

The University of the State of New York
REGENTS HIGH SCHOOL EXAMINATION

PHYSICAL SETTING
EARTH SCIENCE

Wednesday, January 26, 2011 — 9:15 a.m. to 12:15 p.m., only

This is a test of your knowledge of Earth science. Use that knowledge to answer all questions in this examination. Some questions may require the use of the *2010 Edition Reference Tables for Physical Setting/Earth Science*. The reference tables are supplied separately. Be certain you have a copy of the *2010 Edition* of these reference tables before you begin the examination.

The answers to *all* questions are to be written in your separate answer booklet. Be sure to fill in the heading on the front of your answer booklet.

You are to answer all questions in all parts of this examination according to the directions provided in the examination booklet. All work should be written in pen, except for graphs and drawings, which should be done in pencil. You may use scrap paper to work out the answers to the questions, but be sure to record all your answers in your answer booklet.

When you have completed the examination, you must sign the statement printed on the first page of your answer booklet, indicating that you had no unlawful knowledge of the questions or answers prior to the examination and that you have neither given nor received assistance in answering any of the questions during the examination. Your answer booklet cannot be accepted if you fail to sign this declaration.

Notice . . .

A four-function or scientific calculator and a copy of the *2010 Edition Reference Tables for Physical Setting/Earth Science* must be available for you to use while taking this examination.

The use of any communications device is strictly prohibited when taking this examination. If you use any communications device, no matter how briefly, your examination will be invalidated and no score will be calculated for you.

DO NOT OPEN THIS EXAMINATION BOOKLET UNTIL THE SIGNAL IS GIVEN.

Part A

Answer all questions in this part

Directions (1–35): For each statement or question, write in your answer booklet the *number* of the word or expression that, of those given, best completes the statement or answers the question. Some questions may require the use of the *2010 Edition Reference Tables for Physical Setting/Earth Science*.

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

- (1) equator (0°)
- (2) North Pole (90° N)
- (3) Tropic of Cancer (23.5° N)
- (4) Tropic of Capricorn (23.5° S)

2 The theory that the universe is expanding is supported by the

- (1) blue shift of light from distant galaxies
- (2) red shift of light from distant galaxies
- (3) nuclear fusion occurring in the Sun
- (4) radioactive decay occurring in the Sun

3 Most scientists believe Earth's Early Archean atmosphere was formed primarily by gases released from

- (1) stream erosion
- (2) chemical weathering
- (3) volcanic eruptions
- (4) plant transpiration

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

- (1) December
- (2) January
- (3) June
- (4) July

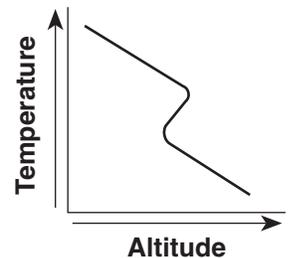
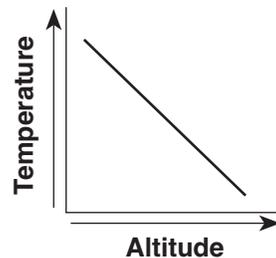
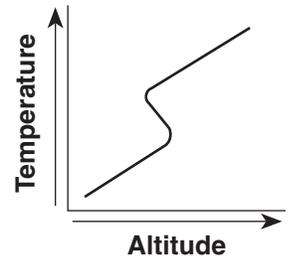
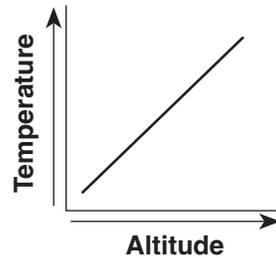
5 How many degrees does the Sun appear to move across the sky in four hours?

- (1) 60°
- (2) 45°
- (3) 15°
- (4) 4°

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

- (1) rough, dark-colored surface
- (2) rough, light-colored surface
- (3) smooth, dark-colored surface
- (4) smooth, light-colored surface

7 Which graph best shows the general relationship between altitude and temperature in the troposphere?



8 Which weather variable is measured by a barometer?

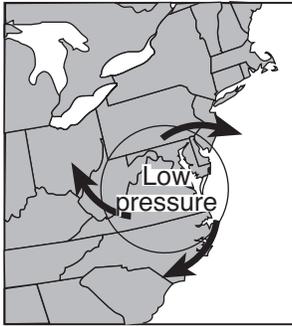
- (1) dewpoint
- (2) wind speed
- (3) air pressure
- (4) visibility

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

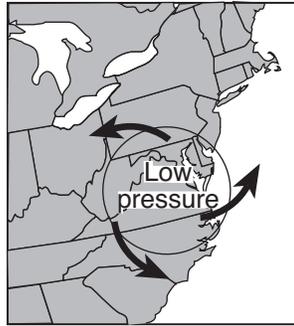
- (1) melting
- (2) freezing
- (3) evaporation
- (4) condensation

- 10 The *least* amount of surface water runoff will occur when soil pore spaces are
- (1) saturated and the slope is steep
 - (2) saturated and the slope is gentle
 - (3) unsaturated and the slope is steep
 - (4) unsaturated and the slope is gentle

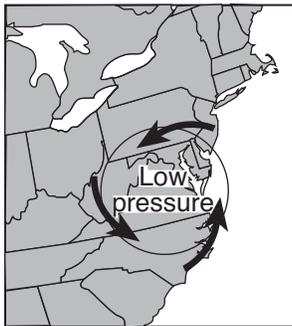
- 11 Which map best shows the general surface wind pattern in a low-pressure system located over the eastern United States?



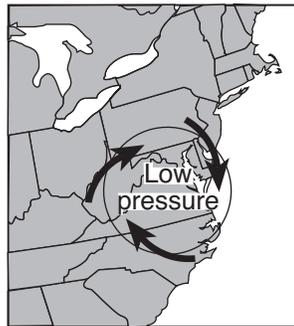
(1)



(3)

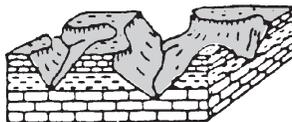


(2)

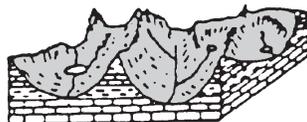


(4)

- 12 Which landscape surface resulted primarily from erosion by glaciers?



(1)



(3)



(2)



(4)

- 13 The formation of soil is primarily the result of
- (1) stream erosion and mass movement
 - (2) stream deposition and runoff
 - (3) precipitation and wind erosion
 - (4) weathering and biological activity

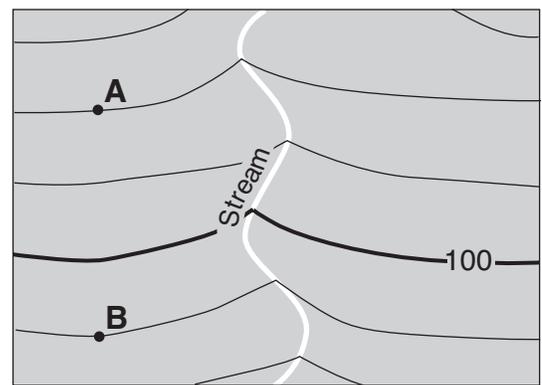
- 14 Sediments found in glacial moraines are best described as

- (1) sorted and layered
- (2) sorted and not layered
- (3) unsorted and layered
- (4) unsorted and not layered

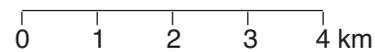
- 15 Old Forge and Watertown, located at nearly the same latitude in New York State, have very different landscapes. Which factor is primarily responsible for these landscape differences?

- (1) average annual temperature
- (2) average annual precipitation
- (3) bedrock structure
- (4) soil characteristics

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



Contour interval = 10 m



What is the gradient between points A and B?

