbled along a stream bottom?

A) garnet
B) selenite gypsum
C) plagioclase feldspar
D) pyroxene

268) The block diagram below shows a cross section of a landscape. Letters *A*, *B*, *C*, *D*, and *E* represent different rock layers.



Which rock layers appear to be *most* resistant to weathering?

A) *A* and *B*
B) *A*, *C*, and *E*
C) *C*, *D*, and *E*
D) *B* and *D*

269) Which rock weathers most rapidly when exposed to acid rain?

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

Questions 270 through 273 refer to the following:

The weathering of four different rock samples with different masses was studied. Each rock sample was placed in a separate beaker containing 500 milliliters of a dilute acid for 10 minutes. Bubbling was observed in some of the beakers. The data table below shows the mass of each sample, in grams, before placement in the acid and after removal from the acid.

DATA TABLE:

Rock	Mass Before (g)	Mass After (g)
limestone	19.72	19.64
granite	20.77	20.77
gneiss	26.83	26.83
marble	20.81	20.73

270) Which Earth process is being modeled by the given experiment?

A) physical weathering in the hydrosphere
B) physical weathering in the mesosphere
C) chemical weathering in the mesosphere
D) chemical weathering in the hydrosphere

271) Which table correctly shows the classification of the rock samples based on the amount of weathering that occurred during the given experiment?

A)

Group *A*	Group *B*
limestone marble	granite gneiss

B)

Group *A*	Group *B*
limestone granite	gneiss marble

C)

Group *A*	Group *B*
limestone	granite marble gneiss

D)

Group *A*	Group *B*
limestone granite gneiss	marble

272) Approximately what percentage of the marble sample remained after the given experiment concluded?

A) 20.7%
B) 8.0%
C) 99.6%
D) 0.4%

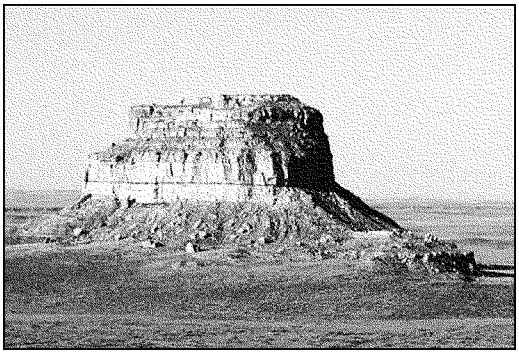
273) Which property of the gneiss sample prevented it from weathering during the given experiment?

A) mineral composition
B) cleavage
C) crystalline texture
D) density

274) Which sediment is most easily picked up and transported by the wind?

A) silt
B) cobbles
C) sand
D) pebbles

275) The photograph below shows a sandstone butte in an arid region.



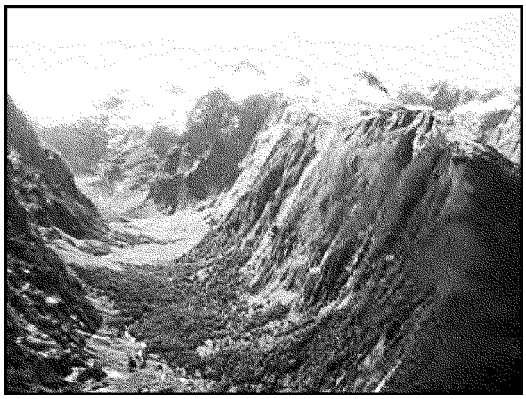
Which agents of erosion are currently changing the appearance of this butte?

A) wind and mass movement
B) glaciers and mass movement
C) running water and glaciers
D) wave action and running water

276) A landslide is an example of

A) mass movement
B) river deposition
C) chemical weathering
D) glacial scouring

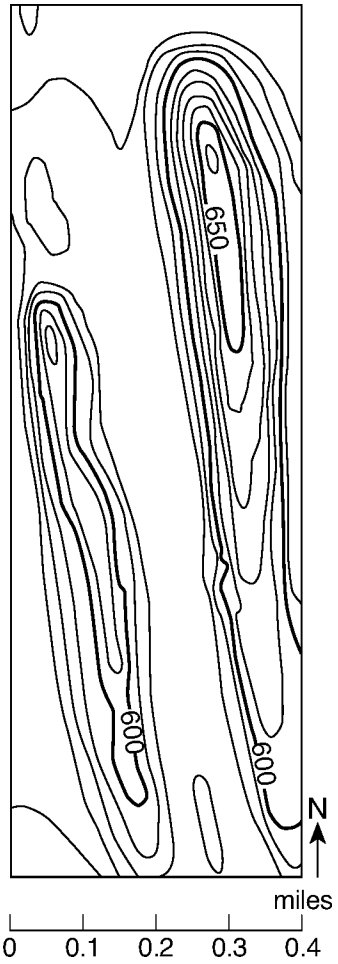
277) The photograph below shows a valley.



Which agent of erosion most likely produced this valley's shape?

A) ocean waves
B) blowing wind
C) moving ice
D) running water

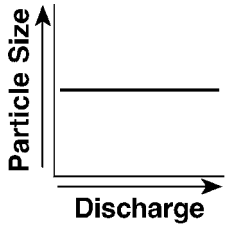
278) The topographic map below shows two hills located in upstate New York.

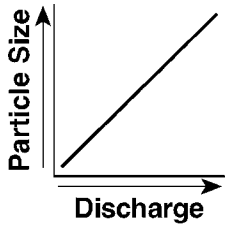


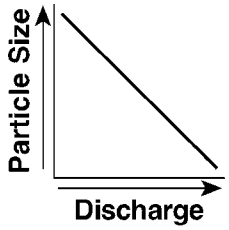
Which agent of erosion is *most* responsible for the shape of these hills?

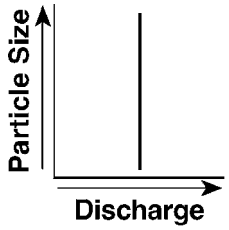
A) waves
B) gravity
C) wind
D) glaciers

279) Which graph *best* represents the correct relationship between the discharge of a river and the particle size that can be transported by that river?

A)


B)


C)


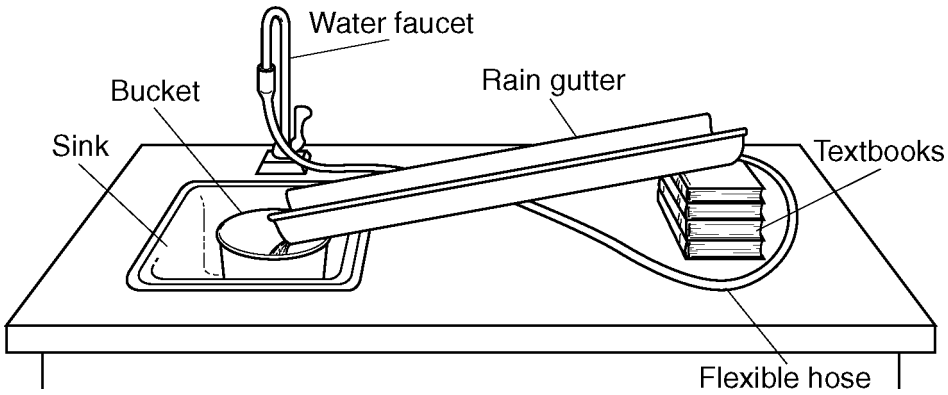
D)


280) What is the approximate minimum stream velocity needed to keep a 6.4-cm-diameter particle in motion?

A) 100 cm/s
B) 200 cm/s
C) 10 cm/s
D) 50 cm/s

Questions 281 and 282 refer to the following:

The diagram below show the equipment used to determine the factors affecting the rate of erosion in a stream. The data table shows the time it took a 10-gram sample of quartz sand to move 100 centimeters down the rain gutter under various conditions.



DATA TABLE:

Rain Gutter Slope	Water Velocity	Erosion Time (s)	
		Fine Sand	Coarse Sand
5°	slow	20	60
	fast	15	40
10°	slow	15	40
	fast	10	30
20°	slow	10	30
	fast	5	15

281) In the given experiment, the water velocity could be increased by

A) decreasing the slope of the rain gutter
B) increasing the amount of water from the faucet
C) widening the rain gutter
D) lowering the flexible hose

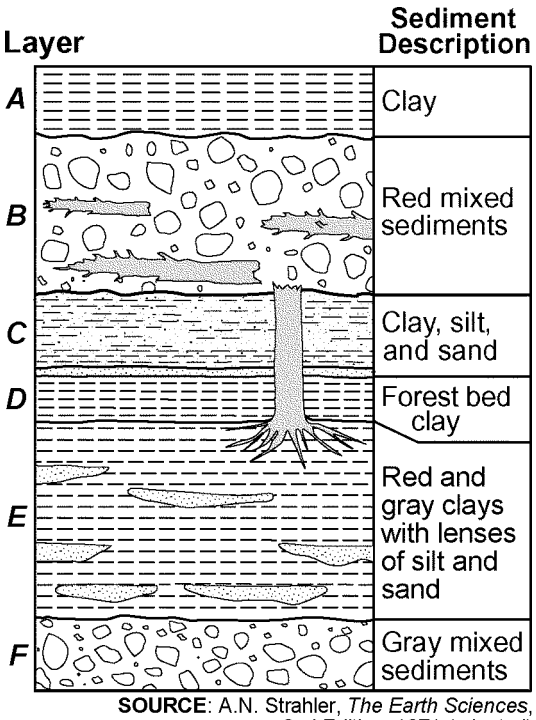
282) What is the relationship between the water velocity and the rate of erosion in the given experiment?

A) If the water velocity decreases, the rate of erosion increases.
B) If the water velocity remains constant, the rate of erosion increases.
C) If the water velocity increases, the rate of erosion increases.
D) If the water velocity remains constant, the rate of erosion decreases.

283) Pieces of bedrock material that are broken from a cliff and deposited by a landslide at the base of the cliff are best described as

A) angular and sorted
B) angular and unsorted
C) rounded and sorted
D) rounded and unsorted

284) The cross section below shows layers of sediments deposited in a region of Wisconsin that has experienced several periods of glaciation. Descriptions of the sediments in layers *A* through *F* are included.



SOURCE: A.N. Strahler, *The Earth Sciences*, 2nd Edition, 1971 (adapted)

Which two layers of sediments were probably deposited directly by glaciers?

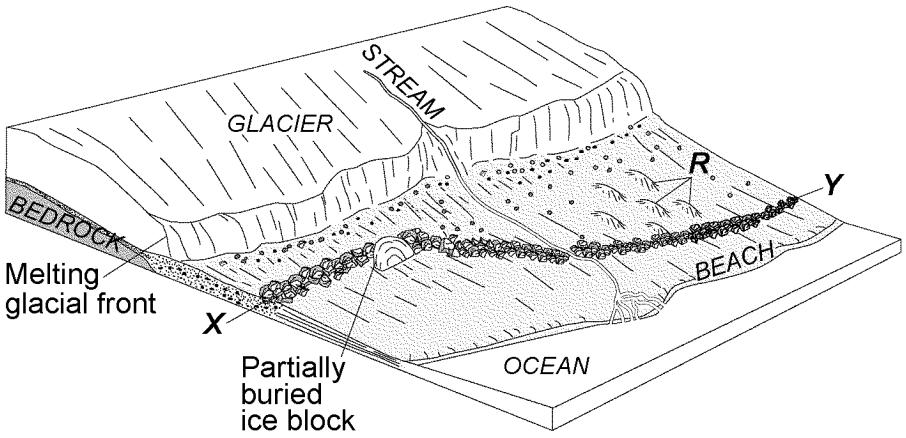
A) *D* and *E*
B) *C* and *E*
C) *B* and *F*
D) *A* and *D*

285) Sediments found in glacial moraines are *best* described as

A) sorted and not layered
B) sorted and layered
C) unsorted and not layered
D) unsorted and layered

Questions 286 through 288 refer to the following:

The diagram below shows the edge of a continental glacier that is receding. *R* indicates elongated hills. The ridge of sediments from *X* to *Y* represents a landscape feature.



286) The ridge of sediments from *X* to *Y* on the given diagram can *best* be described as

A) unsorted and deposited by ice
B) unsorted and deposited by meltwater
C) sorted and deposited by meltwater
D) sorted and deposited by ice

287) The elongated hills labeled *R* on the given diagram are *most* useful in determining the

A) age of the glacier
B) thickness of the glacier
C) direction the glacier has moved
D) rate at which the glacier is melting

288) Which feature will most likely form when the partially buried ice block on the given diagram melts?

A) finger lake
B) moraine
C) drumlin
D) kettle lake

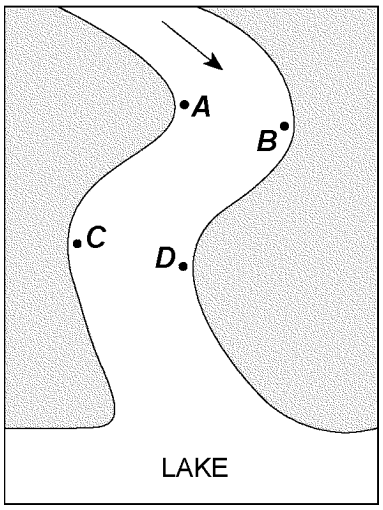
289) Sandstone, limestone, and conglomerate cobbles are found in a streambed in New York State where the surrounding bedrock is composed of shales and siltstones. The most likely explanation for the presence of these cobbles is that they were

A) weathered from the surrounding bedrock
B) formed when shale and siltstone bedrock were eroded
C) transported to this area from another region
D) metamorphosed from shale and siltstone

290) What is the approximate minimum stream velocity needed to keep a particle in motion that has a diameter of 10 centimeters?

