

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

**PHYSICAL SETTING
EARTH SCIENCE**

Thursday, August 18, 2011 — 12:30 to 3:30 p.m., only

Use your knowledge of Earth science to answer all questions in this examination. Before you begin this examination, you must be provided with the *2010 Edition Reference Tables for Physical Setting/Earth Science*. You will need these reference tables to answer some of the questions.

You are to answer all questions in all parts of this examination. You may use scrap paper to work out the answers to the questions, but be sure to record your answers on your answer sheet and in your answer booklet. A separate answer sheet for Part A and Part B–1 has been provided to you. Follow the instructions from the proctor for completing the student information on your answer sheet. Record your answers to the Part A and Part B–1 multiple-choice questions on this separate answer sheet. Record your answers for the questions in Part B–2 and Part C in your separate answer booklet. Be sure to fill in the heading on the front of your answer booklet.

All answers in your answer booklet should be written in pen, except for graphs and drawings, which should be done in pencil.

When you have completed the examination, you must sign the declaration printed on your separate answer sheet, 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 sheet and 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.

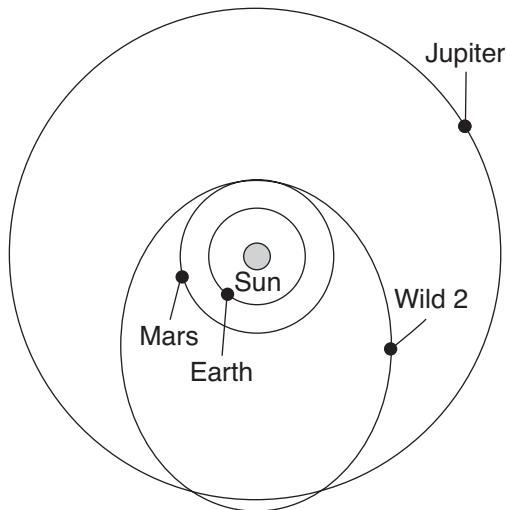
DO NOT OPEN THIS EXAMINATION BOOKLET UNTIL THE SIGNAL IS GIVEN.

Part A

Answer all questions in this part.

Directions (1–35): For each statement or question, choose 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*. Record your answers on your separate answer sheet.

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

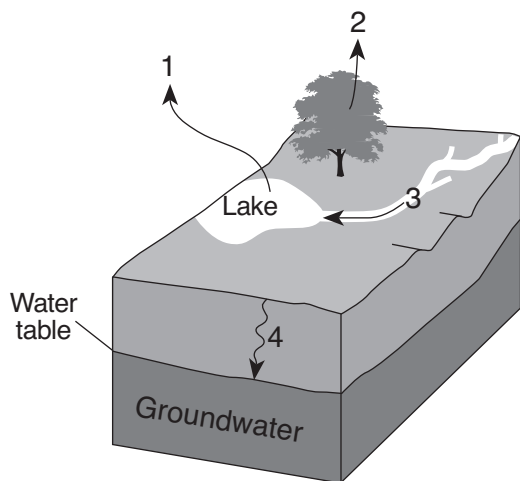


(Not drawn to scale)

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

- (1) 150 million kilometers
(2) 228 million kilometers
(3) 778 million kilometers
(4) 820 million kilometers
- 2 The Sun revolves around the center of
- (1) *Polaris*
(2) *Aldebaran*
(3) Earth
(4) the Milky Way Galaxy
- 3 Which motion is responsible for the regular seasonal changes of the constellations visible in the night sky?
- (1) The stars orbit Earth.
(2) The stars orbit the Sun.
(3) The Moon orbits Earth.
(4) Earth orbits the Sun.
- 4 What evidence suggests that a mass extinction of the dinosaurs occurred at the end of the Cretaceous Period?
- (1) an absence of dinosaur fossils in Paleocene bedrock
(2) drawings of dinosaurs made by humans in caves during the Paleocene Epoch
(3) an abundance of dinosaur fossils in Early Cretaceous bedrock
(4) evolution of dinosaurs during the Late Cretaceous Epoch
- 5 Compared to Jovian planets, terrestrial planets have
- (1) larger masses
(2) larger equatorial diameters
(3) shorter periods of revolution
(4) shorter periods of rotation
- 6 The motion of a Foucault pendulum provides evidence that Earth
- (1) varies in distance from the Sun
(2) is tilted on its axis
(3) spins on its axis
(4) travels around the Sun
- 7 In the Northern Hemisphere, planetary winds deflect to the
- (1) right, due to the Coriolis effect
(2) right, due to the Doppler effect
(3) left, due to the Coriolis effect
(4) left, due to the Doppler effect
- 8 Which air mass is associated with low relative humidity and high air temperature?
- (1) maritime polar (3) continental polar
(2) maritime tropical (4) continental tropical

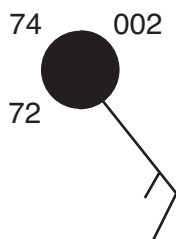
9 The arrows in the block diagram below show the movement of water after it has fallen as precipitation.



Which arrow indicates the process of transpiration?

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

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

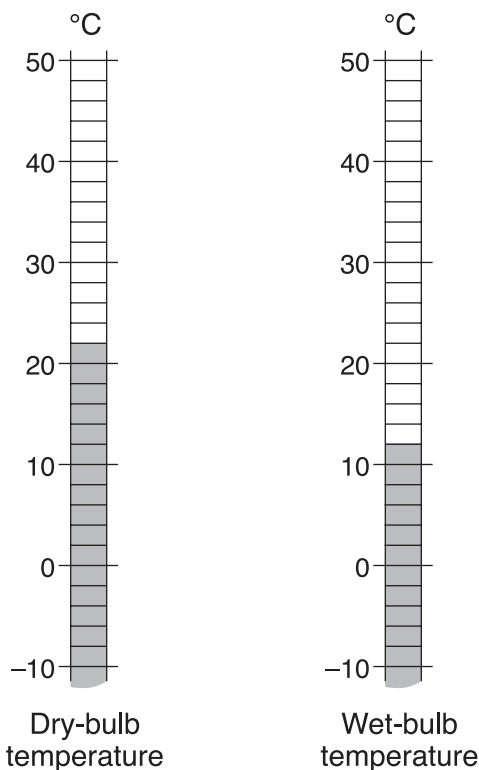


- (1) 72°F and wind from the northeast
- (2) 72°F and wind from the southeast
- (3) 74°F and wind from the northwest
- (4) 74°F and wind from the southwest

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

- (1) warm, moist, and rising
- (2) warm, dry, and rising
- (3) cool, moist, and sinking
- (4) cool, dry, and sinking

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



What is the dewpoint of the air?

- (1) 27°C
- (2) 10°C
- (3) 3°C
- (4) -5°C

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

- (1) troposphere
- (2) stratosphere
- (3) mesosphere
- (4) thermosphere

14 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?

- (1) monsoons
- (2) volcanic eruptions
- (3) El Niño
- (4) deforestation

15 Which form of electromagnetic energy has the longest wavelength?

- (1) ultraviolet rays
- (2) visible light
- (3) gamma rays
- (4) radio waves

- 16 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

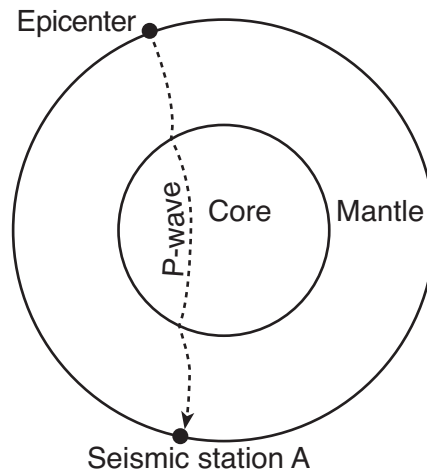
The most likely cause of this air temperature difference is that New York City is located

- (1) in a different prevailing wind belt
 - (2) at a higher latitude
 - (3) near a large body of water
 - (4) at a higher elevation
- 17 Which igneous rock has a vesicular texture and a felsic composition?
- (1) pumice
 - (2) basalt
 - (3) granite
 - (4) scoria
- 18 Which radioactive element is used to determine the absolute age of late Pleistocene animal remains?
- (1) rubidium-87
 - (2) uranium-238
 - (3) potassium-40
 - (4) carbon-14
- 19 Which mineral precipitates from oceans and forms rock salt?
- (1) quartz
 - (2) fluorite
 - (3) halite
 - (4) olivine
- 20 Which river in New York State flows for several miles over surface bedrock that is more than 542 million years old?
- (1) Mohawk
 - (2) Susquehanna
 - (3) Genesee
 - (4) Hudson
- 21 Which sediment is most easily picked up and transported by the wind?
- (1) cobbles
 - (2) pebbles
 - (3) sand
 - (4) silt