- (1) 1 m/km
- (2) 2 m/km
- (3) 10 m/km
- (4) 20 m/km

17 In which New York State landscape region have fossilized footprints of *Coelophysis* dinosaurs been found in the surface bedrock?

- (1) Allegheny Plateau
- (2) Tug Hill Plateau
- (3) Hudson-Mohawk Lowlands
- (4) Newark Lowlands

18 Which geologic event is inferred to have occurred most recently?

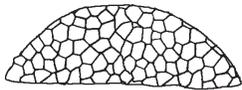
- (1) collision between North America and Africa
- (2) metamorphism of the bedrock of the Hudson Highlands
- (3) formation of the Queenston delta
- (4) initial opening of the Atlantic Ocean

19 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?



Lichenaria

(1)



Manticoceras

(3)



Elliptocephala

(2)



Eospirifer

(4)

20 Which rock is only formed by regional metamorphism?

- (1) slate
- (2) hornfels
- (3) dunite
- (4) marble

21 The Indian-Australian tectonic plate is moving

- (1) away from the Philippine Plate
- (2) away from the Fiji Plate
- (3) toward the Pacific Plate
- (4) toward the Antarctic Plate

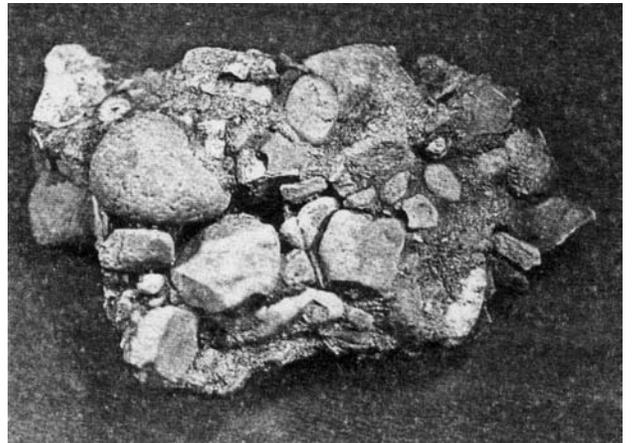
22 The inferred temperature at the interface between the stiffer mantle and the asthenosphere is closest to

- (1) 1000°C
- (2) 2500°C
- (3) 4500°C
- (4) 5000°C

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

- (1) pyroxene
- (2) quartz
- (3) biotite
- (4) potassium feldspar

24 A student classified the rock below as sedimentary.



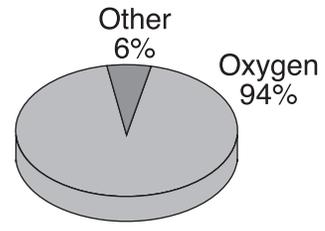
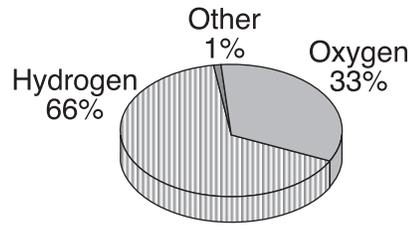
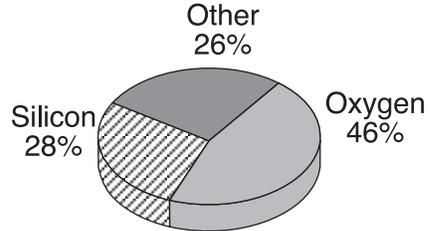
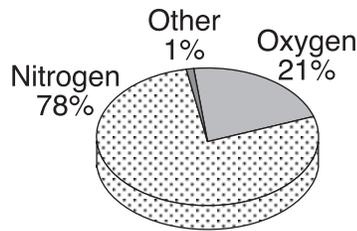
Which observation about the rock best supports this classification?

- (1) The rock is composed of several minerals.
- (2) The rock has a vesicular texture.
- (3) The rock contains fragments of other rocks.
- (4) The rock shows distorted and stretched pebbles.

25 Which material is made mostly of the mineral quartz?

- (1) sulfuric acid
- (2) pencil lead
- (3) plaster of paris
- (4) window glass

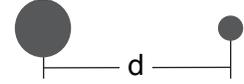
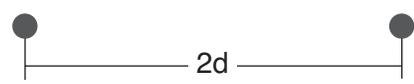
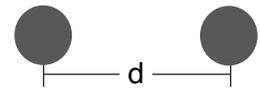
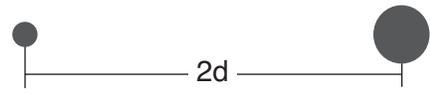
26 Which pie graph correctly shows the percentage of elements by volume in Earth's troposphere?



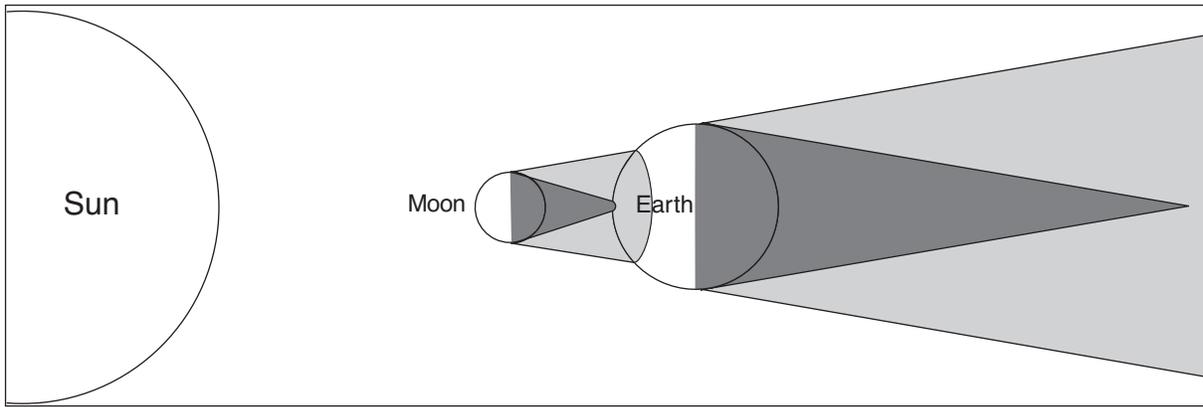
27 The symbols below represent star masses and distances.

- 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?



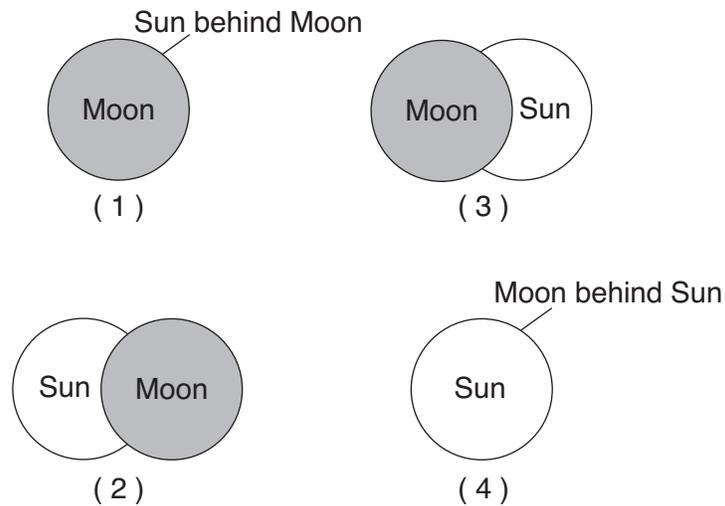
28 The diagram below shows the position of the Sun, the Moon, and Earth during a solar eclipse. The full shadow (umbra) and partial shadow (penumbra) of the Moon and Earth are shown.