A) 110 cm/s
B) 190 cm/s
C) 425 cm/s
D) 325 cm/s

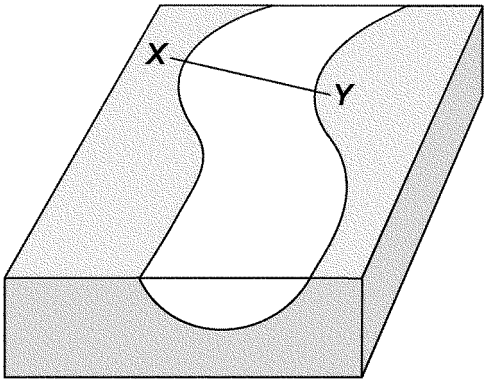
291) The map below shows a meandering stream as it enters a lake. The arrow shows the direction of stream flow. Points *A* through *D* represent locations on the surface of the stream.



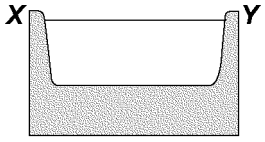
The greatest stream velocities are found *closest* to points

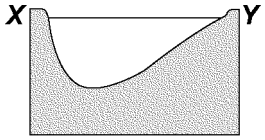
A) *B* and *C*
B) *D* and *A*
C) *A* and *B*
D) *C* and *D*

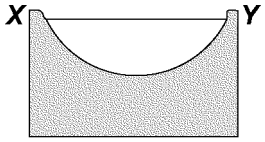
292) The block diagram below shows part of a meandering stream. Line *XY* shows the location of a stream cross section.

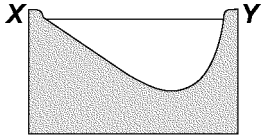


Which cross section *best* represents the shape of the stream channel at line *XY*?

A)


B)


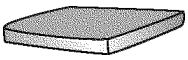
C)


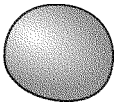
D)


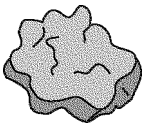
293) Trees growing on the edge of a river's meander are most likely to fall into the river due to

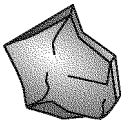
A) erosion on the outside of the meander
B) deposition on the inside of the meander
C) deposition on the outside of the meander
D) erosion on the inside of the meander

294) Each of the rock particles below has the same density and volume. Which particle will most likely settle at the *fastest* rate in moving water?

A) 

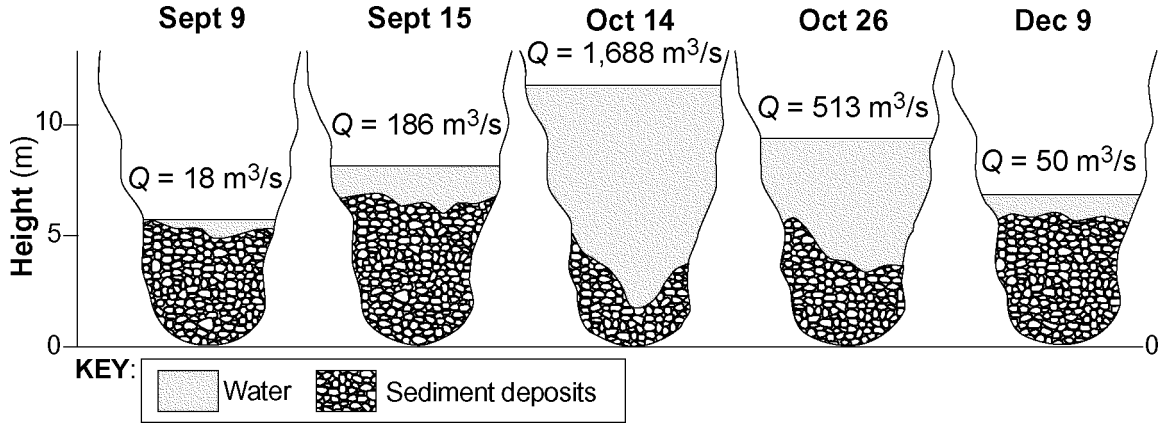
C) 

B) 

D) 

Questions 295 through 297 refer to the following:

The cross sections below represent a particular location of the channel of the San Juan River in Utah. Changes in river discharge (*Q*), in cubic meters per second, and sediment deposits before, during, and after a flood are shown.



295) During the time from September 9 to October 14 shown on the given diagram, the thickness of the sediment deposits at the bottom of the San Juan River channel

A) increased, only
B) decreased and then increased
C) increased and then decreased
D) decreased, only

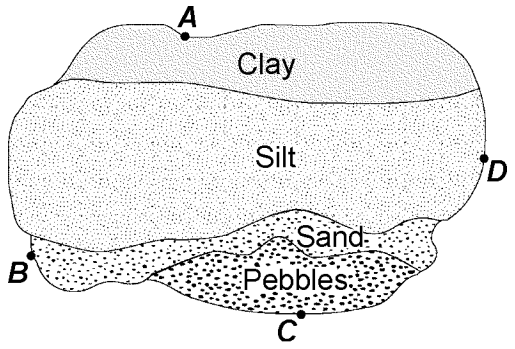
296) On October 14, during the flood, the discharge of the San Juan River changed dramatically. The change in the river's discharge at this location was related to an increase in the river's

A) channel length
B) gradient
C) sediment deposits
D) velocity

297) If the *greatest* velocity of the San Juan River on December 9 was 10 centimeters per second, what was the approximate diameter of the *largest* particles that the river could have carried?

A) 1.0 cm
B) 10.0 cm
C) 0.2 cm
D) 2.0 cm

298) The map below shows an overhead view of sediments that have accumulated at the bottom of a lake. Points *A* through *D* represent locations on the shoreline of the lake.



A river most likely flows into the lake nearest to which location?

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

299) Sediment is deposited in a river delta because the

A) force of gravity decreases
B) velocity of the river decreases
C) volume of the river increases
D) gradient of the river increases

300) A stream's velocity decreases from 100 cm/s to 5 cm/s. Which size sediment particles will still be transported by the stream?

A) sand, silt, and clay, only
B) silt and clay, only
C) clay, only
D) pebbles, sand, silt, and clay

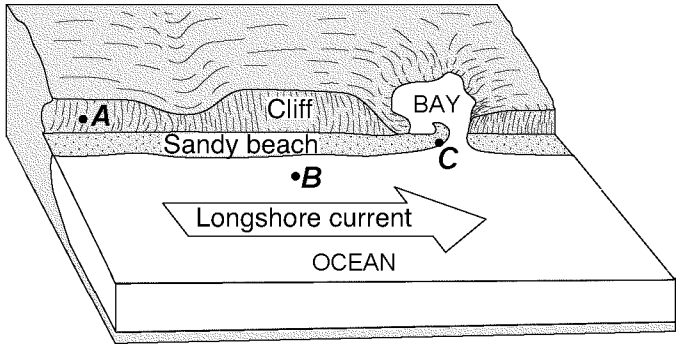
301) A river's current carries sediments into the ocean. Which sediment size will most likely be deposited in deeper water *farthest* from the shore?

A) silt
B) clay
C) sand
D) pebble

302) The narrow, sandy, barrier islands in the ocean along the south coast of Long Island were deposited by

A) streams
B) wind
C) wave action
D) glacial ice

303) The block diagram below shows a part of the eastern coastline of North America. Points *A*, *B*, and *C* are reference points along the coast.

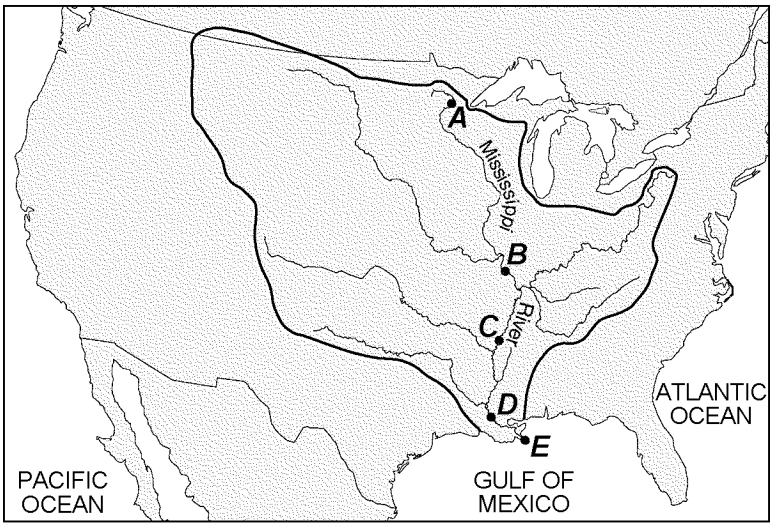


Which list *best* represents the primary processes occurring along the coastline at points *A*, *B*, and *C*?

A) *A* ‡‡ folding; *B* ‡‡ subduction; *C* ‡‡ crosscutting
B) *A* ‡‡ precipitation; *B* ‡‡ infiltration; *C* ‡‡ evaporation
C) *A* ‡‡ faulting; *B* ‡‡ conduction; *C* ‡‡ mass movement
D) *A* ‡‡ weathering; *B* ‡‡ erosion; *C* ‡‡ deposition

Questions 304 through 306 refer to the following:

The map below shows a portion of the continent of North America and outlines the Mississippi River watershed. Points *A*, *B*, *C*, *D*, and *E* represent locations on Earth's surface.



304) At which location on the map would the Mississippi River's discharge most likely be the *greatest*?

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

305) Sediments deposited by the river at location *B* on the map are *best* described as

A) unsorted and layered
B) unsorted and not layered
C) sorted and not layered
D) sorted and layered

306) Which landform is produced at location *E* on the map where the Mississippi River enters the Gulf of Mexico?

A) a delta
B) an outwash plain
C) an escarpment
D) a drumlin

307) Which mineral precipitates from oceans and forms rock salt?

A) quartz
B) halite
C) fluorite
D) olivine

308) Which material is made mostly of the mineral quartz?

A) window glass
B) sulfuric acid
C) plaster of paris
D) pencil lead

309) Mineral crystals of quartz, biotite mica, and amphibole are produced primarily by the

A) deposition of sediments by a glacier
B) metamorphism of bituminous coal
C) chemical reaction of elements in seawater
D) cooling and solidification of magma

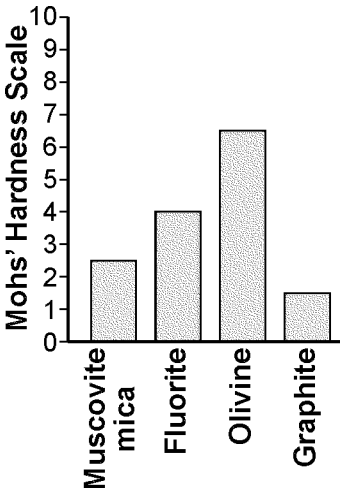
310) Which two properties are *most* useful in distinguishing between galena and halite?

A) hardness and streak
B) luster and color
C) streak and cleavage
D) cleavage and color

311) Which mineral will scratch fluorite, galena, and pyroxene?

A) olivine
B) dolomite
C) calcite
D) graphite

312) The graph below shows the hardness of four minerals.



Which mineral is hard enough to scratch calcite but is *not* hard enough to scratch amphibole?

A) muscovite mica
B) olivine
C) graphite
D) fluorite

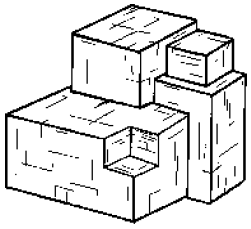
Questions 313 and 314 refer to the following:

The table provides information about four minerals, *A* through *D*.

DATA TABLE:

Mineral	Breakage	Hardness	Luster	Color
A	cleavage	2.5	metallic	silver
B	cleavage	2.5	nonmetallic	black
C	cleavage	3	nonmetallic	colorless
D	fracture	6.5	nonmetallic	green

313) The diagram below represents a sample of mineral *A*.



According to the information given in the table, mineral *A* is most likely

A) galena
B) garnet
C) halite
D) olivine

314) Based on the data given in the table, which mineral can scratch *A*, *B*, and *C*, but can *not* scratch *D*?

A) fluorite
B) quartz
C) talc
D) selenite gypsum

315) The table below lists some information about the minerals graphite and diamond.

DATA TABLE:

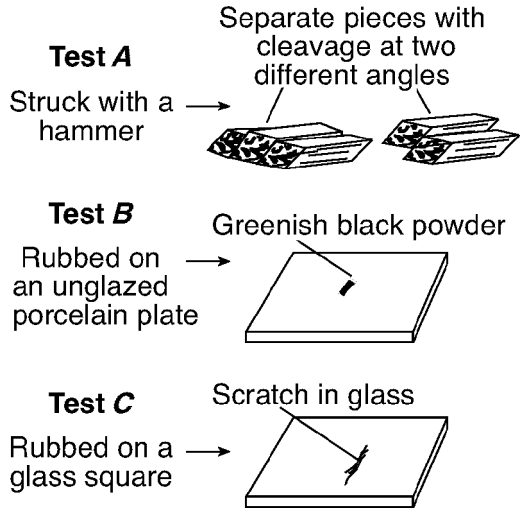
Mineral	Composition	Depth of Formation	Hardness	Electrical Conductor
graphite	carbon	shallow	1	good
diamond	carbon	very deep	10	poor

Some properties of diamond are different from those of graphite because diamond

A) has a different composition
B) has a different arrangement of atoms
C) forms larger crystals
D) is older in geologic age

Questions 316 and 317 refer to the following:

The diagram below shows the results of three different physical tests, *A*, *B*, and *C*, that were performed on a mineral.