- 22 The presence of coal in Antarctica indicates that
- (1) forests can grow on continental glaciers
 - (2) coal can form in cold climates
 - (3) Antarctica's climate was once warmer
 - (4) Antarctica currently has areas of tropical climate

- 23 Organisms that later became good index fossils lived over a
- (1) wide geographic area and existed for a long geologic time
 - (2) wide geographic area and existed for a short geologic time
 - (3) limited geographic area and existed for a long geologic time
 - (4) limited geographic area and existed for a short geologic time

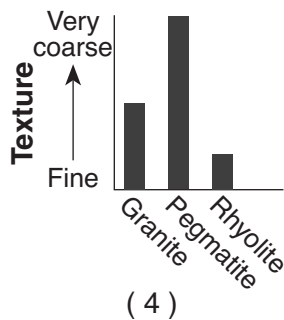
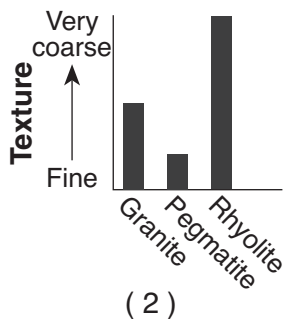
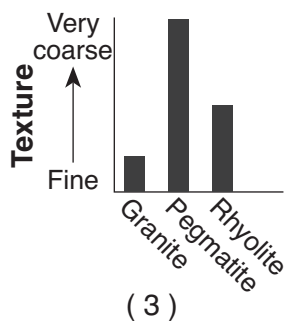
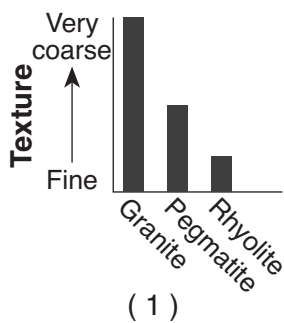
- 24 The cross section of Earth below shows a *P*-wave moving away from an earthquake epicenter to seismic station A.



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

- (1) some parts of the core are liquid
- (2) *S*-waves travel too slowly
- (3) the distance to seismic station A is too great
- (4) seismic station A is located on glacial ice

25 Which graph best represents the textures of granite, pegmatite, and rhyolite?



26 Which type of surface bedrock is commonly found in New York State between Elmira and Ithaca?

- (1) granite
- (2) quartzite
- (3) shale
- (4) marble

27 New York's Tug Hill landscape region is classified as a plateau because this region has a

- (1) high elevation with distorted bedrock
- (2) high elevation with nearly horizontal layers of bedrock
- (3) low elevation with distorted bedrock
- (4) low elevation with nearly horizontal layers of bedrock

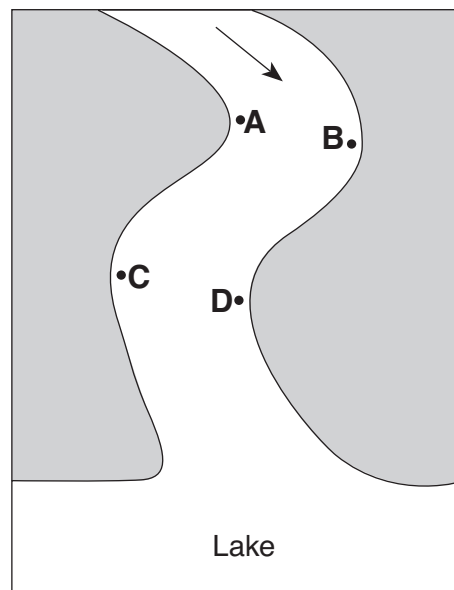
28 Which two locations are found in the same major geographic landscape province?

- (1) Albany and Old Forge
- (2) Elmira and Riverhead
- (3) Jamestown and Slide Mountain
- (4) Massena and Mount Marcy

29 Which mineral is most frequently found in both granitic continental crust and basaltic oceanic crust?

- (1) olivine
- (2) potassium feldspar
- (3) plagioclase feldspar
- (4) quartz

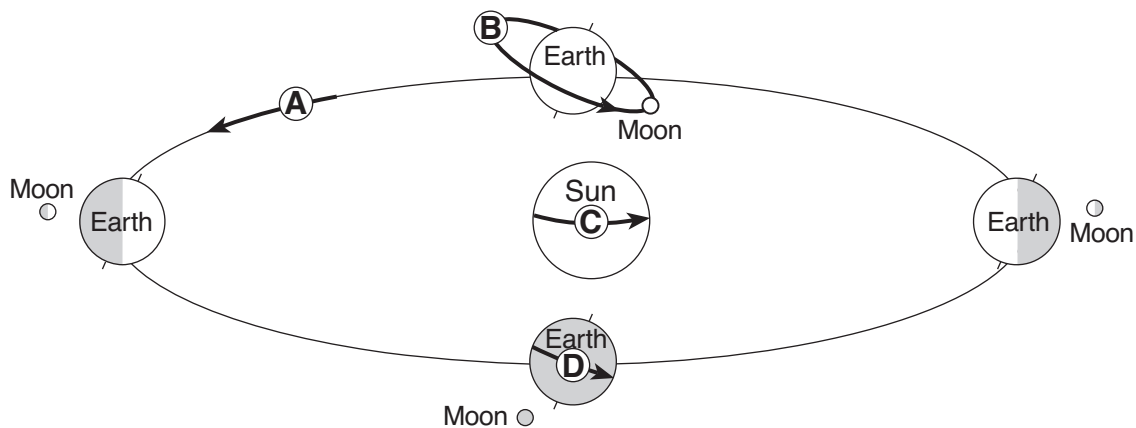
30 The map below shows a meandering stream as it enters a lake. The arrow shows the direction of stream flow. Points A through D represent locations on the surface of the stream.



The greatest stream velocities are found closest to points

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

31 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.

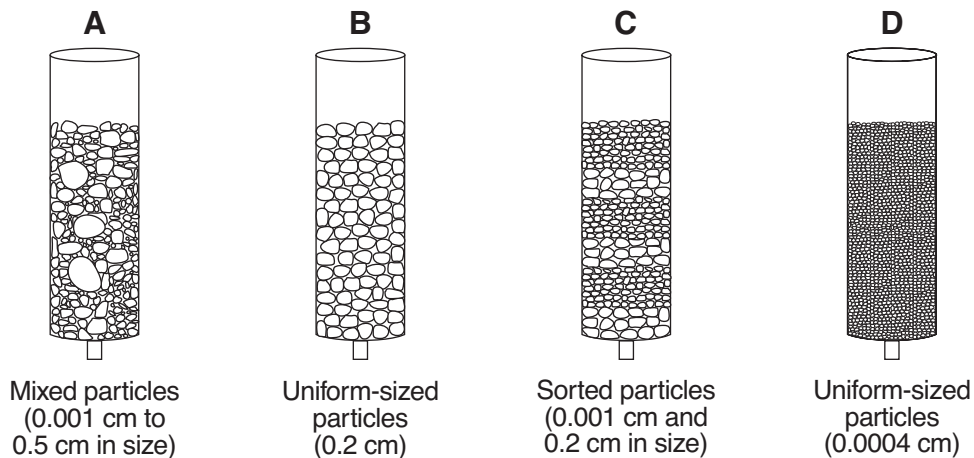


(Not drawn to scale)