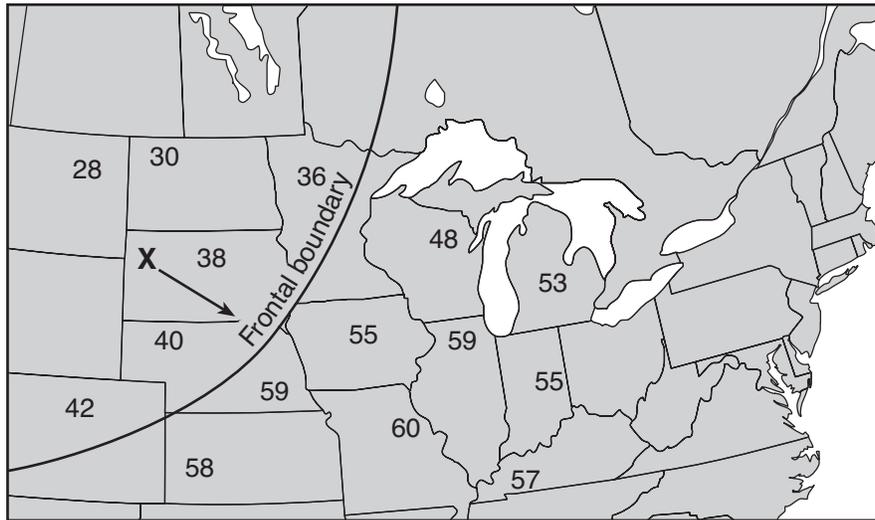
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Key	
	Umbra
	Penumbra

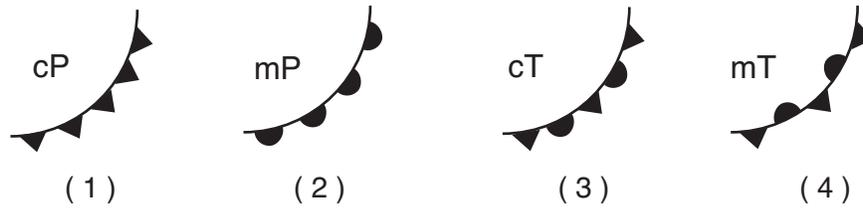
Which diagram best represents the appearance of the Sun and the Moon to an observer located within the umbra of the Moon's shadow on Earth's surface?



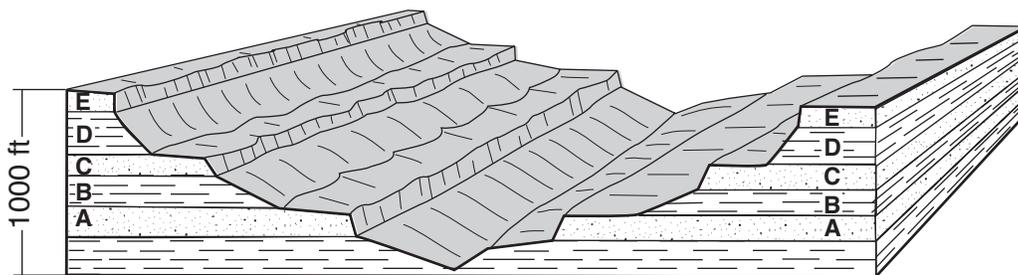
- 29 The map below shows surface air temperatures, in degrees Fahrenheit, reported by weather stations in the north-central United States. Letter X represents an air mass moving in the direction shown by the arrow. A line marks a frontal boundary advancing in a southeasterly direction.



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



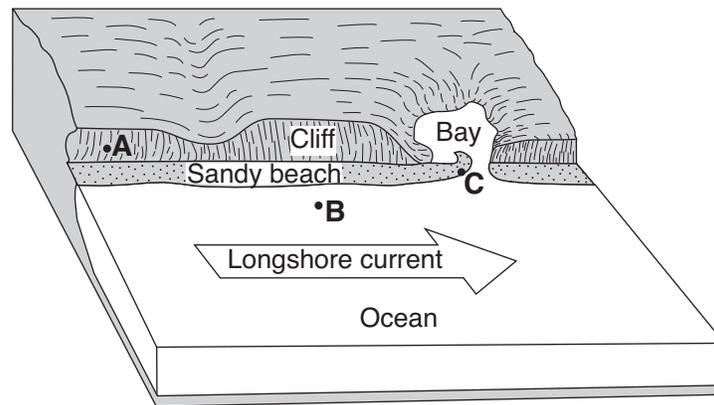
- 30 The block diagram below shows a cross section of a landscape. Letters A, B, C, D, and E represent different rock layers.



Which rock layers appear to be most resistant to weathering?

- (1) A and B
 (2) B and D
 (3) C, D, and E
 (4) A, C, and E

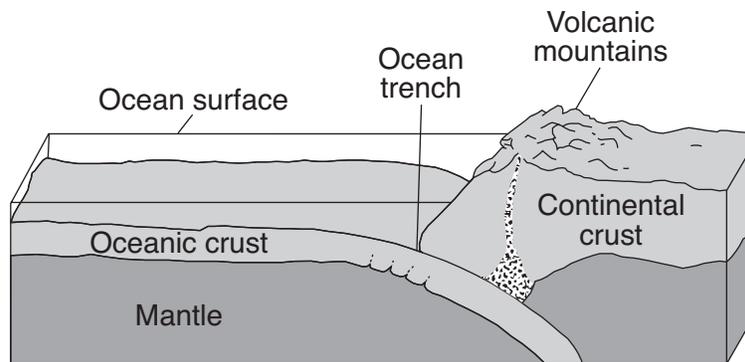
31 The block diagram below shows a part of the eastern coastline of North America. Points *A*, *B*, and *C* are reference points along the coast.



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

- (1) *A* — folding; *B* — subduction; *C* — crosscutting
- (2) *A* — weathering; *B* — erosion; *C* — deposition
- (3) *A* — faulting; *B* — conduction; *C* — mass movement
- (4) *A* — precipitation; *B* — infiltration; *C* — evaporation