316) Which mineral was tested in the given diagram?

A) amphibole
B) galena
C) graphite
D) quartz

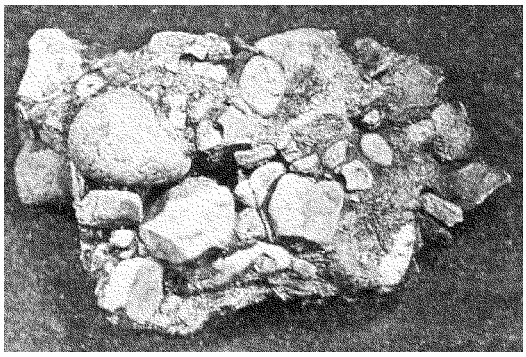
317) The luster of the mineral tested in the given diagram could be determined by

A) using a graduated cylinder
B) observing how light reflects from the surface of the mineral
C) using an electronic balance
D) observing what happens when acid is placed on the mineral

318) Most of the sediment that is compacted and later forms shale bedrock is

A) clay
B) sand
C) silt
D) pebbles

319) A student classified the rock below as sedimentary.



Which observation about the rock *best* supports this classification?

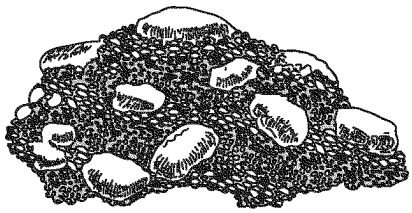
A) The rock has a vesicular texture.
B) The rock contains fragments of other rocks.
C) The rock is composed of several minerals.
D) The rock shows distorted and stretched pebbles.

320) Most rocks that form from fragmental rock particles are classified as

A) clastic sedimentary
B) intrusive igneous
C) extrusive igneous
D) chemical sedimentary

Questions 321 and 322 refer to the following:

The diagram below represents a rock composed of cemented pebbles and sand.



321) The rock shown in the diagram should be classified as

A) an extrusive igneous rock
B) a bioclastic sedimentary rock
C) a clastic sedimentary rock
D) an intrusive igneous rock

322) Which change would most likely occur if the given rock became buried deep within Earth's crust and was subjected to intense heat and pressure, but did *not* melt?

A) The pebbles would become distorted and the sand would be recrystallized.
B) The density of the pebbles and sand would decrease.
C) The rock would become a plutonic rock composed mostly of quartz.
D) The rock would become more felsic with a higher concentration of magnesium.

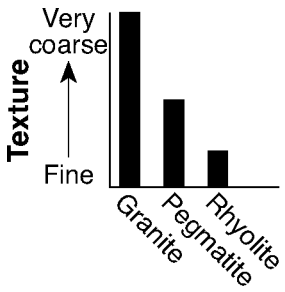
323) Which processes lead directly to the formation of igneous rock?

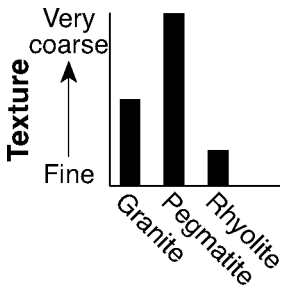
A) heat and pressure
B) weathering and erosion
C) compaction and cementation
D) melting and solidification

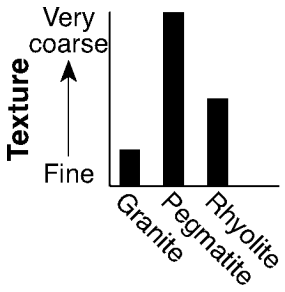
324) Which mineral can be found in all samples of rhyolite and andesite?

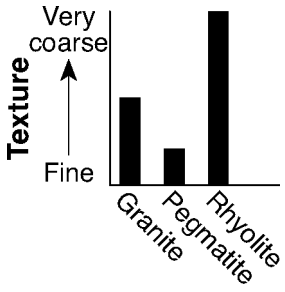
A) pyroxene
B) potassium feldspar
C) quartz
D) biotite

325) Which graph *best* represents the textures of granite, pegmatite, and rhyolite?

A)


B)


C)


D)


326) Which texture *best* describes an igneous rock that formed deep underground?

A) coarse grained
B) vesicular
C) fine grained
D) glassy

327) What is the color and type of rock that forms oceanic crust at mid-ocean ridges?

A) light colored and igneous
B) light colored and sedimentary
C) dark colored and sedimentary
D) dark colored and igneous

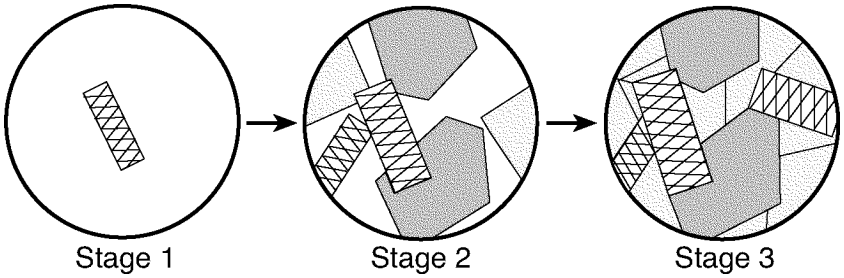
328) Obsidian's glassy texture indicates that it formed

A) slowly, on Earth's surface
B) quickly, deep below Earth's surface
C) slowly, deep below Earth's surface
D) quickly, on Earth's surface

329) Which igneous rock has a vesicular texture and a felsic composition?

A) scoria
B) pumice
C) granite
D) basalt

330) The diagram below shows magnified views of three stages of mineral crystal formation as molten material gradually cools.



Which rock normally forms when minerals crystallize in these stages?

A) gneiss
B) breccia
C) gabbro
D) shale

331) A nonvesicular rock is made entirely of green 2-millimeter-diameter crystals that have a hardness of 6.5 and show fracture, but *not* cleavage. The rock is most likely

A) shale
B) phyllite
C) dunite
D) schist

332) Which rock is only formed by regional metamorphism?

A) dunite
B) marble
C) hornfels
D) slate

333) The data table below lists characteristics of rocks *A*, *B*, *C*, and *D*.

Rock Characteristics

Rock	Texture	Grain Size	Mineral Composition
A	nonfoliated	fine to coarse	calcite, dolomite, carbon
B	banding	coarse	biotite, quartz, plagioclase feldspar
C	bioclastic	microscopic to coarse	carbon, pyroxene, mica
D	foliated	fine to medium	quartz, amphibole, garnet

Which rock is most likely phyllite?

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

334) Earth's internal heat is the primary source of energy that

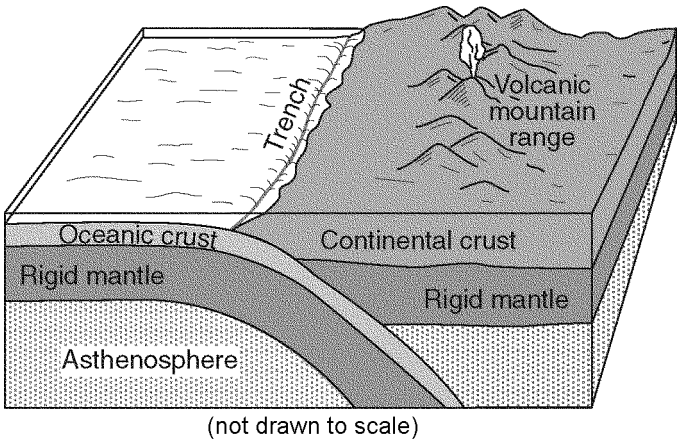
A) warms the lower troposphere
B) pollutes deep groundwater with radioactivity
C) melts glacial ice at lower altitudes
D) moves the lithospheric plates

335) The Indian-Australian tectonic plate is moving

A) toward the Pacific Plate
B) away from the Philippine Plate
C) toward the Antarctic Plate
D) away from the Fiji Plate

Questions 336 and 337 refer to the following:

The block diagram below shows a tectonic plate boundary.



(not drawn to scale)

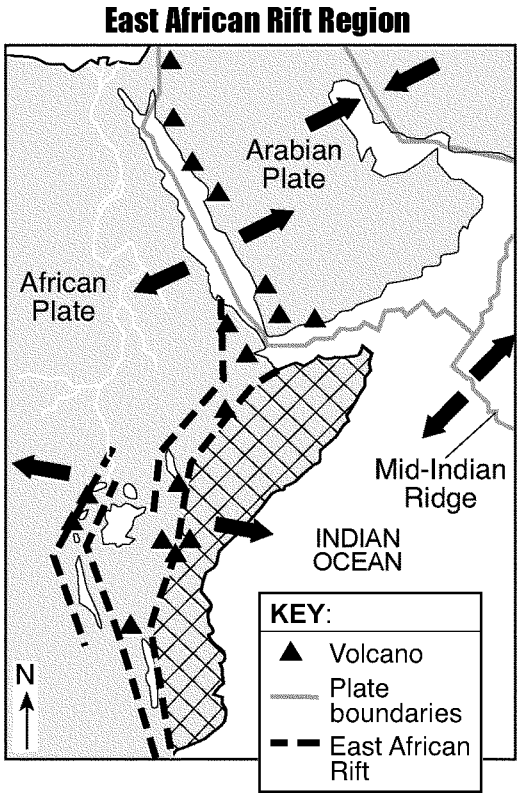
336) Which tectonic plate boundary is *best* represented by the given diagram?

A) Juan de Fuca Plate and North American Plate boundary
B) Antarctic Plate and Indian-Australian Plate boundary
C) Scotia Plate and South American Plate boundary
D) Nazca Plate and Pacific Plate boundary

337) Compared to the oceanic crust, the continental crust is

A) less dense and more felsic
B) less dense and more mafic
C) more dense and more felsic
D) more dense and more mafic

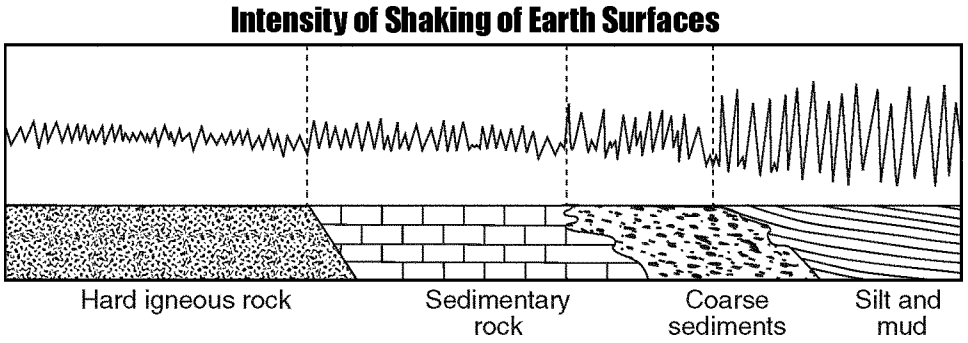
338) The map below shows the tectonic plate boundaries near the East African Rift. Arrows show relative tectonic plate movement. A region of Africa is crosshatched ( ).



What appears to be happening to the crosshatched region of eastern Africa in the given map?

A) This region is moving northward relative to the rest of Africa.
B) A folded mountain range is forming as this region collides with the rest of Africa.
C) Several volcanic mountains are forming as the rest of Africa subducts under this region.
D) This region is moving eastward relative to the rest of Africa.

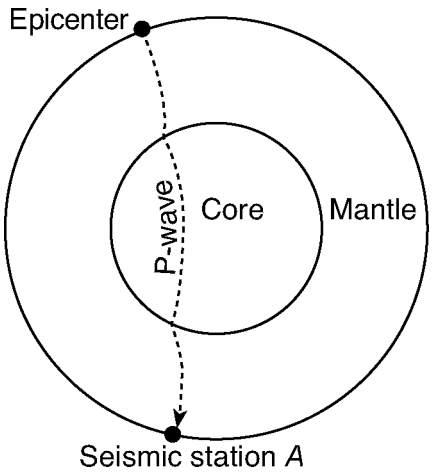
339) The diagram below represents the intensity of the shaking that occurs on different Earth surfaces during the same earthquake.



The *greatest* earthquake hazard to homes exists when they are built on

A) coarse sediments
B) sedimentary rock
C) silt and mud
D) hard igneous rock

340) The cross section of Earth below shows a *P*-wave moving away from an earthquake epicenter to seismic station *A*.