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

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

32 The diagram below shows columns A, B, C, and D that contain different sediments.

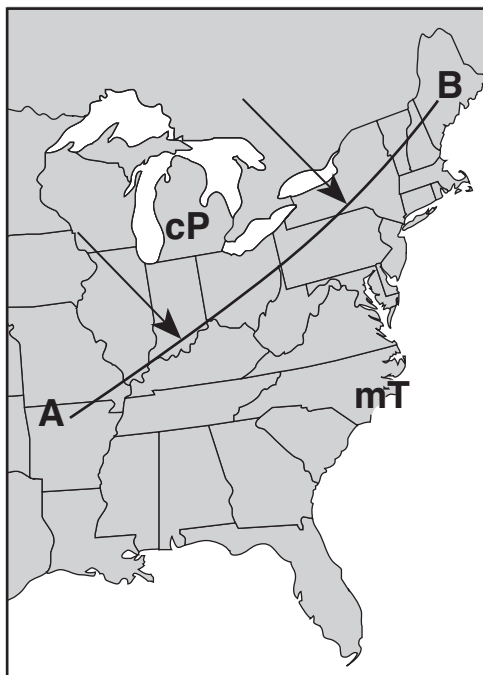


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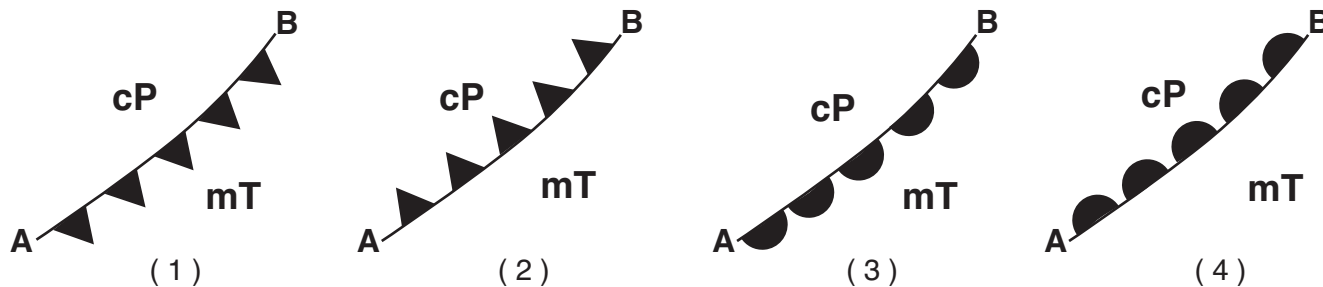
Equal volumes of water were poured through each column. Which column of sediment retained the most water?

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

33 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.

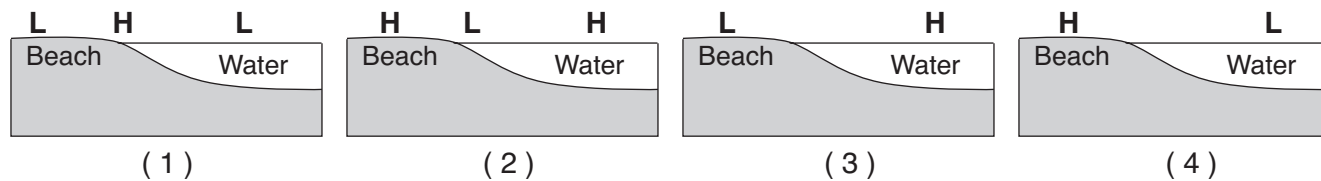


Which symbol correctly represents the frontal boundary at line *AB*?

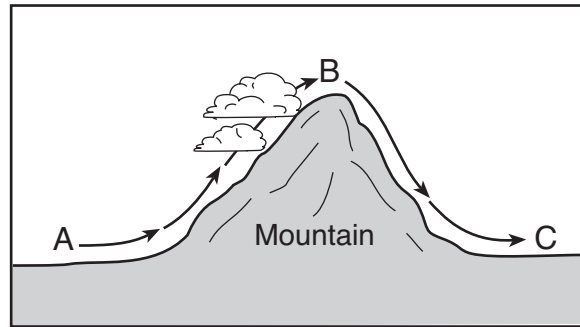


34 Which cross section below best shows the locations of high air pressure and low air pressure near a beach on a hot, sunny, summer afternoon?

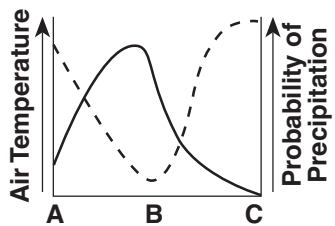
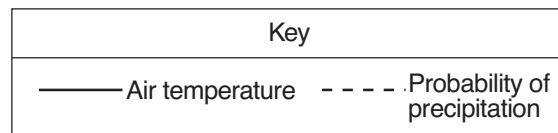
Key	
H	High air pressure
L	Low air pressure



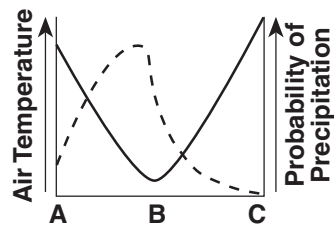
35 The diagram below shows the flow of air over a mountain, from location A to B to C.



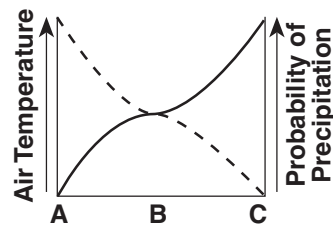
Which graph best shows how the air temperature and probability of precipitation change during this air movement?



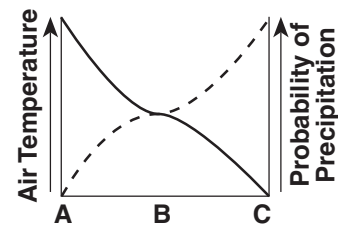
(1)



(2)



(3)



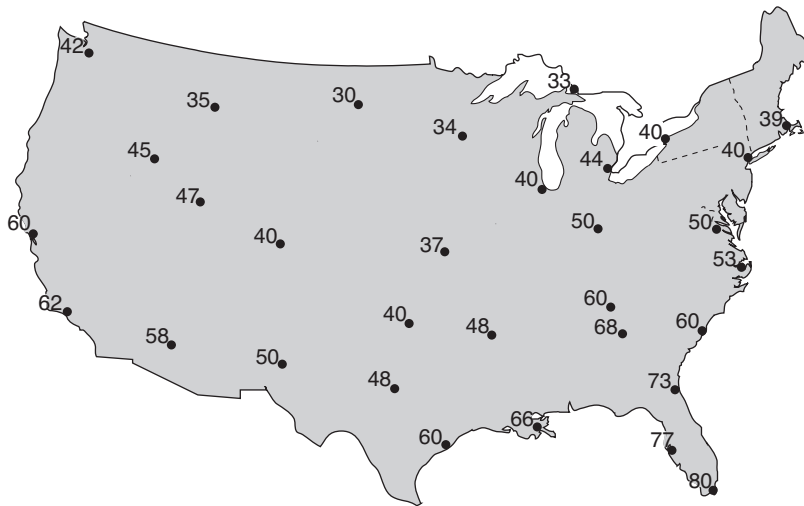
(4)

Part B-1

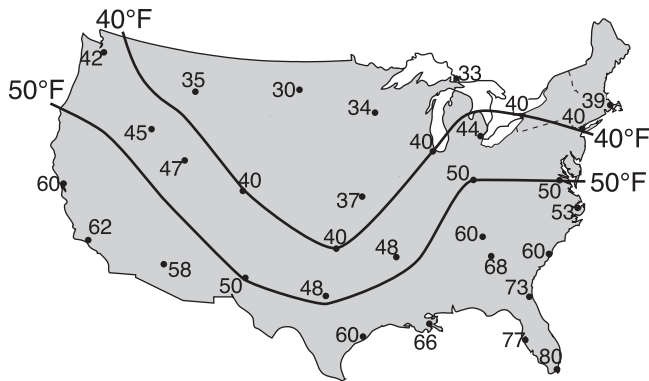
Answer all questions in this part.

Directions (36–50): For each statement or question, choose 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. Record your answers on your separate answer sheet.

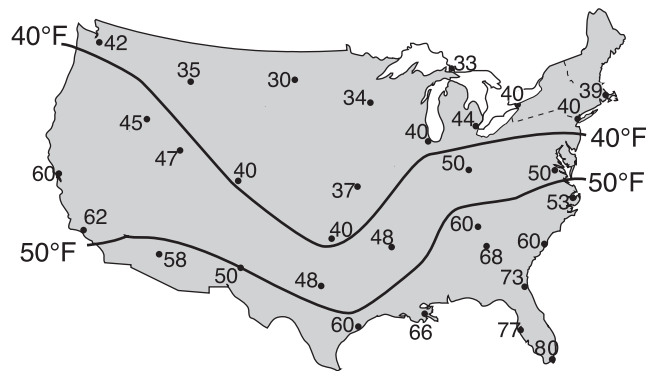
36 The weather map below shows the air temperatures recorded at the same time at cities across the United States.



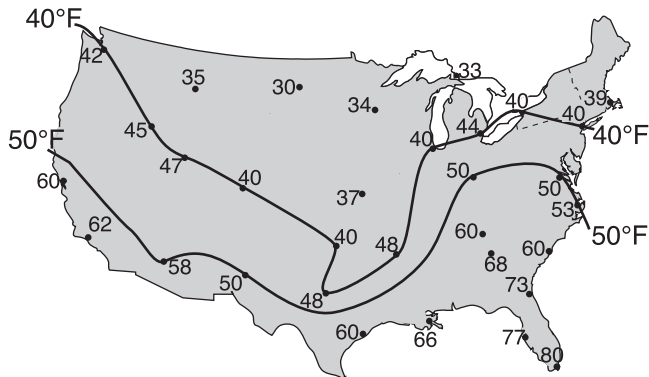
Which map correctly shows the locations of the 40°F and 50°F isotherms?