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

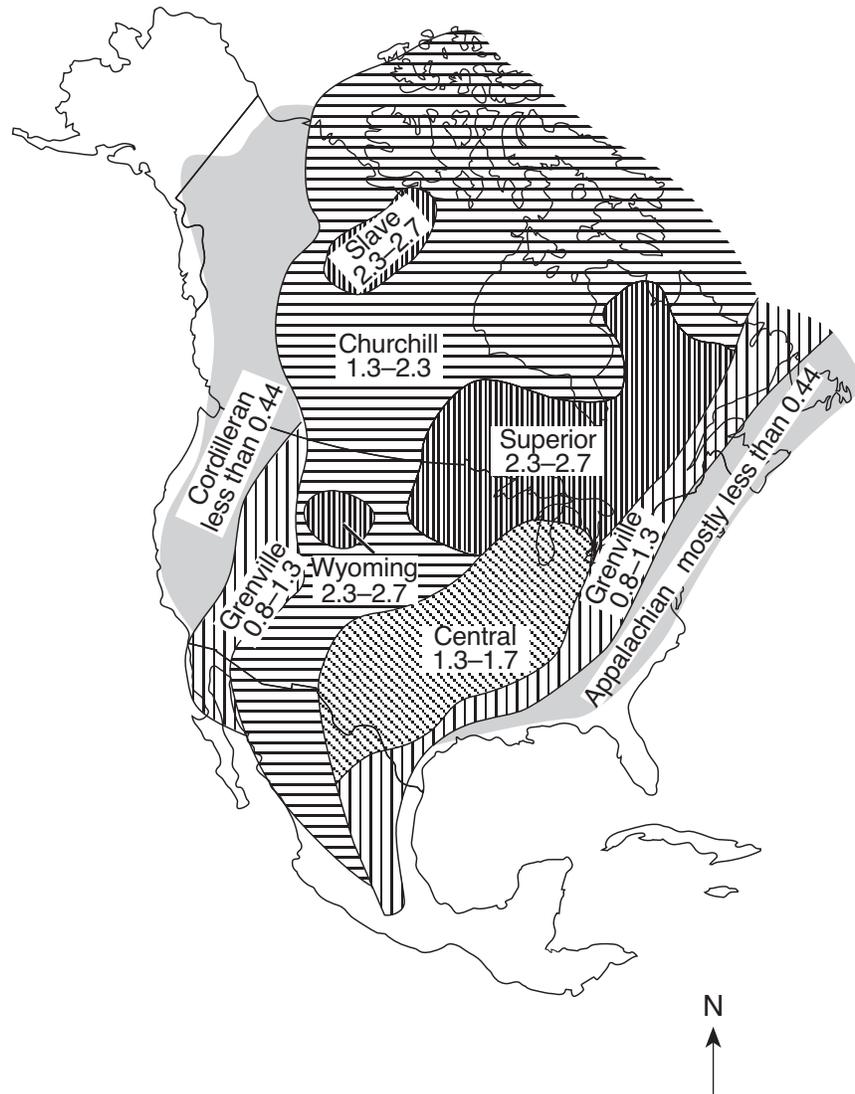


(Not drawn to scale)

Which type of plate boundary is shown?

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

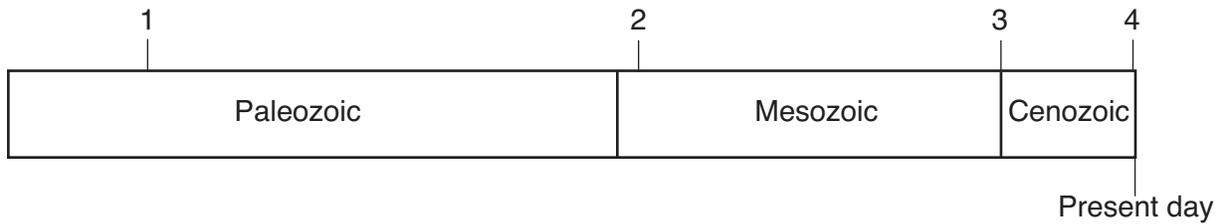
33 The map below shows the names and ages of different bedrock formations in North America. The bedrock ages are shown in billions of years.



The ages shown on the map suggest that the

- (1) oldest bedrock is located in the Churchill formation
- (2) youngest bedrock is located in the Wyoming formation
- (3) younger bedrock has been added to the east and west coasts of the continent
- (4) age of bedrock increases from west to east across the continent

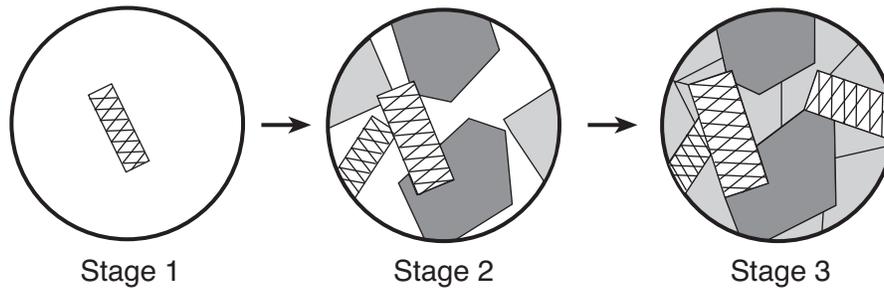
34 The geologic time line below represents the three most recent geologic eras. The numbers represent events in Earth's history.



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

- (1) 1
- (2) 2
- (3) 3
- (4) 4

35 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?

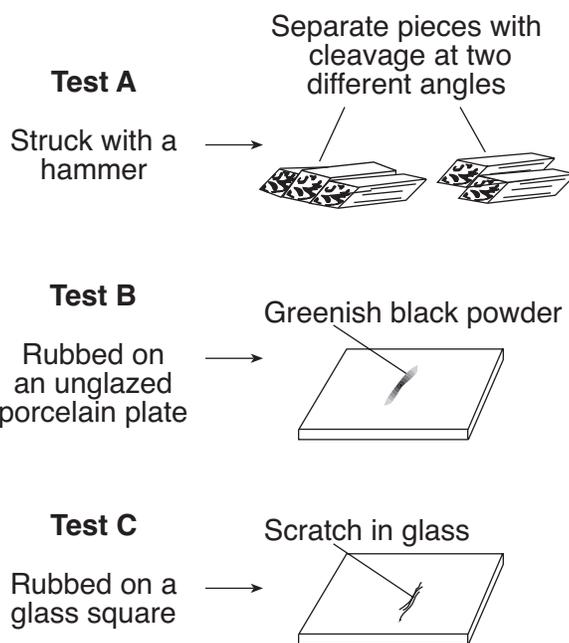
- (1) shale
- (2) gneiss
- (3) gabbro
- (4) breccia

Part B-1

Answer all questions in this part.

Directions (36–50): For *each* statement or question, write in your answer booklet the *number* of the word or expression that, of those given, best completes the statement or answers the question. Some questions may require the use of the *2010 Edition Reference Tables for Physical Setting/Earth Science*.

Base your answers to questions 36 and 37 on the diagram below, which shows the results of three different physical tests, A, B, and C, that were performed on a mineral.



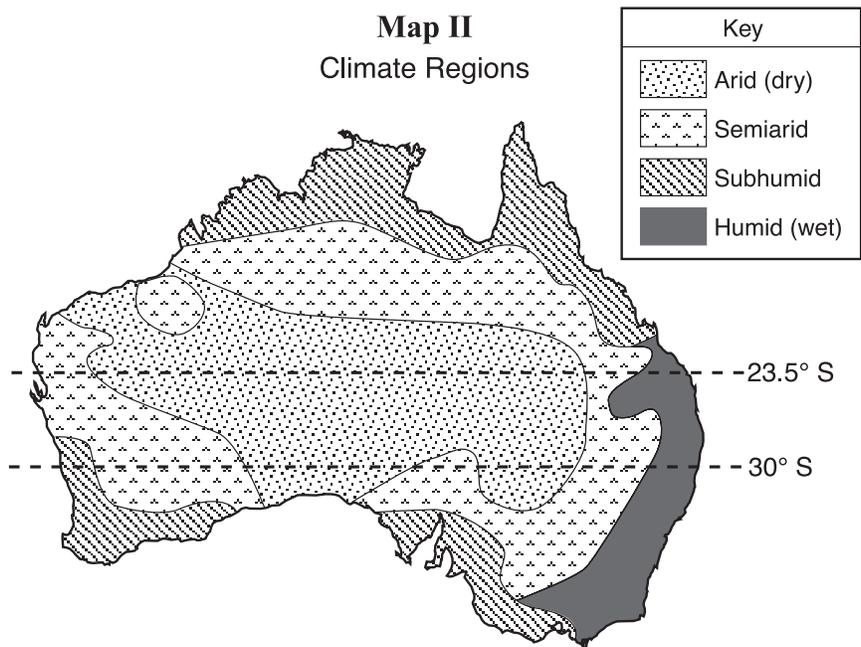
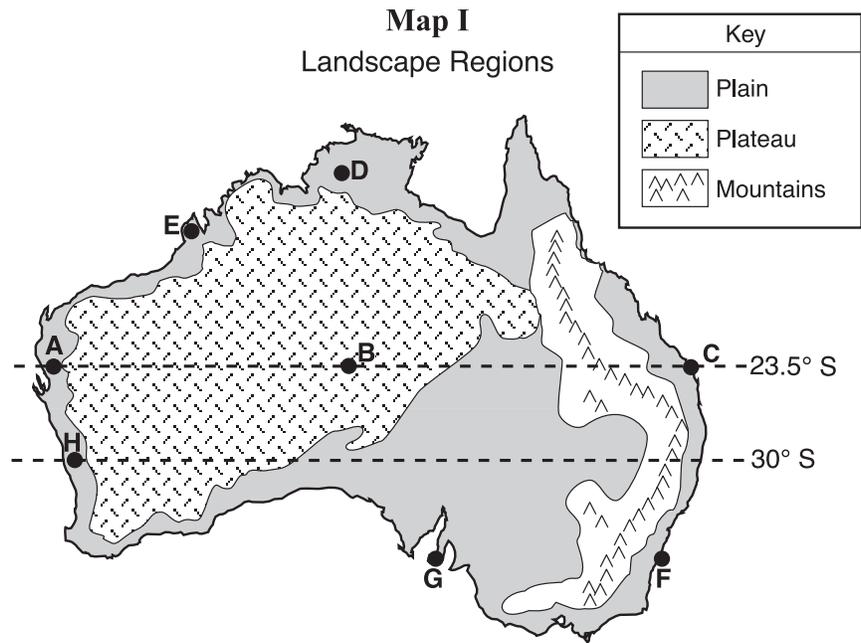
36 Which mineral was tested?