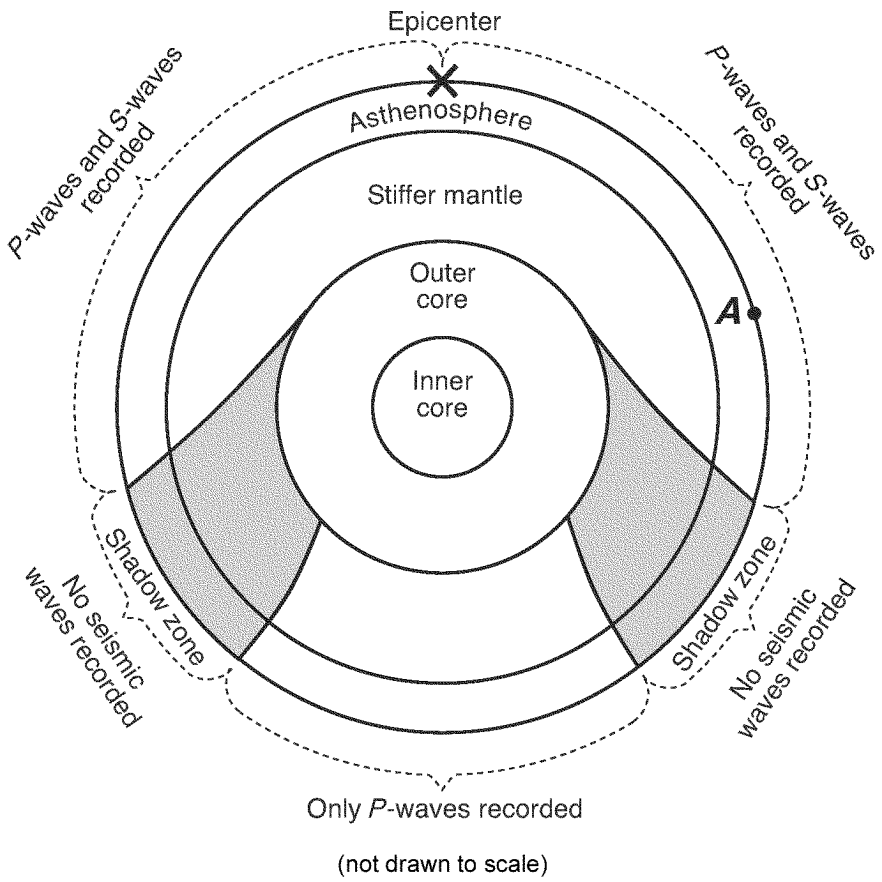


No *S*-waves arrive directly at seismic station *A* because

A) some parts of the core are liquid
B) seismic station *A* is located on glacial ice
C) *S*-waves travel too slowly
D) the distance to seismic station *A* is too great

Questions 341 and 342 refer to the following:

The cross section below shows the type of seismic waves recorded at various locations after an earthquake has occurred. Point *A* is location on Earth's surface and **X** is the epicenter of the earthquake.



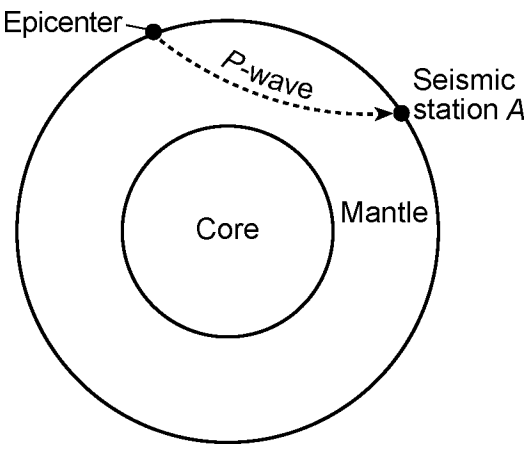
341) How many kilometers did the seismic waves shown travel from the earthquake directly to the outside of the outer core?

A) 2,900 km
B) 6,400 km
C) 800 km
D) 1,400 km

342) Point *A* on the given cross section is located 7,600 kilometers from the epicenter of this earthquake. How many minutes did it take the *first S*-wave to reach point *A*?

A) 9 min
B) 16 min
C) 11 min
D) 20 min

343) 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?

A) 21 minutes 20 seconds
B) 8 minutes 40 seconds
C) 5 minutes 00 second
D) 9 minutes 40 seconds

344) What is the approximate time difference between the first *P*-wave and the first *S*-wave recorded at a seismic station located 8,000 kilometers from an earthquake's epicenter?

A) 11 minutes 20 seconds
B) 8 minutes 40 seconds
C) 9 minutes 20 seconds
D) 20 minutes 40 seconds

345) 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?

A) 12:19:40 p.m. and 4,000 km
B) 12:11:25 p.m. and 4,000 km
C) 12:19:40 p.m. and 6,000 km
D) 12:11:25 p.m. and 6,000 km

346) 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?

A) 1:38 p.m.
B) 1:22 p.m.
C) 1:20 p.m.
D) 1:40 p.m.

347) The arrival time of the first earthquake *P*-wave at a seismograph station was 10:11:20 (hours: minutes: seconds). If the epicenter of the earthquake is 8,000 km away, what was the approximate arrival time of the first *S*-wave from this earthquake?

A) 10:02:00
B) 10:20:40
C) 10:32:00
D) 10:09:20

Questions 348 through 350 refer to the following:

The data table below gives information collected at seismic stations *W*, *X*, *Y*, and *Z* for the same earthquake. Some of the data have been omitted.

DATA TABLE:

Seismic Station	*P*-Wave Arrival Time (h:min:s)	*S*-Wave Arrival Time (h:min:s)	Difference in Arrival Times (h:min:s)	Distance to Epicenter (km)
W	10:50:00	no *S*-waves arrived		
X	10:42:00	10:46:40		
Y	10:39:20		00:02:40	
Z	10:45:40			6,200

348) Which of the seismic stations represented in the data table was *farthest* from the earthquake epicenter?

A) *Z*
B) *Y*
C) *W*
D) *X*

349) What is the *most* probable reason for the absence of *S*-waves at station *W*?

A) *S*-waves cannot travel through liquids.
B) Station *W* was located on solid bedrock.
C) *S*-waves were not generated at the epicenter.
D) Station *W* was located on an island.

350) At what time did the *S*-wave arrive at station *Y*?

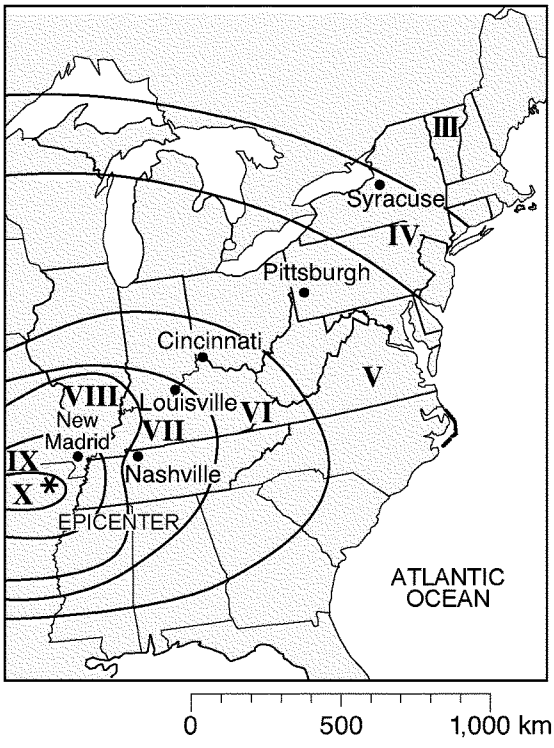
A) 10:36:40
B) 10:42:00
C) 10:45:20
D) 10:39:20

Questions 351 and 352 refer to the following: *

The map below shows the intensities of the earthquake that occurred slightly southwest of New Madrid, Missouri, on December 16,

1811. The epicenter of this earthquake is represented by . The Roman numerals on the map show zones of earthquake intensities

determined by using the modified Mercalli scale.



Modified Mercalli Intensity Scale

I:	Not felt except under unusual conditions
II:	Felt by only a few persons Suspended objects might swing
III:	Quite noticeable indoors
IV:	Dishes and windows rattle
V:	Felt by nearly everyone Some dishes and windows break
VI:	Furniture moves Some plaster falls
VII:	Everybody runs outdoors Some chimneys break
VIII:	Chimneys, smokestacks, and walls fall Heavy furniture is overturned
IX:	Buildings shift off foundations Ground cracks
X:	Most ordinary structures are destroyed Landslides are common
XI:	Few structures remain standing Bridges are destroyed Broad cracks form in the ground
XII:	Damage is total Objects are thrown upward into the air

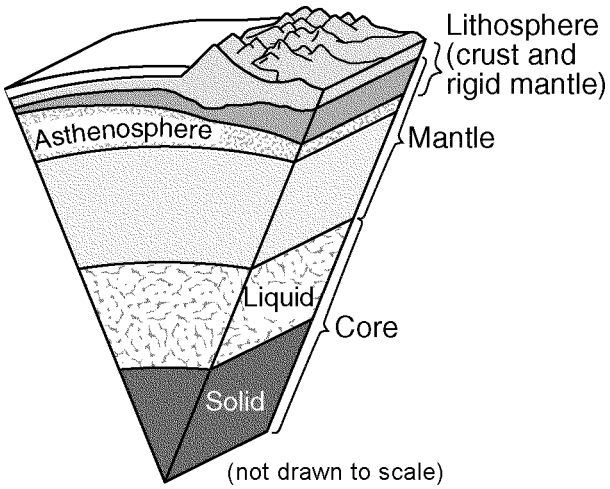
351) Which location on the given map would most probably have issued the report: "Many structures shifted off foundations"?

A) Nashville
B) New Madrid
C) Syracuse
D) Pittsburgh

352) The intensity numbers shown on the map were determined by

A) observations made at different locations during and after the earthquake
B) the recorded time difference in the arrival of the first *P*-wave and *S*-wave at each city
C) the arrival time of the first *P*-wave recorded at each city
D) observations made only at the earthquake epicenter

353) A model of Earth's internal structure is shown below.



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

A) seismic waves
B) depth of Earth's oceans
C) electromagnetic radiation
D) isobar gradients

354) What caused the interior of Earth to separate into layers?

A) collisions with meteors and comets
B) a decrease in the rate of rotation of Earth
C) variations in heating by the Sun due to Earth's tilt
D) the gravitational pull on materials of varying densities

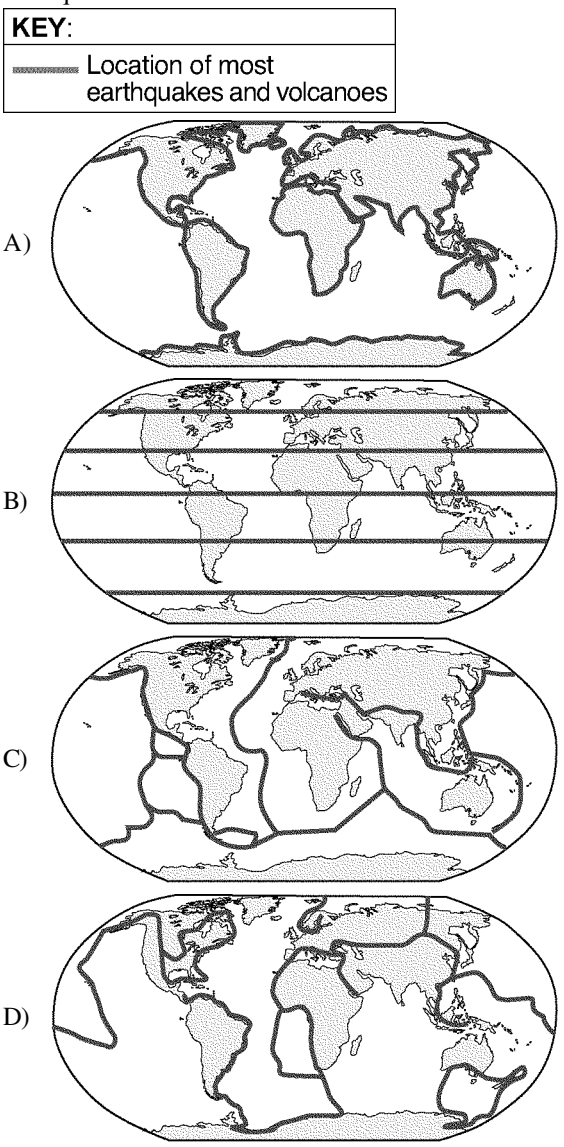
355) The inferred temperature and pressure of Earth's interior at a depth of 3,000 kilometers are approximately

A) 5,000DC and 3.0 million atmospheres
B) 1,000DC and 1.0 million atmospheres
C) 1,000DC and 0.5 million atmospheres
D) 5,000DC and 1.5 million atmospheres

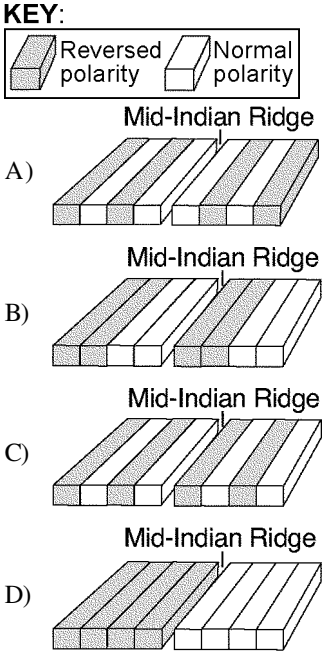
356) Which mineral is most frequently found in *both* granitic continental crust and basaltic oceanic crust?

A) olivine
B) quartz
C) potassium feldspar
D) plagioclase feldspar

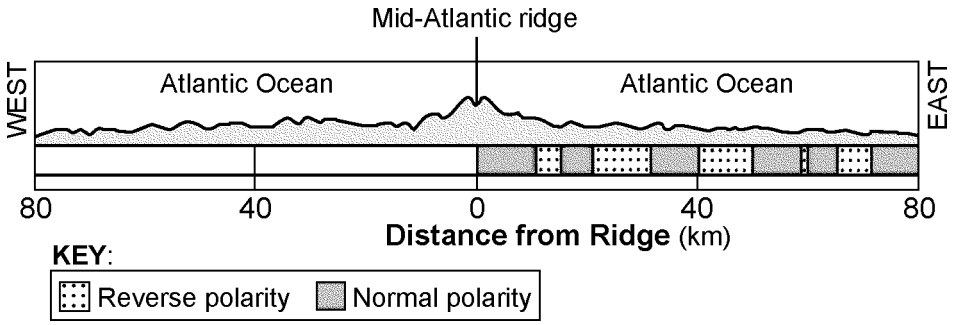
357) Which world map shows the locations where *most* earthquakes and volcanoes occur on Earth?



358) Which diagram *best* represents the polarity of the magnetic field preserved in the ocean-floor bedrock found on both sides of the Mid-Indian Ridge?