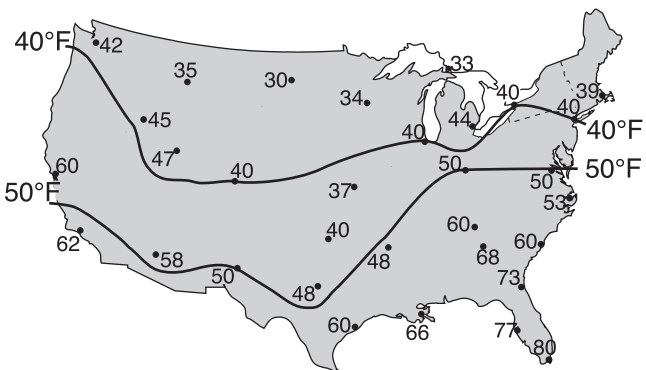
(1)



(3)



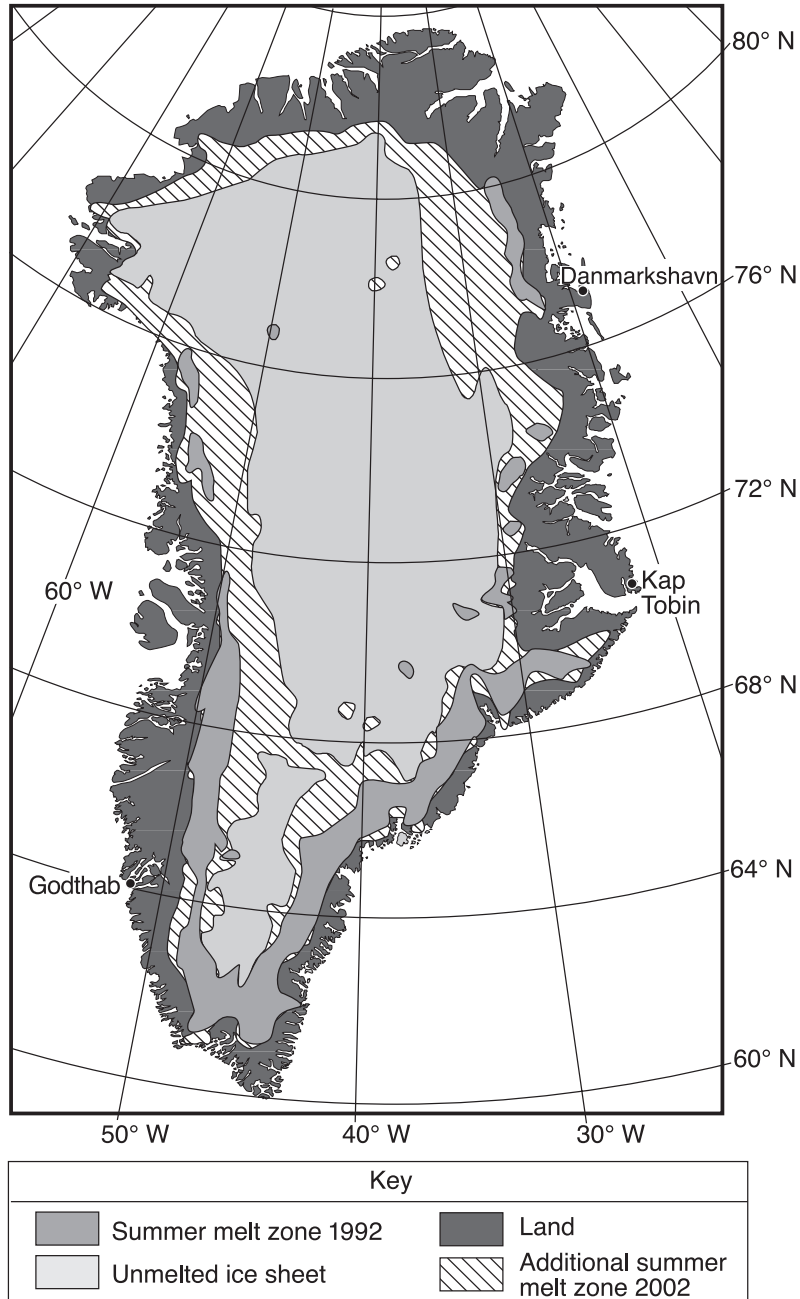
(2)



(4)

Base your answers to questions 37 through 39 on the map below and the passage on the next page. The map 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.

Greenland Summer Ice Melting




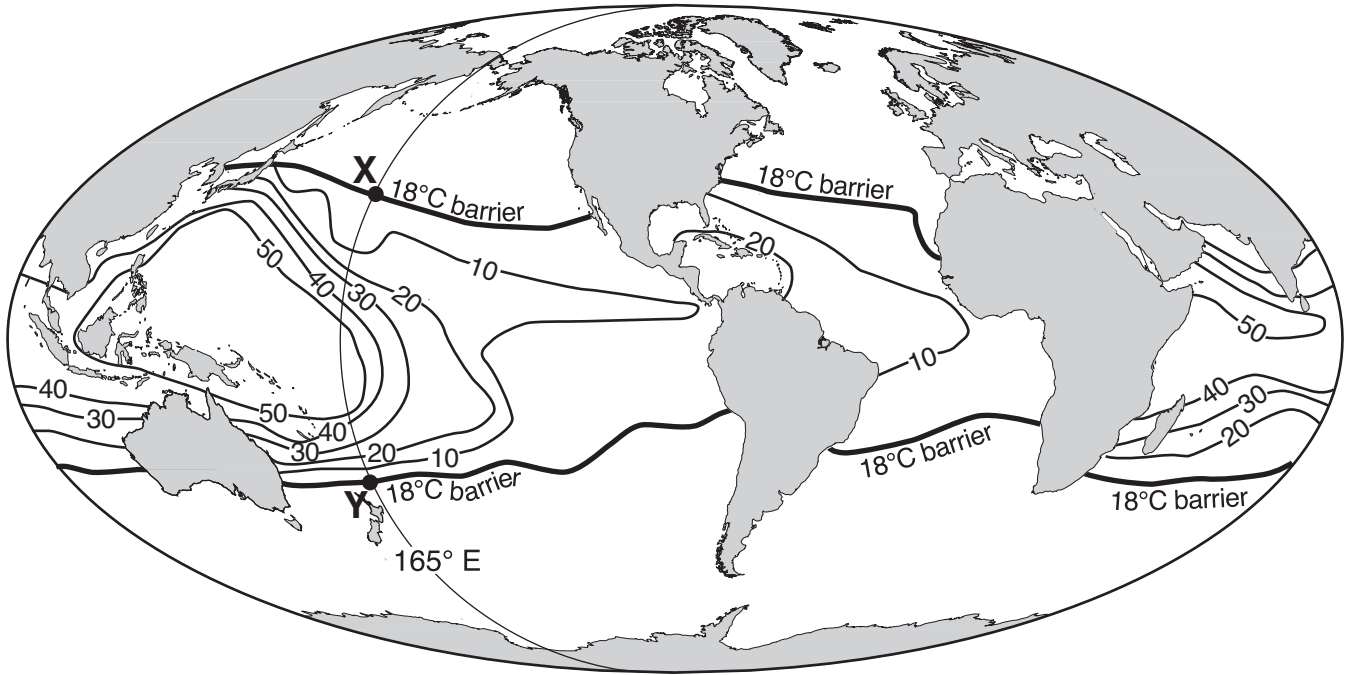
Arctic Meltdown

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.

- 37 Two of the greenhouse gases that may be responsible for the increased ice melting in Greenland are
- | | |
|-------------------------|--------------------------------|
| (1) nitrogen and oxygen | (3) hydrogen and helium |
| (2) oxygen and silicon | (4) carbon dioxide and methane |
- 38 What is the approximate latitude and longitude of Godthab, Greenland?
- | | |
|-------------------|-------------------|
| (1) 51.5° N 64° W | (3) 64° N 51.5° W |
| (2) 70.5° N 22° W | (4) 22° N 70.5° W |
- 39 A decrease in areas covered in snow and ice leads to an increase in the absorption of insolation because exposed land surfaces are
- | | |
|-------------------------|--------------------------|
| (1) rougher and darker | (3) smoother and darker |
| (2) rougher and lighter | (4) smoother and lighter |
-

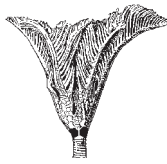
Base your answers to questions 40 through 42 on the map below, which shows coral reef distribution and diversity (number of different coral types) around the world. Isolines on the map represent the number of different types of coral. Coral reefs are found mostly in shallow tropical waters and do not 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.