- (1) amphibole
- (2) quartz
- (3) galena
- (4) graphite

37 The luster of this mineral could be determined by

- (1) using an electronic balance
 - (2) using a graduated cylinder
 - (3) observing how light reflects from the surface of the mineral
 - (4) observing what happens when acid is placed on the mineral
-

Base your answers to questions 38 through 42 on the two maps of Australia 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.



- 38 Location *B* is in a landscape region that has
- (1) high elevations and deformed bedrock
 - (2) high elevations and horizontal bedrock
 - (3) low elevations and deformed bedrock
 - (4) low elevations and horizontal bedrock

39 On which day will the noon Sun be directly overhead at location C?

- (1) March 21
- (2) June 21
- (3) September 23
- (4) December 21

40 The greatest yearly temperature range was most likely recorded at location

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

41 Which location's climate is most affected by the East Australia Current?

- (1) E
- (2) F
- (3) G
- (4) H

42 Which two locations have the driest climates?

- (1) A and B
 - (2) G and H
 - (3) C and F
 - (4) D and E
-

Base your answers to questions 43 through 45 on the data table below, which 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			6200

43 Which seismic station was farthest from the earthquake epicenter?

- (1) W
- (2) X
- (3) Y
- (4) Z

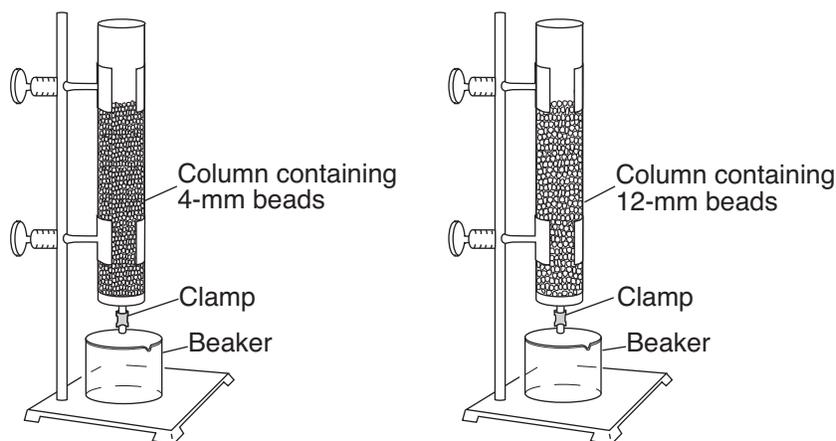
44 What is the most probable reason for the absence of S-waves at station W?

- (1) S-waves were not generated at the epicenter.
- (2) S-waves cannot travel through liquids.
- (3) Station W was located on solid bedrock.
- (4) Station W was located on an island.

45 At what time did the S-wave arrive at station Y?

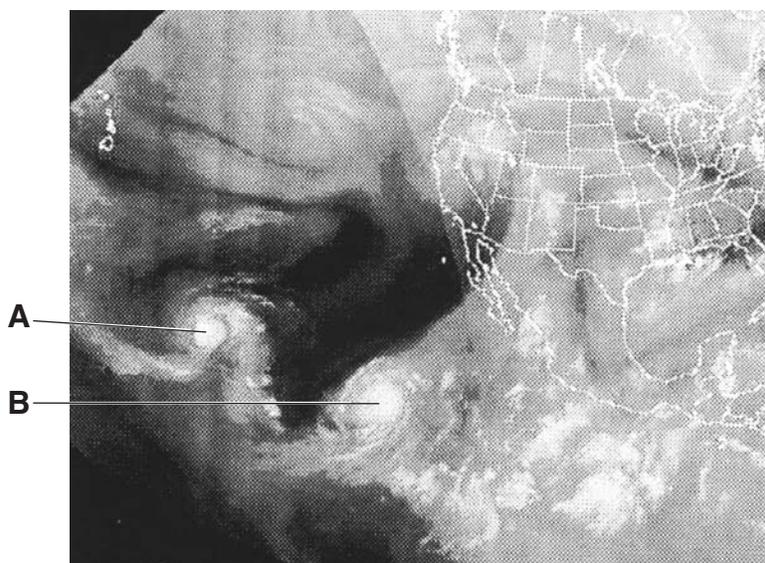
- (1) 10:36:40
 - (2) 10:39:20
 - (3) 10:42:00
 - (4) 10:45:20
-

- 46 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?

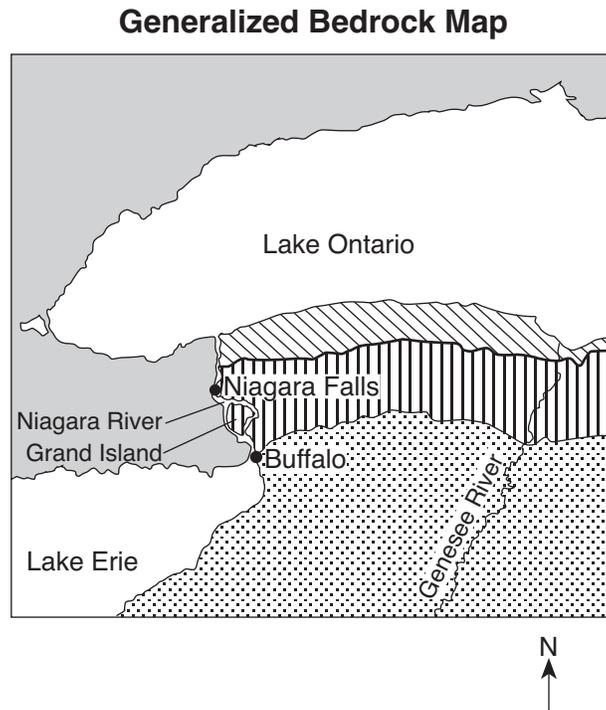
- (1) The column with 4-mm beads has greater water retention and permeability.
 - (2) The column with 12-mm beads has greater water retention and permeability.
 - (3) The column with 4-mm beads has greater water retention and the column with 12-mm beads has greater permeability.
 - (4) The column with 12-mm beads has greater water retention and the column with 4-mm beads has greater permeability.
- 47 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

- (1) polar air masses
- (2) warm fronts
- (3) tornadoes
- (4) hurricanes

Base your answers to questions 48 through 50 on the map below, which shows the generalized bedrock of a part of western New York State.