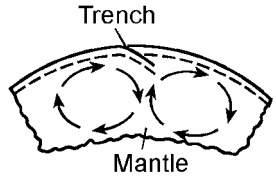


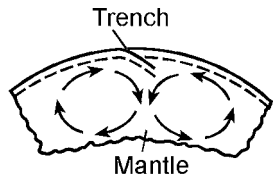
359) The cross section below represents a pattern of magnetic field reversals preserved in the igneous bedrock of the oceanic crust east of the Mid-Atlantic ridge.

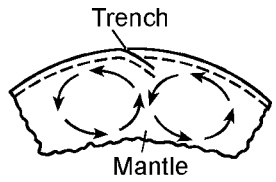


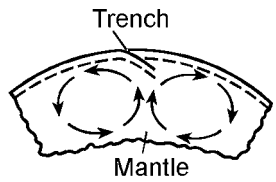
Which cross section best represents the magnetic field pattern west of the Mid-Atlantic ridge?

360) Which cross section *best* represents the convection currents in the mantle beneath the Peru-Chile Trench?

A)


B)


C)


D)


361) Which surface feature was produced by crustal movements at a transform plate boundary?

A) Aleutian Trench
B) San Andreas Fault
C) East African Rift
D) Tasman Hot Spot

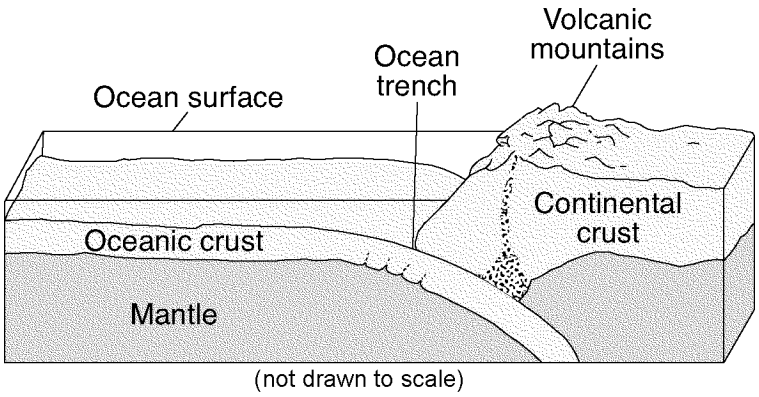
362) Which one of the following landmasses is moving northward with Australia as part of the same tectonic plate?

A) India
B) Antarctica
C) North America
D) South America

363) A ship is at a location of 40DS 77DW. Which type of surface ocean current and tectonic plate boundary are located beneath this ship?

A) cool ocean current and a transform boundary
B) warm ocean current and a transform boundary
C) warm ocean current and a convergent boundary
D) cool ocean current and a convergent boundary

364) The block diagram below shows the boundary between two tectonic plates.



Which type of plate boundary is shown?

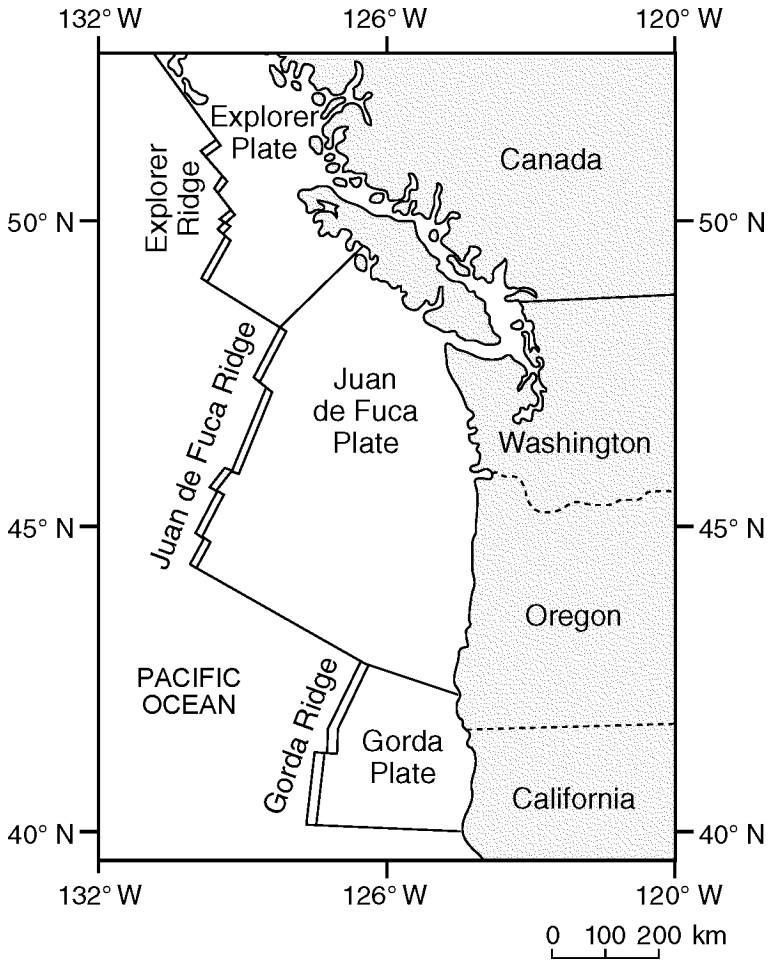
A) transform
B) divergent
C) convergent
D) complex

365) 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

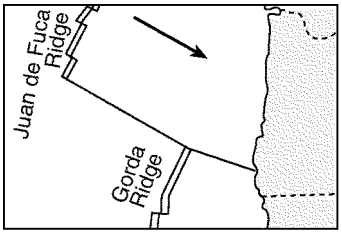
A) divergence of a continental plate
B) subduction of a continental plate
C) divergence of an oceanic plate
D) subduction of an oceanic plate

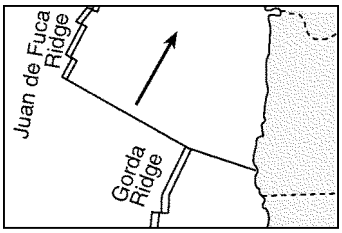
Questions 366 and 367 refer to the following:

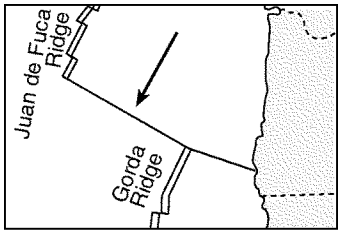
The map below shows the coast of the northwestern United States. The Explorer and Gorda ridges and plates are parts of the Juan de Fuca tectonic system.

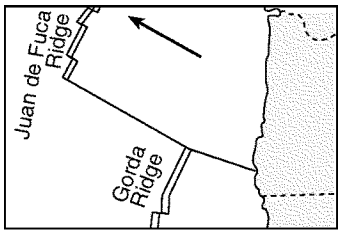


366) The arrow on which map below *best* shows the direction of movement of the Juan de Fuca Plate in relation to the Juan de Fuca Ridge?

A)


B)


C)


D)


367) Based on the data shown on the map, the Explorer Ridge is the boundary between the Explorer Plate and the

A) Gorda Plate
B) Pacific Plate
C) North American Plate
D) Juan de Fuca Plate

Questions 368 through 370 refer to the following:

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.

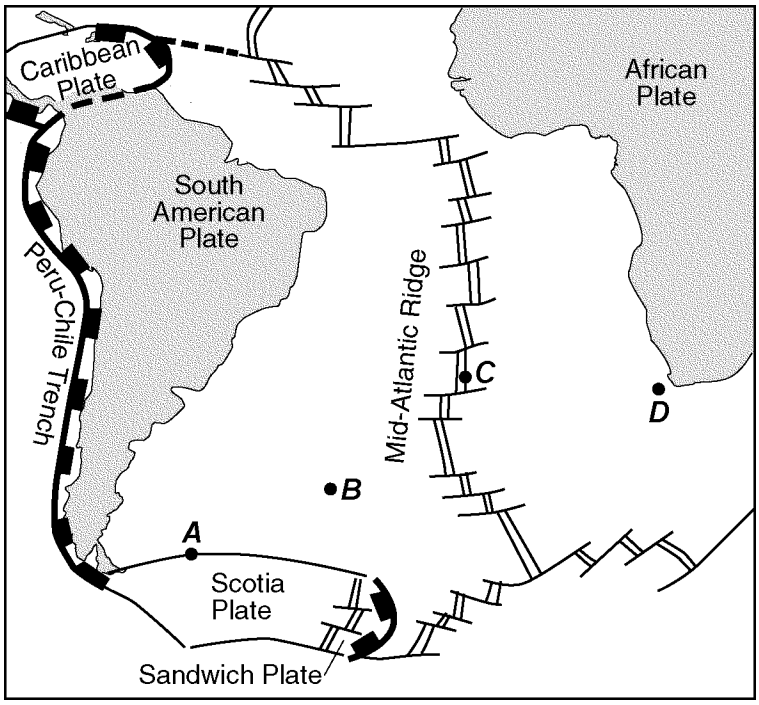
368) Based on the reading passage, which type of tectonic plate boundary is located at mid-ocean ridges?

A) transform
B) complex
C) convergent
D) divergent

369) Which mantle hot spot is located *closest* to a mid-ocean ridge?

A) Easter Island
B) Canary Islands
C) Tasman
D) Hawaii

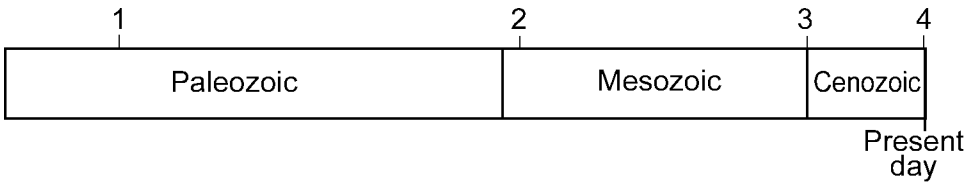
370) The map below shows a part of Earth's surface. Points *A* through *D* are locations on the ocean floor.



Based on the reading passage, at which location is the temperature of the ocean floor bedrock most likely *highest*?

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

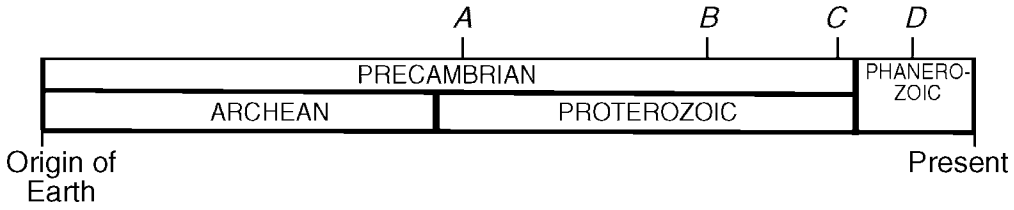
371) The geologic time line below represents the three most recent geologic eras. The numbers represent events in Earth's history.



Which number *best* represents when humans are inferred to have first appeared on Earth?

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

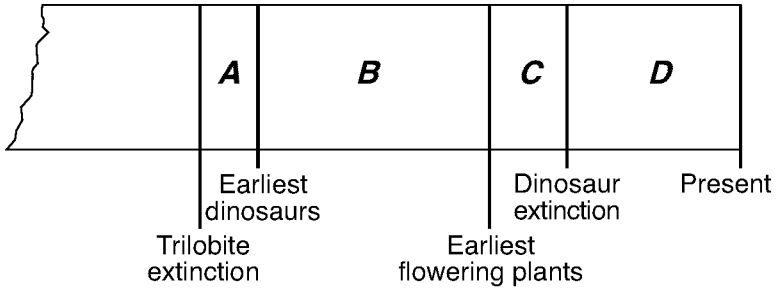
372) A timeline from the origin of Earth until the present is shown below.



At which letter on the timeline did the Ediacaran fauna exist?

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

373) The diagram below is a portion of a geologic timeline. Letters *A* through *D* represent the time intervals between the labeled events, as estimated by scientists.



(not drawn to scale)

Fossil evidence indicates that the *earliest* birds developed during which time interval?

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

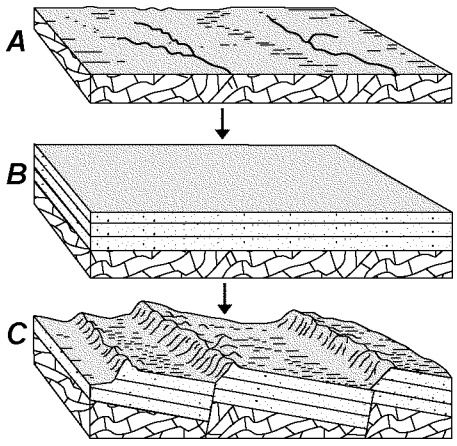
374) Which group of organisms has the *shortest* record of life on Earth?

A) graptolites
B) birds
C) eurypterids
D) placoderm fish

375) Evidence indicates that 251 million years ago a mass extinction of many life-forms occurred on Earth. Which form of life became extinct at this time?

A) dinosaurs
B) trilobites
C) mammoths
D) eurypterids

376) 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?