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



(1)



(2)



(3)



(4)

41 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?

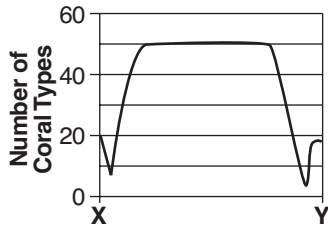
(1) angle of the Sun's rays

(2) temperature of the ocean currents

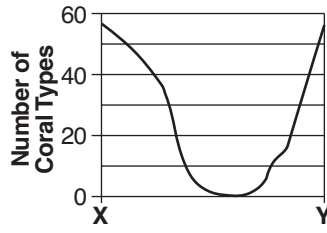
(3) distance from the equator

(4) seasonal air temperature range

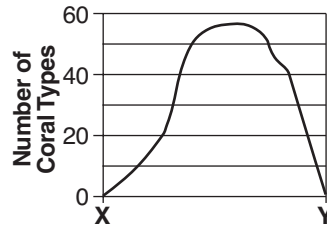
42 Which graph shows the number of coral types found along the 165° east longitude line between point X and point Y?



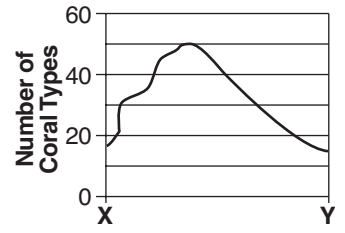
(1)



(2)



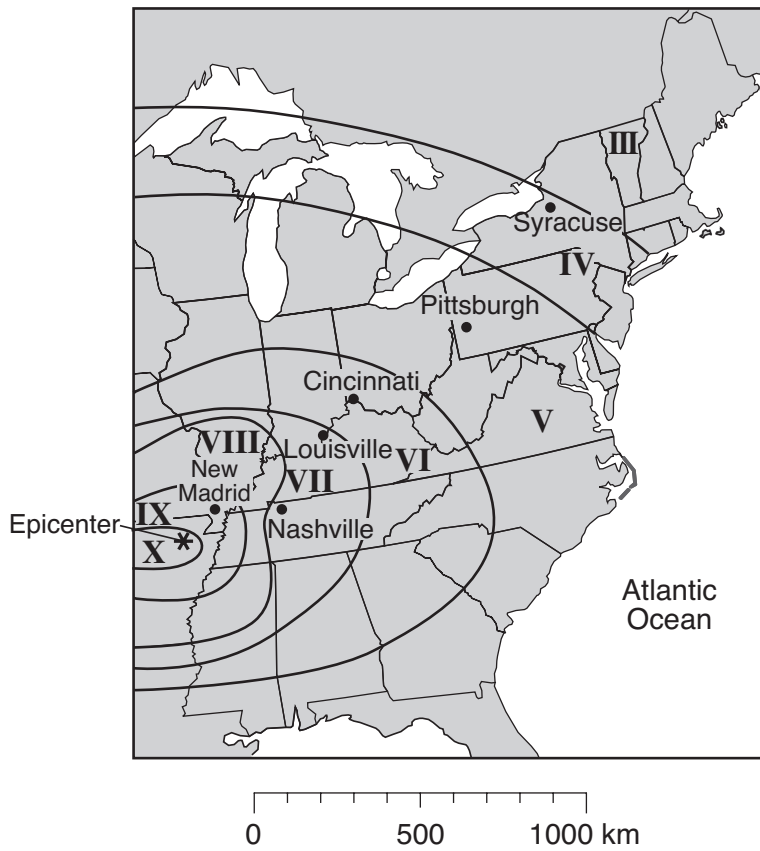
(3)



(4)

Base your answers to questions 43 and 44 on the map and the modified Mercalli scale shown below. The map 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.

**Earthquake Intensity
with 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

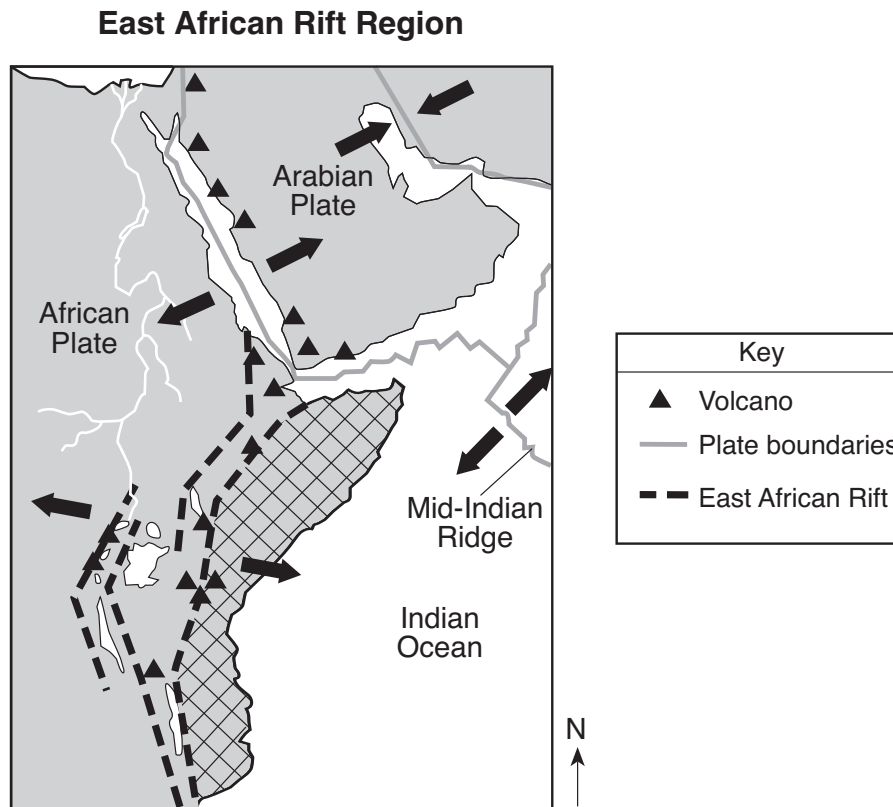
43 Which location would most probably have issued the report: “Many structures shifted off foundations”?

- | | |
|----------------|----------------|
| (1) New Madrid | (3) Pittsburgh |
| (2) Syracuse | (4) Nashville |

44 The intensity numbers shown on the map were determined by

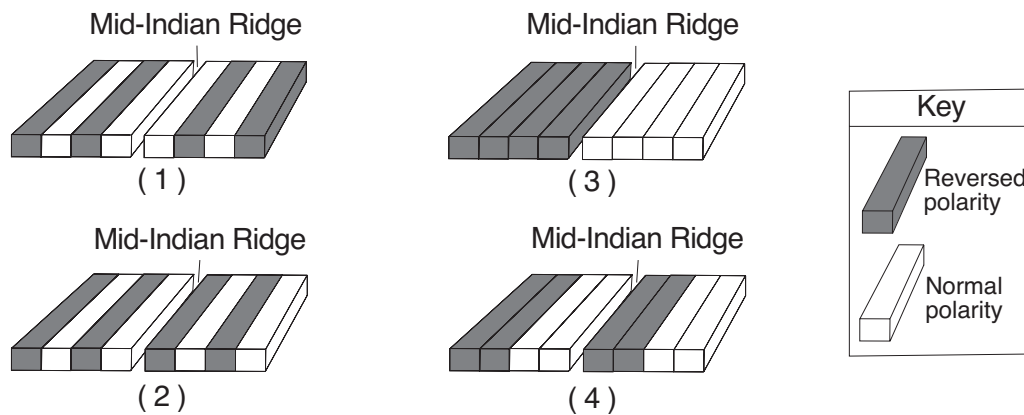
- (1) the arrival time of the first *P*-wave recorded at each city
- (2) the recorded time difference in the arrival of the first *P*-wave and *S*-wave at each city
- (3) observations made at different locations during and after the earthquake
- (4) observations made only at the earthquake epicenter

Base your answers to questions 45 and 46 on the map below, which shows the tectonic plate boundaries near the East African Rift. Arrows show relative tectonic plate movement. A region of Africa is crosshatched (⊗).