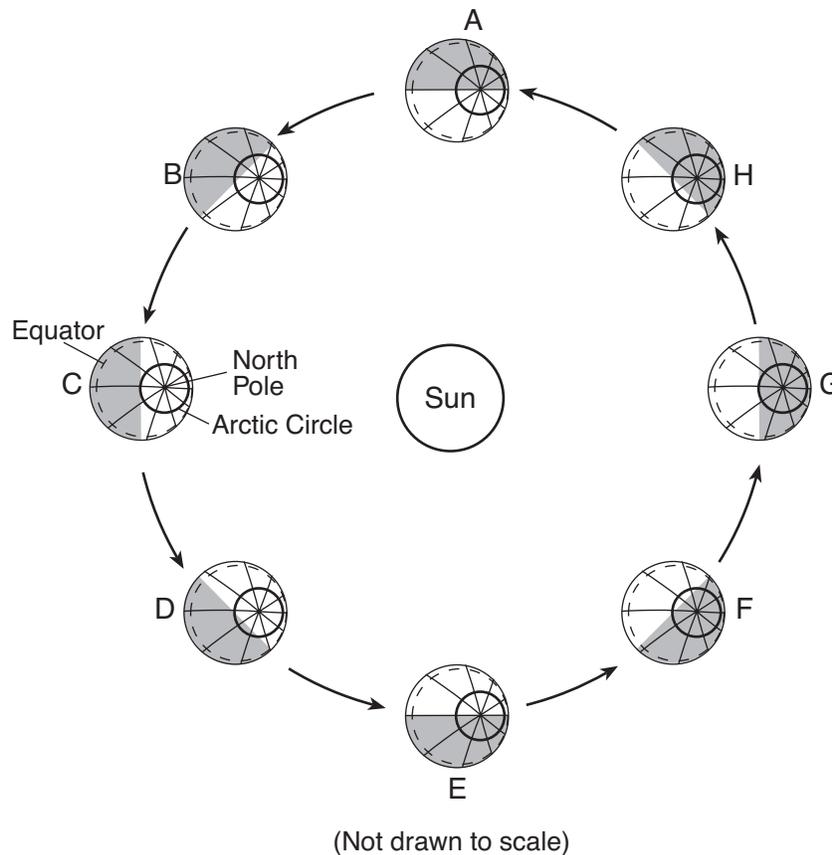
- 48 During which geologic time period was the surface bedrock of Grand Island formed?
- | | |
|----------------|--------------|
| (1) Cambrian | (3) Silurian |
| (2) Ordovician | (4) Devonian |
- 49 Sediments that are transported by the Genesee River generally become
- | | |
|------------------------------|-----------------------------|
| (1) smaller and rounder | (3) larger and rounder |
| (2) smaller and more angular | (4) larger and more angular |
- 50 As the Niagara River enters Lake Ontario, the velocity of the river water
- | |
|---|
| (1) decreases and larger sediments are deposited first |
| (2) decreases and smaller sediments are deposited first |
| (3) increases and larger sediments are deposited first |
| (4) increases and smaller sediments are deposited first |
-

Part B–2

Answer all questions in this part.

Directions (51–65): Record your answers in the spaces provided in your answer booklet. Some questions may require the use of the *2010 Edition Reference Tables for Physical Setting/Earth Science*.

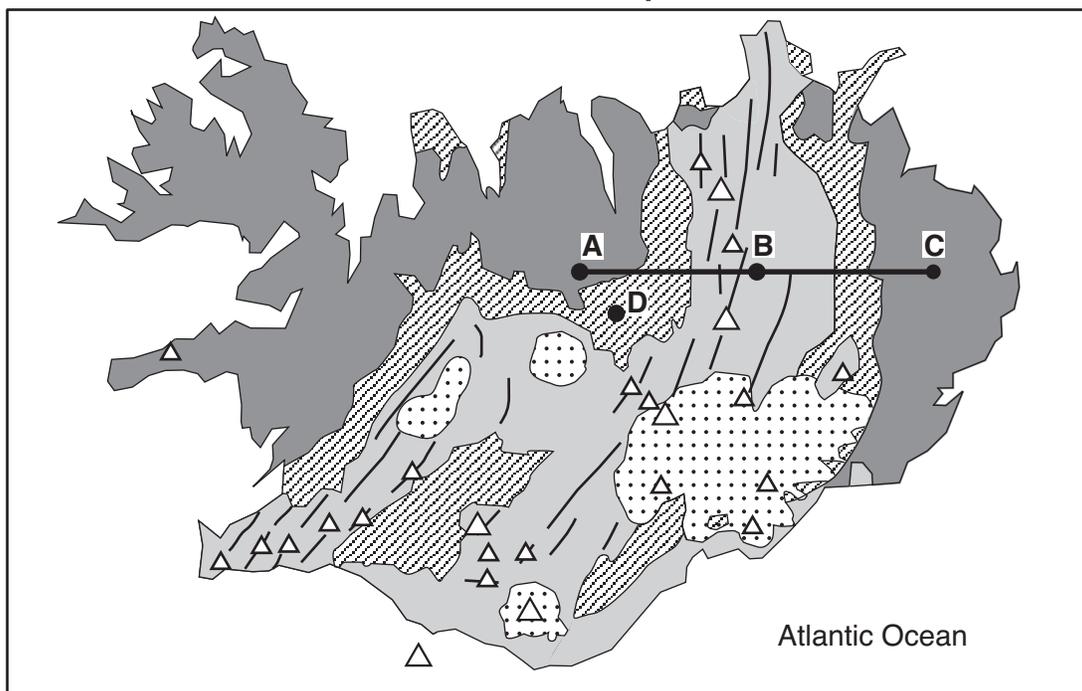
Base your answers to questions 51 and 52 on the diagram below, which shows Earth's orbit around the Sun as viewed from space. Earth is shown at eight different positions labeled A through H. Earth's North Pole, Arctic Circle, and equator have been labeled at position C. The arrows show the direction of orbital motion.



- 51 Complete the data table *in your answer booklet* by placing the letter that represents the position of Earth at the start of *each* season in the Northern Hemisphere. [1]
- 52 Approximately how many days does Earth take to move from position A to position C? [1]
-

Base your answers to questions 53 through 57 on the map below, which shows the generalized surface bedrock geology of Iceland, an island located on the Mid-Atlantic Ridge. Points A, B, C, and D are locations on surface bedrock which is igneous in origin. Glaciers cover some surface bedrock.

Generalized Bedrock Map of Iceland



Key	
Glacier	Rock 700,000 to 3,100,000 years old
Rock less than 700,000 years old	Rock more than 3,100,000 years old
Rifting region	Volcano

- 53 State the change in the relative ages of the surface bedrock along the line from A to B to C. [1]
- 54 According to the map, during which geologic era did the surface bedrock at location D form? [1]
- 55 Identify *one* fine-grained, highly mafic, volcanic rock likely found as surface bedrock in Iceland. [1]
- 56 State the names of the *two* crustal plates that are diverging at Iceland. [1]
- 57 In addition to crustal plate divergence, what feature located in the mantle beneath Iceland may be causing Iceland's volcanic activity? [1]

Base your answers to questions 58 and 59 on the table below, which shows weather data recorded at Albany, New York.

Data Table

Location	Temperature (°F)	Dewpoint (°F)	Cloud Cover (%)	Pressure (mb)	Wind Direction	Wind Speed (knots)
Albany	58	36	25	1017.0	from the west	20

58 Complete the station model *in your answer booklet*, using the proper format to accurately represent these *six* weather conditions. [1]

59 State *one* reason why rain was unlikely at the time the data was collected. Support your answer by using the data. [1]

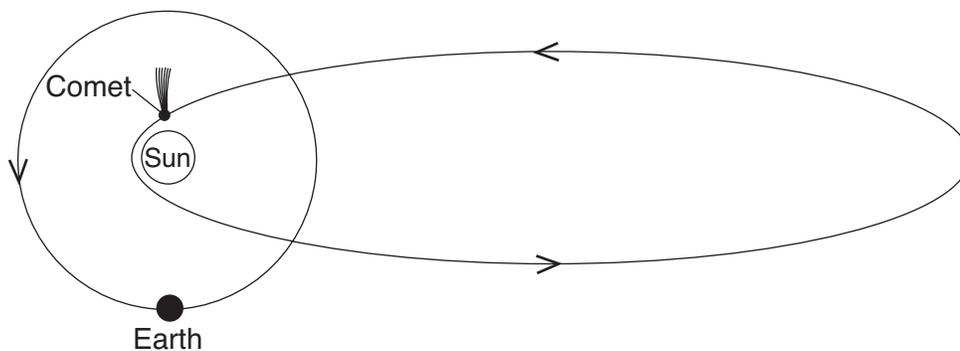
Base your answers to questions 60 and 61 on the passage below.