A) uplift and deposition , flooding , folding and erosion
B) erosion , subsidence and deposition , uplift and faulting
C) uplift and erosion , subsidence and erosion , folding
D) metamorphism , erosion and deposition , volcanic eruptions

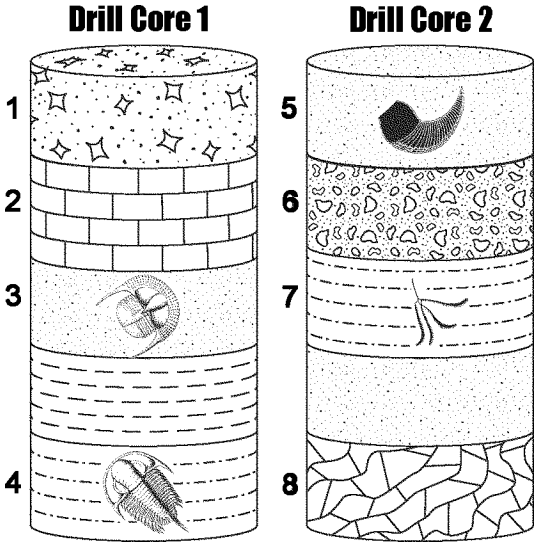
377) Which scientific principle states that younger rock layers are generally deposited on top of older rock layers?

A) evolution
B) superposition
C) original horizontality
D) inclusion

378) Thin layers of volcanic ash act as excellent time markers in the correlation of bedrock because volcanic ash

A) falls to Earth over a large area in a short period of time
B) is deposited over millions of years
C) is easily eroded and lasts only a short time on Earth's surface
D) stays in the atmosphere for millions of years

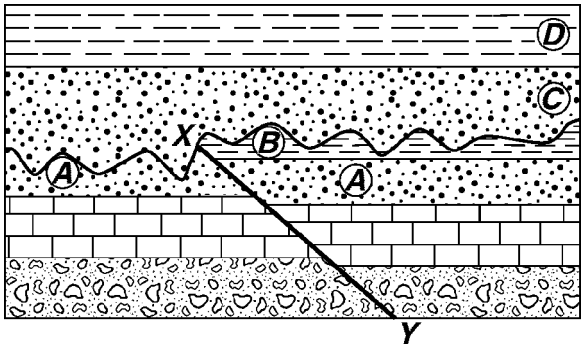
379) The drill-core samples below were taken from two locations 1,000 kilometers apart. Rock layers 1 through 8 have been labeled. Some index fossils are shown in the layers.



Which numbered layers most likely formed at the same time?

A) 3 and 5
B) 2 and 8
C) 1 and 6
D) 4 and 7

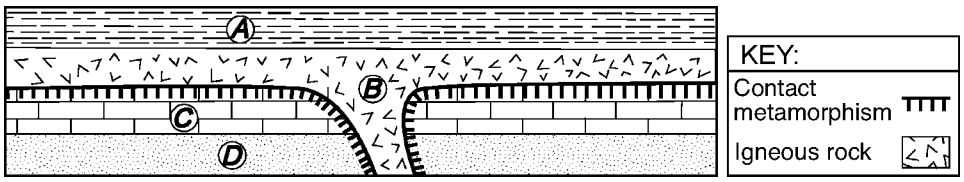
380) The geologic cross section below shows bedrock layers *A* through *D*. Line *XY* is a fault.



The fault most likely occurred after

A) layer *B* formed, but before layer *C* formed
B) layer *C* formed, but before layer *D* formed
C) all bedrock layers were formed
D) layer *A* formed, but before layer *B* formed

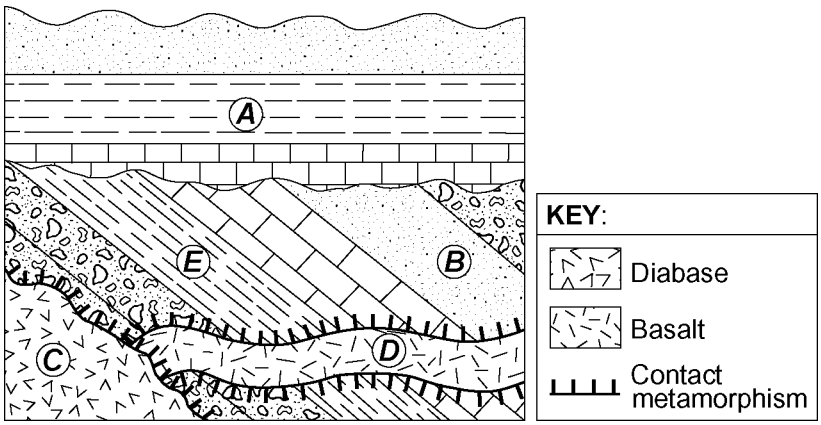
381) The cross section below shows four rock units, *A*, *B*, *C*, and *D*.



Which rock unit is *youngest* in age?

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

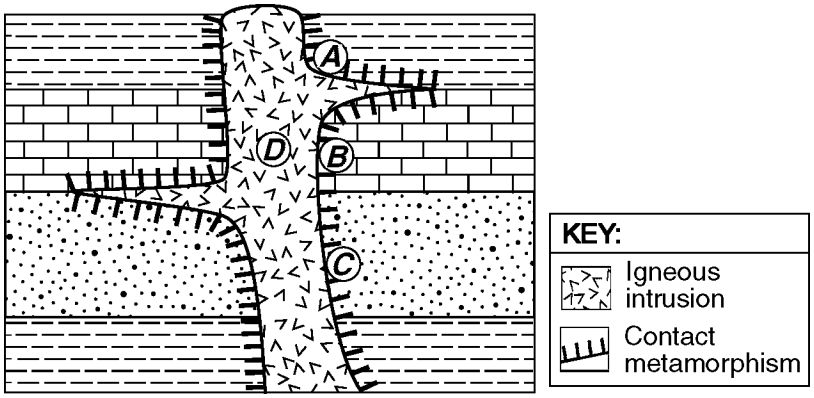
382) The geologic cross section below shows several rock units of Earth's crust. Some rock units are labeled *A* through *E*.



Which two rock units formed from sediments deposited in horizontal layers?

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

383) The cross section below represents a portion of Earth's crust. Letters *A* through *D* are locations within the rock units.

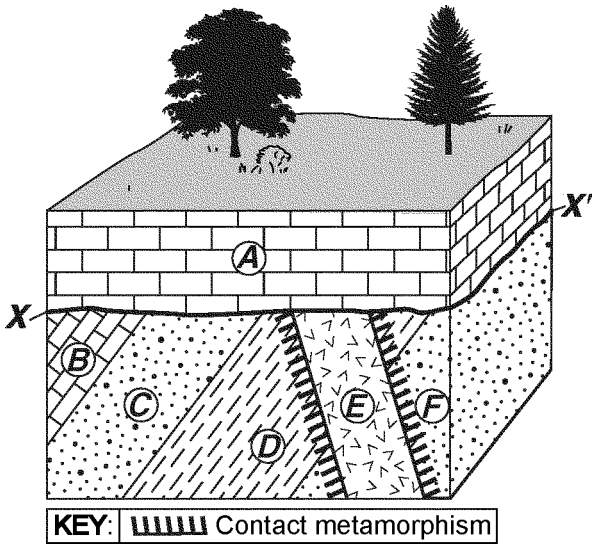


At which location is quartzite most likely found?

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

Questions 384 and 385 refer to the following:

The block diagram below shows bedrock units *A* through *F* and boundary *XX*1.



384) The rock that formed in the contact metamorphic zone between rock unit *E* in the given diagram and rock unit *D* is

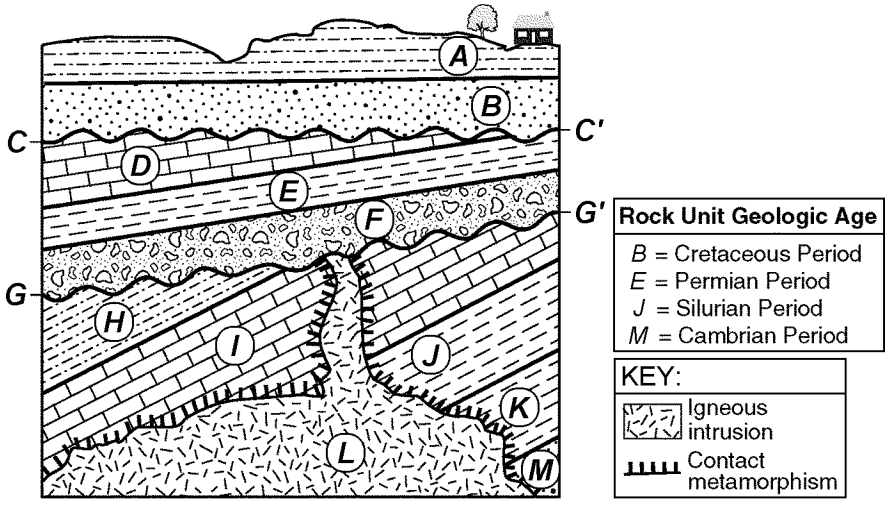
A) marble
B) hornfels
C) anthracite coal
D) schist

385) Which sequence *best* describes the geologic history, from *oldest* to *youngest*, that occurred at the site shown in the diagram?

A) deposition of *F*, *D*, *C*, *B*, *A* , uplift and erosion , intrusion of *E*
B) deposition of *F*, *D*, *C*, *B*, *A* , intrusion of *E* , uplift and erosion
C) deposition of *F*, *D*, *C*, *B* , intrusion of *E* , uplift and erosion , deposition of *A*
D) intrusion of *E* , deposition of *F*, *D*, *C*, *B* , uplift and erosion , deposition of *A*

Questions 386 through 389 refer to the following:

The cross section below represents rock units that have not been overturned. Lines *CC*1 and *GG*2 represent unconformities. The geologic ages of some of the lettered rock units are shown to the right of the cross section.



386) Based on the given cross section, which rock unit was formed most recently?

A) *M*
B) *A*
C) *F*
D) *L*

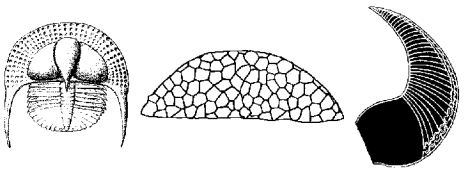
387) Why is there *no* contact metamorphism indicated between rock unit *L* and rock unit *F* in the given cross section?

A) The contact metamorphism within rock unit *F* eroded away.
B) Conglomerate does not metamorphose.
C) The intrusion was not hot enough to metamorphose rock unit *F*.
D) Rock unit *F* was deposited after the intrusion of rock unit *L*.

388) Which inference about rock units *D*, *E*, and *H* can *best* be supported by evidence in the cross section?

A) They were altered by contact metamorphism.
B) They contain mostly sand-sized sediment.
C) They contain both land and marine fossils.
D) They were deposited as horizontal layers and were later tilted.

389) The diagrams below represent three index fossils found in one of the rock units in the cross section shown.



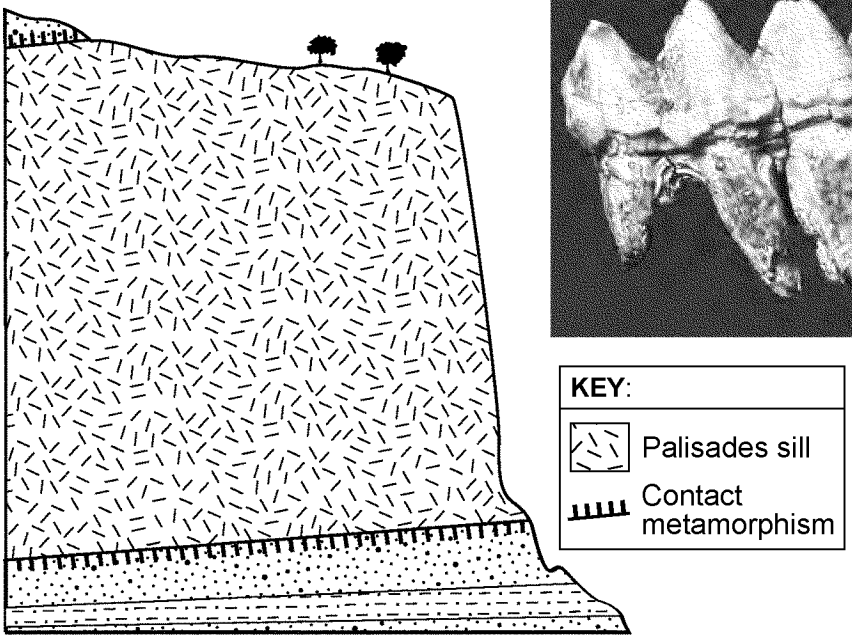
These fossils are most likely found in which rock unit?

A) *M*
B) *J*
C) *K*
D) *I*

Questions 390 through 392 refer to the following:

The cross section below represents the Palisades sill in southern New York State and the surrounding bedrock. Potassium-40 analysis determined the sill to be approximately 200,000,000 years old. The photograph shows a mastodont tooth found in glacial sediments nearby. Carbon-14 analysis determined this tooth to be approximately 11,400 years old.

Geologic Cross Section



(not drawn to scale)

Mastodont Tooth

390) Which metamorphic rock was most likely produced in the contact zone between the Palisades sill and the sedimentary rock?

A) schist
B) gneiss
C) quartzite
D) slate

391) Potassium-40 is useful for radioactive dating of the Palisades sill because the half-life of potassium-40

A) increased as pressure from the overlying sedimentary rock increased
B) was shortened by the high temperature of the magma that formed the sill
C) remained constant during the radioactive decay process
D) decreased as the amounts of ^{40}Ar and ^{40}Ca in the sill increased

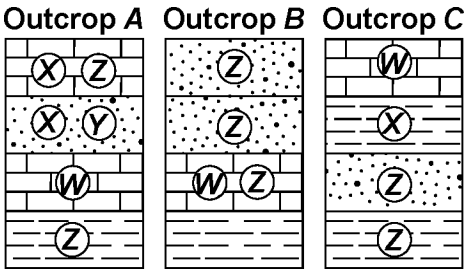
392) The mastodont tooth and the entire Palisades sill represented by the given diagrams are similar in that both

A) are fossils of animals that once lived in New York State
B) can be found in deposits left by the last continental ice sheet in New York State
C) can be used as time markers to date nearby geologic events
D) are Mesozoic in age

393) Organisms that later became good index fossils lived over a

A) wide geographic area and existed for a short geologic time
B) limited geographic area and existed for a long geologic time
C) wide geographic area and existed for a long geologic time
D) limited geographic area and existed for a short geologic time

394) The cross sections below represent three widely separated bedrock outcrops labeled *A*, *B*, and *C*. Letters *W*, *X*, *Y*, and *Z* represent fossils found in the rock layers.