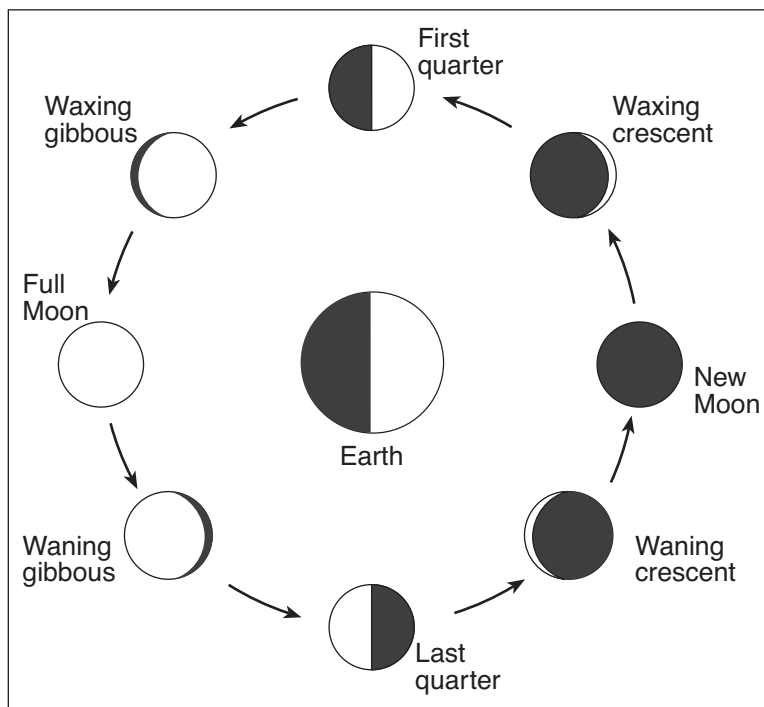


- 45 What appears to be happening to the crosshatched region of eastern Africa?
- (1) A folded mountain range is forming as this region collides with the rest of Africa.
 - (2) Several volcanic mountains are forming as the rest of Africa subducts under this region.
 - (3) This region is moving eastward relative to the rest of Africa.
 - (4) This region is moving northward relative to the rest of Africa.

- 46 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?



Base your answers to questions 47 through 50 on the diagram below, which shows positions of the Moon in its orbit and phases of the Moon as viewed from New York State.



(Not drawn to scale)

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

- (1) 7 d
- (2) 15 d
- (3) 29.5 d
- (4) 365.26 d

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

- (1) new Moon
- (2) first quarter
- (3) full Moon
- (4) last quarter

49 What is the eccentricity of the Moon's orbit?

- (1) 0.017
- (2) 0.055
- (3) 0.386
- (4) 0.723

50 Which statement best explains why the same side of the Moon is viewed from Earth as the Moon goes through its phases?

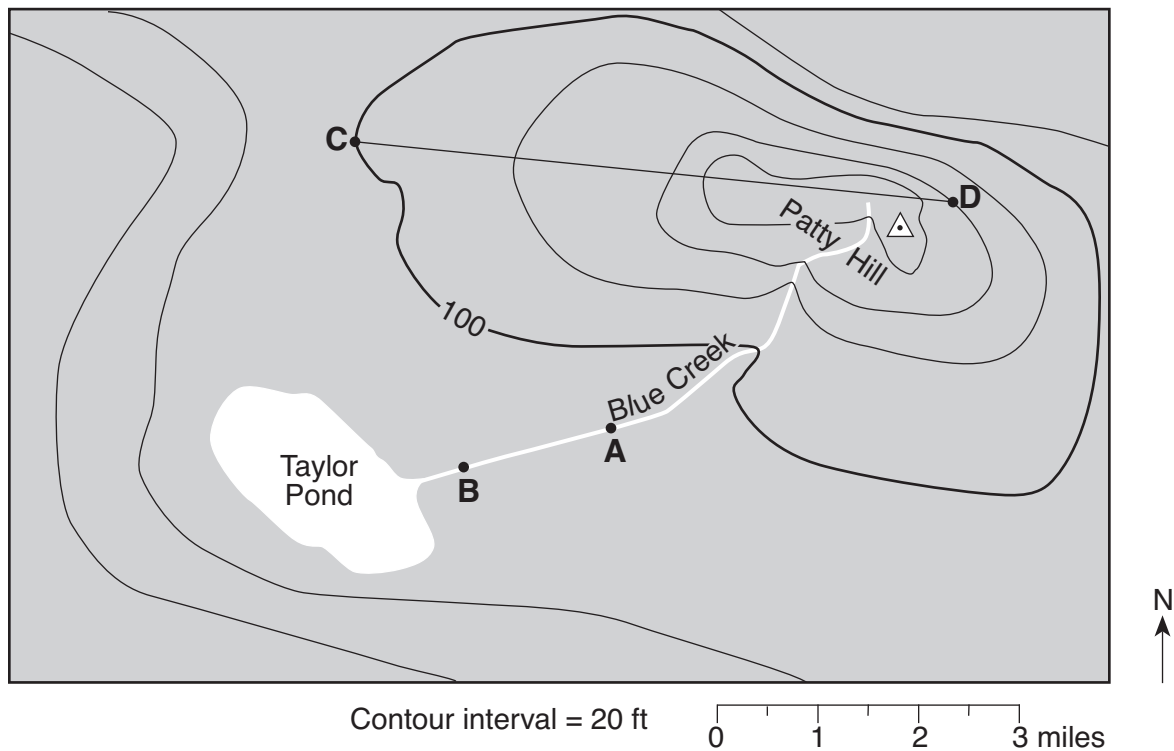
- (1) The Moon does not rotate as it revolves around Earth.
- (2) The Moon's period of rotation equals Earth's period of rotation.
- (3) The Moon's period of rotation equals Earth's period of revolution around the Sun.
- (4) The Moon's period of rotation equals the Moon's period of revolution around Earth.

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 through 55 on the topographic map shown below. Letters *A*, *B*, *C*, and *D* represent locations on Earth's surface. The \triangle symbol marks the highest elevation on Patty Hill. Elevations are shown in feet.



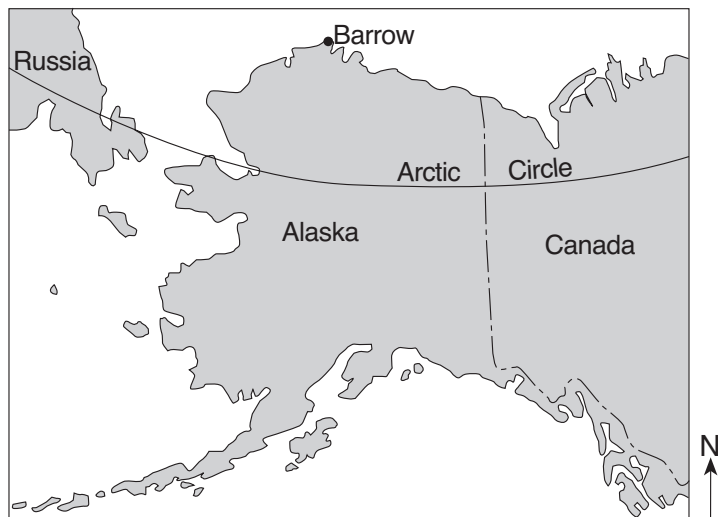
- 51 What is a possible elevation at the \triangle symbol at the top of Patty Hill? [1]
- 52 Indicate, using a compass direction, the steepest side of Patty Hill. [1]
- 53 Explain how the shape of the contour lines crossing Blue Creek shows the direction that the creek is flowing. [1]
- 54 A student placed a floating wooden block in Blue Creek at location *A*. Fifteen minutes later, the floating block arrived at location *B*. What was the creek's rate of flow from *A* to *B*? Express your answer to the nearest tenth. [1]
- 55 On the grid in your answer booklet, construct a profile of the land surface along line *CD*. Plot the elevation of each contour line that crosses line *CD*. Connect the plots with a line to complete the profile. [1]

Base your answers to questions 56 through 60 on the table and map below. The table shows the duration of insolation, in hours, at Barrow, Alaska, on the twentieth day of each month during 2008. The map shows the location of Barrow at 71° N 156.5° W.