Average temperatures on Earth are primarily the result of the total amount of insolation absorbed by Earth's surface and atmosphere compared to the amount of long-wave energy radiated back into space. Scientists believe that the addition of greenhouse gases into Earth's atmosphere gradually increases global temperatures.

60 Identify *one* major greenhouse gas that contributes to global warming. [1]

61 Explain how increasing the amount of greenhouse gases in Earth's atmosphere increases global temperatures. [1]

Base your answers to questions 62 and 63 on the diagram below, which shows Earth's orbit and the orbit of a comet within our solar system.

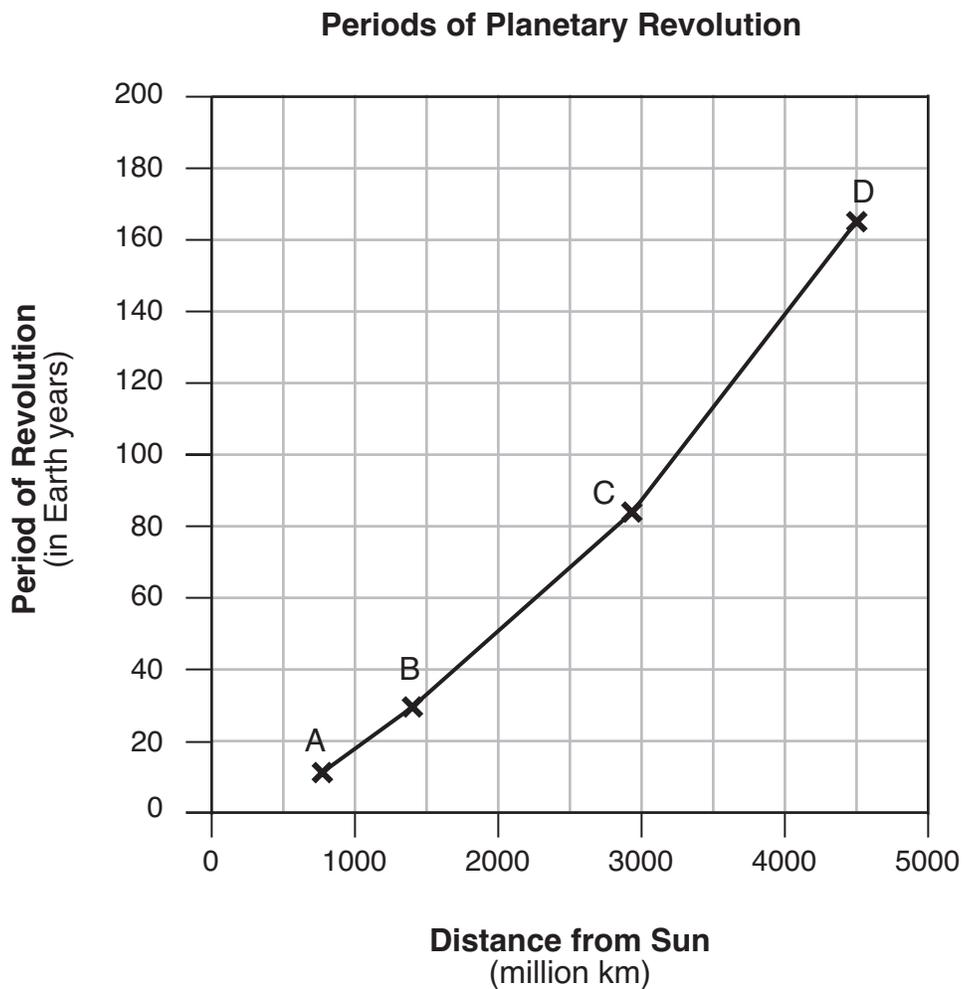


(Not drawn to scale)

62 Explain how this comet's orbit illustrates the heliocentric model of our solar system. [1]

63 Explain why the time required for one revolution of the comet is more than the time required for one revolution of Earth. [1]

Base your answers to questions 64 and 65 on the graph below, which shows the distance from the Sun and the period of revolution for four planets in our solar system labeled A, B, C, and D.



64 State the name of *each* of the planets represented by A, B, C, and D. [1]

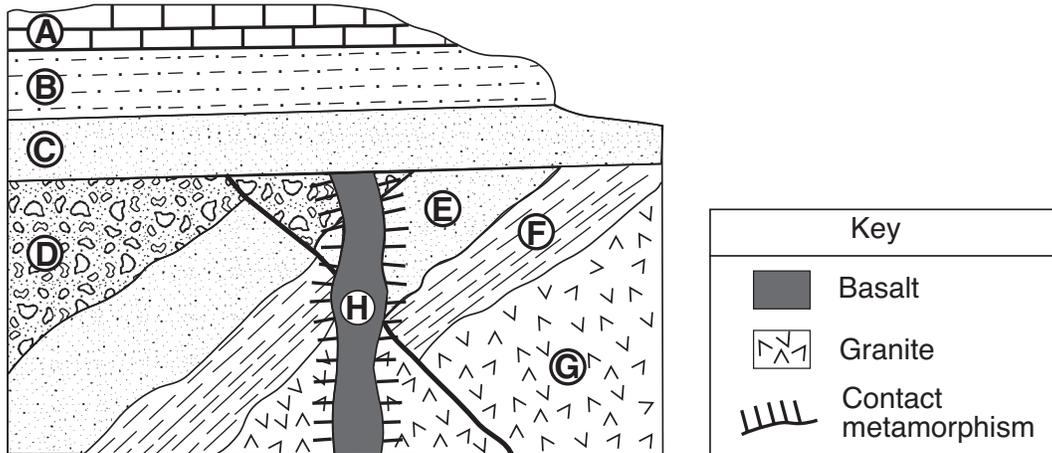
65 Describe the relationship between the distance from the Sun and the period of revolution for these four planets. [1]

Part C

Answer all questions in this part.

Directions (66–85): Record your answers in the spaces provided in your answer booklet. Some questions may require the use of the *2010 Edition Reference Tables for Physical Setting/Earth Science*.

Base your answers to questions 66 through 70 on the cross section below. Letters A through H represent rock units in which overturning has not occurred.



66 Identify *one* metamorphic rock that could have formed at the boundary between rock unit *E* and rock unit *H*. [1]

67 Rock unit *B* contains fossils of *Centroceras* while rock unit *F* contains fossils of *Tetraraptus*. Identify *one* geologic time period when rock unit *D* could have formed. [1]

68 Two inferences about the cross section are listed below.

Inference 1: Rock unit *G* is older than the fault.

Inference 2: Rock unit *A* is younger than rock unit *C*.