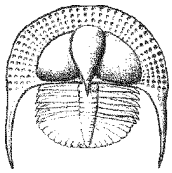
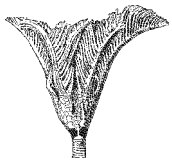
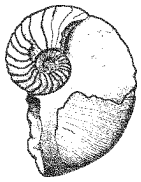
Which fossil could best be used as an index fossil?

A) *Y*
B) *W*
C) *Z*
D) *X*

395) What evidence suggests that a mass extinction of the dinosaurs occurred at the end of the Cretaceous Period?

A) an absence of dinosaur fossils in Paleocene bedrock
B) evolution of dinosaurs during the Late Cretaceous Epoch
C) an abundance of dinosaur fossils in Early Cretaceous bedrock
D) drawings of dinosaurs made by humans in caves during the Paleocene Epoch

396) Which index fossil has been found in Ordovician-age bedrock?

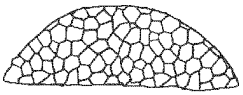
A) 
C) 
B) 
D) 

397) The index fossil shown below has been found in New York State sedimentary bedrock.


Phacops

Which other index fossil could also be found in New York State bedrock of the same age?

A) 
Manticoceras

B) 
Lichenaria

C) 
Elliptocephala

D) 
Eospirifer

398) Which radioactive element is used to determine the absolute age of late Pleistocene animal remains?

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

399) Which radioactive isotope is m*ost* often used when determining the age of fossil bones found in sediments deposited during the Holocene Epoch?

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

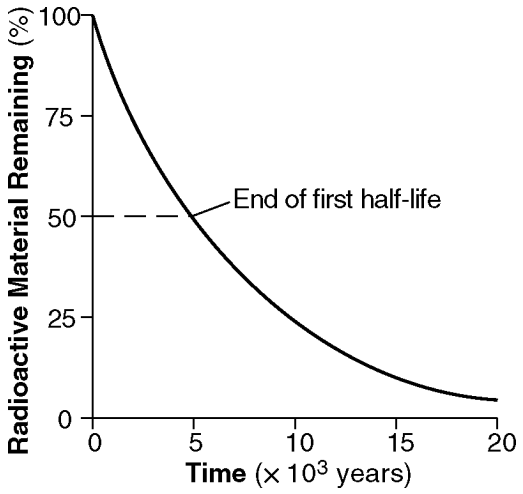
400) How much of an 800-gram sample of potassium-40 will remain after 3.9×10^9 years of radioactive decay?

A) 400 grams
B) 50 grams
C) 200 grams
D) 100 grams

401) Due to radioactive decay, an igneous rock sample now contains one-fourth of the amount of potassium-40 that it originally contained. The age, in years, of this rock sample is approximately

A) 2.6×10^9 y
B) 0.7×10^9 y
C) 5.2×10^9 y
D) 1.3×10^9 y

402) The graph below shows the decay of a radioactive material over time.



How long does it take for this radioactive material to decay through 2 half-lives?

A) 10×10^3 years
B) 40×10^3 years
C) 5×10^3 years
D) 1×10^3 years

Questions 403 and 404 refer to the following:

The data table below shows the percentage of original carbon-14 remaining in three different fossils. The approximate ages of the gastropod shell and the tree wood are shown in years. The age of the human bone has been left blank.

DATA TABLE

Fossil	Original ^{14}C Remaining (%)	Approximate Age (y)
gastropod shell	50	5,700
tree wood	25	11,400
human bone	12.5	

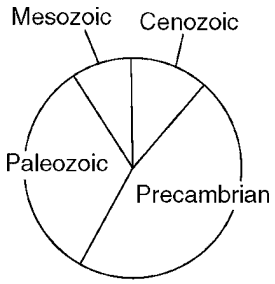
403) What is the approximate age of the human bone fossil on the given data table?

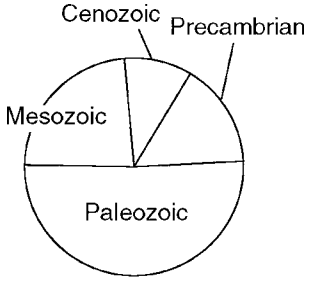
A) 5,700 y
B) 22,800 y
C) 17,100 y
D) 39,900 y

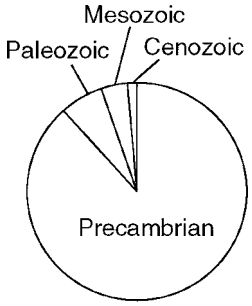
404) During which geologic period did all three fossils in the given data table form?

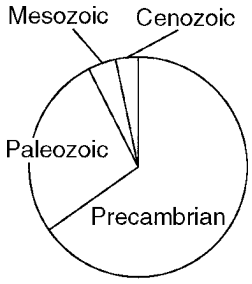
A) Permian
B) Quaternary
C) Paleogene
D) Neogene

405) Which pie graph *best* shows the relative length of time of the major intervals of Earth's geologic history?

A)


B)


C)


D)


406) Most scientists believe Earth's Early Archean atmosphere was formed primarily by gases released from

A) chemical weathering
B) volcanic eruptions
C) stream erosion
D) plant transpiration

407) Approximately 2.2 billion years ago, which gas was first added in large amounts to Earth's atmosphere from life-forms that evolved in the oceans?

A) water vapor
B) carbon dioxide
C) oxygen
D) nitrogen

408) What is inferred to be the *main* source of the free oxygen that first entered Earth's atmosphere?

A) oxygen-producing organisms
B) meteorite impacts releasing oxygen
C) radioactive decay of rocks containing oxygen
D) melting of glacial ice into hydrogen and oxygen

409) Which geologic event is inferred to have occurred most recently?

A) formation of the Queenston delta
B) metamorphism of the bedrock of the Hudson Highlands
C) collision between North America and Africa
D) initial opening of the Atlantic Ocean

410) During which period in geologic history did the uplifting of the Adirondack Mountains begin?

A) Cambrian
B) Cretaceous
C) Quaternary
D) Triassic

411) Which geologic event occurred in New York State at the end of the Triassic Period?

A) formation of the Catskill delta
B) intrusion of the Palisades sill
C) domelike uplift of the Adirondack region
D) retreat of the last continental ice

412) Which plate tectonic events occurred as the Iapetus Ocean closed?

A) Alleghenian orogeny and Acadian orogeny
B) Alleghenian orogeny and Grenville orogeny
C) Taconian orogeny and Acadian orogeny
D) Taconian orogeny and Grenville orogeny

413) A 65.5-million-year-old impact crater in Mexico provides evidence for the cause of the

A) extinction of ammonoids
B) evolution of the earliest corals
C) breakup of Pangaea
D) Alleghenian orogeny

414) Which geologic event occurred in New York State at about the same time as the extinction of dinosaurs and ammonoids?

A) initial opening of the Atlantic Ocean
B) formation of the Queenston Delta
C) deposition of the sands and clays underlying Long Island
D) advance and retreat of the last continental ice sheet

415) When did the *earliest* humans appear on Earth?

A) during the Late Triassic Epoch
B) before the earliest flowering plants
C) before the earliest dinosaurs
D) during the Pleistocene Epoch

416) What percentage of Earth's history represents human existence?

A) more than 98.6%
B) 23.5%
C) less than 1.0%
D) 1.8%

Questions 417 and 418 refer to the following:

ICE AGES:

Earth has undergone many ice ages, each lasting millions of years. Some scientists infer that most ice ages were caused by landmasses blocking the ocean currents between equatorial regions and the poles. Ice ages usually ended when the positions of continents allowed ocean currents to resume transporting equatorial heat to the poles.

During each ice age there were advances and retreats of glaciers. These cool glacial and warm interglacial climate intervals were caused mostly by changes in Earth's orbit and tilt. Earth is presently in a warm interglacial interval.

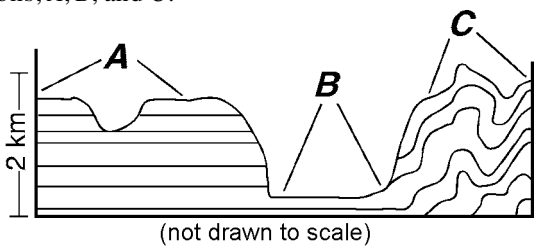
417) According to the given reading passage, Earth's warm interglacial intervals are due primarily to

A) increases in elevation of North America
B) changes in Earth's period of rotation
C) changes in Earth's orbit and tilt
D) divergence at the Mid-Atlantic Ridge

418) Approximately 359 million years ago, the average intensity of insolation received in a year by the land area that is now eastern North America was likely

A) greater, because eastern North America was at a lower latitude
B) less, because eastern North America was at a higher latitude
C) greater, because eastern North America was at a higher latitude
D) less, because eastern North America was at a lower latitude

419) The cross section below shows the general bedrock structure of an area containing three different landscape regions, *A*, *B*, and *C*.



Which list correctly identifies the type of landscapes represented by letters *A*, *B*, and *C*?

A) *A* = plateau, *B* = plain, *C* = mountain
B) *A* = mountain, *B* = plain, *C* = plateau
C) *A* = plain, *B* = plateau, *C* = mountain
D) *A* = mountain, *B* = plateau, *C* = plain

420) The large waterfall at Niagara Falls, New York, was originally located at the Niagara Escarpment. Which term *best* describes an escarpment?

A) drumlin
B) V-shaped valley
C) U-shaped valley
D) cliff

421) Landscapes characterized by gentle slopes and meandering streams are most often found in regions with

A) recently active faults and folds
B) high volcanic activity
C) steep mountain cliffs
D) sediment-covered bedrock

422) Old Forge and Watertown, located at nearly the same latitude in New York State, have very different landscapes. Which factor is primarily responsible for these landscape differences?

A) average annual precipitation
B) soil characteristics
C) bedrock structure
D) average annual temperature

423) A plane traveling in a straight line from Watertown to Utica would fly over which landscape region?

A) St. Lawrence Lowlands
B) Tug Hill Plateau
C) Champlain Lowlands
D) Adirondack Mountains

424) The Catskills landscape region is classified as a plateau because it has

A) low elevations and mostly faulted or folded bedrock
B) low elevations and mostly horizontal bedrock
C) high elevations and mostly horizontal bedrock
D) high elevations and mostly faulted or folded bedrock

425) New York's Tug Hill landscape region is classified as a plateau because this region has a

A) high elevation with distorted bedrock
B) high elevation with nearly horizontal layers of bedrock
C) low elevation with distorted bedrock
D) low elevation with nearly horizontal layers of bedrock

426) Which type of surface bedrock is most commonly found in New York State Tug Hill Plateau region?

A) intrusive igneous rock layers
B) extrusive igneous rock layers
C) faulted metamorphic rock layers
D) horizontal sedimentary rock layers

427) The *longest* portion of the Genesee River in New York State flows through which landscape region?

A) St. Lawrence Lowlands
B) Allegheny Plateau
C) Tug Hill Plateau
D) Erie-Ontario Lowlands

428) Which river in New York State flows for several miles over surface bedrock that is more than 542 million years old?

A) Genesee
B) Hudson
C) Susquehanna
D) Mohawk

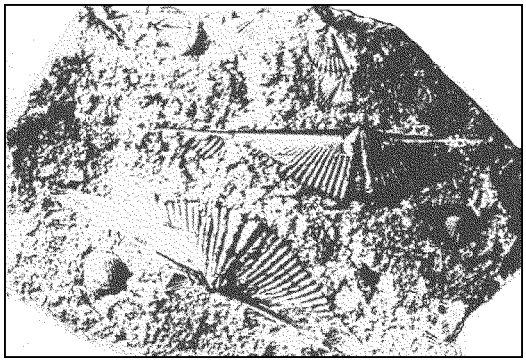
429) Which of the following two cities in New York State are located in the Interior Lowlands?

A) Buffalo and Watertown
B) Elmira and Binghamton
C) Riverhead and New York City
D) Massena and Old Forge

430) In which New York State landscape region have fossilized footprints of *Coelophysis* dinosaurs been found in the surface bedrock?

A) Newark Lowlands
B) Hudson-Mohawk Lowlands
C) Allegheny Plateau
D) Tug Hill Plateau

431) The photograph below shows index fossil shells found in bedrock in New York State.



These index fossil shells were most likely found in the surface bedrock of which landscape region?

A) St. Lawrence Lowlands
B) Tug Hill Plateau
C) Adirondack Mountains
D) the Catskills

432) Which two locations are found in the same major geographic landscape province?

A) Albany and Old Forge
B) Elmira and Riverhead
C) Jamestown and Slide Mountain
D) Massena and Mount Marcy

433) Which type of surface bedrock is commonly found in New York State between Elmira and Ithaca?