**Duration of Insolation
at Barrow, Alaska**

Date	Duration of Insolation (h)
Jan 20	0
Feb 20	7.8
Mar 20	12.5
Apr 20	17.6
May 20	24
June 20	24
July 20	24
Aug 20	16.7
Sept 20	12.6
Oct 20	7.8
Nov 20	0
Dec 20	0

Barrow, Alaska



56 On the grid in your answer booklet, construct a line graph by plotting the data for the duration of insolation at Barrow for *each* date shown on the data table. Connect the plots with a line. [1]

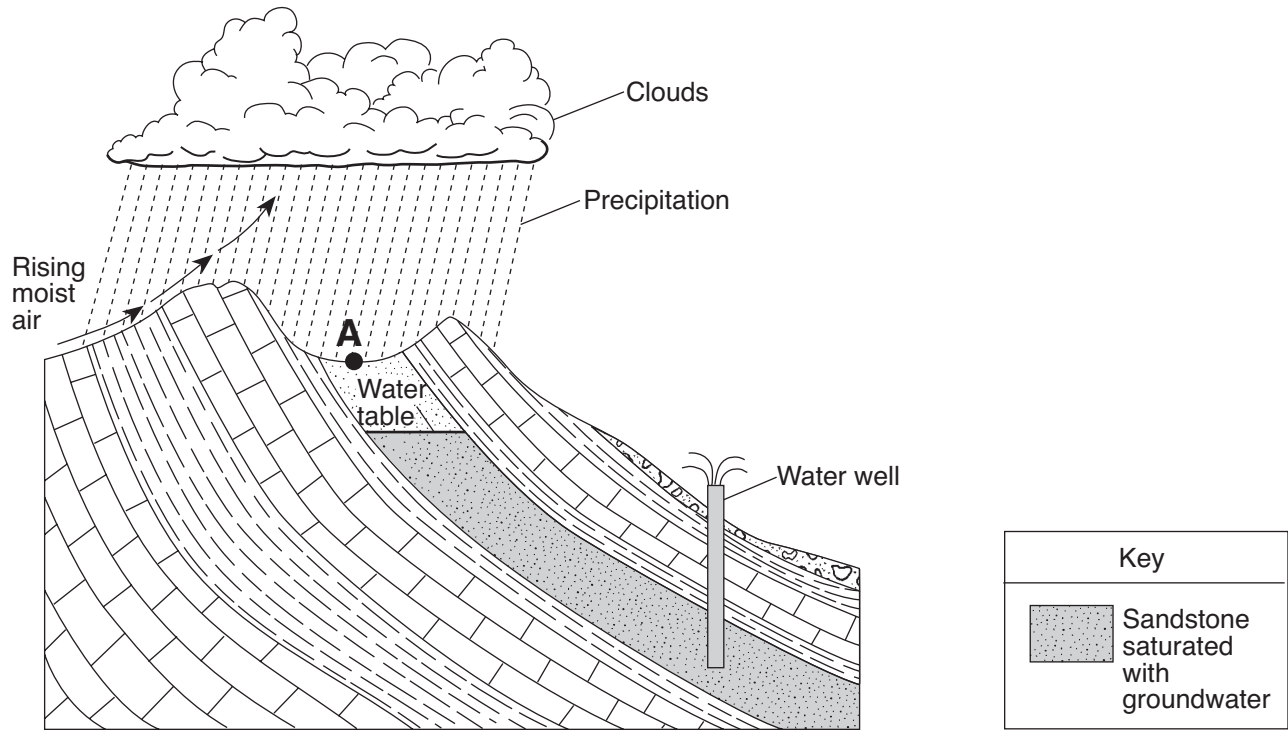
57 Explain why Barrow receives 0 hours of insolation on December 20. [1]

58 State the altitude of *Polaris* as seen from Barrow. [1]

59 Explain why Barrow is in a different time zone than New York City. [1]

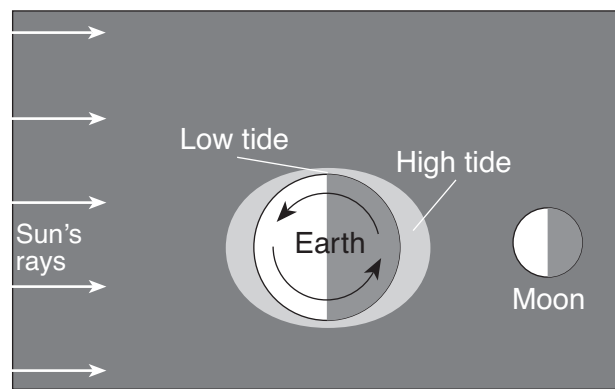
60 On what date was the noontime Sun highest in the sky at Barrow? [1]

Base your answers to questions 61 through 63 on the cross section below, which shows water flowing out of a well drilled through tilted sedimentary bedrock. Point A represents a location on Earth's surface.



- 61 Describe *one* characteristic of the sandstone layer that allowed part of this layer to become saturated with groundwater. [1]
- 62 Identify *one* process that causes the clouds to form in the rising moist air. [1]
- 63 Explain why point A would be a poor location for a garbage dump or landfill. [1]
-

Base your answers to questions 64 and 65 on the diagram below, which shows the locations of high and low tides on Earth at a particular time.



(Not drawn to scale)

- 64 Identify the force that causes ocean tides on Earth. [1]
- 65 Approximately how many hours will pass between high tide and the following low tide? [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 68 on the passage below.

Carbon


Carbon may be the most important element on our planet because it is the chemical building block of all living things. The element carbon is formed in dying stars and scattered when the stars explode. Our solar system formed from such star remnants. Pure carbon comes in several forms, which include the minerals graphite and diamond (hardness = 10), and the fossil fuels bituminous coal and anthracite coal. Almost all diamonds are mined from igneous rocks that originate at an approximate depth of 150 kilometers under immense pressure. Most graphite is formed through the metamorphism of organic material in rocks closer to Earth's surface.

66 Identify *two* uses for the mineral graphite. [1]

67 Explain why graphite and diamond have different properties. [1]

68 Complete the table *in your answer booklet* to show the properties of the minerals diamond and graphite. [1]

Base your answers to questions 69 through 72 on the geologic cross section of bedrock in your answer booklet. Letters *A* through *G* identify rock units and line *XY* represents a fault. The rocks have not been overturned.

69 On the cross section *in your answer booklet*, draw a dark line () to indicate the most likely location of an unconformity. [1]

70 What evidence indicates that the folded bedrock is older than fault line *XY*? [1]

71 Identify *one* metamorphic rock that would likely form in layer *G* along igneous intrusion *A*. [1]

72 *Maclurites* fossils are found in rock unit *F*. During which geologic time period were the sediments that formed rock unit *F* deposited? [1]

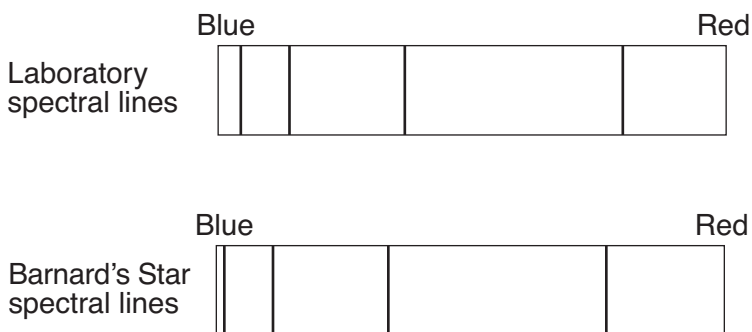
Base your answers to questions 73 through 77 on the table below, which lists some information about *Barnard's Star*.

Barnard's Star

Distance from Sun	<ul style="list-style-type: none"> • 6.0 light-years* • currently moving toward the Sun (and Earth) and will get as close as 3.8 light-years in approximately 11,000 years
Characteristics of Barnard's Star	<ul style="list-style-type: none"> • less than 17 percent of the Sun's mass • approximately 20 percent of the Sun's diameter • age thought to be between 11 and 12 billion years old and may last another 40 billion years • no planets observed orbiting Barnard's Star

* A light-year is the distance light travels in one year.

73 The diagram below shows four spectral lines produced by glowing hydrogen gas in a laboratory and four spectral lines produced by hydrogen gas as seen in the light from *Barnard's Star*.



Explain why the positions of the spectral lines of *Barnard's Star* are all shifted toward the blue end of the spectrum. [1]

74 The distance from point *A* to point *S* on the line in your answer booklet represents the equatorial diameter of the Sun. On this line, place a point labeled *B* at the correct scale distance from point *A* to represent the equatorial diameter of *Barnard's Star*. [1]