Explain how *each* inference is supported by evidence in the cross section. [1]

69 Identify *two* processes that formed rock unit *D* from sediment. [1]

70 State the diameter of a particle normally found in rock unit *B*. [1]

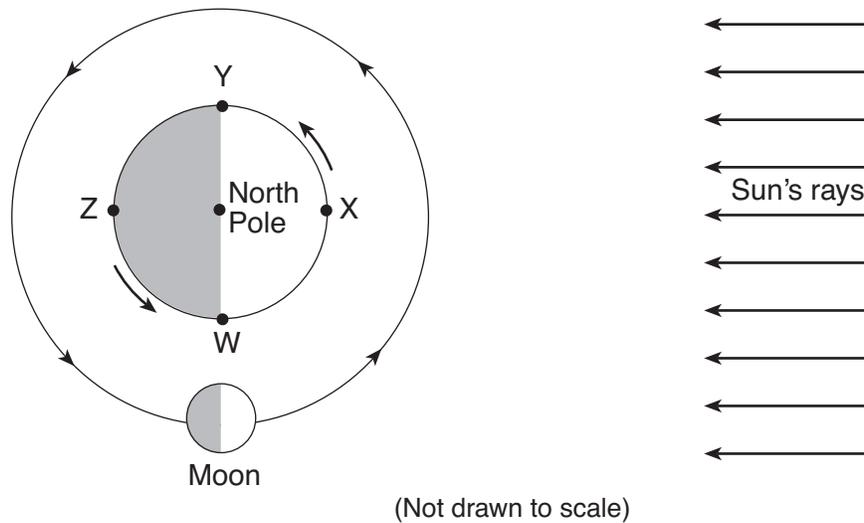
Base your answers to questions 71 through 73 on the passage below.

Extrasolar Planets

Astronomers have discovered more than 400 planets outside of our solar system. The first extrasolar planet was detected in 1995 orbiting a star known as *51 Pegasi*, which is similar in color and luminosity to our Sun. Astronomers can detect planets by identifying stars that move in response to the gravitational pull of planets revolving around them. Other planets have been discovered by finding stars whose luminosity varies as orbiting planets block outgoing starlight. Nearly all of these discovered planets are thought to be Jovian-like planets similar to Jupiter.

- 71 Other than Jupiter, identify *one* Jovian planet in our solar system. [1]
- 72 Compared to Jupiter, state how Earth's equatorial diameter and density are different. [1]
- 73 State the color and luminosity of *51 Pegasi*. [1]
-

Base your answers to questions 74 through 76 on the diagram below, which shows one position of the Moon in its orbit around Earth. Letters W, X, Y, and Z are locations on Earth's surface.



- 74 On the diagram of the Moon *in your answer booklet*, shade the part of the Moon that appears dark to an observer in New York State when the Moon is at the position shown in the diagram. [1]
- 75 *In your answer booklet*, write "high" or "low" to indicate whether a high ocean tide or low ocean tide is occurring at locations W, X, Y, and Z. [1]
- 76 What is the solar time at location Y? Include a.m. or p.m. in your answer. [1]
-

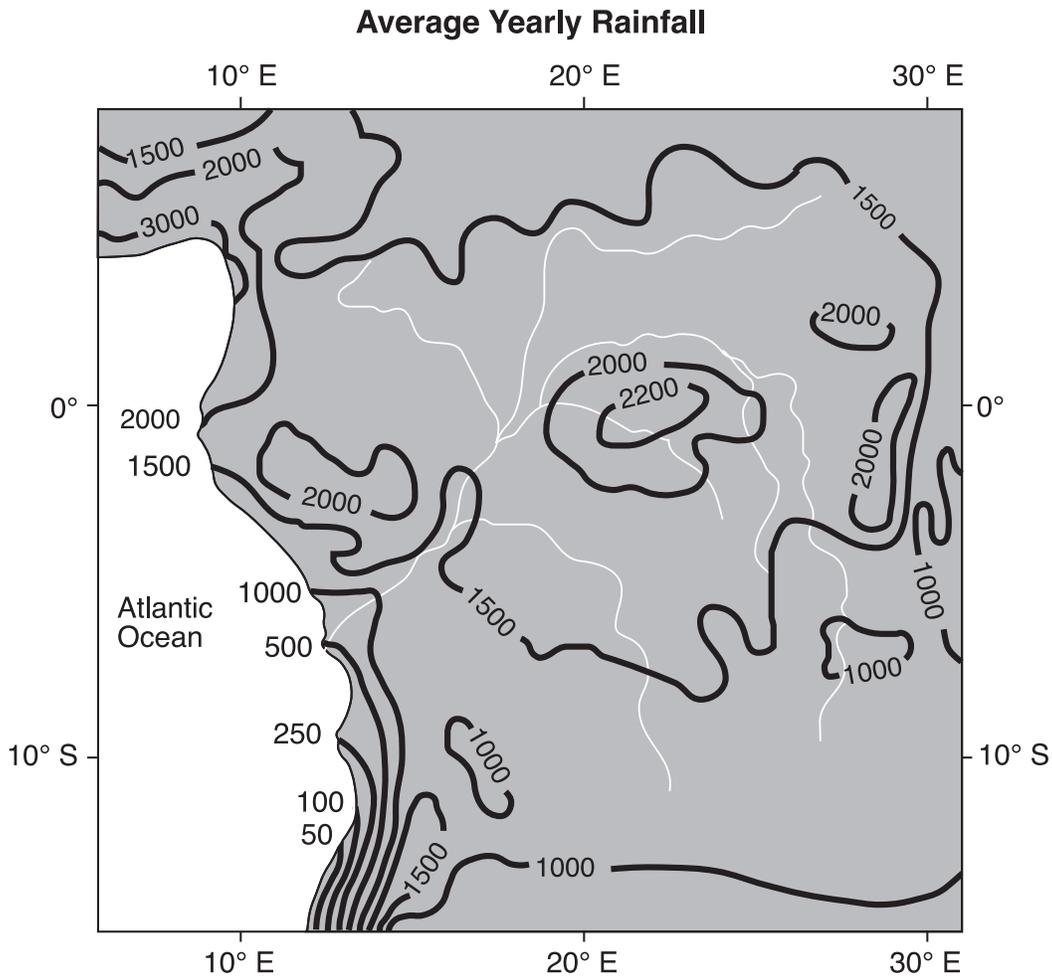
Base your answers to questions 77 through 79 on the map in your answer booklet, which shows the snowfall from the fall of 1976 through the spring of 1977, measured in inches, for most of New York State. The 200-inch snowfall isolines are shown on the map.

- 77 On the map *in your answer booklet*, draw the 100-inch snowfall isoline. Extend the isoline to the edges of New York State. [1]
- 78 The amount of snowfall for Massena is shown on the map. What was the amount of snowfall for Massena? [1]
- 79 Identify *one* factor that contributes to the high snowfall amounts at locations on the eastern side of *both* Lake Erie and Lake Ontario. [1]
-

Base your answers to questions 80 through 83 on the topographic map in your answer booklet, which shows an area of the Saranac River just west of Plattsburgh, New York. Points *A* and *B* are locations in the river.

- 80 In this region of the Saranac River, the land area that is lower in elevation than 450 feet is a floodplain. On the map *in your answer booklet*, draw a diagonal-line pattern, , to indicate the entire floodplain area. [1]
- 81 Describe how the contour lines shown on the map indicate that the Saranac River flows from point *A* to point *B*. [1]
- 82 Why is erosion of the stream bank more likely at point *A* than at point *B*? [1]
- 83 Identify *one* emergency preparedness activity that people living in the floodplain area can take to protect themselves and their property from possible flooding. [1]
-

Base your answers to questions 84 and 85 on the map and passage below. The map shows isolines of average yearly rainfall, in centimeters, for the Congo River region of Africa.



The climate of the Congo River region is mainly influenced by air from two source regions. One air-mass source region is over the Benguela Current along the west coast of Africa. This air mass moves at low altitudes toward the Congo River region. A second air-mass source region is located over the South Equatorial Current along the east coast of Africa. This air mass moves at higher altitudes over the Congo River region.

84 According to the map, what is a possible average yearly rainfall amount received on the equator (0°) at 20° E? [1]

85 Explain why air masses that form over the South Equatorial Current move at higher altitudes than air masses that form over the Benguela Current. [1]