A) marble
B) quartzite
C) granite
D) shale

434) In New York State, the surface bedrock of the Catskills consists mainly of

A) conglomerates, red sandstones, basalt, and diabase
B) weakly consolidated gravels and sands
C) quartzites, dolostones, marbles, and schists
D) limestones, shales, sandstones, and conglomerates

435) The surface bedrock in the Hudson Highlands consists mostly of

A) diabase, dolostone, and granite
B) gneiss, quartzite, and marble
C) slate, siltstone, and basalt
D) limestone, shale, sandstone, and conglomerate

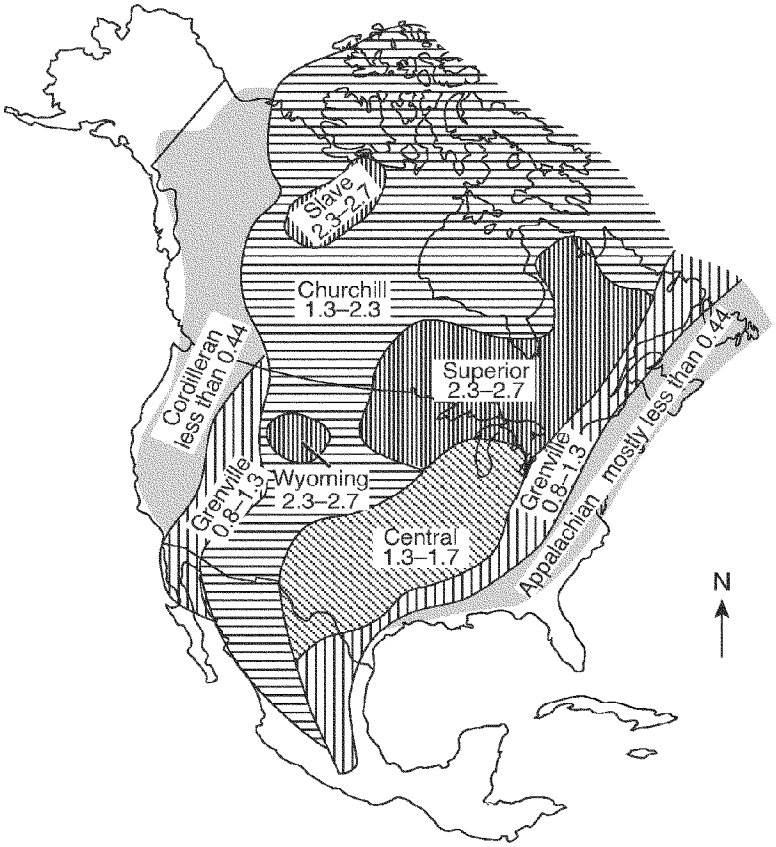
436) The bedrock of the Adirondack Mountains was formed mainly by the

A) compaction and recrystallization of volcanic material
B) cementation of clastic sediments and precipitates from seawater
C) regional metamorphism of sedimentary and igneous rocks
D) contact metamorphism of unconsolidated gravels

437) Which New York State location has surface bedrock that has been subjected to very intense regional metamorphism?

A) 44D301 N 74D001 W
B) 41D001 N 72D151 W
C) 44D001 N 76D001 W
D) 42D301 N 75D001 W

438) The map below shows the names and ages of different bedrock formations in North America. The bedrock ages are shown in billions of years.

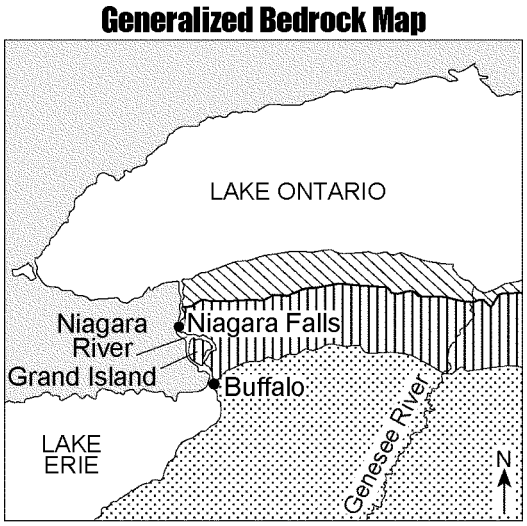


The ages shown on the map suggest that the

A) younger bedrock has been added to the east and west coasts of the continent
B) youngest bedrock is located in the Wyoming formation
C) age of bedrock increases from west to east across the continent
D) oldest bedrock is located in the Churchill formation

Questions 439 through 441 refer to the following:

The map below shows the generalized bedrock of a part of western New York State.



439) During which geologic time period was the surface bedrock of Grand Island formed?

A) Silurian
B) Devonian
C) Cambrian
D) Ordovician

440) Sediments that are transported by the Genesee River generally become

A) smaller and rounder
B) smaller and more angular
C) larger and rounder
D) larger and more angular

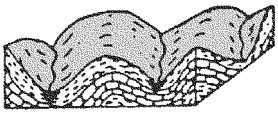
441) As the Niagara River enters Lake Ontario the velocity of the river water

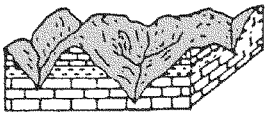
A) increases and smaller sediments are deposited first
B) decreases and larger sediments are deposited first
C) increases and larger sediments are deposited first
D) decreases and smaller sediments are deposited first

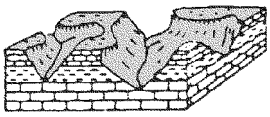
442) Which agent of erosion most likely formed the drumlins and finger lakes in New York State?

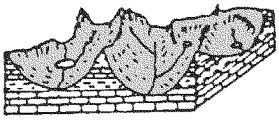
A) wave action
B) moving ice
C) running water
D) mass movement

443) Which landscape surface resulted primarily from erosion by glaciers?

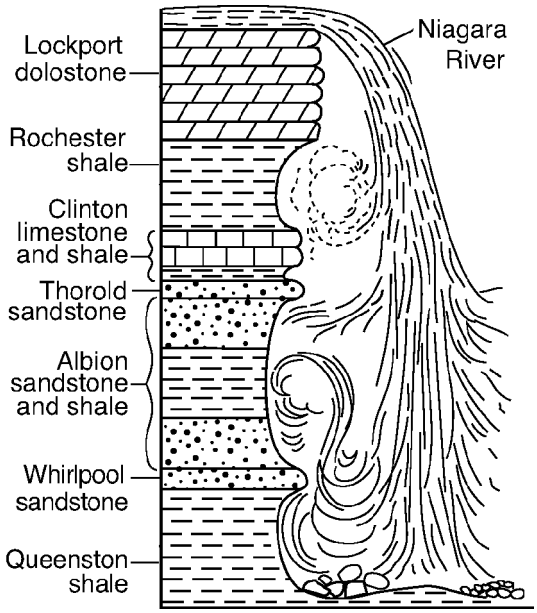
A) 

B) 

C) 

D) 

444) A cross section of Niagara Falls is shown below.



Which two rock units appear to be *most* resistant to weathering and erosion?

A) Lockport dolostone and Whirlpool sandstone
B) Rochester shale and Albion sandstone and shale
C) Clinton limestone and shale and Queenston shale
D) Thorold sandstone and Queenston shale

445) The presence of coal in Antarctica indicates that

A) forests can grow on continental glaciers
B) Antarctica currently has areas of tropical climate
C) coal can form in cold climates
D) Antarctica's climate was once warmer

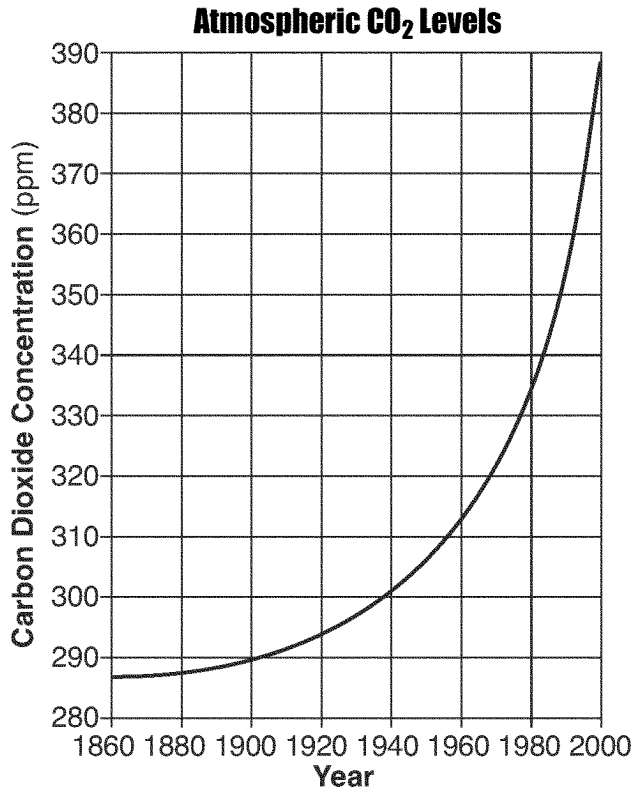
446) Which change is most likely to occur in a landscape if its climate changes from humid to arid?

A) Chemical weathering will increase.
B) Surface features will become more rounded.
C) Vegetation will increase.
D) Wind will become a more important agent of erosion.

447) Which factor most likely determines why a greater number of coral types are found farther south along the east coast of southern Africa than along the west coast?

A) distance from the equator
B) temperature of the ocean currents
C) seasonal air temperature range
D) angle of the Sun's rays

448) The graph below shows changes in carbon dioxide concentrations in Earth's atmosphere over a 140-year period. Carbon dioxide concentrations are shown in parts per million (ppm).



This significant change in CO_2 concentration is most likely caused by

A) decreased volcanic activity, and is predicted to increase average global temperatures
B) increased use of fossil fuels, and is predicted to increase average global temperatures
C) decreased cloud cover, and is predicted to decrease average global temperatures
D) increased El Niño activity, and is predicted to decrease average global temperatures

1) B

2) B

3) D

4) A

5) D

6) B

7) A

8) A

9) A

10) D

11) C

12) B

13) D

14) C

15) D

16) A

17) A

18) D

19) C

20) B

21) B

22) B

23) D

24) C

25) D

26) C

27) A

28) B

29) B

30) A

31) A

32) A

33) B

34) A

35) B

36) A

37) C

38) C

39) A

40) D

41) C

42) C

43) D

44) C

45) D

46) A

47) A

48) B

49) B

50) A

51) A

52) C

53) C

54) A

55) C

56) C

57) A

58) D

59) B

60) A

61) C

62) D

63) A

64) A

65) C

66) D

67) B

68) A

69) B

70) B

71) C

72) C

73) D

74) D

75) B

76) D

77) B

78) D

79) B

80) B

81) D

82) B

83) B

84) B

85) C

86) A

87) D

88) D

89) D

90) B

91) C

92) A

93) D

94) A

95) B

96) D

97) A

98) B

99) C

100) A

101) A

102) A

103) D

104) A

105) A

106) A

107) D

108) B

109) D

110) C

111) D

112) C

113) D

114) A

115) D

116) D

117) A

118) D

119) A

120) D

121) A

122) C

123) D

124) C

125) B

126) A

127) A

128) D

129) D

130) A

131) B

132) A

133) A

134) A

135) D

136) A

137) C

138) D

139) A

140) D

141) B

142) D

143) C

144) D

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146) C

147) D

148) B

149) C

150) A

151) A

152) D

153) C

154) C

155) D

156) B

157) B

158) A

159) B

160) C

161) B

162) D

163) D

164) A

165) A

166) C

167) D

168) C

169) B

170) B

171) B

172) D

173) D

174) D

175) A

176) A

177) A

178) B

179) D

180) C

181) A

182) B

183) C

184) D

185) D

186) B

187) A

188) D

189) C

190) D

191) B

192) D

193) C

194) B

195) A

196) A

197) D

198) B

199) A

200) A

201) B

202) A

203) C

204) B

205) C

206) D

207) C

208) A

209) A

210) C

211) C

212) B

213) A

214) C

215) B

216) D

217) D

218) C

219) A

220) C

221) B

222) A

223) B

224) C

225) C

226) C

227) B

228) A

229) A

230) B

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253) C

254) B

255) D

256) B

257) D

258) C

259) B

260) D

261) B

262) A

263) C

264) A

265) A

266) D

267) B

268) B

269) D

270) D

271) A

272) C

273) A

274) A

275) A

276) A

277) C

278) D

279) B

280) B

281) B

282) C

283) B

284) C

285) C

286) A

287) C

288) D

289) C

290) B

291) A

292) B

293) A

294) C

295) C

296) D

297) C

298) C

299) B

300) A

301) B

302) C

303) D

304) D

305) D

306) A

307) B

308) A

309) D

310) B

311) A

312) D

313) A

314) A

315) B

316) A

317) B

318) A

319) B

320) A

321) C

322) A

323) D

324) D

325) B

326) A

327) D

328) D

329) B

330) C

331) C

332) D

333) D

334) D

335) A

336) A

337) A

338) D

339) C

340) A

341) A

342) D

343) D

344) C

345) D

346) B

347) B

348) C

349) A

350) B

351) B

352) A

353) A

354) D

355) D

356) D

357) C

358) A

359) C

360) B

361) B

362) A

363) D

364) C

365) D

366) A

367) B

368) D

369) A

370) C

371) D

372) C

373) B

374) D

375) B

376) B

377) B

378) A

379) A

380) A

381) A

382) D

383) C

384) B

385) C

386) B

387) D

388) D

389) C

390) C

391) C

392) C

393) A

394) B

395) A

396) A

397) A

398) D

399) B

400) D

401) A

402) A

403) C

404) B

405) C

406) B

407) C

408) A

409) D

410) B

411) B

412) C

413) A

414) C

415) D

416) C

417) C

418) A

419) A

420) D

421) D

422) C

423) B

424) C

425) B

426) D

427) B

428) B

429) A

430) A

431) D

432) C

433) D

434) D

435) B

436) C

437) A

438) A

439) A

440) A

441) B

442) B

443) D

444) A

445) D

446) D

447) B

448) B