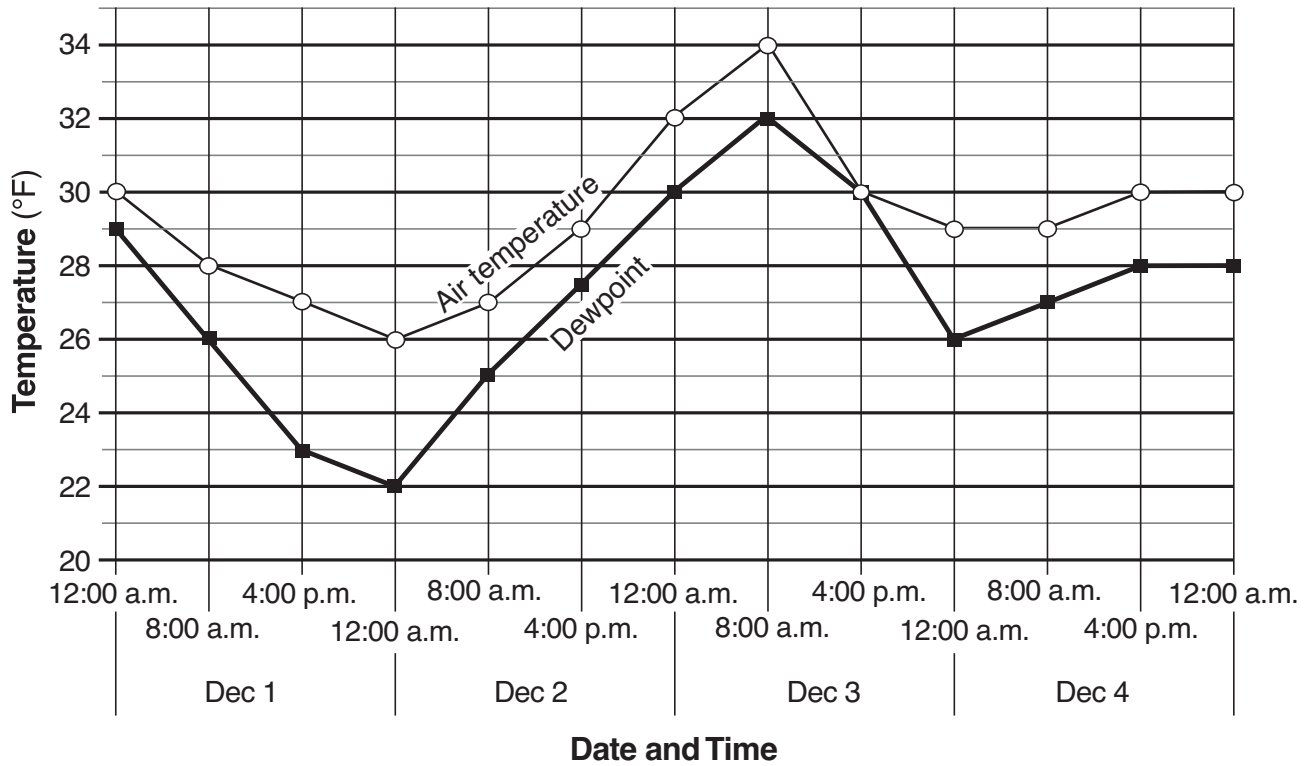
75 Compared to the surface temperature and luminosity of the Sun, describe the relative surface temperature and the relative luminosity of *Barnard's Star*. [1]

76 List *Barnard's Star*, the Sun, and the universe in order by age from oldest to youngest. [1]

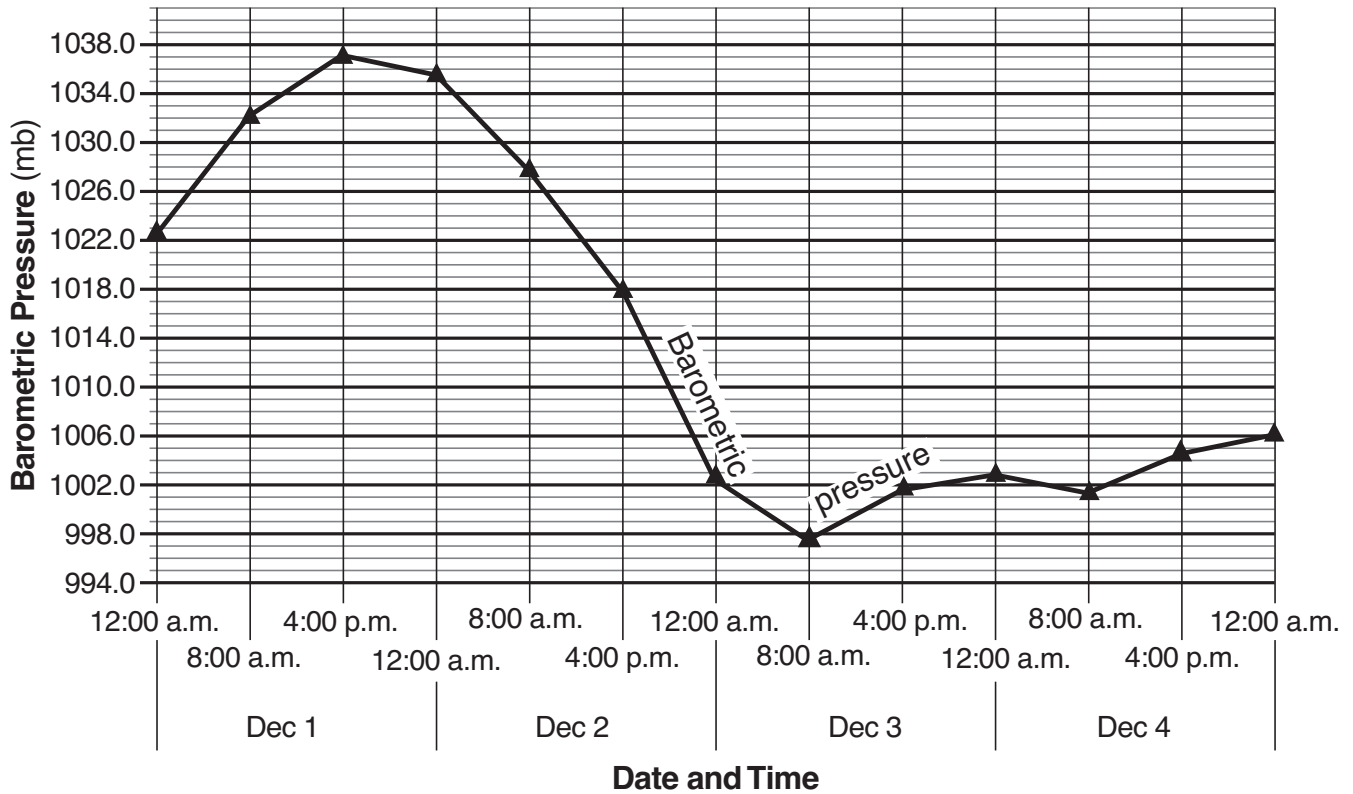
77 If a planet with the same mass as Earth were discovered orbiting *Barnard's Star* at the same distance that Earth is orbiting the Sun, why would there be less gravitational attraction between this new planet and *Barnard's Star* than there is between Earth and the Sun? [1]

Base your answers to questions 78 through 82 on the weather graphs below, which show data recorded at Syracuse, New York, as a winter storm moved across the region between December 1 and December 4, 2007. Graph 1 shows air temperatures and dewpoints. Graph 2 shows barometric pressures.

Graph 1: Air Temperature and Dewpoint at Syracuse, New York

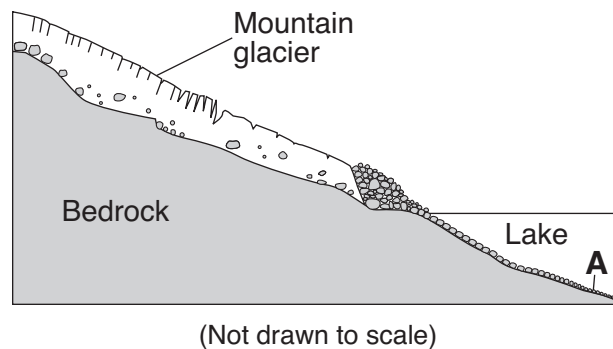


Graph 2: Barometric Pressure at Syracuse, New York



- 78 State the relationship between the air temperature and the barometric pressure in Syracuse on December 2. [1]
- 79 On which date and at what time did the relative humidity reach 100% in Syracuse? [1]
- 80 On the station model *in your answer booklet*, record the barometric pressure for Syracuse at 4 p.m. on December 2. [1]
- 81 A radar image of this storm is shown *in your answer booklet*. The darkest regions on the radar image show areas of precipitation. Letter *L* marks the location of the center of the low-pressure system. Draw an arrow on the radar image to show the most probable path this winter storm followed. Begin the arrow at letter *L*. [1]
- 82 Complete the table *in your answer booklet* by identifying *one* instrument used to determine barometric pressure and *one* weather variable determined by using a psychrometer. [1]
-

Base your answers to questions 83 through 85 on the cross section below, which represents a glacier moving down a mountain valley. The water from the melting glacier is flowing into a lake. Letter *A* represents a location on the bottom of the lake.



- 83 Describe the most likely shape of a cross section of the glacial valley as viewed from the lake. [1]
- 84 After the glacier melts, what evidence might be found on the surface of the bedrock indicating that the glacier had passed over the surface? [1]
- 85 Sediments found at location *A* range in diameter from 0.0004 to 0.006 centimeter. What name is given to this size sediment? [1]
-

